Technical Report Overview

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Report: Interpretive Report: 2016 Chronic Toxicity Testing Program – Elk Valley Testing to Satisfy Permit Requirements

Overview: This report presents the results of quarterly and semi-annual chronic toxicity tests undertaken in 2016 for Teck's steelmaking coal mining operations in the Elk Valley. The report interprets results by evaluating correspondence between water chemistry and toxicological responses and identifies recommendations for revision or augmentation of planned future programs.

This report was prepared for Teck by Golder Associates Ltd.

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Future studies will be made available at **teck.com/elkvalley**

March 2017

INTERPRETIVE REPORT

2016 Chronic Toxicity Program—Elk Valley Testing to Satisfy Permit Requirements

Submitted to:
Teck Coal Limited
c/o Nick Manklow
Lead Adaptive Water Management
Sparwood Environmental Office

REPORT

Report Number: 1523293-3200-3201

Golder Associates

Executive Summary

Golder Associates Ltd. (Golder) was retained by Teck Coal Limited (Teck) to prepare this interpretive report on quarterly and semi-annual chronic toxicity tests undertaken in 2016 for Teck's coal mining operations in the Elk Valley.

The objective of this report was to present the results from 2016 chronic testing, interpret test results by comparing to reference waters and evaluating correspondence between water chemistry and toxicological responses, and identify recommendations for revision or augmentation of planned future programs.

The following bullets summarize the findings of 2016 quarterly and semi-annual toxicity testing:

- Statistically significant test site responses compared to at least one reference water were observed for at least one test endpoint in toxicity tests conducted with *Ceriodaphnia dubia* (14 of 28 tests), *Pseudokirchneriella subcapitata* (10 of 28 tests), *Hyalella azteca* (8 of 12 tests), *Oncorhynchus mykiss* (13 of 14 tests), and *Pimephales promelas* (1 of 12 tests). For quarters in which both reference waters were tested (i.e., Q2 and Q4), statistically significant test site responses compared to both reference waters were observed in tests with *C. dubia* (4 of 14 tests), *P. subcapitata* (4 of 14 tests), and *O. mykiss* (6 of 14 tests).
- Of the tests for which a statistically significant response was identified in laboratory reports, approximately one third showed a significant effect relative to one but not both reference waters and/or had mean responses within the typical range of test organism performance in reference waters (characterized as a 'reference envelope'). For these tests, there is uncertainty regarding whether the results represent an adverse response to toxicants in the test water or variance in test organism performance related to background water quality. A review and statistical analysis of water chemistry did not identify any consistent relationships that could explain the statistically significant responses.
- Eight tests exhibited a response that was statistically significantly different from reference, below the reference envelope, and potentially attributable to water quality constituents in test waters. Statistically significant adverse responses with *C. dubia* (test sites FR_FRCP1 in Q1, Q2, Q3, and Q4; GH_FR1 in Q2; LC_LCDSSLCC in Q2), *P. subcapitata* (FR_FRCP1 in Q1), and *H. azteca* (FR_FRCP1 in Q1) were associated with concentrations that were higher than the lowest level 1 benchmark from the Elk Valley Water Quality Plan (EVWQP) and/or effects concentrations determined in previous toxicity testing with Elk Valley waters. In all of the *C. dubia* tests listed above, nitrate may have contributed to the observed responses, although the evidence for nitrate toxicity as the primary explanatory factor is these experiments was weak based on a comparison to *C. dubia* responses in other quarterly tests. The Q1 FR_FRCP1 test with *C. dubia* was the only test with a significant result that appears to be potentially attributable to water quality parameters and that is consistent with responses observed in other quarterly tests.
- The Q1 FR_FRCP1 test resulted in adverse effects attributable to water quality for three test species (*C. dubia*, *P. subcapitata*, and *H. azteca*). Water quality under winter low flow conditions at FR_FRCP1 is not representative of conditions in the upper Fording River (Teck 2017). The reach of the river upstream of FR_FRCP1 goes dry during low flow periods of the year. Current water quality and quantity data indicate that isolated surface water present at FR_FRCP1 during winter low-flow conditions is predominantly mine discharge water from Cataract Creek and is not representative for compliance monitoring of conditions in the Fording River. This observation may assist in explaining water quality data and chronic toxicity results obtained at FR_FRCP1 during low flow periods (Q1 and Q4) in 2016.

Study Limitations

This report was prepared for the exclusive use of Teck Coal Limited. Any use that a third party may make of this report, or any reliance on or decisions made based on it, is the responsibility of the third parties. We disclaim responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

We have relied in good faith on information provided by others as noted. We assume that the information provided is factual and accurate. We accept no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

The services performed as described in this report were conducted in a manner consistent with the level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services. The content of this report is based on information collected during our investigation, our present understanding of site conditions, the assumptions stated in this report, and our professional judgement in light of such information at the time of this report. This report provides a professional opinion and, therefore, no warranty is expressed, implied, or made as to the conclusions, advice and recommendations offered in this report. This report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change. The findings and conclusions of this report are valid only as of the date of the report. If new information is discovered in future work, or if the assumptions stated in this report are not met, Golder Associates should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

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Abbreviations

%	percent
<	less than
>	greater than
±	plus or minus
°C	degrees Celsius
µg/L	micrograms per litre
AB	Alberta
ALS	ALS Environmental
AMP	Adaptive Management Plan
ANOVA	analysis of variance
BC	British Columbia
MOE	British Columbia Ministry of Environment
BC WQG	British Columbia Water Quality Guideline
$CaCO_3$	calcium carbonate
CCME	Canadian Council of Ministers of the Environment
CETIS™	Comprehensive Environmental Toxicity Information System
DOC	dissolved organic carbon
e.g.	for example
ECx	concentration resulting in x percent effect
EMC	Environmental Monitoring Committee
EMS	Environmental Monitoring Station
EVWQP	Elk Valley Water Quality Plan
Golder	Golder Associates Ltd.
ID	identification
i.e.	that is
ICx	concentration resulting in x percent inhibition
LCx	concentration resulting in x percent lethality
mg	milligrams
mg/L	milligrams per litre
mL	millilitres
mm	millimetres
NaBr	sodium bromide
NaCl	sodium chloride

NO_3-N	nitrate as nitrogen
NTU	Nephelometric Turbidity Units
PCA	principal component analysis
PC1	first principal component identified via principal component analysis
Q1	quarter 1
Q2	quarter 2
Q3	quarter 3
Q4	quarter 4
QA/QC	quality assurance/quality control
RAEMP	Regional Aquatic Effects Monitoring Program
Ref	reference
SD	standard deviation
SDM	standard deviation about the mean
SPO	Site Performance Objective
TDS	total dissolved solids
Teck	Teck Coal Limited
the Permit	Permit #107517 issued under the *Environmental Management Act*
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TSS	total suspended solids
US EPA	United States Environmental Protection Agency
WCT	westslope cutthroat trout
WQ	water quality

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) is pleased to provide Teck Coal Limited (Teck) with the following interpretive report on quarterly and semi-annual chronic toxicity tests undertaken in 2016 for Teck's coal mining operations in the Elk Valley. This study represents the second full year of chronic toxicity testing and interpretation to satisfy legal requirements under permits and associated regulatory approvals.

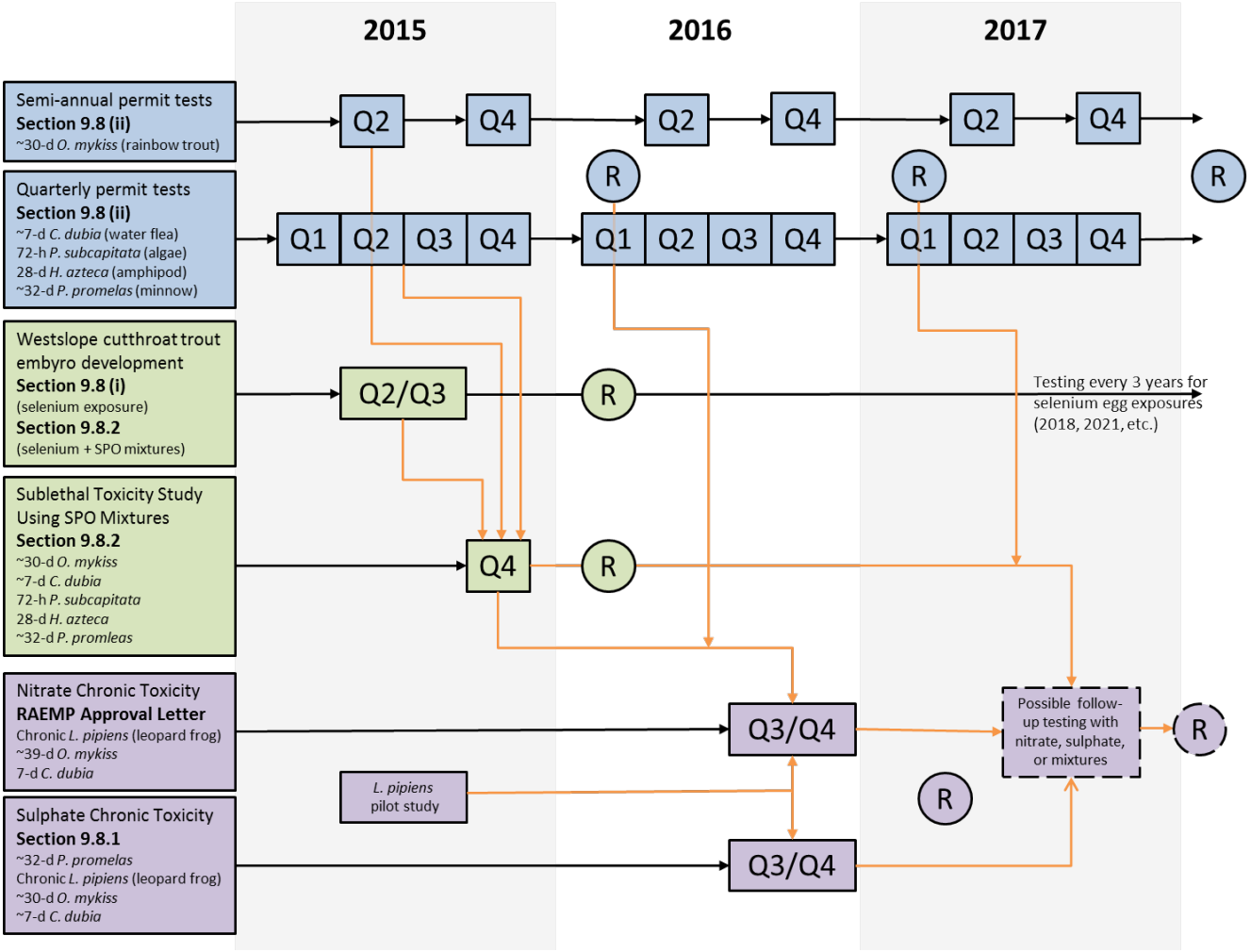
1.1 Context and Background

Requirements for chronic toxicity testing associated with Teck's coal mining operations in the Elk Valley are specified in Section 9.8 of Permit #107517 issued under the *Environmental Management Act* (the Permit) and a 14 November 2014 letter from the British Columbia Ministry of Environment (MOE) approving the study design for the Regional Aquatic Effects Monitoring Program (the RAEMP approval letter). Chronic toxicity testing requirements specified in these documents are summarized in Appendix A.

The chronic toxicity testing program has been organized into three components (Figure 1.1-1), reflecting the underlying objectives of Permit and RAEMP approval letter requirements:

- **Quarterly and Semi-Annual Testing**. This program, depicted in blue in Figure 1.1-1, includes ongoing Permit requirements for periodic testing of water samples at compliance points in the Elk Valley. This subprogram addresses Permit requirements in Section 9.8(ii).
- **Westslope Cutthroat Trout Gamete Study and Sublethal Toxicity Study Using Site Performance Objectives Mixtures**. This supporting study, depicted in green in Figure 1.1-1, includes chronic toxicity tests required to satisfy Permit requirements specified in sections 9.8(i) and 9.8.2. Most of these tests entailed testing of site waters amended to concentrations of nitrate, sulphate, selenium, and cadmium equal to long-term site performance objectives (SPOs) specified in the Permit. Section 9.8(i) testing of westslope cutthroat trout (WCT) gametes was included in this supporting study because the WCT gamete test was conducted both in laboratory water (i.e., testing effects of maternally derived selenium) and with SPO mixture exposures (i.e., testing interactions between maternally derived selenium and waterborne constituents at SPO concentrations). Because the SPO Mixtures portion of this supporting study was completed in 2015 (Golder 2016), future Permit requirements are to Section 9.8(i) testing of WCT gametes, with a requirement to test every three years (i.e., next round scheduled for summer of 2018).
- **Nitrate and Sulphate Toxicity Studies**. This supporting study, depicted in purple in Figure 1.1-1, addresses requirements for additional chronic testing of nitrate and sulphate. Requirements for additional nitrate testing are specified in the RAEMP approval letter and requirements for additional sulphate testing are specified in Permit Section 9.8.1. Both requirements are intended to address residual uncertainty for these substances at high hardness levels. Most of the required additional chronic testing of nitrate and sulphate was completed in the Fall of 2016, based on a study design reviewed by the Environmental Monitoring Committee (EMC).

Figure 1.1-1: Overview of Elk Valley Chronic Toxicity Testing Program



Semi-annual and quarterly chronic testing program (Permit 107517)

WCT egg selenium exposures and SPO mixtures chronic testing program (Permit 107517)

Nitrate and Sulphate chronic testing program (RAEMP approval letter, Permit 107517)

R — Reporting period for chronic testing component(s). For example, the three reports scheduled for Q1 of 2016 summarize the collective information from Q1-Q4 of 2015.

Program continuation per Permit 107517 requirements

Information flow among chronic testing components. Information obtained from earlier studies will be used to inform design details for other components (e.g., choice of sensitive species, replication, stations).

1.2 Linkages to the Water Quality Adaptive Management Plan for Teck Coal in the Elk Valley

As required in Permit 107517 Section 11, Teck has developed an Adaptive Management Plan (AMP) to support implementation of the Elk Valley Water Quality Plan (EVWQP), to achieve water quality targets including calcite targets, ensure that human health and the environment are protected and where necessary restored, and to facilitate continuous improvement of water quality in the Elk Valley. Teck has provided this section of Golder's report in order to provide a consistent approach to describing linkages between Adaptive Management and related programs and reports.

Following an adaptive management framework, the AMP identifies six Big Questions that will be re-evaluated at regular intervals as part of AMP updates throughout the duration of EVWQP implementation. For each Big Question, the AMP describes how the Big Question will be periodically re-evaluated, and how key uncertainties under the Big Question will be reduced.

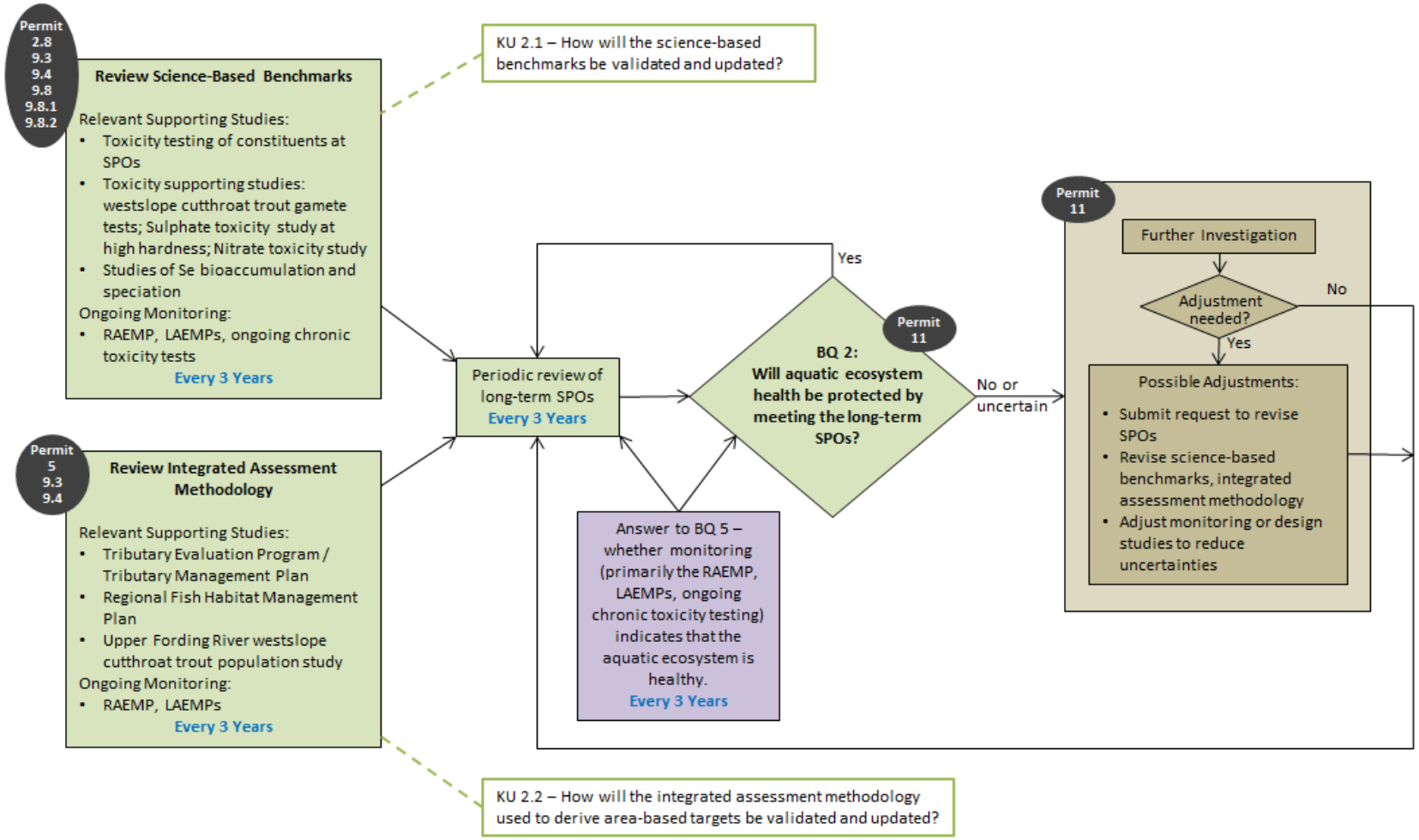
The AMP was submitted to the EMC and MOE Director on 31 July 2016, as required. Study designs for many programs were established before the document was submitted. Teck is working to embed elements of the AMP within each program through reviews of monitoring programs at the study design and annual report stages. As the AMP is currently under review and in the process of being implemented, this is the first cycle where the monitoring programs are being explicitly reviewed to confirm all required monitoring is included. Gaps identified in review of 2016 annual reports will inform study design updates as required.

The chronic toxicity testing program will support Big Question 2 (*"Will aquatic ecosystem health be protected by meeting the long-term SPOs?"*) and Big Question 5 (*"Does monitoring for mine-related effects indicate that the aquatic ecosystem is healthy"*). These questions will be re-evaluated through periodic review to assess whether there is new information indicating that adjustments may be warranted.

Figure 1.2-1 shows inputs and information flow for Big Question 2 and adjustments that work under Big Question 2 would inform. There are two main inputs to the periodic review of long-term SPOs: i) information from supporting studies and ongoing monitoring of science-based environment benchmarks (e.g., chronic toxicity testing); and ii) information from supporting studies and ongoing monitoring related to the integrated assessment methodology (e.g., tributary evaluation program). Review of the long-term SPOs will occur every three years as part of the 3-year AMP update, unless the results of evaluations that support this Big Question (e.g., toxicity testing of constituents at SPOs) indicate that an earlier review is needed. The next 3-year AMP update is scheduled for July 2019. This chronic toxicity interpretive report supports the re-evaluation of Big Question 2 by providing ongoing information and reducing uncertainty related to the relationships between water chemistry and toxicity, and will therefore be directly relevant to ongoing evaluation of the science-based benchmarks under a range of conditions. The information from this report will be reviewed to inform key uncertainty 2.1 ("*How will science based benchmarks be validated and updated?*").

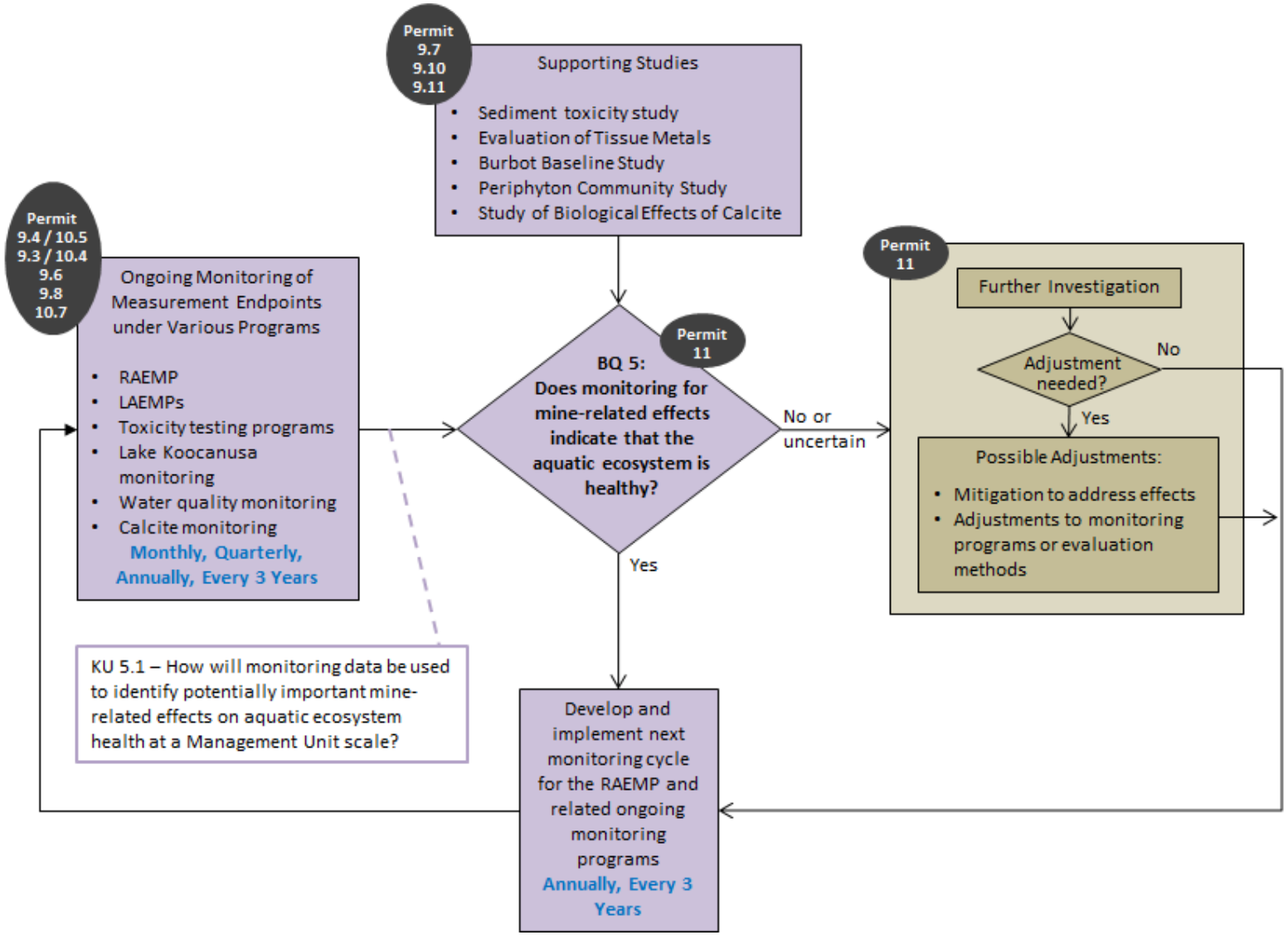
Figure 1.2-2 shows inputs and information flow for Big Question 5 and adjustments that work under Big Question 5 would inform. Routine monitoring under the RAEMP is the main source of information for answering Big Question 5, but other monitoring programs (e.g., chronic toxicity testing) and supporting studies also provide important information. This chronic toxicity interpretive report provides one line of evidence in support of the re-evaluation of Big Question 5 by providing ongoing information on spatial and temporal patterns of chronic toxicity observed in tests conducted with mine-influenced water, and will therefore be directly relevant to ongoing evaluation of the health of the aquatic ecosystem.

Figure 1.2-1: Overview of Elk Valley Chronic Toxicity Testing Program Linkages to Big Question 2



Note: Figure is from Teck 2016a (Figure 9).

Figure 1.2-2: Overview of Elk Valley Chronic Toxicity Testing Program Linkages to Big Question 5



Note: Figure is from Teck 2016a (Figure 18).

1.3 Objectives

The purpose of this interpretive report is to present the results from 2016 chronic testing, interpret test results by evaluating correspondence between water chemistry and toxicological responses, and identify recommendations for revision or augmentation of planned future programs. This report is submitted to meet the chronic toxicity related requirements of Permit 107517 Section 10.2.4 (v) (date amended May 26, 2016).

1.4 Incorporating Feedback from the Environmental Monitoring Committee

Several pieces of feedback provided by EMC members on the 2015 chronic toxicity interpretive report (via written feedback and subsequent discussions during the 14 February 2017 conference call) were incorporated into the 2016 chronic toxicity interpretive report. Changes made in response to feedback were:

- Consideration of control normalization to reduce or eliminate variation in test responses related to variable test organism performance among test batches (Section 2.3.2).
- Consideration of seasonal variability in reference water responses when developing a pooled reference response envelope (Section 2.3.2).
- Developing a pooled reference response envelope based on the mean and variability of mean reference responses rather than the mean and variability of individual test replicates (Section 2.3.2).
- Use of principal component analysis (PCA) to develop a metric characterizing overall mine influence on water quality for correlation with response variables (Section 2.3.4).

1.5 Report Organization

The remaining sections of this report present the methods (Section 2.0), results (Section 3.0), uncertainty assessment (Section 4.0), summary of findings (Section 5.0), and recommendations (Section 6.0) for the 2016 quarterly and semi-annual chronic toxicity testing program.

2.0 METHODS

2.1 Field

Water samples were collected from reference locations upstream of mining and test sites downstream of mining, as shown in Table 2.1-1. Water samples were submitted to Nautilus Environmental (Nautilus; Burnaby, BC and Calgary, AB) for toxicity testing (Section 2.2) and to ALS Environmental (ALS; Burnaby, BC) for chemical analysis. Weekly refresh samples were collected for toxicity tests longer than 7 days. Water collection dates and maps of reference and test sites are provided in Appendix B.

Table 2.1-1: Reference Locations and Tests Sites used in the Quarterly and Semi-Annual Toxicity Testing

Watercourse	Reference or Test Site	Teck WQ Station ID[(a)]	EMS Location ID	Station Name
Fording River	Reference	FR_UFR1	E216777	Fording River upstream of Henretta Creek
	Test Site	FR_FRCP1	E300071	Fording River downstream of Cataract Creek
		GH_FR1	200378	Upper Fording River downstream of Josephine Falls [Order Station FR4]
Elk River	Reference	GH_ER2	200389	Elk River upstream of Greenhills Operations
	Test Site	GH_ERC	E300090	Elk River downstream of Thompson Creek
Michel Creek	Test Site	CM_MC2	E258937	Michel Creek upstream of Andy Goode Creek
		EV_MC2	E300091	Michel Creek at Highway 3 Bridge
Harmer Creek		EV_HC1	E102682	Harmer Spillway at Elk Valley Operations
Line Creek		LC_LCDSSLCC	E297110	Line Creek downstream of South Line Creek

(a) Stations are listed from upstream to downstream for each watercourse.

2.2 Laboratory

Test organisms and procedures used in the quarterly and semi-annual testing program followed requirements outlined in Permit Section 9.8(ii). An overview of this program is provided in Table 2.2-1. Laboratory reports for each round of quarterly and semi-annual testing are provided in Appendix B, including detailed methodology, raw data, laboratory notes, quality assurance overview, and statistical significance tests, per protocol requirements.

Table 2.2-1: Summary of Quarterly and Semi-Annual Toxicity Tests

Test Species	Test Duration [days]	Endpoint(s)	Test Protocol	Number of Replicates per Test	Frequency of Testing
Water flea—*Ceriodaphnia dubia*	7 ± 1	Survival and reproduction	Environment Canada (2007a)	10	Quarterly
Green alga—*Pseudokirchneriella subcapitata* (formerly *Selenastrum capricornutum*, reclassified as *Raphidocelis subcapitata*)	3	Cell yield (growth inhibition)	Environment Canada (2007b)	8 (references and laboratory control); 4 (test sites)	Quarterly
Rainbow trout—*Oncorhynchus mykiss*	30	Survival, viability (which assesses incidence of deformities), length, weight, behaviour[(a)]	Environment Canada (1998) embryo-alevin test	4	Semi-annual
Amphipod—*Hyalella azteca*	28	Survival and growth	Modified from US EPA (2000), as described in Norberg-King et al. (2014)	5	Quarterly
Fathead minnow—*Pimephales promelas*	28 days post-hatch[(b)]	Survival, hatch, length, biomass, normal development	US EPA (1996) and ASTM (2013)	4	Quarterly[(c)]

(a) Permit 107517 also includes hatching as an endpoint. Hatch rate is not part of the Environment Canada (1998) protocol. However, the survival endpoint provides an appropriate measure of successful hatch, since the test is terminated shortly following hatch (Appendix B).

(b) Test duration is from <24 hour eggs until the organisms reach 28 days post-hatch. Total test duration is usually between 30 and 32 days (James Elphick, pers. comm.).

(c) P. promelas tests in Q1, Q2, Q3, and Q4 were conducted using both untreated and copper-amended samples (Appendix B).

Table 2.2-2 summarizes the number of tests conducted in 2016 for each test species and location. Following Permit requirements, quarterly (*Ceriodaphnia dubia* and *Pseudokirchneriella subcaptiata*) and semi-annual (*Oncorhynchus mykiss*) chronic toxicity tests were conducted using water collected from all non-reference locations listed in Table 2.1-1. The Fording River reference site (FR_UFR1) and Elk River reference site (GH_ER2) were incorporated by Teck to provide information on responses in Elk Valley waters for samples upstream of the zone of mine influence. The Fording River reference site (FR_UFR1) was tested in all four quarters, whereas the Elk River reference site (GH_ER2) was tested in Q2 and Q4. Quarterly toxicity tests with *Hyalella azteca* and *Pimephales promelas* were conducted at a subset of locations per Permit requirements. These two tests were performed in all four quarters using water collected from the Fording River reference (FR_UFR1) and three test sites (CM_MC2, FR_FRCP1, GH_FR1). Laboratory control water tests were also conducted for each species and test date, as specified in Appendix B.

Pimephales promelas tests in 2016 were conducted in both non-amended water and in copper-amended water. Copper-amended water was used to curtail growth of microbes in site water, as discussed in Appendix B. Per discussions with EMC[1] and subsequent approval by MOE[2], non-amended *P. promelas* test results are not included in the statistical analysis of quarterly chronic toxicity test result due to their unreliability for assessing toxicant-based responses. Results for non-amended water are provided in Appendix B. Results of tests

[1] EMC conference call on 30 November 2016; summary of the conference call is provided in Teck (2016b).

[2] MOE (2016). Letter to Teck Coal Limited. Re: Copper amendment for microbial control in the Fish Early-Life Stage Toxicity Test. 23 December 2016.

conducted subsequent to the MOE approval continue to support the appropriateness of the 10 µg/L copper amendment to fathead minnow toxicity tests; for example, the nitrate and sulphate testing in December 2016 (Appendix D) indicated that microbial responses to survival and biomass endpoints were removed through copper amendment without introducing chemical toxicity to this species.

Table 2.2-2: Summary of Quarterly and Semi-Annual Tests Conducted in 2016 [a,b,c]

Watercourse	Reference or Test Site	Teck WQ Station ID	*C. dubia*	*P. subcapitata*	*O. mykiss*	*H. azteca*	*P. promelas* [c]
Fording River	Reference	FR_UFR1	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4	Q2, Q4	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4
	Test Site	FR_FRCP1	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4	Q2, Q4	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4
		GH_FR1	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4	Q2, Q4	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4
Elk River	Reference	GH_ER2	Q2, Q4	Q2, Q4	Q2, Q4	-	-
	Test Site	GH_ERC	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4	Q2, Q4	-	-
Michel Creek	Test Site	CM_MC2	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4	Q2, Q4	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4
		EV_MC2	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4	Q2, Q4	-	-
Harmer Creek		EV_HC1	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4	Q2, Q4	-	-
Line Creek		LC_LCDSSLCC	Q1, Q2, Q3, Q4	Q1, Q2, Q3, Q4	Q2, Q4	-	-
Total number of tests per species			34	34	18	16	16

(a) Stations are listed from upstream to downstream for each watercourse.

(b) One test was conducted per test species, quarter, and station (i.e., each Q in this table represents one test). Q1 = quarter 1; Q2 = quarter 2; Q3 = quarter 3; Q4 = quarter 4. "-" indicates that the test is not required under Permit 107517.

(c) *P. promelas* tests in Q1, Q2, Q3, and Q4 were conducted using both untreated and copper-amended samples (Appendix B).

2.3 Data Analysis

2.3.1 Quality Assurance

Laboratory reports for each round of quarterly and semi-annual testing include a quality assurance section (Appendix B). Quality assurance information was reviewed and summarized to establish that organism performance in the laboratory control water met the acceptability criteria for the protocol, as it pertains to the health histories and sensitivity of the organisms, and that no deviations from the test procedures occurred that would influence the reliability of the data.

2.3.2 Evaluation of Sources of Variance in Test Water Results

Responses observed in test waters are subject to several sources of variance, including variation in test organism performance, variation in test organism sensitivity to toxicants, variation in background water quality characteristics (e.g., environmental and toxicity modifying factors; environmental and toxicity modifying factor) and their effect on test responses, variation in concentrations of toxicants in test waters, and other random inter-individual variability that manifests as experimental 'noise'. One of the objectives of the quarterly and semi-annual interpretive report is to identify toxicological responses and distinguish these responses from other sources of variance; the ability to detect a true toxicological response is improved when confounding effects of the other sources of variance are minimized. Therefore, the following sections outline the approach used to evaluate and address the first three sources of variance. The approach used to evaluate toxicity is described in Sections 2.3.3 and 2.3.4.

Organism Performance

To evaluate whether temporal variation in test organism performance (batch sensitivity) was a potential confounding factor, mean responses in reference waters were plotted in comparison to the paired batch-specific laboratory control for each test species and endpoint. For *P. promelas*, responses in reference waters were plotted in comparison to the copper-treated laboratory control. Correlation coefficients were calculated for the Fording River and Elk River references separately and for both references combined. Endpoints with strongly correlated reference and control results were considered to reflect batch-specific variance in test organism performance. If responses were strongly correlated for an endpoint, then all response data for that endpoint (including reference waters and test waters) were control-normalized[3] before performing subsequent data analyses. The objective of control normalization was to use control responses to reduce or eliminate variation in test organism performance among test batches, such that the ability to detect a true toxicological response between test site waters and reference waters is improved.

Organism Sensitivity

To evaluate whether temporal variation in test organism sensitivity was a potential confounding factor, reference toxicant test data were summarized from laboratory reports and compared across test batches. For each test species and endpoint, effect concentrations from reference toxicant tests were expressed as a percentage of the historical mean reference toxicant effect concentration and plotted for visual examination. Values greater than 100% indicate that organisms in that batch are less sensitive relative to the historical mean, whereas values less than 100% indicate organisms are more sensitive relative to the historical mean. Observations of organism sensitivity were considered qualitatively in the evaluation of test results to assess whether variation in test responses might be confounded by variation in test organism sensitivity among test batches.

Background Conditions

To evaluate whether temporal or spatial variation in background water quality and its effect on test responses might be a confounding factor, statistical and qualitative methods were used to develop reference envelopes for mean responses for each endpoint; then evaluated whether these envelopes varied across years, quarters, or sites. Reference envelopes were developed for all test endpoints. The pooled reference response envelope is one of several tools used in the evaluation of test results, as described in the following section. The approach used herein to develop reference envelopes, as well as the envelopes themselves, are based on findings to date. The approach and reference envelopes developed herein are expected to undergo refinement with future chronic toxicity testing results.

Reference envelopes were developed using the 2015 and 2016 quarterly results from Elk River and Fording River reference tests. Two-way or three-way analysis of variance (ANOVA) was used to evaluate the effect of each categorical factor (i.e., year, quarter, and site) and their interactions on test endpoints.[4] For some endpoints, assumptions of the ANOVA related to normality and homogeneity of error variance were not strictly met, indicating a potential increase in the Type I error rate (i.e., an increased chance of a false positive result),

[3] $control - normalized\ response = \left(\frac{site\ water\ response}{control\ response}\right) \times 100$

[4] For *C. dubia* and *P. subcapitata*, the Fording River reference water was tested in all quarters and the Elk River reference was tested in Q2 and Q4, per Permit requirements. Therefore, two ANOVAs were conducted (one ANOVA with Fording River and Elk River Q2 and Q4 data, and one ANOVA with Fording River data for all quarters).

although ANOVA is generally considered to be robust to violations of these assumptions and the effect on error rate is expected to be small. Results of these analyses were still considered to be useful for the overall purpose of the ANOVA to inform a practical level of pooling. Responses in reference waters tested in 2015 and 2016 were also plotted for visual assessment.

If there was no significant effect of categories or their interactions on the endpoint ($p > 0.05$), responses from all reference tests were considered suitable for pooling and a single reference envelope was developed for that endpoint (i.e., it was concluded that variation in background water quality was not an important confounding factor). If the two-way or three-way ANOVA indicated a significant effect of one or more categorical factors or interactions, then statistical and qualitative methods were used to develop a practical level of pooling. First, responses were visually assessed to identify tests that appeared to have unusually high or low responses relative to other reference tests. A one-way ANOVA was then conducted with individual tests as the categorical factor. Results of the one-way ANOVA were used to identify groups of test batches that were suitable for pooling based on having similar reference test responses. Reference envelopes were only developed if the ANOVA and post-hoc analysis identified a small number (one or two) of logical groupings of test batches that addressed a systematic effect of year or quarter. More complex variation among test batches was interpreted to mean that no practical pooling across batches is possible at this time, and that the most reliable basis for interpreting test water responses is by comparison to batch-specific reference tests.

Tests identified as being suitable for pooling were used to calculate a pooled mean reference response. The grand mean (i.e., the mean of individual test means) and variability in mean reference responses (± 2 standard deviations of the grand mean) was calculated for each test endpoint. Thus, the approach used herein differed from that used in the 2015 interpretive report (Golder 2016) by describing the normal variability of *mean* reference responses, rather than describing the normal variability of individual replicate responses. Development of separate reference envelopes for groups of batches with distinct reference test results was intended to address potential confounding effects of background water quality and its effect on test responses.

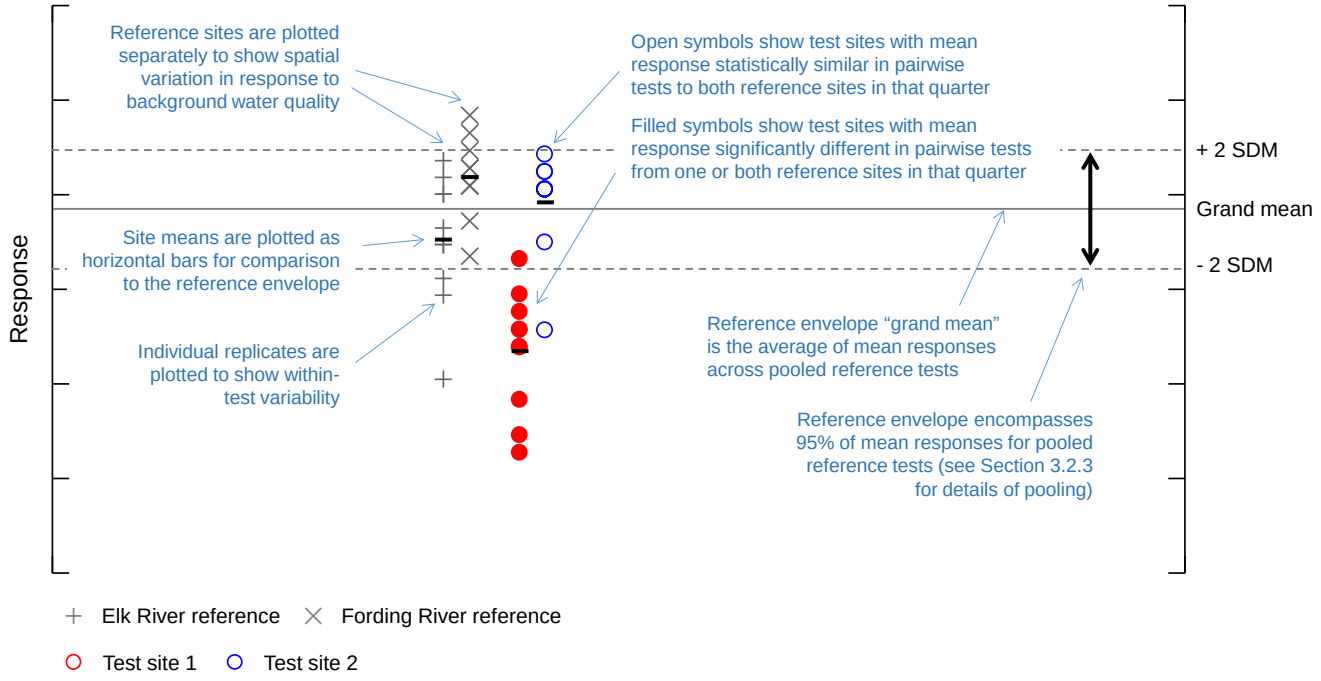
2.3.3 Evaluation of Test Results

The results of each test were statistically compared to the Fording River reference (Q1 to Q4) and Elk River reference (Q2 and Q4) to assess whether significant adverse responses could be detected. Each quarterly laboratory report includes statistical analyses using CETIS™ (Comprehensive Environmental Toxicity Information System; Tidepool Scientific Software 2013) to identify test sites with mean results significantly ($p < 0.05$) lower than the mean response in associated Fording or Elk River reference waters.[5]

Individual replicate and mean results for all endpoints were plotted. The pooled mean and variability in reference responses (± 2 standard deviations) developed using the approach described in the previous section were shown on these plots to illustrate the normal range of test organism responses observed in Fording River and Elk River reference waters tested in 2015 and 2016. Figure 2.3-1 shows an example data plot with annotation to explain how data plots were interpreted in Section 3.3.

[5] Q2 *C. dubia* and *P. subcapitata* tests in LC_LCDSSLCC water were reported under a separate reporting program in which CETIS significance tests were not presented. For these tests, responses were compared to reference waters using *t*-tests (if assumptions of normality and equality of variances were met) or Mann-Whitney U tests with Conover Inman post-hoc multiple comparisons (if assumptions were not met).

Figure 2.3-1: Example data plot.



Test results were interpreted as follows:

- Tests with mean endpoint results not significantly lower than both references were not considered to reflect an adverse response.
- Tests with mean endpoint results significantly lower than one but not both references and/or within the reference envelope (i.e., within 2 standard deviations of the associated pooled reference mean) if a reference envelope was calculated, were considered to represent a possible adverse response, with elevated uncertainty. There is uncertainty regarding whether the result represents an adverse response to toxicants in the test water or rather reflects variance in test organism performance related to background water quality. For example, statistically significant effects in some cases appeared to be the result of atypically low variability (assessed qualitatively, relative to variability observed in other quarterly tests) in the paired reference water test; in these cases, the low variability led to a small difference in test organism performance being identified as statistically significant.
- Tests with mean endpoint results significantly lower than both references (or one if only one was tested in that quarter) and outside the reference envelope if a reference envelope was calculated were considered to represent a likely adverse response to the test water.

2.3.4 Concentration-Response Analysis

A concentration-response analysis was conducted to examine potential causes of adverse responses observed in 2016 quarterly and semi-annual tests. Methods used in the concentration-response analysis are summarized in Figure 2.3-2. Additional details are provided below.

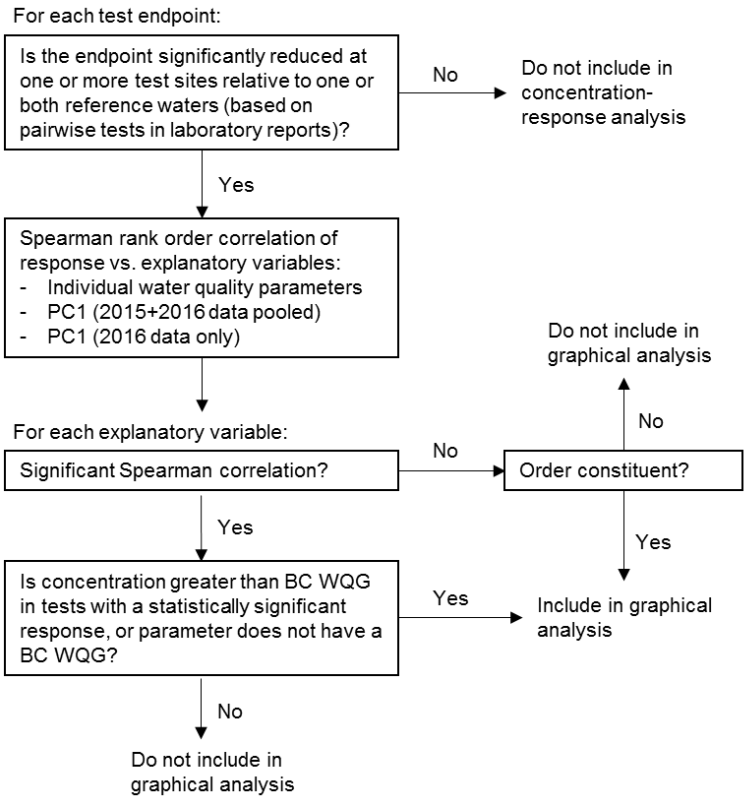
The analysis was conducted for all endpoints identified in the laboratory reports as being significantly reduced relative to the Fording or Elk River reference waters (i.e., including both possible and likely adverse responses, as described above). Although correlation does not necessarily indicate causation, the analysis of correspondence between test results and water quality may provide insight into potential causes. The correlation analysis included all 2015 and 2016 quarterly and semi-annual test results for reference locations and test sites.

To conduct the correlation analysis, effects data were paired with matching water chemistry data. The selection of matched (concurrent and co-located) chemistry data depended on the duration of the test, as some tests entailed multiple measurements of chemical parameters. *Ceriodaphnia dubia* and *P. subcapitata* tests, conducted using water collected on a single day, were paired with water chemistry collected on that day. For other test species, effects data were paired with the mean concentration of the weekly submitted samples collected over the duration of the test. If a concentration was below the reported detection limit, the full detection limit was used.

The examination of potential causes of responses in the quarterly and semi-annual tests followed three steps:

- Spearman rank order correlation
- Screening against water quality guidelines and/or site-specific or published toxicity data
- Graphical concentration-response analysis

Figure 2.3-2: Decision framework for inclusion of endpoints and parameters in the concentration-response analysis.



Spearman rank order correlations were conducted using paired response and water chemistry data from all reference and test sites. Total concentrations were used for metals that have a chronic British Columbia water quality guideline (BC WQG) for the total fraction (e.g., copper) or that lack a chronic BC WQG (e.g., lithium). Dissolved concentrations were used for metals with a chronic BC WQG for the dissolved fraction (e.g., cadmium).

Correlations were also conducted using responses paired with the first principal component identified via PCA of water quality data. The objective of this analysis was to test whether responses could be explained by an overall indicator of mine water influence on water quality, in addition to testing individual water quality parameters. PCA is a multivariate analysis technique used to describe patterns of inter-correlations among variables of interest. It calculates dominant components of variance from a matrix of chemical variables. These components reduce the multidimensional nature of the data while retaining much of the information from the original variables. Because the first principal component (PC1) accounts for the largest proportion of variance in the original dataset, PC1 scores were used in the Spearman rank correlation as an overall indicator of mine water influence on water quality. The percent of variance explained by PC1 is provided for each endpoint in Section 3.4. Water quality variables were $\log_{10}$ transformed prior to conducting the PCA. PCA was conducted with the 2016 water quality dataset only and with the pooled 2015 and 2016 water quality datasets.

Parameters with significant correlations with a test response ($p < 0.05$) were carried forward to screening against BC WQGs and/or toxicity data. PC1 scores with significant correlations with a test response ($p < 0.05$) were carried forward to the graphical analysis.

For parameters with significant correlations, concentrations in tests with a statistically significant response (relative to either reference water) were screened against chronic BC WQGs. Parameters with concentrations lower than the chronic BC WQG were not carried forward. If the concentration was greater than a chronic BC WQG or if the parameter did not have a chronic BC WQG, then the parameter was carried forward to the graphical analysis.

Graphical analysis was conducted for all Order constituents (cadmium, selenium, nitrate, sulphate), and for all other constituents that had statistically significant correlations and that were either greater than a chronic BC WQG or did not have a chronic BC WQG (i.e., met the first two conditions). PC1 scores with statistically significant correlations were also included in the graphical analysis as a combined indicator of exposure to mine-affected water. To evaluate parameters that lack a chronic BC WQG but that are commonly assessed as a component of total dissolved solids (TDS) (e.g., calcium), responses were plotted against the concentration of TDS. Concentration-response plots were visually examined to assess the consistency of correspondence between parameter concentrations and test responses. Water chemistry associated with each statistically significant response was also inspected to identify parameters that may have contributed to the observed response in that test. If the concentration of a parameter in a test with a statistically significant response was lower than concentrations measured in tests that did not have statistically significant results, then that parameter was considered unlikely to be causing toxicity.

2.3.5 Comparison of 2015 and 2016 Quarterly Test Results

Similarities and differences between test results in the 2015 program and 2016 program were summarized, focusing on the incidence of adverse responses by season and sampling location. The purpose of this comparison was to identify potential seasonal patterns (i.e., were adverse responses observed in the same

quarter and test species in 2015 and 2016) and to evaluate consistencies in the concentration-response analysis (i.e., were adverse responses attributed to the same constituents in 2015 and 2016). The repeatability of toxicity responses (or lack thereof) in samples tested under similar water quality conditions among years was used as a line of evidence in evaluating whether observed responses are likely to reflect test organism sensitivity to toxicants or some other source of variance.

3.0 RESULTS

3.1 Quality Assurance/Quality Control

Detailed laboratory quality assurance/quality control (QA/QC) information is provided in the Nautilus reports (Appendix B). The following bullets summarize QA/QC information for all quarterly and semi-annual tests:

- Health histories of the test organisms used in the exposures were acceptable and met requirements of the test protocols.
- Water quality parameters remained within ranges specified in the protocol throughout the tests, except the Q4 *P. promelas* FR_UFR1 test (Fording River reference). Survival and biomass endpoints in the copper-amended Fording River site control were significantly lower than the copper-amended laboratory control. The adverse effect observed on survival and biomass in this sample was primarily related to mortalities that occurred in the final 24 hours of the test; survival on day 31 of exposure was 85 ± 10% (which was not statistically different from the control), but was 53.3 ± 9.4% the following day in this sample. Dissolved oxygen measured in the sample on the final day of the test was 5.7 milligrams per litre (mg/L), which was lower than the typical dissolved oxygen level observed in the test, although within the protocol-specified acceptable range for this species. It is possible that stress associated with depressed dissolved oxygen contributed to the adverse effect (Appendix B-4).
- Tests met all control acceptability criteria, except for the Q1 *P. promelas* copper treated test. Survival rate in the copper treated laboratory control was 56.7%, which is below the minimum post hatch survival of 70% specified by the test method. The Q1 copper amendments were conducted prior to the establishment of the 10 micrograms per litre [µg/L] concentration; instead, 20 µg/L was added to test water to curtail microbial growth in the site water tests. Reduced survival in this test is likely related to the addition of copper. Because the copper treated laboratory control did not meet the acceptability criteria, Q1 results for *P. promelas* were not considered further herein[6]. Exclusion of the Q1 results is not expected to affect the overall interpretation for *P. promelas* quarterly results because there were no adverse effects for this species in Q1 relative to the copper-treated Fording River reference (Appendix B-1).
- There were no deviations from the test methodologies, except the following:
  - Planned modification to the *H. azteca* method—All site waters were supplemented with 25 mg/L chloride and 0.02 mg/L bromide using NaCl and NaBr according to recommendations of the *Hyalella* Advisory Group (chaired by Chris Ingersoll, United States Geological Survey) (Norberg-King et al. 2014) because low concentrations of these halides are known to impair growth of this species (Appendix B).

[6] Exclusion of the Q1 *P. promelas* results was discussed at the EMC conference call on 30 November 2016.

- Planned modification to the *P. promelas* tests—*P. promelas* tests were conducted on untreated samples and following the addition of copper (20 µg/L in Q1; 10 µg/L in Q2 to Q4) to reduce potential adverse effects caused by fungi and microbes in the samples (Appendix B). Unamended and copper-treated laboratory control results were similar in Q2, Q3, and Q4 (Appendix B-2, B-3, B-4).
- Q4 *O. mykiss* test—Eggs were fertilized with milt pooled from two males rather than four as specified in the method, because the remaining samples of milt provided by the hatchery exhibited poor motility. The control met the acceptability criterion, indicating that the eggs were successfully fertilized and therefore this minor deviation is not expected to have affected test results (Appendix B-4).

- Results of reference toxicant tests fell within the acceptable range for organism performance of mean and two standard deviations based on historical results obtained by the laboratory (i.e., sensitivity of organisms used in the tests was acceptable), except the following:
  - Q1 *C. dubia* test—The *C. dubia* reference toxicant result for survival (LC_{50} = 1.8 g/L NaCl) was below the warning limit of two standard deviations of the historical mean (LC_{50} = 1.9 to 2.2 g/L NaCl), but was within three standard deviations of the historical mean. This level of divergence from a long-term mean is expected to occur by chance alone in 5% of cases (Appendix B-1).
  - Q4 *P. promelas* test—The result for survival in the *P. promelas* reference toxicant test (LC_{50} = 0.6 g/L NaCl) was marginally outside the historical two standard deviation range (LC_{50} = 0.7 to 0.8 g/L NaCl); this is expected to occur by chance alone in 5% of cases. Moreover, the result for biomass in this reference toxicant test fell within the historical two standard deviation range, indicating that the fish were of acceptable sensitivity. Consequently, the results from this reference toxicant test were considered to be acceptable (Appendix B-4).
- In Q3, growth results for *P. promelas* were identified as being anomalously high for one replicate in the copper-amended test (FR_FRCP1 replicate C). Fish in this replicate were re-weighed after removal from the weigh pans, since it was suspected that the pan weights may have been recorded incorrectly; data for these replicates were excluded from the statistical analysis because they were handled differently from other test replicates (Appendix B-3).

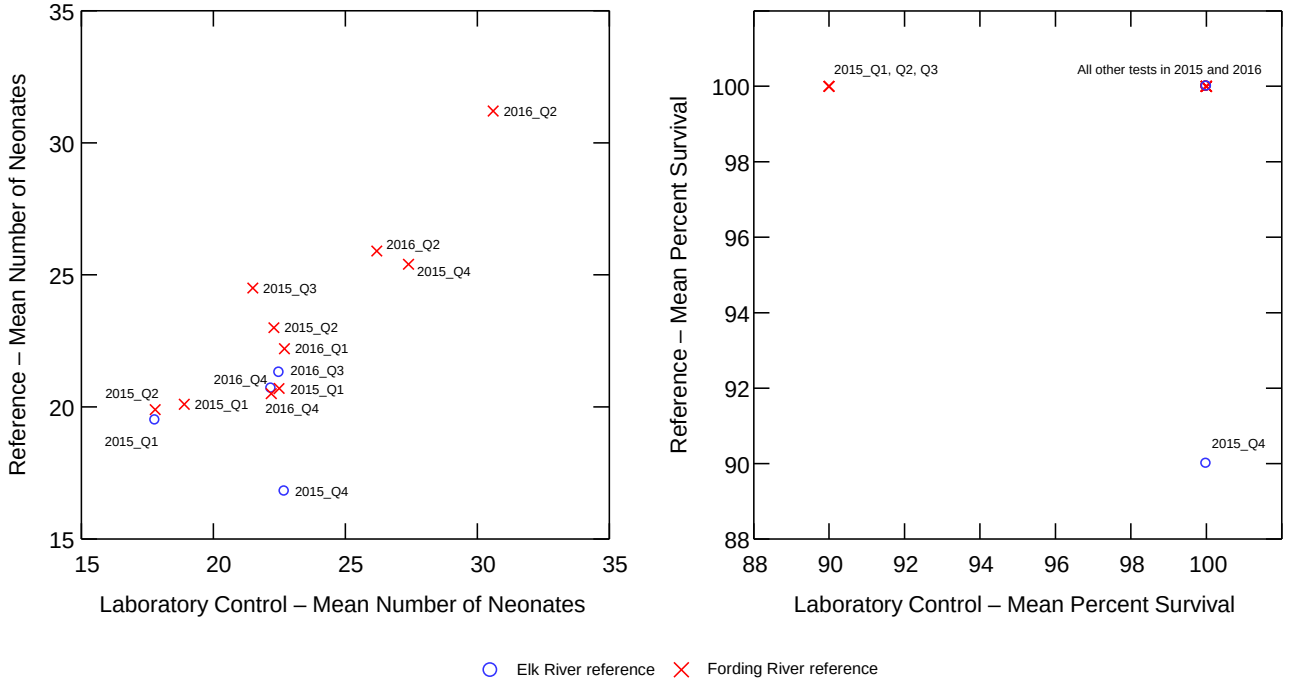
3.2 Sources of Variance in Test Waters

3.2.1 Organism Performance

Endpoints with positively correlated reference and control results were considered to reflect batch-specific variance in test organism performance that could be reduced by control-normalization, such that the ability to detect a true toxicological response is improved. Mean responses in reference waters tested in 2015 and 2016 are plotted against the mean response in the paired laboratory control test for *C. dubia* (Figure 3.2-1), *P. subcapitata* (Figure 3.2-2), *H. azteca* (Figure 3.2-3), *O. mykiss* (Figure 3.2-4), and *P. promelas* (Figure 3.2-5). Table 3.2-1 includes a description of these figures, correlation coefficients relating reference water results to the paired laboratory control, and rationales for decisions on control-normalization for each test species and endpoint.

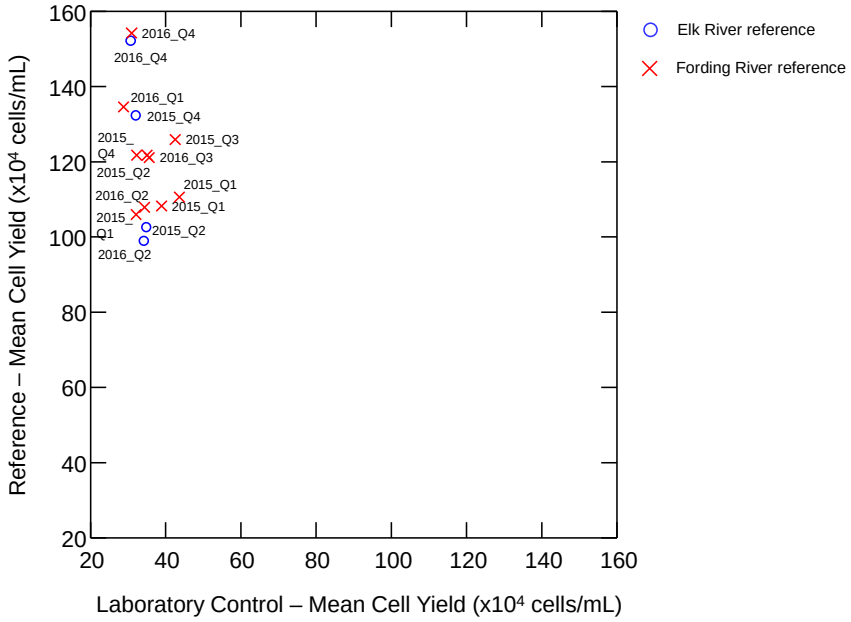
Based on the rationale provided in Table 3.2-1, the following endpoints were control normalized for subsequent analyses: *C. dubia* reproduction, *H. azteca* dry weight, all four *O. mykiss* endpoints, and *P. promelas* length and biomass. The strongest evidence for batch sensitivity was observed for the *C. dubia* reproduction endpoint, where significant statistical correlation between laboratory and reference endpoint results was observed (Figure 3.2-1). The *P. subcapitata* cell yield endpoint yielded substantially different test performance in laboratory negative controls and reference waters; this phenomenon is commonly encountered due to the beneficial effect of nutrients in natural waters relative to laboratory control water (Appendix B).

Figure 3.2-1: Mean results for C. dubia reproduction (left) and survival (right) in laboratory control and reference waters tested in 2015 and 2016.



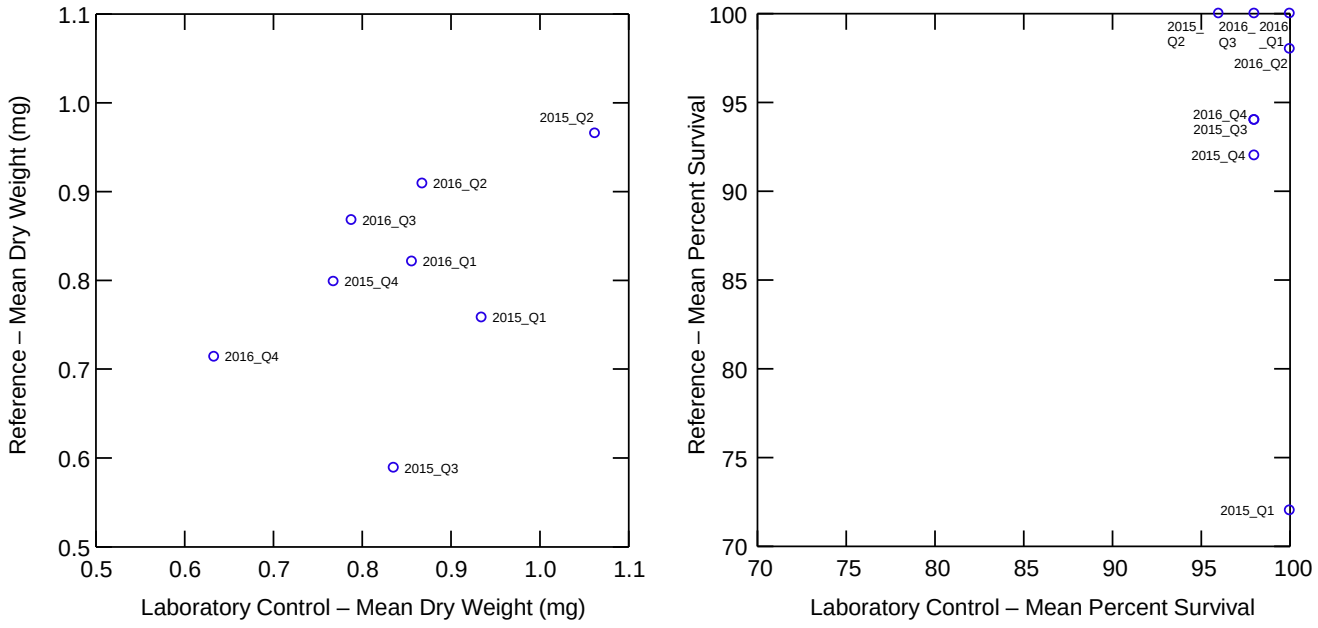
Note: Correlation coefficients are provided in Table 3.2-1.

Figure 3.2-2: Mean results for P. subcapitata cell yield in laboratory control and reference waters tested in 2015 and 2016.



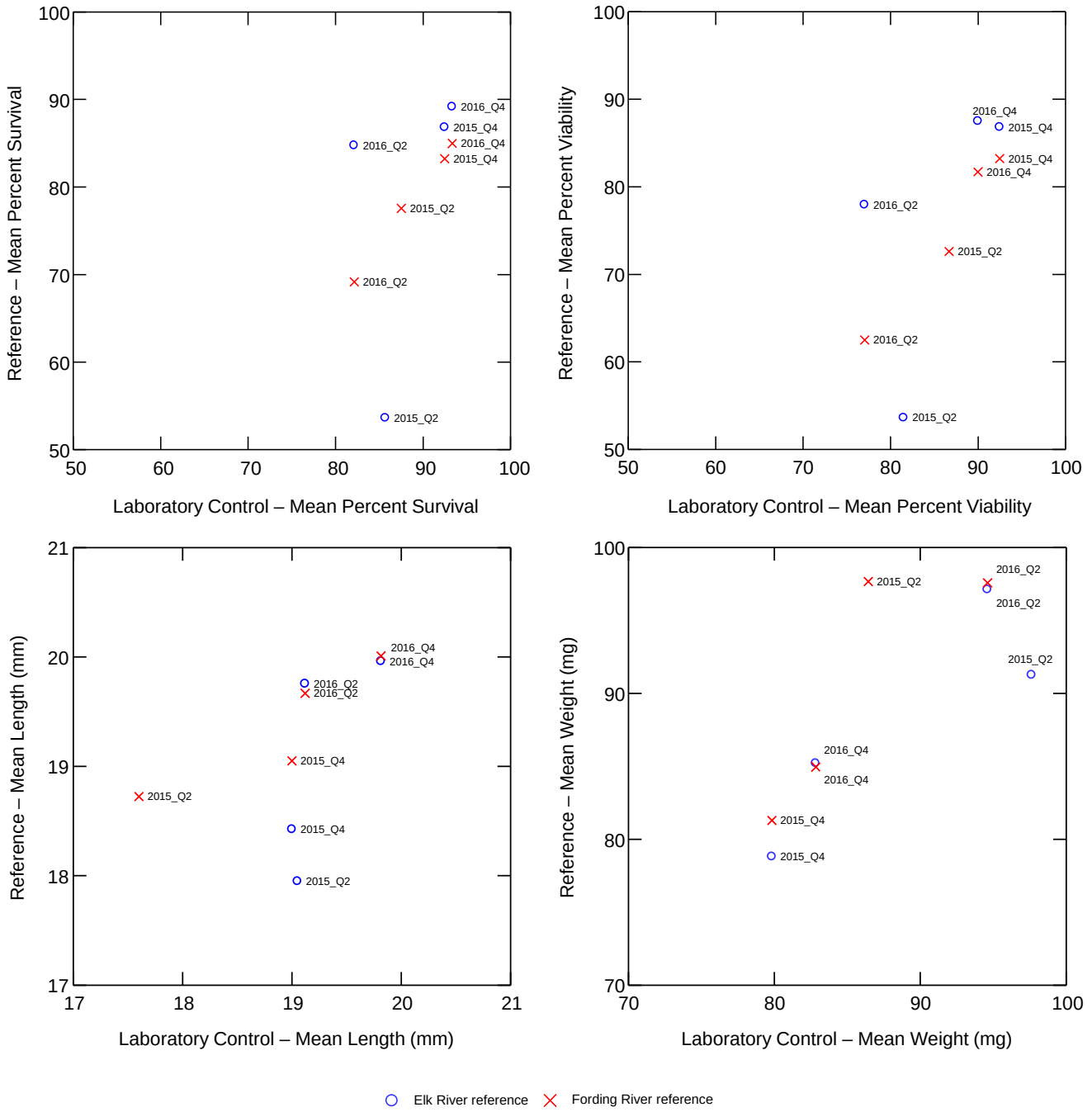
Note: Correlation coefficients are provided in Table 3.2-1.

Figure 3.2-3: Mean results for H. azteca growth (left) and survival (right) in laboratory control and Fording River reference waters tested in 2015 and 2016.



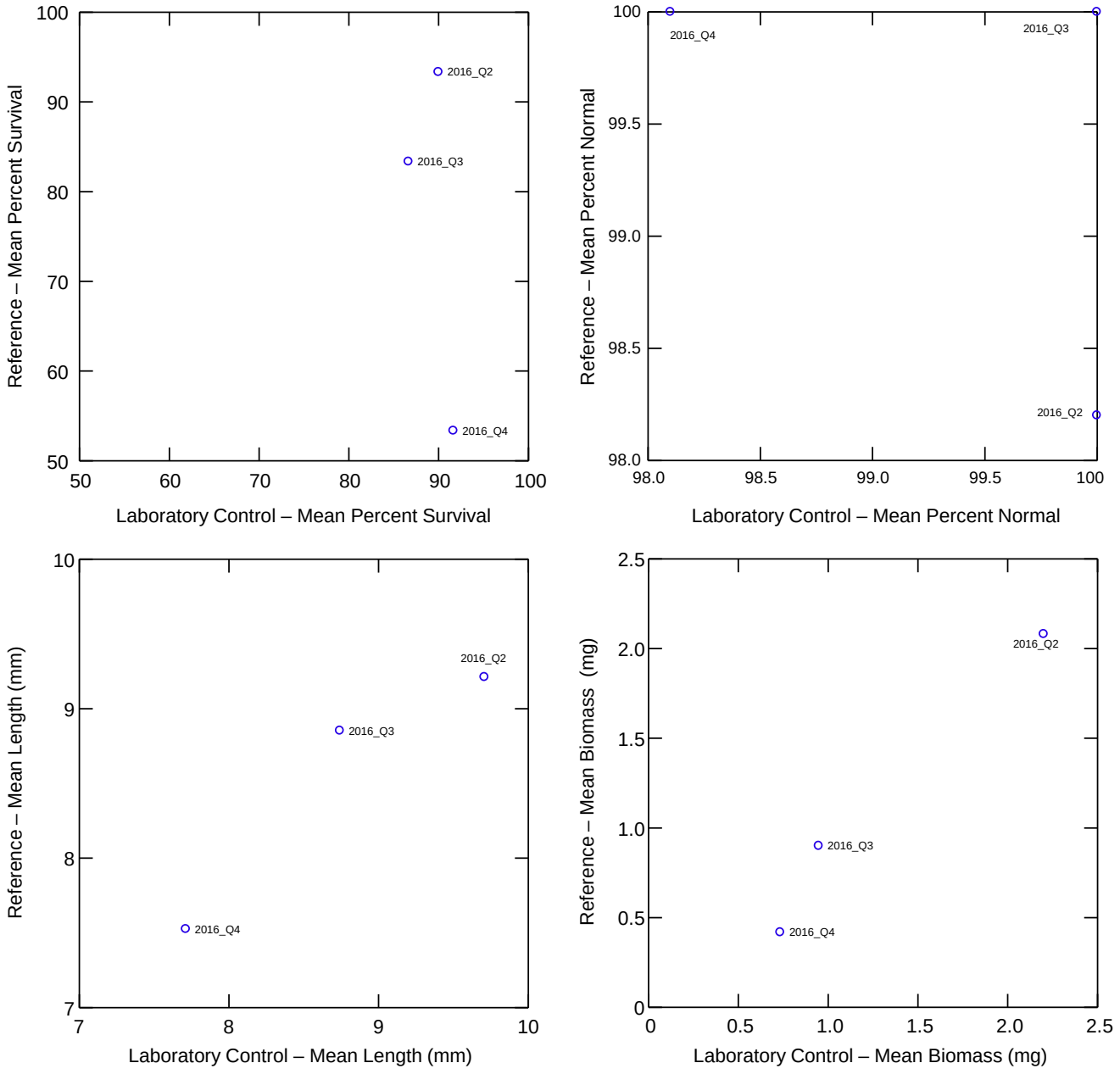
Note: Correlation coefficients are provided in Table 3.2-1.

Figure 3.2-4: Mean results for O. mykiss survival (top left), viability (top right), length (bottom left), and weight (bottom right) in laboratory control and Fording River reference waters tested in 2015 and 2016.



Note: Correlation coefficients are provided in Table 3.2-1.

Figure 3.2-5: Mean results for P. promelas survival (top left), normal development (top right), length (bottom left), and weight (bottom right) in laboratory control and Fording River reference waters tested in 2016.



Note: Hatch endpoint not shown. Hatch was 100% in laboratory control and reference waters in Q2 and Q4. In Q3, hatched was 98% in the reference and 92% in the control. Q1 data not shown based on rationale provided in Section 3.1. Correlation coefficients are provided in Table 3.2-1.

Table 3.2-1: Correlation Coefficients between Control and Reference Responses for Quarterly and Semi-Annual Toxicity Test Endpoints

Test Species	Endpoint	Correlation Coefficient (r^2)			Interpretation
		Elk River	Fording River	Combined	
C. dubia	Reproduction	<0.01	0.81	0.64	Reproduction in Fording River reference water tests was positively correlated with responses observed in the paired laboratory control test. The lack of correlation observed for Elk River is related to one test (Q4 2015). Reproduction in other Elk River reference tests appears to correlate with responses in the laboratory control. Overall, results support control-normalization of *C. dubia* reproduction.
	Survival	0.02	n/a	n/a	Survival was greater than or equal to 90% in all reference water and laboratory control tests. Overall, results do not support control-normalization of *C. dubia* survival.
P. subcapitata	Cell yield	0.96	0.18	0.19	Cell yield in reference waters was inversely correlated to responses observed in the paired laboratory control. Overall, results do not support control-normalization of *P. subcapitata* cell yield.
H. azteca	Dry weight	Insufficient data	0.25	Insufficient data	Dry weight in Fording River reference water tests was positively correlated with responses observed in the paired laboratory control test. Overall, results support control-normalization of *H. azteca* dry weight.
	Survival		0.14		Survival was greater than or equal to 90% in all reference water and laboratory control tests, except Q1 2015 in the Fording River reference. Overall, results do not support control-normalization of *H. azteca* survival.
O. mykiss	Survival	0.18	0.99	0.31	Responses in Elk River and Fording River reference waters were positively correlated with responses observed in the paired laboratory control test. Correlations for survival, viability, and length were strongest for the Fording River, whereas correlation for weight was strongest in the Elk River. Overall, results support control-normalization of *O. mykiss* endpoints.
	Viability	0.34	0.96	0.49	
	Length	0.5	0.81	0.29	
	Weight	0.77	0.72	0.62	
P. promelas	Hatch	Insufficient data	1	Insufficient data	Hatch was 100% in laboratory control and reference waters in Q2 and Q4. In Q2, hatch was 98% in the reference and 92% in the control. The correlation coefficient is 1 because there are only two distinct points. There is insufficient information to evaluate the hatch endpoint. Therefore, results were not control-normalized.
	Survival		0.33		Survival and development in reference waters was inversely correlated to responses observed in the paired laboratory control. Overall, results do not support control-normalization of *P. promelas* survival and development.
	Development		0.25		
	Length		0.91		Responses in Fording River reference tests were positively correlated with responses observed in the paired laboratory control test. Overall, results support control-normalization of *P. promelas* length and biomass.
	Biomass		0.98		

n/a—Not applicable— Insufficient variance in response to conduct correlation analysis (i.e., all Fording samples had 100% survival).

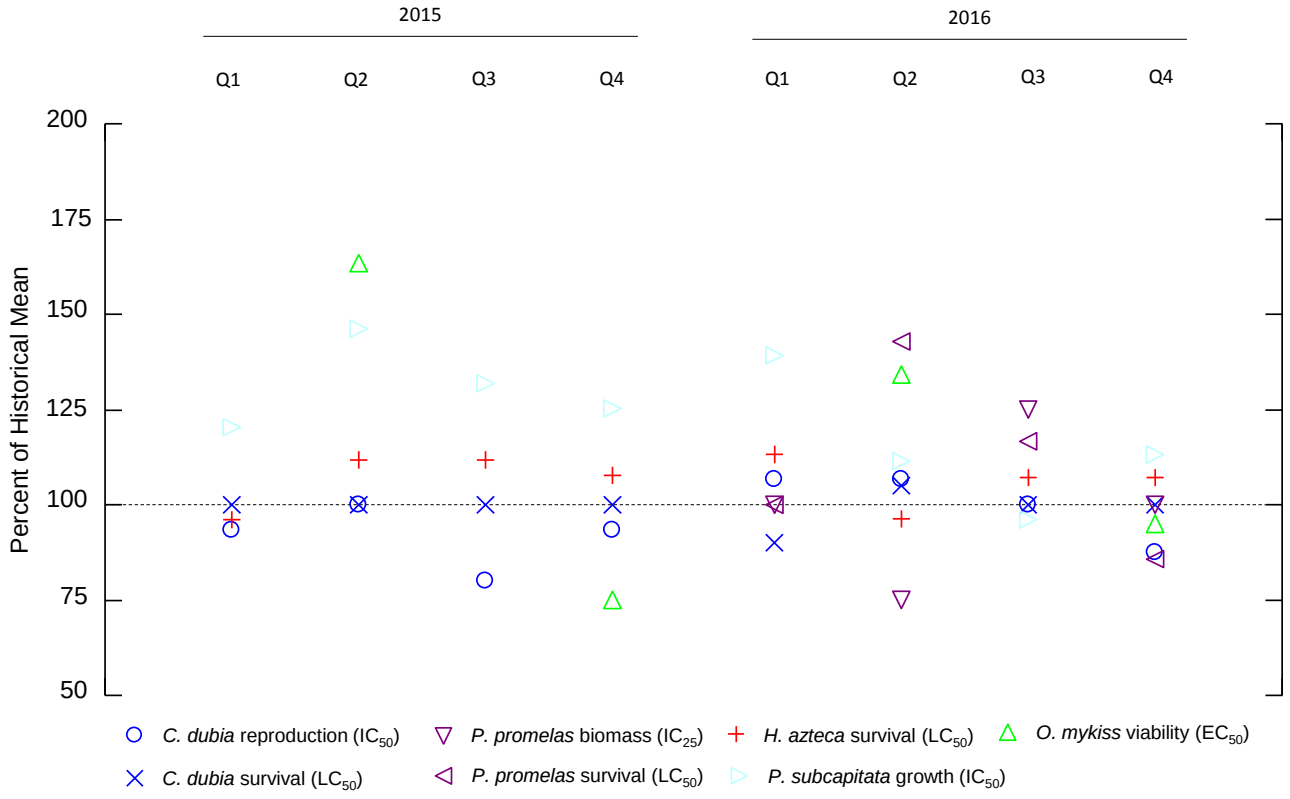
3.2.2 Organism Sensitivity

Effect concentrations from reference toxicant tests are plotted in Figure 3.2-6 as a percentage of the historical mean reference toxicant effect concentration. With the exception of *C. dubia* survival in Q1 of 2016 and

P. promelas survival in Q4 of 2016, reference toxicant results were within two standard deviations of the historical mean (Section 3.1; Golder 2016).

In 2015 and 2016, the majority of effect concentrations fell close to the historical mean (i.e., within 15% of the historical mean), indicating that test organism sensitivity was usually stable (Figure 3.2-6). The largest positive deviation from the historical mean was observed in Q2 2015 for *O. mykiss* viability (163% of the historical mean) and the largest negative deviations were observed in Q2 2016 for *P. promelas* biomass and Q4 2016 for *O. mykiss* viability (75% of the historical mean). Overall, test organism sensitivity does not appear to be a confounding factor of variability in the interpretation of toxicity testing results among test batches.

Figure 3.2-6: Reference toxicant data from 2015 and 2016 laboratory reports.



Note: IC_{50} = concentration resulting in 50% inhibition; IC_{25} = concentration resulting in 25% inhibition; LC_{50} = concentration resulting in 50% lethality; EC_{50} = concentration resulting in 50% effect. Dashed line indicates effect concentration is equal to the mean historical effect concentration.

3.2.3 Background Conditions

As outlined in Section 2.3.2, statistical and qualitative methods were used to develop reference envelopes for mean responses. Development of separate reference envelopes for groups or batches with distinct reference test results was intended to address potential confounding effects of background water quality and its effect on test responses. The following sections present the results of the evaluation of background conditions for each endpoint.

Ceriodaphnia dubia

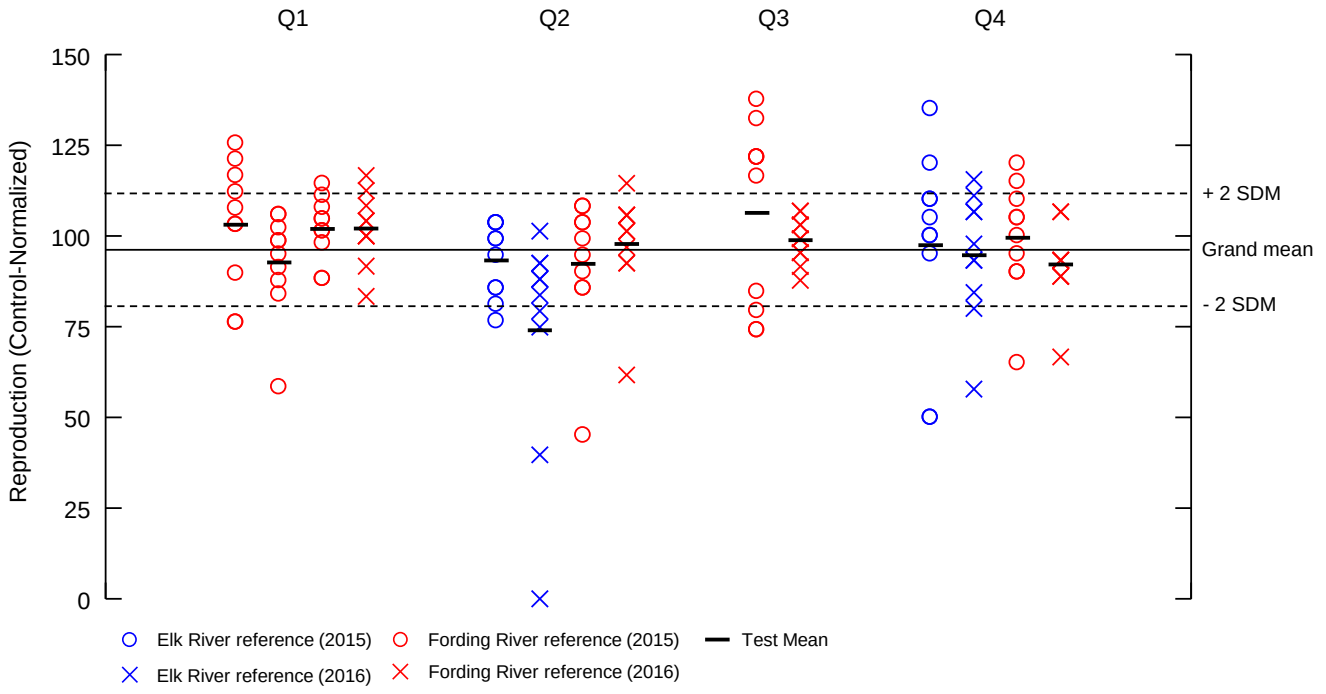
Figure 3.2-7 shows control-normalized *C. dubia* reproduction in reference waters for quarterly tests conducted in 2015 and 2016. Results are as follows:

- A three-way ANOVA of Q2 and Q4 reference data indicated a significant effect of quarter ($p = 0.007$) and year ($p = 0.009$) on reproduction. Visual inspection of the data indicated that Q4 2015 control-normalized reproduction results were unusually high; this appeared to be caused by unusually low reproduction in the paired laboratory control (mean = 17.8 neonates). The Q4 2015 result was a distinct negative outlier to the correlation between reference and control responses shown in Figure 2.3-1. Two replicates in the Q4 2015 laboratory control test had unusually low reproduction (9 or 10 neonates) compared to the remaining replicates in the test (18 to 23 neonates). Excluding the two low replicates, the mean number of neonates in the Q4 2015 laboratory control was 20; the latter is considered to be a better representation of test organism performance in that batch relative to the mean that includes the two low replicates. Therefore, Elk River and Fording River reference results from Q4 2015 were normalized to a mean number of neonates of 20. When the three-way ANOVA was conducted with these revised Q4 2015 results, there was no significant effect of quarter, year, site, or interaction ($p > 0.05$). These results indicate that control-normalized Q2 and Q4 results can be pooled to develop a mean reference response.
- A two-way ANOVA with Fording River reference data indicated there was a significant interaction between quarter and year ($p = 0.001$). Visual inspection of the data indicated that Q4 2015 and Q1 2016 yielded atypically high reproduction, and this appeared to be caused by lower than average reproduction in the paired laboratory controls (mean = 17.8 and 21.5, respectively). The Q4 2015 laboratory control was adjusted to a mean of 20 neonates, based on the rationale provided in the previous bullet. For Q1 2016, one replicate had very low reproduction (3 neonates) compared to the remaining replicates (19 to 27 neonates). Excluding the low replicate, the mean number of neonates in the Q1 2016 laboratory control was 24, which is considered to be a better representation of test organism performance in that batch than the mean including the low replicate. Therefore, Fording River reference results from Q1 2016 were normalized to a mean number of neonates of 24. When the two-way ANOVA was conducted with the revised Q4 2015 and Q1 2016 results, there was no significant effect of quarter, year, or interaction ($p > 0.05$). These results indicate that control-normalized Fording River reference results can be pooled to develop a mean reference response.

Overall, the results discussed above indicate that all Elk River and Fording River reference tests can be pooled to develop a mean reference response. The grand mean of control-normalized *C. dubia* reproduction in pooled Fording and Elk River reference tests (± 2 standard deviations) was 96% ± 16%.

A reference envelope was not developed for survival due to lack of variance in the response endpoint; survival was 100% in reference waters tested in 2015 and 2016, except one test in Q2 2016 (Elk River reference; 90% survival).

Figure 3.2-7: Individual replicate and mean results for C. dubia reproduction in Elk River reference (n = 40) and Fording River reference (n = 100) water.

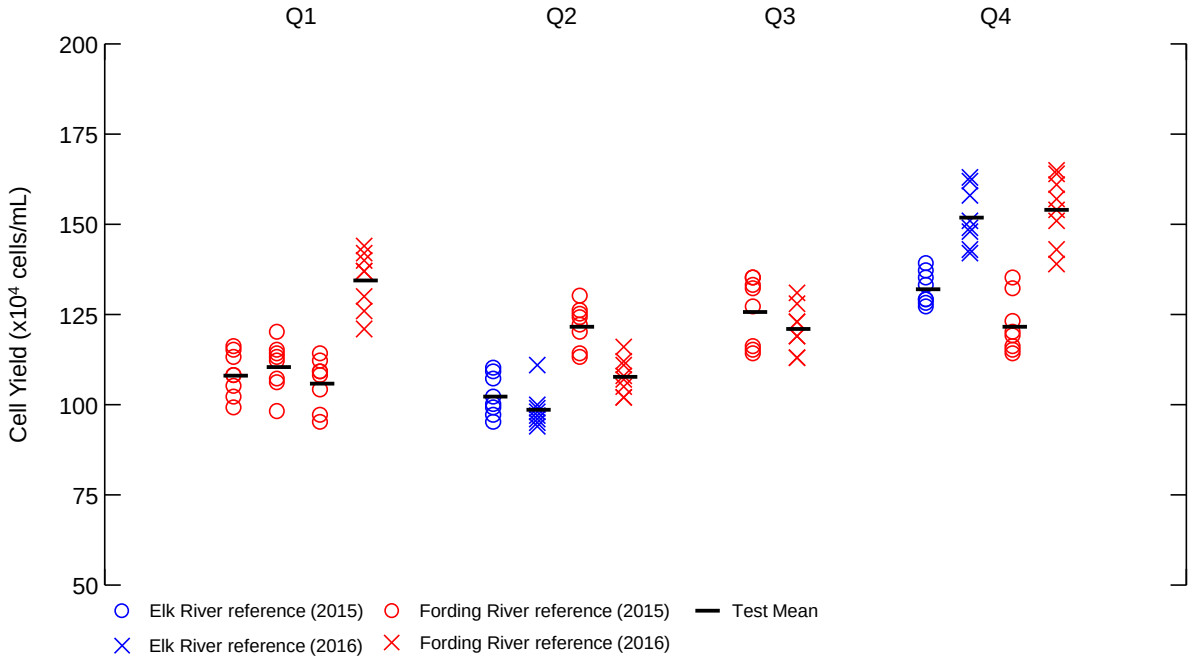


Note: See Figure 2.3-1 for description of lines and symbols.

Pseudokirchneriella subcapitata

Figure 3.2-8 shows *P. subcapitata* cell yield in Fording River reference waters tested in 2015 and 2016. A three-way ANOVA of Q2 and Q4 reference data indicated there was a significant effect of quarter ($p < 0.001$), year ($p < 0.001$), site ($p = 0$ 0.004), interaction of quarter and year ($p < 0.001$), interaction of quarter and site ($p < 0.001$), and interaction of quarter, site, and year ($p = 0.001$). A two-way ANOVA of Fording River reference data also indicated a significant effect of year, quarter, and their interaction ($p < 0.001$). Therefore, a pooled reference response may not be appropriate for this test endpoint at this time. Variability in this endpoint is considered to be related to the ionic strength of the sample (Appendix B), which varies spatially, seasonally, and between years. Therefore, results for test sites were compared to batch-specific reference test(s) only.

Figure 3.2-8: Individual replicate and mean results for P. subcapitata cell yield in Elk River reference (n =40) and Fording River reference (n = 100) water.



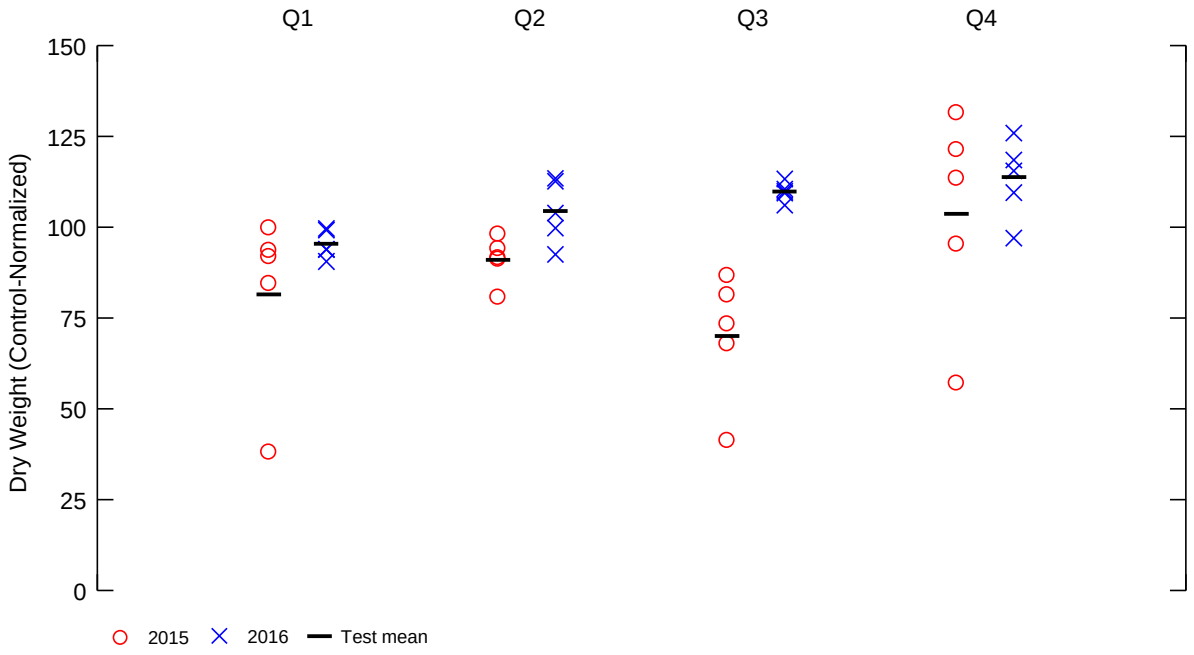
Note: See Figure 2.3-1 for description of lines and symbols.

Hyalella azteca

Figure 3.2-9 shows control-normalized dry weight in Fording River reference waters tested in 2015 and 2016. A two-way ANOVA indicated there was a significant effect of quarter (p = 0.033) and year (p = 0.001) on dry weight. Post-hoc analysis of the data indicated several distinct groups. Therefore, a pooled reference response may not be appropriate for this test endpoint at this time and results for test sites were compared to the batch-specific reference test only.

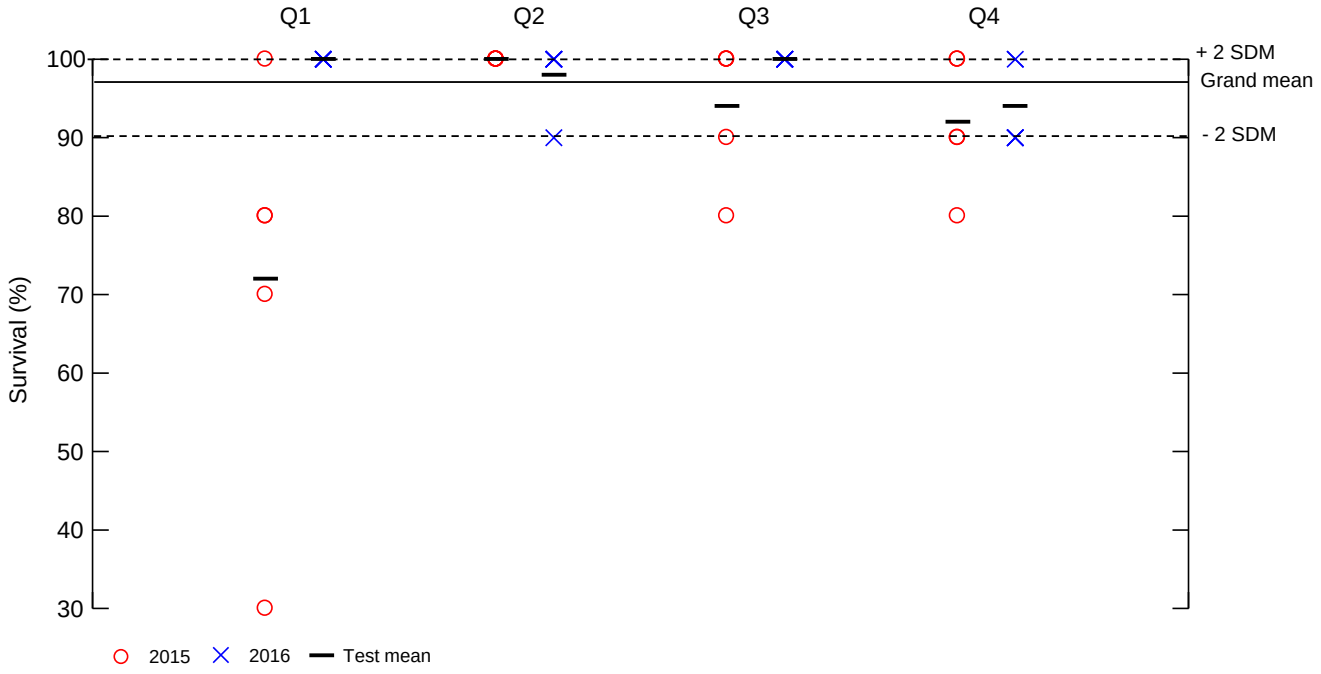
Figure 3.2-10 shows survival in Fording River reference waters tested in 2015 and 2016. Mean survival was greater than or equal to 92% in all tests with the exception of one Q1 test (2015). In Q1 2015, the mean survival was reduced due to 30% survival in a single replicate, compared to 70% to 90% survival in the other four replicates. This inconsistency in response among replicates exposed to the same test water suggests that the result may have reflected unusual conditions in a single test vessel, rather than an adverse response to the test water. Survival data from seven of the eight tests (i.e., all but Q1 2015) were pooled to develop a mean reference response. The grand mean of survival in pooled reference tests (± 2 standard deviations) was 97% ± 7% (maximum survival of 100%).

Figure 3.2-9: Individual replicate and mean results for H. azteca growth in Fording River reference (n = 40) water.



Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.2-10: Individual replicate and mean results for H. azteca survival in Fording River reference (n = 40) water.



Note: See Figure 2.3-1 for description of lines and symbols.

Oncorhynchus mykiss

Three-way ANOVAs were conducted for control-normalized *O. mykiss* endpoints to inform a practical level of pooling for reference responses. Results are as follows.

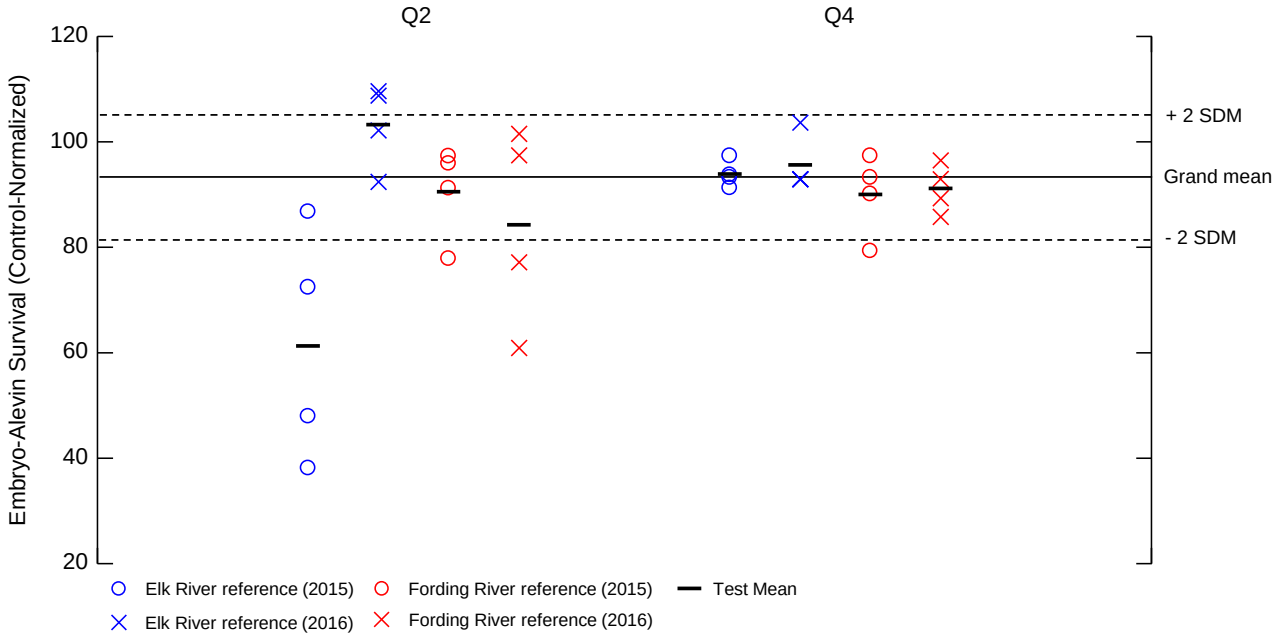
Figure 3.2-11 shows *O. mykiss* survival in Elk River and Fording River reference waters tested in 2015 and 2016. There was a significant effect of year (p = 0.029), interaction of year and site (p = 0.007), and interaction of year, site, and quarter (p = 0.009). Visual inspection of the data indicated that the Q2 2015 Elk River test had lower survival than other tests, and was therefore not included in the pooled reference envelopes developed for 2016 test data. Exclusion of the Q2 2015 Elk River test is considered conservative because the lower response in this test would lower the reference envelope. A one-way ANOVA was conducted for the remaining tests. Mean survival was statistically similar in the seven remaining tests, indicating that responses can be pooled. Exclusion of the Q2 2015 Elk River results was considered conservative because responses in this test were lower than other tests (i.e., inclusion of this test would lower the reference range). The grand mean of control-normalized survival in pooled reference tests (± 2 standard deviations) was 93% ± 12%.

Figure 3.2-12 shows *O. mykiss* viability in Elk River and Fording River reference waters tested in 2015 and 2016. There was a significant effect of year (p = 0.042), quarter (p = 0.029), interaction of year and site (p = 0.006), and interaction of year, site, and quarter (p = 0.013). Visual inspection of the data indicated that the Q2 2015 Elk River test had distinct results. This test was removed from the dataset and a one-way ANOVA was conducted for the remaining tests. Mean viability was statistically similar in the seven tests, indicating that responses can be pooled. Exclusion of the Q2 2015 Elk River results was considered conservative because responses in this test were lower than all other tests (i.e., inclusion of this test would lower the reference range). The grand mean of control-normalized viability in pooled reference tests (± 2 standard deviations) was 92% ± 13%.

Figure 3.2-13 shows *O. mykiss* length in Elk River and Fording River reference waters tested in 2015 and 2016. There was a significant effect of year on length (p = 0.033). Visual inspection of the data indicated that the Q4 2015 Elk River test had distinct results. This test was removed from the dataset and a one-way ANOVA was conducted for the remaining tests. Mean length was statistically similar in the seven tests, indicating that responses can be pooled. Exclusion of the Q4 2015 Elk River results was considered conservative because responses in this test were lower than all other tests (i.e., inclusion of this test would lower the reference range). The grand mean of control-normalized length in pooled reference tests (± 2 standard deviations) was 101% ± 3%.

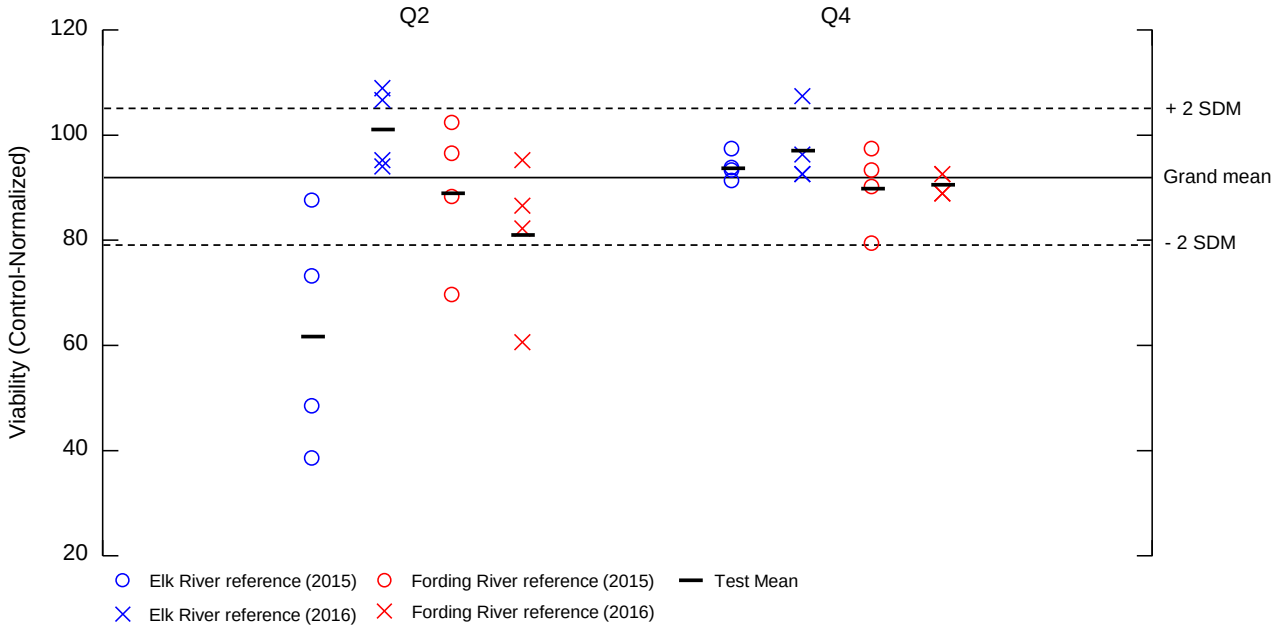
Figure 3.2-14 shows *O. mykiss* weight in Elk River and Fording River reference waters tested in 2015 and 2016. There was no significant effect of year, site, quarter, or any interactions on wet weight (p > 0.05), indicating that all reference tests can be pooled to develop a mean reference response. The grand mean of control-normalized weight in pooled reference tests (± 2 standard deviations) was 102% ± 4%.

Figure 3.2-11: Individual replicate and mean results for O. mykiss survival in Elk River reference (n = 16) and Fording River reference (n = 16) water.



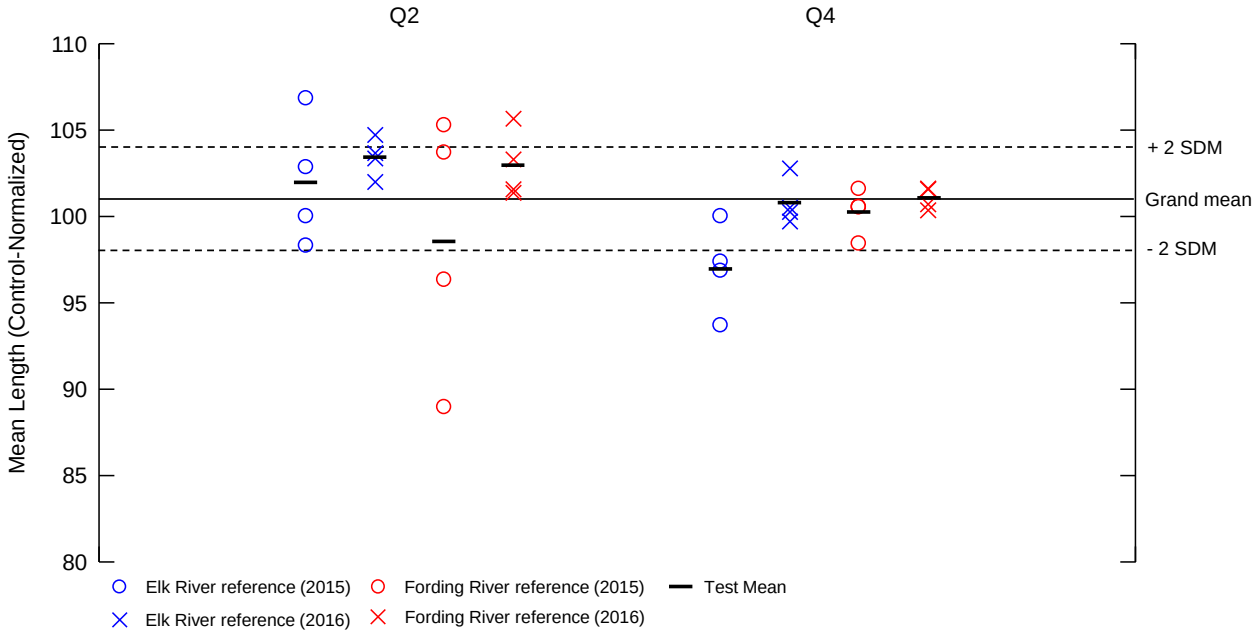
Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.2-12: Individual replicate and mean results for O. mykiss viability in Elk River reference (n = 16) and Fording River reference (n = 16) water.



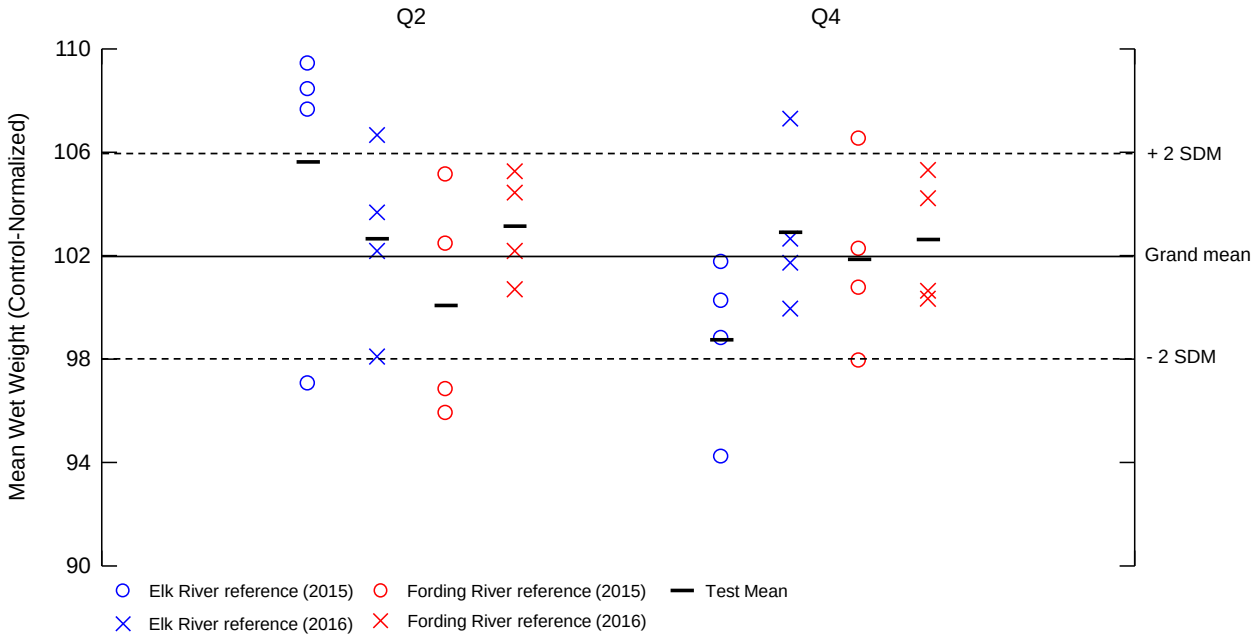
Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.2-13: Individual replicate and mean results for O. mykiss length in Elk River reference (n = 16) and Fording River reference (n = 16) water.



Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.2-14: Individual replicate and mean results for O. mykiss weight in Elk River reference (n = 16) and Fording River reference (n = 16) water.



Note: See Figure 2.3-1 for description of lines and symbols.

P. promelas

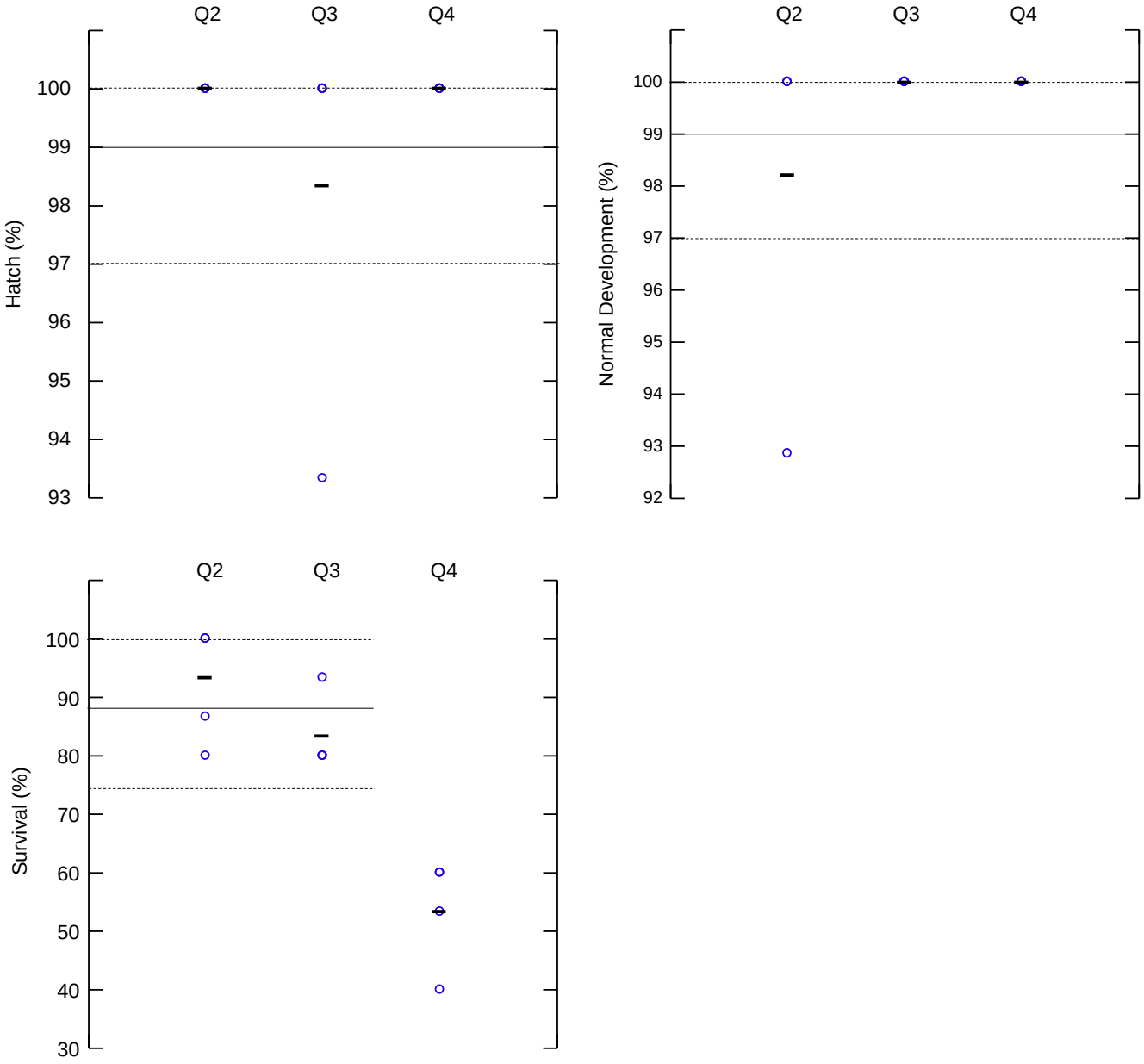
Figure 3.2-15 shows *P. promelas* hatch, normal development, and survival in Fording River reference waters tested in 2016. Hatch and normal development were statistically similar in Q2, Q3, and Q4, indicating that all reference tests can be pooled to develop a mean reference response. The grand mean of hatch in pooled reference tests (± 2 standard deviations) was 99% ± 2%. The grand mean of normal development in pooled reference tests (± 2 standard deviations) was 99% ± 2%.

Mean survival was statistically similar in Q2 and Q3. Both Q2 and Q3 were significantly higher than Q4[7]. These results indicate that Q2 and Q3 tests can be pooled to develop a mean reference response that is applicable to these quarters. The grand mean of survival in pooled reference tests (± 2 standard deviations) was 88% ± 14%.

Figure 3.2-16 shows *P. promelas* length and biomass in Fording River reference waters tested in 2016. Mean biomass was significantly different in all quarters, indicating that a pooled reference response may not be appropriate for this test endpoint at this time. Mean length was significantly lower in Q2 relative to Q3. There is insufficient information at this time to develop a pooled reference envelope for this test endpoint. For the evaluation of test results, biomass and length results for test sites were compared to the batch-specific reference test only.

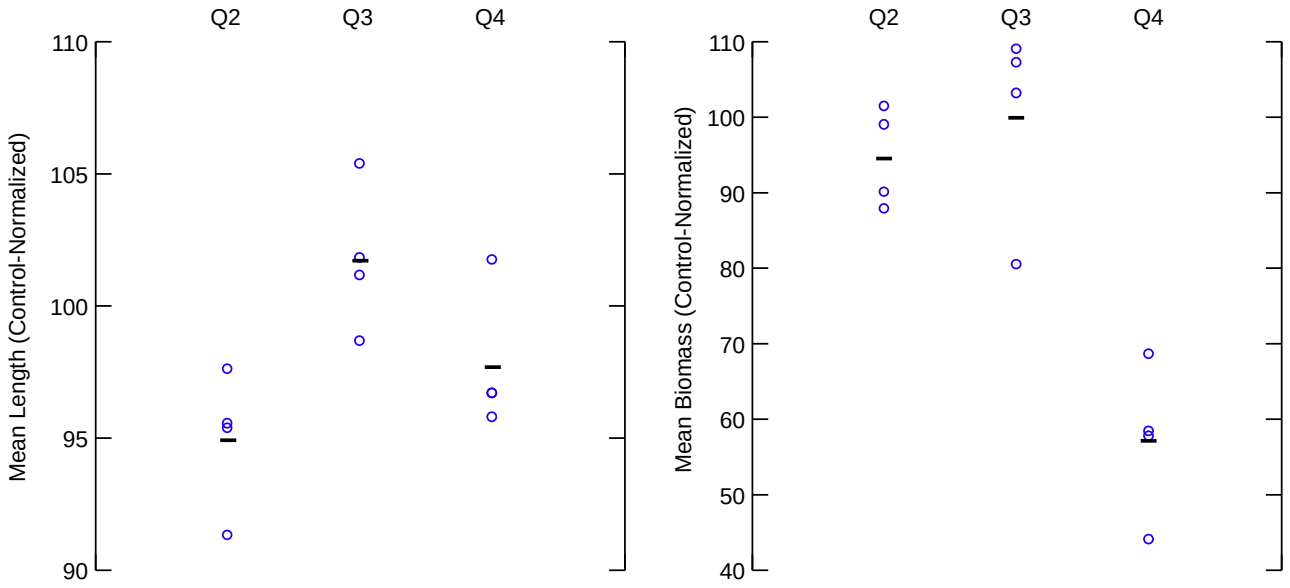
[7] The reduced survival and biomass in this sample was primarily related to mortalities that occurred in the final 24 hours of the test; survival on day 31 of exposure was 85 ± 10% (which was not statistically different from the control), but was 53.3 ± 9.4% the following day in this sample (Appendix B-4). Dissolved oxygen measured in the sample on the final day of the test was 5.7 mg/L, which was within the acceptable range for this species, but it is possible that stress associated with depressed dissolved oxygen contributed to the adverse effect (Appendix B-4).

Figure 3.2-15: Individual replicate and mean results for P. promelas hatch (top left), normal development (top right), and survival (bottom left) in Fording River reference (n = 12 per endpoint) water (2016 only).



Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.2-16: Individual replicate and mean results for P. promelas length (left) and biomass (right) in Fording River reference (n = 12) water (2016 only).



Note: See Figure 2.3-1 for description of lines and symbols.

3.3 Test Results

3.3.1 Ceriodaphnia dubia

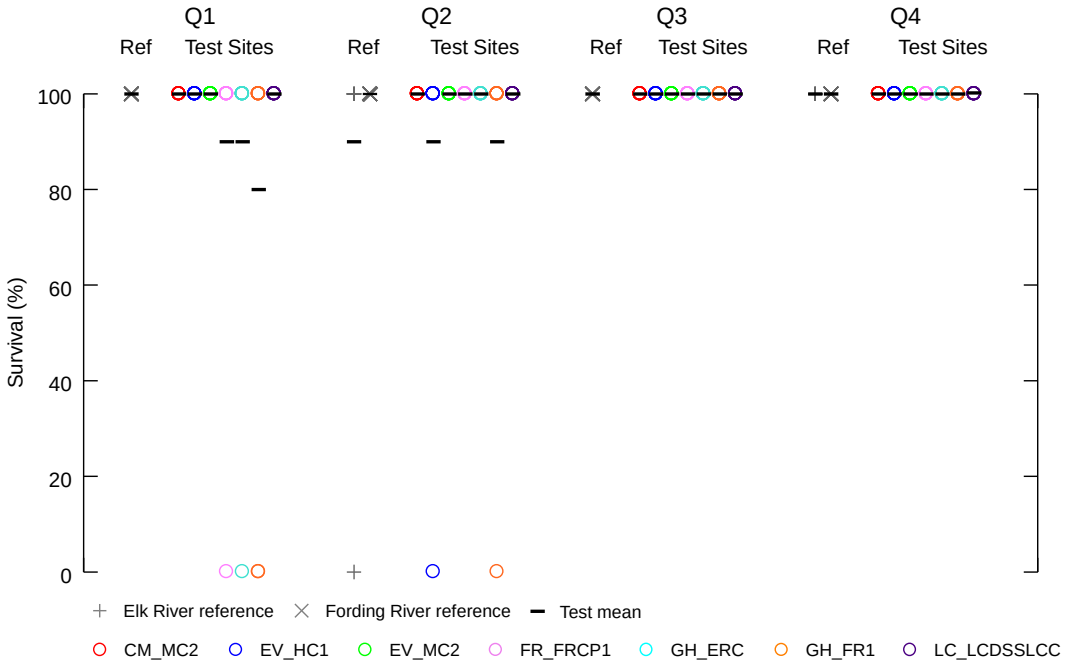
There was no evidence of statistically significant adverse effects on mean *C. dubia* survival in any test (Figure 3.3-1; Table 3.3-1; Table 3.3-2). The few individual replicates for which mortality was observed in Q1 and Q2 were insufficient to cause a statistically significant response. Replicate results for survival are binomial (either 0% or 100%) because each replicate consists of a single female.

Reproduction was significantly reduced relative to the Fording River or Elk River references in four CM_MC2 tests (Q1 to Q4), four FR_FRCP1 tests (Q1 to Q4), two EV_MC2 tests (Q2 and Q4), and all other test site waters tested in Q2 (GH_FR1, GH_ERC, EV_HC1, LC_LCDSSLCC) (Figure 3.3-2).

For the Q1 CM_MC2 test and Q2 FR_FRCP1 test, mean reproduction was significantly lower than the Fording River reference, but was within the reference envelope (CM_MC2) or equal to the lower bound of the reference envelope (FR_FRCP1). It is uncertain whether these results indicate an adverse response or natural variance in test organism performance related to background water quality. For the remaining tests with significant results (CM_MC2 [Q2, Q3, Q4], FR_FRCP1 [Q1, Q3, Q4], EV_MC2 [Q2, Q4], GH_FR1 Q2, GH_ERC Q2, EV_HC1 Q2, LC_LCDSSLCC Q2), mean reproduction was lower than the reference envelope, and therefore may have indicated an adverse response to the test water. Evidence for adverse effects was equivocal for tests in Q2 (except CM_MC2) because reproduction was significantly reduced relative to one but not both reference waters.

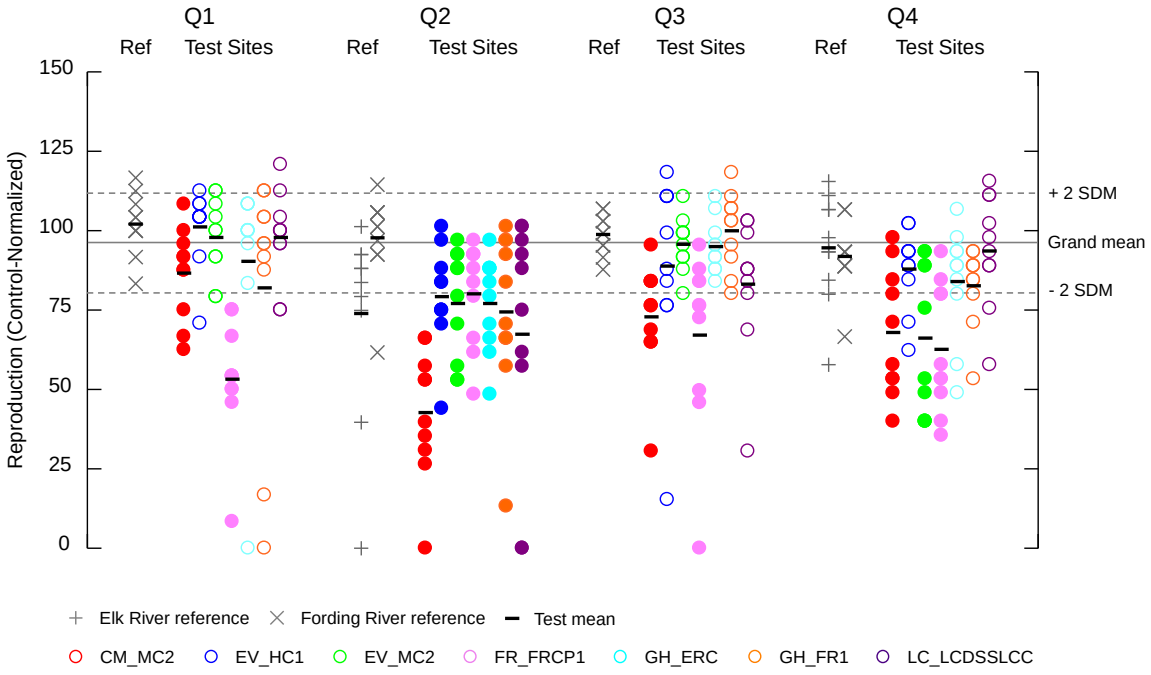
The concentration-response analysis for *C. dubia* reproduction is presented in Section 3.4.1.

Figure 3.3-1: Individual replicate and mean results for C. dubia survival in reference (Ref) and test site waters.



Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.3-2: Individual replicate and mean results for C. dubia reproduction in reference (Ref) and test site waters.



Note: See Figure 2.3-1 for description of lines and symbols.

Table 3.3-1: Results of Quarterly and Semi-Annual Toxicity Tests [a,b]

Quarter	Location	*C. dubia*		*P. subcapitata*	*H. azteca*		*P. promelas* (copper treated)					*O. mykiss*			
		% Survival	Reproduction (% control-normalized)	Cell Yield [× 10^4 cells/mL]	% Survival	Dry weight (% control-normalized)	% Hatch	% Survival	Biomass (% control-normalized)	Length (% control normalized)	% Normal Development	Survival (% control-normalized)	Viability (% control-normalized)	Length (% control-normalized)	Wet Weight (% control-normalized)
Q1	Fording River reference	100	114 ± 11	134.6 ± 8.1	100 ± 0.0	95 ± 4	100 ± 0.0	73.3 ± 13.3	99 ± 31	98 ± 7	100 ± 0.0	—			
	FR_FRCP1	90	**60 ± 21**	**93.5 ± 7.0**	100 ± 0.0	**58 ± 14**	93.3 ± 9.4	76.7 ± 8.6	104 ± 12	95 ± 6	97.7 ± 4.5				
	GH_FR1	80	92 ± 45	**119.5 ± 4.7**	94.0 ± 8.9	88 ± 7	98.3 ± 3.3	96.7 ± 3.8	96 ± 7	91 ± 2	100 ± 0.0				
	GH_ERC	90	101 ± 36	129.5 ± 9.3	—		—								
	EV_MC2	100	109 ± 14	130.3 ± 12.4	—		—								
	EV_HC1	100	113 ± 13	**120.3 ± 6.4**	—		—								
	CM_MC2	100	**97 ± 16**	**121.8 ± 2.2**	**80.0 ± 15.8**	**58 ± 6**	98.3 ± 3.3	93.3 ± 7.7	88 ± 2	90 ± 1	100 ± 0.0				
	LC_LCDSSLCC	100	109 ± 16	129.5 ± 5.3	—		—								
Q2	Fording River reference	100	98 ± 14	107.9 ± 4.9	98.0 ± 4.5	104 ± 9	100 ± 0.0	93.3 ± 9.4	95 ± 7	95 ± 3	98.2 ± 3.6	84 ± 19	81 ± 15	103 ± 2	103 ± 2
	Elk River reference	90	**74 ± 31**	**98.8 ± 5.3**	—		—					103 ± 8	101 ± 8	103 ± 1	103 ± 4
	FR_FRCP1	100	**80 ± 16**	**78.8 ± 1.9**	98.0 ± 4.5	**51 ± 13**	98.3 ± 3.3	93.3 ± 5.4	87 ± 11	96 ± 4	100 ± 0.0	80 ± 13	79 ± 8	**99 ± 2**	102 ± 5
	GH_FR1	90	**74 ± 27**	**100.0 ± 5.9**	98.0 ± 4.5	**60 ± 21**	96.7 ± 6.7	90.0 ± 11.6	92 ± 13	99 ± 5	100 ± 0.0	76 ± 13	77 ± 14	104 ± 1	101 ± 7
	GH_ERC	100	**77 ± 15**	103.8 ± 8.5	—		—					81 ± 11	77 ± 9	102 ± 3	108 ± 8
	EV_MC2	100	**77 ± 17**	111.5 ± 8.1	—		—					68 ± 5	66 ± 4	105 ± 3	113 ± 13
	EV_HC1	90	**79 ± 16**	113.5 ± 1.3	—		—					86 ± 9	81 ± 11	102 ± 1	111 ± 3
	CM_MC2	100	**43 ± 21**	**94.0 ± 4.2**	94.0 ± 8.9	**30 ± 7**	100 ± 0.0	96.7 ± 6.7	99 ± 6	97 ± 2	100 ± 0.0	73 ± 11	73 ± 8	102 ± 1	101 ± 8
	LC_LCDSSLCC	100	**67 ± 39**	**91.0 ± 4.8**	—		—					88 ± 16	78 ± 6	104 ± 2	97 ± 12
Q3	Fording River reference	100	99 ± 6	121.1 ± 6.5	100 ± 0.0	110 ± 3	98.3 ± 3.3	83.3 ± 6.7	100 ± 13	102 ± 3	100 ± 0.0	—			
	FR_FRCP1	100	**67 ± 28**	124.5 ± 4.8	98.0 ± 4.5	**93 ± 13**	96.7 ± 6.7	80.0 ± 10.9	107 ± 9	105 ± 3	100 ± 0.0				
	GH_FR1	100	100 ± 12	118.0 ± 9.2	96.0 ± 5.5	**97 ± 7**	98.3 ± 3.3	88.3 ± 8.4	85 ± 7	102 ± 7	100 ± 0.0				
	GH_ERC	100	95 ± 9	121.3 ± 6.6	—		—								
	EV_MC2	100	96 ± 9	120.0 ± 5.7	—		—								
	EV_HC1	100	89 ± 30	120.5 ± 6.6	—		—								
	CM_MC2	100	**73 ± 18**	**107.5 ± 2.1**	98.0 ± 4.5	113 ± 6	**86.7 ± 10.9**	**63.3 ± 24.6**	91 ± 25	106 ± 10	100 ± 0.0				
	LC_LCDSSLCC	100	83 ± 21	119.5 ± 5.5	—		—								
Q4	Fording River reference	100	92 ± 11	154.3 ± 9.5	94.0 ± 5.5	113 ± 11	100 ± 0.0	53.3 ± 9.4	57 ± 10	98 ± 3	100 ± 0.0	91 ± 5	91 ± 2	101 ± 1	103 ± 3
	Elk River reference	100	95 ± 17	152.0 ± 8.1	—		—					96 ± 5	97 ± 7	101 ± 1	103 ± 3
	FR_FRCP1	100	**63 ± 20**	**141.0 ± 2.9**	94.0 ± 8.9	**95 ± 13**	96.7 ± 3.8	80.0 ± 9.4	94 ± 8	103 ± 5	100 ± 0.0	**54 ± 7**	**55 ± 6**	98 ± 2	100 ± 3
	GH_FR1	100	83 ± 12	158.5 ± 1.9	86.0 ± 20.7	92 ± 37	98.3 ± 3.3	81.7 ± 8.4	92 ± 8	102 ± 3	100 ± 0.0	**44 ± 20**	**46 ± 20**	98 ± 4	105 ± 0
	GH_ERC	100	84 ± 18	156.8 ± 10.4	—		—					98 ± 6	102 ± 6	**97 ± 3**	103 ± 4
	EV_MC2	100	**66 ± 24**	166.3 ± 2.2	—		—					87 ± 9	88 ± 7	102 ± 1	110 ± 4
	EV_HC1	100	88 ± 13	157.8 ± 2.2	—		—					**60 ± 16**	**59 ± 14**	98 ± 2	104 ± 3
	CM_MC2	100	**68 ± 20**	156.0 ± 10.1	98.0 ± 4.5	112 ± 8	100 ± 0.0	96.7 ± 3.8	92 ± 4	102 ± 2	100 ± 0.0	87 ± 16	84 ± 15	102 ± 1	110 ± 3
	LC_LCDSSLCC	100	94 ± 18	156.0 ± 4.5	—		—					**69 ± 8**	**70 ± 10**	104 ± 1	116 ± 11

(a) Results presented as percent survival or endpoint mean ± standard deviation.

(b) For any endpoint that was determined to be influenced by organism performance (Section 3.2.1), results are expressed as percent control normalized units. Raw results are provided for all endpoints in Table 3.3-2.

Notes: **Bold values** = result significantly lower than Fording River reference.

Underlined values = result significantly lower than Elk River reference.

- = not tested; mg = milligrams; mL = millilitre; mm = millimetres; % = percent; ± = plus or minus.

Table 3.3-2: Results of Quarterly and Semi-Annual Toxicity Tests – Raw Results [a,b]

Quarter	Location	*C. dubia*		*P. subcapitata*	*H. azteca*		*P. promelas* (copper treated)					*O. mykiss*			
		% Survival	Reproduction	Cell Yield [x 104 cells/mL]	% Survival	Dry weight [mg]	% Hatch	% Survival	Biomass [mg]	Length [mm]	% Normal Development	% Survival	% Viability	Length [mm]	Wet Weight [mg]
Q1	Fording River reference	100	24.5 ± 2.3	134.6 ± 8.1	100 ± 0.0	0.82 ± 0.03	100 ± 0.0	73.3 ± 13.3	1.4 ± 0.4	9.1 ± 0.7	100 ± 0.0				
	FR_FRCP1	90	**12.8 ± 4.5**	**93.5 ± 7.0**	100 ± 0.0	**0.50 ± 0.12**	93.3 ± 9.4	76.7 ± 8.6	1.5 ± 0.2	8.8 ± 0.6	97.7 ± 4.5				
	GH_FR1	80	19.7 ± 9.6	**119.5 ± 4.7**	94.0 ± 8.9	0.75 ± 0.06	98.3 ± 3.3	96.7 ± 3.8	1.3 ± 0.1	8.5 ± 0.2	100 ± 0.0				
	GH_ERC	90	21.7 ± 7.8	129.5 ± 9.3	-		-								
	EV_MC2	100	23.5 ± 3.0	130.3 ± 12.4	-		-								
	EV_HC1	100	24.3 ± 2.9	**120.3 ± 6.4**	-		-								
	CM_MC2	100	**20.8 ± 3.5**	**121.8 ± 2.2**	**80.0 ± 15.8**	**0.50 ± 0.05**	98.3 ± 3.3	93.3 ± 7.7	1.2 ± 0.0	8.4 ± 0.1	100 ± 0.0				
	LC_LCDSSLCC	100	23.5 ± 3.4	129.5 ± 5.3	-		-								
Q2	Fording River reference	100	22.2 ± 3.3	107.9 ± 4.9	98.0 ± 4.5	0.91 ± 0.08	100 ± 0.0	93.3 ± 9.4	2.1 ± 0.1	9.2 ± 0.3	98.2 ± 3.6	69.2 ± 15.5	62.5 ± 11.3	19.7 ± 0.4	97.6 ± 2.0
	Elk River reference	90	**16.8 ± 7.0**	**98.8 ± 5.3**	-		-					84.8 ± 6.5	77.9 ± 5.9	19.8 ± 0.2	97.1 ± 3.4
	FR_FRCP1	100	**18.2 ± 3.7**	**78.8 ± 1.9**	98.0 ± 4.5	**0.44 ± 0.11**	98.3 ± 3.3	93.3 ± 5.4	1.9 ± 0.2	9.3 ± 0.4	100 ± 0.0	66.1 ± 10.4	61.1 ± 6.4	**19.0 ± 0.4**	96.6 ± 4.7
	GH_FR1	90	**16.9 ± 6.0**	**100.0 ± 5.9**	98.0 ± 4.5	**0.52 ± 0.18**	96.7 ± 6.7	90.0 ± 11.6	2.0 ± 0.3	9.6 ± 0.5	100 ± 0.0	62.7 ± 10.3	59.3 ± 10.7	19.9 ± 0.2	95.8 ± 6.5
	GH_ERC	100	**17.5 ± 3.4**	103.8 ± 8.5	-		-					66.1 ± 8.7	59.5 ± 6.7	19.5 ± 0.5	102.1 ± 7.3
	EV_MC2	100	**17.5 ± 4.0**	111.5 ± 8.1	-		-					55.8 ± 3.9	50.8 ± 2.8	20.1 ± 0.5	106.7 ± 12.4
	EV_HC1	90	**18.0 ± 3.6**	113.5 ± 1.3	-		-					70.5 ± 7.1	62.6 ± 8.8	19.5 ± 0.2	105.0 ± 3.0
	CM_MC2	100	**9.7 ± 4.7**	**94.0 ± 4.2**	94.0 ± 8.9	**0.26 ± 0.06**	100 ± 0.0	96.7 ± 6.7	2.2 ± 0.1	9.4 ± 0.2	100 ± 0.0	60.2 ± 9.0	56.1 ± 6.3	19.5 ± 0.3	95.8 ± 7.5
	LC_LCDSSLCC	100	**15.3 ± 8.8**	**91.0 ± 4.8**	-		-					69.0 ± 7.2	61.6 ± 7.0	19.8 ± 0.3	97.7 ± 3.5
Q3	Fording River reference	100	25.9 ± 1.7	121.1 ± 6.5	100 ± 0.0	0.87 ± 0.02	98.3 ± 3.3	83.3 ± 6.7	0.9 ± 0.1	8.9 ± 0.2	100 ± 0.0				
	FR_FRCP1	100	**17.6 ± 7.4**	124.5 ± 4.8	98.0 ± 4.5	**0.74 ± 0.10**	96.7 ± 6.7	80.0 ± 10.9	1.0 ± 0.1	9.1 ± 0.3	100 ± 0.0				
	GH_FR1	100	26.2 ± 3.2	118.0 ± 9.2	96.0 ± 5.5	**0.77 ± 0.05**	98.3 ± 3.3	88.3 ± 8.4	0.8 ± 0.1	8.8 ± 0.6	100 ± 0.0				
	GH_ERC	100	24.9 ± 2.2	121.3 ± 6.6	-		-								
	EV_MC2	100	25.1 ± 2.2	120.0 ± 5.7	-		-								
	EV_HC1	100	23.3 ± 7.9	120.5 ± 6.6	-		-								
	CM_MC2	100	**19.1 ± 4.7**	**107.5 ± 2.1**	98.0 ± 4.5	0.89 ± 0.04	**86.7 ± 10.9**	**63.3 ± 24.6**	0.8 ± 0.2	9.2 ± 0.9	100 ± 0.0				
	LC_LCDSSLCC	100	21.8 ± 5.6	119.5 ± 5.5	-		-								
Q4	Fording River reference	100	20.7 ± 2.5	154.3 ± 9.5	94.0 ± 5.5	0.71 ± 0.07	100 ± 0.0	53.3 ± 9.4	0.42 ± 0.07	7.5 ± 0.2	100 ± 0.0	85.0 ± 4.3	81.7 ± 1.9	20.0 ± 0.1	85.0 ± 2.1
	Elk River reference	100	21.3 ± 3.9	152.0 ± 8.1	-		-					89.2 ± 5.0	87.5 ± 6.3	20.0 ± 0.3	85.2 ± 2.6
	FR_FRCP1	100	**14.1 ± 4.5**	**141.0 ± 2.9**	94.0 ± 8.9	**0.60 ± 0.08**	96.7 ± 3.8	80.0 ± 9.4	0.69 ± 0.06	7.9 ± 0.4	100 ± 0.0	**50.0 ± 6.8**	**49.1 ± 5.2**	19.5 ± 0.3	82.8 ± 2.5
	GH_FR1	100	18.6 ± 2.8	158.5 ± 1.9	86.0 ± 20.7	0.58 ± 0.23	98.3 ± 3.3	81.7 ± 8.4	0.67 ± 0.06	7.8 ± 0.2	100 ± 0.0	**41.4 ± 18.3**	**41.4 ± 18.3**	19.4 ± 0.9	86.8 ± 0.3
	GH_ERC	100	18.9 ± 4.0	156.8 ± 10.4	-		-					91.7 ± 5.8	91.7 ± 5.8	**19.2 ± 0.6**	85.2 ± 3.5
	EV_MC2	100	**14.9 ± 5.4**	166.3 ± 2.2	-		-					81.6 ± 8.5	79.0 ± 6.5	20.1 ± 0.2	91.2 ± 3.2
	EV_HC1	100	19.8 ± 2.9	157.8 ± 2.2	-		-					**56.3 ± 15.1**	**53.0 ± 12.4**	19.3 ± 0.4	86.3 ± 2.3
	CM_MC2	100	**15.3 ± 4.5**	156.0 ± 10.1	98.0 ± 4.5	0.71 ± 0.05	100 ± 0.0	96.7 ± 3.8	0.67 ± 0.03	7.9 ± 0.1	100 ± 0.0	81.4 ± 14.9	75.4 ± 13.2	20.2 ± 0.2	90.9 ± 2.1
	LC_LCDSSLCC	100	21.2 ± 4.0	156.0 ± 4.5	-		-					**64.5 ± 7.4**	**62.8 ± 8.6**	20.6 ± 0.2	96.2 ± 8.8

(a) Results presented as percent survival or endpoint mean ± standard deviation.

(b) For any endpoint that was determined to be influenced by organism performance (Section 3.2.1), results are expressed as percent control normalized in Table 3.2-1.

Notes: **Bold values** = result significantly lower than Fording River reference.

Underlined values = result significantly lower than Elk River reference.

- = not tested; mg = milligrams; mL = millilitre; mm = millimetres; % = percent; ± = plus or minus.

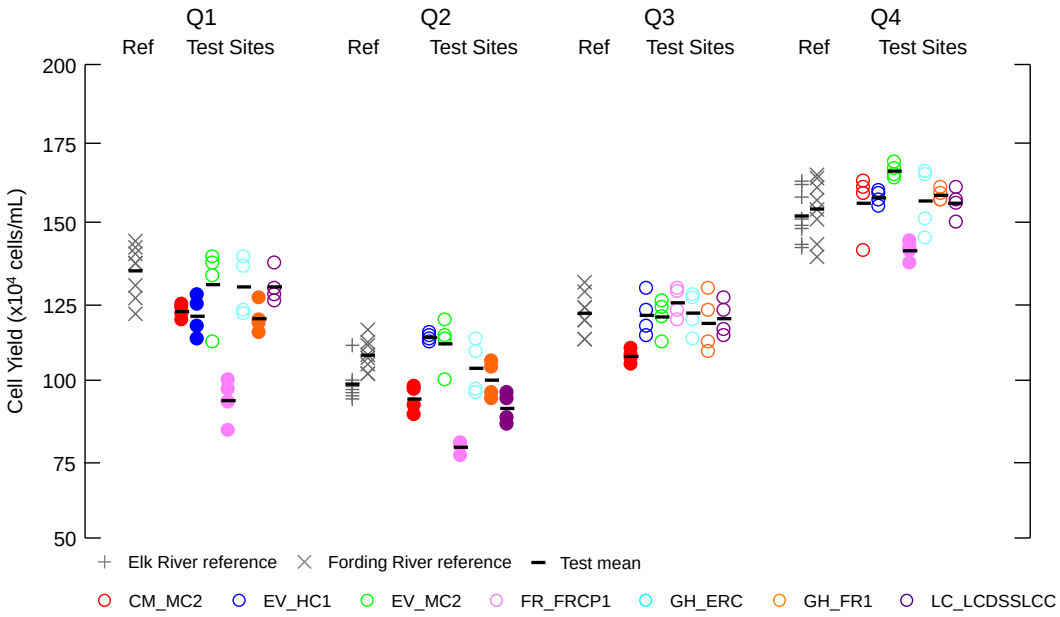
3.3.2 *Pseudokirchneriella subcapitata*

Cell yield was significantly reduced relative to the Fording River or Elk River references in three CM_MC2 tests (Q1 to Q3), three FR_FRCP1 tests (Q1, Q2, and Q4), two GH_FR1 tests (Q1 and Q2), one EV_HC1 test (Q1), and one LC_LCDSSLCC test (Q2) (Figure 3.3-3).

In two Q2 tests (CM_MC2 and GH_FR1), cell yield was significantly reduced relative to one but not both reference waters. There is uncertainty as to whether these results represent an adverse response to the test water or variance in test organism performance related to background water quality. In the remaining tests with significant results, mean cell yield was significantly lower than the paired reference. These results may indicate an adverse response to the test water.

The concentration-response analysis for *P. subcapitata* cell yield is presented in Section 3.4.2.

Figure 3.3-3: Individual replicate and mean results for P. subcapitata cell yield in reference (Ref) and test site waters.



Note: See Figure 2.3-1 for description of lines and symbols.

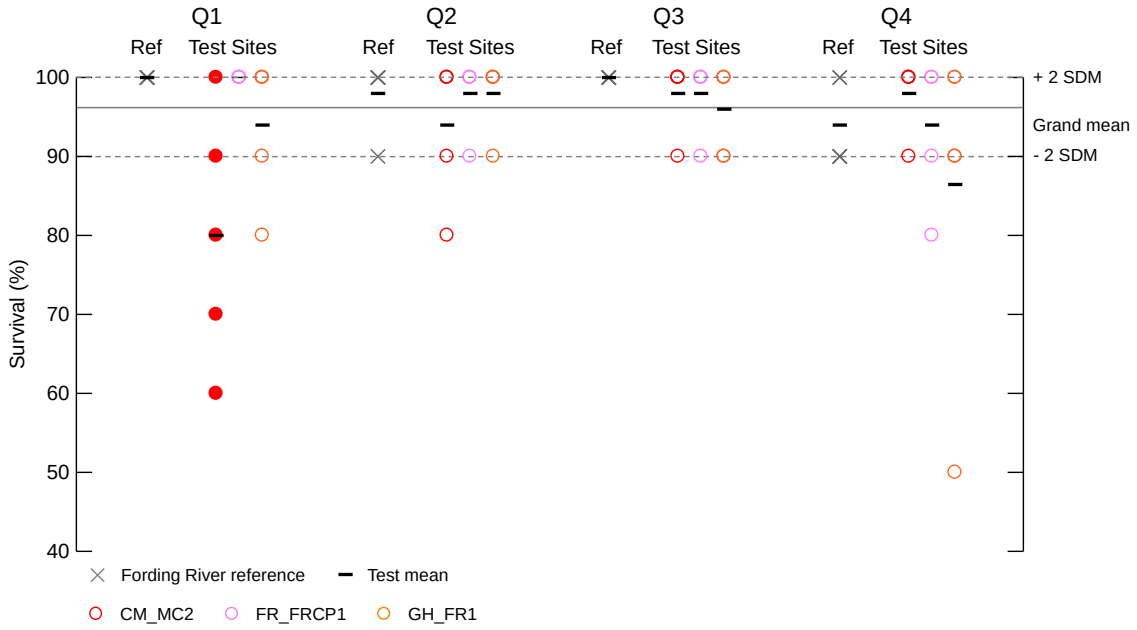
3.3.3 *Hyalella azteca*

There was no evidence of statistically significant adverse effects on mean *H. azteca* survival in any test, with the exception of one Q1 test (CM_MC2) in which mean survival ranged from 60% to 100% in individual replicates (Figure 3.3-4). This inconsistency in response among replicates exposed to the same test water suggests that the statistically significant result may have reflected unusual conditions in test vessels, rather than an adverse response to the test water.

Dry weight was significantly reduced compared to the Fording River reference in most tests. Exceptions were one test in Q1 (GH_FR1), one test in Q3 (CM_MC2), and two tests in Q4 (GH_FR1, CM_MC2) (Figure 3.3-5). Mean dry weight in these tests was lower than the paired reference test, and therefore may indicate an adverse response to the test water.

The concentration-response analysis for *H. azteca* dry weight is presented in Section 3.4.3.

Figure 3.3-4: Individual replicate and mean results for H. azteca survival in reference (Ref) and test site waters.



Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.3-5: Individual replicate and mean results for H. azteca dry weight in reference (Ref) and test site waters.

Note: See Figure 2.3-1 for description of lines and symbols.

3.3.4 *Oncorhynchus mykiss*

There were no adverse behavioral responses of *O. mykiss* in any test. The survival and viability endpoint responses were numerically similar, indicating a low rate of deformities in all samples (Appendix B).

Survival (Figure 3.3-6) was significantly reduced in all Q2 tests, although results were equivocal for these tests because survival was significantly reduced relative to the Elk River reference but not the Fording River reference. For three of the Q2 tests (GH_ERC, EV_HC1, LC_LCDSSLCC), mean survival was within the reference envelope. There is uncertainty as to whether these results represent an adverse response to the test water or variance in test organism performance related to background water quality. In Q4, mean survival was significantly reduced in the majority of test site waters (exceptions were CM_MC2, EV_MC2, and GH_ERC). For the Q4 tests with significant results, mean survival was significantly lower than both references and outside of the reference envelope. These results likely indicate an adverse response to the test water.

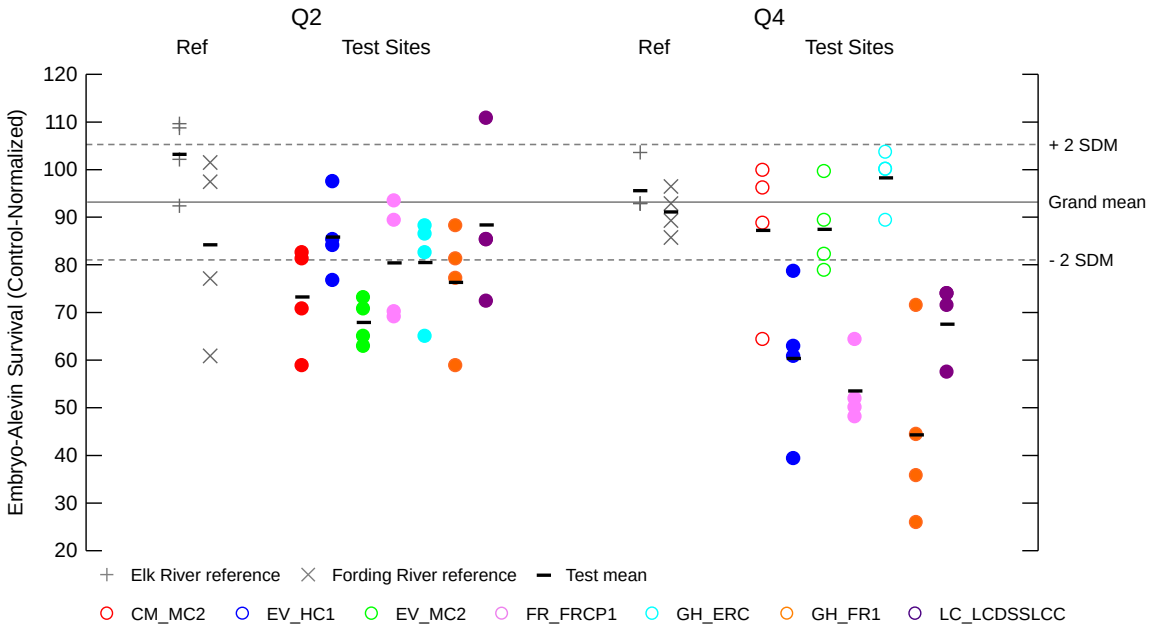
Viability (Figure 3.3-7) was significantly reduced in all Q2 tests, although results were equivocal for these tests because viability was significantly reduced relative to the Elk River reference but not the Fording River reference. For two of the Q2 tests (FR_FRCP1, EV_HC1), mean viability was within the reference envelope. There is uncertainty as to whether these results represent an adverse response to the test water or variance in test organism performance related to background water quality. In Q4, mean viability was significantly reduced in the majority of test site waters (exceptions were EV_MC2 and GH_ERC). For the Q4 tests with significant results, mean viability was significantly lower than both references and outside of the reference envelope. These results likely indicate an adverse response to the test water.

Length (Figure 3.3-8) was significantly reduced in one Q2 test (FR_FRCP1) and one Q4 test (GH_ERC) relative to both references. For the FR_FRCP1 test, mean length was within the reference envelope. There is uncertainty as to whether this result represents an adverse response to the test water or variance in test organism performance related to background water quality. For the GH_ERC test, mean length was significantly lower than both references and outside of the reference envelope. This result likely indicates an adverse response to the test water.

There was no evidence of adverse effects on *O. mykiss* weight in any test (Table 3.3-1; Table 3.3-2; Figure 3.3-9).

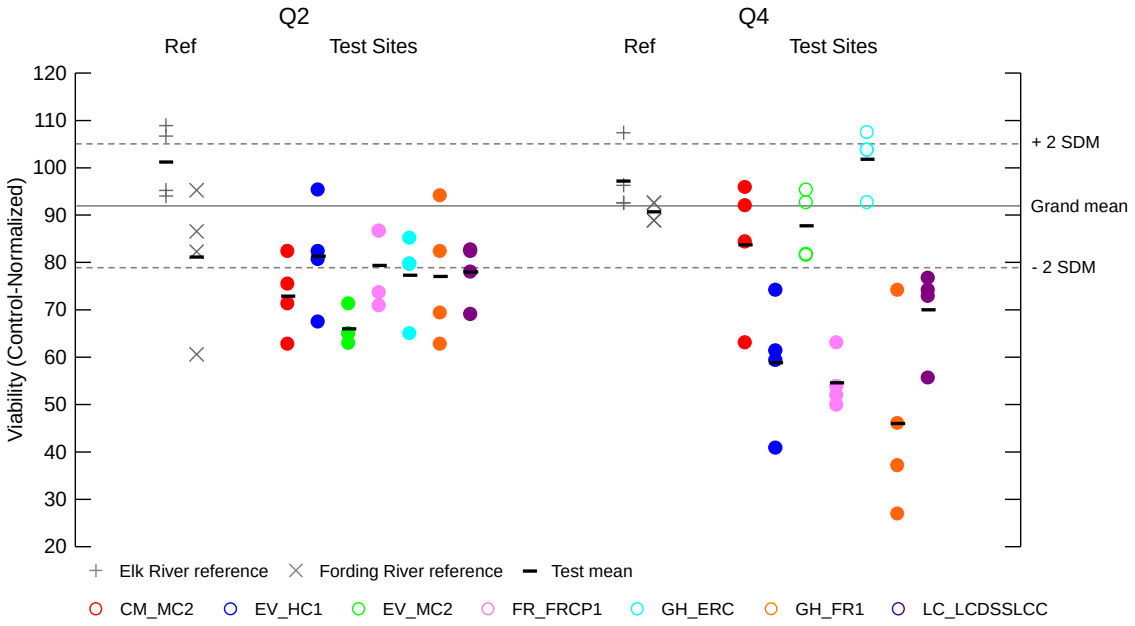
Concentration-response analyses for *O. mykiss* survival, viability, and length are presented in Section 3.4.4.

Figure 3.3-6: Individual replicate and mean results for O. mykiss survival in reference (Ref) and test site waters.



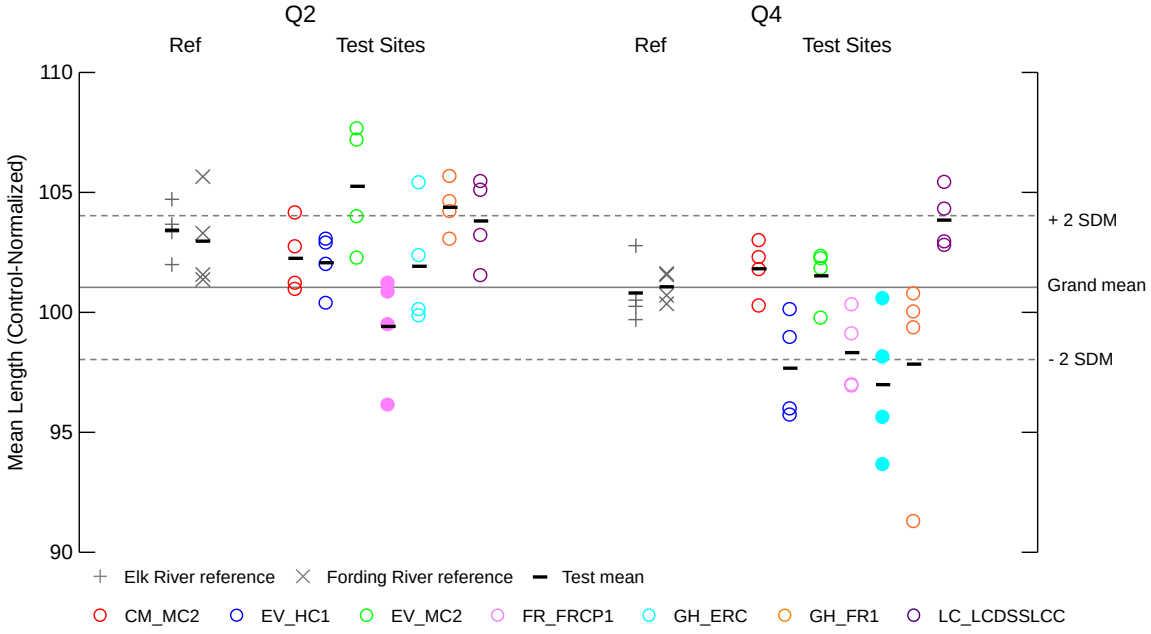
Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.3-7: Individual replicate and mean results for O. mykiss viability in reference (Ref) and test site waters.



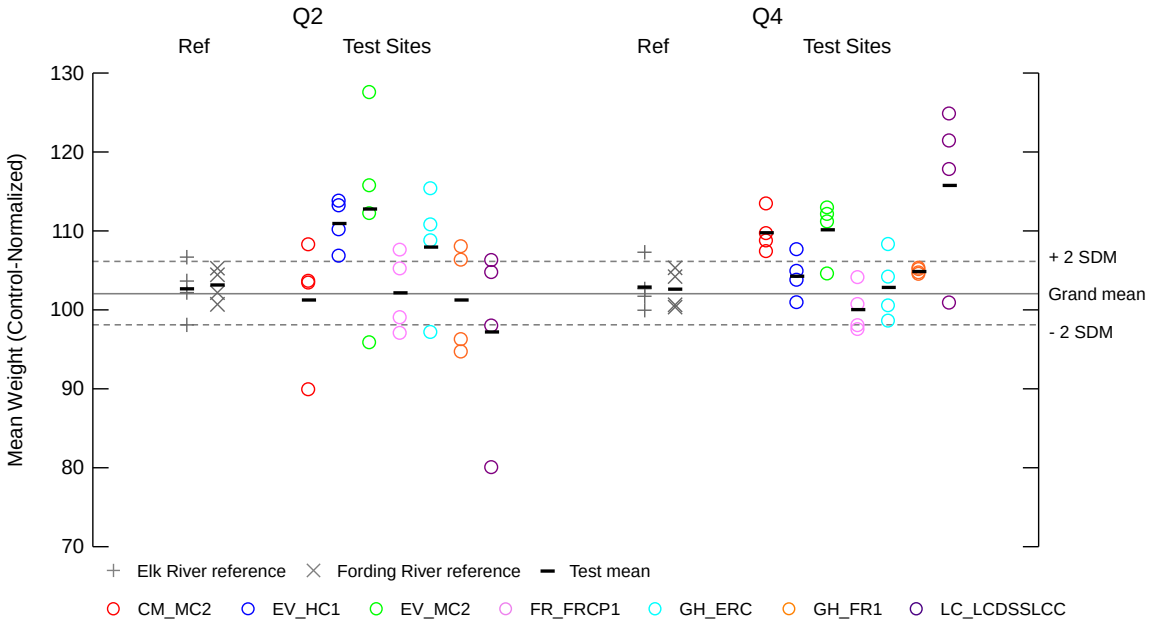
Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.3-8: Individual replicate and mean results for O. mykiss length in reference (Ref) and test site waters.



Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.3-9: Individual replicate and mean results for O. mykiss weight in reference (Ref) and test site waters.



Note: See Figure 2.3-1 for description of lines and symbols.

3.3.5 *Pimephales promelas*

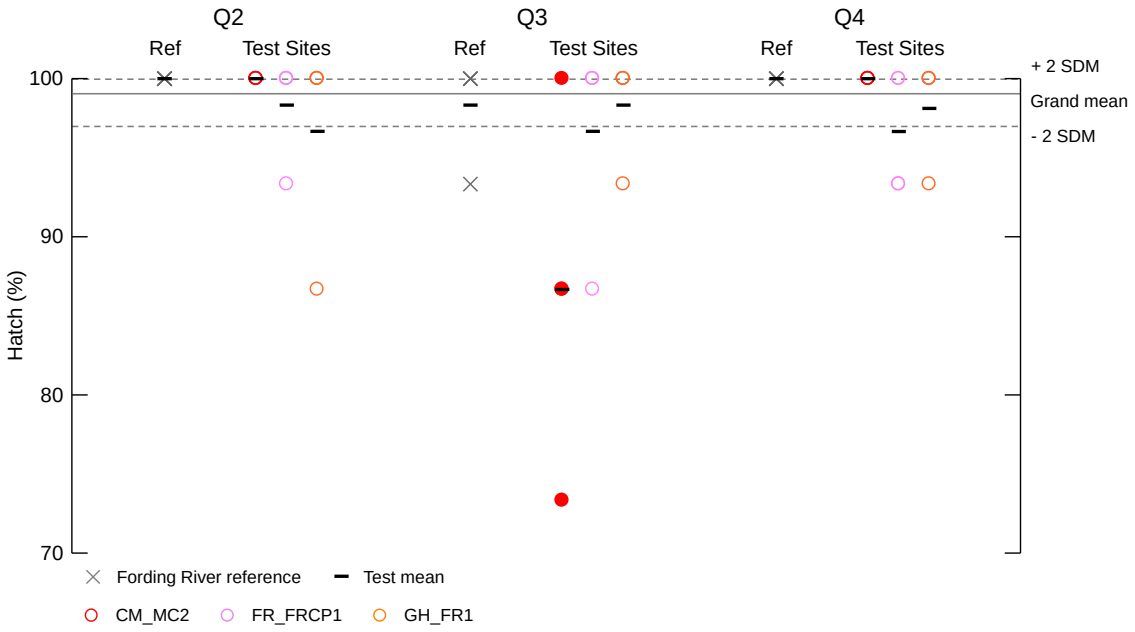
There was no evidence of adverse effects on hatch rate (Figure 3.3-10), survival (Figure 3.3-11), biomass (Figure 3.2-12, length (Figure 3.3-13), or development (Figure 3.3-14), except for hatch rate and survival in the Q3 CM_MC2 test. In this test, reduced survival was largely associated with one replicate (replicate A) and occurred primarily between days 6 and 12 of exposure (Appendix B-3). Thus, the pattern of effects observed in this copper-amended sample was consistent with an effect caused by microbial activity (i.e., sporadic mortality phenomenon), suggesting that the 10 µg/L amendment may have been insufficient in this case to fully control microbial effects in this case. Excluding replicate A, the remaining replicates for sample CM_MC2 yielded survival of 75.6 ± 3.8%, which was not significantly different from the Fording River reference (Appendix B-3).

In Q4, *P. promelas* survival and biomass were lower in the Fording River reference relative to test sites. The reduced survival and biomass in this sample was primarily related to mortalities that occurred in the final 24 hours of the test; survival on day 31 of exposure was 85 ± 10% (which was not statistically different from the control), but was 53.3 ± 9.4% the following day in this sample (Appendix B-4). Dissolved oxygen measured in the sample on the final day of the test was 5.7 mg/L, which was within the acceptable range for this species, but it is possible that stress associated with depressed dissolved oxygen contributed to the adverse effect.

Responses in test site waters in Q4 were not significantly different than the paired laboratory control (Appendix B-4) and mean survival in test site waters was within the reference envelope. Furthermore, the mean *P. promelas* survival and biomass responses in Q4 at all test sites were similar to the responses at the same test sites observed in Q2 and Q3. Overall, even though survival and biomass were lower in the Q4 reference water, the available information indicates no evidence of adverse effects on survival and biomass in test site waters.

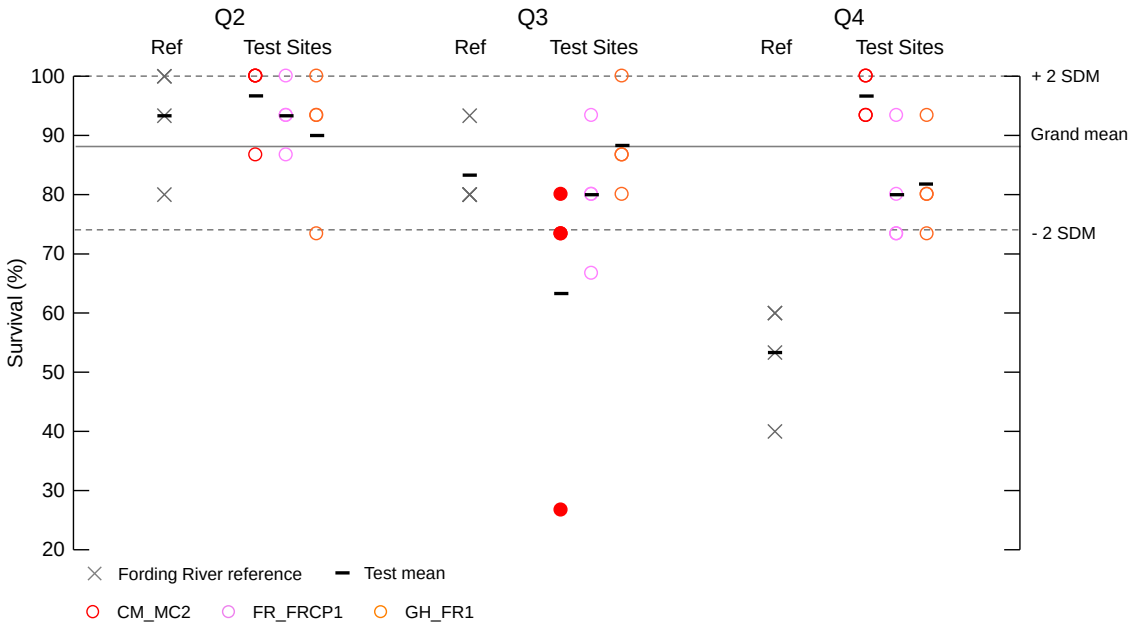
Concentration-response analysis for *P. promelas* hatch is presented in Section 3.4.5.

Figure 3.3-10: Individual replicate and mean results for P. promelas hatch rate in reference (Ref) and test site waters.



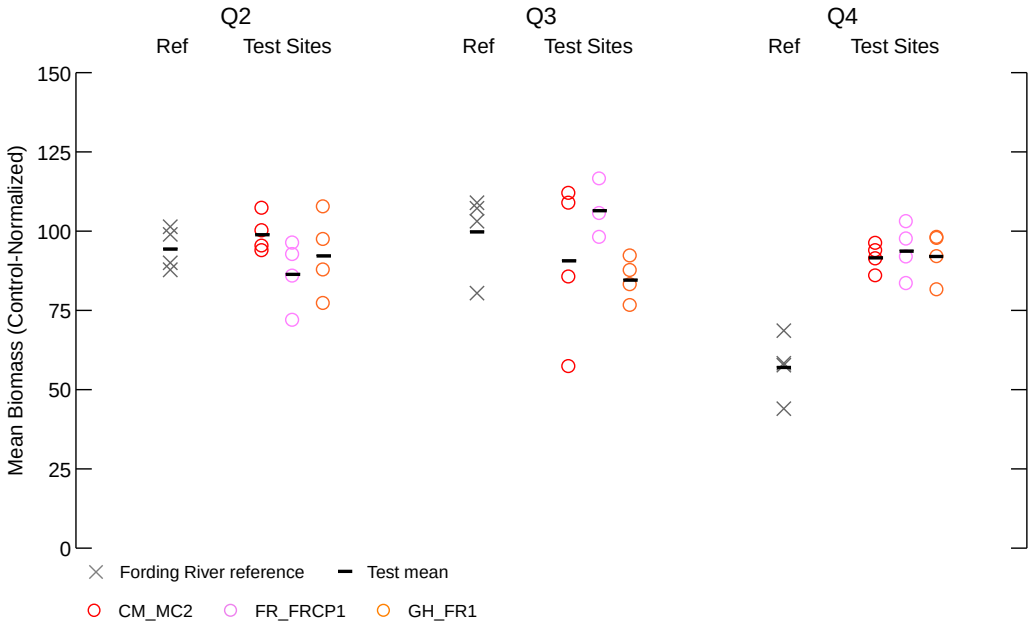
Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.3-11: Individual replicate and mean results for P. promelas survival in reference (Ref) and test site waters.



Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.3-12: Individual replicate and mean results for P. promelas biomass in reference (Ref) and test site waters.

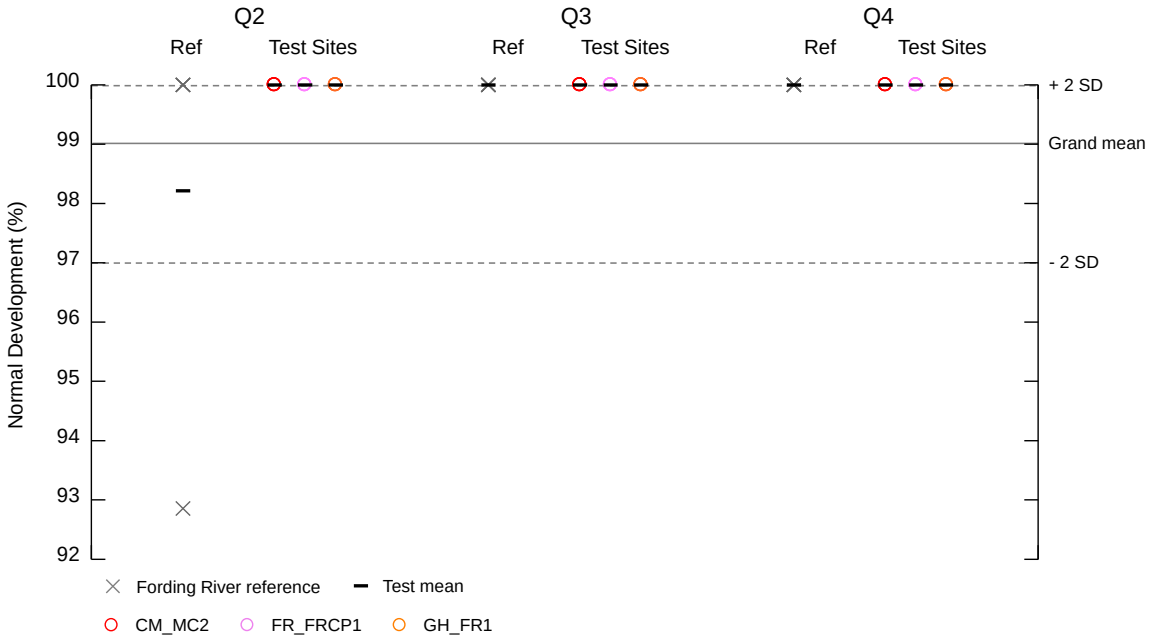


Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.3-13: Individual replicate and mean results for P. promelas length in reference (Ref) and test site waters.

Note: See Figure 2.3-1 for description of lines and symbols.

Figure 3.3-14: Individual replicate and mean results for P. promelas development in reference (Ref) and test site waters.



Note: See Figure 2.3-1 for description of lines and symbols.

3.4 Concentration Response Analysis

Concentration-response analyses were conducted for endpoints that were significantly reduced in one or more test site waters relative to reference waters (i.e., *C. dubia* reproduction, *P. subcapitata* cell yield, *H. azteca* growth, *O. mykiss* survival, viability, and length, and *P. promelas* hatch)[8]. Response data paired with water chemistry data are shown in Appendix C, Tables C-1 to C-5. Spearman rank order correlations are shown in Appendix C, Tables C-6 to C-10. Concentrations of parameters in tests with statistically significant responses are screened against chronic BC WQGs in Appendix C, Table C-11. The following sections present the results of the concentration-response analysis for each endpoint listed above.

3.4.1 Ceriodaphnia dubia Reproduction

The four Order constituents (dissolved cadmium, nitrate, sulphate, total selenium; Figure 3.4-1) and seven additional parameters were carried through to graphical analysis (Table C-6). The additional parameters (dissolved organic carbon [DOC], total lithium, total Kjeldahl nitrogen [TKN], total organic carbon [TOC], total suspended solids [TSS], turbidity, and total vanadium; Figure 3.4-2 and Figure 3.4-3) included those with statistically significant negative Spearman rank correlations and that did not screen out when compared to water quality guidelines. PC1 scores for the 2015 and 2016 combined dataset (which accounted for 35.1% of the variance) and the 2016 dataset only (which accounted for 31.5% of the variance) did not have statistically significant negative Spearman rank correlations (Table C-6).

[8] *P. promelas* survival was significantly reduced in one test. Because the reduced survival was consistent with sporadic mortality phenomenon (Section 3.3.5), this endpoint was not included in the concentration-response analysis. *H. azteca* survival was significantly reduced in one test. Because the inconsistency in response among replicates exposed to the same test water suggests that the result may have reflected unusual conditions in the test vessels (Section 3.3.3), this endpoint was not included in the concentration-response analysis.

None of the evaluated parameters exhibited a consistent concentration-response relationship across all tests (Figure 3.4-1 to Figure 3.4-3). Concentrations of most parameters in tests with a statistically significant result were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-1) and/or were lower than a chronic BC WQG (Table C-11). Such parameters are not expected to contribute to toxicity in these tests. Parameters that were greater than concentrations in reference waters and/or test site waters with non-significant results, and that were greater than a chronic BC WQG (when such exists), were:

- **CM_MC2 (Q1, Q3)—**Concentrations of sodium and strontium in these tests were higher than reference waters and test site waters with non-significant results. However, the strontium concentration in these tests (0.32 mg/L in Q1 and 0.34 mg/L in Q3) were more than an order of magnitude lower than the reported IC20 of 11 mg/L for C. dubia (McPherson et al. 2014), indicating that it is not likely contributing to toxicity. The sodium concentrations in these tests (13 mg/L in Q1 and 11.2 mg/L in Q3) were an order of magnitude lower than the reported IC25 for C. dubia of 122 mg/L sodium tested as NaCl9. Because the toxicity of sodium salts is primarily attributable to the corresponding anion (Mount et al. 1997) and the sodium concentrations in test waters were an order of magnitude lower than the effect concentration, sodium is not likely contributing to toxicity. Extensive testing by Mount et al. (2016) with C. dubia as a follow up to Mount et al. (1997) experiments determined “sodium salts being less toxic than salts of other cations”. Overall, no water quality parameter was identified as a potential cause of the statistically significant result in these tests.

- **CM_MC2 (Q2), GH_ERC (Q2)**—Turbidity in the CM_MC2 test (6.5 Nephelometric Turbidity Units [NTU]) and GH_ERC test (5.7 NTU) were only slightly higher than the Q2 EV_MC2 test in 2015 (4.7 NTU) that had a non-significant result. Therefore, turbidity is unlikely to be the cause of observed responses. Overall, no water quality parameter was identified as a potential cause of the statistically significant result in these tests.

- **CM_MC2 (Q4), EV_HC1 (Q2)**—Concentrations of all parameters were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-1, Table C-11). No water quality parameter was identified as a potential cause of the significant result in these tests.

- **EV_MC2 (Q2)**—Concentrations of DOC, ortho-phosphate, phosphorus, TOC, TSS, turbidity, and total vanadium were higher than reference waters and test site waters with non-significant results. The vanadium concentration in this test (0.0019 mg/L) was several orders of magnitude lower than the federal WQG of 0.12 mg/L (Environment Canada 2016), indicating that it is not as plausible explanation for toxicity. Phosphorus is a constituent that may result in ecological changes in the receiving environment under long-term discharge conditions, but does not have the potential for direct aquatic toxicity at the concentrations observed in these samples. DOC and TOC are considered toxicity-modifying factors rather than toxicants, indicating that these parameters are not likely contributing to toxicity; furthermore, moderate levels of DOC supplementation have an ameliorative effect on potential toxicants (e.g., divalent metals cations) in surface water through formation of organic ligand complexes that reduce the bioavailable fraction of these substances. The TSS concentration in this test (24.9 mg/L) was only slightly higher than observed in the Q2 EV_MC2 test in 2015 (23.4 mg/L) that had non-significant results, indicating that TSS is unlikely to be the

[9] Report available at: http://www2.dupont.com/Clean_Technologies/es_MX/assets/downloads/appendix_j1.pdf

cause of observed responses. Turbidity in this test (10.8 NTU) was 2.3 to 83 times higher than concentrations in reference waters and/or test site waters with non-significant results. Turbidity, or some factor associated with the turbid sample condition, may have contributed to the statistically significant response in this test.

- **EV_MC2 (Q4)**—Concentrations of DOC, ortho-phosphate, TOC, and turbidity in this test were higher than reference waters and test site waters with non-significant results. As discussed in the previous bullet, ortho-phosphate, TOC, and DOC would not be expected to contribute to toxicity and DOC tends to reduce toxicity to many constituents. Turbidity in this test (5.46 NTU) was only slightly higher than the Q2 EV_MC2 test in 2015 (4.7 NTU) that had non-significant results. Turbidity is unlikely to be the cause of observed responses. Overall, no water quality parameter was identified as a potential cause of the statistically significant result in this test.

- **FR_FRCP1 (Q1)**—Concentrations of nitrate, selenium, and sulphate in this test were greater than the lowest level 1 benchmark from the EVWQP (Table C-11).[10] The sulphate concentration in this test (765 mg/L) was slightly lower than the IC_{20} value for sulphate in alkalinity-supplemented Fording River water (840 mg/L) (Golder 2013), indicating that it is close to the threshold for toxicity to *C. dubia*. The concentration of nitrate in this test (27.9 mg/L NO_3-N) was approximately equal to the level 2 benchmark from the EVWQP (28.2 mg/L NO_3-N at hardness of 1,120 mg/L as $CaCO_3$). The level 2 benchmark is associated with 20% effect on *C. dubia* reproduction, indicating that nitrate may have contributed to the observed response in this test. The selenium concentration in this test (209 µg/L) was higher than the maximum concentration tested in a mixture toxicity study that resulted in no adverse effects (149 µg/L) (Golder 2013), so it cannot be ruled out that selenium may have also contributed to the observed response in this test. Titanium was also higher than test site waters with non-significant results, but this difference was small (less than 20%). In addition to these parameters, lithium, TDS, and several parameters related to TDS (e.g., calcium) were also higher in this test than concentrations in reference waters and/or test site waters with non-significant results. The lithium concentration in this test (0.0585 mg/L) was lower than the reported IC_{25} of 0.32 mg/L for *C. dubia* (Kszos et al. 2003)[11], indicating that it is not likely contributing to toxicity. TDS in this test (1,520 mg/L) was higher than the IC_{20} for TDS in alkalinity-supplemented Fording River water (1,322 mg/L) (Golder 2013), indicating that TDS may have contributed to the observed response in this test. In summary, parameters that may have contributed to the observed response in this test are nitrate, selenium, TDS, or a combination of these factors.

- **FR_FRCP1 (Q2, Q3, Q4)**—Concentrations of nitrate and selenium in these tests were greater than the lowest level 1 benchmark from the EVWQP (Table C-11). The concentration of nitrate in Q2 (7.35 mg/L NO_3-N), Q3 (11.9 mg/L NO_3-N), and Q4 (10 mg/L NO_3-N) were approximately equal to the level 2 benchmark from the EVWQP (7.7 mg/L NO_3-N at hardness of 305 mg/L as $CaCO_3$, 11.5 mg/L NO_3-N at hardness of 455 mg/L as $CaCO_3$, and 11.4 mg/L NO_3-N at hardness of 453 mg/L as $CaCO_3$). The level 2 benchmark is associated with 20% effect on *C. dubia* reproduction observed in Fall 2013 testing, indicating

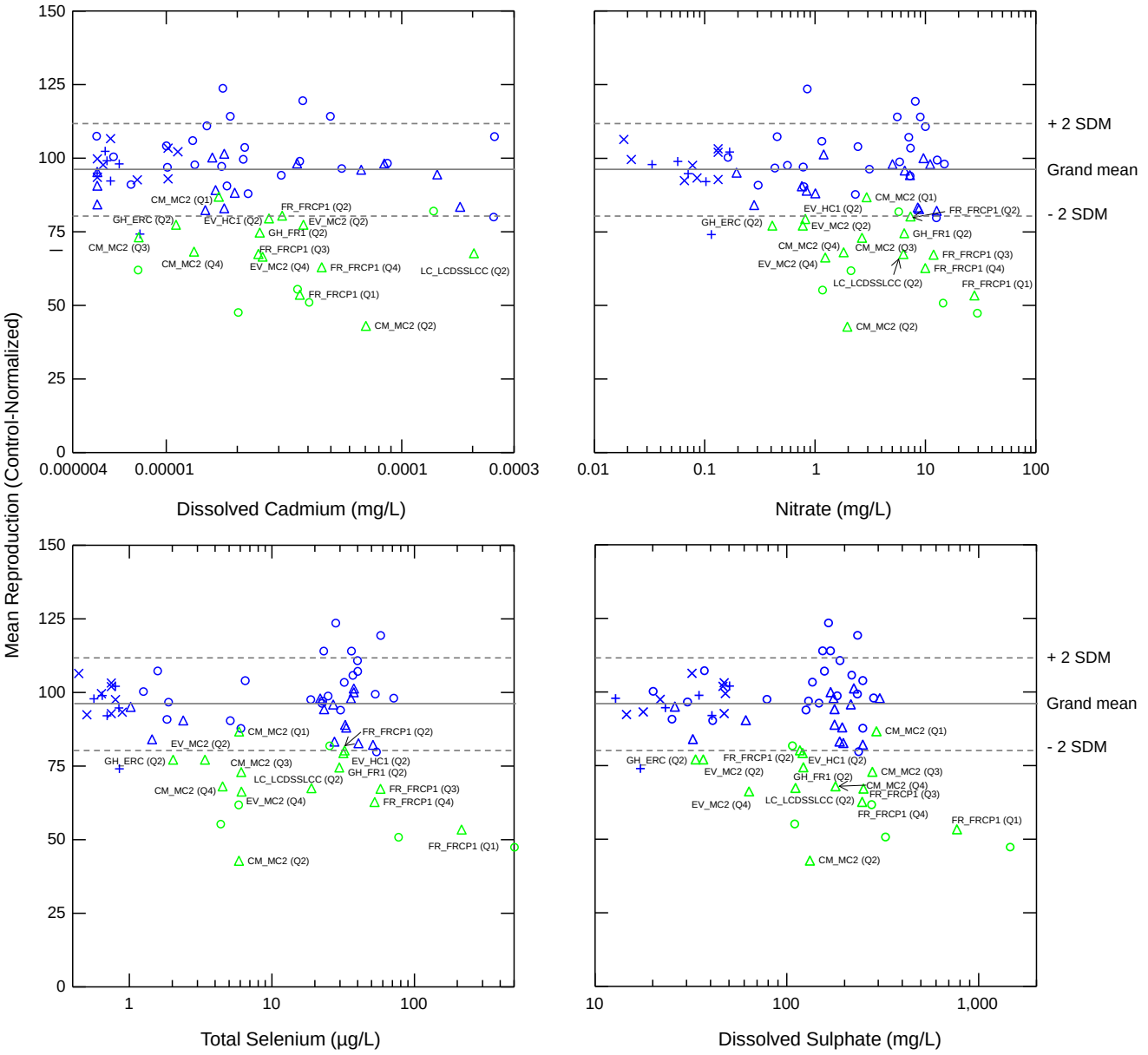
[10] As discussed further in Section 2.4, water quality under winter low flow conditions at FR_FRCP1 is not representative of conditions in the upper Fording River to satisfy its primary intent which is to monitor and evaluate cumulative discharges from Fording River Operations in the receiving environment (Teck 2017).

[11] Sodium has been shown to ameliorate lithium toxicity (Kszos et al. 2003). The sodium concentration in the Q1 FR_FRCP1 test (2.18 mg/L) was similar to conditions in which the IC_{25} was derived (2.8 mg/L), making the effect concentration from Kszos et al. (2003) relevant to the FR_FRCP1 test.

that nitrate may have contributed to the observed responses in these tests. The selenium concentrations in Q2 (31.6 µg/L), Q3 (56.4 µg/L), and Q4 (51.3 µg/L) were lower than the maximum concentration tested in a mixture toxicity study that resulted in no adverse effects (149 µg/L) (Golder 2013), indicating that it is not likely contributing to toxicity. In addition to these parameters, TOC in Q2 was also higher than concentrations in reference waters and/or test site waters with non-significant results. As discussed in the previous bullet, TOC would not be expected to contribute to toxicity. Overall, nitrate is the only parameter identified that may have contributed to the observed response in these tests.

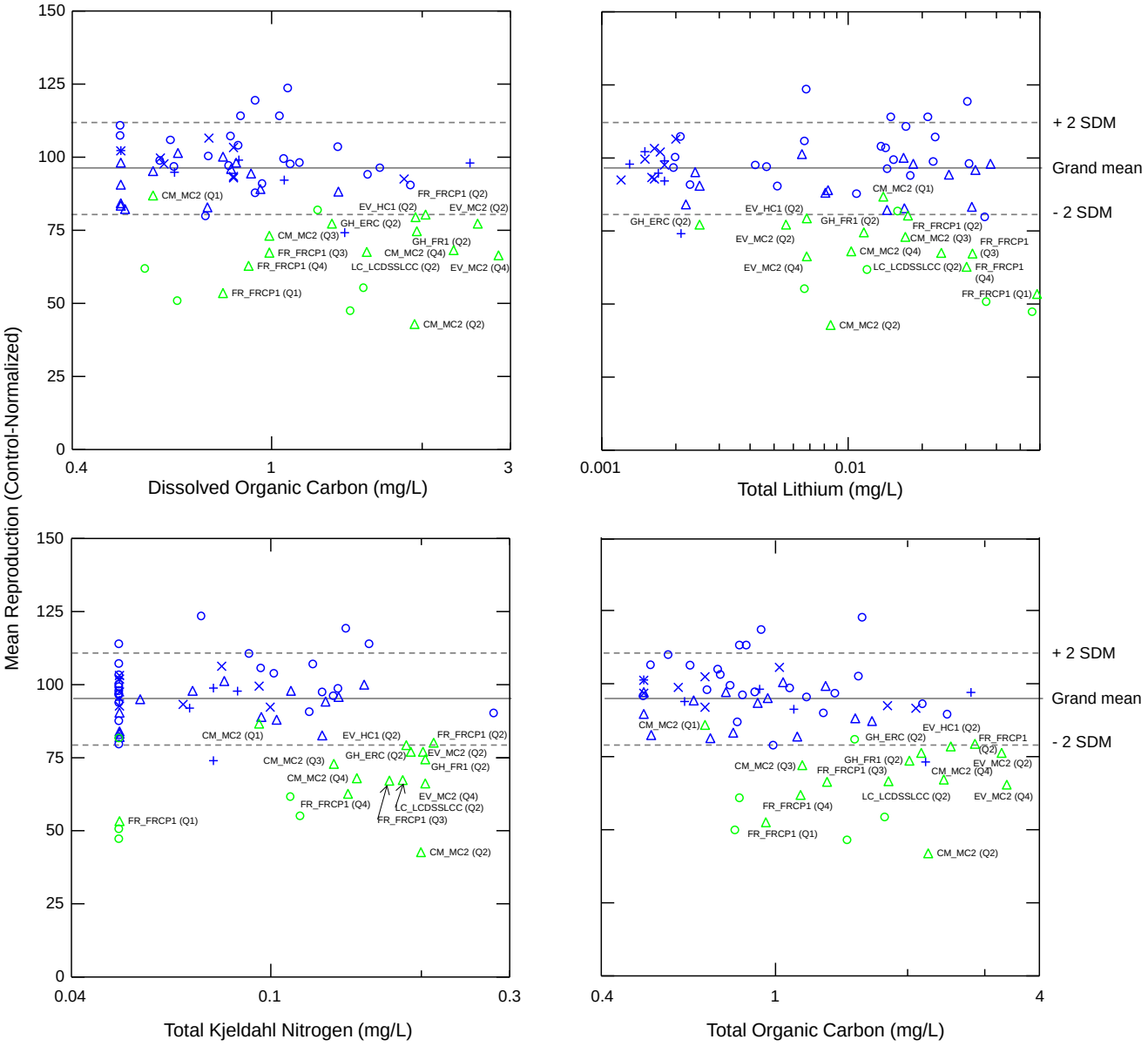
- **GH_FR1 (Q2)**—Concentrations of nitrate and selenium in this test were greater than the lowest level 1 benchmark from the EVWQP (Table C-11). The concentration of nitrate in this test (6.45 mg/L NO_3-N) was slightly lower than the level 2 benchmark from the EVWQP (7.8 mg/L NO_3-N at hardness of 312 mg/L as $CaCO_3$), indicating that nitrate may have contributed to the observed response in this test. The selenium concentration in this test (29 µg/L) was lower than the maximum concentration tested in a mixture toxicity study that resulted in no adverse effects (149 µg/L) (Golder 2013), indicating that it is not likely contributing to toxicity. Overall, nitrate is the only parameter identified that may have contributed to the observed response in this test.
- **LC_LCDSSLCC (Q2)**—The concentration of nitrate in this test (6.33 mg/L NO_3-N) was slightly lower than the level 2 benchmark from the EVWQP (7.4 mg/L NO_3-N at hardness of 293 mg/L as $CaCO_3$), indicating that nitrate may have contributed to the observed response in this test.

Figure 3.4-1: Mean reproduction of C. dubia versus concentrations of dissolved cadmium (top left), nitrate (top right), total selenium (bottom left), and sulphate (bottom right).



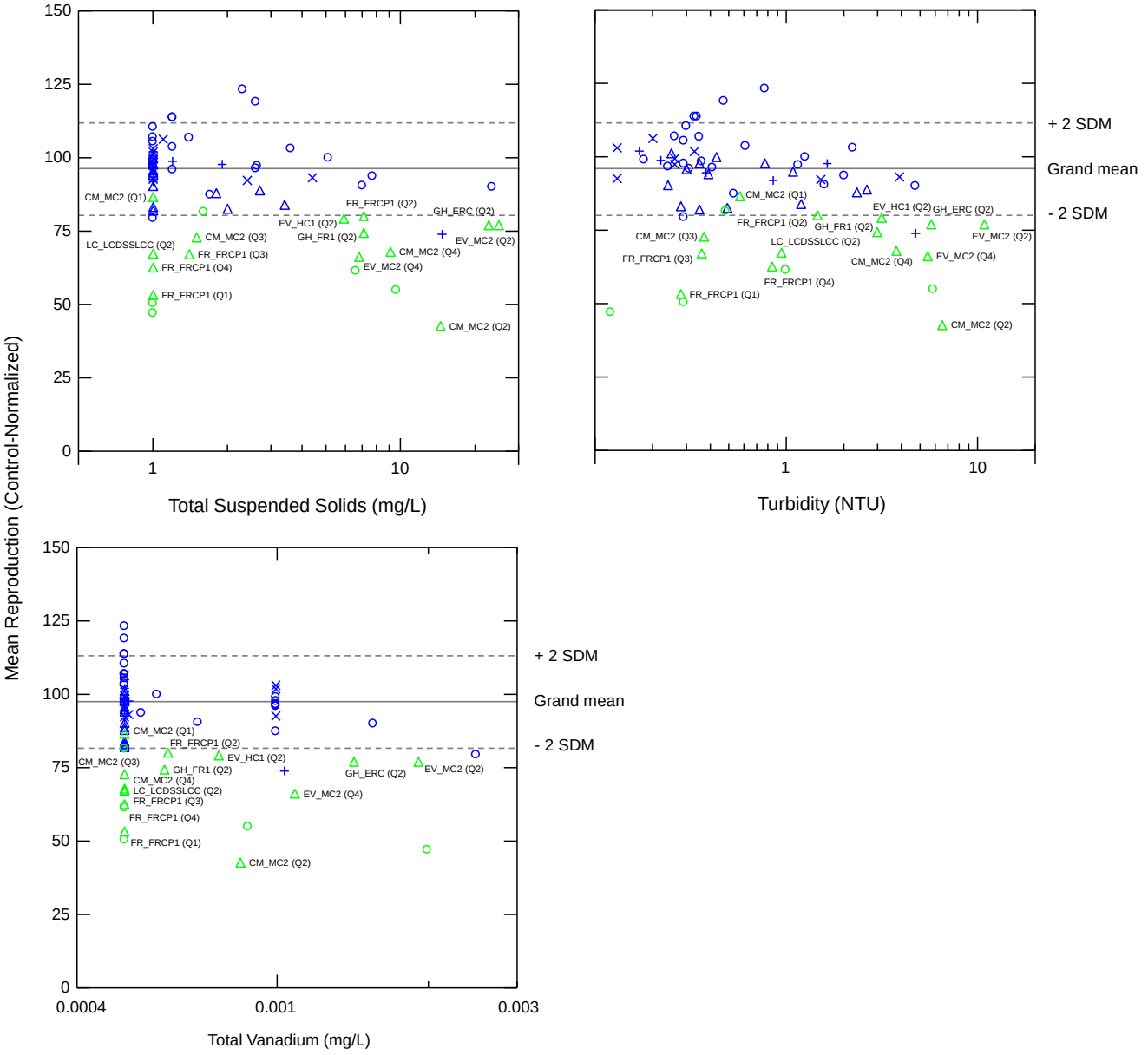
Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter. Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

Figure 3.4-2: Mean reproduction and concentration of dissolved organic carbon (top left), total lithium (top right), total Kjeldahl nitrogen (bottom left), and total organic carbon (bottom right).



Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter. Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

Figure 3.4-3: Mean reproduction and concentration of total suspended solids (top left), turbidity (top right), and total vanadium (bottom left).



Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter. Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

3.4.2 *Pseudokirchneriella subcapitata* Cell Yield

The four Order constituents (dissolved cadmium, nitrate, sulphate, total selenium; Figure 3.4-4), and seven additional parameters with statistically significant negative Spearman rank correlations (DOC, phosphorus, total titanium, TKN, TOC, TSS, and total vanadium; Figure 3.4-5 and Figure 3.4-6) that did not screen out when compared to water quality guidelines, were carried through to graphical analysis (Table C-7). PC1 scores for the 2015 and 2016 combined dataset (which accounted for 35.1% of the variance) and the 2016 only dataset (which accounted for 31.5% of the variance) did not have statistically significant negative Spearman rank correlations (Table C-7).

None of the evaluated parameters exhibited a consistent concentration-response relationship across all tests (Figure 3.4-4 to Figure 3.4-6). Concentrations of most parameters in tests with a significant result were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-2) and/or were lower than a chronic BC WQG (Table C-11). Such parameters are not expected to contribute to toxicity in these tests. Parameters that were greater than concentrations in reference waters and/or test site waters with non-significant results, and that were greater than a chronic BC WQG (when such exists), were:

- **CM_MC2 (Q1, Q3)**: Concentrations of sodium and strontium in these tests were higher than reference waters and test site waters with non-significant results. However, the strontium concentration in these tests (0.32 mg/L in Q1 and 0.34 mg/L in Q3) were more than an order of magnitude lower than the reported IC_{20} of 36 mg/L for *P. subcapitata* (McPherson et al. 2014), indicating that it is not likely a contributor to toxicity. The sodium concentrations in these tests (13 mg/L in Q1 and 11.2 mg/L in Q3) were more than an order of magnitude lower than the reported *P. subcapitata* IC_{50} of 342 mg/L for sodium as NaCl[12]. Because the toxicity of sodium salts is primarily attributable to the corresponding anion (Mount et al. 1997) and the sodium concentrations in this test was an order of magnitude lower than the effect concentration, sodium is not likely contributing to toxicity. Overall, no water quality parameter was identified as a potential cause of the statistically significant result in this test.
- **CM_MC2 (Q2)**: Concentrations of all parameters were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-2). No water quality parameter was identified as a potential cause of the significant result in this test.
- **EV_HC1 (Q1)**: The concentration of selenium in this test was higher than the lowest level 1 benchmark from the EVWQP, which was derived for invertebrates. The concentration of selenium in this test (36.7 µg/L) is lower than the highest concentration in the Golder (2013) mixture toxicity test that resulted in no significant adverse effects to *P. subcapitata* cell yield (139 µg/L). Overall, no water quality parameter was identified as a potential cause of the statistically significant result in this test.
- **FR_FRCP1 (Q1)**: Concentrations of nitrate, selenium, and sulphate in this test were greater than the lowest level 1 benchmark from the EVWQP (Table C-11).[13] Nitrate and sulphate are not expected to have contributed to toxicity in this test because the test site concentrations (27.9 mg/L NO_3-N and 765 mg/L) were lower than the highest concentrations tested in the Golder (2013) mixture toxicity study that reported

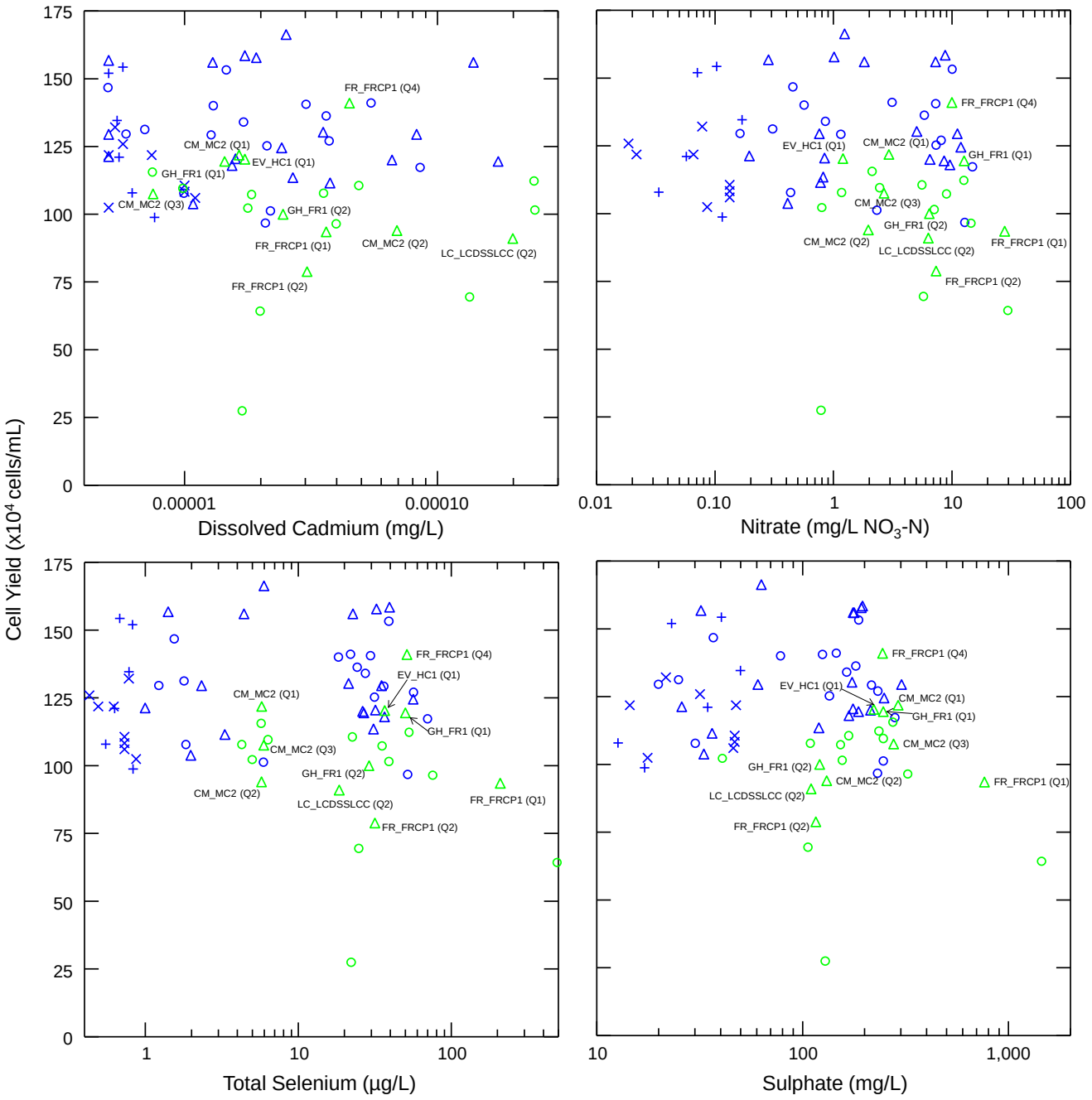
[12] Report available at: http://www2.dupont.com/Clean_Technologies/es_MX/assets/downloads/appendix_j1.pdf

[13] As discussed further in Section 2.4, water quality under winter low flow conditions at FR_FRCP1 is not representative of conditions in the upper Fording River to satisfy its primary intent which is to monitor and evaluate cumulative discharges from Fording River Operations in the receiving environment (Teck 2017).

no adverse effects to this species (41 mg/L NO_3-N and 931 mg/L). The concentration of selenium (209 µg/L) in this test was higher than the range tested in the mixture toxicity study. Titanium was also higher than test site waters with non-significant results, but this difference was small (less than 20%). In addition to these parameters, lithium, TDS, and several parameters related to TDS (e.g., calcium) were also higher in this test than concentrations in reference waters and/or test site waters with non-significant results. The concentration of TDS in this test (1,520 mg/L) was approximately equal to the highest concentration in the Golder (2013) mixture toxicity test that resulted in no significant adverse effects to *P. subcapitata* cell yield (1,498 mg/L). The concentration of lithium in this test was greater (more than 20%) relative to reference waters and/or test site waters with non-significant results. Overall, no constituent was identified as a likely explanation for the observed response, although it could not be definitively determined whether lithium, selenium, and/or titanium contributed to the statistically significant response in this test. Titanium and lithium are not normally considered to be toxicants to aquatic life. There are no BC, Canadian Council of Ministers of the Environment (CCME), or US EPA WQGs for the protection of aquatic life for these constituents, and as of January 2017, the US EPA ECOTOX database does not have titanium or lithium toxicity data. Therefore, it is unlikely that these parameters contributed to the observed response in this test.

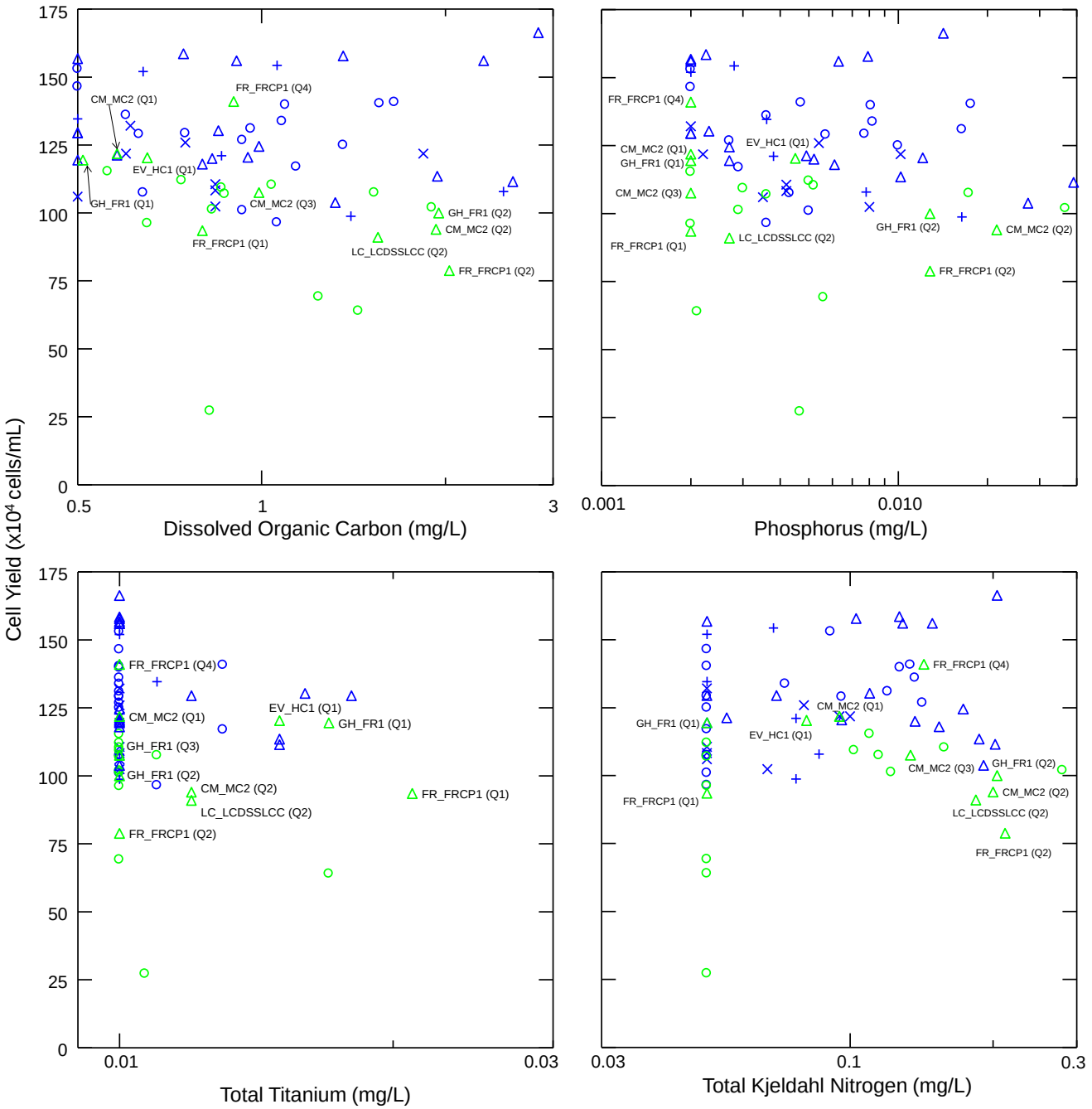
- **FR_FRCP1 (Q2, Q4), GH_FR1 (Q1, Q2), LC_LCDSSLCC (Q2)**: Concentrations of nitrate and selenium in these tests were greater than the lowest level 1 benchmark from the EVWQP (Table C-11), except for selenium in the LC_LCDSSLCC test. Concentrations of nitrate (range: 6.33 to 12.7 mg/L NO_3-N) and selenium (range: 29 to 51.3 µg/L) were lower than the highest concentrations tested in the Golder (2013) mixture toxicity study that reported no adverse effects to *P. subcapitata* (41 mg/L NO_3-N and 139 µg/L), indicating that these parameters are not likely contributing to toxicity. In the Q2 FR_FRCP1 test, TKN was also higher than test site waters with non-significant results, but this difference was small (less than 4%). Therefore, TKN is unlikely to be the cause of observed responses. Overall, no water quality parameter was identified as a potential cause of the statistically significant result in these tests.

Figure 3.4-4: Mean cell yield of P. subcapitata versus concentrations of dissolved cadmium (top left), nitrate (top right), total selenium (bottom left), and sulphate (bottom right).



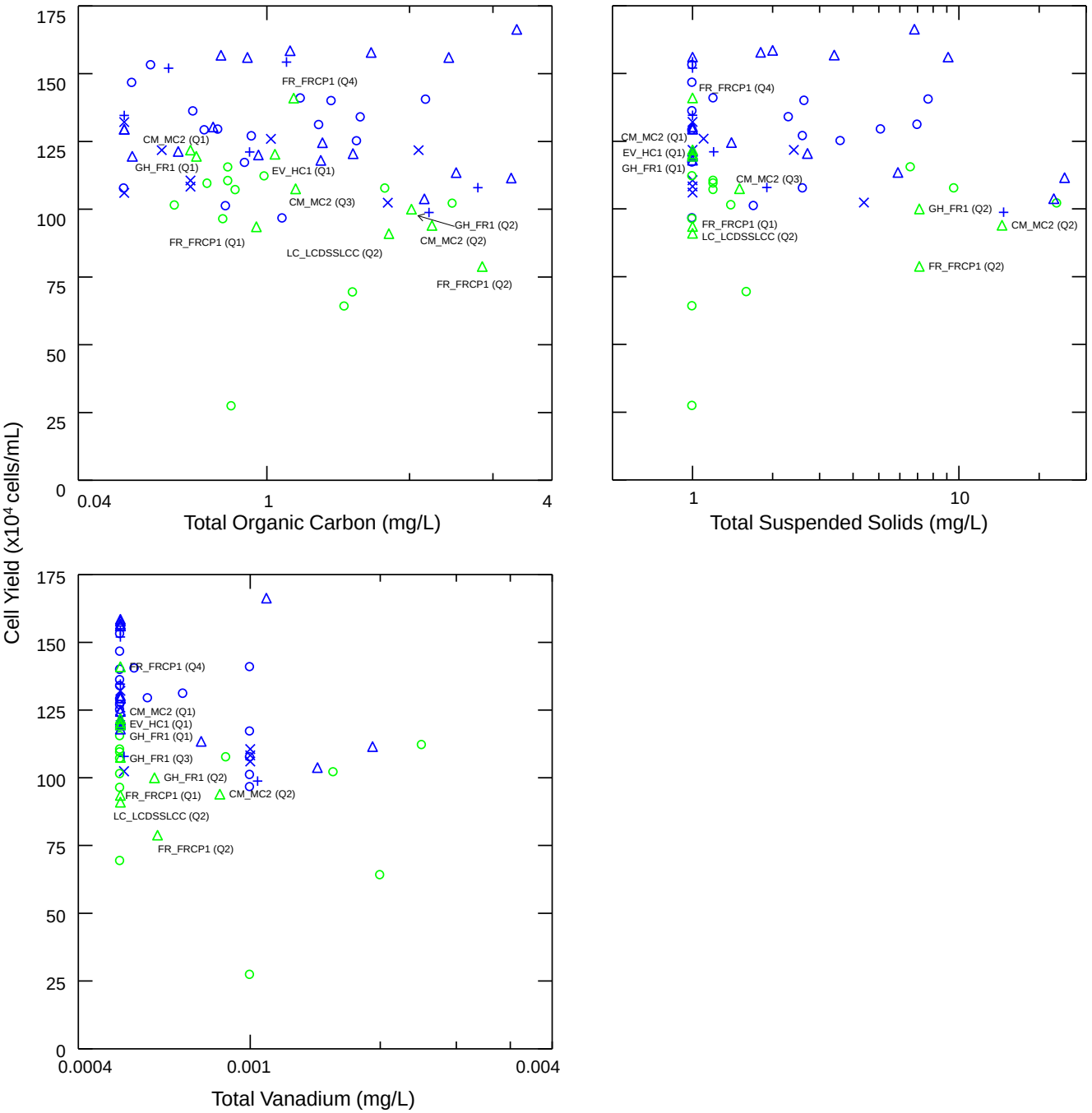
Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter.

Figure 3.4-5: Mean cell yield P. subcapitata versus concentrations of dissolved organic carbon (top left), phosphorus (top right), total titanium (bottom left), and total Kjeldahl nitrogen (bottom right).



Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter.

Figure 3.4-6: Mean cell yield P. subcapitata versus concentrations of total organic carbon (top left), total suspended solids (top right), and total vanadium.



Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter.

3.4.3 *Hyalella azteca* Growth

The four Order constituents (dissolved cadmium, nitrate, sulphate, total selenium; Figure 3.4-7) and two additional parameters with statistically significant negative Spearman rank correlations (total lithium, total titanium, TDS, TKN, TSS, total vanadium; Figure 3.4-8 and Figure 3.4-9) that did not screen out when compared to water quality guidelines were carried through to graphical analysis (Table C-8). Parameters related to TDS (e.g., alkalinity) also had significant correlations but were not evaluated separately from TDS. Although total bismuth had a significant negative correlation, it was not included in graphical analysis because of low detection frequency[14]. PC1 scores for the 2015 and 2016 combined dataset (which accounted for 38.6% of the variance) and the 2016 only dataset (which accounted for 43.3% of the variance) did not have statistically significant negative Spearman rank correlations (Table C-8).

None of the evaluated parameters exhibited a consistent concentration-response relationship across all tests (Figure 3.4-7 to Figure 3.4-9). Concentrations of most parameters in tests with a significant result were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-3), and/or were lower than the chronic BC WQG (Table C-11). Such parameters are not expected to contribute to toxicity in these tests. Parameters that were greater than concentrations in reference waters and/or test site waters with non-significant results, and that were greater than a chronic BC WQG (when such exists), were:

- **CM_MC2 (Q1):** Concentrations of all parameters in this test were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-3), and/or were lower than the chronic BC WQG (Table C-11). No water quality parameter was identified as a potential cause of the statistically significant result in this test.
- **CM_MC2 (Q2)**: The concentration of sodium in this test (13 mg/L) was higher than reference waters and test site waters with non-significant results, but this difference was small (13%). Mount et al. (1997, 2016) document that the toxicity of sodium salts to crustaceans is low relative to other major ion salts, reflects primarily an influence of the paired anions, and correlates well with osmolarity. Therefore, sodium as an individual constituent is unlikely to be the cause of observed responses. Overall, no water quality parameter was identified as a potential cause of the statistically significant result in this test.
- **FR_FRCP1 (Q1)**: Concentrations of nitrate, selenium, and sulphate in this test were greater than the lowest level 1 benchmark from the EVWQP (Table C-11).[15] The nitrate concentration in this test (25.7 mg/L NO_3-N) was slightly higher than the 14-day EC_{20} of 23 mg/L for *H. azteca* biomass in Fording River water (Annex F of Teck 2014), indicating that nitrate may have contributed to the observed response in this test. Sulphate is not expected to have contributed to toxicity in this test because the test site concentration (561 mg/L) was lower than the no-observed effect concentration of 1,110 mg/L in Fording River water (Annex F of Teck 2014). The selenium concentration in this test (148 µg/L) was higher than the maximum concentration tested in the SPO mixture study that resulted in no adverse effects (57 µg/L) (Golder 2016), so it cannot be ruled out that selenium may have also contributed to the observed response in this test. In addition to these parameters, lithium, TDS, and several parameters related to TDS (e.g., calcium) were also higher in this

[14] Of 16 samples, one had a detected concentration of total bismuth (Table C-3).

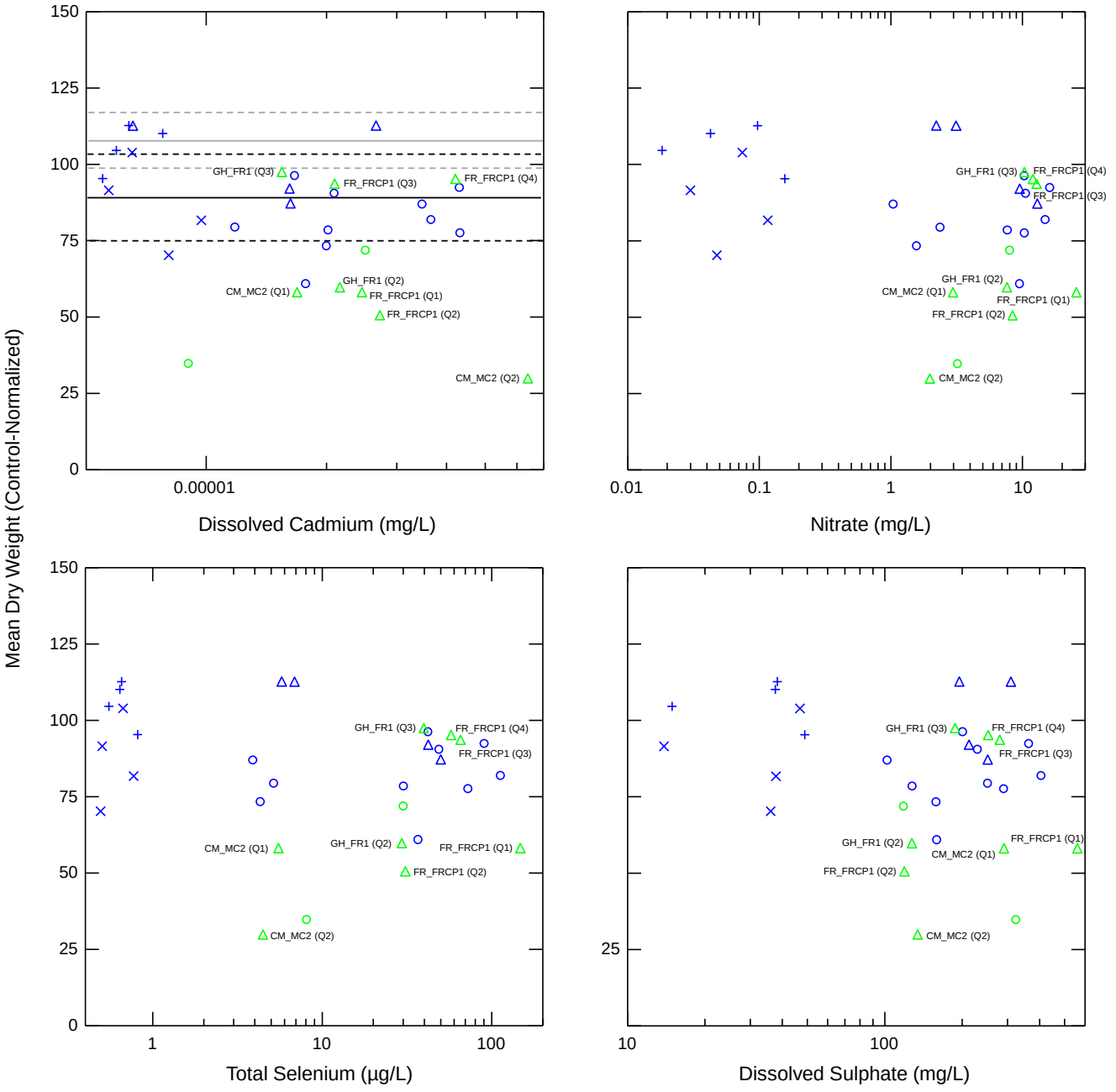
[15] As discussed further in Section 2.4, water quality under winter low flow conditions at FR_FRCP1 is not representative of conditions in the upper Fording River to satisfy its primary intent which is to monitor and evaluate cumulative discharges from Fording River Operations in the receiving environment (Teck 2017).

test than concentrations in reference waters and/or test site waters with non-significant results. TDS is not expected to have contributed to toxicity in this test because the test site concentration (1,205 mg/L) was lower than the no-observed effect concentration of ~1,700 mg/L in Fording River water (Annex F of Teck 2014). The concentration of lithium in this test was greater (more than 20%) relative to reference waters and/or test site waters with non-significant results. It could not be determined whether lithium contributed to the statistically significant response in this test. However, as discussed in Section 3.4.2, lithium is not normally considered to be a toxicant to aquatic life. There are no BC, CCME, or US EPA WQGs for the protection of aquatic life for lithium, and as of January 2017, the US EPA ECOTOX database does not have lithium toxicity data. Therefore, it is unlikely that these parameters contributed to the observed response in this test. Overall, nitrate and selenium were the only parameters identified that may have contributed to the statistically significant response in this test.

- **FR_FRCP1 (Q2, Q4), GH_FR1 (Q2, Q3)**: Concentrations of nitrate and selenium in these tests were greater than the lowest level 1 benchmark from the EVWQP (Table C-11). Concentrations of nitrate (range: 7.6 to 12 mg/L NO_3-N) and selenium (range: 30 to 57 µg/L) were lower than or equal to the highest concentrations in the SPO mixture tests with *H. azteca* exposed to Fording River water (21.6 mg/L NO_3-N and 57 µg/L) with no significant adverse effects (Golder 2016). Therefore, these parameters are unlikely to be the cause of observed responses. Overall, no water quality parameter was identified as a potential cause of the statistically significant result in these tests.

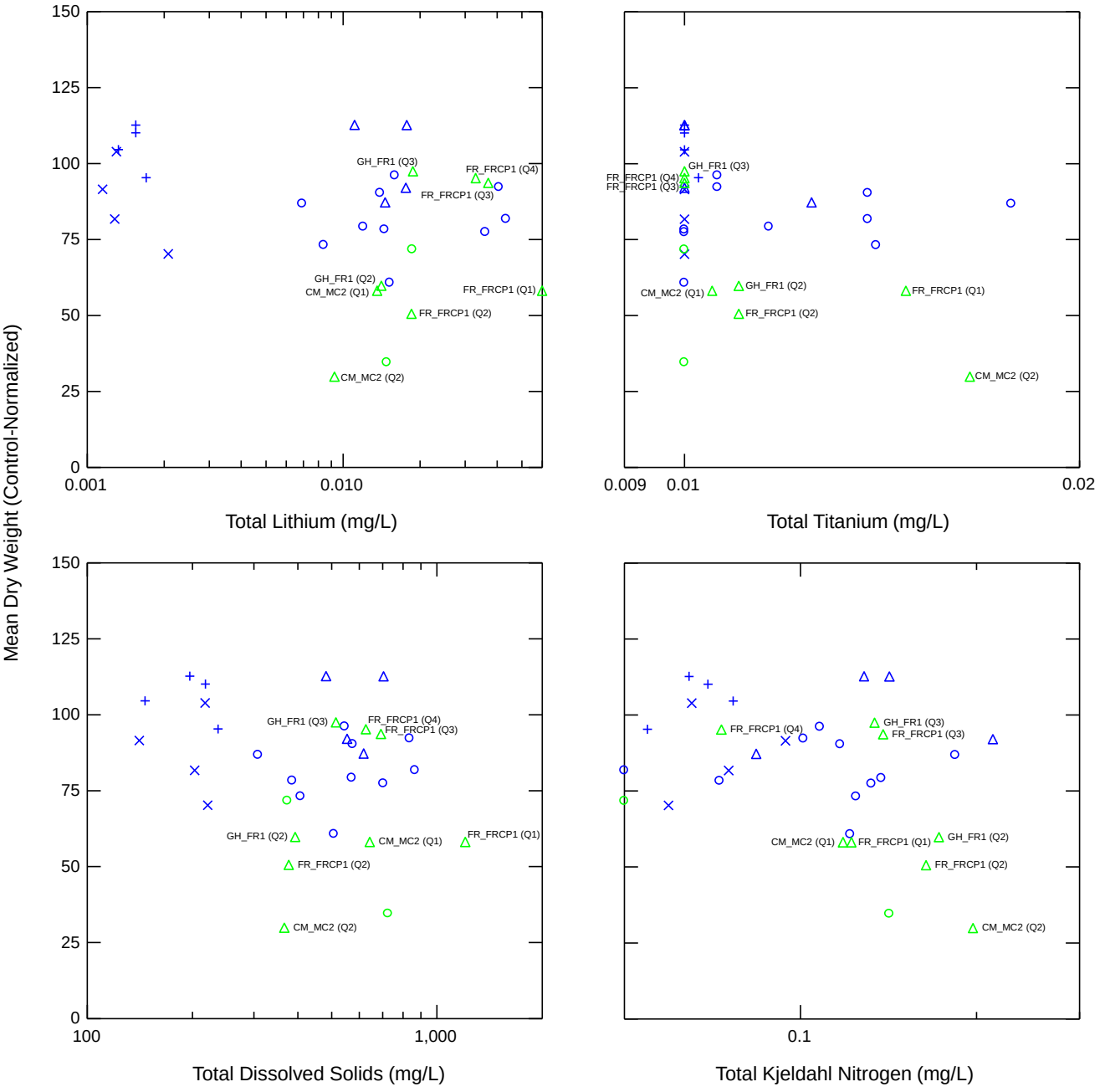
- **FR_FRCP1 (Q3)**: Concentrations of nitrate and selenium in this test were greater than the lowest level 1 benchmark from the EVWQP (Table C-11). Nitrate is not expected to have contributed to toxicity in this test because the test site concentration (12.8 mg/L NO_3-N) was lower than the nitrate concentration in the SPO mixture toxicity study with Fording River water (21.6 mg/L NO_3-N) that resulted in no adverse effects to *H. azteca* (Golder 2016). The concentration of selenium in this test (66 µg/L) was higher than the maximum concentration tested in the SPO mixture study that resulted in no adverse effects (57 µg/L) (Golder 2016), so it cannot be ruled out that selenium may have also contributed to the observed response in this test. Acidity was also higher than test site waters with non-significant results, but this difference was small (less than 2%). Overall, no water quality parameter was identified as a likely cause of the statistically significant result in this test.

Figure 3.4-7: Mean dry weight of H. azteca and concentration of dissolved cadmium (top left), nitrate (top right), total selenium (bottom left), and sulphate (bottom right).



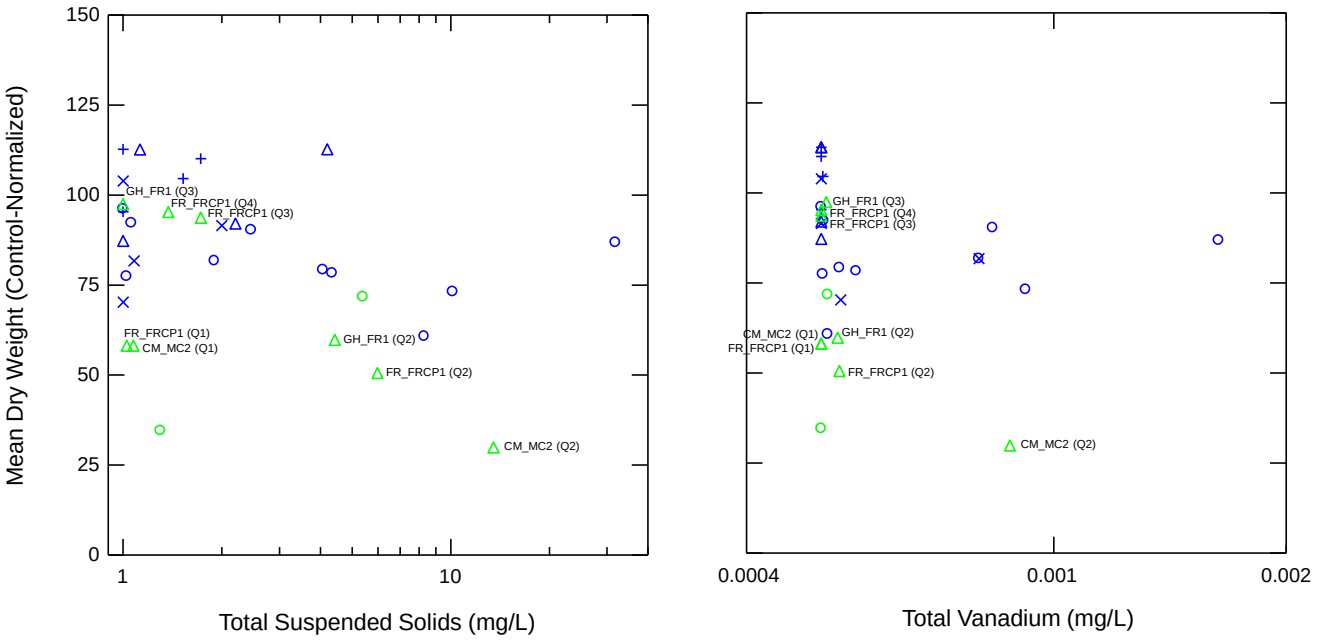
Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter.

Figure 3.4-8: Mean dry weight of H. azteca and concentration of total lithium (top left), total titanium (top right), total dissolved solids (bottom left), and total Kjeldahl nitrogen (bottom right).



Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter.

Figure 3.4-9: Mean dry weight of H. azteca and concentration of total suspended solids (left) and total vanadium (right).



Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter.

3.4.4 *Oncorhynchus mykiss*

Survival and Viability

The four Order constituents (dissolved cadmium, nitrate, sulphate, total selenium), and four parameters with statistically significant negative Spearman rank correlations (total lithium, phosphorus, TDS, TKN, total silicon [viability only]) that did not screen out when compared to water quality guidelines, were carried through to graphical analysis (Table C-9). Parameters related to TDS (e.g., alkalinity) also had significant correlations but were not evaluated separately from TDS. Although bromide had a significant negative correlation, it was not included in graphical analysis because of low detection frequency[16]. PC1 scores for the 2015 and 2016 combined dataset (which accounted for 32% of the variance) and the 2016 only dataset (which accounted for 35% of the variance) had statistically significant negative Spearman rank correlations (Table C-9); these parameters were therefore carried through to graphical analysis.

Survival is plotted in Figure 3.4-10 (Order constituents), Figure 3.4-11 (other parameters with significant correlations), and Figure 3.4-12 (PC1). Viability is plotted in Figure 3.4-13 (Order constituents), Figure 3.4-14 (other parameters with significant correlations), and Figure 3.4-15 (TKN and PC1). None of the evaluated parameters exhibited a consistent concentration-response relationship across all tests.

Concentrations of most parameters in tests with a significant result were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-4), and/or were lower than the

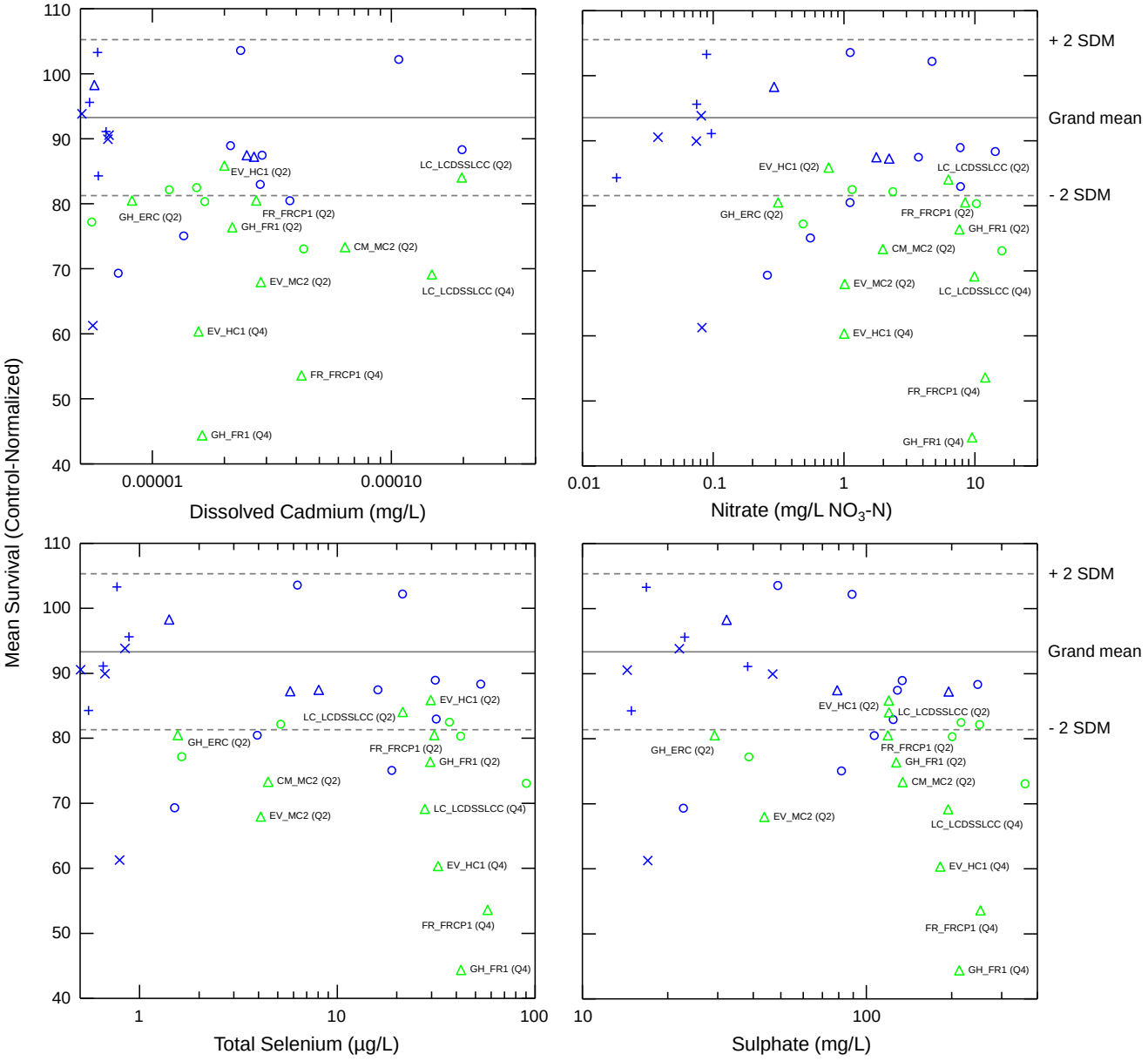
[16] Bromide concentrations were below the detection limit in all 2016 tests (Table C-4).

chronic BC WQG (Table C-11). Such parameters are not expected to contribute to toxicity in these tests. Selenium and nitrate were the only two parameters that were greater than a chronic BC WQG or level 1 benchmark from EVWQP (Table C-11). In tests with significant results, concentrations of selenium (maximum = 57 µg/L) and nitrate (maximum = 12 mg/L NO_3-N) were lower than effect concentrations reported in the Golder (2013) mixture toxicity study in Fording River water (nitrate IC_{20} = 25 mg/L NO_3-N; selenium no observed effect concentration >139 µg/L). Therefore, these parameters are unlikely to be the cause of observed responses. Parameters that were greater than concentrations in reference waters and/or test site waters with non-significant results were:

- **CM_MC2 (Q2)**: The titanium concentration in this test was higher than reference waters and test site waters with non-significant results, but this difference was small (less than 20%). No water quality parameter was identified as a potential cause of the significant result in this test.
- **CM_MC2 (Q4; viability only)**: The strontium concentration in this test was higher than reference waters and test site waters with non-significant results. However, the strontium concentration (0.24 mg/L) was more than two orders of magnitude lower than the reported LC_{10} of 67 mg/L for *O. mykiss* (McPherson et al. 2014), indicating that it is not likely contributing to toxicity. Sodium in this test (7.7 mg/L) was higher than reference waters and test site waters with non-significant results, but this difference was small (less than 10%). Overall, no water quality parameter was identified as a potential cause of the significant result in this test.
- **EV_HC1 (Q2)**: Alkalinity (carbonate) and titanium in this test were higher than reference waters and test site waters with non-significant results. Titanium in this test (0.011 mg/L) was higher than reference waters and test site waters with non-significant results, but this difference was small (10%). Alkalinity (carbonate) in this test (9.1 mg/L) was 1.3 to 9.1 times higher than test site waters with non-significant results. It could not be determined whether alkalinity may have contributed to the observed response in this test.
- **EV_MC2 (Q2)**: DOC and orthophosphate in this test were higher than reference waters and test site waters with non-significant results. Phosphorus is a constituent that may result in ecological changes in the receiving environment under long-term discharge conditions, but does not have the potential for direct aquatic toxicity. For this reason, phosphorus compounds are not likely contributing to toxicity. DOC is considered a toxicity-modifying factor rather than a toxicant, indicating that these parameters are not likely contributing to toxicity. Overall, no water quality parameter was identified as a potential cause of the statistically significant results.
- **FR_FRCP1 (Q2), GH_FR1 (Q2)**: Titanium in these tests were higher than reference waters and test site waters with non-significant results, but this difference was small (less than 10%). No water quality parameter was identified as a potential cause of the statistically significant results in these tests.
- **FR_FRCP1 (Q4)**: Several parameters related to TDS (e.g., magnesium) were higher than reference waters and test site waters with non-significant results. The TDS concentration in this test (626 mg/L) was lower than the effect concentration reported in the Golder (2013) mixture toxicity study in Fording River water (923 mg/L), indicating that TDS is unlikely to be the cause of the observed responses. Overall, no water quality parameter was identified as a potential cause of the significant result in this test.

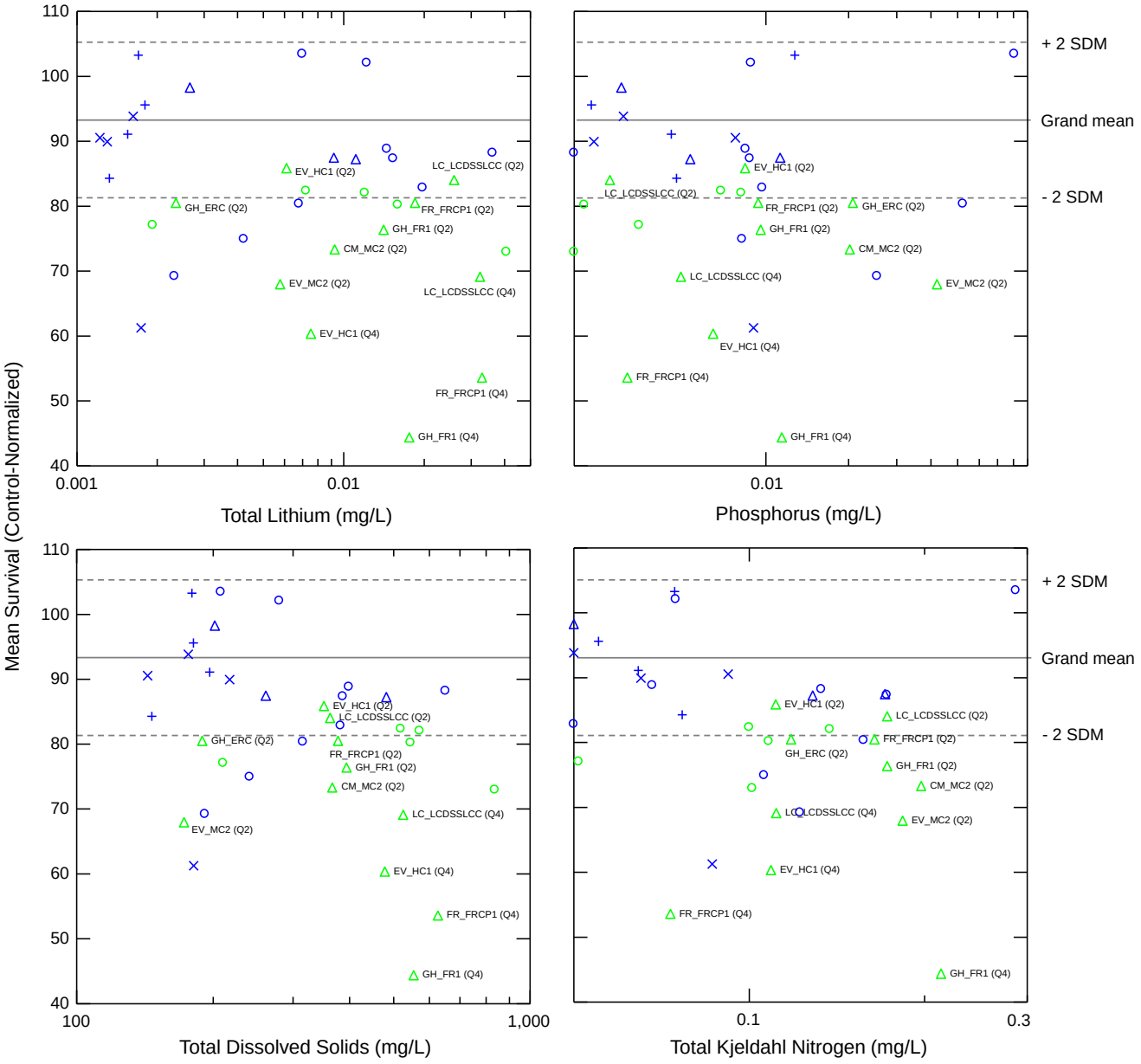
- **EV_HC1 (Q4), GH_ERC (Q2), GH_FR1 (Q4), LC_LCDSSLCC (Q2, Q4)**: Concentrations of all parameters in these tests were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-4), and/or were lower than the chronic BC WQG (Table C-11). No water quality parameter was identified as a potential cause of the statistically significant result in these tests.

Figure 3.4-10: Mean survival of O. mykiss and concentration of dissolved cadmium (top left), nitrate (top right), total selenium (bottom left), and sulphate (bottom right).



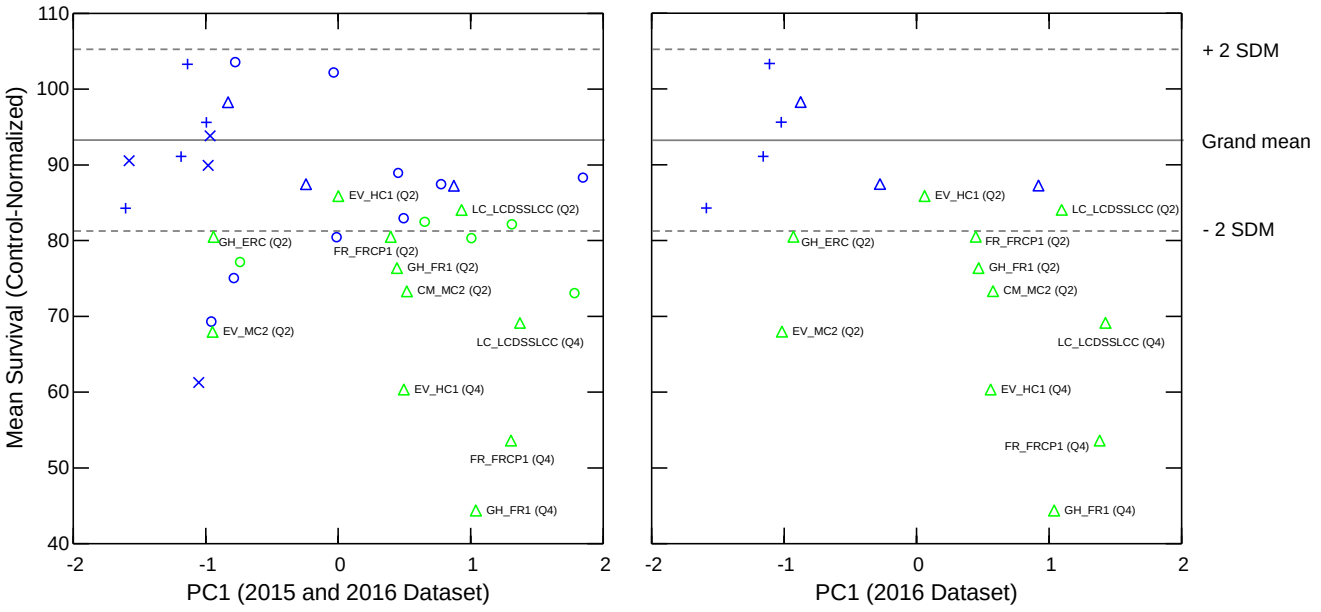
Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter. Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

Figure 3.4-11: Mean survival of O. mykiss and concentration of total lithium (top left), phosphorus (top right), total dissolved solids (bottom left), and total Kjeldahl nitrogen (bottom right).



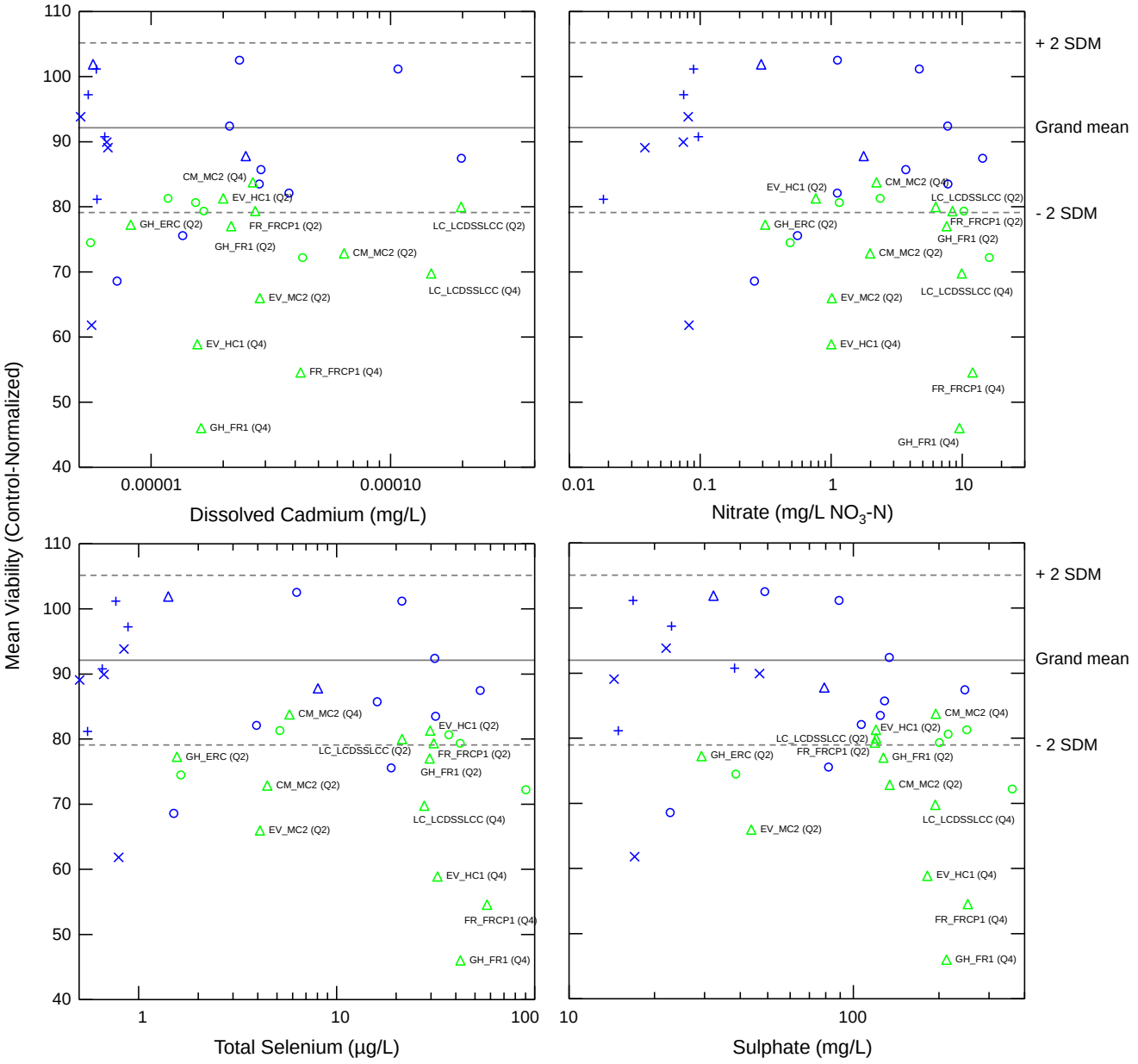
Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter. Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

Figure 3.4-12: Mean survival of O. mykiss and principal component 1 (PC1) using the 2015 and 2016 dataset combined (left) and 2016 dataset only (right).



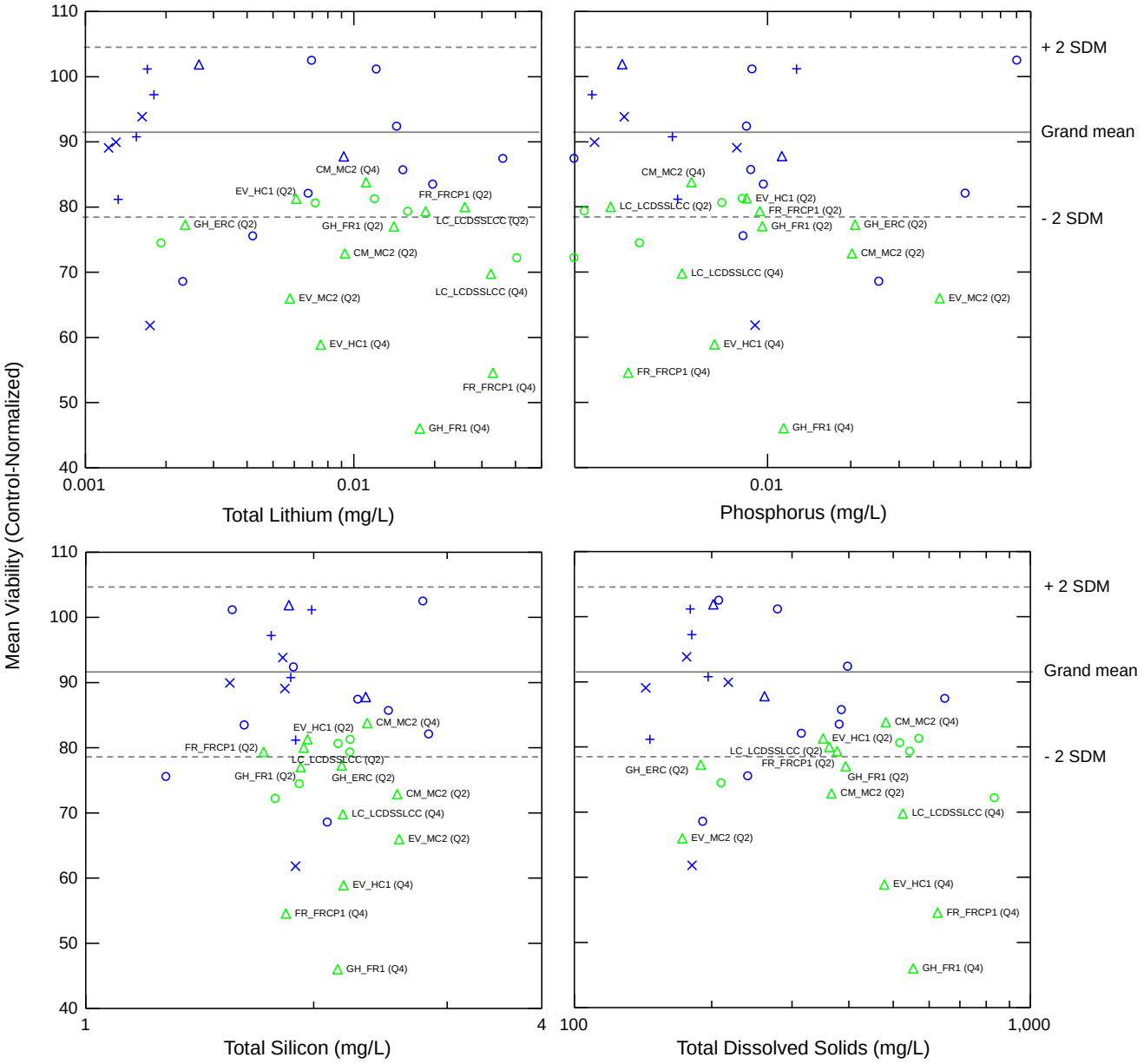
Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter. Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

Figure 3.4-13: Mean viability of O. mykiss and concentration of dissolved cadmium (top left), nitrate (top right), total selenium (bottom left), and sulphate (bottom right).



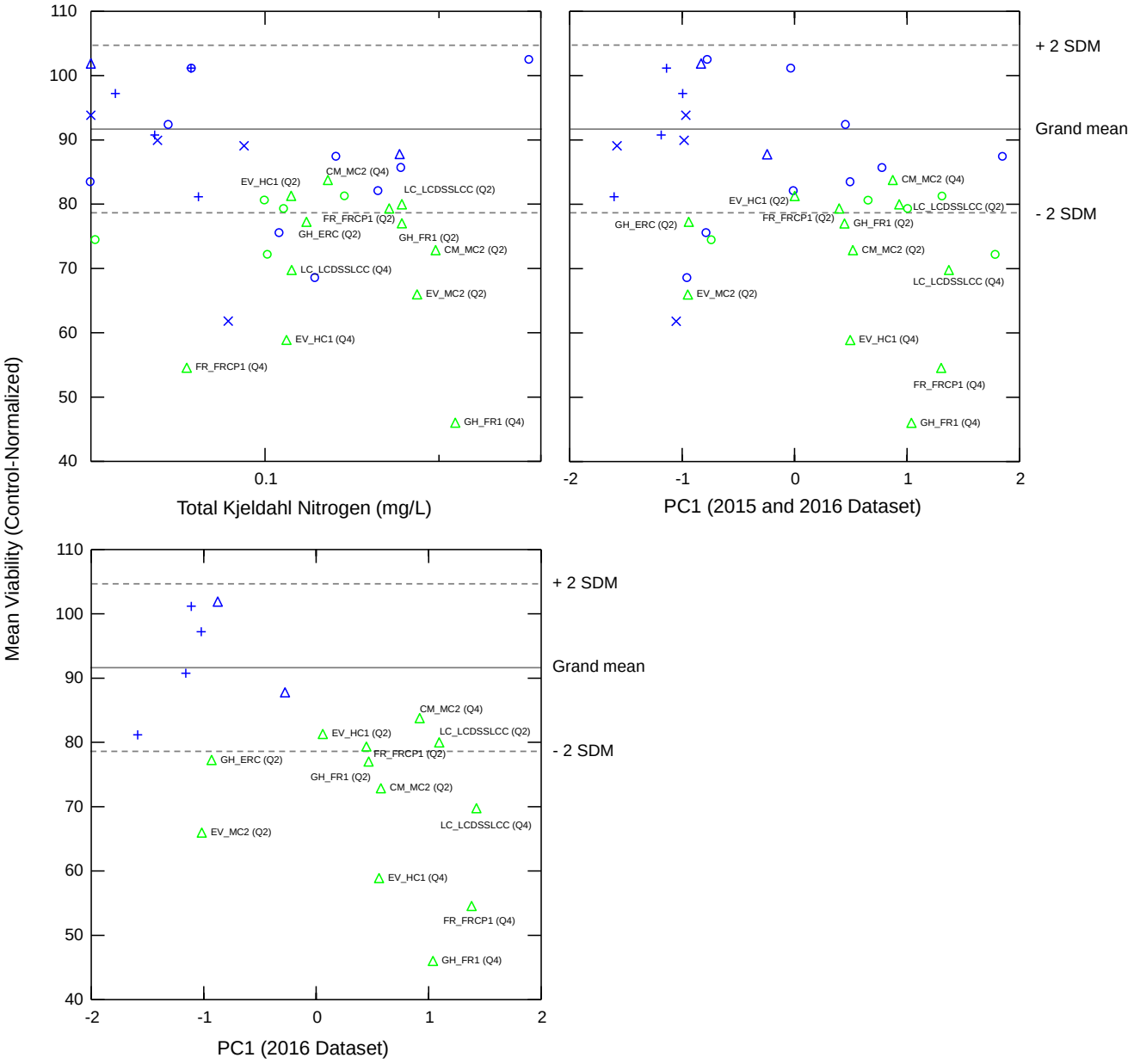
Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter. Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

Figure 3.4-14: Mean viability of O.mykiss and concentration of total lithium (top left), phosphorus (top right), total silicon (bottom left), and total dissolved solids (bottom right).



Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter. Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

Figure 3.4-15: Mean viability of O. mykiss and concentration of total Kjeldahl nitrogen (top left), principal component 1 (PC1) using the 2015 and 2016 dataset combined (top right), and PC1 using the 2016 dataset only (bottom left).



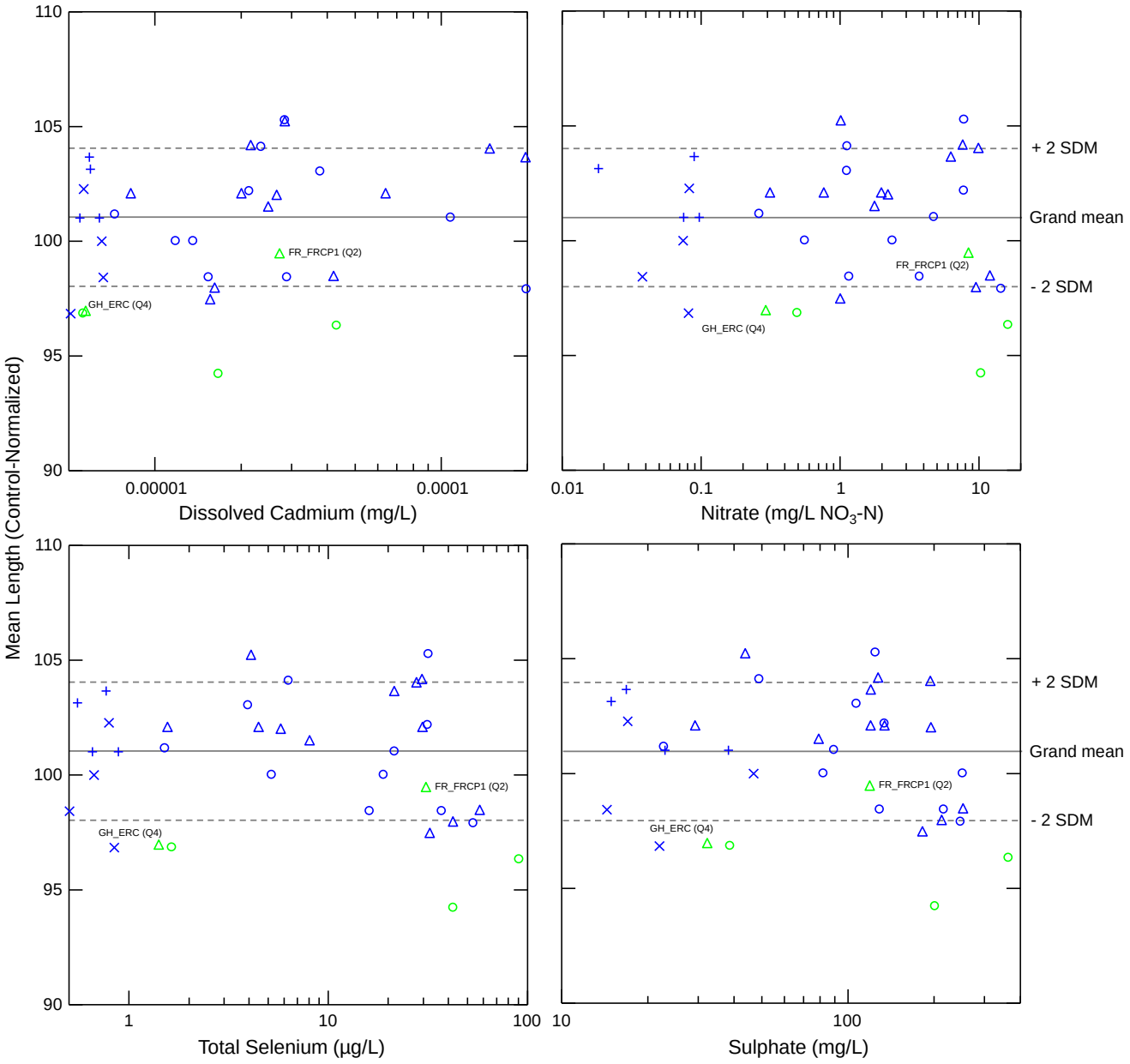
Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter. Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

Length

The four Order constituents (dissolved cadmium, nitrate, sulphate, total selenium; Figure 3.4-16) and one parameter with a statistically significant negative Spearman rank correlation (TDS; Figure 3.4-17) that did not screen out when compared to water quality guidelines were carried through to graphical analysis (Table C-9). Parameters related to TDS (e.g., alkalinity) also had significant correlations but were not evaluated separately from TDS.

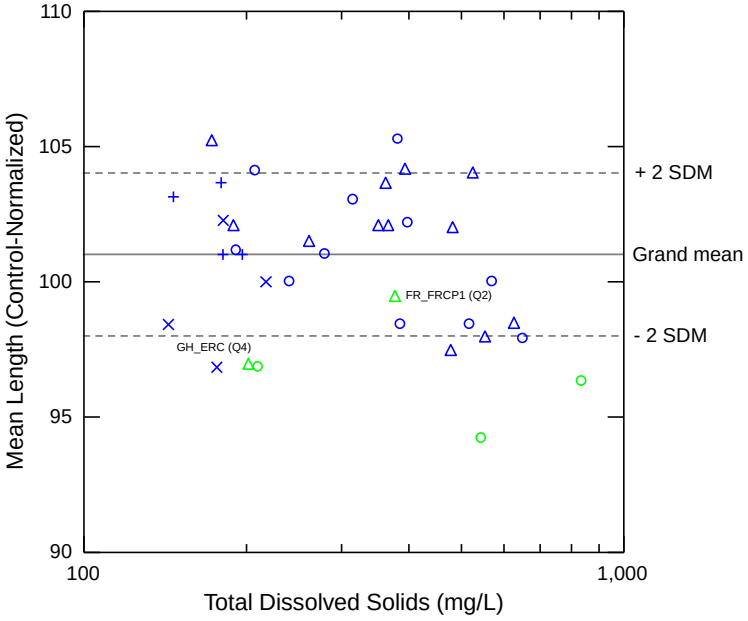
None of the evaluated parameters exhibited a consistent concentration-response relationship across all tests (Figure 3.4-16 and Figure 3.4-17). Length was significantly reduced in only two tests (Q2 FR_FRCP1, Q4 GH_ERC) relative to reference waters. Concentrations of all parameters in these tests were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-11), except selenium and nitrate in the FR_FRCP1 test. Concentrations of selenium (31 µg/L) and nitrate (8.4 mg/L NO_3-N) in this test were lower than effect concentrations reported in the Golder (2013) mixture toxicity study in Fording River water (nitrate IC_{20} = 25 mg/L NO_3-N; selenium no observed effect concentration >139 µg/L). Therefore, these parameters are unlikely to be the cause of observed responses. Overall, no water quality parameter was identified as a potential cause of the statistically significant results in these tests.

Figure 3.4-16: Mean length of O. mykiss and concentration of dissolved cadmium (top left), nitrate (top right), total selenium (bottom left), and sulphate (bottom right).



Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter.

Figure 3.4-17: Mean length of O. mykiss and concentration of total dissolved solids.



Note: Symbols indicate reference waters (blue × = 2015; blue + = 2016), test site waters with mean results statistically similar to the paired reference (blue ○ = 2015; blue Δ = 2016), and test site waters with mean results significantly lower than the paired reference (green ○ = 2015; green Δ = 2016). Test site waters in 2016 with significant results are labelled with the test site and quarter.

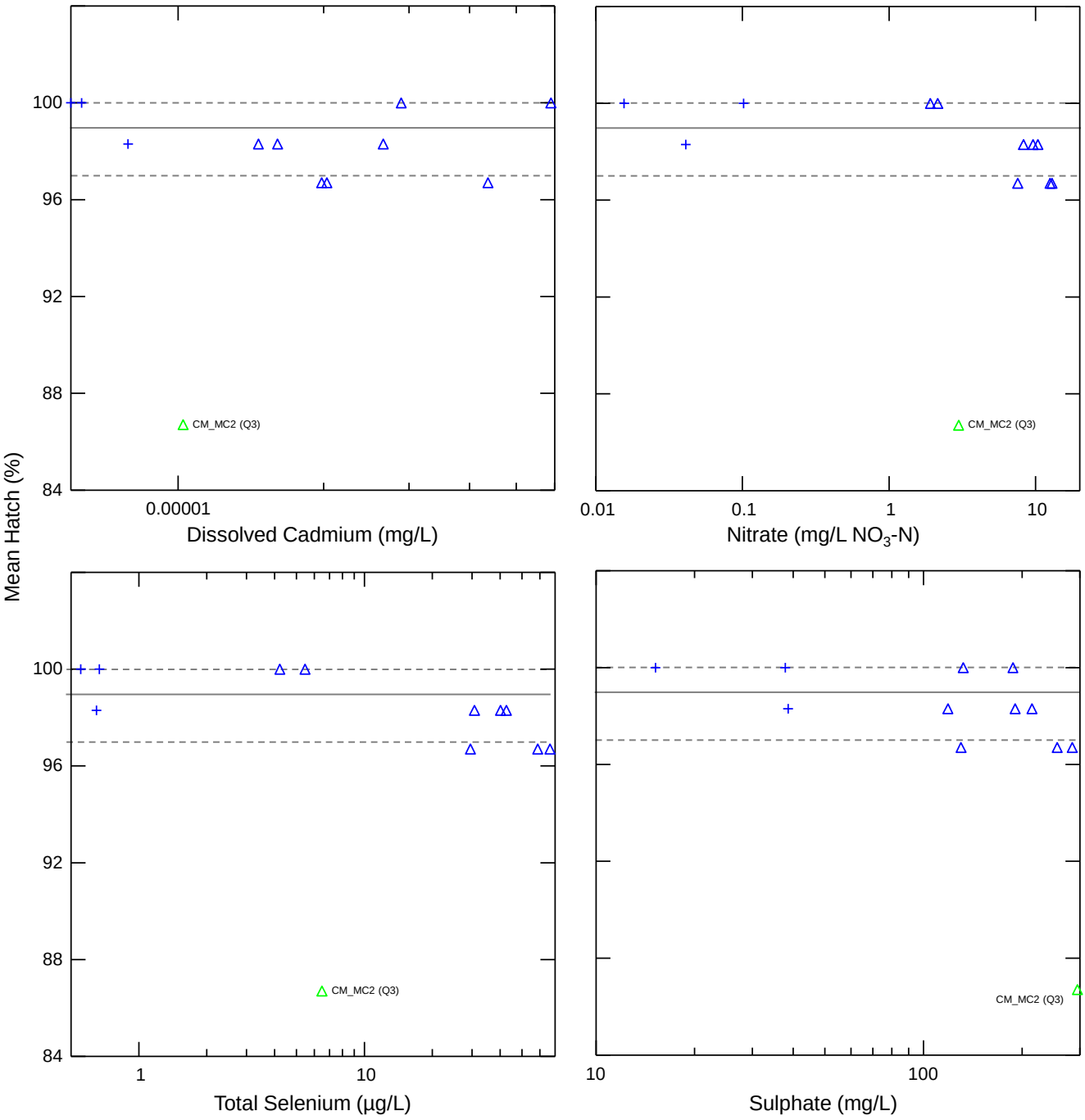
3.4.5 *Pimephales promelas* Hatch

The four Order constituents (dissolved cadmium, nitrate, sulphate, total selenium; Figure 3.4-18) and two parameters with statistically significant negative Spearman rank correlations (total lithium, TDS; Figure 3.4-19) that did not screen out when compared to water quality guidelines were carried through to graphical analysis (Table C-10). Parameters related to TDS (e.g., alkalinity) also had significant correlations but were not evaluated separately from TDS. The PC1 score for the 2016 dataset (which accounted for 43.4% of the variance) did not have a statistically significant negative Spearman rank correlation (Table C-10).

None of the evaluated parameters exhibited a consistent concentration-response relationship across all tests (Figure 3.4-18 and Figure 3.4-19). Hatch was significantly reduced in only one test (Q3 CM_CM2) relative to reference waters. Concentrations of most parameters in tests with a significant result were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results (Table C-10), and/or were lower than the chronic BC WQG (Table C-11). Such parameters are not expected to contribute to toxicity in these tests.

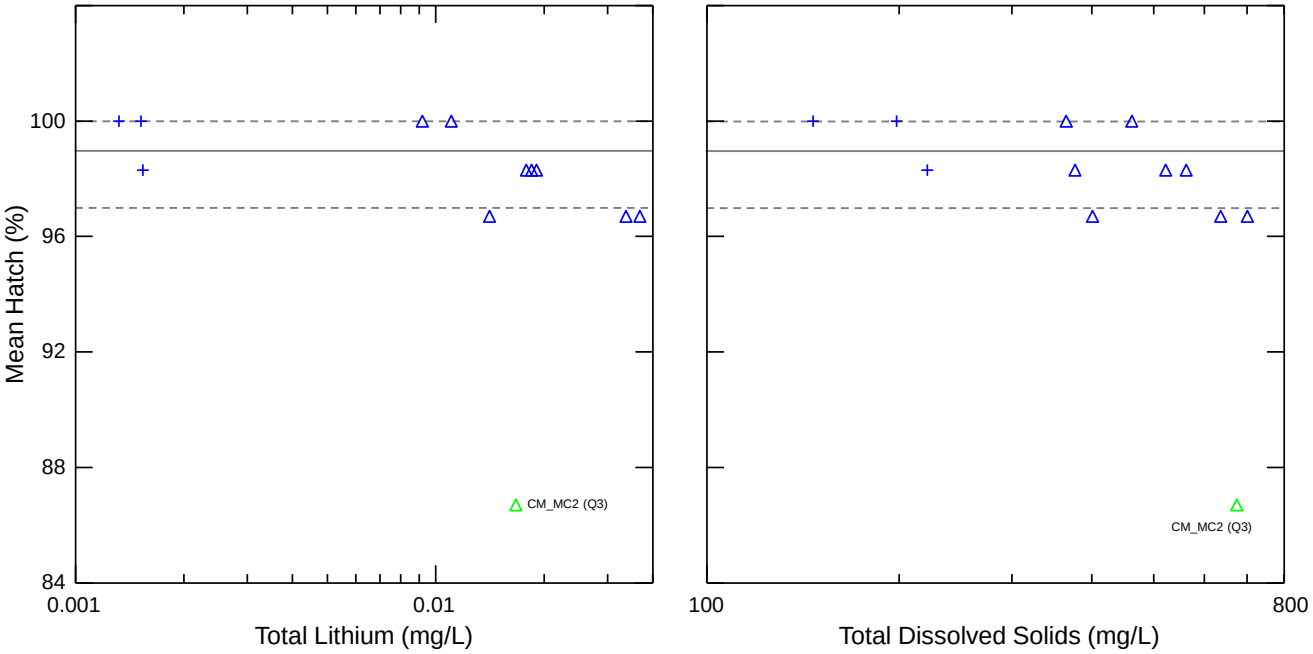
Parameters that were greater than concentrations in reference waters and/or test site waters with non-significant results were strontium, TKN, and several parameters related to TDS (e.g., calcium). The TDS concentration in this test was lower than reference waters and test site waters with non-significant results, indicating that the parameters related to TDS are not likely contributing to toxicity. The strontium concentration (0.35 mg/L) was more than two orders of magnitude lower than the reported IC_{20} of 66 mg/L for *O. mykiss* (McPherson et al. 2014), indicating that it is not likely contributing to toxicity. TKN in this test (0.2 mg/L) was higher than reference waters and test site waters with non-significant results, but this difference was small (less than 5%). Overall, no water quality parameter was identified as a potential cause of the statistically significant results in these tests.

Figure 3.4-18: Mean hatch of P. promelas and concentration of dissolved cadmium (top left), nitrate (top right), total selenium (bottom left), and sulphate (bottom right).



Note: Symbols indicate reference waters (blue +), test site waters with mean results statistically similar to the paired reference (blue Δ), and test site waters with mean results significantly lower than the paired reference (green Δ; labelled with test site and quarter). Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

Figure 3.4-19: Mean hatch of P. promelas and concentration of total lithium (left) and total dissolved solids (right).



Note: Symbols indicate reference waters (blue +), test site waters with mean results statistically similar to the paired reference (blue Δ), and test site waters with mean results significantly lower than the paired reference (green Δ; labelled with test site and quarter). Lines are grand mean of Elk and Fording River references (solid grey line) plus or minus two standard deviations of means in the pooled batches (± 2 SDM) (dashed grey lines) (see Figure 2.3-1 for description).

4.0 UNCERTAINTY ASSESSMENT

Sources of uncertainty associated with the interpretation of the quarterly and semi-annual toxicity testing program were:

- **Pairing of water quality and response data**—For the *H. azteca*, *P. promelas*, and *O. mykiss* tests, refresh water samples were collected on a weekly basis for the duration of the test. The effects data for these tests were paired with the mean concentration of the weekly samples. In the concentration-response analysis, potential causes of toxicity were evaluated by comparing the mean water quality to water quality observed in tests that did not have significant effects, chronic BC WQGs, and effect concentrations reported in the literature. If concentrations of water quality parameters were higher (or lower) in one of the weekly samples, then examination of weekly samples may have resulted in different conclusions regarding potential causes of test responses. Conversely, elevated concentrations in one of the weekly samples may have caused mean parameter concentrations to be higher than concentrations measured in tests that did not have significant effects. These parameters may have been identified as potential causes of toxicity, even though adverse effects were not related to these parameters. Water quality for most parameters (including Order constituents and other potential toxicants) is expected to have low variability across consecutive weekly samples, and average concentrations are expected to provide a reasonable estimate of relevant exposure conditions for the test organisms; therefore, this uncertainty is not expected to affect the overall interpretation of the quarterly and semi-annual toxicity testing program.

- **Mixture effects**—The concentration-response analysis presented in Section 3.4 evaluated individual water quality parameters potentially contributing to observed test responses. It cannot be ruled out that some parameters may act in combination. A qualitative multiple-stressor analysis was completed in Chapter 8 of the EVWQP to assess potential interactions among the four EVWQP constituents. Although mechanisms of action have not been definitively determined, the available information indicates that these constituents likely have different mechanisms of action:
  - Selenium produces adverse effects following dietary accumulation of seleno-amino acids into protein-rich tissues.
  - Although the specific mechanism of action is uncertain, nitrate may exhibit toxicity following uptake and conversion to nitrite, which can then impair oxygen transport. In the Elk Valley, nitrate is not likely to contribute meaningfully to the osmotic pressure that may be important for sulphate toxicity, because it is present at low concentrations relative to the total ionic content of mine-influenced water.
  - Sulphate appears to act primarily on the iono-regulatory organs of freshwater organisms, and may exert stress because of general osmoregulatory pressure or disruption of cellular membrane function in conjunction with other components of TDS.

  Notwithstanding the different mechanisms of action, conceptually it is possible that effects from multiple constituents could operate in an additive manner where they ultimately affect the same toxicological endpoint (e.g., nitrate and TDS could separately influence *O. mykiss* survival via different toxicological pathways).

  Most water quality parameters evaluated in the concentration-response analysis had concentrations below water quality guidelines or orders of magnitude below effect concentrations. Based on the information above (i.e., different mechanisms of action and most concentrations below water quality guidelines or toxicological benchmarks), there is a low potential for additive effects of multiple constituents. It is unlikely that combined effects among the parameters would occur, and the approach taken in the assessment of evaluating each substance independently is expected to provide a reliable assessment of the overall potential for adverse effects from the predicted changes to water quality.

- **Microbial Influence**—For fathead minnows, the uncertainty related to microbial activity (i.e., sporadic mortality phenomenon) has been substantial reduced through use of the 10 µg/L copper amendment. Hatch rate and survival were still affected in the Q3 CM_MC2 test, and the timing of mortalities suggested insufficient control for microbial effects in this case. However, the implementation of copper amendment has greatly reduced this source of variance (that is unrelated to mining activity) and thereby reduced the incidence of false positive toxicity findings. As a result, the incidence of toxicity to fathead minnows decreased substantially from 2015 to 2016, to the extent that fathead minnows currently yield the lowest rate of toxicity among the five species tested in quarterly or semi-annual chronic testing. For other test species, the potential for sporadic mortality remains. Although routine whole effluent testing does not indicate the same potential for microbial confounding of *C. dubia* toxicity relative to *P. promelas* (Downey et al. 2000), the other tests in the Permit-based testing program may be influenced by microbial factors, particularly chronic tests of salmonids (i.e., rainbow trout, westslope cutthroat trout). Suggestions of potential interferences in these tests include:

- High interreplicate variability in response
- Significant difference between responses observed in the Elk River reference and Fording River reference
- Responses to survival endpoint, rather than chronic endpoint that is usually more sensitive to toxicity mechanisms
- Moderate response sizes that are unrelated to chemical constituents in water samples

In addition, other testing programs with rainbow trout in Elk Valley water have observed significant sudden mortality in a number of replicates during days 13–24. The observation of mortality within a specific time window matches the sporadic mortality phenomenon observed for fathead minnow testing. In conjunction with sporadic mortalities, observations of fungal growth on dead embryos have been observed, indicative of microbial presence.

5.0 SUMMARY

5.1 2016 Results

Ceriodaphnia dubia

A total of 34 tests were conducted with *C. dubia* in 2016, including six tests with reference waters and 28 tests with waters collected from mine-influenced test sites. There was no evidence of statistically significant adverse effects on mean *C. dubia* survival in any test. Reproduction was significantly reduced relative to reference in four CM_MC2 tests (Q1 to Q4), four FR_FRCP1 tests (Q1 to Q4), two EV_MC2 tests (Q2 and Q4), and all test site waters tested in Q2. For all Q2 tests except CM_MC2, evidence for adverse effects was equivocal because reproduction was significantly reduced relative to one but not both reference waters. For two of the tests (Q1 CM_MC2 and Q2 FR_FRCP1), mean responses were within the reference envelope.

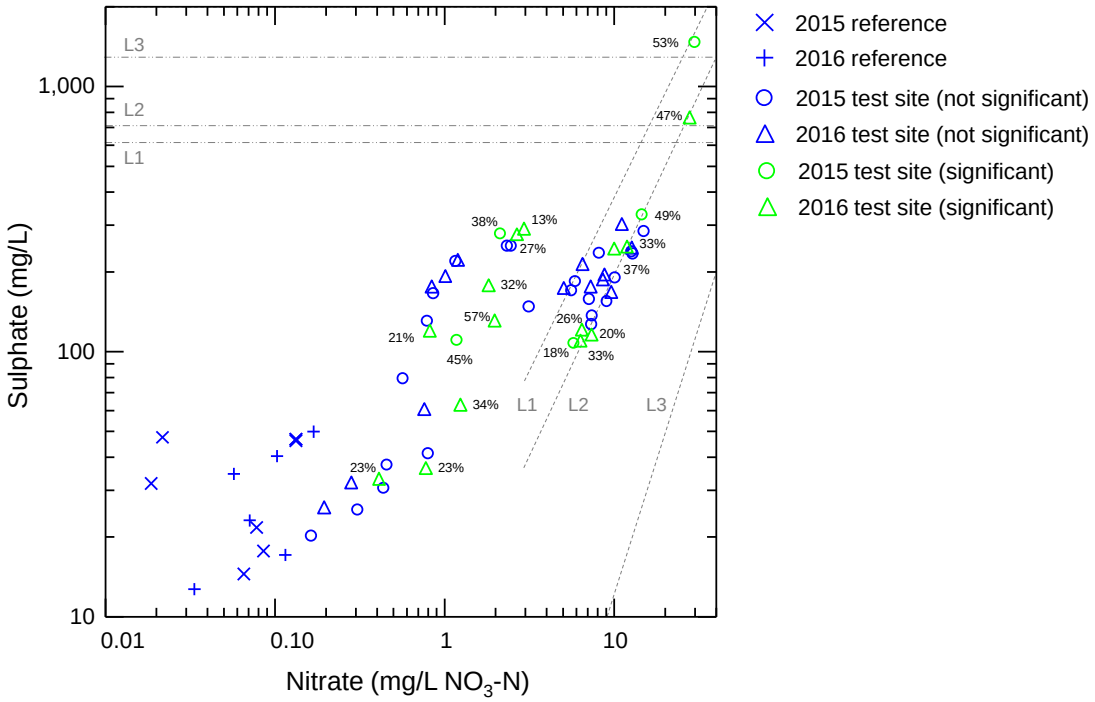
In seven of the 14 tests with significant responses, no water quality parameter was identified as a potential cause of the statistically significant results in these tests. A single parameter was identified in the Q2 EV_MC2 test (turbidity) as having a concentration higher than tests with non-significant results. In the FR_FRCP1 Q1 test, there were several parameters that may have contributed to the observed response in this test, including nitrate, selenium, and TDS. In three FR_FRCP1 tests (Q2, Q3, Q4), one GH_FR1 test (Q2), and one LC_LCDSSLCC test (Q2), nitrate may have contributed to the observed responses, although the evidence for nitrate toxicity as the primary explanatory factor is these experiments was weak.

As summarized above, nitrate was identified in the concentration-response analysis as a potential contributor to the observed responses in six of the 14 tests with significant responses in 2016. Figure 5.1-1 shows the relationship between observed toxicity at various nitrate and sulphate concentrations measured in 2015 and 2016 quarterly tests. The following observations were made:

- Ten tests with significant results (green symbols) were below the level 1 benchmarks for nitrate and sulphate. These parameters are not expected to have contributed to observed responses in these tests. The level of confidence in this conclusion is high given the conservatism inherent in the derivation of level 1 benchmarks.

- Seven tests with significant results (green symbols) had sulphate concentrations below the level 1 benchmark and nitrate concentrations near the level 2 benchmark. Five of these seven tests were conducted in 2016, including three FR_FRCP1 tests (Q2, Q3, Q4), one GH_FR1 test (Q2), and one LC_LCDSSLCC test (Q2). It is possible that nitrate contributed to adverse responses in these tests. However, these tests have nitrate and sulphate combinations that are similar to tests that were not significantly different than reference. Based on this comparison, it is uncertain whether nitrate contributed to observed responses in these tests.

Figure 5.1-1: Percent adverse effect on mean control-normalized reproduction of C. dubia at various combinations of nitrate and sulphate in 2015 and 2016 quarterly toxicity tests.



Note: Test site waters in 2016 with significant results are labelled with percent reduction in control-normalized reproduction (% effect). Horizontal dashed lines represent the level 1 (L2), level 2 (L2), and level 3 (L3) sulphate benchmarks from the EVWQP. Diagonal dashed lines represent the hardness-based level 1 (L2), level 2 (L2), and level 3 (L3) nitrate benchmarks from the EVWQP at nitrate concentrations greater than the BC WQG (3 mg/L NO_3-N). Nitrate benchmarks (hardness-adjusted) were estimated using the relationship between sulphate and hardness concentrations in quarterly tests (sulphate = 0.7961 × hardness – 117.21; r^2 = 0.99).

- Two tests with significant results (green symbols) appear in the upper right corner. Both of these tests were conducted with water collected from FR_FRCP1 in Q1. Nitrate and sulphate concentrations in these tests were greater than the level 1 benchmarks from the EVWQP, indicating that one or both of these parameters may have contributed to the observed responses in these tests.

Other sources of variance, including variation in test organism performance, variation in test organism sensitivity to toxicants, and variation in background water quality and its effect on test responses, were evaluated. Where possible, these sources of variance were controlled, and where they could not be controlled, the data were evaluated for patterns that may explain the observed results. Aside from the identification of a few anomalous

replicate results, no clear explanations for the pattern of toxicity in *C. dubia* reproduction were identified. For example:

- Reproduction data were control-normalized to reduce variation in test organism performance among batches, but still failed to exhibit a clear concentration-response relationship for any individual constituent.
- Effect concentrations in reference toxicant tests conducted with *C. dubia* in Q1, Q2, and Q3 2016 were approximately equal to the historical mean (Figure 3.2-6), indicating that test organism sensitivity did not contribute to the variance illustrated on Figure 5.1-1.
- Of the six tests in 2016 for which nitrate was identified in the concentration-response analysis, all but one test (Q2 FR_FRCP1) had mean responses below the reference envelope which reduces the likelihood of confounding effects of background water quality.

Overall, the Q1 FR_FRCP1 test in 2016 is the only test with a significant reduction in *C. dubia* reproduction that appears to be influenced by water quality parameters and that is consistent with the concentration-response profile identified in previous testing with this species. The reproduction inhibition observed in Q1 FR_FRCP1 corresponds to the effect threshold for nitrate developed in conjunction with the EVWQP, and potential influence of major ions that contribute to TDS cannot be discounted. Furthermore, the toxicity observed in Q1 FR_FRCP1 validates the observation of toxicity at the same station and same quarter in Q1 of 2015 (also associated with elevated nitrate, sulphate, and TDS in the Fording River flows that were heavily influenced by mine discharge water from Cataract Creek).

Pseudokirchneriella subcapitata

A total of 34 tests were conducted with *P. subcapitata* in 2016, including six tests with reference waters and 28 tests with waters collected from test sites. Cell yield was significantly reduced in 10 tests relative to either the Fording River or Elk River reference water. For four of those statistically significant responses, evidence for adverse effects was equivocal because cell yield was significantly reduced relative to one but not both reference waters. In six tests (FR_FRCP1 Q1, Q2, Q4; GH_FR1 Q4; EV_HC1 Q1; LC_LCDSSLCC Q2), cell yield was significantly lower than all references tested in that quarter.

For nine of the tests with statistically significant results, no water quality parameter was identified as a potential cause of the significant result. In the Q1 FR_FRCP1 test, it could not be definitively determined whether lithium, selenium, and/or titanium contributed to the statistically significant response in this test.

Hyalella azteca

A total of 16 tests were conducted with *H. azteca* in 2016, including 4 tests with reference waters and 12 tests with waters collected from test sites. There was no evidence of statistically significant adverse effects on mean *H. azteca* survival in any test, with the exception of a significant reduction in one Q1 test (CM_MC2) that had an unusual distribution of mortality among replicates and therefore may not reflect an adverse response to the test water. Dry weight was significantly reduced compared to the reference in all tests, except for one test in Q1 (GH_FR1), one test in Q3 (CM_MC2), and two tests in Q4 (GH_FR1, CM_MC2). Dry weight was outside of the reference envelope in all tests with significant results.

In seven of the eight tests, no water quality parameter was identified as a potential cause of the statistically significant results in these tests. In the FR_FRCP1 Q1 test, nitrate or selenium may have contributed to the

observed response. The nitrate concentration in this test did not overlap with nitrate concentrations in other quarterly tests, as was observed for *C. dubia*.

Oncorhynchus mykiss

A total of 18 tests were conducted with *O. mykiss* in 2016, including two Q2 tests and two Q4 tests with reference waters and seven Q2 tests and seven Q4 tests with waters collected from test sites. There was no evidence of statistically significant adverse effects on mean *O. mykiss* weight in any test. Survival was significantly reduced in all Q2 tests and most Q4 tests (exceptions were CM_MC2, EV_MC2, and GH_ERC), viability was significantly reduced in all Q2 tests and most Q4 tests (exceptions were EV_MC2 and GH_ERC), and length was significantly reduced in one Q2 test (FR_FRCP1) and one Q4 test (GH_ERC). Mean responses were below the reference envelope, except for survival in three Q2 tests (GH_ERC, EV_HC1, LC_LCDSSLCC), viability in two Q2 tests (FR_FRCP1, EV_HC1), and length on one Q2 test (FR_FRCP1).

For tests with statistically significant reductions in length, as well as all but one test (Q4 EV_HC1) with statistically significant reductions in survival and viability, no water quality parameter was identified as a potential cause of the result. A single parameter was identified in the Q4 EV_HC1 test (carbonate alkalinity) as having a concentration higher than tests with non-significant results. The high frequency of survival/viability reductions for trout in the 2016 program is inconsistent with the concentration-response profiles for nitrate, sulphate, and other Order constituents from the toxicity studies used to develop the EVWQP.

Pimephales promelas

A total of 16 tests were conducted with *P. promelas* in 2016, including 4 tests with reference waters and 12 tests with waters collected from test sites. There was no evidence of statistically significant adverse effects on mean hatch, survival, biomass, length, or development, except for hatch and survival in the Q3 CM_MC2 test. In this test, reduced survival was largely associated with one of the replicates, and occurred primarily between day 6 and 12 of exposure. Thus, the pattern of effects observed in this copper-amended sample was consistent with sporadic mortality phenomenon. No water quality parameter was identified as a potential cause of the statistically significant result.

Overall Summary

There was no evidence of adverse effects in the majority of quarterly and semi-annual toxicity tests conducted in test site waters with *P. subcapitata* (18 of 28 tests) and *P. promelas* (11 of 12 tests). Significant effects were observed in half of the tests conducted with *C. dubia* (14 of 28 tests) and the majority of tests conducted with *H. azteca* (8 of 12 tests) and *O. mykiss* (13 of 14 tests).

Of the tests for which a statistically significant response was identified in the laboratory reports, many were significant relative to one reference but not both reference waters or had mean responses within the reference envelope. This applied to seven of the 14 significant results for *C. dubia*, two of the 10 significant results for *P. subcapitata*, and seven of the 13 significant results for *O. mykiss*. Review of water chemistry did not indicate any parameters that could explain the high frequency of statistically significant responses for *C. dubia*, *H. azteca*, or *O. mykiss*.

Eight tests exhibited a response that was statistically significantly different from reference, below the reference envelope, and that were potentially attributable to water quality constituents in test waters. Statistically significant

adverse responses with *C. dubia* (FR_FRCP1 [Q1, Q2, Q3, Q4] [17], GH_FR1 [Q2], LC_LCDSSLCC [Q2]), *P. subcapitata* (Q1 FR_FRCP1), and *H. azteca* (FR_FRCP1 Q1) were associated with nitrate and/or selenium concentrations that were higher than the lowest level 1 benchmark from the EVWQP and/or effects concentrations determined in previous toxicity testing with Elk Valley waters (*C. dubia* and *H. azteca*) or higher than the concentration range tested in previous testing with Elk Valley waters (*P. subcapitata*). Based on a comparison to *C. dubia* responses in other quarterly tests, it is uncertain whether nitrate contributed to observed responses in five of the six tests listed above. The Q1 FR_FRCP1 test with *C. dubia* is the only test with a significant result that appears to be potentially attributable to water quality parameters and that is consistent with responses observed in other quarterly tests.

5.2 Comparison of 2015 and 2016 Test Results

In 2015, there was no evidence of adverse effects in the majority of quarterly and semi-annual toxicity tests. In 2016, there was no evidence of adverse effects in the majority of tests conducted with *P. subcapitata* and *P. promelas*. Significant effects were observed in half of the tests conducted with *C. dubia* and the majority of tests conducted with *H. azteca* and *O. mykiss*. In both years, several tests results exhibited statistically significant reductions of test endpoints, and in most of these cases, the concentrations of Order constituents and other potential toxicants did not explain the pattern of toxicity observed. In a small subset of these results (e.g., Q1 FR_FRCP1), the potential for influence of mine-related parameters was identified.

In 2015, two tests exhibited a response that was statistically significantly different from reference, outside the normal range of variability of test organism performance, and that were potentially attributable to water quality constituents in test waters. Statistically significant adverse responses in Q1 tests with *C. dubia* and *P. subcapitata* at FR_FRCP1 were observed that were associated with nitrate and sulphate concentrations above chronic BC WQG and/or effects concentrations determined in previous toxicity testing with Elk Valley waters.

In 2016, there were eight tests that exhibited a response that was statistically significantly different from reference, below the reference envelope, and that were potentially attributable to water quality constituents in test waters. Similar to 2015, statistically significant adverse responses were observed in the Q1 FR_FRCP1 test with *C. dubia, P. subcapitata*, and *H. azteca*. The repeatability of this result among sampling years provides a degree of validation for the findings. Nitrate may have contributed to observed responses in these tests, although the magnitude of responses observed is greater than indicated by other site-specific testing. In 2016, nitrate concentrations in five other *C. dubia* tests (FR_FRCP1 [Q2, Q3, Q4], GH_FR1 [Q2], LC_LCDSSLCC [Q2]) were greater than effect concentrations observed in some historical site-specific testing of Elk Valley waters, but these responses were not consistent with the 2015 quarterly tests conducted at the same locations and during the same season.

Overall, no water quality parameter was identified as a potential cause of the majority of statistically significant results observed in 2015 and 2016. The Q1 FR_FRCP1 test resulted in adverse effects attributable to water quality in both 2015 (*C. dubia* and *P. subcapitata*) and 2016 (*C. dubia*, *P. subcapitata*, and *H. azteca*). Other observations of statistically significant toxicity do not align with the concentration-response patterns for mine-related constituents, indicating that some other source of variance is affecting the results.

[17] In the Q1 test, the mean response was equal to the lower end of the reference envelope.

Water quality under winter low-flow conditions at FR_FRCP1 is not representative of conditions in the upper Fording River as a whole (Teck 2017). The reach of the river upstream of FR_FRCP1 goes dry during low flow periods of the year. Current water quality and quantity data indicate that isolated surface water present at FR_FRCP1 during winter low-flow conditions is predominantly mine-influenced water from Cataract Creek and is not representative for compliance monitoring of conditions in the Fording River. This observation may assist in explaining water quality data and chronic toxicity results obtained at FR_FRCP1 during low flow periods (Q1 and Q4) in 2015 and 2016.

6.0 RECOMMENDATIONS

Recommendations for future quarterly and semi-annual toxicity testing programs are:

- **Maintain modified *P. promelas* test procedures**—Nautilus conducted *P. promelas* quarterly tests in 2016 with unamended site water and copper-treated site water (Appendix B). Due to the consistent efficacy and minimal impact on control performance, copper treatment is recommended as a method to effectively mitigate toxicity due to microbial/fungal interference, while still allowing a relevant measure of the presence of other toxicants in the samples. Based on finding to date, a copper amendment using 10 µg/L has been established as a suitable compromise between the effectiveness of the treatment (ability to eliminate microbial interference) and the specificity of the treatment (ability to target microbes without causing toxicity from excessive copper. For future quarterly tests, only copper-treated *P. promelas* tests are recommended.
- **Continue toxicity testing with Elk River and Fording River reference waters**—Test organism responses in Elk River and Fording River references were usually comparable within a given season. However, in some quarterly tests, responses were significantly different in the two reference waters. Inclusion of both references provided useful information about the natural variability in reference responses and important context for the interpretation of test site results.

7.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

GOLDER ASSOCIATES LTD/

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APPENDIX A

Summary of Legal Requirements for Chronic Toxicity Testing

Permit #107517 issued under the Environmental Management Act (Elk Valley EMA Permit) – Section 9.8

9.8 CHRONIC TOXICITY TESTING PROGRAM

The Permittee must develop and implement a toxicity testing program for receiving environments affected by coal mining operations. The purpose of the program is to evaluate chronic toxicity at the compliance points and other locations throughout the Elk Valley.

The toxicity testing program must include, at a minimum, the following elements:

i. Once every three years beginning in 2015, bioassays to evaluate the survival and development (incidence of deformities) of westslope cutthroat trout using gametes obtained from fish utilizing habitats in the Fording River, tributaries, and associated lentic habitats (e.g., Fording River oxbow). The concentrations of selenium in the eggs of each female spawned must be measured;

ii. Quarterly or semi-annual surface-water chronic toxicity testing using a suite of toxicity tests:

The following toxicity test must be conducted during each semi-annual (spring and fall) sampling event:

- 30-day early life-stage test with the rainbow trout (*Oncorhynchus mykiss;* EPS1/RM/28) using <24-hour post-fertilization eggs; **endpoints:** survival, hatching, growth, deformity, behaviour;

The following toxicity tests must be conducted during each quarterly sampling event at all compliance points:

- 7-day water-only test with the cladoceran, *Ceriodaphnia dubia* (EPS1/RM/21); **endpoints:** survival, reproduction;

- 72-hour test with the alga, *Pseudokirchneriella subcapitata* (EPS1/RM/25); **endpoints:** growth inhibition;

The following toxicity tests must be conducted during each quarterly sampling event at compliance points in the Fording River (specifically FRO and GHO Fording) and Michel Creek (CMO):

- 28-day water-only test with amphipod, *Hyalella Azteca* (adapted from USEPA 2000); **endpoints:** survival, growth; and
- 30-day early life-stage test with the fathead minnow, *Pimephales promelas* (USEPA 1996) using <24-hour post-fertilization eggs; **endpoints:** survival, hatching, growth, deformity.

iii. Toxicity testing methods must be consistent with Environment Canada's, U.S. Environmental Protection Agency's, or ASTM's approved biological test methods;

iv. A Quality Assurance/Quality Control component; and

v. A proposed schedule of dates that coincide with water quality sampling and that target predicted worst-case times such as low flow, during flocculant use, or when discharge quality is expected to be reduced.

The suite of toxicity tests will be reviewed on an annual basis by the EMC and recommendations provided to the Director for consideration.

9.8.1 Sulphate Toxicity at High Hardness Concentrations

The Permittee must develop with input from the EMC, and implement a toxicity testing program specifically to assess sulphate toxicity at high hardness concentrations. Results will be used to support finalization of long term sulphate site performance objectives.

The following toxicity test shall be conducted as a component of the Sulphate toxicity testing program.

- 30-day early life-stage test with the fathead minnow, *Pimephales promelas* (USEPA 1996) using <24-hour post-fertilization eggs; **endpoints:** survival, hatching, growth, deformity.
- Other sensitive species (amphibian, trout, water flea, etc.) shall be included.

Monitoring results and interpretation must be compiled into a written report and submitted to the satisfaction of the Director by December 31, 2017.

9.8.2 Sublethal Toxicity Study

The Permittee must develop with input from the EMC, and implement a sublethal toxicity study to confirm that surface waters meeting the Site Performance Objectives for the order stations are not toxic to sensitive aquatic receptors. The Permittee must submit the study design to the Director by March 31, 2015.

Letter from the British Columbia (B.C.) Ministry of Environment (MOE) approving the study design for the Regional Aquatic Effects Monitoring Program (RAEMP)

Excerpt of toxicity testing requirements:

Teck shall work in collaboration with the Ministry and Ktunaxa Nation representatives ideally in a monitoring committee forum to prioritize the following studies for discussion and implementation. Recommendations from the monitoring committee must include brief study designs and be submitted to the Director for approval. These studies shall consider, at a minimum, the following studies previously recommended by the Technical Advisory Committee (TAC) established for the ABMP.

Nitrate Toxicity

Additional toxicity testing to study the effects of nitrate, including:

a. Amphibian toxicity testing to assess the sensitivity of representative species to nitrate using long-term metamorphosis tests;
b. Chronic toxicity testing to assess the sensitivity of invertebrates to nitrate using long-term tests; and
c. Early life stage rainbow trout toxicity testing to assess the relationship between water hardness and nitrate toxicity across a range of hardness representative of the Elk and Fording Rivers.

APPENDIX B

Nautilus Reports - Quarterly and Semi-Annual Toxicity Testing

Appendix B-1 First Quarter 2016 Results: Toxicity testing on Elk Valley samples with *Ceriodaphnia dubia, Pseudokirchneriella subcapitata, Hyalella azteca* and *Pimephales promelas*

Nautilus Environmental

Toxicity testing on Elk Valley samples with *Ceriodaphnia dubia, Pseudokirchneriella subcapitata, Hyalella azteca* and *Pimephales promelas*

First Quarter 2016 Results

Final Report

Report date:
July 28, 2016

Submitted to:

Teck Coal Ltd.
Sparwood, BC

8664 Commerce Court
Burnaby, BC
V5A 4N7

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SIGNATURE PAGE

Krysta Pearcy, B.Sc.
Laboratory Biologist

James Elphick, R.P.Bio.
Senior Reviewer

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

1.0 INTRODUCTION

Nautilus Environmental conducted toxicity tests for Teck Coal Ltd. on samples collected from various locations in the Elk Valley as part of a quarterly toxicity testing program required under BC Ministry of Environment permit number 107517. Test species required to be tested quarterly included a cladoceran (*Ceriodaphnia dubia*), a unicellular green alga (*Pseudokirchneriella subcapitata*), an amphipod (*Hyalella azteca*), and the fathead minnow (*Pimephales promelas*). Tests are also required on a semi-annual basis (in alignment with second and forth quarterly testing) using rainbow trout (*Oncorhynchus mykiss*).

Water samples used for testing were transported in 20-L plastic containers in coolers containing ice packs. Samples were received at temperatures ranging from 0.4 to 8.0°C and were stored in the dark at 4 ± 2°C prior to testing. Table 1 summarizes the toxicity tests that were conducted on each sample as well as sample collection dates. Samples were collected weekly on the dates shown in Table 1 for the duration of the *H. azteca* and *P. promelas* tests. The *P. promelas* test was conducted at the Nautilus Environmental laboratory in Calgary, AB; the other toxicity tests were conducted at the Burnaby, BC location.

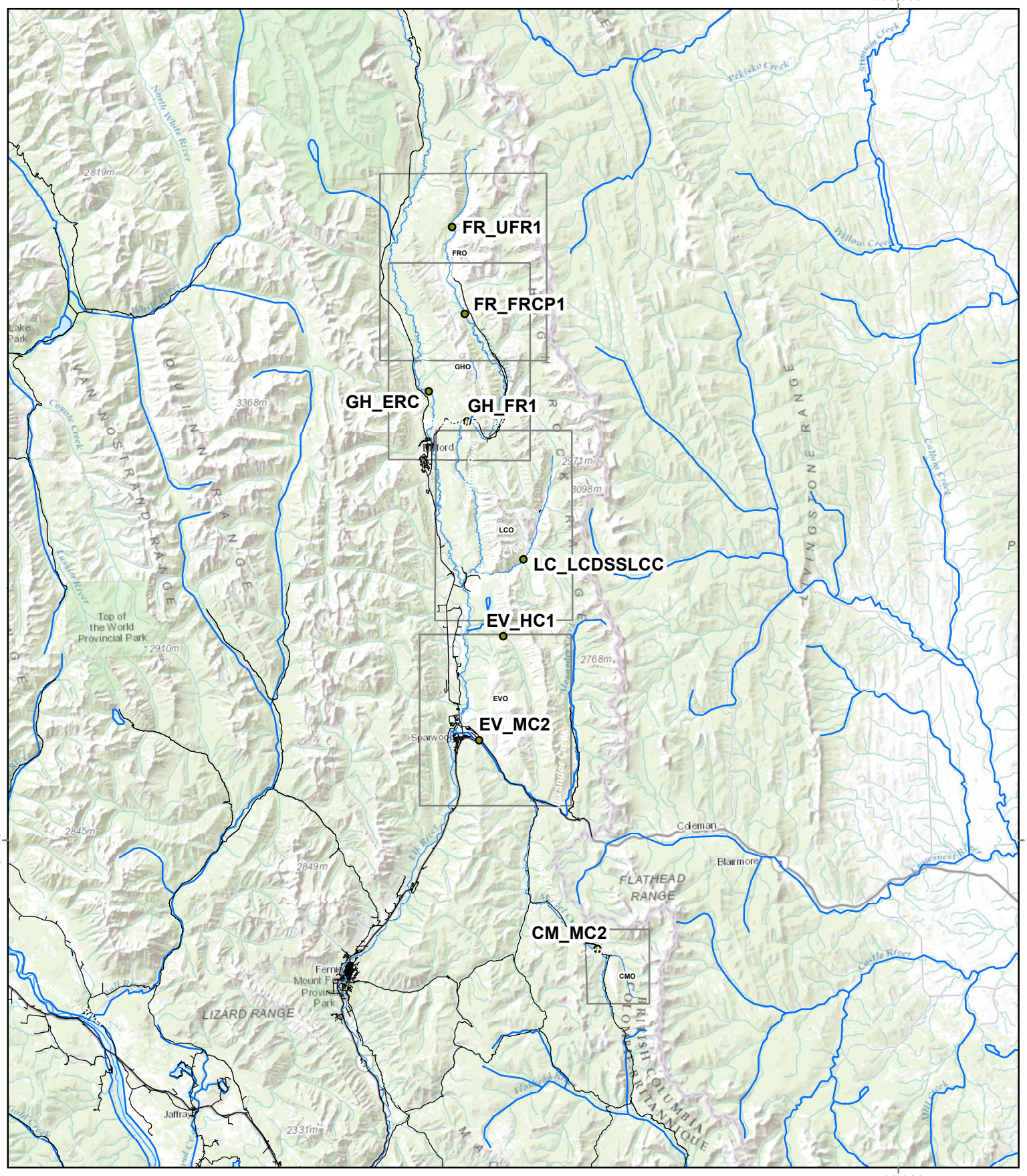
This report presents the results of the toxicity tests. Copies of laboratory data sheets and printouts of statistical analyses are provided in Appendices A through D. Results of analytical chemistry that was performed on the samples tested in this program are provided in Appendix E. These samples were collected by Teck personnel at the same time the samples were collected for toxicity testing. The chain-of-custody forms are provided in Appendix F.

Table 1. Summary of toxicity testing program.

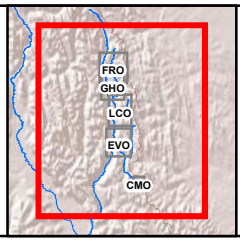
Sample ID	EMS Location ID	Species Tested	Sample Collection Dates
FR_UFR1 *	E216777	*C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* †	March 1, March 8, March 15, March 22 and March 29, 2016
FR_FRCP1	E300071	*C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* †	March 1, March 8, March 15, March 22 and March 29, 2016
GH_FR1	0200378	*C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* †	March 1, March 8, March 15, March 22 and March 29, 2016
GH_ERC	E300090	*C. dubia* and *P. subcapitata*	March 1, 2016
EV_MC2	E300091	*C. dubia* and *P. subcapitata*	March 1, 2016
EV_HC1	E102682	*C. dubia* and *P. subcapitata*	March 1, 2016
CM_MC2	E258937	*C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* †	March 1, March 8, March 15, March 22 and March 29, 2016
LC_LCDSSLCC	E297110	*C. dubia* and *P. subcapitata*	March 1, 2016

* Site water control

† *P. promelas* tests were conducted on untreated and copper-amended samples



Teck



Chronic Toxicity Monitoring Locations

- Roads
- Rivers
- Monitoring Locations

N

0 4,000 8,000 16,000 Meters

DATE:	MINE OPERATION:
7/24/2015	Elk Valley
SCALE:	COORDINATE SYSTEM:
1:550,000	NAD 1983 UTM Zone 11N

Document Path: \\teckcominco.loc\CGO\Groups\TCGIS\Data\Operations\SPO\Dan_Vasiga\BaseLandscape_letter.mxd

2.0 METHODS

Methods for the toxicity tests using *C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* are summarized in Tables 2 through 5. Laboratory control water was 20% Perrier water prepared with deionized water for *C. dubia*; moderately hard water prepared by addition of reagent grade salts to dechlorinated municipal tap water for *P. promelas* according to a recipe provided by ASTM (1980); and moderately hard water prepared by addition of reagent grade salts to dechlorinated municipal tap water for *H. azteca* according to a recipe provided in Environment Canada (2013).

For the *H. azteca* tests, all of the site waters were supplemented with 25 mg/L chloride and 0.02 mg/L bromide using NaCl and NaBr, respectively, according to recommendations of the *Hyalella* Advisory Group (chaired by Chris Ingersoll, USGS) (Norberg-King et al., 2014), since low concentrations of these halides are known to impair growth of this species. The laboratory control water contained approximately 75 mg/L chloride and 0.8 mg/L bromide, respectively.

Fathead minnows are known to be susceptible to adverse effects caused by fungi and microbes (Grothe and Johnson, 1996; Ksoz et al., 2997; Downey et al. 2000). Results of toxicity tests and Toxicity Identification Evaluation efforts conducted in 2015 indicated that artefactual toxicity (i.e., adverse effects that were not associated with toxicants in the sample) had occurred in fathead minnow tests using ambient water samples from the Elk Valley and amendment of the samples with a low dose of copper appeared to counteract the adverse effect. Consequently, the *P. promelas* tests were tested on both untreated samples, as well as following the addition of 20 µg/L copper, in order to reduce the potential adverse effects caused by fungi and microbes in the samples. A copper-amended control water treatment was also evaluated to test whether the copper itself caused any adverse response.

Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013), and involved comparison of results to both the laboratory and site water controls.

Table 2. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction test.

Test organism	*Ceriodaphnia dubia*
Test organism source	In-house culture
Test organism age	<24 h old neonates produced within 12 h
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20 mL glass test tube
Test volume	15 mL
Test solution depth	10 cm
Test concentrations	100% (v/v) sample, plus laboratory control
Test replicates	10 test replicates per treatment
Number of organisms	1 per replicate
Control water	20% Perrier water and 80% deionized water (hardness 80-100 mg/L $CaCO_3$)
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	Daily with *Pseudokirchneriella subcapitata* and YCT (3:1 ratio)
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light/8 hours dark
Sample filtration	None
Aeration	None
pH adjustment	None
Test protocol	Environment Canada (2007a)
Statistical software	CETIS
Test endpoint	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods, no ephippia present
Reference toxicant	Sodium chloride

Table 3. Summary of test conditions: *Pseudokirchneriella subcapitata* growth inhibition test.

Test organism	*Pseudokirchneriella subcapitata*, strain CPCC #37
Test organism source	In-house axenic culture, obtained from Canadian Phycological Culture Centre, and originally isolated from Nitelva River, Norway.
Test organism age	3-to 7-day old culture in logarithmic growth phase
Test type	Static
Test duration	72 hours
Test vessel	Microplate
Test volume	220 µL
Test concentrations	95.2% (v/v) sample, plus laboratory control
Test replicates	4 replicates per treatment; 8 replicates for control
Number of organisms	10, 000 cells/mL
Control water	Deionized water with nutrients added
Test solution renewal	None
Test temperature	24 ± 2°C
Feeding	None
Light intensity	3600 to 4400 lux
Photoperiod	24 hours light
Sample filtration	Through a preconditioned membrane filter of 0.45 µm using a vacuum pump
Aeration	None
pH adjustment	None
Test protocol	Environment Canada (2007b)
Statistical software	CETIS
Test endpoint	Algal cell growth inhibition
Test acceptability criteria for controls	>16-fold increase in number of algal cells; CV ≤20%; no trend when analyzed using Mann-Kendall test
Reference toxicant	Zinc

Table 4. Summary of test conditions: *Hyalella azteca* survival and growth test.

Test organism	*Hyalella azteca*
Test organism source	Aquatic Research Organisms, NH
Test organism age	7-8 days old
Test type	Static-renewal
Test duration	28 days
Test vessel	375 mL glass container
Test volume	300 mL of water
Test concentrations	100% (v/v) sample, plus laboratory control
Test replicates	5 test replicates per treatment
Number of organisms	10 per replicate
Control water	Moderately-hard water (hardness 80-100 mg/L $CaCO_3$) containing ~75 mg/L Cl and supplemented with 0.8 mg/L Br. Samples also supplemented with 25 mg/L Cl and 0.02 mg/L Br.
Test solution renewal	Twice daily (~80% renewal)
Test temperature	23 ± 1°C
Feeding	1 mL of YCT daily to each container. Tetramin daily, with amounts increasing weekly: Week 1: 0.5 mg, Week 2: 0.75 mg, Week 3: 1 mg, Week 4: 1.5 mg in each test container.
Light intensity	500 to 1000 lux at water surface
Photoperiod	16 hours light/8 hours dark
Sample filtration	None
Aeration	None
pH adjustment	None
Test protocol	Modified from US EPA (2000), as described in Norberg-King et al. (2014)
Statistical software	CETIS
Test endpoint	Survival and dry weight
Test acceptability criteria for controls	Mean control survival of ≥80% survival
Reference toxicant	Sodium chloride

Table 5. Summary of test conditions: *Pimephales promelas* survival and growth test.

Test organism	*Pimephales promelas*
Test organism source	Aquatox, Hot Springs, AR
Test organism age	<24 hours
Test type	Static renewal
Test duration	28 days post hatch
Test vessel	1-L plastic container
Test volume	1 L
Test concentrations	100% (v/v) sample, plus laboratory control
Test replicates	4 test replicates per treatment
Number of organisms	10 per replicate
Control water	Moderately-hard water (hardness 80-100 mg/L $CaCO_3$)
Test solution renewal	Daily (~80%)
Test temperature	25 ± 1°C
Feeding	Twice a day, after hatch, with newly hatched brine shrimp *(Artemia* nauplii*)*
Light intensity	100 to 500 lux at water surface
Photoperiod	16 hours light / 8 hours dark
Sample filtration	None
Aeration	Provided post hatch (<100 bubbles/min)
pH adjustment	None
Test protocol	US EPA (1996) and ASTM (2013)
Statistical software	CETIS
Test endpoint	Hatch, survival, length, biomass, normal development (which assesses incidence of deformities)
Test acceptability criteria for controls	>66% hatch; ≥70% post-hatch survival
Reference toxicant	Sodium chloride

3.0 RESULTS

Results of the toxicity tests using *C. dubia* are provided in Table 6. The site water and laboratory water controls performed similarly for this species, indicating that there was no adverse effect associated with the upstream Fording River station. No adverse effect was observed on survival of *C. dubia*; survival ranged from 80 to 100% in all of the samples. Compared to the laboratory control, a statistically significant reduction in *C. dubia* reproduction was observed in one sample (FR_FRCP1); there was a 40% percent reduction in reproduction compared to the laboratory control in this sample. Compared to the site water control, a statistically significant reduction in *C. dubia* reproduction was observed in two samples (FR_FRCP1 and CM_MC2); percent reduction compared to the site water control was 48 and 15% for FR_FRCP1 and CM_MC2, respectively.

Results of the toxicity tests using *P. subcapitata* are provided in Table 7. In these tests, the site water control produced 4.7-fold greater growth than the laboratory water control. This finding is not unusual, since the higher ionic strength associated with the site water controls would be expected to stimulate cell growth of this species relative to the very low ionic strength associated with the laboratory control water. Similarly, the other samples also exhibited a stimulation of cell growth relative to the laboratory water control; none of the samples exhibited a statistically significant reduction in cell growth relative to the laboratory water control. Compared to the site water control, a statistically significant reduction in cell yield was observed for four samples (FR_FRCP1, GH_FR1, EV_HC1 and CM_MC2); percent reduction compared to the site water control was 31, 11, 11 and 10% for FR_FRCP1, GH_FR1, EV_HC1 and CM_MC2, respectively.

Results of the toxicity tests using *H. azteca* are provided in Table 8. Survival and dry weight in the site water and laboratory water controls were similar for this species, indicating that there was no adverse effects associated with the sample from the upstream Fording River station. A statistically significant reduction in *H. azteca* survival was observed for one sample (CM_CM2) compared to the laboratory and site water controls; survival was reduced by 20% compared to both controls. Compared to the laboratory control, a statistically significant reduction in dry weight was observed for three samples (FR_FRCP1, GH_FR1 and CM_MC2); percent reduction compared to the laboratory control was 42, 12 and 42% for FR_FRCP1, GH_FR1 and CM_MC2, respectively. Compared to the site water control a statistically significant reduction in dry weight was observed for two samples (FR_FRCP1 and CM_MC2); percent reduction compared to the site water control was 39% for both samples.

Results of the untreated and copper-amended toxicity tests using *P. promelas* are provided in Tables 9 and 10, respectively. Survival in the untreated site control was statistically significantly lower than the untreated laboratory control (~31% reduction). Hatch, biomass, length and normal development were similar in the untreated site and laboratory water controls for this species, indicating that there was no adverse or stimulatory effects associated with the upstream Fording River station for these endpoints.

A statistically significant reduction in *P. promelas* survival was observed in two untreated samples (GH_FR1 and CM_MC2) compared to the laboratory water control; percent reduction was 42 and 27% for GH_FR1 and CM_MC2, respectively. There was no adverse effect on survival in any of the samples compared to the site water control. There were no adverse effects on hatch, biomass, length, or normal development (i.e., incidence of deformities) in the untreated samples compared to the untreated site water and laboratory water controls.

The effects that were observed on fathead minnows in the untreated tests were restricted to mortalities, and occurred predominantly between days 6 and 12 of the tests. Fathead minnows are known to be susceptible to adverse effects caused by fungi and microbes (Grothe and Johnson, 1996; Ksoz et al., 2997; Downey et al. 2000). These effects have been termed "sporadic mortality phenomenon", and are associated with mortalities that generally occur beginning on day 4 of the 7-day test with this species (Downey et al. 2000); this age is equivalent to day 6 of the 32-day test, which starts with an earlier life-stage. Effects associated with this phenomenon are generally associated with a high degree of between-replicate variability, as was in these 32-day tests. Thus, the pattern of effects observed with the samples tested here is consistent with effects caused by sporadic mortality phenomenon.

The samples, site water and laboratory control were also tested with the addition of 20 µg/L Cu, to reduce fungal and microbial growth in the samples throughout the test. However, survival in the copper-treated laboratory control was 56.7% and did not meet test acceptability criteria (≥70% post hatch survival). Despite the fact that the copper-amendment control indicated a failed test, the results were interpreted for the purpose of further evaluating effective copper treatment dose rates. A statistically significant reduction in biomass was observed in one of the copper treated samples (CM_MC2) compared to the copper treated laboratory control; percent reduction was 9%. A statistically significant reduction in length was observed in two of the copper treated samples (GH_FR1 and CM_MC2) compared to the copper-treated laboratory control; percent reduction was 9 and 10% for GH_FR1 and CM_MC2,

respectively. There were no adverse effects on hatch, survival, or normal development (i.e., incidence of deformities) in the copper treated samples compared to the copper treated laboratory water control. There were no adverse effects on hatch, survival, biomass, length or normal development (i.e., incidence of deformities) in the copper treated samples compared to the copper treated site water control.

Table 6. Results: *Ceriodaphnia dubia* survival and reproduction test.

Sample ID	Survival (%)	Reproduction (Mean ± SD)
Laboratory Control	90	21.5 ± 7.0
FR_UFR1 (Site Control)	100	24.5 ± 2.3
FR_FRCP1	90	12.8 ± 4.5 * α
GH_FR1	80	19.7 ± 9.6
GH_ERC	90	21.7 ± 7.8
EV_MC2	100	23.5 ± 3.0
EV_HC1	100	24.3 ± 2.9
CM_MC2	100	20.8 ± 3.5 α
LC_LCDSSLCC	100	23.5 ± 3.4

SD = Standard Deviation
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control FR_UFR1

Table 7. Results: *Pseudokirchneriella subcapitata* growth inhibition test.

Sample ID	Cell Yield (x 10^4 cells/mL) (Mean ± SD)	Stimulation relative to laboratory control (%)
Laboratory Control	28.8 ± 2.4	-
FR_UFR1 (Site Control)	134.6 ± 8.1	368.3
FR_FRCP1	93.5 ± 7.0 α	225.2
GH_FR1	119.5 ± 4.7 α	315.7
GH_ERC	129.5 ± 9.3	350.4
EV_MC2	130.3 ± 12.4	353.0
EV_HC1	120.3 ± 6.4 α	318.3
CM_MC2	121.8 ± 2.2 α	323.5
LC_LCDSSLCC	129.5 ± 5.3	350.4

SD = Standard Deviation
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control FR_UFR1

Table 8. Results: *Hyalella azteca* survival and growth test.

Sample ID	Mean ± SD	
	Survival (%)	**Dry Weight (mg)**
Laboratory Control	100 ± 0.0	0.86 ± 0.01
FR_UFR1 (Site Control)	100 ± 0.0	0.82 ± 0.03
FR_FRCP1	100 ± 0.0	0.50 ± 0.12 * α
GH_FR1	94.0 ± 8.9	0.75 ± 0.06 *
CM_MC2	80.0 ± 15.8 * α	0.50 ± 0.05 * α

SD = Standard Deviation
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control FR_UFR1

Table 9. Results: *Pimephales promelas* survival and growth test (untreated).

Sample ID	(Mean ± SD)				
	Hatch (%)	Survival (%)	Biomass (mg)	Length (mm)	Normal development (%)
Laboratory Control	96.7 ± 3.8	86.7 ± 5.4	1.2 ± 0.1	9.4 ± 0.3	100 ± 0.0
FR_UFR1 (Site Control)	96.7 ± 3.8	60.0 ± 31.3 *	1.2 ± 0.3	10.5 ± 1.3	100 ± 0.0
FR_FRCP1	96.7 ± 6.7	85.0 ± 14.8	1.3 ± 0.1	9.3 ± 0.7	98.2 ± 3.6
GH_FR1	96.7 ± 3.8	50.0 ± 12.8 *	1.0 ± 0.2	9.9 ± 0.6	96.4 ± 7.1
CM_MC2	95.0 ± 3.3	63.3 ± 20.7 *	1.1 ± 0.1	9.8 ± 1.3	100 ± 0.0

SD = Standard Deviation
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control FR_UFR1

Table 10. Results: *Pimephales promelas* survival and growth test (copper treated).

Sample ID	Mean ± SD				
	Hatch (%)	Survival (%)	Biomass (mg)	Length (mm)	Normal development (%)
Laboratory Control [+Cu]	100 ± 0.0	56.7 ± 11.6	1.4 ± 0.1	9.3 ± 0.5	100 ± 0.0
FR_UFR1 (Site Control) [+Cu]	100 ± 0.0	73.3 ± 13.3	1.4 ± 0.4	9.1 ± 0.7	100 ± 0.0
FR_FRCP1 [+Cu]	93.3 ± 9.4	76.7 ± 8.6	1.5 ± 0.2	8.8 ± 0.6	97.7 ± 4.5
GH_FR1 [+Cu]	98.3 ± 3.3	96.7 ± 3.8	1.3 ± 0.1	8.5 ± 0.2 *	100 ± 0.0
CM_MC2 [+Cu]	98.3 ± 3.3	93.3 ± 7.7	1.2 ± 0.0 *	8.4 ± 0.1 *	100 ± 0.0

SD = Standard Deviation
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control FR_UFR1

4.0 QA/QC

The health histories of the test organisms used in the exposures were acceptable and met the requirements of the test protocols. There were no deviations from the test methodologies other than the planned modification to the *H. azteca* method and the addition of copper in the *P. promelas* tests, as described in Section 2.0. Uncertainty associated with these tests is best described by the standard deviations around the means.

Water quality parameters remained within ranges specified in the protocols throughout the tests, with the exception of the *P. promelas* untreated test. On days 9 and 29 of the *P. promelas* untreated test, the temperature of some test solutions used during water renewal was 23°C, which is below the range of 25 ± 1°C specified by the test method. This minor deviation from the specified range would not be expected to affect the outcome of the test.

The tests met all control acceptability criteria, with the exception of the *P. promelas* copper treated test. Survival rate in the copper treated laboratory control was 56.7%, which is below the minimum post hatch survival of 70% specified by the test method.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 11. The *C. dubia* reference toxicant result was below two standard deviations but within three standard deviations of the historical mean. This was likely due to natural variability as one in twenty results may be outside of two standard deviations due to variability alone. Results of the reference toxicant tests with the remaining species fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in these tests was appropriate. The reference toxicant tests were performed under the same conditions as those used for the samples.

Table 11. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
C. dubia	Survival (LC50): 1.8 g/L NaCl	2.0 (1.9–2.2)	5	March 16, 2016
	Reproduction (IC50): 1.6 g/L NaCl	1.5 (1.2–1.9)	12	
P. subcapitata	Growth (IC50): 41.2 µg/L Zn	29.6 (17.3–50.7)	31	March 1, 2016
H. azteca	Survival (LC50): 6.0 g/L NaCl	5.3 (4.5–6.2)	9	March 3, 2016
P. promelas	Survival (LC50): 0.8 g/L NaCl	0.8 (0.5–1.1)	12	March 7, 2016
	Biomass (IC25): 0.5 g/L NaCl	0.5 (0.3–0.7)	14	

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration, EC = Effect Concentration

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6.0 END OF REPORT

APPENDIX A – *Ceriodaphnia dubia* Toxicity Test Data

Ceriodaphnia dubia Summary Sheet

Client: Teck Coal
Work Order No.: 16284

Start Date/Time: March 3/16 @ 1000h
Set up by: MLT/EMM

Sample Information:

Sample ID: various, see results table for IDs
Sample Date: March 1/16
Date Received: March 2/16, March 3/16
Sample Volume: various

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: D22416A
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 23
Mortality (%) in previous 7 d: Ø
Individual female # used ≥8 young on test day: 6, 7, 8, 9, 10, 11, 12, 13, 14

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd141
Stock Solution ID: 15NaD3
Date Initiated: March 16/16

7-d LC50 (95% CL): 1.8 (1.5 - 2.2) g/L NaCL
7-d IC50 (95% CL): 1.6 (1.1 - 1.8) g/L NaCL

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.9 - 2.2) g/L NaCL CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2 - 1.9) g/L NaCL CV (%): 12

Test Results:

100% (v/v)	Survival (%)	Reproduction (Mean ± SD)
Negative Control	90	21.5 ± 7.0
FR_UFR1_Q_04012016_N ①	100	24.5 ± 2.3
FR_FRCP1_Q_04012016_N	90	12.8 ± 4.5 *a
GH_FR1_WS_2016_03_01_NP	80	19.7 ± 9.6
GH_ERC_WS_2016_03_01_NP	90	21.7 ± 7.8
EV_HC1_WS_2016-03-01_N	100	24.3 ± 2.9
EV_MC2_WS_2016-03-01_N	100	23.5 ± 3.0
CN_MC2_WS_20160301_N	100	20.8 ± 3.5 a
LC_LCDSSLCC_WS_2016-03-07_N	100	23.5 ± 3.4

a. Reproduction was significantly less than site control FR_UFR

① site control * Reproduction was significantly less than the lab control

Reviewed by: JOH
Date reviewed: March 24/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck Coal
Sample ID: Teck Pass/Fail Variants
Work Order #: 16284

Start Date & Time: March 3/16 @ 1000h
Stop Date & Time: March 10/16 @ 1530h
Test Species: *Ceriodaphnia dubia*

Concentration: lab control

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.4	8.1	7.5	8.2	7.4	8.0	7.8	8.0	7.5	8.0	7.6	8.0	7.4
pH	8.0	7.3	8.0	7.8	7.9	7.7	8.0	7.5	8.0	7.5	8.0	7.7	8.0	7.6
Cond. (µS/cm)	219	226		228		228		227		226		221		223
Initials	EMM	EMM/EC		A		A		EMM		EMM		EMM		EMM

Concentration: Site control (FR_UFR1 (100%))

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.2	7.5	8.2	7.6	8.2	7.5	8.1	7.8	8.2	7.8	8.2	7.7	8.2	7.4
pH	7.9	7.7	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.7	7.9	7.7	7.9	7.8
Cond. (µS/cm)	356	360		358		360		359		357		361		360
Initials	EMM	EMM/EC		A		A		EMM		EMM		EMM		EMM

Concentration: FR_FRCP1 (100% (v/v))

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.2	7.5	8.2	7.6	8.1	7.5	8.1	7.6	8.2	7.7	8.1	7.6	8.2	7.6
pH	7.9	7.8	7.9	8.0	7.9	8.0	7.8	7.9	7.9	7.8	7.9	7.8	7.9	7.8
Cond. (µS/cm)	1688	1699		1683		1685		1689		1690		1689		1670
Initials	EMM	EMM/EC		A		A		EMM		EMM		EMM		EMM

Concentration: GH_FR1 (100% (v/v))

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.2	7.5	8.2	7.5	8.2	7.6	8.2	7.5	8.2	7.8	8.2	7.6	8.1	7.5
pH	8.0	7.9	7.9	8.1	8.0	8.0	8.0	7.8	8.0	7.8	8.0	7.8	7.9	7.9
Cond. (µS/cm)	849	867		866		867		867		868		865		838
Initials	EMM	EMM/EC		A		A		EMM		EMM		EMM		EMM

Thermometer: 4 DO meter: 1 pH meter: 2 Conductivity meter: 4

	Control	FR_UPR1	FR_FRCP1	GH_FR1
Hardness*	100	190	890	426
Alkalinity*	94	136	232	190

* mg/L as CaCO3

Analysts: EMM, MLT, AWD, EC, KL
Reviewed by: JBR
Date reviewed: March 22/16

Sample Description: clear, colourless, odourless, no particulates (all samples)

Comments: Broodboard Used: 022416A (C6→14)

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck Coal
Sample ID: Teck Pass/Fail variants
Work Order #: 16284

Start Date & Time: March 3/16 @ 1000h
Stop Date & Time: March 10/16 @ 1530h
Test Species: *Ceriodaphnia dubia*

(100)(v/v) Concentration GH ERC	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	7.8	8.2	7.6	8.2	7.5	8.1	7.6	8.0	7.8	8.1	7.6	8.2	7.5
pH	7.9	7.9	7.9	8.1	7.9	8.2	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.9
Cond. (µS/cm)	402	412		402		405		409		410		406		404
Initials	EMM	EMM/EC		A		A		EMM		EMM		EMM		EMM

(100)(v/v) Concentration EV_HCl	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	7.8	8.2	7.5	8.2	7.4	8.1	7.6	8.2	7.6	8.1	7.6	8.2	7.5
pH	8.1	8.0	8.1	8.1	8.1	8.2	8.0	8.1	8.1	8.1	8.0	8.1	8.0	8.1
Cond. (µS/cm)	727	744		740		739		740		744		745		750
Initials	EMM	EMM/EC		A		A		EMM		EMM		EMM		EMM

(100)(v/v) Concentration EV_MC2	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	7.8	8.2	7.6	8.1	7.5	8.2	7.5	8.2	7.9	8.1	7.7	8.2	7.6
pH	7.9	7.9	7.8	8.1	7.9	8.2	7.9	7.9	7.9	7.9	7.8	7.9	7.9	7.9
Cond. (µS/cm)	700	704		702		700		703		704		704		691
Initials	EMM	EMM/EC		A		A		EMM		EMM		EMM		EMM

(100)(v/v) Concentration CM_MC2	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.2	7.5	8.1	7.4	8.2	7.6	8.2	7.9	8.2	7.8	8.1	7.4
pH 8.1	7.9	8.1	8.1	8.2	8.0	8.2	8.1	8.0	8.1	8.0	8.1	8.0	8.1	8.0
Cond. (µS/cm)	700	907		902		905		905		906		908		905
Initials	EMM	EMM/EC		A		A		EMM		EMM		EMM		EMM

EMM @ 875

Thermometer: 4 DO meter: 1 pH meter: 2 Conductivity meter: 4

	Control	GH_ERC	EV_HCl	EV_MC2
Hardness*	100	226	416	408
Alkalinity*	94	152	194	178

* mg/L as CaCO3

Analysts: EMM, MLT, AWD, EC, KL
Reviewed by: JGu
Date reviewed: March 22/16

Sample Description: clear, colourless, odourless, no particulates (all samples)

Comments: **Broodboard Used:** 022416A (6→14)

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck Coal
Sample ID: Teck Pass/Fail Various
Work Order #: 16284

Start Date & Time: March 3/16 @ 1000h
Stop Date & Time: March 10/16 @ 1530h
Test Species: *Ceriodaphnia dubia*

100% (v/v) Concentration ~~LCO-LC~~ MO (i)	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.5	24.0	25.0	24.0	25.0	24.0	29.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.2	7.6	8.2	7.4	8.2	7.5	8.2	7.6	8.2	7.9	8.1	7.7	8.2	7.8
pH	8.1	8.0	8.0	8.1	8.0	8.2	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Cond. (µS/cm)	971	992		984		986		980		990		992		983
Initials	EMM	EMM/EC		^		^		EMM		EMM		EMM		EMM

(i) LC_LCDSSLCC

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: 4 DO meter: 1 pH meter: 2 Conductivity meter: 4

	Control	CM_MC2	LC_LCDSSLCC	
Hardness*	100	486	570	
Alkalinity*	94	202	188	

* mg/L as CaCO3

Analysts: EMM, MLT, AWD, EC, KL
Reviewed by: JOU
Date reviewed: March 22/16

Sample Description: clear, colourless, odourless, no particulates (all samples)

Comments: **Broodboard Used:** 022416A (6-14)

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck COal
Sample ID: Teck Dass/Fail Vanoy
Work Order: 16284

100% (v/v)

Start Date & Time: March 3/16 @ 1000h
Stop Date & Time: March 10/16 @ 1530h
Set up by: MLT/EMM

Concentration: lab control

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~
4	✓	✓	4	4	4	4	3	3X	4	4	KL
5	7 8	4 5	9 ✓	8	9	7 8	9 ✓	↓	8 ✓	10 ✓	MT EMM
6	✓	✓	✓	✓	✓	✓	✓		✓	✓	EMM
7	11	11	10	11	12	✓	13		12	13	EMM
8											
Total	26	20	23	23	25	19	25	3X	24	27	EMM

Concentration: site control FRUFR1

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~
4	5	5	6	5	4	4	2	4	5	5	KL
5	9	7	10	9	9	10	6	9	10	10	MT
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
7	11	12	12	10	11	11	12	9	11	12	EMM
8											
Total	25	24	28	24	24	25	20	22	26	27	EMM

Concentration: FR FRCP1

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~
4	✓	✓	3	✓	✓	3	2	4	✓	✓	KL
5	3	4	6	6	5	3	X	6	4	6	MT
6	7	8	✓	7	6	✓	✓	✓	8	7	EMM
7	6	✓	9	✓	✓	7	✓	8	✓	✓	EMM
8											
Total	16	12	18	13	11	13	2X	18	12	13	EMM

Concentration: GH FR1

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EC
2	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	A
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~
4	4	4	6	|	5	6	4	5	2	4	KL
5	8	7	9	|	8	9	8	9	✓	X	MT
6	✓	✓	✓	|	✓	✓	✓	✓	8	|	EMM
7	9	12	10	|	12	12	11	13	12	|	EMM
8											
Total	21	23	25	0X	25	27	23	27	22	4X	EMM

Concentration: GH ERC

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~
4	4	X	✓	2	5	5	✓	5	5	4	KL
5	8	|	9	7	9	8	4	9	10	9	MT
6	✓	|	6	✓	✓	✓	9	✓	✓	✓	EMM
7	12	|	11	11	10	10	13	12	9	11	EMM
8											
Total	24	0X	26	20	29	23	26	26	24	24	EMM

Concentration: EV HC1

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~
4	5	5	✓	24	3	4	4	4	4	4	KL
5	8	10	8	10	9	10	9	9	10	9	MT
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
7	12	12	9	11	10	11	12	13	12	12	EMM
8											
Total	25	27	17	25	22	25	25	26	26	25	EMM

Concentration: EV MC2

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~
4	4	4	4	4	✓	4	5	5	3	6	KL
5	7	6	8	7	7	9	9	10	7	9	MD
6	✓	✓	✓	✓	10	✓	✓	✓	✓	✓	EMM
7	8	9	12	11	7	12	13	12	12	11	EMM
8											
Total	19	19	24	22	24	25	27	27	22	26	EMM

Concentration: CM MC2

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~
4	4	5	4	5	3	3	4	3	5	4	KL
5	8	9	5	9	✓	7	9	6	7	8	MT
6	✓	✓	✓	✓	10	✓	✓	✓	✓	✓	EMM
7	9	10	6	12	10	6	9	9	10	9	EMM
8											
Total	21	24	15	26	23	16	22	18	22	21	EMM

Concentration: LC LCOSSLCC

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~
4	5	4	5	5	5	5	4	5	4	5	KL
5	✓	9	9	8	8	10	9	8	6	7	MT
6	11	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
7	13	10	10	11	10	12	11	12	8	6	EMM
8											
Total	29	23	24	24	23	27	24	25	18	18	EMM

Notes: X = mortality.

Sample Description: clear colourless, odourless, no particulates (all samples)
Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JCh
Date reviewed: March 22/16

Version 2.1 Issued July 29, 2009

CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Batch ID:	15-2157-4268	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	03 Mar-16 10:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	10 Mar-16 15:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 6h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	58h	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	47h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	48h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	46h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	47h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	49h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	48h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	46h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	45h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
① Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

① Lab control = 20% Perrier lab water
FR-UFR1 = site control

7d Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	10	0.9	0.6738	1	0	1	0.1	0.3162	35.14%	0.0%
FR_UFR1	10	1	1	1	1	1	0	0	0.0%	-11.11%
FR_FRCP1	10	0.9	0.6738	1	0	1	0.1	0.3162	35.14%	0.0%
GH_FR1	10	0.8	0.4984	1	0	1	0.1333	0.4216	52.7%	11.11%
GH_ERC	10	0.9	0.6738	1	0	1	0.1	0.3162	35.14%	0.0%
EV_HC1	10	1	1	1	1	1	0	0	0.0%	-11.11%
EV_MC2	10	1	1	1	1	1	0	0	0.0%	-11.11%
CM_MC2	10	1	1	1	1	1	0	0	0.0%	-11.11%
LC_LCDSSLCC	10	1	1	1	1	1	0	0	0.0%	-11.11%

7d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	0	1	1
FR_UFR1	1	1	1	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	0	1	1	1
GH_FR1	1	1	1	0	1	1	1	1	1	0
GH_ERC	1	0	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	1
EV_MC2	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1
LC_LCDSSLCC	1	1	1	1	1	1	1	1	1	1

Ceriodaphnia 7-d Survival and Reproduction Test **Nautilus Environmental**

7d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1
FR_UFR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	0/1
GH_ERC	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
LC_LCDSSLCC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	05-8783-3357	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Mar-16 16:26	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	15-2157-4268	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	03 Mar-16 10:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	10 Mar-16 15:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 6h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	58h	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	47h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	48h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	46h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	47h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	49h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	48h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	46h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	45h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		FR_FRCP1	0.7632	1.0000	Exact	Non-Significant Effect
Lab Control		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
Lab Control		GH_ERC	0.7632	1.0000	Exact	Non-Significant Effect
Lab Control		EV_HC1	1	1.0000	Exact	Non-Significant Effect
Lab Control		EV_MC2	1	1.0000	Exact	Non-Significant Effect
Lab Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect
Lab Control		LC_LCDSSLCC	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Negative Contr	9	1	10	0.9	0.1	0.0%
FR_UFR1		10	0	10	1	0	-11.11%
FR_FRCP1		9	1	10	0.9	0.1	0.0%
GH_FR1		8	2	10	0.8	0.2	11.11%
GH_ERC		9	1	10	0.9	0.1	0.0%
EV_HC1		10	0	10	1	0	-11.11%
EV_MC2		10	0	10	1	0	-11.11%
CM_MC2		10	0	10	1	0	-11.11%
LC_LCDSSLCC		10	0	10	1	0	-11.11%

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID: 05-8783-3357 **Endpoint:** 7d Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 18 Mar-16 16:26 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

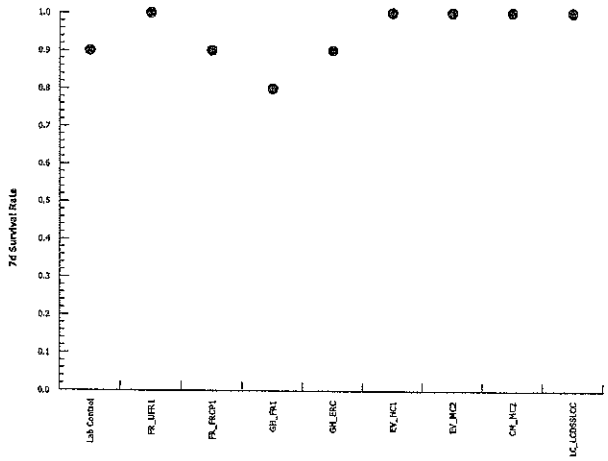
7d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	0	1	1
FR_UFR1	1	1	1	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	0	1	1	1
GH_FR1	1	1	1	0	1	1	1	1	1	0
GH_ERC	1	0	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	1
EV_MC2	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1
LC_LCDSSLCC	1	1	1	1	1	1	1	1	1	1

7d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1
FR_UFR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	0/1
GH_ERC	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
LC_LCDSSLCC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	10-0460-7355	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Mar-16 14:12	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	15-2157-4268	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	03 Mar-16 10:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	10 Mar-16 15:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 6h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	47h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	48h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	46h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	47h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	49h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	48h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	46h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	45h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.2368	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_ERC	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_HC1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_MC2	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		LC_LCDSSLCC	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	10	0	10	1	0	0.0%
FR_FRCP1		9	1	10	0.9	0.1	10.0%
GH_FR1		8	2	10	0.8	0.2	20.0%
GH_ERC		9	1	10	0.9	0.1	10.0%
EV_HC1		10	0	10	1	0	0.0%
EV_MC2		10	0	10	1	0	0.0%
CM_MC2		10	0	10	1	0	0.0%
LC_LCDSSLCC		10	0	10	1	0	0.0%

Ceriodaphnia 7-d Survival and Reproduction Test | **Nautilus Environmental**

Analysis ID: 10-0460-7355 **Endpoint:** 7d Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 22 Mar-16 14:12 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

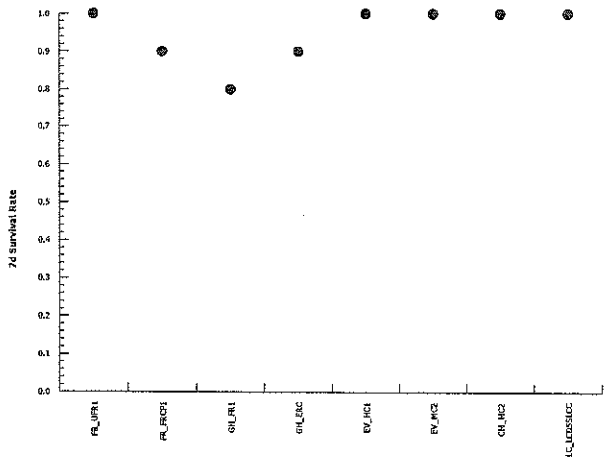
7d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
FR_UFR1	1	1	1	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	0	1	1	1
GH_FR1	1	1	1	0	1	1	1	1	1	0
GH_ERC	1	0	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	1
EV_MC2	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1
LC_LCDSSLCC	1	1	1	1	1	1	1	1	1	1

7d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
FR_UFR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	0/1
GH_ERC	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
LC_LCDSSLCC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	19-6205-4962	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Mar-16 16:26	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	15-2157-4268	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	03 Mar-16 10:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	10 Mar-16 15:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 6h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	58h	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	47h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	48h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	46h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	47h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	49h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	48h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	46h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	45h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	27.5%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	119	73	5	18	0.9944	Asymp	Non-Significant Effect
		FR_FRCP1	64	73	0	18	0.0067	Asymp	Significant Effect
		GH_FR1	103	73	3	18	0.8496	Asymp	Non-Significant Effect
		GH_ERC	109	73	4	18	0.9445	Asymp	Non-Significant Effect
		EV_HC1	120.5	73	3	18	0.9963	Asymp	Non-Significant Effect
		EV_MC2	109.5	73	5	18	0.9496	Asymp	Non-Significant Effect
		CM_MC2	88	73	3	18	0.3652	Asymp	Non-Significant Effect
		LC_LCDSSLCC	108	73	4	18	0.9333	Asymp	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1041.4	130.175	8	4.362	0.0002	Significant Effect
Error	2417.5	29.84568	81			
Total	3458.9		89			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	35.37	20.09	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.7793	0.962	<0.0001	Non-normal Distribution

Analysis ID: 19-6205-4962 **Endpoint:** Reproduction **CETIS Version:** CETISv1.8.7
Analyzed: 18 Mar-16 16:26 **Analysis:** Nonparametric-Control vs Treatments **Official Results:** Yes

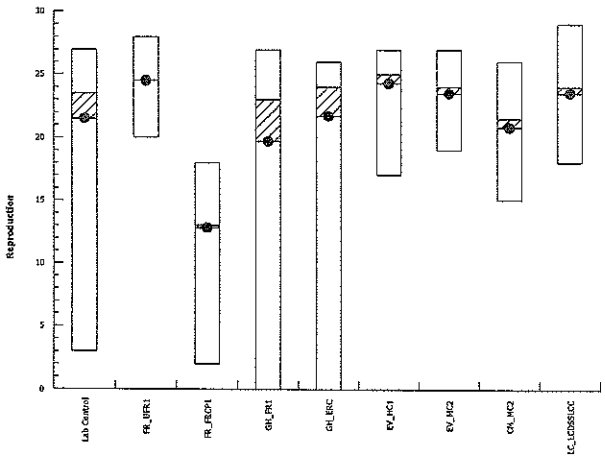
Reproduction Summary

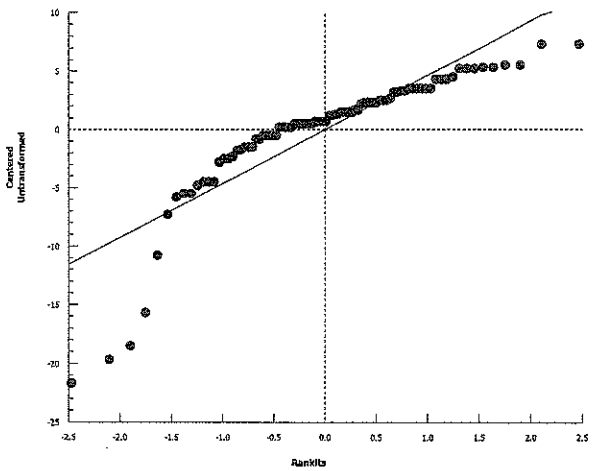
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	21.5	16.52	26.48	23.5	3	27	2.202	32.39%	0.0%
FR_UFR1	10	24.5	22.84	26.16	24.5	20	28	0.7341	9.48%	-13.95%
FR_FRCP1	10	12.8	9.551	16.05	13	2	18	1.436	35.48%	40.47%
GH_FR1	10	19.7	12.85	26.55	23	0	27	3.03	48.63%	8.37%
GH_ERC	10	21.7	16.1	27.3	24	0	26	2.477	36.09%	-0.93%
EV_HC1	10	24.3	22.25	26.35	25	17	27	0.9074	11.81%	-13.02%
EV_MC2	10	23.5	21.39	25.61	24	19	27	0.9339	12.57%	-9.3%
CM_MC2	10	20.8	18.3	23.3	21.5	15	26	1.104	16.78%	3.26%
LC_LCDSSLCC	10	23.5	21.04	25.96	24	18	29	1.088	14.64%	-9.3%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	26	20	23	23	25	19	25	3	24	27
FR_UFR1	25	24	28	24	24	25	20	22	26	27
FR_FRCP1	16	12	18	13	11	13	2	18	12	13
GH_FR1	21	23	25	0	25	27	23	27	22	4
GH_ERC	24	0	26	20	24	23	26	26	24	24
EV_HC1	25	27	17	25	22	25	25	26	26	25
EV_MC2	19	19	24	22	24	25	27	27	22	26
CM_MC2	21	24	15	26	23	16	22	18	22	21
LC_LCDSSLCC	29	23	24	24	23	27	24	25	18	18

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	04-0801-9631	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Mar-16 16:28	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	15-2157-4268	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	03 Mar-16 10:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	10 Mar-16 15:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 6h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	47h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	48h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	46h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	47h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	49h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	48h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	46h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	45h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	22.8%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	55	74	0	18	0.0005	Asymp	Significant Effect
		GH_FR1	90.5	74	3	18	0.4299	Asymp	Non-Significant Effect
		GH_ERC	94	74	3	18	0.5561	Asymp	Non-Significant Effect
		EV_HC1	110	74	4	18	0.9467	Asymp	Non-Significant Effect
		EV_MC2	95.5	74	5	18	0.6094	Asymp	Non-Significant Effect
		CM_MC2	73	74	3	18	0.0413	Asymp	Significant Effect
		LC_LCDSSLCC	94	74	3	18	0.5561	Asymp	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1041.2	148.7429	7	5.406	<0.0001	Significant Effect
Error	1981	27.51389	72			
Total	3022.2		79			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	33.92	18.48	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.7923	0.9579	<0.0001	Non-normal Distribution

Analysis ID:	04-0801-9631	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Mar-16 16:28	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

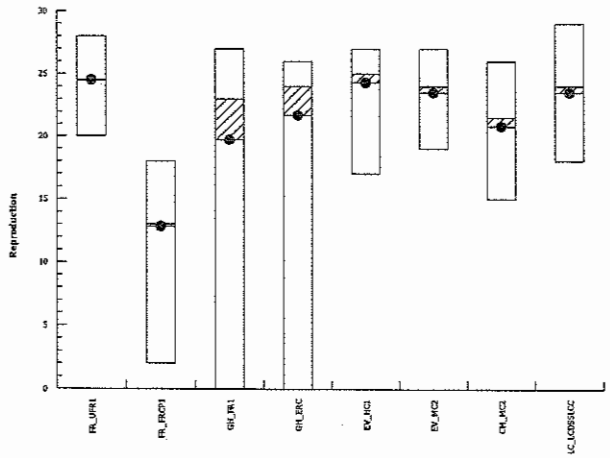
Reproduction Summary

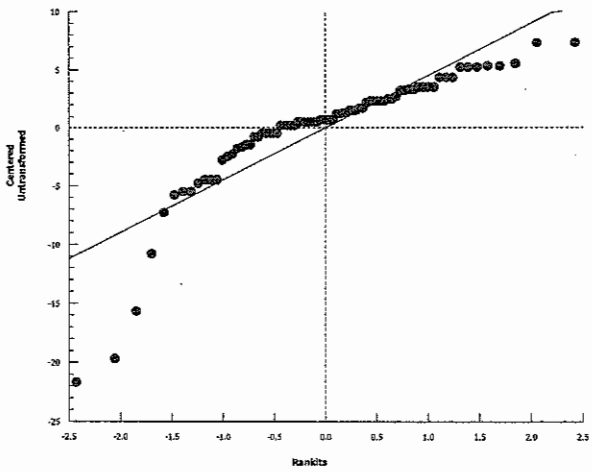
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	10	24.5	22.84	26.16	24.5	20	28	0.7341	9.48%	0.0%
FR_FRCP1	10	12.8	9.551	16.05	13	2	18	1.436	35.48%	47.76%
GH_FR1	10	19.7	12.85	26.55	23	0	27	3.03	48.63%	19.59%
GH_ERC	10	21.7	16.1	27.3	24	0	26	2.477	36.09%	11.43%
EV_HC1	10	24.3	22.25	26.35	25	17	27	0.9074	11.81%	0.82%
EV_MC2	10	23.5	21.39	25.61	24	19	27	0.9339	12.57%	4.08%
CM_MC2	10	20.8	18.3	23.3	21.5	15	26	1.104	16.78%	15.1%
LC_LCDSSLCC	10	23.5	21.04	25.96	24	18	29	1.088	14.64%	4.08%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
FR_UFR1	25	24	28	24	24	25	20	22	26	27
FR_FRCP1	16	12	18	13	11	13	2	18	12	13
GH_FR1	21	23	25	0	25	27	23	27	22	4
GH_ERC	24	0	26	20	24	23	26	26	24	24
EV_HC1	25	27	17	25	22	25	25	26	26	25
EV_MC2	19	19	24	22	24	25	27	27	22	26
CM_MC2	21	24	15	26	23	16	22	18	22	21
LC_LCDSSLCC	29	23	24	24	23	27	24	25	18	18

Graphics





Client: Teck Coal

W.O.#: ~~16285~~ 16284

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
FR_FRUFR1	Mar 3/16	50	6.9	7.0	136		50	9.5	190	JS
FR_FRCP1	↓	↓	11.8	12.0	232		100①	8.9	890	↓
GH_FR1			9.7	9.9	190		50	21.3	426	↓
GH_ERC			7.7	7.8	152		↓	11.3	226	KL
EV_MC1			9.8	9.9	194			20.8	416	↓
EV_MC2			9.1	9.3	178			20.4	408	↓
GH_MC2			10.3	10.5	202		↓	24.3	486	JS
LCO_LC	↓	↓	9.6	9.8	188		100	5.7	570	KL
20% Perrier	March 3/16	50	4.8	4.9	94		50	5.0	100	MT

Notes: ① Sample diluted w/ DI up to 100mL

Reviewed by: JCh Date Reviewed: March 22/16

APPENDIX B – *Pseudokirchneriella subcapitata* Toxicity Test Data

Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 16285

Start Date: March 4/16
Set up by: MG

Sample Information:

Sample ID: various, See results table for ID's
Sample Date: March 1/16
Date Received: March 2/16, March 3/16
Sample Volume: various

Test Organism Information:

Culture Date: Feb 26/16
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC139
Stock Solution ID: 15Zn03
Date Initiated: March 1/16

72-h IC50 (95% CL): 41.2 (34.4 – 45.9) mg/L Zn (MG)

72-h IC50 Reference Toxicant Mean and Range: 29.6 (17.3 – 50.7) mg/L Zn CV (%): 31

Test Results:

	Cell Yield (Mean ± SD)
Negative Control	28.8 ± 2.4
FR_UFR1_Q_04012016_N ①	134.6 ± 8.1 *
FR_FRCP1_Q_04012016_N	93.5 ± 7.0 *a
GH_FR1_WS_2016_03_01_NP	119.5 ± 4.7 *a
GH_ERC_WS_2016_03_01_NP	129.5 ± 9.3 *
EV_HC1_WS_2016-03-01_N	120.3 ± 6.4 *a
EV_MC2_WS_2016-03-01_N	130.3 ± 12.4 *
CM_MC2_WS_20160301_N	121.8 ± 2.2 *a
LC_LCDSSLCC_WS_2016-03-07_N	129.5 ± 5.3 *

a. indicates ce yield that were significantly le than the site control FR_UFR1

~~b. indicates~~ MG

① Site control * indicates cell yield that were significantly greater than the lab contr

Reviewed by: JSa
Date reviewed: March 22/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Teck Coal | Setup by: MLJ

Sample ID: various. | Test Date/Time: March 4/16 @ 0830h

Work Order No.: 16285 | Test Species: *Pseudokirchneriella subcapitata*

Culture Date: Feb 26/16 | Age of Culture: 7d | Culture Health: Good

Culture Count: 1 329 2 306 | Average: 317.5 | Culture Cell Density (c1): 317.5 x 10^4 cells/mL

v1 = 220,000 cells/ml x 100 ml / (c1) 317.5 x 104 cells/ml = 6.93mL

Time Zero Counts: 1 20 2 24 | Average: 22

No. of Cells/mL: 22 x 104 | Initial Density: # cells/mL ÷ 220 µL x 10 µL = 10000 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	6.7	23.0	24.0	25.0	25.0	25.0	✓	✓	✓	✓
FR_UFR1 (site control)	8.0	23.0	↓	↓	↓	↓	✓	✓	✓	✓
FR_FRCP1	8.0	23.0					✓	✓	✓	✓
GH_FR1	8.0	23.0					✓	✓	✓	✓
GH_ERC	8.0	23.0					✓	✓	✓	✓
EV_HC1	8.1	23.0					✓	✓	✓	✓
EV_MC2	8.0	23.0					✓	✓	✓	✓
CM_MC2	8.1	23.0					✓	✓	✓	✓
LC_LCDSSLCC	8.1	23.0					✓	✓	✓	✓
Initials	MLJ	MLJ	MLJ	^	^	MLJ	MLJ	^	^	MLJ

Initial control pH: Well 1: 8.7 Well 2: 8.7

Final control pH: Well 1: 6.5 Well 2: 6.5

Light intensity (lux): 4310 Date measured: March 4/16

Instruments: Thermometer 4 pH meter 2 Light meter 1

Sample Description: clear (all samples), colourless, odourless, no particulates (all samples)

Comments:

Reviewed: JCM Date reviewed: March 21/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal
Start Date/Time: March 4/16 @ 0830h
Work Order #: 16285
Termination Date: March 7/16 @ 0830h
Sample ID: various
Test set up by: MLT
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	32					MLT
	B	28					
Lab control	C	27					
	D	29					
(DI w/	E	30					
nutrients)	F	33					
	G	27					
	H	32					
100% (v/v)	A	MLT ~~107~~ 127					
	B	145					
FR_UFR1	C	143					
(site control)	D	131					
	E	138					
	F	122					
	G	141					
	H	138					
100% (v/v)	A	101					
	B	98					
FR_FRCP1	C	94					
	D	85					
100% (v/v)	A	119					
	B	120					
GH_FR1	C	127					
	D	116					
100% (v/v)	A	122					
	B	140					
GH_ERC	C	137					
	D	123					
100% (v/v)	A	128					
	B	125					
EV_HC1	C	114					
	D	118					
100% (v/v)	A	138					
	B	140					
EV_MC2	C	134					
	D	113					

Comments:

Reviewed by: JCh
Date Reviewed: March 21/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck coal | Start Date/Time: March 4/16 @ 0830h
Work Order #: 16285 | Termination Date: March 7/16 @ 0830h
Sample ID: various | Test set up by: MLT
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
~~Control~~ MLT	A						
	B						
	C						
	D						
	E						
	F						
	G						
	H						
100% (v/v) CM_MC2	A	124					MLT
	B	120					↓
	C	125					
	D	122					
100% (v/v) LC_LCDSSLCC	A	126					
	B	130					
	C	128					
	D	138					↓
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: JCM | Date Reviewed: March 21/16

Pseudokirchneriella subcapitata Algal Counts

Client: Teck Coal
WO#: 16285
Sample ID: Teck Coal samples pass/fail

Start Date/Time: 04-Mar-16 @ 0830h
Termination Date: 07-Mar-16 @ 0830h

Initial Cell Density: 10000 cell/mL

220000
0.22
0.01
10000

Concentration	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		
Control	A	32				32	31.0	mean	28.8
Lab Water	B	28				28	27.0	SD	2.37547
	C	27				27	26.0	CV	8.262504
	D	29				29	28.0		
	E	30				30	29.0		
	F	33				33	32.0		
	G	27				27	26.0		
	H	32				32	31.0		
Control	A	127				127	126.0	mean	134.6
Site Water	B	145				145	144.0	SD	8.140507
(FR_UFRI)	C	143				143	142.0	CV	6.046802
100% (v/v)	D	131				131	130.0		
	E	138				138	137.0		
	F	122				122	121.0		
	G	141				141	140.0		
	H	138				138	137.0		
FR_FRCPI	A	101				101	100.0		
100% (v/v)	B	98				98	97.0		
	C	94				94	93.0		
	D	85				85	84.0		
GH_FRI	A	119				119	118.0		
100% (v/v)	B	120				120	119.0		
	C	127				127	126.0		
	D	116				116	115.0		
GH_ERC	A	122				122	121.0		
100% (v/v)	B	140				140	139.0		
	C	137				137	136.0		
	D	123				123	122.0		
EV_HC1	A	128				128	127.0		
100% (v/v)	B	125				125	124.0		
	C	114				114	113.0		
	D	118				118	117.0		
EV_MC2	A	138				138	137.0		
100% (v/v)	B	140				140	139.0		
	C	134				134	133.0		
	D	113				113	112.0		
CM_MC2	A	124				124	123.0		
100% (v/v)	B	120				120	119.0		
	C	125				125	124.0		
	D	122				122	121.0		
LC_LCDSSLCC	A	126				126	125.0		
100% (v/v)	B	130				130	129.0		
	C	128				128	127.0		
	D	138				138	137.0		

JCL
March 21/16

CETIS Summary Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Batch ID:	04-4641-7548	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	04 Mar-16 08:30	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	07 Mar-16 08:30	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	80h	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	69h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	71h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	69h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	70h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	71h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	71h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	68h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	67h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
(1) Lab Control	Lab Control	Teck Coal	Lab Control		
(2) FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

① Lab control = DI w/nutrients
② site control

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	8	28.75	26.76	30.74	26	32	0.8399	2.375	8.26%	0.0%
FR_UFR1	8	134.6	127.8	141.4	121	144	2.878	8.141	6.05%	-368.3%
FR_FRCP1	4	93.5	82.44	104.6	84	100	3.476	6.952	7.44%	-225.2%
GH_FR1	4	119.5	112.1	126.9	115	126	2.327	4.655	3.9%	-315.7%
GH_ERC	4	129.5	114.7	144.3	121	139	4.664	9.327	7.2%	-350.4%
EV_HC1	4	120.3	110.1	130.4	113	127	3.198	6.397	5.32%	-318.3%
EV_MC2	4	130.3	110.5	150	112	139	6.21	12.42	9.54%	-353.0%
CM_MC2	4	121.8	118.2	125.3	119	124	1.109	2.217	1.82%	-323.5%
LC_LCDSSLCC	4	129.5	121.1	137.9	125	137	2.63	5.26	4.06%	-350.4%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	31	27	26	28	29	32	26	31
FR_UFR1	126	144	142	130	137	121	140	137
FR_FRCP1	100	97	93	84				
GH_FR1	118	119	126	115				
GH_ERC	121	139	136	122				
EV_HC1	127	124	113	117				
EV_MC2	137	139	133	112				
CM_MC2	123	119	124	121				
LC_LCDSSLCC	125	129	127	137				

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	14-8158-5500	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Mar-16 15:17	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	04-4641-7548	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	04 Mar-16 08:30	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	07 Mar-16 08:30	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	80h	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	71h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	69h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	70h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	71h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	71h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	68h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	67h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	35.1%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_FRCP1	-16.19	2.526	10.1	10	1.0000	CDF	Non-Significant Effect
		GH_FR1	-22.7	2.526	10.1	10	1.0000	CDF	Non-Significant Effect
		GH_ERC	-25.2	2.526	10.1	10	1.0000	CDF	Non-Significant Effect
		EV_HC1	-22.88	2.526	10.1	10	1.0000	CDF	Non-Significant Effect
		EV_MC2	-25.38	2.526	10.1	10	1.0000	CDF	Non-Significant Effect
		CM_MC2	-23.26	2.526	10.1	10	1.0000	CDF	Non-Significant Effect
		LC_LCDSSLCC	-25.2	2.526	10.1	10	1.0000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	56455.89	8065.127	7	189.2	<0.0001	Significant Effect
Error	1193.75	42.63393	28			
Total	57649.64		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.87	18.48	0.0263	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9525	0.9166	0.1251	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	14-8158-5500	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Mar-16 15:17	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

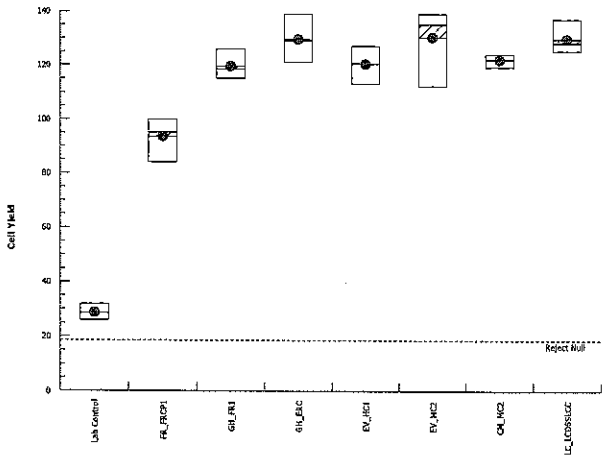
Cell Yield Summary

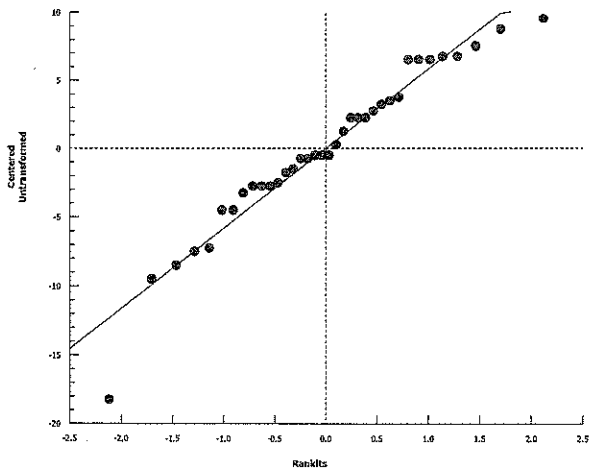
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	28.75	26.76	30.74	28.5	26	32	0.8399	8.26%	0.0%
FR_FRCP1	4	93.5	82.44	104.6	95	84	100	3.476	7.44%	-225.2%
GH_FR1	4	119.5	112.1	126.9	118.5	115	126	2.327	3.9%	-315.7%
GH_ERC	4	129.5	114.7	144.3	129	121	139	4.664	7.2%	-350.4%
EV_HC1	4	120.3	110.1	130.4	120.5	113	127	3.198	5.32%	-318.3%
EV_MC2	4	130.3	110.5	150	135	112	139	6.21	9.54%	-353.0%
CM_MC2	4	121.8	118.2	125.3	122	119	124	1.109	1.82%	-323.5%
LC_LCDSSLCC	4	129.5	121.1	137.9	128	125	137	2.63	4.06%	-350.4%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	31	27	26	28	29	32	26	31
FR_FRCP1	100	97	93	84				
GH_FR1	118	119	126	115				
GH_ERC	121	139	136	122				
EV_HC1	127	124	113	117				
EV_MC2	137	139	133	112				
CM_MC2	123	119	124	121				
LC_LCDSSLCC	125	129	127	137				

Graphics





CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	15-3293-3946	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Mar-16 16:49	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	04-4641-7548	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	04 Mar-16 08:30	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	07 Mar-16 08:30	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	69h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	71h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	69h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	70h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	71h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	71h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	68h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	67h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	8.74%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	8.834	2.526	11.76	10	<0.0001	CDF	Significant Effect
		GH_FR1	3.249	2.526	11.76	10	0.0094	CDF	Significant Effect
		GH_ERC	1.101	2.526	11.76	10	0.5002	CDF	Non-Significant Effect
		EV_HC1	3.088	2.526	11.76	10	0.0140	CDF	Significant Effect
		EV_MC2	0.9398	2.526	11.76	10	0.5817	CDF	Non-Significant Effect
		CM_MC2	2.766	2.526	11.76	10	0.0296	CDF	Significant Effect
		LC_LCDSSLCC	1.101	2.526	11.76	10	0.5002	CDF	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.7195	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	5177.097	739.5853	7	12.8	<0.0001	Significant Effect
Error	1618.125	57.79018	28			
Total	6795.222		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	8.051	18.48	0.3281	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9499	0.9166	0.1041	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	15-1161-3759	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Mar-16 16:48	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

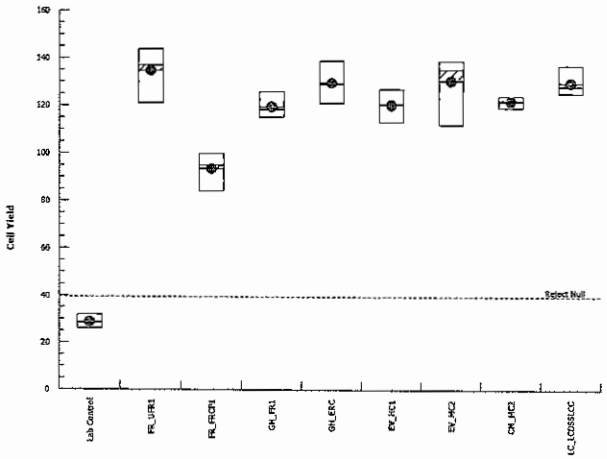
Cell Yield Summary

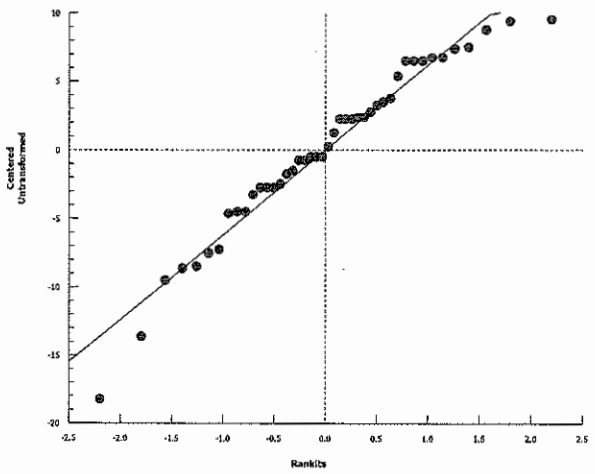
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	28.75	26.76	30.74	28.5	26	32	0.8399	8.26%	0.0%
FR_UFR1	8	134.6	127.8	141.4	137	121	144	2.878	6.05%	-368.3%
FR_FRCP1	4	93.5	82.44	104.6	95	84	100	3.476	7.44%	-225.2%
GH_FR1	4	119.5	112.1	126.9	118.5	115	126	2.327	3.9%	-315.7%
GH_ERC	4	129.5	114.7	144.3	129	121	139	4.664	7.2%	-350.4%
EV_HC1	4	120.3	110.1	130.4	120.5	113	127	3.198	5.32%	-318.3%
EV_MC2	4	130.3	110.5	150	135	112	139	6.21	9.54%	-353.0%
CM_MC2	4	121.8	118.2	125.3	122	119	124	1.109	1.82%	-323.5%
LC_LCDSSLCC	4	129.5	121.1	137.9	128	125	137	2.63	4.06%	-350.4%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	31	27	26	28	29	32	26	31
FR_UFR1	126	144	142	130	137	121	140	137
FR_FRCP1	100	97	93	84				
GH_FR1	118	119	126	115				
GH_ERC	121	139	136	122				
EV_HC1	127	124	113	117				
EV_MC2	137	139	133	112				
CM_MC2	123	119	124	121				
LC_LCDSSLCC	125	129	127	137				

Graphics





Analyst:_____ QA: JOL March 21/16

CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	15-1161-3759	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Mar-16 16:48	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	04-4641-7548	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	04 Mar-16 08:30	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	07 Mar-16 08:30	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	80h	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	69h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	71h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	69h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	70h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	71h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	71h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	68h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	67h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	37.3%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	30.77	2.541	8.745	14	<0.0001	CDF	Significant Effect
		FR_FRCP1	15.36	2.541	10.71	10	<0.0001	CDF	Significant Effect
		GH_FR1	21.53	2.541	10.71	10	<0.0001	CDF	Significant Effect
		GH_ERC	23.91	2.541	10.71	10	<0.0001	CDF	Significant Effect
		EV_HC1	21.71	2.541	10.71	10	<0.0001	CDF	Significant Effect
		EV_MC2	24.08	2.541	10.71	10	<0.0001	CDF	Significant Effect
		CM_MC2	22.07	2.541	10.71	10	<0.0001	CDF	Significant Effect
		LC_LCDSSLCC	23.91	2.541	10.71	10	<0.0001	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.9061	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	64215.29	8026.911	8	169.5	<0.0001	Significant Effect
Error	1657.625	47.36071	35			
Total	65872.91		43			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	16.52	20.09	0.0355	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9579	0.9295	0.1082	Normal Distribution

Analysis ID: 15-3293-3946 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 18 Mar-16 16:49 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

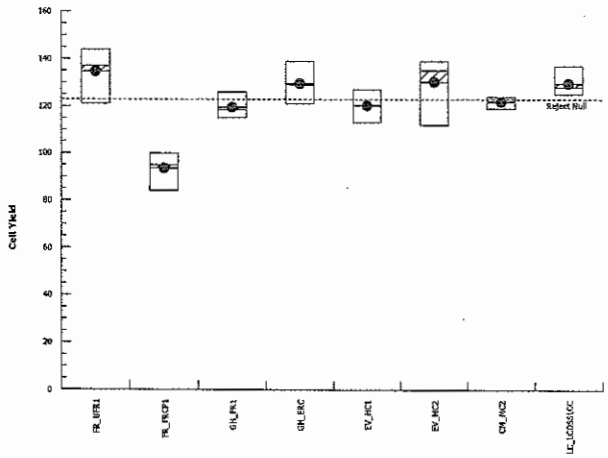
Cell Yield Summary

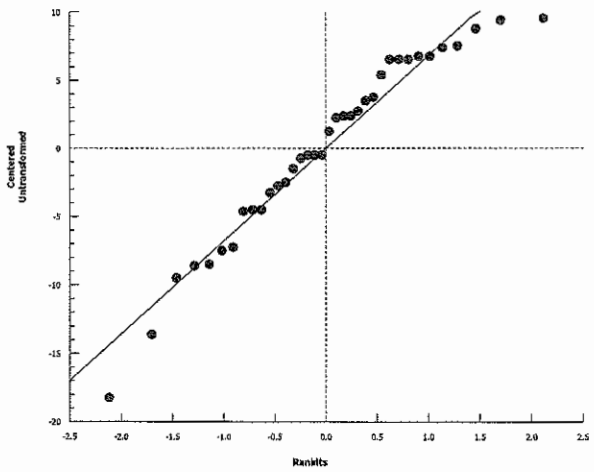
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	8	134.6	127.8	141.4	137	121	144	2.878	6.05%	0.0%
FR_FRCP1	4	93.5	82.44	104.6	95	84	100	3.476	7.44%	30.55%
GH_FR1	4	119.5	112.1	126.9	118.5	115	126	2.327	3.9%	11.23%
GH_ERC	4	129.5	114.7	144.3	129	121	139	4.664	7.2%	3.81%
EV_HC1	4	120.3	110.1	130.4	120.5	113	127	3.198	5.32%	10.68%
EV_MC2	4	130.3	110.5	150	135	112	139	6.21	9.54%	3.25%
CM_MC2	4	121.8	118.2	125.3	122	119	124	1.109	1.82%	9.56%
LC_LCDSSLCC	4	129.5	121.1	137.9	128	125	137	2.63	4.06%	3.81%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
FR_UFR1	126	144	142	130	137	121	140	137
FR_FRCP1	100	97	93	84				
GH_FR1	118	119	126	115				
GH_ERC	121	139	136	122				
EV_HC1	127	124	113	117				
EV_MC2	137	139	133	112				
CM_MC2	123	119	124	121				
LC_LCDSSLCC	125	129	127	137				

Graphics





CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	08-4893-3010	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Mar-16 15:22	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	04-4641-7548	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	04 Mar-16 08:30	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	07 Mar-16 08:30	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	69h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	71h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	69h (3.8 °C)		
GH_ERC	12-5925-0501	01 Mar-16 10:30	02 Mar-16 11:30	70h (4 °C)		
EV_HC1	17-5895-5723	01 Mar-16 09:05	02 Mar-16 11:30	71h (1.6 °C)		
EV_MC2	04-5050-0174	01 Mar-16 09:55	02 Mar-16 11:30	71h (0.4 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	68h (4.2 °C)		
LC_LCDSSLCC	04-9754-6534	01 Mar-16 13:10	02 Mar-16 11:30	67h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_03_01_NP		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-03-01_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-03-01_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-03-07		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	8.74%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	-8.834	2.526	11.76	10	1.0000	CDF	Non-Significant Effect
		GH_FR1	-3.249	2.526	11.76	10	1.0000	CDF	Non-Significant Effect
		GH_ERC	-1.101	2.526	11.76	10	0.9981	CDF	Non-Significant Effect
		EV_HC1	-3.088	2.526	11.76	10	1.0000	CDF	Non-Significant Effect
		EV_MC2	-0.9398	2.526	11.76	10	0.9965	CDF	Non-Significant Effect
		CM_MC2	-2.766	2.526	11.76	10	1.0000	CDF	Non-Significant Effect
		LC_LCDSSLCC	-1.101	2.526	11.76	10	0.9981	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	5177.097	739.5853	7	12.8	<0.0001	Significant Effect
Error	1618.125	57.79018	28			
Total	6795.222		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	8.051	18.48	0.3281	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9499	0.9166	0.1041	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 08-4893-3010 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 22 Mar-16 15:22 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

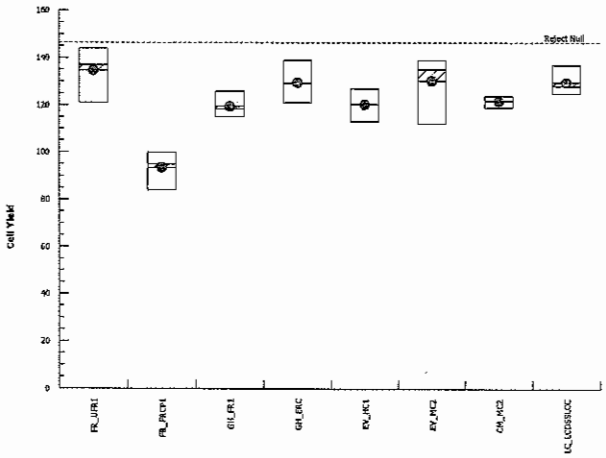
Cell Yield Summary

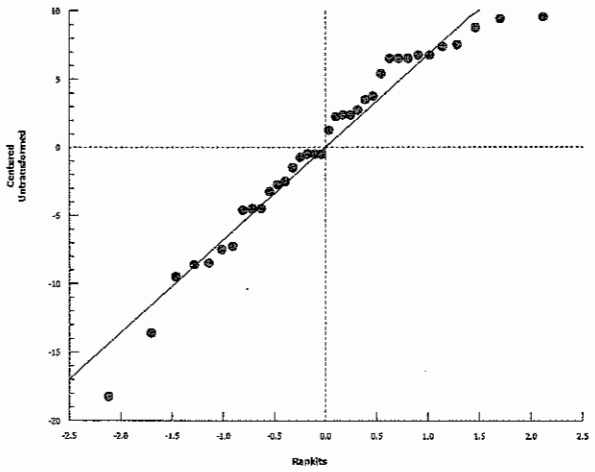
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	8	134.6	127.8	141.4	137	121	144	2.878	6.05%	0.0%
FR_FRCP1	4	93.5	82.44	104.6	95	84	100	3.476	7.44%	30.55%
GH_FR1	4	119.5	112.1	126.9	118.5	115	126	2.327	3.9%	11.23%
GH_ERC	4	129.5	114.7	144.3	129	121	139	4.664	7.2%	3.81%
EV_HC1	4	120.3	110.1	130.4	120.5	113	127	3.198	5.32%	10.68%
EV_MC2	4	130.3	110.5	150	135	112	139	6.21	9.54%	3.25%
CM_MC2	4	121.8	118.2	125.3	122	119	124	1.109	1.82%	9.56%
LC_LCDSSLCC	4	129.5	121.1	137.9	128	125	137	2.63	4.06%	3.81%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
FR_UFR1	126	144	142	130	137	121	140	137
FR_FRCP1	100	97	93	84				
GH_FR1	118	119	126	115				
GH_ERC	121	139	136	122				
EV_HC1	127	124	113	117				
EV_MC2	137	139	133	112				
CM_MC2	123	119	124	121				
LC_LCDSSLCC	125	129	127	137				

Graphics





APPENDIX C – *Hyalella azteca* Toxicity Test Data

Hyalella azteca Test Summary Sheet

Client: Teck
Work Order No.: 16286

Start Date: 03-Mar-16
Set up by: KJL

Sample Information:

Sample ID: Various - See Below
Sample Date: Mar 1, 8, 15, 22, 2016
Date Received: Mar 3, 8, 16, 23, 2016
Sample Volume: 1x 20L per refresh

Test Organism Information:

Species: *Hyalella azteca*
Supplier: Aquatic Research Organisms, NH
Date received: 03-Mar-16
Age or size (Day 0): 8-days

NaCl Reference Toxicant Results:

Reference Toxicant ID: HA108
Stock Solution ID: n/a
Date Initiated: 03-Mar-16

96-h LC50 (95% CL): 6.0 (4.8 - 7.5)

96-h LC50 Reference Toxicant Mean and Range: 5.3 (4.5 - 6.2) CV (%): 9

Test Results:

Sample ID	Survival ± SD (%)	Average Dry Wt. ± SD (mg)
Control	100.0 ± 0.0	0.86 ± 0.01
FR_UFR1	100.0 ± 0.0	0.82 ± 0.03
GH_FR1	94.0 ± 8.9	0.75 ± 0.06*
FR_FRCP1	100 ± 0.0	0.50 ± 0.12*, 1
CM_MC2	80.0 ± 15.8*, 1	0.50 ± 0.05*, 1

* Samples that are significantly different from Control.

1 Samples that are significantly different from reference site FR_UFR1

Reviewed by: JOL

Date reviewed: Apr. 13/16

Chronic *H. azteca* Toxicity Test Data Sheet

Water Quality

Client: Teck
WO #: 16286
Sample ID: See below

Start Date: Mar 3/16
Termination Date: Mar 14/16
Test Organism: *H. azteca* 3rd

Temperature (°C)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	24.0	22.0	22.5	23.0	22.0	22.5	22.5	23.5	23.0	23.5	23.0	23.5	23.0	23.0	23.0
FR_UFR1	22.0	22.0	22.5	23.0	22.0	22.5	22.5	23.5	23.5	23.5	23.0	23.5	23.0	23.0	23.0
GH_FR1	22.0	22.0	22.5	23.0	22.0	22.5	22.5	23.5	23.5	23.5	23.0	23.5	23.0	23.0	23.0
FR_FRCP1	22.0	22.0	22.5	23.0	22.0	22.5	22.5	23.5	23.5	23.5	23.0	23.5	23.0	23.5	23.0
CM_MC2	22.0	22.0	22.5	23.0	22.0	22.5	22.5	23.5	23.5	23.5	23.0	23.5	23.0	23.5	23.0
Technician Initials	MLT	KL	A	A	KL	KL	KL	KL	KL	A	A	KL	KL	KL	KL

Conductivity (µS)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	410	412	405	409	473	416	420	421	423	418	429	441	429	429	429
FR_UFR1	437	446	437	449	459	453	456	461	457	448	428	464	463	461	465
GH_FR1	928	922	934	932	937	940	943	946	952	942	947	938	948	950	965
FR_FRCP1	1754	1741	1749	1733	1732	1742	1753	1749	1774	1704	1420	1413	1416	1415	1407
CM_MC2	975	973	977	986	983	978	982	971	969	965	959	941	955	958	946
Technician Initials	MLT	KL	A	A	KL	KL	KL	KL	KL	A	A	KL	KL	KL	KL

① 458

Dissolved oxygen (mg/L)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	8.1	7.3	7.5	7.4	6.8	7.0	6.3	6.4	6.5	6.3	6.3	6.6	6.2	6.3	6.3
FR_UFR1	8.7	7.4	7.6	7.5	6.8	7.0	6.3	6.3	6.5	6.0	6.2	6.6	6.2	6.0	6.3
GH_FR1	8.7	7.5	7.6	7.5	7.0	7.1	6.3	6.3	6.6	6.2	6.4	6.6	6.2	6.3	6.3
FR_FRCP1	8.7	7.6	7.6	7.4	7.0	7.0	6.3	6.5	6.7	6.1	6.3	6.6	6.3	6.3	6.3
CM_MC2	8.7	7.5	7.6	7.4	7.1	7.1	6.3	6.5	6.7	6.9	6.9	6.6	6.4	6.4	6.4
Technician Initials	MLT	KL	A	A	KL	KL	KL	KL	KL	A	A	KL	KL	KL	KL

pH

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	7.8	7.6	7.5	7.5	7.8	7.6	7.5	7.5	7.5	7.5	7.4	7.6	7.5	7.5	7.6
FR_UFR1	8.1	8.0	7.9	7.8	8.2	8.0	7.9	8.0	7.9	7.8	8.0	8.1	7.9	7.9	8.1
GH_FR1	8.0	8.1	8.0	8.0	8.4	8.1	8.1	8.1	8.1	8.0	8.1	8.2	8.1	8.1	8.2
FR_FRCP1	8.0	8.1	8.0	8.0	8.2	8.1	8.1	8.1	8.1	8.0	8.0	8.1	8.0	8.0	8.1
CM_MC2	8.1	8.2	8.1	8.1	8.3	8.1	8.1	8.1	8.2	8.1	8.2	8.2	8.0	8.1	8.2
Technician Initials	MLT	KL	A	A	KL	KL	KL	KL	KL	A	A	KL	KL	KL	KL

① 7.8

Comments:

Reviewed by: JOh

Date Reviewed: Apr. 11/16

Chronic *H. azteca* Toxicity Test Data Sheet

Water Quality

Client: Teck
WO #: 16286
Sample ID: See below

Start Date: Mar 3/16
Termination Date: Mar 29/16
Test Organism: *H. azteca* 31

Temperature (°C)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	23.0	23.0	24.0	23.0	24.0	22.0	23.0	23.5	23.5	24.0	23.5	23.5	23.5	23.5
FR_UFR1	23.0	23.0	24.0	23.0	24.0	22.0	23.0	23.5	23.5	24.0	23.5	23.5	23.5	23.5
GH_FR1	23.0	23.0	24.0	23.0	24.0	22.0	23.0	23.5	23.5	24.0	23.5	23.5	23.5	23.5
FR_FRCP1	23.0	23.0	24.0	23.0	24.0	22.0	23.0	23.5	23.5	24.0	23.5	23.5	23.5	23.5
CM_MC2	23.0	23.0	24.0	23.0	24.0	22.0	23.0	23.5	23.5	24.0	23.5	23.5	23.5	23.5
Technician Initials	KL	JW	AS	KL	KL	KL	KL	KL	AS	AS	KL	KL	KL	KL

Conductivity (µS)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	428	469	465	439	432	429	394	401	425	432	436	432	412	411
FR_UFR1	455	462	464	458	458	455	457	446	444	447	450	448	445	445
GH_FR1	953	945	954	941	925	943	939	958	977	973	960	953	961	950
FR_FRCP1	1419	1409	1408	1387	1363	1390	1386	1393	1388	1365	~~1368~~	1356	1365	1356
CM_MC2	974	978	959	953	927	950	948	1009	1007	994	975	973	984	974
Technician Initials	KL	JW	AS	KL	KL	KL	KL	KL	AS	AS	KL	KL	KL	KL

0867

Dissolved oxygen (mg/L)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	6.1	6.7	6.5	6.4	5.6	5.6	5.7	5.5	6.1	5.6	5.2	5.1	5.4	6.0
FR_UFR1	6.4	6.8	6.4	6.4	5.9	5.7	5.7	5.7	6.2	5.4	5.0	5.1	5.2	5.3
GH_FR1	6.4	6.8	6.6	6.5	5.9	5.8	5.6	5.6	6.1	5.5	5.1	5.2	5.3	5.3
FR_FRCP1	6.5	6.8	6.6	6.7	6.0	5.8	5.8	5.6	6.1	5.4	5.2	5.2	5.6	5.7
CM_MC2	6.5	7.0	6.6	6.8	6.1	6.1	5.9	5.8	6.2	5.5	6.0	6.0	6.2	6.1
Technician Initials	KL	JW	AS	KL	KL	KL	KL	KL	AS	AS	KL	KL	KL	KL

pH

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	7.6	7.5	7.6	7.6	7.3	7.3	7.4	7.3	7.5	7.5	7.2	7.2	7.2	7.4
FR_UFR1	8.1	8.1	8.1	8.1	7.8	7.8	7.8	7.8	7.9	7.7	7.86	7.6	7.6	7.6
GH_FR1	8.2	8.2	8.2	~~8.3~~ 8.3	7.9	8.0	7.9	7.9	8.0	7.8	7.8	7.8	7.8	7.9
FR_FRCP1	8.2	8.3	8.1	8.2	7.9	8.0	7.9	8.0	8.0	7.9	7.8	7.8	7.9	8.0
CM_MC2	8.3	8.3	8.2	8.3	8.0	8.1	8.0	8.0	8.1	7.9	7.9	7.9	8.0	8.0
Technician Initials	KL	JW	AS	KL	KL	KL	KL	KL	AS	AS	KL	KL	KL	KL

Comments:

Reviewed by: JGL

Date Reviewed: Apr. 11/16

H. azteca Toxicity Test Data Sheet

Survival and Weight

Client: **Teck**

WO #: 16286

Sample ID: **See below**

Start Date: Mar 3/16 (3 KJL)

Termination Date: Mar 31/16

Test Organism: H. azteca (KJL)

Sample ID	Rep	T2 Pan No. Blue	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	A	1	10 ①	0	0	KJL	1008.39	1016.96	10	EC/KL
	B	2	10	0	0	↓	1015.25	1023.75	10	↓
	C	3	10	0	0		1009.10	1017.83	10	
	D	4	10	0	0		1024.73	1033.36	10	
	E	5	10	0	0		1020.03	1028.42	10	
FR_UFR1	A	6	10 ①	0	0	KJL	973.13	981.20	10	
	B	7	10	0	0		996.80	1004.59	10	
	C	8	10 ①	0	0		986.89	994.97	10	
	D	9	10	0	0		973.55	982.08	10	
	E	10	10	0	0	↓	1009.37	1017.94	10	
GH_FR1	A	11	10 ①	0	0	KJL	1006.81	1014.19	10	
	B	12	9 ①	0	0		1014.53	1020.68	9	
	C	13	8	0	0		1025.22	1032.04	8	
	D	14	10	0	0		1011.66	1019.41	10	
	E	15	10	0	0	↓	1017.81	1025.05	10	
FR_FRCP1	A	16	10	0	0	KJL	973.60	979.26	10	
	B	17	10	0	0		983.28 31 EC	986.02	9 ②	
	C	18	10	0	0		986.50	991.16	10	
	D	19	10	0	0		977.05	983.08	10	
	E	20	10	0	0	↓	991.70	997.36	10	↓

Comments: ① young present ② lost in transfer

10% re-weigh: #1: 1017.11mg, #10: 1017.93 mg

Reviewed by: JCL

Date Reviewed: Apr. 11/16

H. azteca Toxicity Test Data Sheet

Survival and Weight

Client: **Teck**
WO #: 16268
Sample ID: **See below**

Start Date: Mar 3/16
Termination Date: Mar 31/16
Test Organism: H. aztpca

Sample ID	Rep	TR Pan No. Blue	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
CM_MC2	A	21	6	0	4	KJL	995.55	998.79	6	EC/K
	B	22	8	1	1	↓	975.07	978.78	8	↓
	C	23	10	0	0		1024.67	1028.96	10	
	D	24	7	0	3		1009.28	1012.80	7	
	E	25	9	0	1	↓	1017.77	1022.76	9	↓
	A									
	B									
	C									
	D									
	E									
	A									
	B									
	C									
	D									
	E									
	A									
	B									
	C									
	D									
	E									

Comments: 10% re-weighs #23: 1029.00mg

Reviewed by: JOL

Date Reviewed: Apr. 11/16

CETIS Summary Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Batch ID:	17-4244-4279	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	03 Mar-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 Mar-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
03-2499-8322	Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	5	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	5	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	5	0.94	0.8289	1	0.8	1	0.04	0.08944	9.52%	6.0%
FR_FRCP1	5	1	1	1	1	1	0	0	0.0%	0.0%
CM_MC2	5	0.8	0.6037	0.9963	0.6	1	0.07071	0.1581	19.76%	20.0%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	1	1	1	1	1
FR_UFR1	1	1	1	1	1
GH_FR1	1	0.9	0.8	1	1
FR_FRCP1	1	1	1	1	1
CM_MC2	0.6	0.8	1	0.7	0.9

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	10/10	10/10	10/10	10/10	10/10
FR_UFR1	10/10	10/10	10/10	10/10	10/10
GH_FR1	10/10	9/10	8/10	10/10	10/10
FR_FRCP1	10/10	10/10	10/10	10/10	10/10
CM_MC2	6/10	8/10	10/10	7/10	9/10

CETIS Analytical Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	03-2499-8322	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 Apr-16 9:43	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	17-4244-4279	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	03 Mar-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 Mar-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Control		GH_FR1	0.1212	0.3636	Exact	Non-Significant Effect
Control		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Control		CM_MC2	0.000593	0.0024	Exact	Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	50	0	50	1	0	0.0%
FR_UFR1		50	0	50	1	0	0.0%
GH_FR1		47	3	50	0.94	0.06	6.0%
FR_FRCP1		50	0	50	1	0	0.0%
CM_MC2		40	10	50	0.8	0.2	20.0%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	1	1	1	1	1
FR_UFR1	1	1	1	1	1
GH_FR1	1	0.9	0.8	1	1
FR_FRCP1	1	1	1	1	1
CM_MC2	0.6	0.8	1	0.7	0.9

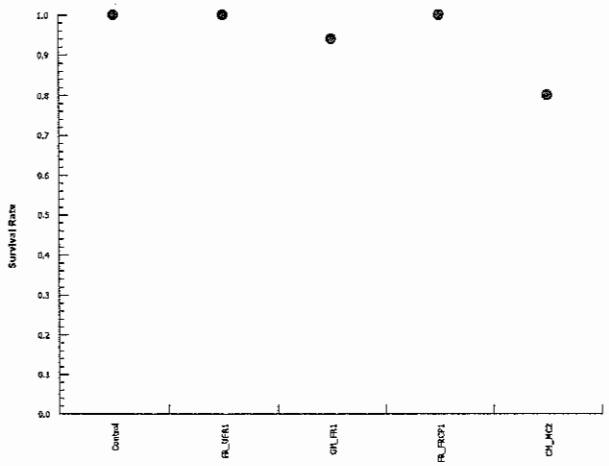
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	10/10	10/10	10/10	10/10	10/10
FR_UFR1	10/10	10/10	10/10	10/10	10/10
GH_FR1	10/10	9/10	8/10	10/10	10/10
FR_FRCP1	10/10	10/10	10/10	10/10	10/10
CM_MC2	6/10	8/10	10/10	7/10	9/10

Hyalella 28-d Survival and Growth Sediment Test **Nautilus Environmental**

Analysis ID:	03-2499-8322	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 Apr-16 9:43	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Test Code: 16286 | 13-2844-7959

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	16-1328-9507	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 Apr-16 9:45	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	17-4244-4279	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	03 Mar-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 Mar-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_FR1	0.1212	0.2424	Exact	Non-Significant Effect
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.000593	0.0018	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Reference Sed	50	0	50	1	0	0.0%
GH_FR1		47	3	50	0.94	0.06	6.0%
FR_FRCP1		50	0	50	1	0	0.0%
CM_MC2		40	10	50	0.8	0.2	20.0%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1	1	1	1	1	1
GH_FR1	1	0.9	0.8	1	1
FR_FRCP1	1	1	1	1	1
CM_MC2	0.6	0.8	1	0.7	0.9

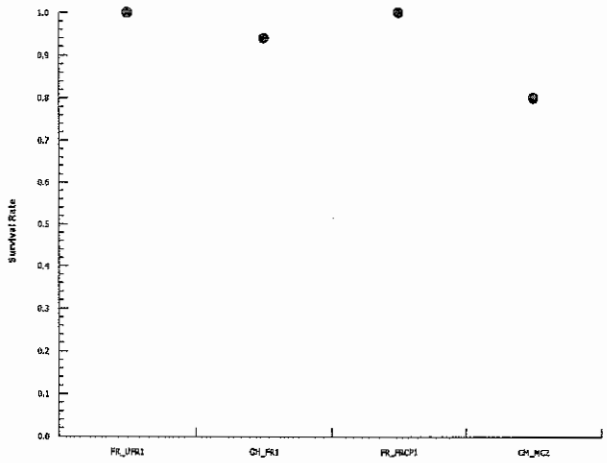
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1	10/10	10/10	10/10	10/10	10/10
GH_FR1	10/10	9/10	8/10	10/10	10/10
FR_FRCP1	10/10	10/10	10/10	10/10	10/10
CM_MC2	6/10	8/10	10/10	7/10	9/10

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	16-1328-9507	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 Apr-16 9:45	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



 Analyst:_____ QA: JGL Apr. 13/16

CETIS Summary Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Batch ID:	17-4244-4279	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	03 Mar-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 Mar-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	5	0.8564	0.8404	0.8724	0.839	0.873	0.005759	0.01288	1.5%	0.0%
FR_UFR1	5	0.8208	0.7794	0.8622	0.779	0.857	0.01491	0.03335	4.06%	4.16%
GH_FR1	5	0.7546	0.6753	0.8338	0.6833	0.8525	0.02854	0.06382	8.46%	11.89%
FR_FRCP1	5	0.5004	0.3483	0.6525	0.3011	0.603	0.05479	0.1225	24.48%	41.57%
CM_MC2	5	0.498	0.4332	0.5628	0.429	0.5544	0.02335	0.05222	10.49%	41.85%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	0.857	0.85	0.873	0.863	0.839
FR_UFR1	0.807	0.779	0.808	0.853	0.857
GH_FR1	0.738	0.6833	0.8525	0.775	0.724
FR_FRCP1	0.566	0.3011	0.466	0.603	0.566
CM_MC2	0.54	0.4638	0.429	0.5029	0.5544

Hyalella 28-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID:	19-2188-2953	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 Apr-16 9:46	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes
Batch ID:	17-4244-4279	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	03 Mar-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 Mar-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	9.33%	

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	19.5	NA	1	8	0.0556	Exact	Non-Significant Effect
		GH_FR1	17	NA	0	8	0.0159	Exact	Significant Effect
		FR_FRCP1	15	NA	0	8	0.0040	Exact	Significant Effect
		CM_MC2	15	NA	0	8	0.0040	Exact	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.6084479	0.152112	4	32.94	<0.0001	Significant Effect
Error	0.09234651	0.004617325	20			
Total	0.7007944		24			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.36	13.28	0.0040	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9192	0.8877	0.0491	Normal Distribution

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	5	0.8564	0.8404	0.8724	0.857	0.839	0.873	0.005759	1.5%	0.0%
FR_UFR1	5	0.8208	0.7794	0.8622	0.808	0.779	0.857	0.01491	4.06%	4.16%
GH_FR1	5	0.7546	0.6753	0.8338	0.738	0.6833	0.8525	0.02854	8.46%	11.89%
FR_FRCP1	5	0.5004	0.3483	0.6525	0.566	0.3011	0.603	0.05479	24.48%	41.57%
CM_MC2	5	0.498	0.4332	0.5628	0.5029	0.429	0.5544	0.02335	10.49%	41.85%

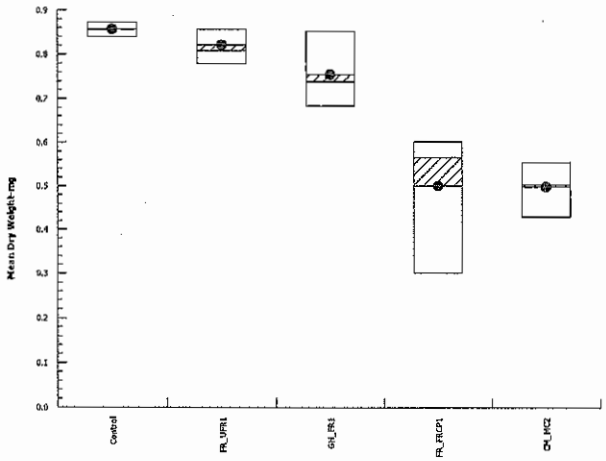
Mean Dry Weight-mg Detail

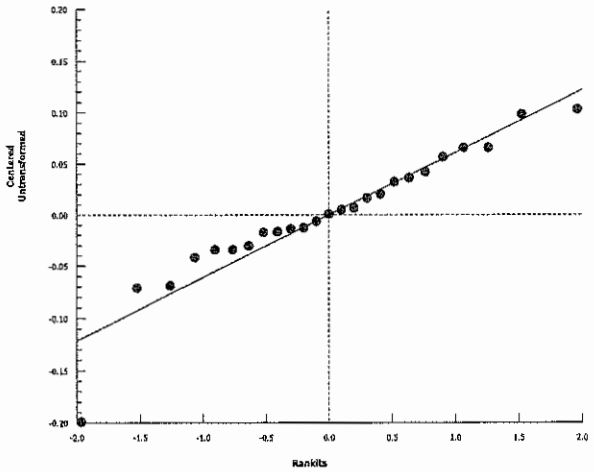
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	0.857	0.85	0.873	0.863	0.839
FR_UFR1	0.807	0.779	0.808	0.853	0.857
GH_FR1	0.738	0.6833	0.8525	0.775	0.724
FR_FRCP1	0.566	0.3011	0.466	0.603	0.566
CM_MC2	0.54	0.4638	0.429	0.5029	0.5544

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	19-2188-2953	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 Apr-16 9:46	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	14-5184-7472	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	08 Apr-16 15:33	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	17-4244-4279	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	03 Mar-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 Mar-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	13.0%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_FR1	1.383	2.227	0.107	8	0.2014	CDF	Non-Significant Effect
		FR_FRCP1	6.692	2.227	0.107	8	<0.0001	CDF	Significant Effect
		CM_MC2	6.742	2.227	0.107	8	<0.0001	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.4270547	0.1423516	3	24.84	<0.0001	Significant Effect
Error	0.09168322	0.005730201	16			
Total	0.5187379		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	6.377	11.34	0.0946	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9272	0.866	0.1367	Normal Distribution

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	5	0.8208	0.7794	0.8622	0.808	0.779	0.857	0.01491	4.06%	0.0%
GH_FR1	5	0.7546	0.6753	0.8338	0.738	0.6833	0.8525	0.02854	8.46%	8.07%
FR_FRCP1	5	0.5004	0.3483	0.6525	0.566	0.3011	0.603	0.05479	24.48%	39.03%
CM_MC2	5	0.498	0.4332	0.5628	0.5029	0.429	0.5544	0.02335	10.49%	39.33%

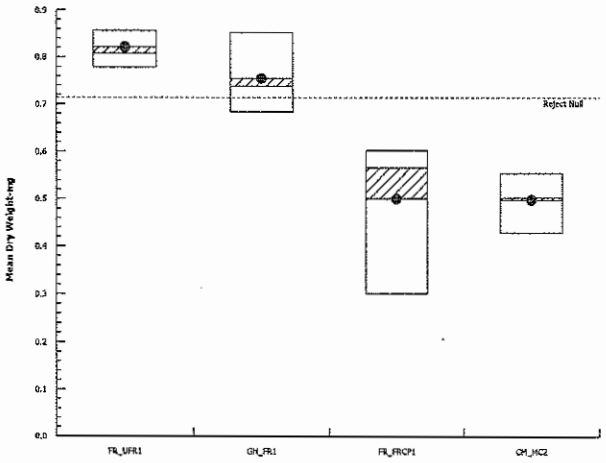
Mean Dry Weight-mg Detail

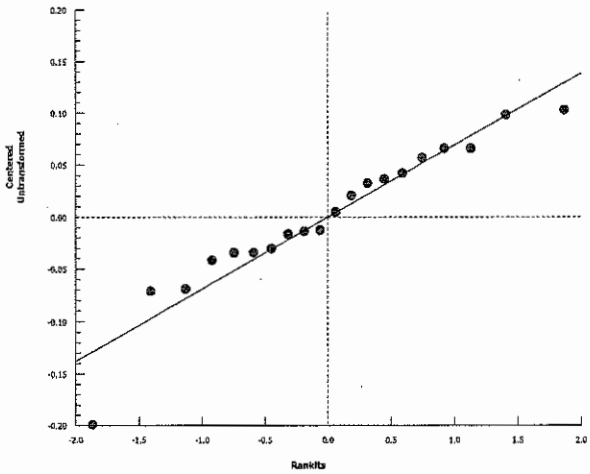
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1	0.807	0.779	0.808	0.853	0.857
GH_FR1	0.738	0.6833	0.8525	0.775	0.724
FR_FRCP1	0.566	0.3011	0.466	0.603	0.566
CM_MC2	0.54	0.4638	0.429	0.5029	0.5544

Hyalella 28-d Survival and Growth Sediment Test | **Nautilus Environmental**

Analysis ID:	14-5184-7472	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	08 Apr-16 15:33	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Client: Teck Coal

W.O.#: 16286

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/L CaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L CaCO_3$)	Technician
GHO-GH-FR1	5~~9~~	50	9.7	9.9	190		50	21.3	426	JS
FRO-FR-FRCP1	5~~9~~	↓	11.8	12.0	232		10①	8.9	890	↓
FRO-FR-UFR1	5~~0~~	↓	6.9	7.0	136		50	9.5	190	↓
CMO-CM-MC2	5~~0~~	↓	10.3	10.5	202		50	24.3	486	↓
MHW 030216	JS Mar 3/16	50	3.1	3.2	60		50	6.2	124	KL
GH_FR1	Mar 11/16	50	10.0	10.2	196		50	23.6	472	KL
FR_FRCP1	↓	↓	10.9	11.1	214		10①	8.1	810	↓
FR_UFR1	↓	↓	7.0	7.1	138		50	9.4	188	↓
CM_MC2	↓	↓	10.2	10.4	200		↓	23.7	474	↓
GH_FR1	Mar 21/16	50	10.~~4~~5 KL	10.7	206		50	24.0	480	KL
FR_FRCP1	↓	↓	11.2	11.4	220		10①	8.0	800	↓
FR_UFR1	↓	↓	7.3	7.5	142		50	9.3 ~~12.8~~ KL	186	↓
CM_MC2	↓	↓	10.5	10.7	206		50	23.7	474	↓
MHW 032216	Mar 28/16	50	2.6	2.8	48		50	6.7	134	KL
GH_FR1	↓	↓	10.4	10.6	204		50	25.0	500	↓
FR_FRCP1	↓	↓	11.2	11.4	220		10①	8.~~8~~0 KL	800	↓
FR_UFR1	↓	↓	7.1	7.3	138		50	~~12.8~~8 KL	176	↓
CM_MC2	↓	↓	10.3	10.5	202		50	24.7	494	↓

Notes: ① Diluted to 100mL with D.I

Reviewed by: JS

Date Reviewed: Apr. 11/16

Client: TecK

W.O.#: 16286

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
032816 Mthly	Mar 29/16	50	2.7	2.8	52		50	6.6	132	KL
Control	Apr 5/16	50	2.7	2.8	52		50	6.4	KL ~~12.8~~ 128	KL
GH_FR1		50	9.2	9.3 KL 4	180		50	23.2	464	
FR_FRCP1			9.4	9.5	186		100 ①	8.1	810	
FR_UFR1			7.3	7.5	142		50	8.9	178	
CM_MC2	↓	↓	8.9 KL 4	9.1	174		~~50~~ 100 KL ① ②	4.4	440	↓

Notes: ① Sample diluted w/ DI up to 100ml

② Not enough sample to analyse hardness with 50ml

Reviewed by: JCh

Date Reviewed: Apr. 11/16

APPENDIX D – *Pimephales promelas* Toxicity Test Data

Nautilus Environmental

ATTN: Krysta Pearcy
Nautilus Environmental
8664 Commerce Court
Burnaby , BC
Canada , V5A 4N7

Received: various dates
Report Date: 2016/05/11
Version: REVISION 1

HydroQual Test Report

Client: NAU104
Reference: 16-0248; 16-0249; 16-0250; 16-0251
Client Reference: CM_MC2_WS
GH_FR1_WS
FR_FRCP1_Q
FR_UFR1_Q
Billing: not given

Jacklyn Poole

Senior Verifier

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0248

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	drop off		
received:	various dates	at:	various times	by:	MC, ML, HS
signed-in:	various dates	at:	various times	by:	MC, ML, HS
container:	6 x 20L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	4.3; 5; 4; 3; 5

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	CM_MC2_WS_20160301_N	CM_MC2_WS_20160308_N	CM_MC2_WS_20160315_N	CM_MC2_WS_20160322_N	CM_MC2_WS_20160329_N	**CM_MC2_WS**
collection date:	2016/03/01	2016/03/08	2016/03/15	2016/03/22	2016/03/29	
collection time:	1220	1130	1140	1140	1330	
pH:	8.2	8.1	8.1	8.2	8.1	
EC (µS/cm):	851	895	924	981	985	
DO (mg/L):	10.5	10.9	10.5	10.5	10.2	
temp (°C):	14.5	6.7	12.0	13.3	16.1	
hardness:	473	460	494	393	450	
alkalinity:	211	190	186	218	240	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/**chem cart 2**/chem cart 3/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/03/03
ended:	2016/04/04
prelim made:	-
prelim sent:	-
reported:	2016/04/18

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Internal Tracking Sheet

Client:	NAU104
Reference:	16-0249

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water		collection method:		grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	drop off		
received:	various dates	at:	various times	by:	MC, ML, HS
signed-in:	various dates	at:	various times	by:	MC, ML, HS
container:	6 x 20L carboys		sample condition:		good condition
seals present:	no		initials on seals:		no
storage:	4 ± 2°C in darkness		initial temperature (°C):		3.3; 6; 5; 3; 5

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	GH_FR1_WS_2016_03_01_NP	2016_03_08_NP	GH_FR1_WS_2016_03_15_NP	2016_03_22_NP	2016_03_29_NP	**GH_FR1_WS**
collection date:	2016/03/01	2016/03/08	2016/03/15	2016/03/22	2016/03/29	
collection time:	not given	0830	not given	0915	0925	

pH:	8.0	8.0	8.0	8.1	8.1
EC (µS/cm):	814	840	888	959	957
DO (mg/L):	11.0	10.9	9.9	10.7	10.1
temp (°C):	13.5	7.1	13.7	12.9	16.1
hardness:	456	477	488	363	429
alkalinity:	197	191	193	173	184
colour:	colourless	colourless	colourless	colourless	colourless
odour:	-	-	-	-	-

Meter/Probe Used: chem cart 1/**chem cart 2**/chem cart 3/product/soils
Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/03/03
ended:	2016/04/04
prelim made:	-
prelim sent:	-
reported:	2016/04/18

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Internal Tracking Sheet

Client:	NAU104
Reference:	16-0250

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	drop off		
received:	various dates	at:	various times	by:	MC, ML, HS
signed-in:	various dates	at:	various times	by:	MC, ML, HS
container:	6 x 20L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	3.5; 8; 8; 2; 6

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_FRCP1_Q_04012016_N	R_18012016_N	FR_FRCP1_QR_11012016_N	R_01012016_N	R_25012016_N	**FR_FRCP1_Q**
collection date:	2016/03/01	2016/03/08	2016/03/15	2016/03/22	2016/03/29	
collection time:	0943	1054	1140	1107	0855	
pH:	8.1	8.1	8.1	8.1	7.8	
EC (µS/cm):	1531	1307	1348	1329	1368	
DO (mg/L):	9.9	11.2	10.5	10.7	10.1	
temp (°C):	15.4	6.8	11.8	13.3	17.2	
hardness:	1020	840	852	604	756	
alkalinity:	246	216	233	210	311	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/**chem cart 2**/chem cart 3/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/03/03
ended:	2016/04/04
prelim made:	-
prelim sent:	-
reported:	2016/04/18

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Internal Tracking Sheet

Client:	NAU104
Reference:	16-0251

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	drop off		
received:	various dates	at:	various times	by:	MC, ML, HS
signed-in:	various dates	at:	various times	by:	MC, ML, HS
container:	6 x 20L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	3.5; 8; 8; 2; 6

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_UFR1_Q_0401206_N	FR_UFR1_QR_18012016_N	FR_UFR1_QR_11012016_N	FR_UFR1_QR_01022016_N	FR_UFR1_QR_25012016_N	**FR_UFR1_Q**
collection date:	2016/03/01	2016/03/08	2016/03/15	2016/03/22	2016/03/29	
collection time:	1105	0907	0954	0909	1053	
pH:	8.0	8.1	8.1	8.1	8.1	
EC (µS/cm):	351	350	390	394	370	
DO (mg/L):	11.1	10.9	10.6	10.6	10.3	
temp (°C):	12.1	8.1	12.0	13.4	16.2	
hardness:	186	156	200	187	167	
alkalinity:	203	161	141	191	162	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/**chem cart 2**/chem cart 3/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/03/03
ended:	2016/04/04
prelim made:	-
prelim sent:	-
reported:	2016/04/18

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Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Organism Information

Source: Aquatox Batch: 20160303FMELS Egg Stag 15 somites Organisms Received in Good Condition: **Yes**

Test Log

Date	Day	Time	Technicians	Chem Cart Used	Fed		Feeding Rate	Sample Pre-Aeration Time	Bench Sheet Review	
					AM	PM			First	Second
2016/03/03	0	1500	ML/HS/DS/JN	2	-	-	-	60 minutes	HS	DS
2016/03/04	1	1430	JN/HS/DS	2	-	-	-	60 minutes	JN	DS
2016/03/05	2	1340	DS/JW	2	-	-	-	60 minutes	JW	EP
2016/03/06	3	1350	JK/ML/BH	2	-	-	-	60 minutes	ML	JK
2016/03/07	4	1345	ML/JK	2	-	✓	1mL	30 minutes	JK	ML
2016/03/08	5	1100	HS/ML	2	✓	✓	1mL	60 minutes	HS	ML
2016/03/09	6	1400	JN	2	✓	✓	1mL	60 minutes	JN	DS
2016/03/10	7	1000	DS/EP	2	✓	✓	1mL	60 minutes	DS	EP
2016/03/11	8	1050	JN	2	✓	✓	1mL	60 minutes	JN	EP
2016/03/12	9	1100	EP/JW	2	✓	✓	1mL	60 minutes	DS	EP
2016/03/13	10	1315	ML/BH	2	✓	✓	1mL	30 minutes	ML	JK
2016/03/14	11	1335	JN/HS	2	✓	✓	1mL	30 minutes	JN	HS
2016/03/15	12	1100	ML/HS	2	✓	✓	1mL	30 minutes	HS	ML
2016/03/16	13	1130	DS/ML	2	✓	✓	1mL	30 minutes	ML	DS
2016/03/17	14	1130	EP/ML	2	✓	✓	1 mL/1.5 mL	30 minutes	ML	HS
2016/03/18	15	0940	JW/EP	2	✓	✓	1 mL/1.5 mL	30 minutes	JW	HS
2016/03/19	16	0950	JW/EP	2	✓	✓	1 mL/1.5 mL	30 minutes	JW	DS
2016/03/20	17	1040	JN/BH	2	✓	✓	1 mL/1.5 mL	30 minutes	JN	HS
2016/03/21	18	1130	JN/BH	2	✓	✓	1 mL/1.5 mL	30 minutes	EP	JN
2016/03/22	19	1030	DS/EP	2	✓	✓	1 mL/1.5 mL	30 minutes	EP	DS
2016/03/23	20	1030	JW/EP	2	✓	✓	1 mL/1.5 mL	30 minutes	EP	JW
2016/03/24	21	1000	EP/ML	2	✓	✓	0.5 mL/1 mL/1.5 mL	30 minutes	ML	-
2016/03/25	22	1230	JW/ML	2	✓	✓	0.5 mL/1 mL/1.5 mL	30 minutes	JW	ML
2016/03/26	23	1130	ML/JW	2	✓	✓	0.5-2.0 mL	30 minutes	ML	JW
2016/03/27	24	1010	JN	2	✓	✓	0.5-2.0 mL	30 minutes	JN	HS
2016/03/28	25	1130	DS	2	✓	✓	0.5-2.0 mL	30 minutes	DS	EP
2016/03/29	26	1330	DS/HS	2	✓	✓	0.5-2.0 mL	30 minutes	DS	HS
2016/03/30	27	1130	JN/EP	2	✓	✓	0.5-2.0 mL	30 minutes	JN	EP
2016/03/31	28	1300	ML/EP	2	✓	✓	0.5-2.0 mL	30 minutes	ML	HS
2016/04/01	29	1100	JW/EP	2	✓	✓	0.5-2.0 mL	30 minutes	JW	CQ
2016/04/02	30	1240	JW/ML	2	✓	✓	0.5-2.0 mL	30 minutes	ML	JW
2016/04/03	31	1310	JN/BH	2	✓	✓	0.5-2.0 mL	30 minutes	JN	HS
2016/04/04	32	1025	JN/EP	2	-	-	-	-	JN	EP

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Control hatching success must be >66% (≥10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

	LAB CTL		16-0248		16-0249		16-0250		16-0251	
	Day 1		Day 1		Day 1		Day 1		Day 1	
replicate	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos
a	15	0	15	0	15	0	15	0	15	0
b	15	0	15	0	15	0	14	1	15	0
c	15	0	14	1	15	0	15	0	15	0
d	14	1	15	0	14	1	15	0	14	1
e	29	1	29	1	30	0	30	0	30	0
f	30	0	29	1	30	0	29	1	30	0

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

	LAB CTL			16-0248			16-0249			16-0250		
	Day 2			Day 2			Day 2			Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	15	0	15	14	1	15	14	1	15	14	1	15
b	15	0	15	15	0	15	13	2	15	11	3	15
c	15	0	15	14	0	15	14	1	15	15	0	15
d	14	0	15	13	2	15	12	2	15	15	0	15
e	26	3		29	0		29	1		28	2	
f	28	2		28	1		26	4		25	4	

	16-0251		
	Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15
a	15	0	15
b	15	0	15
c	14	1	15
d	12	3	15
e	30	0	
f	28	2	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2

Comments/Observations:

Nautilus Environmental

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL		16-0248		16-0249		16-0250		16-0251	
	Day 3		Day 3		Day 3		Day 3		Day 3	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	13	2	13	2	15	0	14	1	13	2
b	11	4	14	1	10	5	9	6	12	3
c	14	1	13	2	12	3	7	8	10	5
d	12	3	13	2	11	4	10	5	13	2

Comments/Observations:

	LAB CTL		16-0248		16-0249		16-0250		16-0251	
	Day 4		Day 4		Day 4		Day 4		Day 4	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	4	11	1	14	0	15	4	11	6	9
b	1	14	2	12	2	13	1	14	1	14
c	2	13	0	14	2	12	1	13	1	14
d	2	13	0	15	0	15	0	15	2	13

Comments/Observations:

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 5	Day 5	Day 5	Day 5	Day 5
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14	14	15	15
b	14	14	14	15	14
c	15	13	14	13	14
d	15	15	15	15	15

Comments/Observations:

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 6	Day 6	Day 6	Day 6	Day 6
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14 (1)	14	15	15
b	14	14	14	15	14
c	15	13	14	13	14
d	15	14	15	15	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 7	Day 7	Day 7	Day 7	Day 7
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	13	12	15	15 (1)
b	14	11	14	15	14
c	15	12	14	12	14
d	15	14	15	15	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 8	Day 8	Day 8	Day 8	Day 8
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	6	12	15	15 (1)
b	14	11	14	15 (1)	14
c	15 (1)	12	14	12	14
d	14	14	14	15	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 9	Day 9	Day 9	Day 9	Day 9
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (1)	6	12	15	15 (1)
b	14	11	14	15	14
c	15(1)	11	14	12	14
d	14	14	14	15	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 10	Day 10	Day 10	Day 10	Day 10
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	6	12	15	15 (1)
b	14	11	14	15(1)	14
c	15 (1)	11	14	12	14
d	14	14	14	15	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 11	Day 11	Day 11	Day 11	Day 11
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	6	10	15	13
b	14	10	12	12(1)	14
c	15(2)	11	10	12	14
d	14	14	12	15	4

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 12	Day 12	Day 12	Day 12	Day 12
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	5	10	15	12
b	14	10	10	11(1)	14
c	14(1)	11	8	12	14
d	14	13	11	15	4

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 13	Day 13	Day 13	Day 13	Day 13
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	5	9	15	12
b	14	10	10	10	14
c	14(1)	11	7	12	14
d	14	12	11	15	4

Comments/Observations: Replicates 16-0248 a, 16-0249 c, 16-0251 d fed 1 mL. All other replicates fed 1.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 14	Day 14	Day 14	Day 14	Day 14
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (1)	5	9	15	11
b	14	10	9	10	13
c	13	11	7	12	14
d	13	12	10	15	3

Comments/Observations: Replicates 16-0248 a, 16-0249 c, 16-0251 d fed 1 mL. All other replicates fed 1.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 15	Day 15	Day 15	Day 15	Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (1)	5	9	15	11
b	14	10	9	10	9 (1)
c	13	11	7	12	14
d	13	12	10	15	3

Comments/Observations: Replicates 16-0248 a, 16-0249 c, 16-0251 d fed 1 mL. All other replicates fed 1.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 16	Day 16	Day 16	Day 16	Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (1)	5	9	15	11
b	14	10	9	10	9 (1)
c	13	11	7	12	14
d	13	12	9	15	3

Comments/Observations: Replicates 16-0248 a, 16-0249 c, 16-0251 d fed 1 mL. All other replicates fed 1.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 17	Day 17	Day 17	Day 17	Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	5	9	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15	3

Comments/Observations: Replicates 16-0248 a, 16-0249 c, 16-0251 d fed 1 mL. All other replicates fed 1.5 mL.

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 18	Day 18	Day 18	Day 18	Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	9	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15	3

Comments/Observations: Replicates 16-0248 a, 16-0249 c, 16-0251 d fed 1 mL. All other replicates fed 1.5 mL.

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 19	Day 19	Day 19	Day 19	Day 19
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15	3

Comments/Observations: Replicates 16-0248 a, 16-0249 c, 16-0251 d fed 1 mL. All other replicates fed 1.5 mL.

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 20	Day 20	Day 20	Day 20	Day 20
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15	3

Comments/Observations: Replicates 16-0248 a, 16-0249 c, 16-0251 d fed 1 mL. All other replicates fed 1.5 mL.

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 21	Day 21	Day 21	Day 21	Day 21
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15 (1)	3

Comments/Observations: Replicates 16-0248 a, 16-0249 a & c fed 1 mL, replicate 16-0251 d fed 0.5 mL. All other replicates fed 1.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 22	Day 22	Day 22	Day 22	Day 22
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15 (1)	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

Nautilus Environmental

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 23	Day 23	Day 23	Day 23	Day 23
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15 (1)	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 24	Day 24	Day 24	Day 24	Day 24
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL.

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 25	Day 25	Day 25	Day 25	Day 25
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15(1)	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 26	Day 26	Day 26	Day 26	Day 26
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	15	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL.

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	14	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL.

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	14	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL.

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13	12	9	14	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL.

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9	10	8
c	13	11	7	12	14
d	13(1)	12	9	14(1)	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 31	Day 31	Day 31	Day 31	Day 31
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9(1)	10	8
c	13	11	7	12	14
d	13(1)	12	9	14(1)	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 32	Day 32	Day 32	Day 32	Day 32
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	5	5	15	11
b	14	10	9(1)	10	8
c	13	11	7	12	14
d	12	12	9	14 (1)	3

Comments/Observations: Control fed 2 mL. 16-0248 fed 1.5 mL, replicate a fed 1 mL. 16-0249 replicates a/c fed 1 mL, replicates b/d fed 1.5 mL. 16-0250 fed 2 mL. 16-0251 replicates a/c fed 2 mL, b fed 1 mL and replicate d fed 0.5 mL. Bracketed # indicates number of fish displaying atypical swimming behaviour

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

New Solutions

Conc. (%)	LAB CTL	16-0248	16-0249	16-0250	16-0251		
Day							
pH (units)							
0	7.9	8.4	8.3	8.3	8.4		
1	7.8	8.4	8.4	8.2	8.3		
2	8.1	8.4	8.4	8.0	8.4		
3	8.0	8.3	8.2	8.0	8.4		
4	8.0	8.3	8.2	8.1	8.4		
5	8.0	8.2	8.1	8.0	8.2		
6	7.7	8.0	8.0	7.9	8.0		
7	7.8	8.3	8.3	8.2	8.4		
8	8.1	8.3	8.2	7.9	8.3		
Conductance (µS/cm)							
0	298	810	781	1452	337		
1	301	789	825	1406	341		
2	305	789	800	1410	364		
3	294	799	785	1378	342		
4	298	775	746	1377	340		
5	295	791	768	1412	340		
6	325	868	826	1420	361		
7	319	852	840	1300	367		
8	329	848	824	1226	361		
Dissolved Oxygen (mg/L) (40-100% saturation)							
0	7.3	7.3	7.3	7.3	7.3		
1	7.2	7.3	7.3	7.3	7.3		
2	7.2	7.2	7.2	7.2	7.2		
3	6.9	6.9	6.9	7.0	6.9		
4	7.2	7.2	7.3	7.2	7.2		
5	7.2	7.3	7.2	7.2	7.2		
6	7.3	7.2	7.3	7.2	7.3		
7	7.0	7.1	7.1	7.1	7.1		
8	7.3	7.2	7.2	7.2	7.2		
Temperature (°C)							
0	24	24	24	24	24		
1	25	24	24	24	24		
2	25	24	24	24	24		
3	26	26	26	26	26		
4	25	25	24	25	25		
5	25	24	25	25	24		
6	24	25	24	25	24		
7	25	25	25	25	25		
8	24	25	25	25	25		

Old Solutions

	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
0							
1	7.4	8.2	8.3	8.0	8.2		
2	7.5	8.1	8.2	8.0	8.4		
3	7.8	8.1	8.1	8.0	8.4		
4	8.3	8.2	8.1	8.0	8.4		
5	7.4	8.0	8.0	7.9	8.1		
6	7.9	7.9	7.9	8.0	8.3		
7	7.8	8.1	8.1	8.1	8.3		
8	7.7	8.0	8.1	8.1	8.4		
Conductance (µS/cm)							
0							
1	303	779	775	1380	385		
2	296	785	800	1411	408		
3	309	743	783	1368	417		
4	311	788	754	1391	363		
5	306	798	758	1409	346		
6	331	826	800	1394	372		
7	332	835	820	1448	446		
8	334	817	807	1267	379		
Dissolved Oxygen (mg/L) (40-100% saturation)							
0							
1	7.3	7.3	7.3	7.3	7.2		
2	7.1	7.1	7.1	7.2	7.2		
3	6.8	6.8	6.8	6.9	6.8		
4	6.9	7.1	6.9	7.1	7.0		
5	6.9	7.0	7.0	7.1	6.9		
6	6.9	7.0	7.2	7.4	7.3		
7	7.0	7.1	7.0	7.0	7.0		
8	6.7	6.7	7.0	7.2	7.0		
Temperature (°C)							
0							
1	24	24	24	24	24		
2	24	24	24	24	24		
3	24	24	24	24	24		
4	24	24	24	24	24		
5	24	24	24	24	24		
6	24	24	24	24	24		
7	24	24	24	24	24		
8	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C

4.5 to 7.2 mg/L at 25°C

4.3 to 7.1 mg/L at 26°C

Comments:

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

	New Solutions								Old Solutions						
Conc. (%)	LAB CTL	16-0248	16-0249	16-0250	16-0251				LAB CTL	16-0248	16-0249	16-0250	16-0251		
Day															
	pH (units)								pH (units)						
9	8.0	8.2	8.0	8.1	8.4			9	7.9	8.1	8.1	8.1	8.4		
10	8.1	8.3	8.3	8.1	8.4			10	7.9	8.1	8.2	8.1	8.3		
11	8.0	8.1	8.1	8.0	8.3			11	7.8	8.1	8.1	8.1	8.3		
12	8.1	8.2	8.2	8.1	8.3			12	8.0	8.2	8.1	8.1	8.4		
13	8.0	8.2	8.3	8.1	8.4			13	7.9	8.2	8.3	8.2	8.3		
14	7.9	8.3	8.3	8.1	8.4			14	8.1	8.2	8.2	8.2	8.4		
15	7.9	8.1	8.1	8.0	8.1			15	7.8	8.1	8.1	7.9	8.1		
16	8.0	8.2	8.2	8.0	8.3			16	7.8	8.1	8.1	8.1	8.1		
17	7.9	8.2	8.2	8.0	8.3			17	7.8	8.1	8.2	8.1	8.3		
	Conductance (µS/cm)								Conductance (µS/cm)						
9	330	844	842	1296	367			9	330	797	826	1231	365		
10	316	805	805	1221	359			10	344	785	792	1219	372		
11	317	845	809	1266	358			11	334	761	794	1191	377		
12	320	852	831	1272	368			12	329	766	817	1170	380		
13	314	838	845	1309	406			13	336	793	785	1210	390		
14	330	847	855	1289	387			14	338	804	845	1231	388		
15	334	875	866	1305	377			15	341	785	787	1225	369		
16	335	870	863	1299	372			16	339	772	793	1172	359		
17	332	850	846	1257	369			17	342	784	774	1187	372		
	Dissolved Oxygen (mg/L) (**40-100% saturation**)								Dissolved Oxygen (mg/L) (**40-100% saturation**)						
9	7.3	7.3	7.3	7.3	7.3			9	7.3	7.3	7.2	7.3	7.3		
10	7.3	7.3	7.3	7.3	7.3			10	7.2	7.3	7.3	7.3	7.3		
11	7.3	7.3	7.3	7.3	7.3			11	7.0	7.2	7.3	7.2	7.3		
12	7.3	7.3	7.3	7.2	7.2			12	7.2	7.3	7.2	7.2	7.3		
13	7.3	7.2	7.2	7.2	7.2			13	6.8	7.2	7.2	7.2	7.2		
14	7.3	7.3	7.2	7.2	7.2			14	7.1	7.2	7.2	7.2	7.3		
15	7.3	7.3	7.3	7.3	7.3			15	7.1	7.2	7.5	7.0	7.0		
16	7.3	7.3	7.3	7.3	7.3			16	7.1	7.3	7.4	7.6	7.6		
17	7.3	7.3	7.3	7.2	7.3			17	7.3	7.3	7.3	7.3	7.4		
	Temperature (°C)								Temperature (°C)						
9	24	24	23	24	24			9	24	24	24	24	24		
10	24	24	24	24	24			10	24	24	24	24	24		
11	24	24	24	24	24			11	24	24	24	24	24		
12	24	24	24	25	25			12	24	24	24	24	24		
13	24	25	25	25	25			13	24	24	24	24	24		
14	24	24	25	25	25			14	24	24	24	24	24		
15	24	25	25	25	25			15	24	24	24	24	24		
16	24	24	25	25	25			16	24	24	24	24	24		
17	24	24	25	25	24			17	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments: temperature out of range (23°C) for 16-0249 new solution on day 9

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

New Solutions

Conc. (%) / Day	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
18	8.0	8.2	8.1	8.0	8.3		
19	8.0	8.2	8.2	8.1	8.4		
20	7.9	8.1	8.1	8.0	8.2		
21	8.1	8.2	8.3	8.1	8.4		
22	7.9	8.1	8.1	7.9	8.3		
23	8.2	8.2	8.2	8.2	8.3		
24	8.0	8.2	8.2	8.1	8.4		
25	8.1	8.3	8.3	8.2	8.4		
26	8.0	8.1	8.1	8.0	8.2		
Conductance (µS/cm)							
18	346	843	839	1230	368		
19	326	870	861	1294	376		
20	315	840	832	1255	360		
21	321	879	868	1265	357		
22	310	828	831	1240	340		
23	322	857	830	1186	352		
24	305	832	858	1232	350		
25	317	859	856	1241	357		
26	327	870	861	1250	358		
Dissolved Oxygen (mg/L) (40-100% saturation)							
18	7.3	7.3	7.3	7.3	7.3		
19	7.3	7.2	7.2	7.2	7.2		
20	7.3	7.3	7.3	7.2	7.2		
21	7.3	7.3	7.2	7.3	7.3		
22	7.3	7.3	7.2	7.3	7.2		
23	7.3	7.2	7.2	7.2	7.2		
24	7.3	7.2	7.2	7.2	7.2		
25	7.3	7.2	7.2	7.1	7.1		
26	7.3	7.3	7.2	7.2	7.2		
Temperature (°C)							
18	24	24	24	24	24		
19	24	25	25	25	25		
20	24	24	24	25	25		
21	24	24	24	24	24		
22	24	24	25	24	25		
23	24	25	25	25	25		
24	24	25	25	25	25		
25	24	25	25	26	26		
26	24	24	25	25	25		

Old Solutions

Day	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
18	8.0	8.2	8.1	8.0	8.4		
19	7.8	8.2	8.3	7.9	8.4		
20	7.6	8.1	8.2	8.1	8.3		
21	8.0	8.2	8.2	8.1	8.3		
22	7.9	8.0	8.1	8.1	8.2		
23	8.0	8.2	8.3	8.2	8.4		
24	7.8	8.1	8.1	8.1	8.3		
25	7.7	8.1	8.3	8.1	8.3		
26	7.7	7.9	8.1	8.0	8.1		
Conductance (µS/cm)							
18	336	785	832	1210	441		
19	358	811	805	1238	390		
20	326	774	772	1146	375		
21	329	769	789	1175	390		
22	327	823	780	1107	379		
23	330	781	785	1111	389		
24	338	773	779	1123	354		
25	326	809	782	1162	375		
26	326	763	751	1156	383		
Dissolved Oxygen (mg/L) (40-100% saturation)							
18	7.3	7.2	7.2	7.1	7.0		
19	7.3	7.1	7.1	7.2	7.1		
20	7.3	7.2	7.3	7.3	7.3		
21	7.2	7.2	7.2	7.2	7.2		
22	7.0	7.0	7.2	7.1	7.1		
23	7.3	7.3	7.3	7.3	7.3		
24	7.3	7.2	7.3	7.4	7.5		
25	6.7	7.0	7.0	7.1	7.0		
26	7.2	7.3	7.3	7.3	7.3		
Temperature (°C)							
18	24	24	24	24	24		
19	24	24	24	24	24		
20	24	24	24	24	24		
21	24	24	24	24	24		
22	24	24	24	24	24		
23	24	24	24	24	24		
24	24	24	24	24	24		
25	24	24	24	24	24		
26	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

New Solutions

Conc. (%) / Day	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
27	8.0	8.2	8.2	7.9	8.3		
28	8.2	8.1	8.2	8.1	8.3		
29	8.0	8.2	8.2	8.1	8.4		
30	8.0	8.2	8.2	8.1	8.3		
31	8.1	8.2	7.2	8.1	8.3		
32							
Conductance (µS/cm)							
27	385	925	893	1293	372		
28	331	896	889	1224	386		
29	318	918	901	1229	349		
30	331	866	900	1212	347		
31	335	906	902	1185	355		
32							
Dissolved Oxygen (mg/L) (40-100% saturation)							
27	7.3	7.2	7.2	7.2	7.2		
28	7.3	7.2	7.2	7.2	7.1		
29	7.3	7.1	7.2	7.3	7.2		
30	7.3	7.2	7.0	7.1	7.1		
31	7.2	7.2	7.2	7.2	7.2		
32							
Temperature (°C)							
27	24	25	25	25	25		
28	24	25	25	25	24		
29	24	26	23	23	25		
30	24	25	26	26	26		
31	25	25	25	25	25		
32							

Old Solutions

Day	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
27	7.7	8.1	8.2	8.1	8.3		
28	7.9	8.1	8.2	8.1	8.3		
29	7.9	8.2	8.2	8.2	8.3		
30	7.6	8.1	8.2	8.0	8.2		
31	7.5	8.1	8.2	8.1	8.4		
32	7.3	8.0	8.0	7.9	7.9		
Conductance (µS/cm)							
27	354	849	820	1166	394		
28	345	828	829	1235	390		
29	344	826	832	1176	392		
30	346	825	818	1176	389		
31	335	838	783	1150	360		
32	354	843	795	1142	369		
Dissolved Oxygen (mg/L) (40-100% saturation)							
27	6.4	6.9	7.2	7.3	7.4		
28	7.1	7.1	7.1	7.2	7.1		
29	7.1	7.1	7.1	7.1	7.1		
30	6.3	6.3	6.3	6.9	6.9		
31	6.5	6.0	7.1	7.1	7.1		
32	6.2	6.7	7.3	7.4	7.4		
Temperature (°C)							
27	24	24	24	24	24		
28	24	24	24	24	24		
29	24	24	24	24	24		
30	24	24	24	24	24		
31	24	24	24	24	24		
32	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments: temperature out of range (23°C) for 16-0249, 16-0250 new solution on day 29

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

LAB CTL

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	Normal	1	8	Normal	1	10	Normal	1	9	Normal
2	9	Normal	2	9	Normal	2	11	Normal	2	12	Normal
3	8	Normal	3	9	Normal	3	9	Normal	3	8	Normal
4	7	Normal	4	9	Normal	4	9	Normal	4	9	Normal
5	10	Normal	5	7	Normal	5	10	Normal	5	11	Normal
6	11	Normal	6	8	Normal	6	10	Normal	6	9	Normal
7	10	Normal	7	11	Normal	7	10	Normal	7	10	Normal
8	12	Normal	8	9	Normal	8	10	Normal	8	10	Normal
9	9	Normal	9	9	Normal	9	9	Normal	9	9	Normal
10	10	Normal	10	12	Normal	10	9	Normal	10	8	Normal
11	9	Normal	11	8	Normal	11	10	Normal	11	9	Normal
12	8	Normal	12	9	Normal	12	8	Normal	12	10	Normal
13	10	Normal	13	9	Normal	13	10	Normal	13	-	-
14	-	-	14	9	Normal	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments:

16-0248

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	12	Normal	1	8	Normal	1	6	Normal	1	9	Normal
2	11	Normal	2	10	Normal	2	7	Normal	2	7	Normal
3	12	Normal	3	9	Normal	3	9	Normal	3	11	Normal
4	11	Normal	4	9	Normal	4	10	Normal	4	9	Normal
5	12	Normal	5	9	Normal	5	11	Normal	5	9	Normal
6	-	-	6	11	Normal	6	9	Normal	6	9	Normal
7	-	-	7	10	Normal	7	9	Normal	7	8	Normal
8	-	-	8	11	Normal	8	9	Normal	8	11	Normal
9	-	-	9	11	Normal	9	9	Normal	9	8	Normal
10	-	-	10	11	Normal	10	10	Normal	10	8	Normal
11	-	-	11	-	-	11	7	Normal	11	9	Normal
12	-	-	12	-	-	12	-	-	12	10	Normal
13	-	-	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments:

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

16-0249

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	11	Normal	1	9	Normal	1	10	Normal	1	8	Normal
2	13	Normal	2	10	Normal	2	8	Normal	2	11	Normal
3	9	Normal	3	11	Normal	3	11	Normal	3	10	Normal
4	10	Normal	4	11	Normal	4	10	Abnormal- S	4	8	Normal
5	10	Normal	5	11	Normal	5	9	Normal	5	9	Normal
6	-	-	6	12	Normal	6	11	Normal	6	9	Normal
7	-	-	7	7	Normal	7	8	Normal	7	11	Normal
8	-	-	8	10	Normal	8	-	-	8	11	Normal
9	-	-	9	9	Normal	9	-	-	9	7	Normal
10	-	-	10	-	-	10	-	-	10	-	-
11	-	-	11	-	-	11	-	-	11	-	-
12	-	-	12	-	-	12	-	-	12	-	-
13	-	-	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-		15	-	-	15	-	-

Comments: C4 Abnormal- body slightly bent

16-0250

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	8	Normal	1	10	Normal	1	8	Normal	1	9	Normal
2	9	Normal	2	10	Normal	2	11	Normal	2	10	Normal
3	8	Normal	3	11	Normal	3	8	Normal	3	8	Normal
4	10	Normal	4	11	Normal	4	9	Normal	4	11	Normal
5	9	Normal	5	11	Normal	5	7	Normal	5	9	Normal
6	9	Normal	6	13	Normal	6	7	Normal	6	10	Normal
7	9	Normal	7	12	Normal	7	11	Normal	7	8	Normal
8	10	Normal	8	7	Normal	8	8	Normal	8	8	Normal
9	9	Normal	9	9	Normal	9	10	Normal	9	9	Normal
10	11	Normal	10	9	Normal	10	13	Normal	10	10	Normal
11	9	Normal	11	-	-	11	9	Normal	11	9	Normal
12	9	Normal	12	-	-	12	7	Normal	12	9	Normal
13	9	Normal	13	-	-	13	-	-	13	9	Normal
14	9	Normal	14	-	-	14	-	-	14	6	Abnomal- F
15	8	Normal	15	-	-	15	-	-	15	-	-

Comments: D4 Abnormal slightly bent tail

Nautilus Environmental

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Test Termination

For normal/abnormal column, use the following notation:
N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. **16-0251**

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	11	Normal	1	11	Normal	1	8	Normal	1	13	Normal
2	13	Normal	2	11	Normal	2	9	Normal	2	12	Normal
3	11	Normal	3	10	Normal	3	11	Normal	3	12	Normal
4	10	Normal	4	12	Normal	4	8	Normal	4	-	-
5	10	Normal	5	7	Normal	5	11	Normal	5	-	-
6	11	Normal	6	9	Normal	6	11	Normal	6	-	-
7	9	Normal	7	9	Normal	7	9	Normal	7	-	-
8	11	Normal	8	8	Normal	8	8	Normal	8	-	-
9	9	Normal	9	-	-	9	9	Normal	9	-	-
10	9	Normal	10	-	-	10	9	Normal	10	-	-
11	11	Normal	11	-	-	11	11	Normal	11	-	-
12	-	-	12	-	-	12	9	Normal	12	-	-
13	-	-	13	-	-	13	11	Normal	13	-	-
14	-	-	14	-	-	14	9	Normal	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

Nautilus Environmental

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-0248, 16-0249, 16-0250, 16-0251

Initial Weight (mg) (dried pan)

			Date:	2016/03/30	Initials:	JW	Balance:	Mettler #1
Conc.	LAB CTL	16-0248	16-0249	16-0250	16-0251			
Replicate								
a	994.90	1007.78	1010.97	1020.99	1013.85			
b	987.64	1009.78	1006.83	1010.93	1014.47			
c	984.87	1000.19	1015.76	1017.61	1010.12			
d	990.71	998.41	1001.87	1023.87	1016.11			
e								

Final Weight (mg) (dried pan+organisms)

			Date:	2016/04/06	Initials:	EP	Balance:	Mettler #1
Conc.	LAB CTL	16-0248	16-0249	16-0250	16-0251			
Replicate								
a	1014.83	1022.83	1023.10	1038.47	1037.53			
b	1005.36	1026.63	1023.72	1032.01	1029.56			
c	1002.41	1017.92	1027.67	1038.03	1030.27			
d	1009.44	1015.17	1018.24	1043.24	1028.35			
e								

Nautilus Environmental

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-0248, 16-0249, 16-0250, 16-0251

Organism weight per replicate (mg)

Dose	LAB CTL	16-0248	16-0249	16-0250	16-0251			
replicate								
a	19.93	15.05	12.13	17.48	23.68			
b	17.72	16.85	16.89	21.08	15.09			
c	17.54	17.73	11.91	20.42	20.15			
d	18.73	16.76	16.37	19.37	12.24			
e								

Dry Weight per Fish (mg)

Dose	LAB CTL	16-0248	16-0249	16-0250	16-0251			
replicate								
a	1.53	3.01	2.43	1.17	2.15			
b	1.27	1.68	1.88	2.11	1.89			
c	1.35	1.61	1.70	1.70	1.44			
d	1.56	1.40	1.82	1.38	4.08			
Average	1.43	1.92	1.96	1.59	2.39			

Nautilus Environmental

32 Day Fathead Minnow Data Summary

Method FMD 32 Day ELS Client NAU104 Reference: 16-0248, 16-0249, 16-0250, 16-0251

Concentration: LAB CTL

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	93%	93%	87%	9	1.53	0%
b	93%	100%	93%	9	1.27	0%
c	100%	87%	87%	10	1.35	0%
d	100%	80%	80%	10	1.56	0%
Average	**97%**	**90%**	**87%**	**9**	**1.43**	**0%**

Concentration: 16-0248

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	93%	36%	33%	12	3.01	0%
b	93%	71%	67%	10	1.68	0%
c	93%	79%	73%	9	1.61	0%
d	100%	80%	80%	9	1.40	0%
Average	**95%**	**66%**	**63%**	**10**	**1.92**	**0%**

Concentration: 16-0249

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	33%	33%	11	2.43	0%
b	93%	64%	60%	10	1.88	0%
c	93%	50%	47%	10	1.70	14%
d	100%	60%	60%	9	1.82	0%
Average	**97%**	**52%**	**50%**	**10**	**1.96**	**4%**

Concentration: 16-0250

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	100%	100%	9	1.17	0%
b	100%	67%	67%	10	2.11	0%
c	87%	92%	80%	9	1.70	0%
d	100%	93%	93%	9	1.38	7%
Average	**97%**	**88%**	**85%**	**9**	**1.59**	**2%**

Concentration: 16-0251

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	73%	73%	10	2.15	0%
b	93%	57%	53%	10	1.89	0%
c	93%	100%	93%	10	1.44	0%
d	100%	20%	20%	12	4.08	0%
Average	**97%**	**63%**	**60%**	**10**	**2.39**	**0%**

Nautilus Environmental

Warning Chart
Fathead minnow

Test Method: 7 days Fathead minnow Survival and Growth Test (7 treatments plus a control)
HydroQual Test Method: WTR-ME-046
Reference: Biological Test Method: Test of Larval Growth and Survival Using Fathead minnows. Environment Canada, EPS 1/RM/22, Second Edition, February 2011.

Test Organism:

test species:	*Pimephales promelas*
culture source:	Aquatox (Arkansas, USA)
temp of breeding aquaria:	23 - 26 ^{o}C
food type:	newly-hatched brine shrimp nauplii
frequency of feeding:	daily
breeding colony mortality:	<1% (last 7 days)
age of test organisms:	<24 hours
condition prior to test initiation:	normal
batch number:	20160303FM

Test Design:

test type:	static renewal
toxicant:	sodium chloride
test vessel:	polypropylene cups, 11 x 9 cm
volume of test vessel (ml):	500
test volume (ml):	250
depth of test solution:	>3 cm
replicates per treatment:	4 replicates
organisms per replicate:	10
feeding:	twice daily
temperature (^{o}C):	24-26
photoperiod:	16 hours light: 8 hours dark
light level (surface):	100-500 lux (full spectrum)

Control/Dilution Water:

source:	dechlorinated City of Calgary tap water no chemicals were added to the dilution water
pH (units):	7.1
conductance (µS/cm):	392
dissolved oxygen (mg/L):	9.6
NH_4^+ (mg/L):	<0.1
hardness (mg $CaCO_3$/L):	191
alkalinity (mg $CaCO_3$/L):	126
total residual chlorine (mg/L):	<0.01

Comments: None

The test data and results are authorized and verified correct.

Jacklyn Poole

Senior Verifier

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

Warning Chart
Fathead minnow

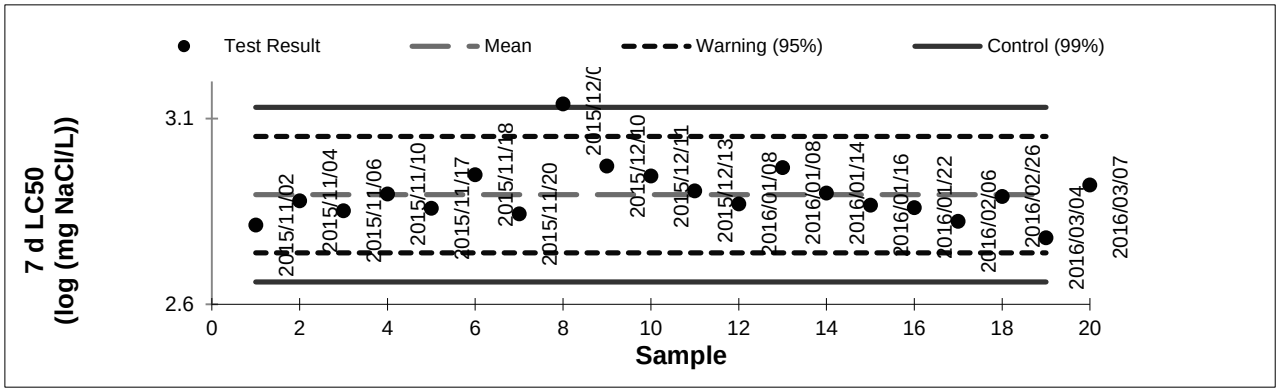
Mortality

Current Test

toxicant	Sodium Chloride (NaCl)				
started on	2016/03/07	ended on	2016/03/14		
Result (7 d LC50):	2.92	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.82	upper	3.01	

Historical Values

mean	2.90	sd	0.08	cv(%):	11.9
	lower	upper			
warning limits (±2 sd)	2.74	3.05	(95% confidence limits)		
control limits (±3 sd)	2.66	3.13	(99% confidence limits)		

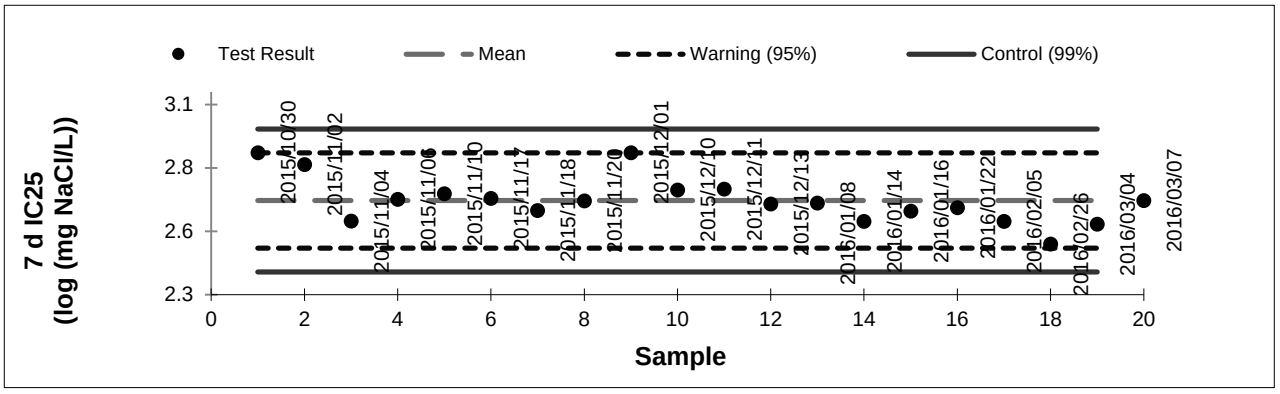


Biomass

started on	2016/03/07	ended on	2016/03/14		
Result (7 d IC25):	2.67	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.58	upper	2.75	

Historical Values

mean	2.67	sd	0.09	cv(%):	14.3
	lower	upper			
warning limits (±2 sd)	2.48	2.86	(95% confidence limits)		
control limits (±3 sd)	2.39	2.95	(99% confidence limits)		



notes: sd, standard deviation; cv, coefficient of variance; N/A, could not be calculated

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

GENERAL TERMS AND CONDITIONS:

These terms and conditions are incorporated into and form part of the Chain of Custody between HydroQual Laboratories Ltd. ("HydroQual") and the party named in the Chain of Custody (the "Client").

1. **Definitions:** Capitalized terms shall have the definition ascribed as such in these General Terms and Conditions and the Chain of Custody.
2. **The Services:** HydroQual will provide the Services to the Client as listed and described in the Chain of Custody.
3. **Prices:** HydroQual may review and change all prices, fees, surcharges or other charges as set out in proposals and/or price quotations if there are changes to HydroQual's cost beyond HydroQual's control, including changes in legislative requirements, Client variations of sample numbers and Client requests for changes to standard reporting requirements. Notwithstanding condition 3, all quotations are reviewed and updated on a yearly basis.
4. **Payment Terms:** The Client shall pay HydroQual within 30 days of the invoice date as provided by HydroQual. HydroQual may, for reasonable business reasons, require the Client to arrange for payment in advance.
5. **Quotation Numbers:** The Client shall provide the proposal and/or price quotation number to HydroQual (where applicable) to ensure correct pricing.
6. **Taxes:** Applicable taxes are not included in prices, surcharges and additional fees and will be added at the time of invoicing.
7. **No Guarantee of Results:** The Client is responsible for informing itself on the limitation of the results and acknowledges that the results are not guaranteed.
8. **Standard of Care:** HydroQual will use reasonable care and diligence as required by the laws of the province or territory where the sample is tested, subject to that level of care and skill ordinarily exercised by other laboratories currently practicing under similar conditions in the same locality, subject to the time limits and financial, physical or other constraints applicable to the Services. No warranty, express or implied, is made.
9. **Storage:** Where possible, HydroQual will store samples until a final report is issued to the Client, after which time HydroQual may discard the sample.
10. **Holds:** If the Client requests a sample be placed on hold, HydroQual will store the sample for the mutually agreed upon written time and price, after which HydroQual will invoice the Client and discard the sample.
11. **Archives:** If the Client requests a sample be archived, HydroQual will store the sample for a mutually agreed upon written time frame and price, after which HydroQual will invoice the Client and discard the sample.
12. **Handling Protocol:** Legal sample handling protocol must be arranged, and provided in writing, before samples are collected. HydroQual will provide a price quotation for legal sample protocol. Samples processed under legal protocol are stored indefinitely, subject to a storage charge as advised by HydroQual.
13. **Samples:** The quality, condition, content and source of samples stored and tested are not known to HydroQual except as declared and described on the Chain of Custody completed and submitted by the Client and accompanying the sample.
14. **Risk of Loss:** HydroQual will use reasonable care to protect samples during storage, however, all samples are stored at the Client's risk and the Client is responsible for obtaining appropriate insurance, if desired. The Client acknowledges that during the performance of the Services samples may be altered, lost, damaged or destroyed and the client forever releases HydroQual from any and all claims the Client may have for any loss or damage to the sample.
15. **Environmental:** the Client must comply with all applicable environmental legislation, including labeling all hazardous samples to comply with Canada's *Workplace Hazardous Materials Information System* and the Alberta *Transfer of Dangerous Goods* regulations, and must provide appropriate material safety data sheets that include the nature of the hazard and a contact name and phone number to call for information. The Client shall defend, indemnify and hold harmless HydroQual for all loss or damages, including any fine or cost of complying with an order of any government authority, resulting from the Client's breach of this paragraph.
16. **Hazardous Materials Disposal:** HydroQual may return, at the Client's cost, hazardous material to the Client for disposal.
17. **Hazardous Materials Surcharge:** HydroQual may apply an additional surcharge for handling of hazardous samples or samples with Naturally Occurring Radioactive Materials ("NORM"), such as and including without limitation, H_2S and CN.
18. **Sample Containers:** HydroQual may ship sample containers to the Client's location by the most cost effective means using HydroQual's preferred courier suppliers, within the specified project timeline. Shipping will be charged back to the Client.
19. **Additional Charges:** HydroQual may charge the Client:
    (a) for pick-up and delivery services when provided subject in each instance to a minimum charge of $50.00; and,
    (b) for rush service (processing samples and/or reporting).
20. **Large Bottle Orders:** The Client shall provide HydroQual with not less than 24 hours' notice for large bottle orders.
21. **Re-Tests:** HydroQual reserves the right to re-test any samples that remain in HydroQual's possession. Re-tests requested by the Client may be charged to Client and Client agrees to pay for such charges.
22. **Waiver:** The Client is responsible for making any assessment regarding the suitability of the Services and the intended results for the Client's purposes and waives any and all claims against HydroQual that the Client may have against HydroQual as a result of the interpretation of the results provided to the Client. The Client shall defend, indemnify and save harmless HydroQual for any and all claims made by any third party against HydroQual in respect of all losses however arising from the performance of the Services or the use of any report provided in the performance of the Services.
23. **LIMITATION OF LIABILITY:** IN NO EVENT SHALL HYDROQUAL BE RESPONSIBLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY OR PUNITIVE DAMAGES, WHETHER FORESEEABLE OR UNFORESEEABLE (INCLUDING CLAIMS FOR LOSS OF PROFITS OR REVENUE OR LOSSES CAUSED BY STOPPAGE OF OTHER WORK OR IMPAIRMENT OF OTHER ASSETS) INCURRED BY THE CLIENT ARISING OUT OF BREACH OR FAILURE OF EXPRESS OF IMPLIED WARRANTY, BREACH OF CONTRACT, BREACH OF WARRANTY, MISREPRESENTATION, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE. IN ANY EVENT, THE LIABILITY OF HYDROQUAL TO THE CLIENT SHALL BE LIMITED TO THE COST OF TESTING THE SAMPLE AS REQUESTED IN THE CHAIN OF CUSTODY UNDER WHICH THE SAMPLE WAS ORIGINALLY DEPOSITED. FOR THE PURPOSES OF THIS PARAGRAPH AND PARAGRAPHS 7, 14, 15, 22, AND 24, AS APPLICABLE, "HYDROQUAL" INCLUDES WITHOUT LIMITATIONS ITS DIRECTORS, OFFICERS, EMPLOYEES AND AFFILIATES AND THE "CLIENT" INCLUDES WITHOUT LIMITATION ANY THIRD PARTY THAT MAY HAVE A CLAIM AGAINST HYDROQUAL THROUGH THE CLIENT.
24. **Notice of Liability:** Notwithstanding paragraph 23, HydroQual shall not be liable to the Client unless the Client provides notice in writing to HydroQual of such loss or damage, together with full particulars thereof, within 30 days of the Client's receipt of the report of the analysis of the sample giving rise to such liability. The provisions of this paragraph allocate the risk between the Client and HydroQual, and the fees to be paid by the Client to HydroQual reflect this allocation of any such risks and the limitations of liability in these General Terms and Conditions.
25. **Entire Agreement:** These General Terms and Conditions, the Chain of Custody and price quotations constitute the entire agreement between the parties and supersede and take precedence over any terms and conditions contained in any documentation provided by the Client. HydroQual's execution of any subsequent documentation from the Client only acknowledges receipt and not acceptance of any terms or conditions therein unless expressly stipulated otherwise by HydroQual. If there is a conflict between these General Terms and Conditions and any other document, these General Terms and Conditions prevail.

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Hatched Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	0.9667	0.9054	1	0.9333	1	0.01925	0.03849	3.98%	0.0%
FR_UFR1	4	0.9667	0.9054	1	0.9333	1	0.01925	0.03849	3.98%	0.0%
FR_FRCP1	4	0.9667	0.8606	1	0.8667	1	0.03333	0.06667	6.9%	0.0%
GH_FR1	4	0.9667	0.9054	1	0.9333	1	0.01925	0.03849	3.98%	0.0%
CM_MC2	4	0.95	0.897	1	0.9333	1	0.01667	0.03333	3.51%	1.72%

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	9.375	8.948	9.802	9	9.62	0.1343	0.2685	2.86%	0.0%
FR_UFR1	4	10.49	8.427	12.55	9.54	12.33	0.6474	1.295	12.35%	-11.87%
FR_FRCP1	4	9.325	8.287	10.36	8.93	10.3	0.3263	0.6525	7.0%	0.53%
GH_FR1	4	9.875	8.988	10.76	9.33	10.6	0.2786	0.5572	5.64%	-5.33%
CM_MC2	4	9.807	7.746	11.87	8.73	11.6	0.6477	1.295	13.21%	-4.61%

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	1.232	1.115	1.349	1.169	1.329	0.03665	0.0733	5.95%	0.0%
FR_UFR1	4	1.186	0.6439	1.728	0.816	1.579	0.1703	0.3406	28.72%	3.75%
FR_FRCP1	4	1.306	1.139	1.473	1.165	1.405	0.05239	0.1048	8.02%	-5.99%
GH_FR1	4	0.955	0.6716	1.238	0.794	1.126	0.08905	0.1781	18.65%	22.48%
CM_MC2	4	1.106	0.9876	1.225	1.003	1.182	0.03735	0.07471	6.75%	10.19%

Proportion Normal Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	4	0.9821	0.9253	1	0.9286	1	0.01786	0.03571	3.64%	1.79%
GH_FR1	4	0.9643	0.8506	1	0.8571	1	0.03571	0.07143	7.41%	3.57%
CM_MC2	4	1	1	1	1	1	0	0	0.0%	0.0%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	0.8667	0.7801	0.9533	0.8	0.9333	0.02722	0.05443	6.28%	0.0%
FR_UFR1	4	0.6	0.1024	1	0.2	0.9333	0.1563	0.3127	52.12%	30.77%
FR_FRCP1	4	0.85	0.6148	1	0.6667	1	0.07391	0.1478	17.39%	1.92%
GH_FR1	4	0.5	0.2969	0.7031	0.3333	0.6	0.06383	0.1277	25.53%	42.31%
CM_MC2	4	0.6333	0.3035	0.9632	0.3333	0.8	0.1036	0.2073	32.73%	26.92%

Control = Regular MHW Control

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.9333	0.9333	1	1
FR_UFR1	1	0.9333	0.9333	1
FR_FRCP1	1	1	0.8667	1
GH_FR1	1	0.9333	0.9333	1
CM_MC2	0.9333	0.9333	0.9333	1

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	9.38	9	9.62	9.5
FR_UFR1	10.45	9.63	9.54	12.33
FR_FRCP1	9.07	10.3	9	8.93
GH_FR1	10.6	10	9.57	9.33
CM_MC2	11.6	9.9	8.73	9

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	1.329	1.181	1.169	1.249
FR_UFR1	1.579	1.006	1.343	0.816
FR_FRCP1	1.165	1.405	1.361	1.291
GH_FR1	0.8087	1.126	0.794	1.091
CM_MC2	1.003	1.123	1.182	1.117

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	0.9286
GH_FR1	1	1	0.8571	1
CM_MC2	1	1	1	1

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.8667	0.9333	0.8667	0.8
FR_UFR1	0.7333	0.5333	0.9333	0.2
FR_FRCP1	1	0.6667	0.8	0.9333
GH_FR1	0.3333	0.6	0.4667	0.6
CM_MC2	0.3333	0.6667	0.7333	0.8

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	14/15	14/15	15/15	15/15
FR_UFR1	15/15	14/15	14/15	15/15
FR_FRCP1	15/15	15/15	13/15	15/15
GH_FR1	15/15	14/15	14/15	15/15
CM_MC2	14/15	14/15	14/15	15/15

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	13/13	14/14	13/13	12/12
FR_UFR1	11/11	8/8	14/14	3/3
FR_FRCP1	15/15	10/10	12/12	13/14
GH_FR1	5/5	9/9	6/7	9/9
CM_MC2	5/5	10/10	11/11	12/12

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	13/15	14/15	13/15	12/15
FR_UFR1	11/15	8/15	14/15	3/15
FR_FRCP1	15/15	10/15	12/15	14/15
GH_FR1	5/15	9/15	7/15	9/15
CM_MC2	5/15	10/15	11/15	12/15

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	10-1668-9405	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	26 Apr-16 16:24	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.6907	1.0000	Exact	Non-Significant Effect
Control		FR_FRCP1	0.6907	1.0000	Exact	Non-Significant Effect
Control		GH_FR1	0.6907	1.0000	Exact	Non-Significant Effect
Control		CM_MC2	0.5	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	58	2	60	0.9667	0.03333	0.0%
FR_UFR1		58	2	60	0.9667	0.03333	0.0%
FR_FRCP1		58	2	60	0.9667	0.03333	0.0%
GH_FR1		58	2	60	0.9667	0.03333	0.0%
CM_MC2		57	3	60	0.95	0.05	1.72%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.9333	0.9333	1	1
FR_UFR1	1	0.9333	0.9333	1
FR_FRCP1	1	1	0.8667	1
GH_FR1	1	0.9333	0.9333	1
CM_MC2	0.9333	0.9333	0.9333	1

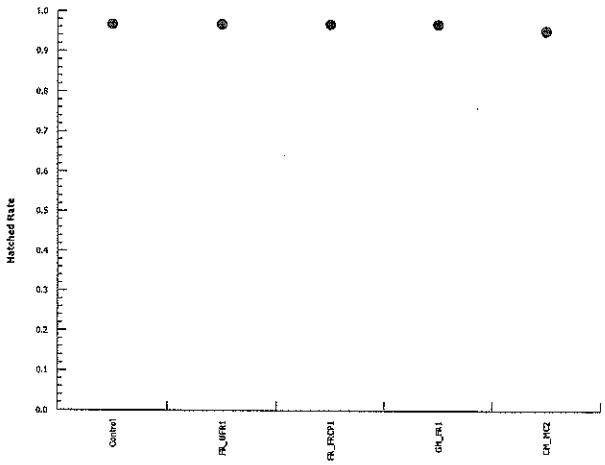
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	14/15	14/15	15/15	15/15
FR_UFR1	15/15	14/15	14/15	15/15
FR_FRCP1	15/15	15/15	13/15	15/15
GH_FR1	15/15	14/15	14/15	15/15
CM_MC2	14/15	14/15	14/15	15/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	10-1668-9405	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	26 Apr-16 16:24	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JCH May 10/16

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	14-7565-6343	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 10:22	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.6907	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.6907	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.5	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	58	2	60	0.9667	0.03333	0.0%
FR_FRCP1		58	2	60	0.9667	0.03333	0.0%
GH_FR1		58	2	60	0.9667	0.03333	0.0%
CM_MC2		57	3	60	0.95	0.05	1.72%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	0.9333	0.9333	1
FR_FRCP1	1	1	0.8667	1
GH_FR1	1	0.9333	0.9333	1
CM_MC2	0.9333	0.9333	0.9333	1

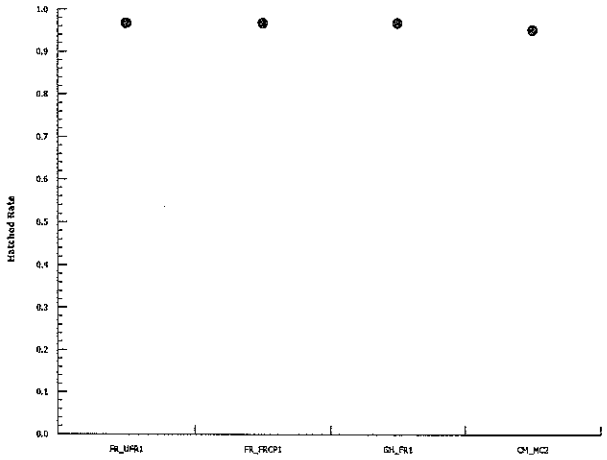
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	15/15	14/15	14/15	15/15
FR_FRCP1	15/15	15/15	13/15	15/15
GH_FR1	15/15	14/15	14/15	15/15
CM_MC2	14/15	14/15	14/15	15/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	14-7565-6343	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 10:22	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: Mary 10/11

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-3456-8257	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	26 Apr-16 16:24	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.000849	0.0025	Exact	Significant Effect
Control		FR_FRCP1	0.5	0.5000	Exact	Non-Significant Effect
Control		GH_FR1	1.31E-05	<0.0001	Exact	Significant Effect
Control		CM_MC2	0.002791	0.0056	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	52	8	60	0.8667	0.1333	0.0%
FR_UFR1		36	24	60	0.6	0.4	30.77%
FR_FRCP1		51	9	60	0.85	0.15	1.92%
GH_FR1		30	30	60	0.5	0.5	42.31%
CM_MC2		38	22	60	0.6333	0.3667	26.92%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.8667	0.9333	0.8667	0.8
FR_UFR1	0.7333	0.5333	0.9333	0.2
FR_FRCP1	1	0.6667	0.8	0.9333
GH_FR1	0.3333	0.6	0.4667	0.6
CM_MC2	0.3333	0.6667	0.7333	0.8

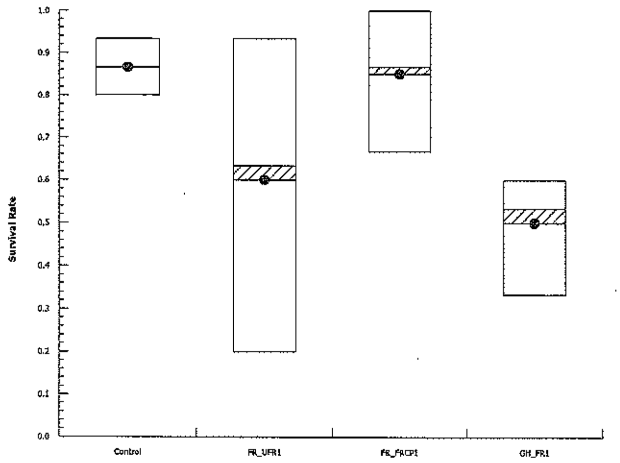
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	13/15	14/15	13/15	12/15
FR_UFR1	11/15	8/15	14/15	3/15
FR_FRCP1	15/15	10/15	12/15	14/15
GH_FR1	5/15	9/15	7/15	9/15
CM_MC2	5/15	10/15	11/15	12/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-3456-8257	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	26 Apr-16 16:24	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	09-1110-4117	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 10:22	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.1795	0.5385	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	36	24	60	0.6	0.4	0.0%
FR_FRCP1		51	9	60	0.85	0.15	-41.67%
GH_FR1		30	30	60	0.5	0.5	16.67%
CM_MC2		38	22	60	0.6333	0.3667	-5.56%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.7333	0.5333	0.9333	0.2
FR_FRCP1	1	0.6667	0.8	0.9333
GH_FR1	0.3333	0.6	0.4667	0.6
CM_MC2	0.3333	0.6667	0.7333	0.8

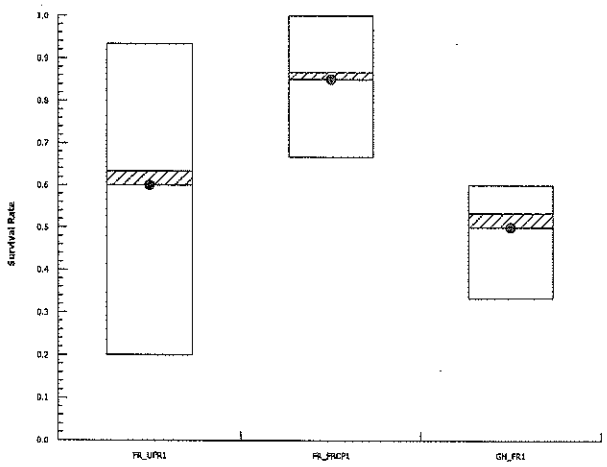
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	11/15	8/15	14/15	3/15
FR_FRCP1	15/15	10/15	12/15	14/15
GH_FR1	5/15	9/15	7/15	9/15
CM_MC2	5/15	10/15	11/15	12/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	09-1110-4117	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 10:22	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGH May 10/16

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-1236-4725	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	26 Apr-16 16:25	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	24.9%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.3531	2.356	0.307	6	0.6677	CDF	Non-Significant Effect
		FR_FRCP1	-0.5667	2.356	0.307	6	0.9317	CDF	Non-Significant Effect
		GH_FR1	2.126	2.356	0.307	6	0.0752	CDF	Non-Significant Effect
		CM_MC2	0.9633	2.356	0.307	6	0.3987	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2878875	0.07197188	4	2.12	0.1287	Non-Significant Effect
Error	0.5091957	0.03394638	15			
Total	0.7970833		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	9.572	13.28	0.0483	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9744	0.866	0.8436	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	1.232	1.115	1.349	1.215	1.169	1.329	0.03665	5.95%	0.0%
FR_UFR1	4	1.186	0.6439	1.728	1.175	0.816	1.579	0.1704	28.73%	3.73%
FR_FRCP1	4	1.306	1.139	1.473	1.326	1.165	1.405	0.05239	8.02%	-5.99%
GH_FR1	4	0.955	0.6716	1.238	0.95	0.794	1.126	0.08905	18.65%	22.48%
CM_MC2	4	1.106	0.9876	1.225	1.12	1.003	1.182	0.03735	6.75%	10.19%

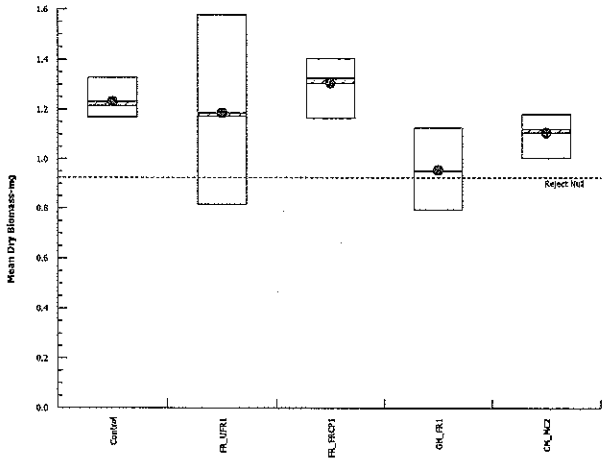
Mean Dry Biomass-mg Detail

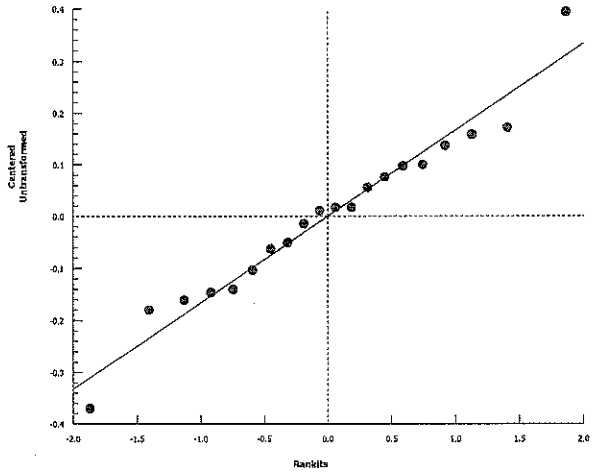
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	1.329	1.181	1.169	1.249
FR_UFR1	1.579	1.006	1.343	0.816
FR_FRCP1	1.165	1.405	1.361	1.291
GH_FR1	0.8087	1.126	0.794	1.091
CM_MC2	1.003	1.123	1.182	1.117

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	02-1236-4725	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	26 Apr-16 16:25	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	05-3998-7749	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 10:23	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	27.6%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	-0.836	2.287	0.328	6	0.9439	CDF	Non-Significant Effect
		GH_FR1	1.612	2.287	0.328	6	0.1487	CDF	Non-Significant Effect
		CM_MC2	0.5547	2.287	0.328	6	0.5218	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2598136	0.08660453	3	2.108	0.1527	Non-Significant Effect
Error	0.493079	0.04108992	12			
Total	0.7528926		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	6.682	11.34	0.0828	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9743	0.8408	0.9021	Normal Distribution

Mean Dry Biomass-mg Summary

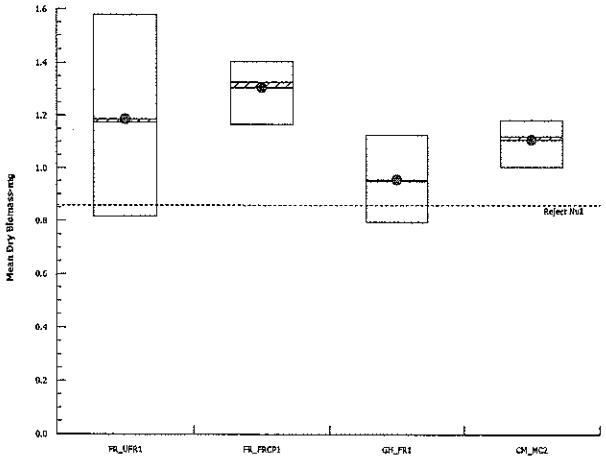
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	1.186	0.6439	1.728	1.175	0.816	1.579	0.1704	28.73%	0.0%
FR_FRCP1	4	1.306	1.139	1.473	1.326	1.165	1.405	0.05239	8.02%	-10.1%
GH_FR1	4	0.955	0.6716	1.238	0.95	0.794	1.126	0.08905	18.65%	19.48%
CM_MC2	4	1.106	0.9876	1.225	1.12	1.003	1.182	0.03735	6.75%	6.7%

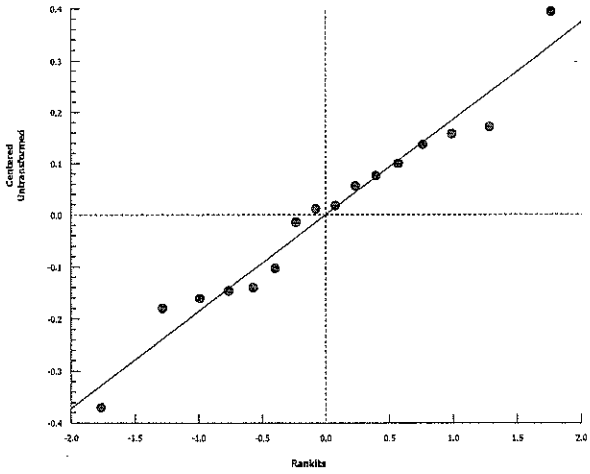
Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1.579	1.006	1.343	0.816
FR_FRCP1	1.165	1.405	1.361	1.291
GH_FR1	0.8087	1.126	0.794	1.091
CM_MC2	1.003	1.123	1.182	1.117

Analysis ID:	05-3998-7749	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 10:23	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	16-1673-4938	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 14:22	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	16.2%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	-1.724	2.356	1.52	6	0.9964	CDF	Non-Significant Effect
		FR_FRCP1	0.07749	2.356	1.52	6	0.7740	CDF	Non-Significant Effect
		GH_FR1	-0.7749	2.356	1.52	6	0.9572	CDF	Non-Significant Effect
		CM_MC2	-0.6703	2.356	1.52	6	0.9456	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3.52483	0.8812074	4	1.058	0.4108	Non-Significant Effect
Error	12.48885	0.8325902	15			
Total	16.01368		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	7.155	13.28	0.1279	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8991	0.866	0.0396	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	9.375	8.948	9.802	9.44	9	9.62	0.1343	2.86%	0.0%
FR_UFR1	4	10.49	8.427	12.55	10.04	9.54	12.33	0.6474	12.35%	-11.87%
FR_FRCP1	4	9.325	8.287	10.36	9.035	8.93	10.3	0.3263	7.0%	0.53%
GH_FR1	4	9.875	8.988	10.76	9.785	9.33	10.6	0.2786	5.64%	-5.33%
CM_MC2	4	9.807	7.746	11.87	9.45	8.73	11.6	0.6477	13.21%	-4.61%

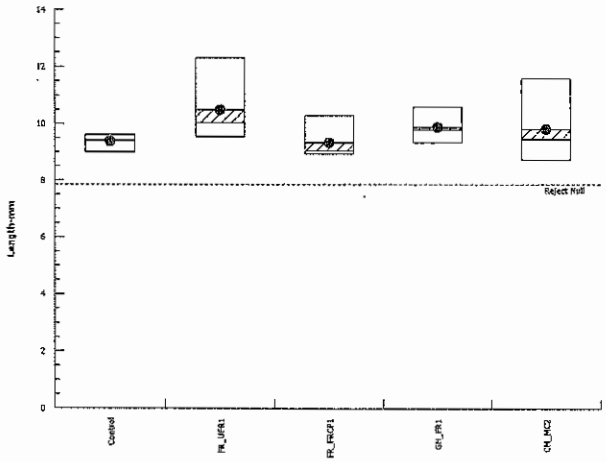
Length-mm Detail

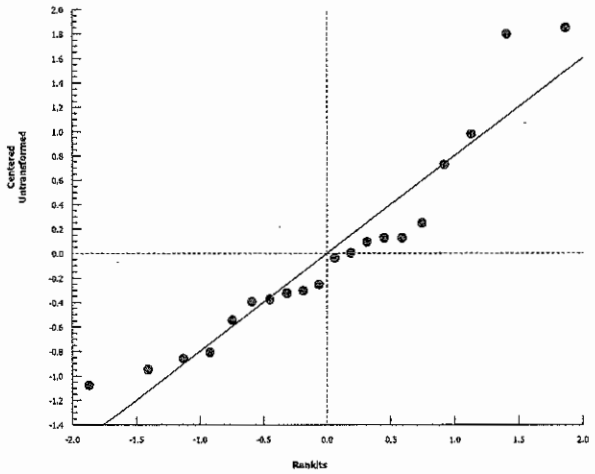
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	9.38	9	9.62	9.5
FR_UFR1	10.45	9.63	9.54	12.33
FR_FRCP1	9.07	10.3	9	8.93
GH_FR1	10.6	10	9.57	9.33
CM_MC2	11.6	9.9	8.73	9

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	16-1673-4938	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 14:22	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	04-7540-4658	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 14:23	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	15.6%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1.626	2.287	1.636	6	0.1456	CDF	Non-Significant Effect
		GH_FR1	0.8565	2.287	1.636	6	0.3920	CDF	Non-Significant Effect
		CM_MC2	0.9509	2.287	1.636	6	0.3539	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.728825	0.9096082	3	0.8894	0.4744	Non-Significant Effect
Error	12.27255	1.022713	12			
Total	15.00138		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	2.842	11.34	0.4166	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8879	0.8408	0.0517	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	10.49	8.427	12.55	10.04	9.54	12.33	0.6474	12.35%	0.0%
FR_FRCP1	4	9.325	8.287	10.36	9.035	8.93	10.3	0.3263	7.0%	11.08%
GH_FR1	4	9.875	8.988	10.76	9.785	9.33	10.6	0.2786	5.64%	5.84%
CM_MC2	4	9.807	7.746	11.87	9.45	8.73	11.6	0.6477	13.21%	6.48%

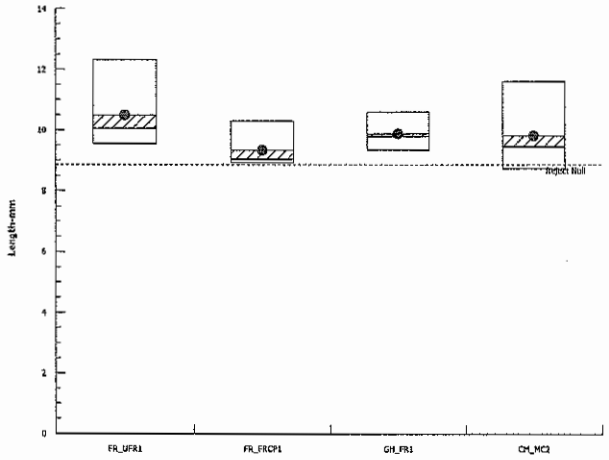
Length-mm Detail

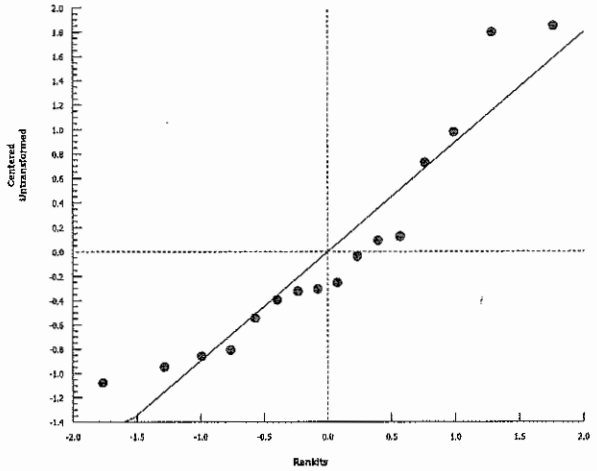
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	10.45	9.63	9.54	12.33
FR_FRCP1	9.07	10.3	9	8.93
GH_FR1	10.6	10	9.57	9.33
CM_MC2	11.6	9.9	8.73	9

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	04-7540-4658	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 14:23	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	19-1548-9364	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	26 Apr-16 16:25	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Control		FR_FRCP1	0.4951	1.0000	Exact	Non-Significant Effect
Control		GH_FR1	0.3659	1.0000	Exact	Non-Significant Effect
Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	52	0	52	1	0	0.0%
FR_UFR1		36	0	36	1	0	0.0%
FR_FRCP1		50	1	51	0.9804	0.01961	1.96%
GH_FR1		29	1	30	0.9667	0.03333	3.33%
CM_MC2		38	0	38	1	0	0.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	0.9286
GH_FR1	1	1	0.8571	1
CM_MC2	1	1	1	1

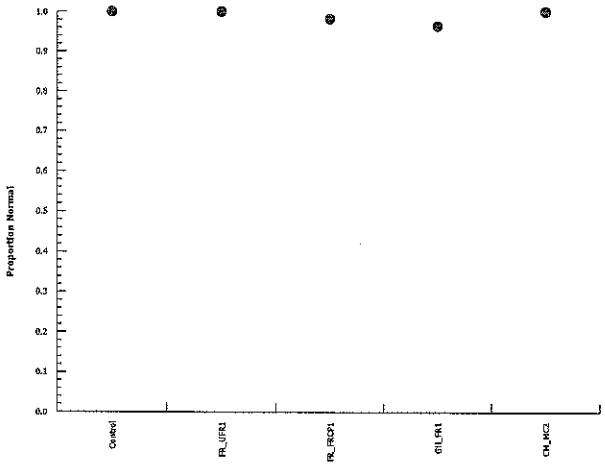
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	13/13	14/14	13/13	12/12
FR_UFR1	11/11	8/8	14/14	3/3
FR_FRCP1	15/15	10/10	12/12	13/14
GH_FR1	5/5	9/9	6/7	9/9
CM_MC2	5/5	10/10	11/11	12/12

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	19-1548-9364	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	26 Apr-16 16:25	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JDL May 11/16

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-9502-4303	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 10:22	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.5862	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.4545	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	36	0	36	1	0	0.0%
FR_FRCP1		50	1	51	0.9804	0.01961	1.96%
GH_FR1		29	1	30	0.9667	0.03333	3.33%
CM_MC2		38	0	38	1	0	0.0%

Proportion Normal Detail

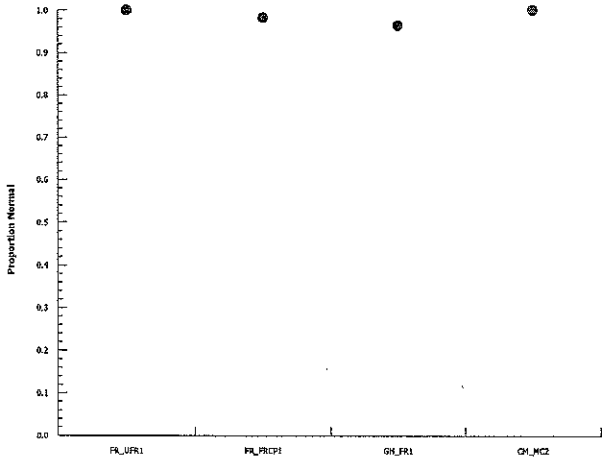
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	0.9286
GH_FR1	1	1	0.8571	1
CM_MC2	1	1	1	1

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	11/11	8/8	14/14	3/3
FR_FRCP1	15/15	10/10	12/12	13/14
GH_FR1	5/5	9/9	6/7	9/9
CM_MC2	5/5	10/10	11/11	12/12

Analysis ID:	01-9502-4303	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 10:22	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Nautilus Environmental

ATTN: Krysta Pearcy
Nautilus Environmental
8664 Commerce Court
Burnaby , BC
Canada , V5A 4N7

Received: various dates
Report Date: 2016/05/11
Version: REVISION 1

HydroQual Test Report

Client: NAU104
Reference: 16-0248; 16-0249; 16-0250; 16-0251
Client Reference: CM_MC2_WS
GH_FR1_WS
FR_FRCP1_Q
FR_UFR1_Q
Billing: not given

Jacklyn Poole

Senior Verifier

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0248

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	drop off		
received:	various dates	at:	various times	by:	MC, ML, HS
signed-in:	various dates	at:	various times	by:	MC, ML, HS
container:	6 x 20L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	4.3; 5; 4; 3; 5

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	CM_MC2_WS_20160301_N	CM_MC2_WS_20160308_N	CM_MC2_WS_20160315_N	CM_MC2_WS_20160322_N	CM_MC2_WS_20160329_N	**CM_MC2_WS**
collection date:	2016/03/01	2016/03/08	2016/03/15	2016/03/22	2016/03/29	
collection time:	1220	1130	1140	1140	1330	

pH:	8.2	8.1	8.1	8.2	8.1
EC (µS/cm):	851	895	924	981	985
DO (mg/L):	10.5	10.9	10.5	10.5	10.2
temp (°C):	14.5	6.7	12.0	13.3	16.1
hardness:	473	460	494	393	450
alkalinity:	211	190	186	218	240
colour:	colourless	colourless	colourless	colourless	colourless
odour:	-	-	-	-	-

Meter/Probe Used: chem cart 1/**chem cart 2**/chem cart 3/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/03/03
ended:	2016/04/04
prelim made:	-
prelim sent:	-
reported:	2016/04/18

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0249

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	drop off		
received:	various dates	at:	various times	by:	MC, ML, HS
signed-in:	various dates	at:	various times	by:	MC, ML, HS
container:	6 x 20L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	3.3; 6; 5; 3; 5

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	GH_FR1_WS_2016_03_01_NP	GH_FR1_WS_2016_03_08_NP	GH_FR1_WS_2016_03_15_NP	GH_FR1_WS_2016_03_22_NP	GH_FR1_WS_2016_03_29_NP	**GH_FR1_WS**
collection date:	2016/03/01	2016/03/08	2016/03/15	2016/03/22	2016/03/29	
collection time:	not given	0830	not given	0915	0925	

pH:	8.0	8.0	8.0	8.1	8.1
EC (µS/cm):	814	840	888	959	957
DO (mg/L):	11.0	10.9	9.9	10.7	10.1
temp (°C):	13.5	7.1	13.7	12.9	16.1
hardness:	456	477	488	363	429
alkalinity:	197	191	193	173	184
colour:	colourless	colourless	colourless	colourless	colourless
odour:	-	-	-	-	-

Meter/Probe Used: chem cart 1/**chem cart 2**/chem cart 3/product/soils
Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/03/03
ended:	2016/04/04
prelim made:	-
prelim sent:	-
reported:	2016/04/18

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0250

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	drop off		
received:	various dates	at:	various times	by:	MC, ML, HS
signed-in:	various dates	at:	various times	by:	MC, ML, HS
container:	6 x 20L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	3.5; 8; 8; 2; 6

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_FRCP1_Q_04012016_N	FR_FRCP1_QR_18012016_N	FR_FRCP1_QR_11012016_N	FR_FRCP1_QR_01012016_N	FR_FRCP1_QR_25012016_N	**FR_FRCP1_Q**
collection date:	2016/03/01	2016/03/08	2016/03/15	2016/03/22	2016/03/29	
collection time:	0943	1054	1140	1107	0855	

pH:	8.1	8.1	8.1	8.1	7.8
EC (µS/cm):	1531	1307	1348	1329	1368
DO (mg/L):	9.9	11.2	10.5	10.7	10.1
temp (°C):	15.4	6.8	11.8	13.3	17.2
hardness:	1020	840	852	6.4	756
alkalinity:	246	216	233	210	311
colour:	colourless	colourless	colourless	colourless	colourless
odour:	-	-	-	-	-

Meter/Probe Used: chem cart 1/**chem cart 2**/chem cart 3/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/03/03
ended:	2016/04/04
prelim made:	-
prelim sent:	-
reported:	2016/04/18

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0251

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	drop off		
received:	various dates	at:	various times	by:	MC, ML, HS
signed-in:	various dates	at:	various times	by:	MC, ML, HS
container:	6 x 20L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	3.5; 8; 8; 2; 6

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_UFR1_Q_04 01206_N	FR_UFR1_QR _18012016_N	FR_UFR1_QR_ 11012016_N	FR_UFR1_QR _01022016_N	FR_UFR1_QR _25012016_N	**FR_UFR1_Q**
collection date:	2016/03/01	2016/03/08	2016/03/15	2016/03/22	2016/03/29	
collection time:	1105	0907	0954	0909	1053	
pH:	8.0	8.1	8.1	8.1	8.1	
EC (µS/cm):	351	350	390	394	370	
DO (mg/L):	11.1	10.9	10.6	10.6	10.3	
temp (°C):	12.1	8.1	12.0	13.4	16.2	
hardness:	186	156	200	187	167	
alkalinity:	203	161	141	191	162	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/**chem cart 2**/chem cart 3/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/03/03
ended:	2016/04/04
prelim made:	-
prelim sent:	-
reported:	2016/04/18

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Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Organism Information

Source: Aquatox Batch: 20160303FMLELS Egg Stag 15 somites Organisms Received in Good Condition: **Yes**

Test Log

Date	Day	Time	Technicians	Chem Cart Used	Fed		Feeding Rate	Sample Pre-Aeration Time	Bench Sheet Review	
					AM	PM			First	Second
2016/03/03	0	1500	ML/HS/DS/JN	2	-	-	-	60 minutes	HS	DS
2016/03/04	1	1430	JN/HS/DS	2	-	-	-	60 minutes	JN	DS
2016/03/05	2	1330	DS/JW	2	-	-	-	60 minutes	JW	EP
2016/03/06	3	1345	ML/JK	2	-	-	-	60 minutes	ML	JK
2016/03/07	4	1340	ML/JK	2	-	✓	1mL	30 minutes	JK	ML
2016/03/08	5	1100	HS/ML	2	✓	✓	1mL	60 minutes	HS	ML
2016/03/09	6	1425	JN/JK	2	✓	✓	1mL	60 minutes	JN	DS
2016/03/10	7	1000	DS/EP	2	✓	✓	1mL	60 minutes	DS	EP
2016/03/11	8	1050	JN	2	✓	✓	1mL	60 minutes	JN	EP
2016/03/12	9	1100	EP/JW	2	✓	✓	1mL	60 minutes	DS	EP
2016/03/13	10	1315	ML/BH	2	✓	✓	1mL	30 minutes	ML	JK
2016/03/14	11	1330	HS/JN	2	✓	✓	1mL	60 minutes	JN	HS
2016/03/15	12	1100	ML/HS	2	✓	✓	1mL	30 minutes	HS	ML
2016/03/16	13	1130	DS/ML	2	✓	✓	1mL	30 minutes	ML	DS
2016/03/17	14	1130	EP/ML	2	✓	✓	1.5mL	30 minutes	ML	HS
2016/03/18	15	0940	JW/EP	2	✓	✓	1.5mL	30 minutes	JW	HS
2016/03/19	16	0950	JW/EP	2	✓	✓	1.5mL	30 minutes	JW	DS
2016/03/20	17	1040	JN/BH	2	✓	✓	1.5mL	30 minutes	JN	HS
2016/03/21	18	1130	JN/EP	2	✓	✓	1.5mL	30 minutes	EP	JN
2016/03/22	19	1030	DS/EP	2	✓	✓	1.5mL	30 minutes	EP	DS
2016/03/23	20	1030	JW/EP	2	✓	✓	1.5mL	30 minutes	JW	EP
2016/03/24	21	1000	EP	2	✓	✓	1.5mL	30 minutes	ML	JN
2016/03/25	22	1230	JW/ML	2	✓	✓	1.5mL	30 minutes	JW	ML
2016/03/26	23	1130	ML/JW	2	✓	✓	2mL	30 minutes	ML	JW
2016/03/27	24	1010	JN	2	✓	✓	2mL	30 minutes	JN	HS
2016/03/28	25	1130	DS/EP	2	✓	✓	2mL	30 minutes	DS	EP
2016/03/29	26	1330	DS/HS	2	✓	✓	2mL	30 minutes	DS	HS
2016/03/30	27	1130	JN/EP	2	✓	✓	2mL	30 minutes	JN	EP
2016/03/31	28	1300	ML/EP	2	✓	✓	2mL	30 minutes	ML	HS
2016/04/01	29	1100	JW/EP	2	✓	✓	2mL	30 minutes	JW	CQ
2016/04/02	30	1240	JW/ML	2	✓	✓	2mL	30 minutes	ML	JW
2016/04/03	31	1310	JN/BH	2	✓	✓	2mL	30 minutes	JN	HS
2016/04/04	32	1320	JN/EP	2	-	-	-	-	JN	EP

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Control hatching success must be >66% (≥10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

	LAB CTL		16-0248		16-0249		16-0250		16-0251	
	Day 1		Day 1		Day 1		Day 1		Day 1	
replicate	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos
a	15	0	15	0	15	0	15	0	15	0
b	15	0	15	0	15	0	15	0	15	0
c	15	0	15	0	15	0	15	0	15	0
d	15	0	15	0	15	0	15	0	15	0
e	30	0	30	0	30	0	29	1	26	4
f	30	0	30	0	30	0	28	2	27	3

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

	LAB CTL			16-0248			16-0249			16-0250		
	Day 2			Day 2			Day 2			Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	14	1	15	13	2	15	15	0	15	15	0	15
b	12	3	15	12	3	15	15	0	15	10	5	15
c	13	2	15	14	1	15	13	2	15	13	2	15
d	13	2	15	14	1	15	11	4	15	11	4	15
e	28	2		23	7		28	2		27	2	
f	27	3		26	4		26	4		20	8	

	16-0251		
	Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15
a	15	0	15
b	12	3	15
c	15	0	15
d	12	3	15
e	21	5	
f	25	2	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2

Comments/Observations:

Nautilus Environmental

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL		16-0248		16-0249		16-0250		16-0251	
	Day 3		Day 3		Day 3		Day 3		Day 3	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	6	9	6	9	13	2	4	11	12	3
b	13	2	7	8	11	4	8	7	11	4
c	13	2	4	11	9	6	4	11	8	7
d	13	2	4	11	12	3	6	8	3	12

Comments/Observations:

	LAB CTL		16-0248		16-0249		16-0250		16-0251	
	Day 4		Day 4		Day 4		Day 4		Day 4	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	0	15	1	14	0	15	1	14	3	12
b	0	15	0	14	0	15	2	13	0	15
c	1	14	0	15	0	14	1	14	0	15
d	0	15	3	12	0	15	0	12	1	14

Comments/Observations:

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 5	Day 5	Day 5	Day 5	Day 5
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	15	15	15
b	15	14	15	14	15
c	15	15	14	15	15
d	15	15	15	12	15

Comments/Observations:

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 6	Day 6	Day 6	Day 6	Day 6
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	15	14	15
b	15	14	15	13	15
c	15	15	14	15	15
d	15	15	15	12	15

Comments/Observations:

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 7	Day 7	Day 7	Day 7	Day 7
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	15	14	15
b	14(2)	14	15	13	15
c	15(2)	15	14	15	15
d	13(2)	14	15	10	15(1)

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 8	Day 8	Day 8	Day 8	Day 8
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	15	14	15
b	14	13	15	13 (1)	15
c	15 (1)	15	14	15	15
d	13(2)	14(1)	14	10	15(1)

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 9	Day 9	Day 9	Day 9	Day 9
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	15	14	14
b	13 (1)	13	15	13(1)	15
c	15(2)	15	14	15	15
d	13(2)	14(1)	14	10	15(1)

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 10	Day 10	Day 10	Day 10	Day 10
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	15(1)	14	14
b	13(1)	13	15	13(1)	15
c	15(2)	15	14	15	15
d	13(2)	14(1)	14	10	15(1)

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 11	Day 11	Day 11	Day 11	Day 11
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	15	14	14
b	13	13	15	13(1)	15
c	15	15	14	15	15
d	11	14(1)	14	10	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 12	Day 12	Day 12	Day 12	Day 12
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	15	14	13
b	13	13	15	13(1)	15
c	15	15	14	15	15
d	11	14(1)	14	10	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 13	Day 13	Day 13	Day 13	Day 13
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	15	14	12
b	12	13	15	13(1)	14(1)
c	15	15	14	15	15
d	10	14(1)	14	10	15(1)

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 14	Day 14	Day 14	Day 14	Day 14
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	15	14	12
b	12	13	15	13(1)	14
c	15	15	14	15	15
d	10	13	14	10	15(2)

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 15	Day 15	Day 15	Day 15	Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	11	15	15	14	12
b	12	13	15	13(1)	14
c	15(1)	15	14	14	15
d	10	13	14	10	15(1)

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 16	Day 16	Day 16	Day 16	Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	10	15	15	14	12(1)
b	12	13	15	13(1)	14
c	15(1)	15	14	11	15
d	10	13	14	10	15(1)

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 17	Day 17	Day 17	Day 17	Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	10	15	15	14	12(1)
b	12	13	15	12	14
c	15	15	14	11(1)	15(1)
d	10	13	14	10	14

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 18	Day 18	Day 18	Day 18	Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	10	15	15	14	12
b	12	13	15	12	14
c	15(1)	15	14	11	15
d	10	13	14	10	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 19	Day 19	Day 19	Day 19	Day 19
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	10	15	15	14	12
b	12(1)	13	15	12	14
c	14(1)	15	14	11(3)	15
d	10	13	14	10	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 20	Day 20	Day 20	Day 20	Day 20
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	9	15	15	14	12
b	12	13	15	12	14
c	13(1)	15	14	11(3)	15
d	10	13	14	10	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 21	Day 21	Day 21	Day 21	Day 21
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	9	15	15	14	12
b	12	15	15	12	14
c	11	15	14	11(3)	15
d	9	13	14	10	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour. Large variation in size in replicates 16-0251 c and d.

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 22	Day 22	Day 22	Day 22	Day 22
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	9	15	15	14	12
b	12(1)	15	15	12	14
c	11	15	14	11(3)	15
d	9	13	14	10	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviourLots of size variability in all control jars. 16-0250 repilcate c stressed/abnormal fish have bent tails.

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 23	Day 23	Day 23	Day 23	Day 23
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	9	15	15	14	12
b	11	13	15	12	14
c	11	15	14	11(1)	15(1)
d	9(1)	13	14	10	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 24	Day 24	Day 24	Day 24	Day 24
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	9	15	15	14	12
b	11	13	15	12	14
c	11	15	14	11	12
d	9	13	14	10	13

Comments/Observations:

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 25	Day 25	Day 25	Day 25	Day 25
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	9	15	15	13	12
b	11	13	15	12	14
c	11	15	14	11	12
d	9	13	14	10	12

Comments/Observations:

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 26	Day 26	Day 26	Day 26	Day 26
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	9	15	15	13	12
b	11	13	15	12	12
c	11	15	14	11	12
d	9(1)	13	14	10	12

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	9	15	15	13	12
b	11	13	15	12	11
c	11	15	14	11	12
d	9(1)	13	14	10	12

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	8	15	15	13	12
b	11(2)	13	15	12	9
c	11	15	14	11	12
d	8	13	14	10	12

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	8	15	15	13	12
b	11(2)	13	15	12	9
c	11	15	14	11(1)	12
d	8	13	14	10	12

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour. 16-0250 replicate C, one fish body is bent.

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	8	15	15	13	12
b	11(1)	13	15	12	9
c	11	15	14	11	12
d	7	13	14	10	12

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 31	Day 31	Day 31	Day 31	Day 31
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	8(1)	15	15	13	12
b	8	13	15	12	8
c	11	15	14	11	12
d	7	13	14	10	12

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-0248	16-0249	16-0250	16-0251
	Day 32	Day 32	Day 32	Day 32	Day 32
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	8	15	15	13	12
b	8	13	15	12	8
c	11	15	14	11	12
d	7	13	14	10	12

Comments/Observations:

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

New Solutions

Conc. (%) / Day	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
0	8.0	8.4	8.4	8.4	8.3		
1	7.9	8.3	8.3	8.3	8.3		
2	8.2	8.4	8.4	8.4	8.4		
3	8.1	8.3	8.2	8.2	8.3		
4	8.1	8.3	8.2	8.2	8.4		
5	8.1	8.2	8.1	8.2	8.2		
6	7.8	8.0	7.9	8.0	8.1		
7	8.1	8.3	8.3	8.2	8.4		
8	8.0	8.2	8.2	8.1	8.3		
Conductance (µS/cm)							
0	306	820	770	1479	343		
1	309	825	784	1451	355		
2	309	792	747	1386	360		
3	311	802	753	1423	346		
4	316	790	750	1416	352		
5	317	783	744	1410	348		
6	320	844	830	1525	363		
7	320	843	833	1275	364		
8	324	844	802	1268	369		
Dissolved Oxygen (mg/L) (40-100% saturation)							
0	7.3	7.3	7.3	7.3	7.2		
1	7.3	7.3	7.3	7.3	7.3		
2	7.2	7.2	7.3	7.3	7.3		
3	6.9	7.1	7.1	7.1	7.1		
4	7.2	7.3	7.2	7.2	7.2		
5	7.3	7.2	7.2	7.2	7.2		
6	7.2	7.2	7.3	7.2	7.2		
7	7.0	7.1	7.2	7.2	7.2		
8	7.3	7.3	7.3	7.3	7.2		
Temperature (°C)							
0	24	24	24	24	24		
1	24	24	24	24	24		
2	25	24	24	24	24		
3	26	25	26	26	26		
4	24	24	25	25	25		
5	24	25	25	25	25		
6	25	25	24	25	25		
7	25	25	24	25	25		
8	24	24	24	24	25		

Old Solutions

Day	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
0							
1	7.7	8.2	8.3	8.0	8.2		
2	7.9	8.2	8.3	8.1	8.4		
3	8.0	8.1	8.1	8.1	8.4		
4	7.9	8.0	8.0	8.1	8.4		
5	7.5	7.9	8.0	7.9	8.3		
6	7.9	8.1	8.0	7.8	8.3		
7	7.9	8.1	8.1	8.1	8.3		
8	7.9	8.2	8.1	8.1	8.4		
Conductance (µS/cm)							
0							
1	304	796	757	1381	341		
2	303	786	782	1441	411		
3	303	776	760	1390	425		
4	311	754	746	1381	360		
5	311	773	765	1423	368		
6	342	793	785	1518	368		
7	324	821	815	1461	446		
8	310	761	779	1297	377		
Dissolved Oxygen (mg/L) (40-100% saturation)							
0							
1	7.3	7.2	7.3	7.2	7.3		
2	7.3	7.1	7.1	7.0	7.1		
3	6.8	6.8	6.8	6.9	6.9		
4	6.9	6.9	6.9	7.0	7.1		
5	6.9	6.8	6.7	6.9	6.7		
6	7.5	7.3	7.1	6.3	7.0		
7	7.1	7.2	7.2	7.1	7.1		
8	7.3	7.2	7.3	7.3	7.3		
Temperature (°C)							
0							
1	24	24	24	24	24		
2	24	24	24	24	24		
3	24	24	24	24	24		
4	24	24	24	24	24		
5	24	24	24	24	24		
6	24	24	24	24	24		
7	24	24	24	24	24		
8	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C

4.5 to 7.2 mg/L at 25°C

4.3 to 7.1 mg/L at 26°C

Comments:

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

New Solutions

Conc. (%) / Day	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
9	8.1	8.2	8.3	8.2	8.3		
10	8.0	8.2	8.2	8.2	8.3		
11	8.0	8.1	8.1	8.0	8.2		
12	8.1	8.2	8.2	8.1	8.3		
13	8.1	8.1	8.2	8.1	8.4		
14	8.0	8.3	8.3	8.2	8.4		
15	7.9	8.1	8.1	8.0	8.1		
16	8.0	8.1	8.2	8.0	8.3		
17	8.0	8.2	8.2	8.1	8.3		
Conductance (µS/cm)							
9	322	829	837	1270	361		
10	313	841	814	1264	361		
11	319	843	831	1254	367		
12	328	835	806	1227	360		
13	328	876	863	1324	379		
14	331	880	872	1298	380		
15	330	877	863	1297	380		
16	334	875	867	1295	378		
17	329	825	840	1239	385		
Dissolved Oxygen (mg/L) (40-100% saturation)							
9	7.2	7.2	7.2	7.3	7.3		
10	7.5	7.3	7.3	7.3	7.3		
11	7.2	7.2	7.2	7.3	7.2		
12	7.3	7.3	7.3	7.2	7.2		
13	7.2	7.3	7.2	7.2	7.2		
14	7.3	7.3	7.2	7.2	7.2		
15	7.3	7.3	7.3	7.3	7.3		
16	7.3	7.3	7.3	7.3	7.3		
17	7.3	7.3	7.3	7.2	7.2		
Temperature (°C)							
9	24	24	24	24	24		
10	24	24	24	24	24		
11	24	24	24	24	25		
12	24	24	24	25	24		
13	25	24	25	25	25		
14	24	24	25	25	25		
15	24	25	25	25	25		
16	24	25	25	25	25		
17	24	24	24	25	25		

Old Solutions

Day	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
9	8.0	8.3	8.1	8.1	8.4		
10	7.9	8.2	8.1	7.9	8.3		
11	7.9	8.0	8.0	8.0	8.2		
12	7.9	8.0	8.1	8.1	8.4		
13	7.8	8.1	8.2	8.2	8.4		
14	8.0	8.2	8.2	8.1	8.4		
15	7.8	8.0	8.1	8.0	8.2		
16	8.0	8.2	8.1	8.0	8.3		
17	8.1	8.1	8.0	8.0	8.4		
Conductance (µS/cm)							
9	320	767	796	1253	366		
10	336	765	802	1242	370		
11	335	764	799	1182	390		
12	334	754	799	1202	387		
13	334	797	795	1112	397		
14	341	799	817	1251	381		
15	323	814	802	1236	400		
16	320	778	762	1235	367		
17	331	787	823	1206	399		
Dissolved Oxygen (mg/L) (40-100% saturation)							
9	7.2	7.3	7.3	7.3	7.2		
10	7.3	7.3	7.3	7.3	7.3		
11	7.3	7.3	7.2	7.3	7.3		
12	7.3	7.3	7.3	7.3	7.3		
13	7.2	7.2	7.3	7.3	7.3		
14	7.3	7.3	7.3	7.3	7.3		
15	7.1	7.1	7.3	7.3	7.1		
16	7.7	7.5	7.6	7.4	7.7		
17	7.5	7.4	7.4	7.5	7.3		
Temperature (°C)							
9	24	24	24	24	24		
10	24	24	24	24	24		
11	24	24	24	24	24		
12	24	24	24	24	24		
13	24	24	24	24	24		
14	24	24	24	24	24		
15	24	24	24	24	24		
16	24	24	24	24	24		
17	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

New Solutions

Conc. (%)	LAB CTL	16-0248	16-0249	16-0250	16-0251		
Day							
pH (units)							
18	8.0	8.2	8.2	8.1	8.3		
19	8.0	8.2	8.2	8.2	8.3		
20	8.0	8.1	8.2	8.1	8.1		
21	8.1	8.2	8.2	8.2	8.3		
22	8.0	8.0	8.1	8.0	8.3		
23	8.2	8.2	8.2	8.2	8.3		
24	8.1	8.2	8.2	8.2	8.3		
25	8.1	8.2	8.1	8.2	8.4		
26	8.0	8.1	8.0	8.0	8.2		
Conductance (µS/cm)							
18	337	844	832	1229	371		
19	340	870	835	1260	385		
20	330	843	828	1243	366		
21	319	880	875	1255	357		
22	320	849	847	1216	357		
23	322	868	865	1240	360		
24	324	858	820	1226	353		
25	327	858	863	1228	360		
26	330	839	855	1208	355		
Dissolved Oxygen (mg/L) (40-100% saturation)							
18	7.3	7.2	7.3	7.3	7.2		
19	7.3	7.3	7.3	7.3	7.2		
20	7.3	7.3	7.2	7.2	7.2		
21	7.3	7.3	7.2	7.3	7.3		
22	7.2	7.2	7.2	7.2	7.1		
23	7.3	7.2	7.1	7.1	7.2		
24	7.2	7.2	7.3	7.2	7.2		
25	7.2	7.2	7.3	7.2	7.2		
26	7.3	7.3	7.4	7.2	7.2		
Temperature (°C)							
18	24	25	24	24	25		
19	24	24	24	24	25		
20	24	24	25	25	25		
21	24	24	24	24	24		
22	25	25	25	25	26		
23	24	25	26	26	25		
24	25	25	24	25	25		
25	25	25	23	25	25		
26	24	24	25	25	25		

Old Solutions

	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
18	7.8	8.1	8.2	7.9	8.3		
19	7.8	8.1	8.1	8.1	8.4		
20	8.1	8.1	8.1	8.3	8.3		
21	8.0	8.2	8.2	8.1	8.4		
22	7.9	8.1	8.0	8.1	8.2		
23	7.9	8.1	8.1	8.0	8.3		
24	8.1	8.1	8.2	8.1	8.3		
25	7.9	8.1	8.1	8.0	8.0		
26	7.9	8.0	8.0	7.9	8.1		
Conductance (µS/cm)							
18	330	758	754	1194	370		
19	339	836	813	1230	398		
20	333	792	791	1179	351		
21	342	793	788	1158	394		
22	328	765	813	1133	391		
23	324	773	800	1133	398		
24	323	810	767	1117	353		
25	331	824	801	1175	377		
26	338	780	827	1170	394		
Dissolved Oxygen (mg/L) (40-100% saturation)							
18	7.3	7.2	7.3	7.3	7.2		
19	7.0	6.6	7.2	7.2	7.1		
20	7.3	7.3	7.3	7.2	7.2		
21	7.3	7.2	7.2	7.1	7.1		
22	7.0	7.0	7.0	7.0	7.1		
23	7.3	7.3	7.3	7.3	7.3		
24	7.2	7.2	7.3	7.3	7.4		
25	7.0	7.0	7.0	7.0	7.0		
26	7.3	7.2	7.3	7.2	7.2		
Temperature (°C)							
18	24	24	24	24	24		
19	24	24	24	24	24		
20	24	24	24	24	24		
21	24	24	24	24	24		
22	24	24	24	24	24		
23	24	24	24	24	24		
24	24	24	24	24	24		
25	24	24	24	24	24		
26	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments: temperature out of range (23°C) for 16-0249 new solution on day 25

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

New Solutions

Conc. (%)	LAB CTL	16-0248	16-0249	16-0250	16-0251		
Day							
pH (units)							
27	8.1	8.1	8.2	8.0	8.3		
28	8.1	8.2	8.2	8.2	8.3		
29	8.1	8.1	8.2	8.2	8.2		
30	8.1	8.1	8.1	8.1	8.2		
31	8.1	8.1	8.1	8.1	8.3		
32							
Conductance (µS/cm)							
27	357	919	924	1291	374		
28	337	929	911	1250	363		
29	332	931	910	1225	364		
30	337	927	906	1241	359		
31	332	911	862	1193	353		
32							
Dissolved Oxygen (mg/L) (40-100% saturation)							
27	7.3	7.2	7.1	7.1	7.2		
28	7.2	7.2	7.2	7.2	7.2		
29	7.2	7.2	7.1	7.2	7.2		
30	7.2	7.1	7.0	7.1	7.1		
31	7.2	7.2	7.2	7.2	7.1		
32							
Temperature (°C)							
27	23	25	26	26	25		
28	25	25	25	25	25		
29	25	25	26	25	25		
30	25	26	26	26	26		
31	25	25	25	25	26		
32							

Old Solutions

	LAB CTL	16-0248	16-0249	16-0250	16-0251		
pH (units)							
27	7.8	8.0	8.0	8.0	8.3		
28	8.0	8.1	8.2	8.1	8.2		
29	7.7	8.1	8.2	8.1	8.2		
30	7.8	8.1	8.1	8.1	8.2		
31	7.8	8.0	8.1	8.0	8.2		
32	7.3	8.0	8.0	8.0	8.0		
Conductance (µS/cm)							
27	345	871	868	1258	375		
28	384	881	873	1214	380		
29	339	860	867	1178	360		
30	345	829	855	1128	408		
31	337	868	822	1151	361		
32	335	845	846	1132	381		
Dissolved Oxygen (mg/L) (40-100% saturation)							
27	7.2	7.1	7.0	7.1	7.4		
28	7.3	7.3	7.3	7.3	7.3		
29	7.0	6.9	6.9	7.0	7.2		
30	7.1	7.1	7.1	7.1	7.1		
31	7.1	7.1	7.1	7.2	7.2		
32	6.8	6.8	7.2	7.3	7.3		
Temperature (°C)							
27	24	24	24	24	24		
28	24	24	24	24	24		
29	24	24	24	24	24		
30	24	24	24	24	24		
31	24	24	24	24	24		
32	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments: temperature out of range (23oC) for the control new solution on day 27

Nautilus Environmental

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

LAB CTL

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	13	Normal	1	10	Normal	1	10	Normal	1	12	Normal
2	11	Normal	2	10	Normal	2	10	Normal	2	11	Normal
3	11	Normal	3	13	Normal	3	10	Normal	3	12	Normal
4	11	Normal	4	12	Normal	4	13	Normal	4	7	Normal
5	13	Normal	5	7	Normal	5	10	Normal	5	7	Normal
6	6	Normal	6	7	Normal	6	6	Normal	6	8	Normal
7	6	Normal	7	7	Normal	7	7	Normal	7	7	Normal
8	8	Normal	8	*	*	8	7	Normal	8	-	-
9	-	-	9	-	-	9	8	Normal	9	-	-
10	-	-	10	-	-	10	7	Normal	10	-	-
11	-	-	11	-	-	11	*	*	11	-	-
12	-	-	12	-	-	12	-	-	12	-	-
13	-	-	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments: one fathead minnow was lost during takedown in the control replicate b and c prior to measurements and observations being made

16-0248

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	8	Normal	1	9	Normal	1	10	Normal	1	8	Normal
2	7	Normal	2	8	Normal	2	9	Normal	2	6	Normal
3	10	Normal	3	8	Normal	3	8	Normal	3	8	Normal
4	8	Normal	4	8	Normal	4	8	Normal	4	10	Normal
5	8	Normal	5	9	Normal	5	10	Normal	5	5	Normal
6	8	Normal	6	9	Normal	6	9	Normal	6	9	Normal
7	9	Normal	7	8	Normal	7	8	Normal	7	9	Normal
8	8	Normal	8	8	Normal	8	8	Normal	8	8	Normal
9	10	Normal	9	10	Normal	9	7	Normal	9	9	Normal
10	9	Normal	10	9	Normal	10	7	Normal	10	9	Normal
11	8	Normal	11	6	Normal	11	9	Normal	11	9	Normal
12	8	Normal	12	10	Normal	12	8	Normal	12	10	Normal
13	9	Normal	13	7	Normal	13	9	Normal	13	10	Normal
14	8	Normal	14	-	-	14	8	Normal	14	-	-
15	6	Normal	15	-	-	15	8	Normal	15	-	-

Comments:

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Test Termination

For normal/abnormal column, use the following notation:
N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

16-0249

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	Normal	1	10	Normal	1	9	Normal	1	8	Normal
2	8	Normal	2	9	Normal	2	8	Normal	2	9	Normal
3	7	Normal	3	8	Normal	3	7	Normal	3	9	Normal
4	8	Normal	4	9	Normal	4	9	Normal	4	8	Normal
5	7	Normal	5	8	Normal	5	11	Normal	5	9	Normal
6	8	Normal	6	7	Normal	6	8	Normal	6	9	Normal
7	8	Normal	7	9	Normal	7	8	Normal	7	9	Normal
8	10	Normal	8	9	Normal	8	10	Normal	8	9	Normal
9	9	Normal	9	10	Normal	9	8	Normal	9	7	Normal
10	8	Normal	10	9	Normal	10	7	Normal	10	8	Normal
11	9	Normal	11	8	Normal	11	6	Normal	11	8	Normal
12	7	Normal	12	9	Normal	12	9	Normal	12	8	Normal
13	9	Normal	13	9	Normal	13	8	Normal	13	9	Normal
14	10	Normal	14	8	Normal	14	8	Normal	14	9	Normal
15	9	Normal	15	9	Normal	15	-	-	15	-	-

Comments

16-0250

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	Normal	1	9	Normal	1	9	Normal	1	9	Normal
2	9	Normal	2	9	Normal	2	8	Normal	2	11	Normal
3	10	Normal	3	9	Normal	3	8	Normal	3	10	Normal
4	8	Normal	4	6	Normal	4	7	Normal	4	9	Normal
5	9	Normal	5	7	Normal	5	8	Normal	5	9	Normal
6	8	Normal	6	9	Normal	6	8	Normal	6	10	Normal
7	8	Normal	7	8	Normal	7	10	Abnormal - S	7	9	Normal
8	9	Normal	8	7	Normal	8	8	Normal	8	8	Normal
9	8	Normal	9	9	Normal	9	12	Normal	9	11	Normal
10	7	Normal	10	11	Normal	10	10	Normal	10	10	Normal
11	11	Normal	11	7	Normal	11	7	Normal	11	-	-
12	10	Normal	12	7	Normal	12	-	-	12	-	-
13	9	Normal	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments: C7 Bent body

Nautilus Environmental

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0248, 16-0249, 16-0250, 16-0251

Test Termination

For normal/abnormal column, use the following notation:
N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. **16-0251**

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	12	Normal	1	10	Normal	1	11	Normal	1	8	Normal
2	9	Normal	2	8	Normal	2	10	Normal	2	10	Normal
3	10	Normal	3	7	Normal	3	19	Normal	3	9	Normal
4	10	Normal	4	7	Normal	4	9	Normal	4	8	Normal
5	10	Normal	5	8	Normal	5	9	Normal	5	11	Normal
6	9	Normal	6	9	Normal	6	8	Normal	6	10	Normal
7	7	Normal	7	7	Normal	7	9	Normal	7	7	Normal
8	9	Normal	8	9	Normal	8	8	Normal	8	10	Normal
9	10	Normal	9	-	-	9	9	Normal	9	8	Normal
10	9	Normal	10	-	-	10	8	Normal	10	7	Normal
11	10	Normal	11	-	-	11	8	Normal	11	10	Normal
12	10	Normal	12	-	-	12	7	Normal	12	10	Normal
13	-	-	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

Nautilus Environmental

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-0248, 16-0249, 16-0250, 16-0251

Initial Weight (mg) (dried pan)

			Date:	2016/03/30	Initials:	JW	Balance:	Mettler #1
Conc.	LAB CTL	16-0248	16-0249	16-0250	16-0251			
Replicate								
a	988.70	991.47	1006.21	1011.26	987.84			
b	994.23	976.91	973.04	984.93	984.64			
c	995.60	1009.01	936.51	986.14	989.55			
d	1010.65	995.71	964.47	982.15	987.60			
e								

Final Weight (mg) (dried pan+organisms)

			Date:	2016/04/05	Initials:	EP	Balance:	Mettler #1
Conc.	LAB CTL	16-0248	16-0249	16-0250	16-0251			
Replicate								
a	1008.95	1009.52	1024.87	1032.11	1013.42			
b	1015.60	995.59	994.01	1006.08	996.02			
c	1014.84	1027.43	958.40	1006.19	1012.00			
d	1031.46	1014.65	983.48	1007.66	1011.71			
e								

Nautilus Environmental

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-0248, 16-0249, 16-0250, 16-0251

Organism weight per replicate (mg)

Dose	LAB CTL	16-0248	16-0249	16-0250	16-0251			
replicate								
a	20.25	18.05	18.66	20.85	25.58			
b	21.37	18.68	20.97	21.15	11.38			
c	19.24	18.42	21.89	20.05	22.45			
d	20.81	18.94	19.01	25.51	24.11			
e								

Dry Weight per Fish (mg)

Dose	LAB CTL	16-0248	16-0249	16-0250	16-0251			
replicate								
a	2.53	1.20	1.24	1.60	2.13			
b	2.67	1.44	1.40	1.76	1.42			
c	1.75	1.23	1.56	1.82	1.87			
d	2.97	1.46	1.36	2.55	2.01			
Average	2.48	1.33	1.39	1.94	1.86			

Nautilus Environmental

32 Day Fathead Minnow Data Summary

Method FMD 32 Day ELS Client NAU104 Reference: 16-0248, 16-0249, 16-0250, 16-0251

Concentration: LAB CTL

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	53%	53%	10	2.53	0%
b	100%	53%	53%	9	2.67	0%
c	100%	73%	73%	9	1.75	0%
d	100%	47%	47%	9	2.97	0%
Average	**100%**	**57%**	**57%**	**9**	**2.48**	**0%**

Concentration: 16-0248

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	100%	100%	8	1.20	0%
b	93%	93%	87%	8	1.44	0%
c	100%	100%	100%	8	1.23	0%
d	100%	87%	87%	8	1.46	0%
Average	**98%**	**95%**	**93%**	**8**	**1.33**	**0%**

Concentration: 16-0249

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	100%	100%	8	1.24	0%
b	100%	100%	100%	9	1.40	0%
c	93%	100%	93%	8	1.56	0%
d	100%	93%	93%	9	1.36	0%
Average	**98%**	**98%**	**97%**	**8**	**1.39**	**0%**

Concentration: 16-0250

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	87%	87%	9	1.60	0%
b	93%	86%	80%	8	1.76	0%
c	100%	73%	73%	9	1.82	9%
d	80%	83%	67%	10	2.55	0%
Average	**93%**	**82%**	**77%**	**9**	**1.94**	**2%**

Concentration: 16-0251

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	80%	80%	10	2.13	0%
b	100%	53%	53%	8	1.42	0%
c	100%	80%	80%	10	1.87	0%
d	100%	80%	80%	9	2.01	0%
Average	**100%**	**73%**	**73%**	**9**	**1.86**	**0%**

Nautilus Environmental

Warning Chart
Fathead minnow

Test Method: 7 days Fathead minnow Survival and Growth Test (7 treatments plus a control)
HydroQual Test Method: WTR-ME-046
Reference: Biological Test Method: Test of Larval Growth and Survival Using Fathead minnows. Environment Canada, EPS 1/RM/22, Second Edition, February 2011.

Test Organism:

test species:	*Pimephales promelas*
culture source:	Aquatox (Arkansas, USA)
temp of breeding aquaria:	23 - 26 ^{o}C
food type:	newly-hatched brine shrimp nauplii
frequency of feeding:	daily
breeding colony mortality:	<1% (last 7 days)
age of test organisms:	<24 hours
condition prior to test initiation:	normal
batch number:	20160303FM

Test Design:

test type:	static renewal
toxicant:	sodium chloride
test vessel:	polypropylene cups, 11 x 9 cm
volume of test vessel (ml):	500
test volume (ml):	250
depth of test solution:	>3 cm
replicates per treatment:	4 replicates
organisms per replicate:	10
feeding:	twice daily
temperature (^{o}C):	24-26
photoperiod:	16 hours light: 8 hours dark
light level (surface):	100-500 lux (full spectrum)

Control/Dilution Water:

source:	dechlorinated City of Calgary tap water no chemicals were added to the dilution water
pH (units):	7.1
conductance (µS/cm):	392
dissolved oxygen (mg/L):	9.6
NH_4^+ (mg/L):	<0.1
hardness (mg $CaCO_3$/L):	191
alkalinity (mg $CaCO_3$/L):	126
total residual chlorine (mg/L):	<0.01

Comments: None

The test data and results are authorized and verified correct.

Jacklyn Poole

Senior Verifier

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

Warning Chart
Fathead minnow

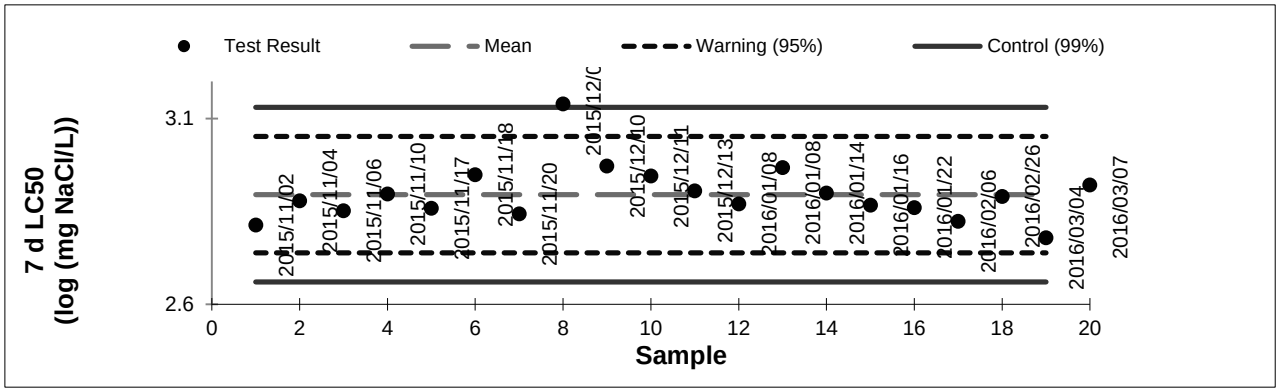
Mortality

Current Test

toxicant	Sodium Chloride (NaCl)				
started on	2016/03/07	ended on	2016/03/14		
Result (7 d LC50):	2.92	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.82	upper	3.01	

Historical Values

mean	2.90	sd	0.08	cv(%):	11.9
	lower	upper			
warning limits (±2 sd)	2.74	3.05	(95% confidence limits)		
control limits (±3 sd)	2.66	3.13	(99% confidence limits)		

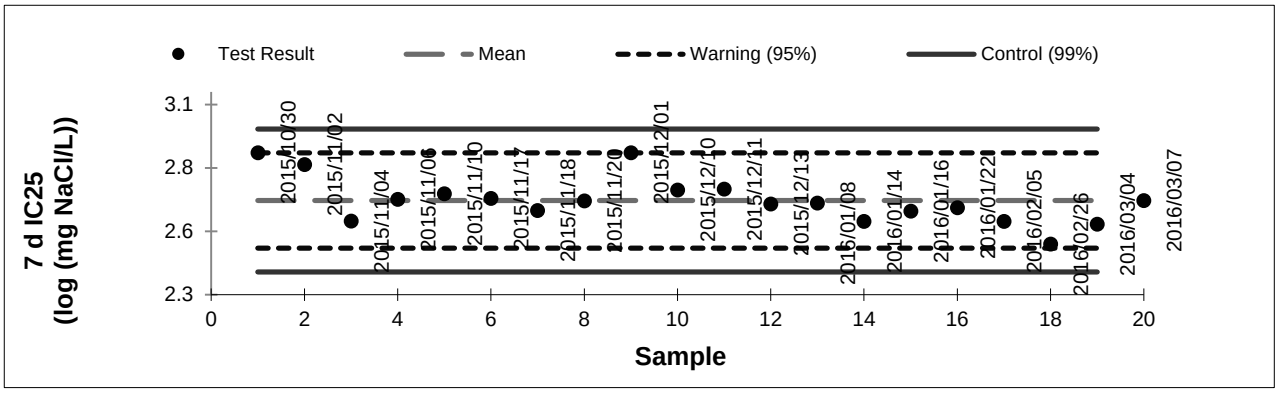


Biomass

started on	2016/03/07	ended on	2016/03/14		
Result (7 d IC25):	2.67	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.58	upper	2.75	

Historical Values

mean	2.67	sd	0.09	cv(%):	14.3
	lower	upper			
warning limits (±2 sd)	2.48	2.86	(95% confidence limits)		
control limits (±3 sd)	2.39	2.95	(99% confidence limits)		



notes: sd, standard deviation; cv, coefficient of variance; N/A, could not be calculated

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
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GENERAL TERMS AND CONDITIONS:

These terms and conditions are incorporated into and form part of the Chain of Custody between HydroQual Laboratories Ltd. ("HydroQual") and the party named in the Chain of Custody (the "Client").

1. **Definitions:** Capitalized terms shall have the definition ascribed as such in these General Terms and Conditions and the Chain of Custody.
2. **The Services:** HydroQual will provide the Services to the Client as listed and described in the Chain of Custody.
3. **Prices:** HydroQual may review and change all prices, fees, surcharges or other charges as set out in proposals and/or price quotations if there are changes to HydroQual's cost beyond HydroQual's control, including changes in legislative requirements, Client variations of sample numbers and Client requests for changes to standard reporting requirements. Notwithstanding condition 3, all quotations are reviewed and updated on a yearly basis.
4. **Payment Terms:** The Client shall pay HydroQual within 30 days of the invoice date as provided by HydroQual. HydroQual may, for reasonable business reasons, require the Client to arrange for payment in advance.
5. **Quotation Numbers:** The Client shall provide the proposal and/or price quotation number to HydroQual (where applicable) to ensure correct pricing.
6. **Taxes:** Applicable taxes are not included in prices, surcharges and additional fees and will be added at the time of invoicing.
7. **No Guarantee of Results:** The Client is responsible for informing itself on the limitation of the results and acknowledges that the results are not guaranteed.
8. **Standard of Care:** HydroQual will use reasonable care and diligence as required by the laws of the province or territory where the sample is tested, subject to that level of care and skill ordinarily exercised by other laboratories currently practicing under similar conditions in the same locality, subject to the time limits and financial, physical or other constraints applicable to the Services. No warranty, express or implied, is made.
9. **Storage:** Where possible, HydroQual will store samples until a final report is issued to the Client, after which time HydroQual may discard the sample.
10. **Holds:** If the Client requests a sample be placed on hold, HydroQual will store the sample for the mutually agreed upon written time and price, after which HydroQual will invoice the Client and discard the sample.
11. **Archives:** If the Client requests a sample be archived, HydroQual will store the sample for a mutually agreed upon written time frame and price, after which HydroQual will invoice the Client and discard the sample.
12. **Handling Protocol:** Legal sample handling protocol must be arranged, and provided in writing, before samples are collected. HydroQual will provide a price quotation for legal sample protocol. Samples processed under legal protocol are stored indefinitely, subject to a storage charge as advised by HydroQual.
13. **Samples:** The quality, condition, content and source of samples stored and tested are not known to HydroQual except as declared and described on the Chain of Custody completed and submitted by the Client and accompanying the sample.
14. **Risk of Loss:** HydroQual will use reasonable care to protect samples during storage, however, all samples are stored at the Client's risk and the Client is responsible for obtaining appropriate insurance, if desired. The Client acknowledges that during the performance of the Services samples may be altered, lost, damaged or destroyed and the client forever releases HydroQual from any and all claims the Client may have for any loss or damage to the sample.
15. **Environmental:** the Client must comply with all applicable environmental legislation, including labeling all hazardous samples to comply with Canada's *Workplace Hazardous Materials Information System* and the Alberta *Transfer of Dangerous Goods* regulations, and must provide appropriate material safety data sheets that include the nature of the hazard and a contact name and phone number to call for information. The Client shall defend, indemnify and hold harmless HydroQual for all loss or damages, including any fine or cost of complying with an order of any government authority, resulting from the Client's breach of this paragraph.
16. **Hazardous Materials Disposal:** HydroQual may return, at the Client's cost, hazardous material to the Client for disposal.
17. **Hazardous Materials Surcharge:** HydroQual may apply an additional surcharge for handling of hazardous samples or samples with Naturally Occurring Radioactive Materials ("NORM"), such as and including without limitation, H_2S and CN.
18. **Sample Containers:** HydroQual may ship sample containers to the Client's location by the most cost effective means using HydroQual's preferred courier suppliers, within the specified project timeline. Shipping will be charged back to the Client.
19. **Additional Charges:** HydroQual may charge the Client:
    (a) for pick-up and delivery services when provided subject in each instance to a minimum charge of $50.00; and,
    (b) for rush service (processing samples and/or reporting).
20. **Large Bottle Orders:** The Client shall provide HydroQual with not less than 24 hours' notice for large bottle orders.
21. **Re-Tests:** HydroQual reserves the right to re-test any samples that remain in HydroQual's possession. Re-tests requested by the Client may be charged to Client and Client agrees to pay for such charges.
22. **Waiver:** The Client is responsible for making any assessment regarding the suitability of the Services and the intended results for the Client's purposes and waives any and all claims against HydroQual that the Client may have against HydroQual as a result of the interpretation of the results provided to the Client. The Client shall defend, indemnify and save harmless HydroQual for any and all claims made by any third party against HydroQual in respect of all losses however arising from the performance of the Services or the use of any report provided in the performance of the Services.
23. **LIMITATION OF LIABILITY:** IN NO EVENT SHALL HYDROQUAL BE RESPONSIBLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY OR PUNITIVE DAMAGES, WHETHER FORESEEABLE OR UNFORESEEABLE (INCLUDING CLAIMS FOR LOSS OF PROFITS OR REVENUE OR LOSSES CAUSED BY STOPPAGE OF OTHER WORK OR IMPAIRMENT OF OTHER ASSETS) INCURRED BY THE CLIENT ARISING OUT OF BREACH OR FAILURE OF EXPRESS OF IMPLIED WARRANTY, BREACH OF CONTRACT, BREACH OF WARRANTY, MISREPRESENTATION, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE. IN ANY EVENT, THE LIABILITY OF HYDROQUAL TO THE CLIENT SHALL BE LIMITED TO THE COST OF TESTING THE SAMPLE AS REQUESTED IN THE CHAIN OF CUSTODY UNDER WHICH THE SAMPLE WAS ORIGINALLY DEPOSITED. FOR THE PURPOSES OF THIS PARAGRAPH AND PARAGRAPHS 7, 14, 15, 22, AND 24, AS APPLICABLE, "HYDROQUAL" INCLUDES WITHOUT LIMITATIONS ITS DIRECTORS, OFFICERS, EMPLOYEES AND AFFILIATES AND THE "CLIENT" INCLUDES WITHOUT LIMITATION ANY THIRD PARTY THAT MAY HAVE A CLAIM AGAINST HYDROQUAL THROUGH THE CLIENT.
24. **Notice of Liability:** Notwithstanding paragraph 23, HydroQual shall not be liable to the Client unless the Client provides notice in writing to HydroQual of such loss or damage, together with full particulars thereof, within 30 days of the Client's receipt of the report of the analysis of the sample giving rise to such liability. The provisions of this paragraph allocate the risk between the Client and HydroQual, and the fees to be paid by the Client to HydroQual reflect this allocation of any such risks and the limitations of liability in these General Terms and Conditions.
25. **Entire Agreement:** These General Terms and Conditions, the Chain of Custody and price quotations constitute the entire agreement between the parties and supersede and take precedence over any terms and conditions contained in any documentation provided by the Client. HydroQual's execution of any subsequent documentation from the Client only acknowledges receipt and not acceptance of any terms or conditions therein unless expressly stipulated otherwise by HydroQual. If there is a conflict between these General Terms and Conditions and any other document, these General Terms and Conditions prevail.

CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Hatched Rate Summary

C-%	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	4	0.9333	0.7833	1	0.8	1	0.04714	0.09428	10.1%	6.67%
GH_FR1	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	1.67%
CM_MC2	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	1.67%

Length-mm Summary

C-%	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	9.312	8.587	10.04	8.8	9.875	0.2275	0.4551	4.89%	0.0%
FR_UFR1	4	9.073	7.976	10.17	8.125	9.583	0.3446	0.6892	7.6%	2.56%
FR_FRCP1	4	8.812	7.862	9.762	8.167	9.6	0.2985	0.5971	6.78%	5.36%
GH_FR1	4	8.48	8.177	8.783	8.286	8.733	0.09518	0.1904	2.25%	8.93%
CM_MC2	4	8.378	8.249	8.508	8.267	8.462	0.04072	0.08145	0.97%	10.02%

Mean Dry Biomass-mg Summary

C-%	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	1.361	1.265	1.458	1.283	1.425	0.03028	0.06056	4.45%	0.0%
FR_UFR1	4	1.392	0.7066	2.077	0.7587	1.705	0.2154	0.4307	30.94%	-2.27%
FR_FRCP1	4	1.459	1.199	1.72	1.337	1.701	0.08192	0.1638	11.23%	-7.21%
GH_FR1	4	1.342	1.178	1.507	1.244	1.459	0.05171	0.1034	7.71%	1.4%
CM_MC2	4	1.235	1.195	1.275	1.203	1.263	0.01266	0.02532	2.05%	9.28%

Proportion Normal Summary

C-%	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	4	0.9773	0.9049	1	0.9091	1	0.02273	0.04545	4.65%	2.27%
GH_FR1	4	1	1	1	1	1	0	0	0.0%	0.0%
CM_MC2	4	1	1	1	1	1	0	0	0.0%	0.0%

Survival Rate Summary

C-%	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	0.5667	0.3829	0.7504	0.4667	0.7333	0.05774	0.1155	20.38%	0.0%
FR_UFR1	4	0.7333	0.5212	0.9455	0.5333	0.8	0.06667	0.1333	18.18%	-29.41%
FR_FRCP1	4	0.7667	0.6297	0.9036	0.6667	0.8667	0.04303	0.08607	11.23%	-35.29%
GH_FR1	4	0.9667	0.9054	1	0.9333	1	0.01925	0.03849	3.98%	-70.59%
CM_MC2	4	0.9333	0.8108	1	0.8667	1	0.03849	0.07698	8.25%	-64.71%

Control = Copper Control

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	0.9333	1	0.8
GH_FR1	1	1	0.9333	1
CM_MC2	1	0.9333	1	1

Length-mm Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	9.875	9.429	8.8	9.143
FR_UFR1	9.583	8.125	9.583	9
FR_FRCP1	8.846	8.167	8.636	9.6
GH_FR1	8.4	8.733	8.286	8.5
CM_MC2	8.267	8.385	8.4	8.462

Mean Dry Biomass-mg Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	1.35	1.425	1.283	1.387
FR_UFR1	1.705	0.7587	1.497	1.607
FR_FRCP1	1.39	1.41	1.337	1.701
GH_FR1	1.244	1.398	1.459	1.267
CM_MC2	1.203	1.245	1.228	1.263

Proportion Normal Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	0.9091	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

Survival Rate Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.5333	0.5333	0.7333	0.4667
FR_UFR1	0.8	0.5333	0.8	0.8
FR_FRCP1	0.8667	0.8	0.7333	0.6667
GH_FR1	1	1	0.9333	0.9333
CM_MC2	1	0.8667	1	0.8667

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Binomials

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	15/15	15/15	15/15	15/15
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	12/15
GH_FR1	15/15	15/15	14/15	15/15
CM_MC2	15/15	14/15	15/15	15/15

Proportion Normal Binomials

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	8/8	8/8	11/11	7/7
FR_UFR1	12/12	8/8	12/12	12/12
FR_FRCP1	13/13	12/12	10/11	10/10
GH_FR1	15/15	15/15	14/14	14/14
CM_MC2	15/15	13/13	15/15	13/13

Survival Rate Binomials

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	8/15	8/15	11/15	7/15
FR_UFR1	12/15	8/15	12/15	12/15
FR_FRCP1	13/15	12/15	11/15	10/15
GH_FR1	15/15	15/15	14/15	14/15
CM_MC2	15/15	13/15	15/15	13/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-7563-0570	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:10	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Control		FR_FRCP1	0.05936	0.2374	Exact	Non-Significant Effect
Control		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
Control		CM_MC2	0.5	1.0000	Exact	Non-Significant Effect

Data Summary

C-%		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	60	0	60	1	0	0.0%
FR_UFR1		60	0	60	1	0	0.0%
FR_FRCP1		56	4	60	0.9333	0.06667	6.67%
GH_FR1		59	1	60	0.9833	0.01667	1.67%
CM_MC2		59	1	60	0.9833	0.01667	1.67%

Hatched Rate Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	0.9333	1	0.8
GH_FR1	1	1	0.9333	1
CM_MC2	1	0.9333	1	1

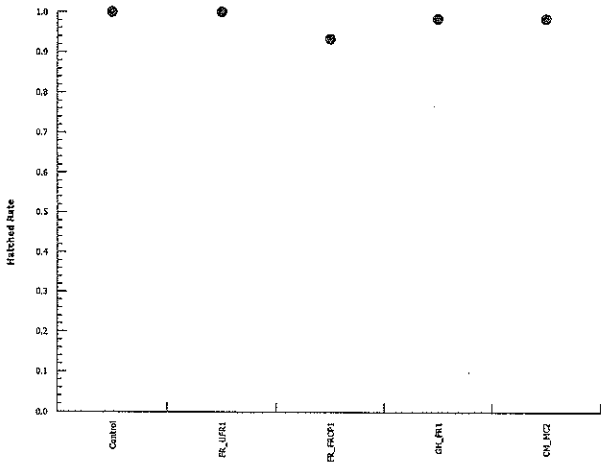
Hatched Rate Binomials

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	15/15	15/15	15/15	15/15
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	12/15
GH_FR1	15/15	15/15	14/15	15/15
CM_MC2	15/15	14/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	02-7563-0570	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:10	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGu Mar 10/16

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	12-5393-8833	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.05936	0.1781	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.5	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	60	0	60	1	0	0.0%
FR_FRCP1		56	4	60	0.9333	0.06667	6.67%
GH_FR1		59	1	60	0.9833	0.01667	1.67%
CM_MC2		59	1	60	0.9833	0.01667	1.67%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	1	1	1
FR_FRCP1	1	0.9333	1	0.8
GH_FR1	1	1	0.9333	1
CM_MC2	1	0.9333	1	1

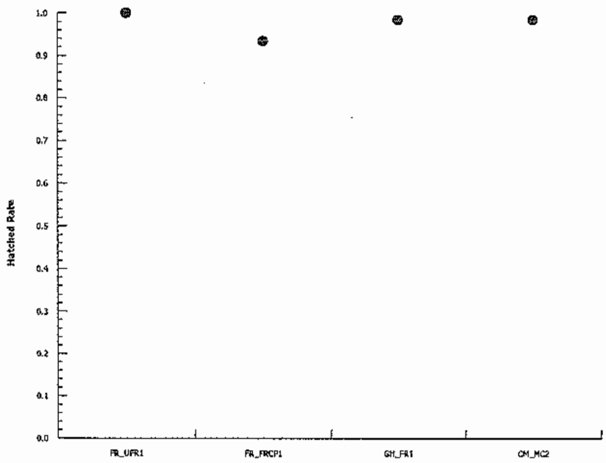
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	12/15
GH_FR1	15/15	15/15	14/15	15/15
CM_MC2	15/15	14/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	12-5393-8833	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	04-3606-6778	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:10	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Control		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Control		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	34	26	60	0.5667	0.4333	0.0%
FR_UFR1		44	16	60	0.7333	0.2667	-29.41%
FR_FRCP1		46	14	60	0.7667	0.2333	-35.29%
GH_FR1		58	2	60	0.9667	0.03333	-70.59%
CM_MC2		56	4	60	0.9333	0.06667	-64.71%

Survival Rate Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.5333	0.5333	0.7333	0.4667
FR_UFR1	0.8	0.5333	0.8	0.8
FR_FRCP1	0.8667	0.8	0.7333	0.6667
GH_FR1	1	1	0.9333	0.9333
CM_MC2	1	0.8667	1	0.8667

Survival Rate Binomials

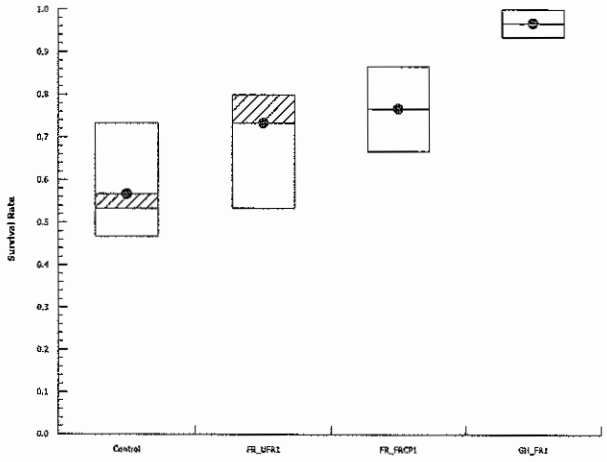
C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	8/15	8/15	11/15	7/15
FR_UFR1	12/15	8/15	12/15	12/15
FR_FRCP1	13/15	12/15	11/15	10/15
GH_FR1	15/15	15/15	14/15	14/15
CM_MC2	15/15	13/15	15/15	13/15

Control failure

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	04-3606-6778	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:10	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



 Analyst:_____ QA: May 10/16

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	18-6589-3746	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	44	16	60	0.7333	0.2667	0.0%
FR_FRCP1		46	14	60	0.7667	0.2333	-4.55%
GH_FR1		58	2	60	0.9667	0.03333	-31.82%
CM_MC2		56	4	60	0.9333	0.06667	-27.27%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.8	0.5333	0.8	0.8
FR_FRCP1	0.8667	0.8	0.7333	0.6667
GH_FR1	1	1	0.9333	0.9333
CM_MC2	1	0.8667	1	0.8667

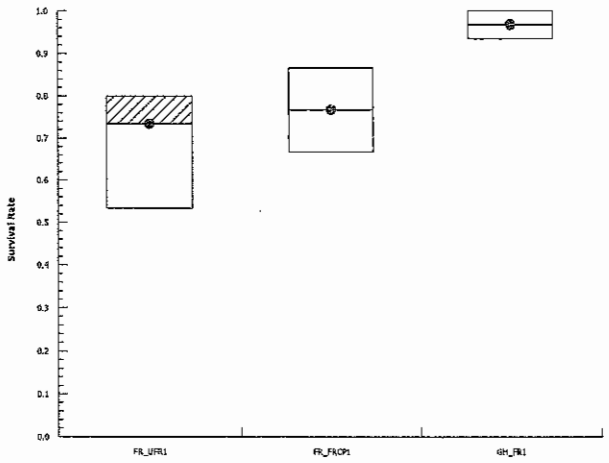
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	12/15	8/15	12/15	12/15
FR_FRCP1	13/15	12/15	11/15	10/15
GH_FR1	15/15	15/15	14/15	14/15
CM_MC2	15/15	13/15	15/15	13/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	18-6589-3746	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-0311-1360	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	26.1%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	22	10	0	6	0.9864	Asymp	Non-Significant Effect
		FR_FRCP1	21	10	0	6	0.9690	Asymp	Non-Significant Effect
		GH_FR1	17	10	0	6	0.6926	Asymp	Non-Significant Effect
		CM_MC2	10	10	0	6	0.0350	Asymp	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1074173	0.02685432	4	0.5905	0.6747	Non-Significant Effect
Error	0.6821497	0.04547665	15			
Total	0.789567		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	19.45	13.28	0.0006	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8265	0.866	0.0022	Non-normal Distribution

Mean Dry Biomass-mg Summary

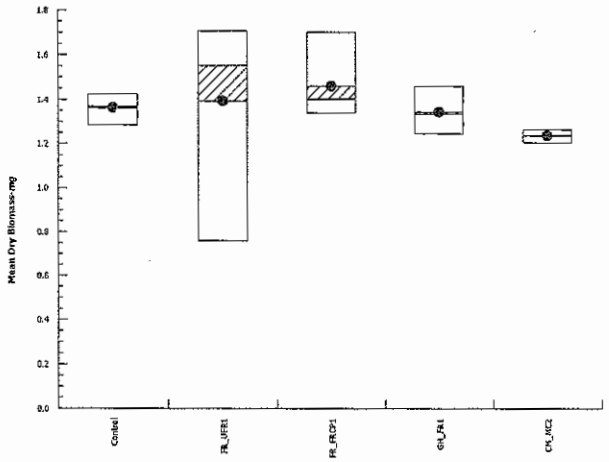
C-%	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	1.361	1.265	1.458	1.369	1.283	1.425	0.03028	4.45%	0.0%
FR_UFR1	4	1.392	0.7066	2.077	1.552	0.7587	1.705	0.2154	30.94%	-2.27%
FR_FRCP1	4	1.459	1.199	1.72	1.4	1.337	1.701	0.08192	11.23%	-7.21%
GH_FR1	4	1.342	1.178	1.507	1.333	1.244	1.459	0.05171	7.71%	1.4%
CM_MC2	4	1.235	1.195	1.275	1.237	1.203	1.263	0.01266	2.05%	9.28%

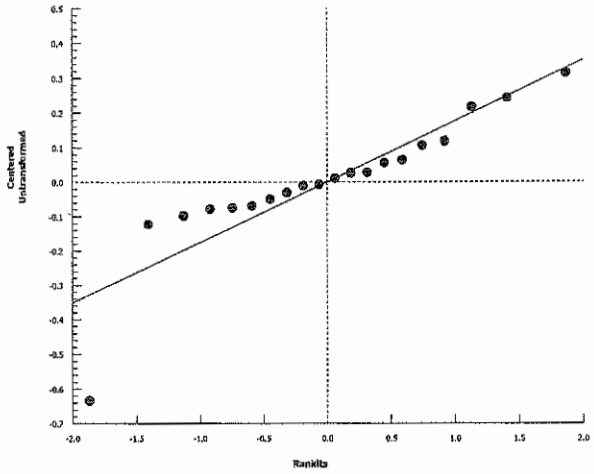
Mean Dry Biomass-mg Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	1.35	1.425	1.283	1.387
FR_UFR1	1.705	0.7587	1.497	1.607
FR_FRCP1	1.39	1.41	1.337	1.701
GH_FR1	1.244	1.398	1.459	1.267
CM_MC2	1.203	1.245	1.228	1.263

Analysis ID:	01-0311-1360	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	00-3966-6873	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	27.5%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	16	10	0	6	0.5065	Asymp	Non-Significant Effect
		GH_FR1	14	10	0	6	0.2626	Asymp	Non-Significant Effect
		CM_MC2	14	10	0	6	0.2626	Asymp	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.107364	0.03578798	3	0.6399	0.6038	Non-Significant Effect
Error	0.6711466	0.05592888	12			
Total	0.7785106		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	14.9	11.34	0.0019	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8476	0.8408	0.0126	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	1.392	0.7066	2.077	1.552	0.7587	1.705	0.2154	30.94%	0.0%
FR_FRCP1	4	1.459	1.199	1.72	1.4	1.337	1.701	0.08192	11.23%	-4.84%
GH_FR1	4	1.342	1.178	1.507	1.333	1.244	1.459	0.05171	7.71%	3.58%
CM_MC2	4	1.235	1.195	1.275	1.237	1.203	1.263	0.01266	2.05%	11.29%

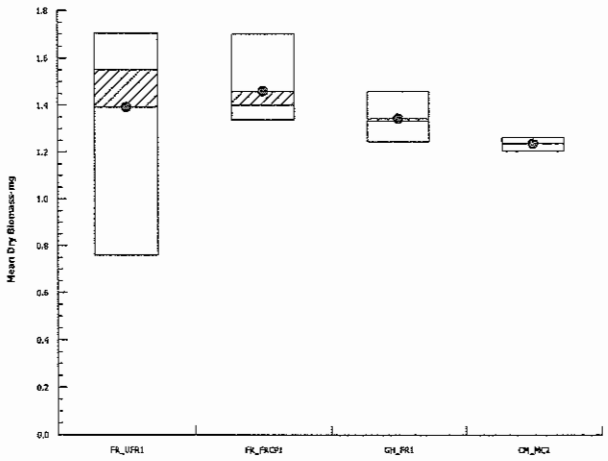
Mean Dry Biomass-mg Detail

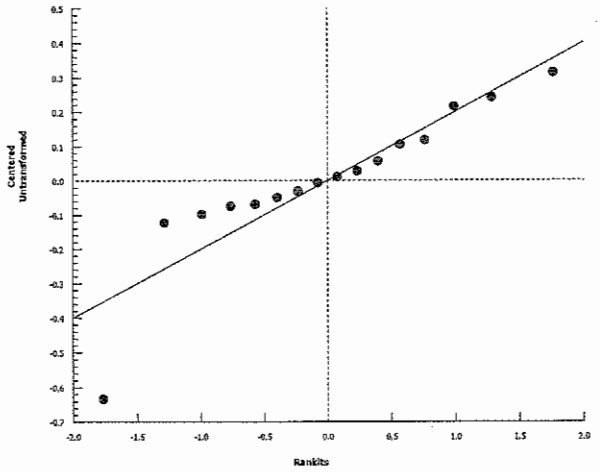
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1.705	0.7587	1.497	1.607
FR_FRCP1	1.39	1.41	1.337	1.701
GH_FR1	1.244	1.398	1.459	1.267
CM_MC2	1.203	1.245	1.228	1.263

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	00-3966-6873	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	05-1664-3360	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:11	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	8.32%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.7258	2.356	0.775	6	0.5033	CDF	Non-Significant Effect
		FR_FRCP1	1.518	2.356	0.775	6	0.1984	CDF	Non-Significant Effect
		GH_FR1	2.53	2.356	0.775	6	0.0363	CDF	Significant Effect
		CM_MC2	2.838	2.356	0.775	6	0.0202	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.464974	0.6162434	4	2.849	0.0611	Non-Significant Effect
Error	3.244237	0.2162824	15			
Total	5.70921		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	10.66	13.28	0.0306	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9562	0.866	0.4709	Normal Distribution

Length-mm Summary

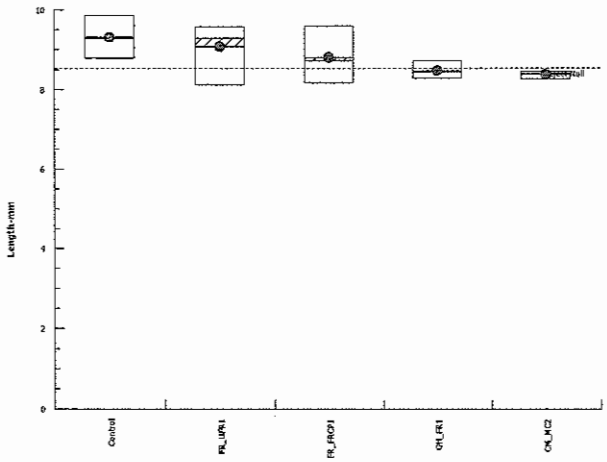
C-%	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	9.312	8.587	10.04	9.286	8.8	9.875	0.2275	4.89%	0.0%
FR_UFR1	4	9.073	7.976	10.17	9.292	8.125	9.583	0.3446	7.6%	2.56%
FR_FRCP1	4	8.812	7.862	9.762	8.741	8.167	9.6	0.2985	6.78%	5.36%
GH_FR1	4	8.48	8.177	8.783	8.45	8.286	8.733	0.09518	2.25%	8.93%
CM_MC2	4	8.378	8.249	8.508	8.392	8.267	8.462	0.04072	0.97%	10.02%

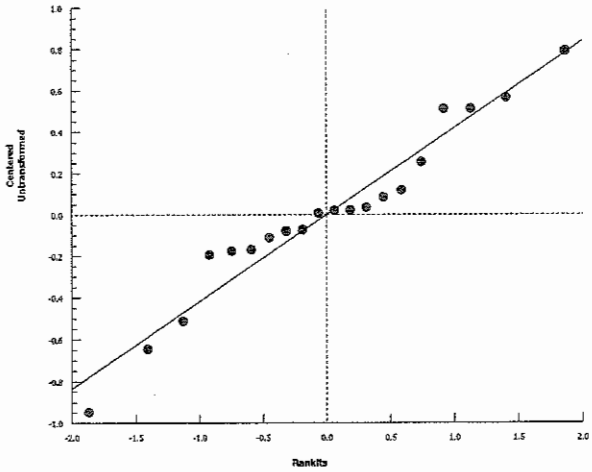
Length-mm Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	9.875	9.429	8.8	9.143
FR_UFR1	9.583	8.125	9.583	9
FR_FRCP1	8.846	8.167	8.636	9.6
GH_FR1	8.4	8.733	8.286	8.5
CM_MC2	8.267	8.385	8.4	8.462

Analysis ID:	05-1664-3360	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:11	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	11-1887-2142	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	8.33%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.7884	2.287	0.756	6	0.4205	CDF	Non-Significant Effect
		GH_FR1	1.794	2.287	0.756	6	0.1125	CDF	Non-Significant Effect
		CM_MC2	2.101	2.287	0.756	6	0.0685	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.211711	0.4039038	3	1.848	0.1923	Non-Significant Effect
Error	2.622928	0.2185773	12			
Total	3.834639		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	10.61	11.34	0.0141	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.933	0.8408	0.2716	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	9.073	7.976	10.17	9.292	8.125	9.583	0.3446	7.6%	0.0%
FR_FRCP1	4	8.812	7.862	9.762	8.741	8.167	9.6	0.2985	6.78%	2.87%
GH_FR1	4	8.48	8.177	8.783	8.45	8.286	8.733	0.09518	2.25%	6.54%
CM_MC2	4	8.378	8.249	8.508	8.392	8.267	8.462	0.04072	0.97%	7.66%

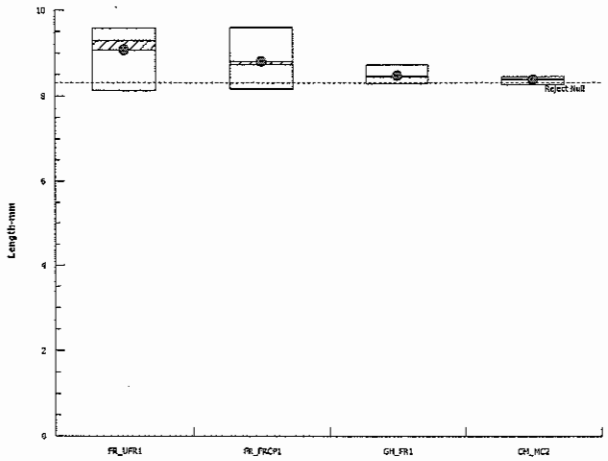
Length-mm Detail

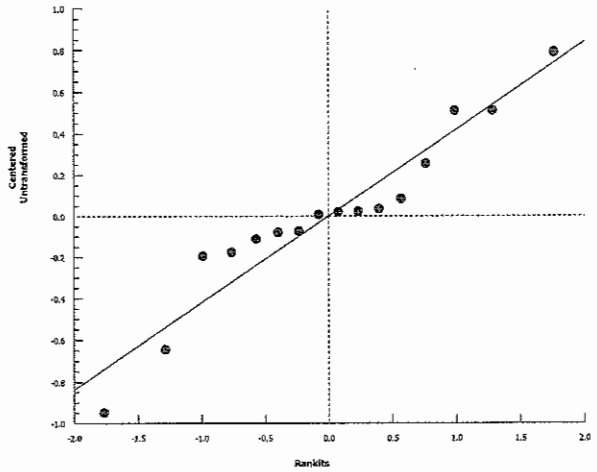
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	9.583	8.125	9.583	9
FR_FRCP1	8.846	8.167	8.636	9.6
GH_FR1	8.4	8.733	8.286	8.5
CM_MC2	8.267	8.385	8.4	8.462

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	11-1887-2142	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-6249-2511	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:11	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)		
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Control		FR_FRCP1	0.575	1.0000	Exact	Non-Significant Effect
Control		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	34	0	34	1	0	0.0%
FR_UFR1		44	0	44	1	0	0.0%
FR_FRCP1		45	1	46	0.9783	0.02174	2.17%
GH_FR1		58	0	58	1	0	0.0%
CM_MC2		56	0	56	1	0	0.0%

Proportion Normal Detail

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	0.9091	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

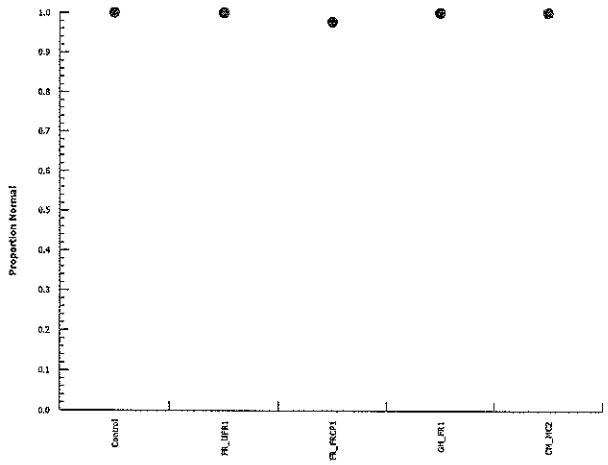
Proportion Normal Binomials

C-%	Rep 1	Rep 2	Rep 3	Rep 4
Control	8/8	8/8	11/11	7/7
FR_UFR1	12/12	8/8	12/12	12/12
FR_FRCP1	13/13	12/12	10/11	10/10
GH_FR1	15/15	15/15	14/14	14/14
CM_MC2	15/15	13/13	15/15	13/13

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	02-6249-2511	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:11	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	04-4709-0490	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	17-9144-1564	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	18-7043-2158	01 Mar-16 11:05	02 Mar-16 11:30	37h (1.1 °C)	Teck Coal	
FR_FRCP1	06-8723-2189	01 Mar-16 09:43	02 Mar-16 11:30	38h (1.5 °C)		
GH_FR1	00-6398-7514	01 Mar-16 11:30	02 Mar-16 11:30	37h (3.8 °C)		
CM_MC2	08-8191-0493	01 Mar-16 12:20	03 Mar-16 08:58	36h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04012016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04012016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_03_01_NP		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160301_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.5111	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	44	0	44	1	0	0.0%
FR_FRCP1		45	1	46	0.9783	0.02174	2.17%
GH_FR1		58	0	58	1	0	0.0%
CM_MC2		56	0	56	1	0	0.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	0.9091	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

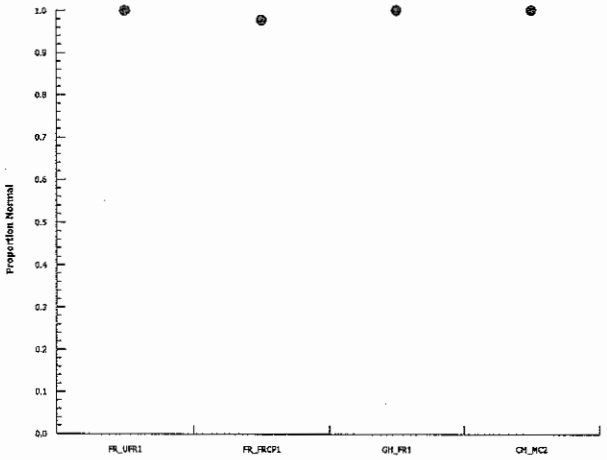
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	12/12	8/8	12/12	12/12
FR_FRCP1	13/13	12/12	10/11	10/10
GH_FR1	15/15	15/15	14/14	14/14
CM_MC2	15/15	13/13	15/15	13/13

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	04-4709-0490	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	27 Apr-16 14:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	12-0294-9137	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 14:11	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	48h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
Lab Control	Lab Control	Teck Coal	Lab Control		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		Lab Control	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control ①	Negative Contr	58	2	60	0.9667	0.03333	0.0%
Lab Control ②	Lab Water	60	0	60	1	0	-3.45%

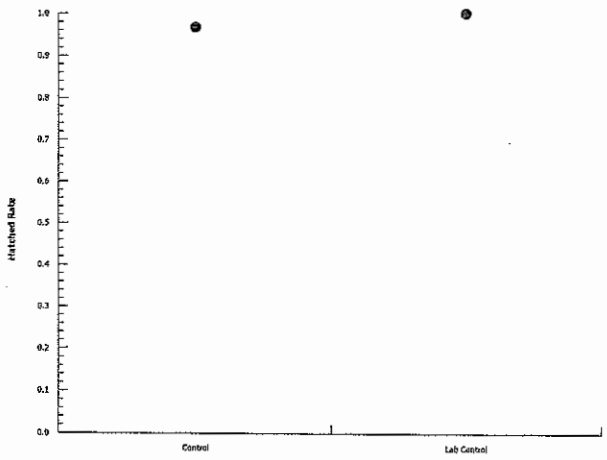
Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control ①	0.9333	0.9333	1	1
Lab Control ②	1	1	1	1

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control ①	14/15	14/15	15/15	15/15
Lab Control ②	15/15	15/15	15/15	15/15

Graphics



① Regular MHW control
② Copper control

Analyst:_____ QA: June 23/11

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-0415-3228	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 14:11	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	48h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
Lab Control	Lab Control	Teck Coal	Lab Control		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control (1)		Lab Control (2)	0.0002338	0.0002	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control (1)	Negative Contr	52	8	60	0.8667	0.1333	0.0%
Lab Control (2)	Lab Water	34	26	60	0.5667	0.4333	34.62%

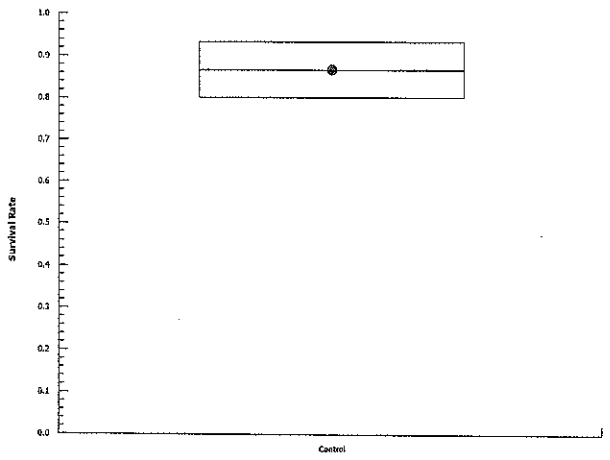
Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control (1)	0.8667	0.9333	0.8667	0.8
Lab Control (2)	0.5333	0.5333	0.7333	0.4667

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control (1)	13/15	14/15	13/15	12/15
Lab Control (2)	8/15	8/15	11/15	7/15

Graphics



(1) Regular MHW Control
(2) Copper Control

 Analyst:_____ QA: June 23/16

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-0329-6203	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 14:11	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	48h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
Lab Control	Lab Control	Teck Coal	Lab Control		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.5%	

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control ①		Lab Control ②	-2.717	1.943	0.092	6	0.9826	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.03336858	0.03336858	1	7.382	0.0348	Significant Effect
Error	0.02711976	0.00451996	6			
Total	0.06048834		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.465	47.47	0.7614	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9548	0.6451	0.7595	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control ①	4	1.232	1.115	1.349	1.215	1.169	1.329	0.03665	5.95%	0.0%
Lab Control ②	4	1.361	1.265	1.458	1.369	1.283	1.425	0.03028	4.45%	-10.48%

Mean Dry Biomass-mg Detail

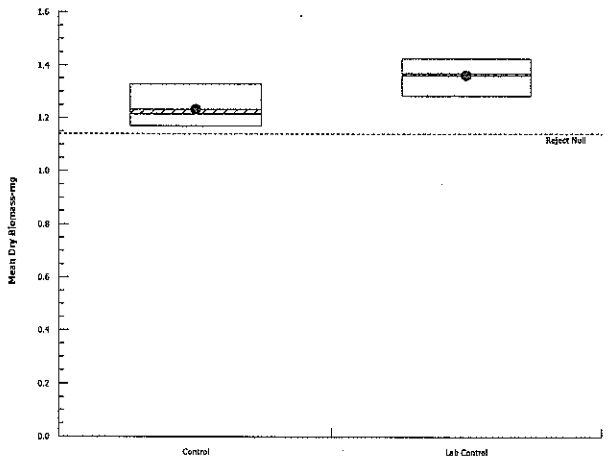
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control ①	1.329	1.181	1.169	1.249
Lab Control ②	1.35	1.425	1.283	1.387

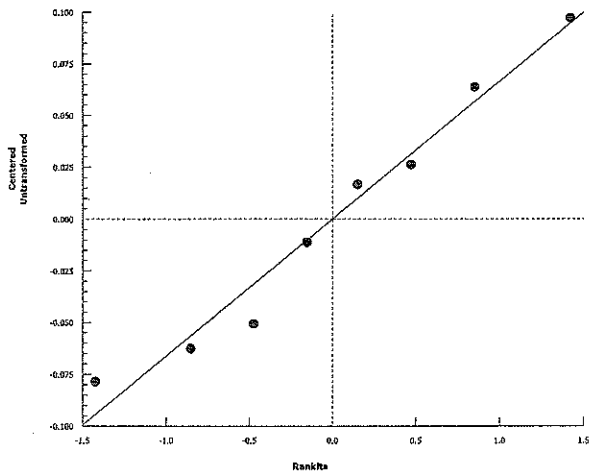
① Regular MHW Control
② Copper Control

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	02-0329-6203	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 14:11	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Graphics





Analyst:_____ QA: June 23/16

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	16-9588-6324	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 14:11	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	48h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
Lab Control	Lab Control	Teck Coal	Lab Control		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	5.48%	

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control ①		Lab Control ②	0.2399	1.943	0.513	6	0.4092	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.008037193	0.008037193	1	0.05757	0.8184	Non-Significant Effect
Error	0.8376089	0.1396015	6			
Total	0.8456461		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.872	47.47	0.4093	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9763	0.6451	0.9425	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control ①	4	9.375	8.948	9.802	9.44	9	9.62	0.1343	2.86%	0.0%
Lab Control ②	4	9.312	8.587	10.04	9.286	8.8	9.875	0.2275	4.89%	0.68%

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control ①	9.38	9	9.62	9.5
Lab Control ②	9.875	9.429	8.8	9.143

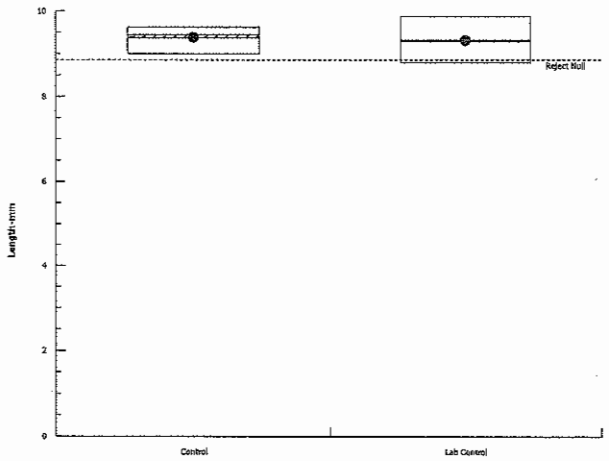
① Regular MHW Control

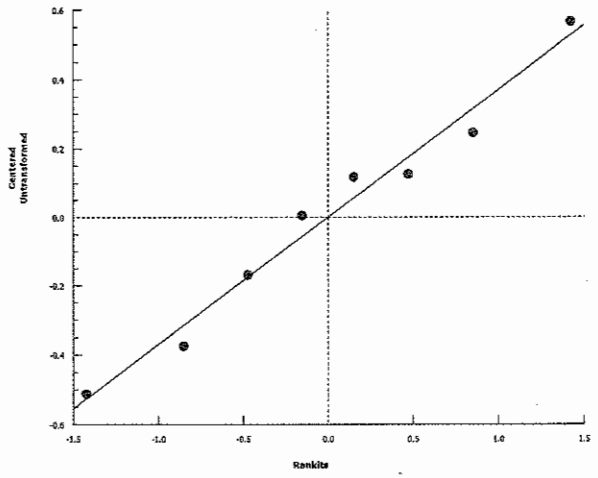
② Copper Control

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	16-9588-6324	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 14:11	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	13-8846-4017	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 14:11	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	06-3076-6015	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	03 Mar-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	04-1817-4276	03 Mar-16	03 Mar-16	NA	Teck Coal	
Lab Control	06-8249-3611	01 Mar-16	01 Mar-16	48h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
Lab Control	Lab Control	Teck Coal	Lab Control		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control ①		Lab Control ②	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	52	0	52	1	0	0.0%
Lab Control	Lab Water	34	0	34	1	0	0.0%

Proportion Normal Detail

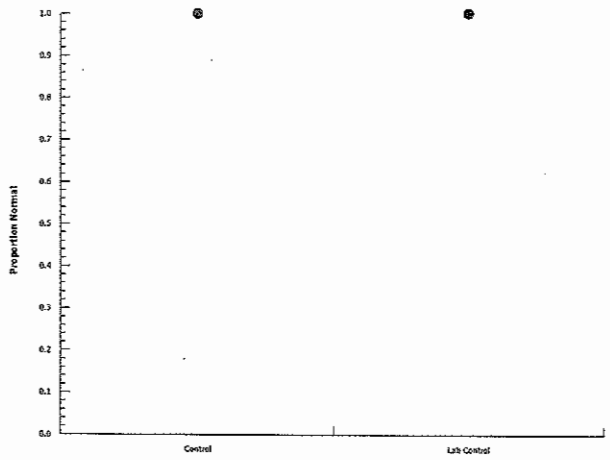
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control ①	1	1	1	1
Lab Control ②	1	1	1	1

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control ①	13/13	14/14	13/13	12/12
Lab Control ②	8/8	8/8	11/11	7/7

Graphics

① Regular MHW Control
② Copper Control



APPENDIX E – Analytical Chemistry

All analytical chemistry for Q1 chronic toxicity has been uploaded to EMS.

APPENDIX F – Chain-of-Custody Forms

Teck

COC ID:	20160301-1239	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS

ANALYSIS REQUESTED

Filtered - F, Field, L, Lab, FL, Field & Lab, N, None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	28 Day H. azteca Pass/Fail	7 D C. Dubia Pass/Fail	72 hr P. subcapitata Pass/Fail	3rd FHM P/F test conducted in Calgary				Temp °C				
FR_FRCP1_Q_04012016_N	FR_FRCP1	WS		2016/03/01	09:43	G	2	x	x	x	x				1.5				
FR_UFR1_Q_04012016_N	FR_UFR1	WS		2016/03/01	11:05	G	2	x	x	x	x				1.1				

WO #: 162286 | 162284 | 162285 | 162287

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
sample description: clear, colourless, odourless, no particulates (FR_FRCP1 and FR_UFR1)	N Macdonald	Mar 1 2016	Nautilus NY - Nan Yamamoto	Mar 02/16 @ 11:30
			2x2x20L	

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	N Macdonald	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	March 1 2016.
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	20160301-1243	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1: Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2: Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3: teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number			
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country					
Phone Number	1-250-865-5289			Phone Number	403-253-7121						

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

16-0250

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30 Day Fathead Minnow (Pass/Fail)
FR_FRCP1_Q_04012016_N	FR_FRCP1	WS		2016/03/01	09:43	G	4	4
FR_UFR1_Q_04012016_N	FR_UFR1	WS		2016/03/01	11:05	G	4	4

16-0251
2016/03/02
1300
8 x 20 L Cubboys
drop off
3.5°C MC
no S/I
Good Condition

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
N MacDonald	Mar 1 2016		

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	N MacDonald	Mobile #	250 865 5204
Sampler's Signature	[signature]	Date/Time	Mar 1 2016

Chain Of Custody Record

COC ID: | Page: 1 of 1

Turnaround Time: | Rush:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	Nautilus Environmental Laboratories Lt			Send Invoice To			
Project Number				Contact Name	Kryst Pearcy			Address			
Contact Name	Leigh Stickney			Address	8664 Commerce Court						
Address	P.O. BOX 5000							City		State	
				City	Burnaby	State	BC	Postal Code		Country	
City	Elkford	State	BC	Postal Code	V5A 4N7	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number				Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

Test conducted in Calgary

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage, fathead minnow, Pass/Fail	28 d Hyallella Pass Fail;	72 h P. subcapitata Pass fail	7 d C. dubia Pass fail	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail	30 Day rainbow trout Early Life stage Pass Fail	7 day Rainbow trout Pass Fail	Lemna minor Pass /Fail	Temp °C	
GH_FR1_WS_2016_03_01_NP	WS	03/01/~~2015~~ 2016	1130	G	2		X	X	X	X						3.8	
						wo #	162871	162869	162845	162852							

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
Sample description: clear, colourless, odourless, no particulates				Nautilus	Mar 02/16	11:30		Y / N	Y / N	Y / N
				NY - Nan Yamamoto				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
				2x20L				Y / N	Y / N	Y / N

Sampler's Name	Leigh Stickney	Mobile #	250 910 0627
Sampler's Signature		Date/Time	

Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Chain Of Custody Record

COC ID:

Page: 1 of 1

Turnaround Time: Rush:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	HydroQual Laboratories Ltd.			Send Invoice To			
Project Number				Contact Name	Jacklyn Pool			Address			
Contact Name	Leigh Stickney			Address	#4, 6125 - 12th Street S.E						
Address	P.O. BOX 5000							City		State	
				City	Calgary	State	AB	Postal Code		Country	
City	Elkford	State	BC	Postal Code	T2H2K1	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number	403.253.7121			Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyalella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail				
16-0249																
GH_FR1_WS_2016_03_01_NP	WS	03/01/2015	1130	G	2		X									
2016/03/02																
1300																
4 < 20 L Cubboys																
drop off																
3.3°C																
NO S/I																
Good Condition																
MC																

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
For both permit requirments and water for special tyreatment testing								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Leigh Stickney	Mobile #	250 910 0627
Sampler's Signature		Date/Time	

Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N

Chain Of Custody Record

COC ID: | Page: 1 of 1

Turnaround Time: | Rush:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	Nautilus Environmental Laboratories Lt			Send Invoice To			
Project Number				Contact Name	Kryst Pearcy			Address			
Contact Name	Leigh Stickney			Address	8664 Commerce Court						
Address	P.O. BOX 5000							City		State	
				City	Burnaby	State	BC	Postal Code		Country	
City	Elkford	State	BC	Postal Code	V5A 4N7	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number				Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella Pass Fail;	72 h P. subcapitata Pass fail	7 d C. dubia Pass fail	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail	30 Day rainbow trout Early Life stage Pass Fail	7 day Rainbow trout Pass Fail	Lemna minor Pass /Fail	Temp °C
GH_ERC_WS_2016_03_01_NP	WS	03/01/~~2015~~ 2016	1030	G	1				X	X						4.0
									wo# 162847	162857						

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
sample description: clear, colourless, odourless, no particulates (GH_ERC)				Nautilus NY - Nain Yamamoto	Mar 02/16	11:30		Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
				1x20L				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Leigh Stickney	Mobile #	250 910 0627
Sampler's Signature		Date/Time	

Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Nautilus Environmental
8664 Commerce Court
Imperial Square Lake City
Burnaby BC, V5A 4N7

COC # 1032016

Page 1 of 1

Report to:		Report Format / Distribution				Service Requested: (rush - subject to availability)
Company:	TECK COAL LTD (ELKVIEW)	☑ Standard	☐ Other			◉ Regular (Default)
Contact:	Michael Moore	☑ PDF	☑ Excel	☑ Digital	☐ Fax	○ Priority (2-3 Business Days) - 50% Surcharge
Address:	RR1 HWY 3	Email 1:	michael.moore@teck.com			○ Emergency (1 Business Day) - 100% Surcharge
Sparwood, BC, V0B 2G1, Canada		Email 2:	james.boldt@teck.com			○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	250-425-8868 Fax:	Email 3:	casandra.knoolhuizen@teck.com			Analysis Request
Invoice To:	Same as Report ? ◉ Yes ○ No	Email 4:	madison.wassick@teck.com			Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:	Send all invoices to: dlteckcoalaccountspayable@teck.com	Client / Project Information:				
Contact:	Attn: Accounting	Job #:	Elkview Chronic Tox Sampling			
Address:	Same as above	PO / AFE:	418934 PO			
		Legal Site Description:				
Phone:	Fax:	Quote #:				
Lab Work Order # (lab use only)		Nautilus Contact: Krysta Pearcy		Sampler:	MW/SB	

Sample	Sample Identification	Date (mmm-dd-yy)	Time (hh:mm)	Matrix	7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)		Temp °C	Number of Containers 20L
	EV_MC2_WS_2016-03-01_N	1-Mar-16	9:55	WS	X	X		0.4	1
	EV_HC1_WS_2016-03-01_N	1-Mar-16	9:05	WS	X	X		1.6	1
									2

WO# 162845 162855

Special Instructions / Regulations / Hazardous Details

Toxicity 7-Day/72-Hr Pass/ Fail =7 d C. dubia and 72 h P. subcapitata
Toxicity 96-Hr/48-Hr = 96 Hr Rainbow Trout pass/fail & 48 Hr Daphnia pass/fail (Daphnia testing to occur at 10 degrees)
Toxicity 30-Day = Rainbow trout embryo-alevin

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)		SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)		
Released by:	Date & Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date & Time:	Observations: Yes / No ? If Yes attach SIF
Madison Wassick	1-Mar-16 10:25	Nautilus NY-Nan Yamamoto	Mar 01/16	11:30				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - REPORT COPY, PINK - FILE COPY, YELLOW - CLIENT COPY

GENF 18.00 Front

sample description: clear, colourless, odourless, no particulates (EV-MC2 and EV-HC1)

2x20L

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com			Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
						ANALYSIS		7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F Test conducted in Calgary					
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20160301_N	WS	March 1,2016	12:30	G	2		WO #	x 16284	x 16285	x 16286	x 16287					

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date ①	Time	Sample Receipt Conditions			
Sample description: clear, colourless, odourless, no particulates				Nautilus NY - Nan Yamamoto 2x20L	Mar 03/16	08:58	4.2	Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

						Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Don Sacino/Carla Romero		Mobile #	2504237350					
Sampler's Signature			Date/Time	1-Mar-16	12:30				

① sent to HydroQual by mistake on Mar 02/16.

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To	
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address	
Address	2261 Corbin Rd.			Address	8664 commerce Court			City	State
City	Sparwood	Prov.	BC	City	Burnaby	State	BC	Postal Code	Country
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	Task Code	
Phone Number	250 425 7350			Phone Number	604-420-8773			Shipping Company	
Email EDD To	Rick.Magliacco@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number	
	Don.Sacino@teck.com			PO Number				CC Hardcopy To	
	Carla.Romero@teck.com							CC Hardcopy To	

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)					
16-0248 Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS										
CM_MC2_WS_20160301_N	WS	March 1,2016	12:20	G	2				x	x	x					
2016/03/02 1300	4.3°C															
Good condition																
6 x 20 L	Cubays															
no S/T																
chop off MC																

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time

Sample Receipt Conditions			
Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

Sampler's Name	Don Sacino/Carla Romero	Mobile #	250 425 7350	
Sampler's Signature		Date/Time	1-Mar-16	12:30

Teck

COC ID:	March 1 2016 chronic tox_NAUT	TURNAROUND TIME:	REGULAR	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Line Creek Operations			Lab Name	Nautilus Environmental Company Inc.			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	x
Email	jay.jones@teck.com			Email	krysta@nautilusenvironmental.ca			Email 2:	jenny.hutchison@teck.com	x	x	x
Address	Box 2003, 15 Km North Hwy 43			Address	8664 Commerce Court			Email 3:	cait.good@teck.com	x	x	x
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number	*Regional Chronic Tox PO #*			
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	250 425 6111			Phone Number	1 604 420 8773							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered - F, Field - L, Lab - FL, Field & Lab - N, None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV.	ANALYSIS: 7-d C. dubia (pass/fail)	ANALYSIS: 72-h P. subcapitata (pass/fail)										Temp °C
LC_LCDSSLCC_WS_2016-03-07_N	LC_LCDSSLCC	WS	No	2016/03/01	1310	G	2		x	x										3.5
							#NAME?													
							#NAME?													
							#NAME?		WO# 16284	16285										
							#NAME?													
							#NAME?													
							#NAME?													
							#NAME?													
							#NAME?													
							#NAME?													

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
sample description: clear, colourless, odourless, no particulates	T. Phillips/ Phillips	March 1, 2016	Nautilus NY - Nair Yamamoto	Mar 02/16 @ 11:30
			2x20L	

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	**Sampler's Name**	**Tyler Phillips**	**Mobile #**	**250 919 0965**
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		**Sampler's Signature**		**Date/Time**	**March 1, 2016**
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	20160308-1302	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS: 28 Day H. azteca Pass/Fail	PRESERV.: 30d FHM P/F that conducted in Calgary	FIL									
FR_FRCP1_QR_18012016_N	FR_FRCP1	WS		2016/03/08	10:54	G	1	1	x										
FR_UFR1_QR_18012016_N	FR_UFR1	WS		2016/03/08	09:07	G	1	1	x										
								wo# 16286	16287										

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
= Refresh sample =	Lee Wilm Mar	8/16 1300	Nautilus NY - Nan Yamamoto 2 x 20L Temp - 3.3°C	Mar 09/16 @ 10:00

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Lee Wilm	Mobile #	250-433-1554
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	Mar 8/16 15:00
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	20160308-1303	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO

Facility Name / Job#	Fording River Operation
Project Manager	Lee Wilm
Email	
Address	PO Box 100
City	Elkford
Province	BC
Postal Code	V0B 1H0
Country	Canada
Phone Number	1-250-865-5289

LABORATORY

Lab Name	Hydroqual
Lab Contact	Elisabeth Henson
Email	elisabeth_henson@golder.com
Address	
City	
Province	
Postal Code	
Country	
Phone Number	403-253-7121

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	Lee.Wilm@teck.com	x	x	x
Email 2:	NeilMacdonald@teck.com	x	x	x
Email 3:	teckcoal@equisonline.com			x

PO number

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30 Day Fathead Minnow
FR_FRCP1_QR_18012016_N	FR_FRCP1	WS		2016/03/08	10:54	G	4	4
FR_UFR1_QR_18012016_N	FR_UFR1	WS		2016/03/08	09:07	G	4	4

160850
16081

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Lee Wilm	Mar 8/16 1300		

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Lee Wilm	Mobile #	250-433-1354
Sampler's Signature	[signature]	Date/Time	Mar 8/16 1300

2016/03/09 by ML ~~@10am~~ @1200
good condition.
no SOI 8°C.
8x20L carboys

Chain Of Custody Record

COC ID: | Page: 1 of 1

Turnaround Time: | Rush:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	Nautilus Environmental Laboratories Lt			Send Invoice To			
Project Number				Contact Name	Kryst Pearcy			Address			
Contact Name	Leigh Stickney			Address	8664 Commerce Court						
Address	P.O. BOX 5000							City		State	
				City	Burnaby	State	BC	Postal Code		Country	
City	Elkford	State	BC	Postal Code	V5A 4N7	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number				Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

T28T conducted in Calgary

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella Pass Fail;	72 h P. subcapitata Pass fail	7 d C. dubia Pass fail	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail	30 Day rainbow trout Early Life stage Pass Fail	7 day Rainbow trout Pass Fail	Lemna minor Pass /Fail	
GH_FR1_WS_2016_03_08_NP	WS	3/8/2016	08:30	G	1		X	X								

WO# 162987 162986

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
	Jevin Wolchuk	March 8/16	08:55	Nautilus	March 9/16	10:00	3.4	Y / N	Y / N	Y / N
				NY- Nan Yamamoto				Y / N	Y / N	Y / N
= refresh sample =				1X20L				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470	Temp in °C	Samples on ice? / Sample intact? / Trip Blank?
Sampler's Signature		Date/Time	March 8/16 (8:55)		

Chain Of Custody Record

COC ID:	Page: 1 of 1
Turnaround Time:	Rush:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Greenhills Operation	Lab Name	HydroQual Laboratories Ltd.	Send Invoice To	
Project Number		Contact Name	Jacklyn Pool	Address	
Contact Name	Leigh Stickney	Address	#4, 6125 - 12th Street S.E.		
Address	P.O. BOX 5000			City	State
		City	Calgary State AB	Postal Code	Country
City	Elkford State BC	Postal Code	T2H2K1 Country Canada	Task Code	
Postal Code	V0B1H0 Country Canada	Phone Number	403.253.7121	Shipping Company	
Phone Number	250-865-3274	Email Address		Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com	Quote Number		CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com			CC Hardcopy To	

SAMPLE DETAILS / ANALYSIS REQUESTED / ADDITIONAL INFORMATION

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 d early life stage fathead minnow Pass/Fail	28 d Hyallela	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/fail				Initial - PASS/FAIL
GH_FR1_WS_2016_03_08_NP	WS	3/8/2016	08:30	G	4		X									

16-0249

2016/03/09 @ 1200 by ML
good condition
no sci. f
8x20L carboys
chip off
6°C

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions		
For both permit requirements and water for special treatment testing	Jevin Wolchuk	March 8/16	08:30				Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470
Sampler's Signature	[signature]	Date/Time	March 8/16 08:30

Temp in °C | Samples on ice? | Sample intact? | Trip Blank?

Chain Of Custody Record

COC ID: 20140902-1509	Page: 1 of 2
Turnaround Time:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com			Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

SAMPLE DETAILS — **ANALYSIS REQUESTED** — **ADDITIONAL INFORMATION**

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	Refresh 28-d H. azteca (pass/fail)	30d FHM P/F Test conducted in Calgary						Additional Information
CM_MC2_WS_20160308_N	WS	March 8 2016	11:30	G	~~1~~ 2 NY						1	X						Refresh

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
= refresh sample =				Nautilus	Mar 09/16	10:00		Y / N	Y / N	Y / N
				NY – Nai Yamamoto				Y / N	Y / N	Y / N
				2 x 20L				Y / N	Y / N	Y / N
				Temp – ~~[illegible]~~ NY 3.3°C				Y / N	Y / N	Y / N

				Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Don Sacino/Carla Romero	Mobile #	~~[illegible]~~ – 2504257350				
Sampler's Signature	[signature]	Date/Time	March 8 2016 12:10				

Chain Of Custody Record

COC ID: 20140902-1509

Turnaround Time:

Page: 1 of 2

PROJECT/CLIENT INFO			
Facility Name	Coal Mountain Operation		
Contact Name	Carla Romero		
Address	2261 Corbin Rd.		
City	Sparwood	Prov.	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250 425 7350		
Email EDD To	Nick.Magliocco@teck.com		
	Don.Sacino@teck.com		
	Carla.Romero@teck.com		

LABORATORY			
Lab Name	Hydroqual Laboratories		
Contact Name	Jacklyn Pool		
Address	#4, 6125-12th Street S.E.		
City	Calgary	State	AB
Postal Code	T2H 2K1	Country	Canada
Phone Number	403-253-7121		
Email Address			
PO Number			

OTHER INFO			
Send Invoice To			
Address			
City		State	
Postal Code		Country	
Task Code			
Shipping Company			
Tracking Number			
CC Hardcopy To			
CC Hardcopy To			

SAMPLE DETAILS / **ANALYSIS REQUESTED** / **ADDITIONAL INFORMATION**

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	Refresh / 30-d P. promelas (pass/fail)	ADDITIONAL INFORMATION
CM_MC2_WS_20160308_N	WS	March 8 2016	11:30	G	4		x	Sending 80 L as per duplicate requirement from SPO.

16-0248

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
				NILEHTI	2016/03/09/	12:00		Y / N	Y / N	Y / N
				good condition no seal				Y / N	Y / N	Y / N
				8x20L carboys				Y / N	Y / N	Y / N
				also ok			5°C	Y / N	Y / N	Y / N
							Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name	D.Sacino/T.Horne	Mobile #	250 425 7377
Sampler's Signature	(signature)	Date/Time	March 8 2016 12:20

Teck

COC ID:	20160315-1401	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL	PRESERV	ANALYSIS: 48 hr Daphnia Sinlge Conc. Pass/Fail	96 Hr Rainbow Trout Single Conc. Pass/Fail	28 Day H. azteca Pass/Fail	30d FHM P/F Test conducted in Calgary							Temp °C
FR_EC1_Q_04012016_N	FR_EC1	WS		2016/03/15	10:43	G	1			X	1									1.3
(1) FR_FRCP1_QR_11012016_N	FR_FRCP1	WS		2016/03/15	11:40	G	1					1	X							2.5
(1) FR_UFR1_QR_11012016_N	FR_UFR1	WS		2016/03/15	09:54	G	1					1	X							2.5
										163326	163327	162866	162867							

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
(1) refresh sample	N MACDONALD	2016/03/15	Nautilus NY - Nan Yamamoto	Mar 16/16 @ 09:50
			3x20L	

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	N MACDONALD	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	MARCH 15 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

16-0250 + 16-0251 Week 3 COC

COC ID:	20160315-1351	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO			
Facility Name / Job#	Fording River Operation	Lab Name	Hydroqual	Report Format / Distribution	Excel	PDF	EDD
Project Manager	Lee Wilm	Lab Contact	Elisabeth Henson	Email 1: lee.Wilm@teck.com	x	x	x
Email		Email	elisabeth_henson@golder.com	Email 2: Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100	Address		Email 3: teckcoal@equisonline.com			x
City	Elkford, Province BC	City	Province	PO number			
Postal Code	V0B 1H0, Country Canada	Postal Code	Country				
Phone Number	1-250-865-5289	Phone Number	403-253-7121				

SAMPLE DETAILS / ANALYSIS REQUESTED

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30 Day Fathead Minnow
FR_FRCP1_QR_11012016_N 16-0250	FR_FRCP1	WS		2016/03/15	11:40	G	4	X
FR_UFR1_QR_11012016_N 16-0251	FR_UFR1	WS		2016/03/15	09:54	G	4	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	N MacDonald	2016/03/15	HS 8°C no S/I	2016/03/16 @1030 drop off 8x coolers, 16x20L carboys good condition

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default) X	Sampler's Name	N MacDonald	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature	[signature]	Date/Time	2016/03/15
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Chain Of Custody Record

COC ID:

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Turnaround Time:

Rush:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	Nautilus Environmental Laboratories Lt			Send Invoice To			
Project Number				Contact Name	Kryst Pearcy			Address			
Contact Name	Leigh Stickney			Address	8664 Commerce Court						
Address	P.O. BOX 5000							City		State	
				City	Burnaby	State	BC	Postal Code		Country	
City	Elkford	State	BC	Postal Code	V5A 4N7	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number				Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.	Test conducted in Calgary									Initial - PASS/FAIL
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella Pass Fail;	72 h P. subcapitata Pass fail	7 d C. dubia Pass fail	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail	30 Day rainbow trout Early Life stage Pass Fail	7 day Rainbow trout Pass Fail	Lemna minor Pass /Fail		
GH_FR1_WS_2016_03_15_NP	WS	3/15/2016	09:30	G	1	WO #	X	X									
							16287	16286									

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
	Jevin Wolchuk	March 15/16	09:50	Nautilus	March 16/16	09:50	2.5	Y / N	Y / N	Y / N
				MP - Nan Yamamoto				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
				IX20L				Y / N	Y / N	Y / N

					Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
= refresh sample =	Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470				
	Sampler's Signature		Date/Time	March 15/16 09:30				

16-0249 Week 3 CoC

Chain Of Custody Record

COC ID:	Page: 1 of 1
Turnaround Time:	Rush:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Greenhills Operation	Lab Name	HydroQual Laboratories Ltd.	Send Invoice To	
Project Number		Contact Name	Jacklyn Pool	Address	
Contact Name	Leigh Stickney	Address	#4, 6125 - 12th Street S.E		
Address	P.O. BOX 5000			City	State
		City	Calgary State AB	Postal Code	Country
City	Elkford State BC	Postal Code	T2H2K1 Country Canada	Task Code	
Postal Code	V0B1H0 Country Canada	Phone Number	403.253.7121	Shipping Company	
Phone Number	250-865-3274	Email Address		Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com	Quote Number		CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com			CC Hardcopy To	

SAMPLE DETAILS / ANALYSIS REQUESTED / ADDITIONAL INFORMATION

Initial - PASS/FAIL

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d H. azteca	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail
GH_FR1_WS_2016_03_15_NP	WS	3/15/2016		G	4		X					

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions
For both permit requirments and water for special tyreatment testing	Jevin Walchuk	March 15/16	08:50	HS	2016/03/16	1030	5C Y / N Y / N Y / N
							Y / N Y / N Y / N
				no SIT	drop off		Y / N Y / N Y / N
				5x cooler	good condition		(Y) / N (Y) / N Y / N

Sampler's Name	Jevin Walchuk	Mobile #	250.910.5470
Sampler's Signature	[signature]	Date/Time	March 15/16 08:50

Temp in °C | Samples on ice? | Sample intact? | Trip Blank?

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO					LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation				Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero				Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.				Address	8664 commerce Court						
City	Sparwood	Prov.	BC						City		State	
Postal Code	V0B 2G0	Country	Canada		City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350				Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com				Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com				Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com				PO Number				CC Hardcopy To			
									CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.					Refresh					
						ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F test conducted in Calgary			Temp °C	
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20160315_N	WS	March 15,2016	11:40	G	1						1	x			2.5	Refresh
											16286	16287				
											WO#					

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
=refresh sample=				Nautilus NY-Nan Yamamoto	Mar16/16	09:50		Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
				1X20L				Y / N	Y / N	Y / N

Sampler's Name	Don Sacino/Carla Romero	Mobile #	2504257350		Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	March 15 2016	13:00HR				

16-0248 Week 3 COC

Chain Of Custody Record

COC ID: 20140902-1509

Turnaround Time:

Page: 1 of 2

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Coal Mountain Operation	Lab Name	Hydroqual Laboratories	Send Invoice To	
Contact Name	Carla Romero	Contact Name	Jacklyn Pool	Address	
Address	2261 Corbin Rd.	Address	#4, 6125-12th Street S.E.		
City	Sparwood Prov. BC			City	State
Postal Code	V0B 2G0 Country Canada	City	Calgary State AB	Postal Code	Country
Phone Number	250 425 7350	Postal Code	T2H 2K1 Country Canada	Task Code	
Email EDD To	teck.Magnoreco@teck.com	Phone Number	403-253-7121	Shipping Company	
	Don.Sacino@teck.com	Email Address		Tracking Number	
	Carla.Romero@teck.com	PO Number		CC Hardcopy To	
				CC Hardcopy To	

SAMPLE DETAILS / **ANALYSIS REQUESTED** / **ADDITIONAL INFORMATION**

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30-d P. promelas (pass/fail) / Refresh	Additional Information
CM_MC2_WS_20160315_N	WS	March 15 2016	11:40	G	4	x	80 L Refresh

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
				HS [illegible] 16x20L carboys, clear of good condition [illegible]	2016/03/16	10:30	4C	Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								(Y) / N	(Y) / N	Y / N
							Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name: D.Sacino/T.Horne

Mobile #:

Sampler's Signature: [signature]

Date/Time: March 15 2016 13:00 hr

Teck

COC ID:	20160322-1300	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operations			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS — ANALYSIS REQUESTED (Filtered - F; Field, L; Lab, FL- Field & Lab, N- None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS: 28 Day H. azteca P/F	ANALYSIS: 30d FHM P/F test conducted in Calgary	PRESERV.	FIL.	Temp °C
FR_FRCP1_QR_01022016_N	FR_FRCP1	WS		2016/03/22	11:07	G	1	X	X			5.2
FR_UFR1_QR_01022016_N	FR_UFR1	WS		2016/03/22	09:09	G	1	X	X			5.2

WO # 162866 162871

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
= Refresh sample =	N MacDonald - MAR 22 2016		Nautilus NY - Nan Yamamoto 2x20L	Mar 23/16 @10:50

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	N MacDonald	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	MAR 22 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

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Teck

COC ID:	20160322-1257	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country						
Phone Number	1-250-865-5289			Phone Number	403-253-7121							

SAMPLE DETAILS								ANALYSIS REQUESTED											
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30 Day Fathead Minnow											
16-0250																			
FR_FRCP1_QR_01022016_N	FR_FRCP1	WS		2016/03/22	11:07	G	4	X											
FR_UFR1_QR_01022016_N	FR_UFR1	WS		2016/03/22	09:09	G	4	X											
16-0251																			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
2016/03/23 1020 Good drop off MC 8x 20L Carboys Condition no s/I 20L	N MacDonald	MAR 22 2016		

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	N MacDonald	Mobile #	250 865 5204.
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	Mar 22 2016.
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Chain Of Custody Record

COC ID: | Page: 1 of 1

Turnaround Time: | Rush:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	Nautilus Environmental Laboratories Lt			Send Invoice To			
Project Number				Contact Name	Kryst Pearcy			Address			
Contact Name	Leigh Stickney			Address	8664 Commerce Court						
Address	P.O. BOX 5000							City		State	
				City	Burnaby	State	BC	Postal Code		Country	
City	Elkford	State	BC	Postal Code	V5A 4N7	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number				Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

Test conducted in Calgary

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella Pass Fail;	72 h P. subcapitata Pass fail	7 d C. dubia Pass fail	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail	30 Day rainbow trout Early Life stage Pass Fail	7 day Rainbow trout Pass Fail	Lemna minor Pass /Fail	
GH_FR1_WS_2016_03_22_NP	WS	3/22/2016	09:15	G	1		X	X								
						WO #	16287	16286								

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions
	Jevin Wolchuk	Mar22/16	09:45	Nautilus NY - Nan Yamamoto	Mar 23/16	10:50	5.5 Y / N Y / N Y / N
							Y / N Y / N Y / N
				1X20L			Y / N Y / N Y / N
							Y / N Y / N Y / N

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470	Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	Mar.22/16 09:45				

= refresh sample =

Chain Of Custody Record

COC ID: | Page: 1 of 1

Turnaround Time: | Rush:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	HydroQual Laboratories Ltd.			Send Invoice To			
Project Number				Contact Name	Jacklyn Pool			Address			
Contact Name	Leigh Stickney			Address	#4, 6125 - 12th Street S.E						
Address	P.O. BOX 5000							City		State	
				City	Calgary	State	AB	Postal Code		Country	
City	Elkford	State	BC	Postal Code	T2H2K1	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number	403.253.7121			Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
16-0249						ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail				
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
GH_FR1_WS_2016_03_22_NP	WS	3/22/2016	09:15	G	4		X									
2016/03/23 620 3°C 4 x 20 L Carboys no SI drop off Good Condition MC																

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time
For both permit requirments and water for special treatment testing	Jevin Wolchuk	March 22/16	09:45			

Sample Receipt Conditions			
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470	
Sampler's Signature		Date/Time	March 22/16 09:45	

Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court			City		State	
City	Sparwood	Prov.	BC	City	Burnaby	State	BC	Postal Code		Country	
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	Task Code			
Phone Number	250 425 7350			Phone Number	604-420-8773			Shipping Company			
Email EDD To	Rick.Maglocco@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Don.Sacino@teck.com			PO Number				CC Hardcopy To			
	Carla.Romero@teck.com							CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.					Refresh					
						ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F Test conducted in Calgary				
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20160322_N	WS	March 22,2016	11:40	G	1						1	1				Refresh

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
①Sample date confirmed w/ Carla KLP				Nautilus NY - Nan Yamamoto	Mar 23/16	10:50	4.1	Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
				1X20L				Y / N	Y / N	Y / N

Sampler's Name	Don Sacino/Carla Romero	Mobile #	2504257350		
Sampler's Signature		Date/Time	March 22 2016 13:00		

Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

= refresh sample =

Chain Of Custody Record

COC ID: 20140902-1509

Turnaround Time:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Coal Mountain Operation	Lab Name	Hydroqual Laboratories	Send Invoice To	
Contact Name	Carla Romero	Contact Name	Jacklyn Pool	Address	
Address	2261 Corbin Rd.	Address	#4, 6125-12th Street S.E.		
City	Sparwood Prov. BC			City	State
Postal Code	V0B 2G0 Country Canada	City	Calgary State AB	Postal Code	Country
Phone Number	250 425 7350	Postal Code	T2H 2K1 Country Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com	Phone Number	403-253-7121	Shipping Company	
	Don.Sacino@teck.com	Email Address		Tracking Number	
	Carla.Romero@teck.com	PO Number		CC Hardcopy To	
				CC Hardcopy To	

16-0248

SAMPLE DETAILS / ANALYSIS REQUESTED / ADDITIONAL INFORMATION

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	Refresh / 30-d P. promelas (pass/fail)	Additional Information
CM_MC2_WS_20160322_N	WS	March 22/2016	11:40	G	4		x	80 L Refresh

2016/03/23 ~~8~~ 4 x 20 L Carboy
1020
drop off MC
3°C
Good Condition
no S/F

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
							Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name	C.Romero/T.Horne	Mobile #	250 425 7350
Sampler's Signature	[signature]	Date/Time	March 22 2016 13:00

Teck

COC ID:	20160329-1215	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO

Facility Name / Job#	Fording River Operation
Project Manager	Lee Wilm
Email	
Address	PO Box 100
City	Elkford
Province	BC
Postal Code	V0B 1H0
Country	Canada
Phone Number	1-250-865-5289

LABORATORY

Lab Name	Hydroqual
Lab Contact	Elisabeth Henson
Email	elisabeth_henson@golder.com
Address	
City	
Province	
Postal Code	
Country	
Phone Number	403-253-7121

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	Lee.Wilm@teck.com	x	x	x
Email 2:	Neil.Macdonald@teck.com	x	x	x
Email 3:	teckcoal@equisonline.com			x
PO number				

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

16-0250

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30 Day Fathead Minnow
FR_FRCP1_QR_25012016_N	FR_FRCP1	WS		2016/03/29	08:55	G	4	4
FR_UFR1_QR_25012016_N	FR_UFR1	WS		2016/03/29	10:53	G	4	4

16-0251

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

2016/03/30 1100 Good Condition
10 5L & 20 L Cars
6°C drop off
MC

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
N MacDonald	Mar 29 2016		

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	N MacDonald.	Mobile #	250 865 5204.
Sampler's Signature	[signature]	Date/Time	Mar 29 2016.

Chain Of Custody Record

COC ID:		Page: 1 of 1	
Turnaround Time:		Rush:	

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Greenhills Operation	Lab Name	HydroQual Laboratories Ltd.	Send Invoice To	
Project Number		Contact Name	Jacklyn Pool	Address	
Contact Name	Leigh Stickney	Address	#4, 6125 - 12th Street S.E		
Address	P.O. BOX 5000			City	State
		City	Calgary State AB	Postal Code	Country
City	Elkford State BC	Postal Code	T2H2K1 Country Canada	Task Code	
Postal Code	V0B1H0 Country Canada	Phone Number	403.253.7121	Shipping Company	
Phone Number	250-865-3274	Email Address		Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com	Quote Number		CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com			CC Hardcopy To	

16-0249

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/fail	ADDITIONAL INFORMATION Initial - PASS/FAIL
GH_FR1_WS_2016_03_29_NP	WS	3/29/2016	09:25	G	4		X						

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time
For both permit requirments and water for special treatment testing	Jevin Wolchuk	March 29/16	09:35			

2016/03/30 1000
Good Condition
4 x 20 L
drop off 5°C Carby
NOS/I MC

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470
Sampler's Signature	[signature]	Date/Time	March 29/16 09:35

Sample Receipt Conditions	Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
		Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N

Chain Of Custody Record

COC ID: 20140902-1509

Turnaround Time:

Page: 1 of 2

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Coal Mountain Operation	Lab Name	Hydroqual Laboratories	Send Invoice To	
Contact Name	Carla Romero	Contact Name	Jacklyn Pool	Address	
Address	2261 Corbin Rd.	Address	#4, 6125-12th Street S.E.		
City	Sparwood Prov. BC			City	State
Postal Code	V0B 2G0 Country Canada	City	Calgary State AB	Postal Code	Country
Phone Number	250 425 7350	Postal Code	T2H 2K1 Country Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com	Phone Number	403-253-7121	Shipping Company	
	Don.Sacino@teck.com	Email Address		Tracking Number	
	Carla.Romero@teck.com	PO Number		CC Hardcopy To	
				CC Hardcopy To	

16-0248

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Refresh / 30-d P. promelas (pass/fail)	Additional Information
CM_MC2_WS_20160329_N	WS	March 29 2016	13:30	G	4	x	R01 Refresh

Additional Comments/Special Instructions

2016/03/30 1100
Good Condition
NOS/F 4×20L
drop off 5°C Carboy
MC

Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions
						Y / N Y / N Y / N
						Y / N Y / N Y / N
						Y / N Y / N Y / N
						Y / N Y / N Y / N

Sampler's Name	D.Sacino/T.Horne	Mobile #	2504257350
Sampler's Signature	[signature]	Date/Time	March 29 2016

Temp in °C | Samples on ice? | Sample intact? | Trip Blank?

Appendix B-2 Second Quarter 2016 Results: Toxicity testing on Elk Valley samples with *Ceriodaphnia dubia, Pseudokirchneriella subcapitata, Hyalella azteca, Pimephales promelas* and *Oncorhynchus mykiss*

Nautilus Environmental

Toxicity testing on Elk Valley samples with *Ceriodaphnia dubia, Pseudokirchneriella subcapitata, Hyalella azteca, Pimephales promelas* and *Oncorhynchus mykiss*

Second Quarter 2016 Results

Final Report

Report date:
August 26, 2016

Submitted to:

Teck Coal Ltd.
Sparwood, BC

8664 Commerce Court
Burnaby, BC
V5A 4N7

TABLE OF CONTENTS

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LIST OF APPENDICES

SIGNATURE PAGE

Krysta Pearcy, B.Sc.
Laboratory Biologist

James Elphick, R.P.Bio.
Senior Reviewer

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

1.0 INTRODUCTION

Nautilus Environmental conducted toxicity tests for Teck Coal Ltd. on samples collected from various locations in the Elk Valley as part of a quarterly and semi-annual chronic toxicity testing program required under BC Ministry of Environment permit number 107517. Test species required to be tested quarterly included a cladoceran (*Ceriodaphnia dubia*), a unicellular green alga (*Pseudokirchneriella subcapitata*), an amphipod (*Hyalella azteca*), and the fathead minnow (*Pimephales promelas*). Tests are also required on a semi-annual basis (in alignment with second and forth quarterly testing) using rainbow trout (*Oncorhynchus mykiss*).

Water samples used for testing were transported in 20-L plastic containers in coolers containing ice packs. Samples were received at temperatures ranging from 4.8 to 16.0°C and were stored in the dark at 4 ± 2°C prior to testing. Table 1 outlines the toxicity tests that were conducted on each sample as well as sample collection dates. Samples were collected weekly on the dates shown in Table 1 for the duration of the *H. azteca, P. promelas* and *O. mykiss* tests. The *P. promelas* test was conducted at the Nautilus Environmental laboratory in Calgary, AB; the other toxicity tests were conducted at the Burnaby, BC location.

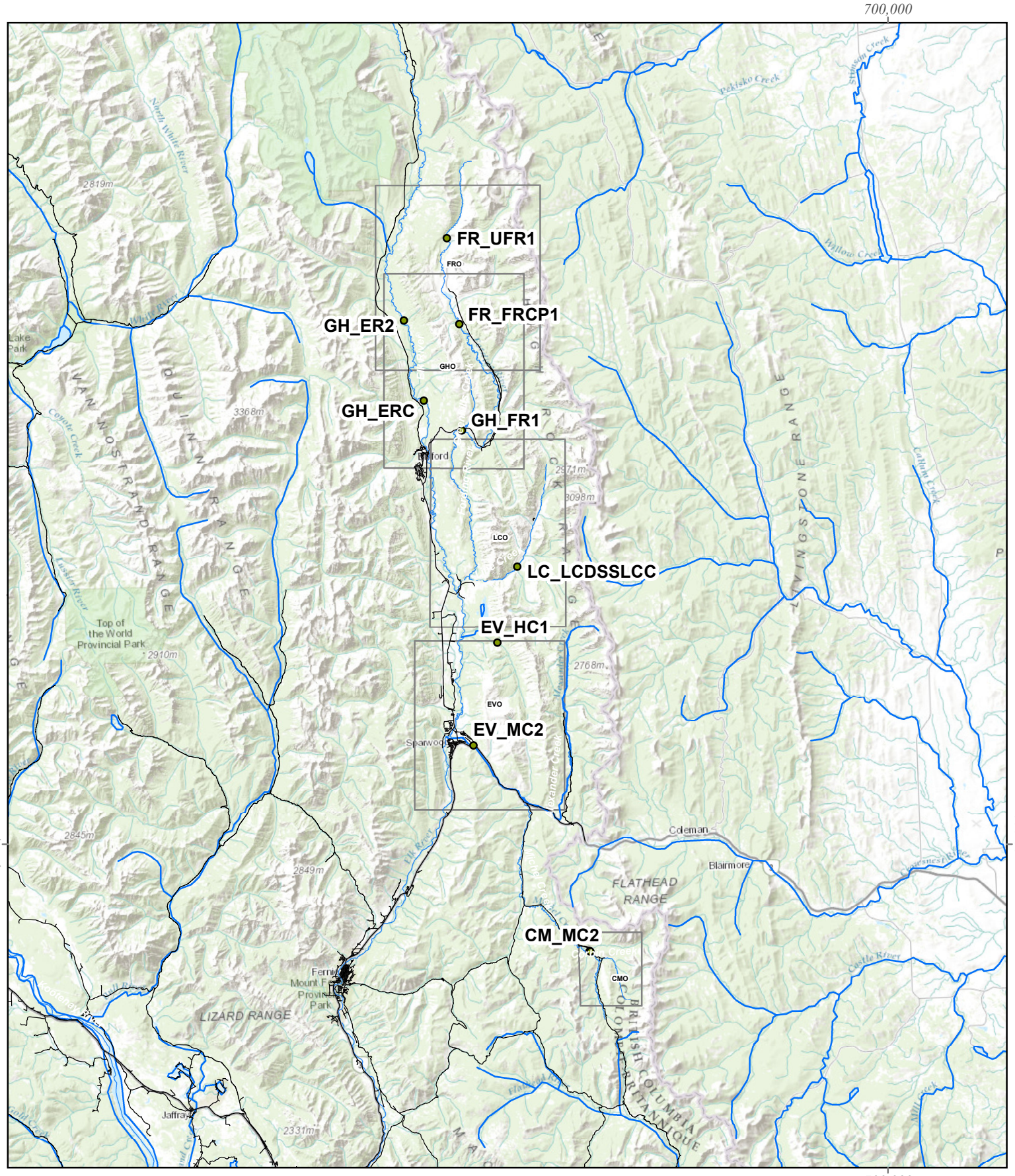
This report presents the results of the toxicity tests. Copies of laboratory data sheets and printouts of statistical analyses are provided in Appendices A through E, with the exception of data for sample LC_LCDSSLCC for *C. dubia* and *P. subcapitata*, which are reproduced here, but the raw data are provided in a separate report (Nautilus Environmental 2016). Results of analytical chemistry that was performed on the samples tested in this program are provided in Appendix F. These samples were collected by Teck personnel at the same time the samples were collected for toxicity testing. The chain-of-custody forms are provided in Appendix G.

Table 1. Summary of toxicity testing program.

Sample ID	EMS Location ID	Species Tested	Sample Collection Dates
FR_UFR1 *	E216777	*C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas* † and *O. mykiss*	April 27, May 4, May 11, May 18 and May 25, 2016
GH_ER2 *	0200389	*C. dubia*, *P. subcapitata* and *O. mykiss*	April 27, May 4, May 11 and May 18, 2016
FR_FRCP1	E300071	*C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas* † and *O. mykiss*	April 27, May 4, May 11, May 18 and May 25, 2016
GH_FR1	0200378	*C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas* † and *O. mykiss*	April 27, May 4, May 11, May 18 and May 25, 2016
GH_ERC	E300090	*C. dubia*, *P. subcapitata* and *O. mykiss*	April 27, May 4, May 11 and May 18, 2016
EV_MC2	E300091	*C. dubia*, *P. subcapitata* and *O. mykiss*	April 27, May 4, May 11 and May 18, 2016
EV_HC1	E102682	*C. dubia*, *P. subcapitata* and *O. mykiss*	April 27, May 4, May 11 and May 18, 2016
CM_MC2	E258937	*C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas* † and *O. mykiss*	April 27, May 4, May 11, May 18 and May 25, 2016
LC_LCDSSLCC	E297110	*C. dubia*, *P. subcapitata* and *O. mykiss*	April 27, May 4, May 11 and May 18, 2016

* Site water controls

† *P. promelas* tests were conducted on untreated and copper-amended samples



Teck

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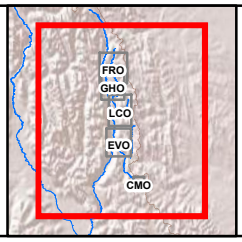

Chronic Toxicity Monitoring Locations

- Roads
- Rivers
- Monitoring Locations

N

0 4,000 8,000 16,000 Meters

DATE:	MINE OPERATION:
11/10/2015	Elk Valley
SCALE:	COORDINATE SYSTEM:
1:550,000	NAD 1983 UTM Zone 11N

Document Path: \\teckcominco.loc\CGO\Groups\TCGIS\Data\Operations\SPO\Dan_Vasiga\BaseLandscape_letter.mxd

2.0 METHODS

Methods for the toxicity tests using *C. dubia*, *P. subcapitata*, *H. azteca, P. promelas* and *O. mykiss* are summarized in Tables 2 through 6. Laboratory control water was 20% Perrier water prepared with deionized water for *C. dubia*; moderately hard water prepared by addition of reagent grade salts to dechlorinated municipal tap water for *P. promelas* according to a recipe provided by ASTM (1980); moderately hard water prepared by addition of reagent grade salts to dechlorinated municipal tap water for *H. azteca* according to a recipe provided in Environment Canada (2013); and dechlorinated municipal tap water for *O. mykiss*.

For the *H. azteca* tests, all of the site waters were supplemented with 25 mg/L chloride and 0.02 mg/L bromide using NaCl and NaBr, respectively, according to recommendations of the *Hyalella* Advisory Group (chaired by Chris Ingersoll, USGS) (Norberg-King et al., 2014), since low concentrations of these halides are known to impair growth of this species. The laboratory control water contained approximately 75 mg/L chloride and 0.8 mg/L bromide, respectively.

Fathead minnows are known to be susceptible to adverse effects caused by fungi and microbes (Grothe and Johnson, 1996; Ksoz et al., 2997; Downey et al. 2000). Results of toxicity tests and Toxicity Identification Evaluation efforts conducted in 2015 indicated that artefactual toxicity (i.e., adverse effects that were not associated with toxicants in the sample) had occurred in fathead minnow tests using ambient water samples from the Elk Valley and amendment of the samples with a low dose of copper appeared to counteract the adverse effect. Consequently, the *P. promelas* tests were tested on both untreated samples, as well as following the addition of 10 µg/L copper, in order to reduce the potential adverse effects caused by fungi and microbes in the samples. The copper amendment concentration was reduced from 20 µg/L, which was used in the first quarter tests, because an adverse effect was observed in the copper-treated control associated with those prior tests. A copper-amended control water treatment was also evaluated to test whether the copper itself caused any adverse response.

Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013), and involved comparison of results to both the laboratory and site water controls, with the exception of sample LC_LCDSSLCC for *C. dubia* and *P. subcapitata,* which was only compared to the laboratory control since this test was conducted separately from the remaining samples.

Table 2. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction test.

Test organism	*Ceriodaphnia dubia*
Test organism source	In-house culture
Test organism age	<24 h old neonates produced within 12 h
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20 mL glass test tube
Test volume	15 mL
Test solution depth	10 cm
Test concentrations	100% (v/v) sample, plus laboratory control
Test replicates	10 test replicates per treatment
Number of organisms	1 per replicate
Control water	20% Perrier water and 80% deionized water (hardness 80-100 mg/L $CaCO_3$)
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	Daily with *Pseudokirchneriella subcapitata* and YCT (3:1 ratio)
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light/8 hours dark
Sample filtration	None
Aeration	None
pH adjustment	None
Test protocol	Environment Canada (2007a)
Statistical software	CETIS
Test endpoint	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods, no ephippia present
Reference toxicant	Sodium chloride

Table 3. Summary of test conditions: *Pseudokirchneriella subcapitata* growth inhibition test.

Test organism	*Pseudokirchneriella subcapitata*, strain CPCC #37
Test organism source	In-house axenic culture, obtained from Canadian Phycological Culture Centre, and originally isolated from Nitelva River, Norway.
Test organism age	3-to 7-day old culture in logarithmic growth phase
Test type	Static
Test duration	72 hours
Test vessel	Microplate
Test volume	220 µL
Test concentrations	95.2% (v/v) sample, plus laboratory control
Test replicates	4 replicates per treatment; 8 replicates for control
Number of organisms	10, 000 cells/mL
Control water	Deionized water with nutrients added
Test solution renewal	None
Test temperature	24 ± 2°C
Feeding	None
Light intensity	3600 to 4400 lux
Photoperiod	24 hours light
Sample filtration	Through a preconditioned membrane filter of 0.45 µm using a vacuum pump
Aeration	None
pH adjustment	None
Test protocol	Environment Canada (2007b)
Statistical software	CETIS
Test endpoint	Algal cell growth inhibition
Test acceptability criteria for controls	>16-fold increase in number of algal cells; CV ≤20%; no trend when analyzed using Mann-Kendall test
Reference toxicant	Zinc

Table 4. Summary of test conditions: *Hyalella azteca* survival and growth test.

Test organism	*Hyalella azteca*
Test organism source	Aquatic Research Organisms, NH
Test organism age	7-8 days old
Test type	Static-renewal
Test duration	28 days
Test vessel	375 mL glass container
Test volume	300 mL of water
Test concentrations	100% (v/v) sample, plus laboratory control
Test replicates	5 test replicates per treatment
Number of organisms	10 per replicate
Control water	Moderately-hard water (hardness 80-100 mg/L $CaCO_3$) containing ~75 mg/L Cl and supplemented with 0.8 mg/L Br. Samples also supplemented with 25 mg/L Cl and 0.02 mg/L Br.
Test solution renewal	Twice daily (~80% renewal)
Test temperature	23 ± 1°C
Feeding	1 mL of YCT daily to each container. Tetramin daily, with amounts increasing weekly: Week 1: 0.5 mg, Week 2: 0.75 mg, Week 3: 1 mg, Week 4: 1.5 mg in each test container.
Light intensity	500 to 1000 lux at water surface
Photoperiod	16 hours light/8 hours dark
Sample filtration	None
Aeration	None
pH adjustment	None
Test protocol	Modified from US EPA (2000), as described in Norberg-King et al. (2014)
Statistical software	CETIS
Test endpoint	Survival and dry weight
Test acceptability criteria for controls	Mean control survival of ≥80% survival
Reference toxicant	Sodium chloride

Table 5. Summary of test conditions: *Pimephales promelas* survival and growth test.

Test organism	*Pimephales promelas*
Test organism source	Aquatox, Hot Springs, AR
Test organism age	<24 hours
Test type	Static renewal
Test duration	28 days post hatch
Test vessel	1-L plastic container
Test volume	1 L
Test concentrations	100% (v/v) sample, plus laboratory control
Test replicates	4 test replicates per treatment
Number of organisms	10 per replicate
Control water	Moderately-hard water (hardness 80-100 mg/L $CaCO_3$)
Test solution renewal	Daily (~80%)
Test temperature	25 ± 1°C
Feeding	Twice a day, after hatch, with newly hatched brine shrimp *(Artemia* nauplii*)*
Light intensity	100 to 500 lux at water surface
Photoperiod	16 hours light / 8 hours dark
Sample filtration	None
Aeration	Provided post hatch (<100 bubbles/min)
pH adjustment	None
Test protocol	US EPA (1996) and ASTM (2013)
Statistical software	CETIS
Test endpoint	Hatch, survival, length, biomass, normal development (which assesses incidence of deformities)
Test acceptability criteria for controls	>66% hatch; ≥70% post-hatch survival
Reference toxicant	Sodium chloride

Table 6. Summary of test conditions: *Oncorhynchus mykiss* embryo-alevin test.

Test organism	*Oncorhynchus mykiss*
Test organism source	Ted's Trout Farm, Little Fort, BC
Gamete quality	Small amount of water added to milt on a dry glass slide; verification of vigorous sperm motility using a compound microscope (100 X magnification)
Test organism age	<30 minutes post fertilization, <24 hour old gametes
Test type	Static renewal
Test duration	30 days
Test vessel	2-L plastic containers
Test volume	2 L
Test solution depth	17 cm
Test concentrations	100% (v/v), plus laboratory control
Test replicates	4 test replicates per treatment
No. of organisms	30 eggs per replicate
Control water	City of Burnaby dechlorinated municipal tap water (hardness 12 mg/L $CaCO_3$)
Test solution renewal	Daily (80% renewal)
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24 hours dark; low intensity light used during solution renewals
Aeration	6.5 ± 1 mL/min/L
Test protocol	Environment Canada (1998)
Statistical software	CETIS
Test endpoint	Survival, viability (which assesses incidence of deformities), length, wet weight
Test acceptability criteria for controls	≥65% normal hatched fish
Reference toxicant	Sodium dodecyl sulphate

3.0 RESULTS

Results of the toxicity tests using *C. dubia* are provided in Table 7. The Fording River site water (FR_UFR1) and laboratory water controls performed similarly for this species, indicating that there was no adverse effect associated with the upstream Fording River station. However, a statistically significant reduction (17%) in reproduction was observed in the upstream Elk River site water (GH_ER2) control compared to the laboratory water control.

There was no adverse effect on survival of *C. dubia* in the samples; survival ranged from 90 to 100%. Compared to the laboratory water and Fording River site water controls, an adverse effect on *C. dubia* reproduction was observed in six samples (FR_FRCP1, GH_FR1, GH_ERC, EV_MC2, EV_HC1 and CM_MC2); percent reduction ranged from 20 to 57% compared to the laboratory water control and from 18 to 56% compared to the Fording River site water control. Compared to the Elk River site water control, a statistically significant reduction in reproduction was observed in one sample (CM_MC2); percent reduction was 42%. Sample LC_LCDSSLCC was tested separately as part of the Line Creek testing program; results of the full strength sample and laboratory control are reproduced here. There was a significant reduction (23%) in reproduction for sample LC_LCDSSLCC compared to the laboratory control in that test.

Results of the toxicity tests using *P. subcapitata* are provided in Table 8. In these tests, the site water controls produced 2.9- to 3.1-fold greater growth than the laboratory water control. This finding is not unusual, since the higher ionic strength associated with the site water controls would be expected to stimulate cell growth of this species relative to the very low ionic strength associated with the laboratory control water. Similarly, the samples exhibited a stimulation of cell growth relative to the laboratory water control; none of the samples exhibited a statistically significant reduction in cell growth relative to the laboratory water control.

A statistically significant reduction in *P. subcapitata* cell yield was observed for three samples (FR_FRCP1, GH_FR1 and CM_MC2) when compared to the Fording River site water control; percent reduction was 27, 7 and 13% for FR_FRCP1, GH_FR1 and CM_MC2, respectively. One sample (FR_FRCP1) had a statistically significant reduction in cell yield when compared to the Elk River site water control; percent reduction was 20%.

Results of the toxicity tests using *H. azteca* are provided in Table 9. The Fording River site water and laboratory water controls performed similarly for this species, indicating that there were no

adverse effects associated with the upstream Fording River station. No adverse effect was observed on *H. azteca* survival in the samples; survival ranged from 94 to 100%. A statistically significant reduction in dry weight was observed in all three samples (FR_FRCP1, GH_FR1 and CM_MC2) compared to the laboratory water and site water controls; percent reduction ranged from 40 to 70% compared to the laboratory water control and from 43 to 72% compared to the site water control.

Results of the untreated and copper treated toxicity tests using *P. promelas* are provided in Tables 10 and 11, respectively. In both the untreated and copper treated tests the Fording River site water and laboratory water controls performed similarly for this species, indicating that there were no adverse effects associated with the upstream Fording River station. The copper amendment did not have an adverse effect on the control or site water control.

In the tests of the untreated samples, a statistically significant reduction in *P. promelas* survival was observed in all samples (FR_FRCP1, GH_FR1 and CM_MC2) compared to the untreated laboratory water control; percent reduction compared to the untreated laboratory water control was 12, 24 and 15% for FR_FRCP1, GH_FR1 and CM_MC2, respectively. There were no adverse effects on hatching, biomass, length or normal development in the untreated samples compared to the untreated laboratory water control. There were no adverse effects in the samples compared to the untreated hard water control and Fording River site water control.

The effects that were observed on fathead minnows were restricted to mortalities, and occurred predominantly between days 6 and 12 of the tests. Fathead minnows are known to be susceptible to adverse effects caused by fungi and microbes (Grothe and Johnson, 1996; Ksoz et al., 2997; Downey et al. 2000). These effects have been termed "sporadic mortality phenomenon", and are associated with mortalities that generally occur beginning on day 4 of the 7-day test with this species (Downey et al. 2000); this age is equivalent to day 6 of the 32-day test, which starts with an earlier life-stage. Effects associated with this phenomenon are generally associated with a high degree of between-replicate variability, as was in these 32-day tests. Thus, the pattern of effects observed with the samples tested here is consistent with effects caused by sporadic mortality phenomenon.

The samples were also tested using *P. promelas* following addition of 10 µg/L Cu to reduce fungal and microbial growth in the samples. There were no adverse effects of the samples compared to the laboratory control or the Fording River site water controls. Thus, amendment with copper removed the adverse effects on fathead minnows that were associated with the

untreated samples, providing further evidence that adverse effects that have been observed with this species using untreated samples from the Elk Valley were likely associated with an artefactual effect caused by microbes in the samples.

Results of the toxicity tests using *O. mykiss* are provided in Table 12. The Elk River site water control and laboratory water control performed similarly for this species, indicating that there were no adverse effects associated with the upstream Elk River station. There was a statistically significant reduction in survival (16% reduction) and viability (19% reduction) in the Fording River site water control compared to the laboratory water control.

Compared to the laboratory control water, a statistically significant reduction in survival of *O. mykiss* was observed in all samples except EV_HC1; percent reduction ranged from 20 to 32%. Viability was statistically significantly reduced in all samples compared to the laboratory control water, with percent reduction ranging from 19 to 34%. There were no adverse effects on length or wet weight in the samples compared to the laboratory control water.

Compared to the Fording River site water control, a small but statistically significant reduction (3%) in length was observed in one sample (FR_FRCP1). Compared to the Elk River site water control, statistically significant reductions in survival and viability of *O. mykiss* were observed in all samples; percent reduction ranged from 17 to 34% for survival and from 19 to 35% for viability. A small but statistically significant reduction (4%) in length was observed in one sample (FR_FRCP1) compared to the Elk River site water control. There were no adverse effects on wet weight in the samples compared to the Elk River site water control.

There were no observations of unusual behaviour of *O. mykiss* in any of the test solutions, and the survival and viability endpoints were similar, indicating a low rate of deformities in all samples. A hatch rate was not calculated in these tests; however, the survival endpoint provides an appropriate measure of successful hatch, since the test is terminated shortly following hatch.

Table 7. Results: *Ceriodaphnia dubia* survival and reproduction test.

Sample ID	Survival (%)	Reproduction (Mean ± SD)
Laboratory Control	100	22.7 ± 2.5
FR_UFR1 (Site Control)	100	22.2 ± 3.3
GH_ER2 (Site Control)	90	16.8 ± 7.0 *, α
FR_FRCP1	100	18.2 ± 3.7 *, α
GH_FR1	90	16.9 ± 6.0 *, α
GH_ERC	100	17.5 ± 3.4 *, α
EV_MC2	100	17.5 ± 4.0 *, α
EV_HC1	90	18.0 ± 3.6 *, α
CM_MC2	100	9.7 ± 4.7 *, α, β
Laboratory Control	100	19.8 ± 7.6
LC_LCDSSLCC †	100	15.3 ± 8.8 *

SD = Standard Deviation
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control FR_UFR1
β Result was significantly lower than the site control GH_ER2
† Conducted as part of the Line Creek testing program. Refer to Nautilus Environmental (2016) for additional information and results. Results not compared to site controls.

Table 8. Results: *Pseudokirchneriella subcapitata* growth inhibition test.

Sample ID	Cell Yield (x 10^4 cells/mL) (Mean ± SD)	Stimulation relative to laboratory control (%)
Laboratory Control	34.4 ± 2.7	-
FR_UFR1 (Site Control)	107.9 ± 4.9	213.8
GH_ER2 (Site Control)	98.8 ± 5.3 [α]	187.3
FR_FRCP1	78.8 ± 1.9 [α, β]	129.1
GH_FR1	100.0 ± 5.9 [α]	190.9
GH_ERC	103.8 ± 8.5	201.8
EV_MC2	111.5 ± 8.1	224.4
EV_HC1	113.5 ± 1.3	230.2
CM_MC2	94.0 ± 4.2 [α]	173.5
Laboratory Control	31.6 ± 1.7	-
LC_LCDSSLCC [†]	91.0 ± 4.8	187.7

SD = Standard Deviation
[α] Result was significantly lower than the site control FR_UFR1
[β] Result was significantly lower than the site control GH_ER2
[†] Conducted as part of the Line Creek testing program. Refer to Nautilus Environmental (2016) for additional information and results. Results not compared to site controls.

Table 9. Results: *Hyalella azteca* survival and growth test.

Sample ID	Survival (%) (Mean ± SD)	Dry Weight (mg) (Mean ± SD)
Laboratory Control	100 ± 0.0	0.87 ± 0.07
FR_UFR1 (Site Control)	98.0 ± 4.5	0.91 ± 0.08
FR_FRCP1	98.0 ± 4.5	0.44 ± 0.11 *, α
GH_FR1	98.0 ± 4.5	0.52 ± 0.18 *, α
CM_MC2	94.0 ± 8.9	0.26 ± 0.06 *, α

SD = Standard Deviation
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control FR_UFR1

Table 10. Results: *Pimephales promelas* survival and growth test (untreated).

Sample ID	Mean ± SD				
	Hatch (%)	Survival (%)	Biomass (mg)	Length (mm)	Normal development (%)
Laboratory Control	100 ± 0.0	98.3 ± 3.3	1.7 ± 0.2	9.8 ± 0.3	100 ± 0.0
Hard Water Control	98.3 ± 3.3	91.7 ± 3.3	1.8 ± 0.1	10.1 ± 0.2	98.1 ± 3.8
FR_UFR1 (Site Control)	98.3 ± 3.3	90.0 ± 3.8	2.1 ± 0.3	10.0 ± 0.5	100 ± 0.0
FR_FRCP1	100 ± 0.0	86.7 ± 9.4 *	2.0 ± 0.1	10.5 ± 0.6	100 ± 0.0
GH_FR1	96.7 ± 6.7	75.0 ± 10.0 *	1.9 ± 0.2	10.8 ± 0.6	100 ± 0.0
CM_MC2	100 ± 0.0	83.3 ± 8.6 *	2.1 ± 0.3	10.8 ± 0.5	98.1 ± 3.8

SD = Standard Deviation
* Result was significantly lower than the laboratory control

Table 11. Results: *Pimephales promelas* survival and growth test (copper treated).

Sample ID	Mean ± SD				
	Hatch (%)	Survival (%)	Biomass (mg)	Length (mm)	Normal development (%)
Hard Water Control [+Cu]	100 ± 0.0	90.0 ± 8.6	2.2 ± 0.4	9.7 ± 0.7	100 ± 0.0
FR_UFR1 (Site Control) [+Cu]	100 ± 0.0	93.3 ± 9.4	2.1 ± 0.1	9.2 ± 0.3	98.2 ± 3.6
FR_FRCP1 [+Cu]	98.3 ± 3.3	93.3 ± 5.4	1.9 ± 0.2	9.3 ± 0.4	100 ± 0.0
GH_FR1 [+Cu]	96.7 ± 6.7	90.0 ± 11.6	2.0 ± 0.3	9.6 ± 0.5	100 ± 0.0
CM_MC2 [+Cu]	100 ± 0.0	96.7 ± 6.7	2.2 ± 0.1	9.4 ± 0.2	100 ± 0.0

SD = Standard Deviation

Table 12. Results: *Oncorhynchus mykiss* embryo-alevin test.

Sample ID	Survival (%) (Mean ± SD)	Viability (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet Weight (mg) (Mean ± SD)
Laboratory Control	82.1 ± 8.8	77.0 ± 10.1	19.1 ± 0.5	94.6 ± 5.3
FR_UFR1 (Site Control)	69.2 ± 15.5 *, β	62.5 ± 11.3 *, β	19.7 ± 0.4	97.6 ± 2.0
GH_ER2 (Site Control)	84.8 ± 6.5	77.9 ± 5.9	19.8 ± 0.2	97.1 ± 3.4
FR_FRCP1	66.1 ± 10.4 *, β	61.1 ± 6.4 *, β	19.0 ± 0.4 α, β	96.6 ± 4.7
GH_FR1	62.7 ± 10.3 *, β	59.3 ± 10.7 *, β	19.9 ± 0.2	95.8 ± 6.5
GH_ERC	66.1 ± 8.7 *, β	59.5 ± 6.7 *, β	19.5 ± 0.5	102.1 ± 7.3
EV_MC2	55.8 ± 3.9 *, β	50.8 ± 2.8 *, β	20.1 ± 0.5	106.7 ± 12.4
EV_HC1	70.5 ± 7.1 β	62.6 ± 8.8 *, β	19.5 ± 0.2	105.0 ± 3.0
CM_MC2	60.2 ± 9.0 *, β	56.1 ± 6.3 *, β	19.5 ± 0.3	95.8 ± 7.5
LC_LCDSSLCC	69.0 ± 7.2 *, β	61.6 ± 7.0 *, β	19.8 ± 0.3	97.7 ± 3.5

SD = Standard Deviation
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control FR_UFR1
β Result was significantly lower than the site control GH_ER2

4.0 QA/QC

The health histories of the test organisms used in the exposures were acceptable and met the requirements of the test protocols. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocols throughout the tests. There were no deviations from the test methodologies other than the planned modification to the *H. azteca* method and addition of copper in the *P. promelas* tests, as described in Section 2.0. Uncertainty associated with these tests is best described by the standard deviations around the means.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 13. Results for these tests fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in these tests was appropriate.

Table 13. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
C. dubia	Survival (LC50): 2.1 g/L NaCl	2.0 (1.8–2.2)	5	April 13, 2016
	Reproduction (IC50): 1.6 g/L NaCl	1.5 (1.2–1.9)	12	
P. subcapitata	Growth (IC50): 34.0 µg/L Zn	30.5 (17.4–53.5)	32	April 26, 2016
H. azteca	Survival (LC50): 5.2 g/L NaCl	5.4 (4.7–6.3)	8	April 28, 2016
P. promelas	Survival (LC50): 1.0 g/L NaCl	0.7 (0.6–1.0)	9	May 3, 2016
	Biomass (IC25): 0.3 g/L NaCl	0.4 (0.3–0.6)	10	
O. mykiss	Viability (EC50): 5.5 mg/L SDS	4.1 (2.1–8.0)	40	April 28, 2016

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration, EC = Effect Concentration

5.0 REFERENCES

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6.0 END OF REPORT

APPENDIX A – *Ceriodaphnia dubia* Toxicity Test Data

Ceriodaphnia dubia Summary Sheet

Client: Teck Coal
Work Order No.: 16478

Start Date/Time: April 28/16 @ 1530h
Set up by: EMM

Sample Information:

Sample ID: various - see results table for IDs
Sample Date: April 27/16
Date Received: April 28/16
Sample Volume: various

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 041916
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 20
Mortality (%) in previous 7 d: 0
Individual female # used ≥8 young on test day: 4, 6, 8, 9, 10, 15, 18, 19

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd143
Stock Solution ID: 16NaCl
Date Initiated: April 13/16

7-d LC50 (95% CL): 2.1 (2.0-2.2) g/L NaCl
7-d IC50 (95% CL): 1.6 (1.4-1.8) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCl CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-1.9) g/L NaCl CV (%): 12

Test Results:

	Survival (%)	Reproduction (Mean ± SD)
① Negative Control	100	22.7 ± 2.5
② FR_UFR1_0_04042016_N	100	22.2 ± 3.3
③ GH_ER2_WS_2016_04_27_N	90	16.8 ± 7.0 a.
FR_FRCP1_Q_04042016_N	100	18.2 ± 3.7 a.
GH_FR1_WS_2016_04_27_N	90	16.9 ± 6.0 a.
GH_ERC_WS_2016_04_27_N	100	17.5 ± 3.4 a.
ER_HC1_WS_2016-04-27_N	90	18.0 ± 3.6 a.
ER_MC2_WS_2016-04-27_N	100	17.5 ± 4.0 a.
CM_MC2_WS_20160427_N	100	9.7 ± 4.7 ab.

① Lab control
② site control

b. Reproduction was significantly less than the lab control and site control GH_ER2

a. Reproduction was significantly less than the lab control and site control FR_UFR1

Reviewed by: JGu
Date reviewed: May 18/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: Various pass/fail Teck
Work Order #: 16478

Start Date & Time: April 28/16 @ 1530h
Stop Date & Time: May 4/16 @ 1715h
Test Species: *Ceriodaphnia dubia*

Concentration: Lab control	0 init.	1 old	1 new	2 old	2 new	3 old	3 new	4 old	4 new	5 old	5 new	Final 6 old	6 new	7 final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.0	7.6	8.2	7.4	7.9	7.4	8.2	7.5	8.2	7.3	8.2	7.4		
pH	7.8	7.7	8.0	7.7	8.0	7.9	7.9	7.9	8.0	7.8	7.9	7.6		
Cond. (µS/cm)	222	222		212		223		223		216		215		
Initials	EMM	JS		KL		YML		JS		JS		MLT		

Concentration: FR_UFR1	0 init.	1 old	1 new	2 old	2 new	3 old	3 new	4 old	4 new	5 old	5 new	Final 6 old	6 new	7 final
Temperature (°C)	24.0	25.0	25.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	25.0	25.0		
DO (mg/L)	8.0	7.5	8.0	7.1	8.1	7.4	8.2	7.5	8.2	7.3	8.0	7.4		
pH	8.1	7.9	7.9	7.8	8.0	8.0	8.0	7.9	7.9	7.8	7.9	7.8		
Cond. (µS/cm)	236	239		233		234		235		235		237		
Initials	EMM	JS		KL		YML		JS		JS		MLT		

Concentration: GH FR1	0 init.	1 old	1 new	2 old	2 new	3 old	3 new	4 old	4 new	5 old	5 new	Final 6 old	6 new	7 final
Temperature (°C)	24.0	25.0	25.0	25.0	25.0	25.0	24.0	25.0	24.8	25.0	25.0	25.0		
DO (mg/L)	8.0	7.5	8.1	7.2	8.1	7.5	8.1	7.5	8.2	7.3	8.0	7.4		
pH	8.1	8.0	8.0	7.9	8.1	8.0	8.1	8.0	8.1	7.9	8.1	7.9		
Cond. (µS/cm)	573	574		KL 570		569		571		571		560		
Initials	EMM	JS		KL		YML		JS		JS		MLT		

Concentration: GH_FR2	0 init.	1 old	1 new	2 old	2 new	3 old	3 new	4 old	4 new	5 old	5 new	Final 6 old	6 new	7 final
Temperature (°C)	24.0	25.0	25.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	25.0	25.0		
DO (mg/L)	8.0	7.5	8.1	7.1	8.2	7.3	8.2	7.5	8.2	7.3	8.1	7.4		
pH	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.8		
Cond. (µS/cm)	300	301		300		298		298		295		296		
Initials	EMM	JS		KL		YML		JS		JS		MLT		

Thermometer: 4 DO meter: 2 pH meter: 4 Conductivity meter: 4

	Control	①		
Hardness*	100			
Alkalinity*	98			

* mg/L as CaCO3

Analysts: JS, MLT, EMM, AWP, YML, KL
Reviewed by: JGW
Date reviewed: May 17/16

Sample Description: ① see page 2 of 3. all samples clear, no ~~precipitate~~ particulate, no odours, except for GH FR2 which has some precipitate. page 1 of 3

Comments: ① see hardness and alkalinity datasheet for 100% v/v samples

Broodboard Used: 041916

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various pass/fail tests
Work Order #: 16418

Start Date & Time: April 28/16 @ 1530h
Stop Date & Time: May 4/16 @ 1715h
Test Species: *Ceriodaphnia dubia*

Concentration: CM-MC2	Days 0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	26.0	25.0	24.0	25.0	24.0	25.0	25.0	25.0		
DO (mg/L)	8.0	7.6	8.1	7.3	8.1	7.9	8.2	7.5	8.2	7.3	8.0	7.3		
pH	8.1	8.0	8.0	8.0	8.0	8.0	8.0	7.9	8.0	7.8	8.0	7.9		
Cond. (µS/cm)	543	540		539		537		539		542		524		
Initials	EMM	JS		K		MK		JS		JS		MH		

Concentration: EV-MC2	Days 0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	25.5	25.0	24.0	25.0	24.0	25.0	25.0	25.0		
DO (mg/L)	8.0	7.5	8.1	7.3	8.1	7.9	8.2	7.5	8.2	7.2	8.1	7.3		
pH	7.9	7.9	7.9	8.0	7.9	8.0	7.9	7.9	7.9	8.0	7.9	7.8		
Cond. (µS/cm)	270	271		272		270		272		271		263		
Initials	EMM	JS		K		MK		JS		JS		MH		

Concentration: GH-EC	Days 0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	26.0	25.0	24.0	25.0	24.0	25.0	25.0	25.0		
DO (mg/L)	8.0	7.5	8.0	7.2	8.0	7.9	8.1	7.5	8.2	7.2	8.1	7.3		
pH	8.0	8.0	8.0	8.2	8.0	8.1	7.9	7.9	7.9	7.8	7.9	7.9		
Cond. (µS/cm)	348	343		344		340		342		341		331		
Initials	EMM	JS		K		MK		JS		JS		MH		

Concentration: EV-HC1	Days 0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	25.5	25.0	24.0	25.0	24.0	25.0	25.0	25.0		
DO (mg/L)	8.0	7.6	8.1	7.2	8.1	7.9	8.2	7.5	8.2	7.2	8.1	7.3		
pH	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	7.9		
Cond. (µS/cm)	561	554		554		551		556		561		531		
Initials	EMM	JS		K		MK		JS		JS		MH		

Thermometer: 4 **DO meter:** 2 **pH meter:** 4 **Conductivity meter:** 4

	Control			
Hardness*	100			
Alkalinity*	98			

* mg/L as CaCO3

Analysts: JS, MH, EMM, AWP, MK, KK
Reviewed by: JOH
Date reviewed: May 17/16

Sample Description: all samples are clear, colourless, some debris, odourless (except GH-EC2 which is clear, colourless, odourless, no debris)

Comments: **Broodboard Used:** 041916

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various pass/fail teck
Work Order #: 16478

Start Date & Time: Apr 128/16 @ 1530h
Stop Date & Time: May 4/16 @ 1715h
Test Species: *Ceriodaphnia dubia*

Concentration FR-FDCP1	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	25.5	25.0	24.0	25.0	24.5	25.0	25.0	25.0		
DO (mg/L)	8.0	7.5	8.1	7.4	8.2	7.4	8.1	7.5	8.2	7.2	8.1	7.3		
pH	8.1	8.1	8.1	8.0	8.1	8.0	8.1	8.0	8.1	7.9	8.1	7.8		
Cond. (µS/cm)	551	549		547		546		548		549		533		
Initials	FMM	JS		KL		YYL		JS		JS		MLT		

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: 4 DO meter: 2 pH meter: 4 Conductivity meter: 4

	Control			
Hardness*	100			
Alkalinity*	98			

* mg/L as CaCO3

Analysts: JS, MLT, AWD, YYL, FMM, KL
Reviewed by: YYL
Date reviewed: May 17/16

Sample Description:

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Comments: Broodboard Used: 041916

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck
Sample ID: various
Work Order: 16478

Start Date & Time: April 28/16 @ 1530h
Stop Date & Time: May 4/16 @ 1715h
Set up by: EMM

Concentration: 2.06 control

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	/	/	/	/	/	/	/	/	/	/	KL
3	/	/	/	/	/	/	/	/	/	/	△
4	3	4	3	4	4	3	3	3	4	4	EMM
5	8	8	7	9	6	8	6	9	9	6	JS
6	13	11	12	12	10	10	11	14	13	10	MG
7											
8											
Total	24	23	22	25	20	21	20	26	26	20	MG

Concentration: FR-UFR1

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	/	/	/	/	/	/	/	/	/	/	KL
3	/	/	/	/	/	/	/	/	/	/	△
4	4	4	5	4	5	5	3	4	4	5	EMM
5	✓	7	7	8	9	8	8	8	8	7	JS
6	10	10	11	12	12	11	10	11	10	12	MG
7											
8											
Total	14	21	23	24	26	24	21	23	22	24	MG

Concentration: GH-ER2

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	/	/	X	/	/	/	/	/	/	/	KL
3	/	/		/	/	/	/	/	/	/	△
4	4	3		3	4	4	3	✓	3	3	EMM
5	6	6		✓	7	6	8	6	5	7	JS
6	10	10		6	12	11	10	12	9	10	MG
7											
8			↓								
Total	20	19	0*	9	23	21	21	18	17	20	MG

Concentration: FR-FRCP1

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	/	/	/	/	/	/	/	/	/	/	KL
3	/	/	/	/	/	/	/	/	/	/	△
4	5	3	2	2	2	4	2	2	3	3	EMM
5	✓	7	7	6	7	✓	7	6	8	7	JS
6	6	10	10	7	9	10	12	13	10	12	MG
7											
8											
Total	11	20	19	15	18	14	21	21	21	22	MG

Concentration: GH-FR1

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	/	/	/	/	/	/	/	/	/	/	KL
3	/	/	/	/	/	/	/	/	/	/	△
4	✓	3	✓	3	3	4	3	3	✓	3	EMM
5	5	8	5	8	7	7	✓	7	4	✓	JS
6	11	12	10	10	9	11	X	12	11	10	MG
7											
8											
Total	16	23	15	21	19	22	3X	22	15	13	MG

Concentration: GH-ERC

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	/	/	/	/	/	/	/	/	/	/	KL
3	/	/	/	/	/	/	/	/	/	/	△
4	✓	✓	3	3	3	✓	3	3	2	3	EMM
5	6	6	8	8	5	4	6	8	6	6	JS
6	9	10	9	11	10	10	10	✓	10	11	MG
7											
8											
Total	15	16	20	22	20	14	19	11	18	20	MG

Concentration: EV-HC1

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	/	/	/	/	/	/	/	/	/	KL
3	/	/	/	/	/	/	/	/	/	/	△
4	3	3	3	✓	3	2	2	3	3	3	EMM
5	6	5	✓	6	7	6	6	8	8	5	JS
6	11	11	7	10	9	9	9	12	11	9X	MG
7											
8											
Total	20	19	10	16	19	17	17	23	22	17X	MG

Concentration: EV-MC2

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	/	/	/	/	/	/	/	/	/	/	KL
3	/	/	/	/	/	/	/	/	/	/	△
4	2	3	3	3	4	4	3	3	3	2	EMM
5	5	5	✓	1	✓	6	7	6	8	6	JS
6	9	12	9	8	9	10	11	12	11	10	MG
7											
8											
Total	16	20	12	12	13	20	21	21	22	18	MG

Concentration: CM-MC2

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	/	/	/	/	/	/	/	/	/	/	KL
3	JS	/	/	/	/	/	/	/	/	/	△
4	4 2	✓	3	✓	✓	3	2	2	2	3	EMM
5	✓	✓	✓	2	✓	5 ✓	✓	4	3	6	JS
6	8	8	6	4	✓	7	5	6	8	6	MG
7											
8											
Total	12	8	9	6	0	15	7	12	13	15	MG

Notes: X = mortality.

Sample Description: all samples clear, no particulates or no precipitate, odourless except GH-ER2 which has some particulate

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count

Reviewed by: JOh

Date reviewed: May 17/16

CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Batch ID:	15-3253-5145	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	28 Apr-16 15:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 17:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 2h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	05-3864-3226	28 Apr-16	28 Apr-16	16h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	30h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	28h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	25h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	32h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	30h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	30h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

6d Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	10	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	10	1	1	1	1	1	0	0	0.0%	0.0%
GH_ER2	10	0.9	0.6738	1	0	1	0.1	0.3162	35.14%	10.0%
FR_FRCP1	10	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	10	0.9	0.6738	1	0	1	0.1	0.3162	35.14%	10.0%
GH_ERC	10	1	1	1	1	1	0	0	0.0%	0.0%
EV_HC1	10	0.9	0.6738	1	0	1	0.1	0.3162	35.14%	10.0%
EV_MC2	10	1	1	1	1	1	0	0	0.0%	0.0%
CM_MC2	10	1	1	1	1	1	0	0	0.0%	0.0%

6d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
FR_UFR1	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	0	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	0	1	1	1
GH_ERC	1	1	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	0
EV_MC2	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1

Ceriodaphnia 7-d Survival and Reproduction Test — Nautilus Environmental

6d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_UFR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
GH_ERC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	18-0254-9532	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 15:37	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	15-3253-5145	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	28 Apr-16 15:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 17:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 2h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	05-3864-3226	28 Apr-16	28 Apr-16	16h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	30h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	28h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	25h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	32h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	30h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	30h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_ER2	0.5	1.0000	Exact	Non-Significant Effect
Lab Control		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
Lab Control		GH_ERC	1	1.0000	Exact	Non-Significant Effect
Lab Control		EV_HC1	0.5	1.0000	Exact	Non-Significant Effect
Lab Control		EV_MC2	1	1.0000	Exact	Non-Significant Effect
Lab Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Negative Contr	10	0	10	1	0	0.0%
FR_UFR1		10	0	10	1	0	0.0%
GH_ER2		9	1	10	0.9	0.1	10.0%
FR_FRCP1		10	0	10	1	0	0.0%
GH_FR1		9	1	10	0.9	0.1	10.0%
GH_ERC		10	0	10	1	0	0.0%
EV_HC1		9	1	10	0.9	0.1	10.0%
EV_MC2		10	0	10	1	0	0.0%
CM_MC2		10	0	10	1	0	0.0%

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID: 18-0254-9532 **Endpoint:** 6d Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 11 May-16 15:37 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

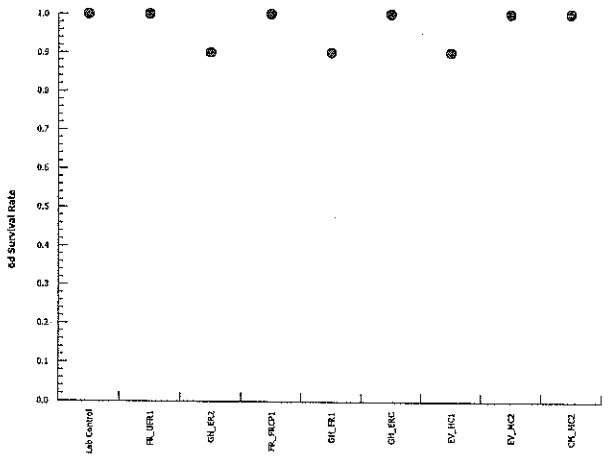
6d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
FR_UFR1	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	0	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	0	1	1	1
GH_ERC	1	1	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	0
EV_MC2	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1

6d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_UFR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
GH_ERC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	12-6000-7345	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 May-16 15:23	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	15-3253-5145	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	28 Apr-16 15:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 17:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 2h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	05-3864-3226	28 Apr-16	28 Apr-16	16h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	30h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	28h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	25h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	32h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	30h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	30h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		Lab Control	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_ER2	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_ERC	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_HC1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_MC2	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control		10	0	10	1	0	0.0%
FR_UFR1	Upstream Contr	10	0	10	1	0	0.0%
GH_ER2		9	1	10	0.9	0.1	10.0%
FR_FRCP1		10	0	10	1	0	0.0%
GH_FR1		9	1	10	0.9	0.1	10.0%
GH_ERC		10	0	10	1	0	0.0%
EV_HC1		9	1	10	0.9	0.1	10.0%
EV_MC2		10	0	10	1	0	0.0%
CM_MC2		10	0	10	1	0	0.0%

Ceriodaphnia 7-d Survival and Reproduction Test | **Nautilus Environmental**

Analysis ID: 12-6000-7345 **Endpoint:** 6d Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 18 May-16 15:23 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

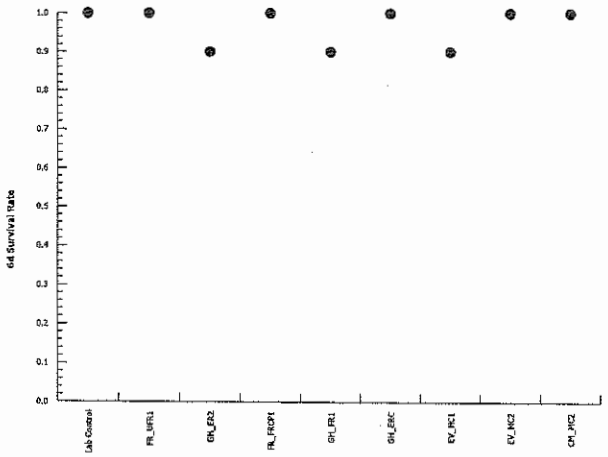
6d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
FR_UFR1	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	0	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	0	1	1	1
GH_ERC	1	1	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	0
EV_MC2	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1

6d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_UFR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
GH_ERC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	04-9781-3957	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 May-16 15:22	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	15-3253-5145	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	28 Apr-16 15:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 17:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 2h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	05-3864-3226	28 Apr-16	28 Apr-16	16h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	30h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	28h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	25h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	32h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	30h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	30h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
GH_ER2		Lab Control	1	1.0000	Exact	Non-Significant Effect
GH_ER2		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
GH_ER2		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
GH_ER2		GH_FR1	0.7632	1.0000	Exact	Non-Significant Effect
GH_ER2		GH_ERC	1	1.0000	Exact	Non-Significant Effect
GH_ER2		EV_HC1	0.7632	1.0000	Exact	Non-Significant Effect
GH_ER2		EV_MC2	1	1.0000	Exact	Non-Significant Effect
GH_ER2		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control		10	0	10	1	0	-11.11%
FR_UFR1		10	0	10	1	0	-11.11%
GH_ER2	Receiving Wate	9	1	10	0.9	0.1	0.0%
FR_FRCP1		10	0	10	1	0	-11.11%
GH_FR1		9	1	10	0.9	0.1	0.0%
GH_ERC		10	0	10	1	0	-11.11%
EV_HC1		9	1	10	0.9	0.1	0.0%
EV_MC2		10	0	10	1	0	-11.11%
CM_MC2		10	0	10	1	0	-11.11%

Ceriodaphnia 7-d Survival and Reproduction Test **Nautilus Environmental**

Analysis ID: 04-9781-3957 **Endpoint:** 6d Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 18 May-16 15:22 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

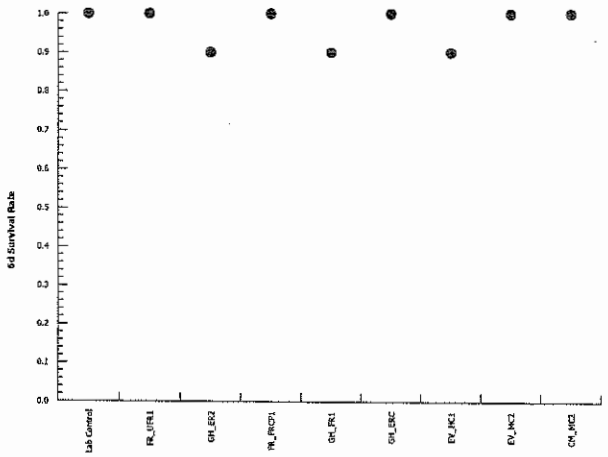
6d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
FR_UFR1	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	0	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	0	1	1	1
GH_ERC	1	1	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	0
EV_MC2	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1

6d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_UFR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
GH_ERC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Summary Report

Test Code: 16478 | 11-7449-0204

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Batch ID:	15-3253-5145	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	28 Apr-16 15:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 17:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 2h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	05-3864-3226	28 Apr-16	28 Apr-16	16h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	30h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	28h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	25h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	32h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	30h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	30h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Reproduction Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	10	22.7	20.95	24.45	20	26	0.7753	2.452	10.8%	0.0%
FR_UFR1	10	22.2	19.87	24.53	14	26	1.031	3.259	14.68%	2.2%
GH_ER2	10	16.8	11.78	21.82	0	23	2.22	7.021	41.79%	25.99%
FR_FRCP1	10	18.2	15.57	20.83	11	22	1.162	3.676	20.2%	19.82%
GH_FR1	10	16.9	12.59	21.21	3	23	1.906	6.027	35.66%	25.55%
GH_ERC	10	17.5	15.06	19.94	11	22	1.078	3.408	19.47%	22.91%
EV_HC1	10	18	15.41	20.59	10	23	1.145	3.621	20.12%	20.7%
EV_MC2	10	17.5	14.67	20.33	12	22	1.249	3.951	22.58%	22.91%
CM_MC2	10	9.7	6.361	13.04	0	15	1.476	4.668	48.12%	57.27%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	24	23	22	25	20	21	20	26	26	20
FR_UFR1	14	21	23	24	26	24	21	23	22	24
GH_ER2	20	19	0	9	23	21	21	18	17	20
FR_FRCP1	11	20	19	15	18	14	21	21	21	22
GH_FR1	16	23	15	21	19	22	3	22	15	13
GH_ERC	15	16	20	22	20	14	19	11	18	20
EV_HC1	20	19	10	16	19	17	17	23	22	17
EV_MC2	16	20	12	12	13	20	21	21	22	18
CM_MC2	12	8	9	6	0	15	7	12	13	15

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	13-3453-4966	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 15:37	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	15-3253-5145	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	28 Apr-16 15:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 17:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 2h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	05-3864-3226	28 Apr-16	28 Apr-16	16h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	30h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	28h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	25h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	32h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	30h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	30h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	21.2%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	106	73	6	18	0.9055	Asymp	Non-Significant Effect
		GH_ER2	70.5	73	3	18	0.0282	Asymp	Significant Effect
		FR_FRCP1	71.5	73	3	18	0.0343	Asymp	Significant Effect
		GH_FR1	73	73	3	18	0.0456	Asymp	Significant Effect
		GH_ERC	64	73	2	18	0.0067	Asymp	Significant Effect
		EV_HC1	66.5	73	3	18	0.0120	Asymp	Significant Effect
		EV_MC2	69.5	73	3	18	0.0230	Asymp	Significant Effect
		CM_MC2	55	73	0	18	0.0006	Asymp	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1111.156	138.8944	8	7.028	<0.0001	Significant Effect
Error	1600.9	19.7642	81			
Total	2712.056		89			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.13	20.09	0.0567	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9053	0.962	<0.0001	Non-normal Distribution

Analysis ID: 13-3453-4966 **Endpoint:** Reproduction **CETIS Version:** CETISv1.8.7
Analyzed: 11 May-16 15:37 **Analysis:** Nonparametric-Control vs Treatments **Official Results:** Yes

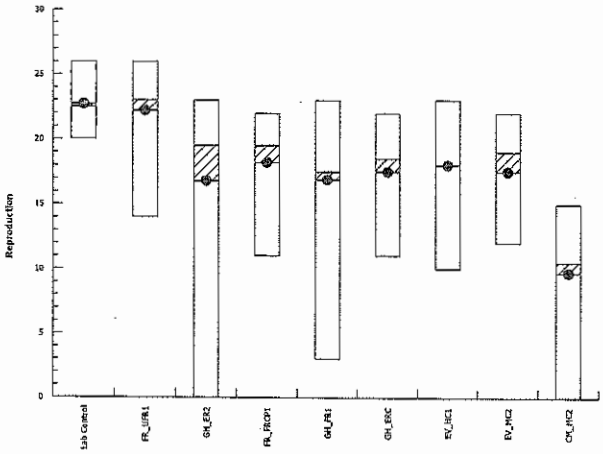
Reproduction Summary

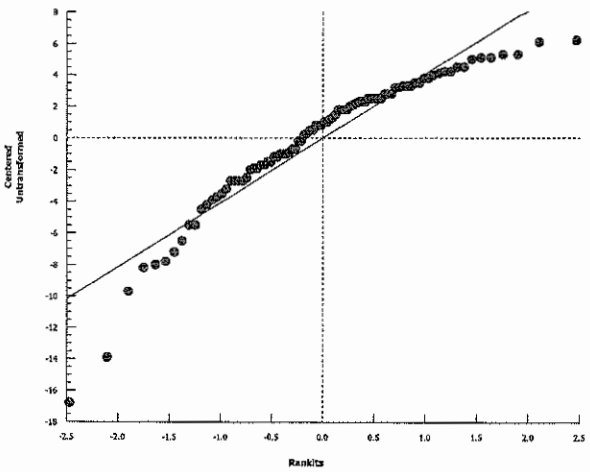
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	22.7	20.95	24.45	22.5	20	26	0.7753	10.8%	0.0%
FR_UFR1	10	22.2	19.87	24.53	23	14	26	1.031	14.68%	2.2%
GH_ER2	10	16.8	11.78	21.82	19.5	0	23	2.22	41.79%	25.99%
FR_FRCP1	10	18.2	15.57	20.83	19.5	11	22	1.162	20.2%	19.82%
GH_FR1	10	16.9	12.59	21.21	17.5	3	23	1.906	35.66%	25.55%
GH_ERC	10	17.5	15.06	19.94	18.5	11	22	1.078	19.47%	22.91%
EV_HC1	10	18	15.41	20.59	18	10	23	1.145	20.12%	20.7%
EV_MC2	10	17.5	14.67	20.33	19	12	22	1.249	22.58%	22.91%
CM_MC2	10	9.7	6.361	13.04	10.5	0	15	1.476	48.12%	57.27%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	24	23	22	25	20	21	20	26	26	20
FR_UFR1	14	21	23	24	26	24	21	23	22	24
GH_ER2	20	19	0	9	23	21	21	18	17	20
FR_FRCP1	11	20	19	15	18	14	21	21	21	22
GH_FR1	16	23	15	21	19	22	3	22	15	13
GH_ERC	15	16	20	22	20	14	19	11	18	20
EV_HC1	20	19	10	16	19	17	17	23	22	17
EV_MC2	16	20	12	12	13	20	21	21	22	18
CM_MC2	12	8	9	6	0	15	7	12	13	15

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	08-7124-1188	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 14:55	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	15-3253-5145	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	28 Apr-16 15:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 17:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 2h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	05-3864-3226	28 Apr-16	28 Apr-16	16h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	30h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	28h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	25h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	32h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	30h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	30h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	21.7%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		Lab Control	104	73	5	18	0.8702	Asymp	Non-Significant Effect
		GH_ER2	69	73	2	18	0.0207	Asymp	Significant Effect
		FR_FRCP1	69	73	3	18	0.0207	Asymp	Significant Effect
		GH_FR1	73	73	3	18	0.0456	Asymp	Significant Effect
		GH_ERC	66	73	2	18	0.0107	Asymp	Significant Effect
		EV_HC1	70.5	73	2	18	0.0282	Asymp	Significant Effect
		EV_MC2	66.5	73	2	18	0.0120	Asymp	Significant Effect
		CM_MC2	57	73	0	18	0.0011	Asymp	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1111.156	138.8944	8	7.028	<0.0001	Significant Effect
Error	1600.9	19.7642	81			
Total	2712.056		89			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.13	20.09	0.0567	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9053	0.962	<0.0001	Non-normal Distribution

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	08-7124-1188	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 14:55	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

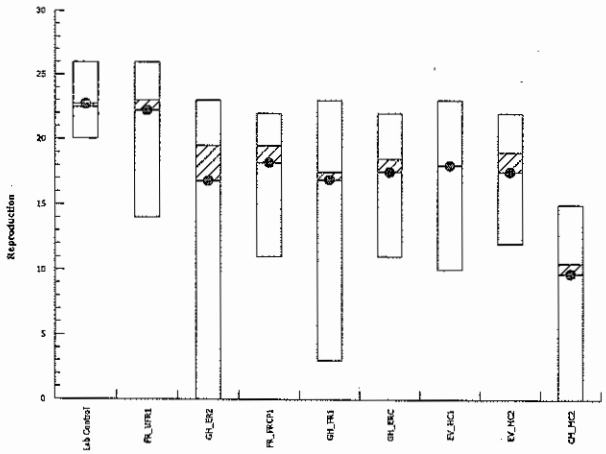
Reproduction Summary

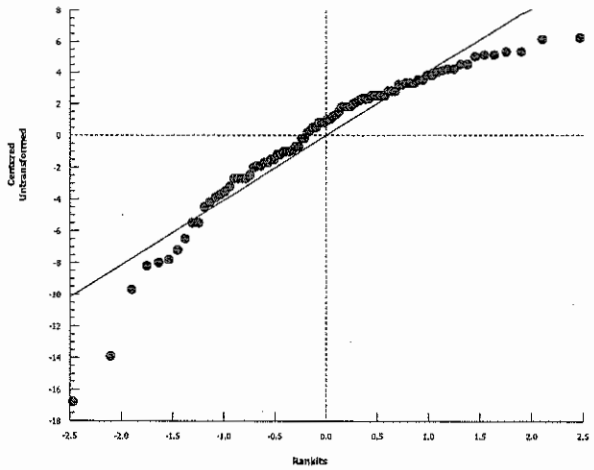
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	22.7	20.95	24.45	22.5	20	26	0.7753	10.8%	0.0%
FR_UFR1	10	22.2	19.87	24.53	23	14	26	1.031	14.68%	2.2%
GH_ER2	10	16.8	11.78	21.82	19.5	0	23	2.22	41.79%	25.99%
FR_FRCP1	10	18.2	15.57	20.83	19.5	11	22	1.162	20.2%	19.82%
GH_FR1	10	16.9	12.59	21.21	17.5	3	23	1.906	35.66%	25.55%
GH_ERC	10	17.5	15.06	19.94	18.5	11	22	1.078	19.47%	22.91%
EV_HC1	10	18	15.41	20.59	18	10	23	1.145	20.12%	20.7%
EV_MC2	10	17.5	14.67	20.33	19	12	22	1.249	22.58%	22.91%
CM_MC2	10	9.7	6.361	13.04	10.5	0	15	1.476	48.12%	57.27%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	24	23	22	25	20	21	20	26	26	20
FR_UFR1	14	21	23	24	26	24	21	23	22	24
GH_ER2	20	19	0	9	23	21	21	18	17	20
FR_FRCP1	11	20	19	15	18	14	21	21	21	22
GH_FR1	16	23	15	21	19	22	3	22	15	13
GH_ERC	15	16	20	22	20	14	19	11	18	20
EV_HC1	20	19	10	16	19	17	17	23	22	17
EV_MC2	16	20	12	12	13	20	21	21	22	18
CM_MC2	12	8	9	6	0	15	7	12	13	15

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	13-1680-7444	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 14:56	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	15-3253-5145	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	28 Apr-16 15:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 17:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 2h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	05-3864-3226	28 Apr-16	28 Apr-16	16h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	30h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	28h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	25h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	40h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	32h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	30h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	30h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	28.7%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
GH_ER2		Lab Control	139.5	73	3	18	1.0000	Asymp	Non-Significant Effect
		FR_UFR1	141	73	2	18	1.0000	Asymp	Non-Significant Effect
		FR_FRCP1	108	73	4	18	0.9333	Asymp	Non-Significant Effect
		GH_FR1	104	73	3	18	0.8702	Asymp	Non-Significant Effect
		GH_ERC	98	73	3	18	0.7162	Asymp	Non-Significant Effect
		EV_HC1	100	73	4	18	0.7753	Asymp	Non-Significant Effect
		EV_MC2	103.5	73	3	18	0.8602	Asymp	Non-Significant Effect
		CM_MC2	70	73	2	18	0.0254	Asymp	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1111.156	138.8944	8	7.028	<0.0001	Significant Effect
Error	1600.9	19.7642	81			
Total	2712.056		89			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.13	20.09	0.0567	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9053	0.962	<0.0001	Non-normal Distribution

Analysis ID: 13-1680-7444 **Endpoint:** Reproduction **CETIS Version:** CETISv1.8.7
Analyzed: 12 May-16 14:56 **Analysis:** Nonparametric-Control vs Treatments **Official Results:** Yes

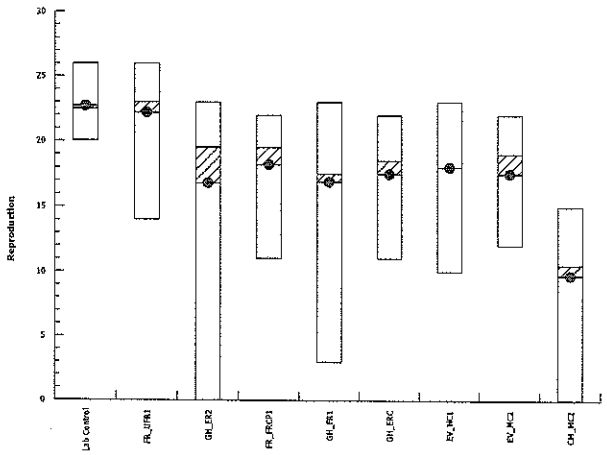
Reproduction Summary

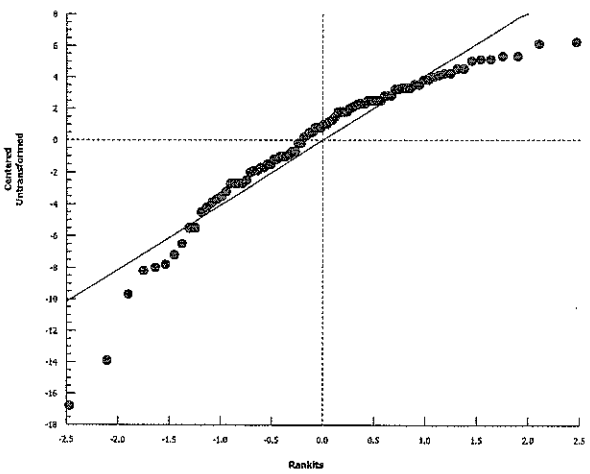
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	22.7	20.95	24.45	22.5	20	26	0.7753	10.8%	0.0%
FR_UFR1	10	22.2	19.87	24.53	23	14	26	1.031	14.68%	2.2%
GH_ER2	10	16.8	11.78	21.82	19.5	0	23	2.22	41.79%	25.99%
FR_FRCP1	10	18.2	15.57	20.83	19.5	11	22	1.162	20.2%	19.82%
GH_FR1	10	16.9	12.59	21.21	17.5	3	23	1.906	35.66%	25.55%
GH_ERC	10	17.5	15.06	19.94	18.5	11	22	1.078	19.47%	22.91%
EV_HC1	10	18	15.41	20.59	18	10	23	1.145	20.12%	20.7%
EV_MC2	10	17.5	14.67	20.33	19	12	22	1.249	22.58%	22.91%
CM_MC2	10	9.7	6.361	13.04	10.5	0	15	1.476	48.12%	57.27%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	24	23	22	25	20	21	20	26	26	20
FR_UFR1	14	21	23	24	26	24	21	23	22	24
GH_ER2	20	19	0	9	23	21	21	18	17	20
FR_FRCP1	11	20	19	15	18	14	21	21	21	22
GH_FR1	16	23	15	21	19	22	3	22	15	13
GH_ERC	15	16	20	22	20	14	19	11	18	20
EV_HC1	20	19	10	16	19	17	17	23	22	17
EV_MC2	16	20	12	12	13	20	21	21	22	18
CM_MC2	12	8	9	6	0	15	7	12	13	15

Graphics





CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	07-3267-8618	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Aug-16 10:06	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	02-3451-4972	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 16:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 16:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 1h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes 6d survival rate

Fisher Exact Test

Control	vs	C-%	Test Stat	P-Value	P-Type	Decision(α:5%)
Negative Control		100	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Negative Contr	10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

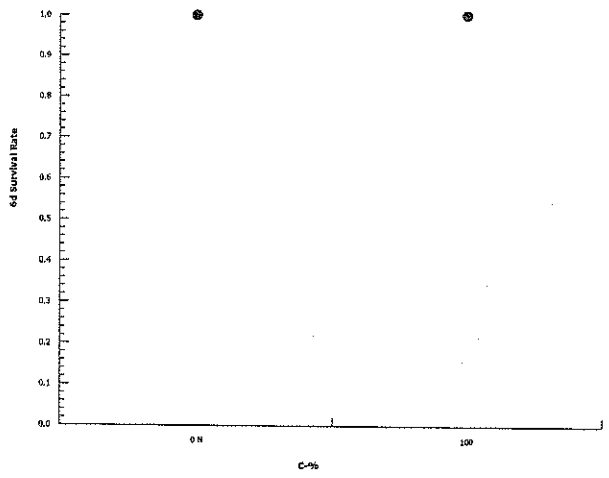
6d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	1

6d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	02-0879-2317	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Aug-16 10:07	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes
Batch ID:	02-3451-4972	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 16:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 16:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 1h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	32.2%	Fails reproduction

Wilcoxon Rank Sum Two-Sample Test

Control	vs	C-%	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		100*	79.5	NA	3	18	0.0263	Exact	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	101.25	101.25	1	1.494	0.2373	Non-Significant Effect
Error	1219.7	67.76111	18			
Total	1320.95		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.329	6.541	0.6783	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7973	0.866	0.0008	Non-normal Distribution

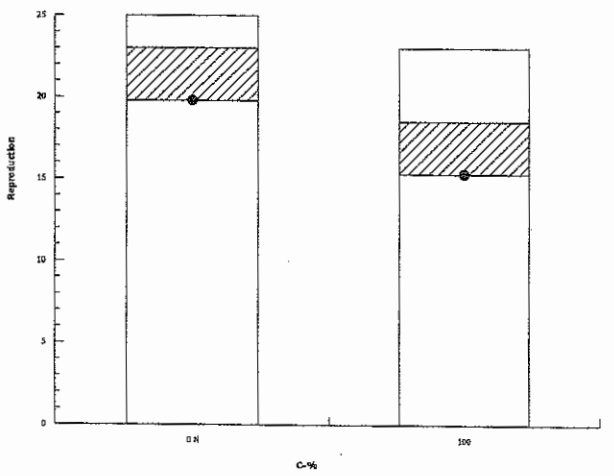
Reproduction Summary

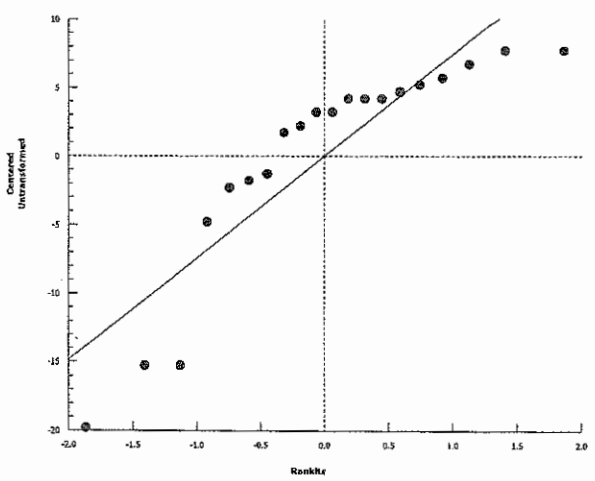
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	10	19.8	14.34	25.26	23	0	25	2.412	38.52%	0.0%
100		10	15.3	9.009	21.59	18.5	0	23	2.781	57.48%	22.73%

Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	18	23	23	24	0	24	25	24	22	15
100		0	23	17	20	0	13	23	14	21	22

Graphics





Client: Teck

W.O.#: 16478

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
GH-ER2	Apr 28/16	50	7.1	7.3	138		50	6.8	136	JS
GH-FR1	↓	↓	7.7	7.8	152		↓	14.1	282	↓
GH-ERC			7.6	7.7	150			8.2	164	
FR-FRCP1			7.8	7.9	154			13.6	272	
FR-UFR1		↓	5.4	5.5	106			5.7	114	JS
EV-HC1		50	9.3	9.5	182			13.6	272	JS
EV-MC2		↓	4.8	4.9	94			7.0	140	↓
CM-MC2	↓	↓	7.2	7.4	140		↓	13.3	266	↓
20% perm	Apr 28/16	50	5.0	5.1	98		50	5.0	100	EMM

Notes:

Reviewed by: JOL

Date Reviewed: May 17/16

APPENDIX B – *Pseudokirchneriella subcapitata* Toxicity Test Data

Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 16480

Start Date: April 29/16
Set up by: MLT

Sample Information:

Sample ID: various, see results table for IDs
Sample Date: April 27/16
Date Received: April 28/16
Sample Volume: various

Test Organism Information:

Culture Date: April 22/16
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC141
Stock Solution ID: 15Zn03
Date Initiated: April 26/16

72-h IC50 (95% CL): 34.0 (31.2-36.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 30.5 (17.4-53.5) ug/L Zn CV (%): 32

Test Results:

	Cell Yield (Mean± SD)
Negative Control	34.4 ± 2.7 ab
FR_UFR1_Q_04042016_N ①	107.9 ± 4.9 *c
GH_ER2_WS_2016_04_27_N ②	98.8 ± 5.3 *a,c
FR_FRCP1_Q_04042016_N	78.8 ± 1.9 *ab
GH_FR1_WS_2016_04_27_N	100.0 ± 5.9 *a
GH_ERC_WS_2016_04_27_N	103.8 ± 8.5 *
EV_HC1_WS_2016-04-27_N	113.5 ± 1.3 *c
EV_MC2_WS_2016-04-27_N	111.5 ± 8.1 *c
CM_MC2_WS_20160427_N	94.0 ± 4.2 *a

a. indicates cell yield that were significantly le than the site control FR_UFR1

b. indicates cell yield that were significantly le than the site control GH_ER

① site control ② site control * indicates cell yield that were significantly greater than the lab control

c. indicates cell yield that were significantly greater than the site control GH_ER2

Reviewed by: JGa
Date reviewed: May 24/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Teck Coal | Setup by: MLT

Sample ID: various | Test Date/Time: April 29/16 @ 1525h

Work Order No.: 16480 | Test Species: *Pseudokirchneriella subcapitata*

Culture Date: April 22/16 | Age of Culture: 7d | Culture Health: Good

Culture Count: 1 555 2 535 | Average: 545 | Culture Cell Density (c1): 545 X 10⁴ cells/mL

v1 = 220,000 cells/ml x 100 ml / (c1) 545 X 10⁴ cells/ml = 4.04mL

Time Zero Counts: 1 20 2 22 | Average: 21

No. of Cells/mL: 21 X 10⁴ | Initial Density: # cells/mL ÷ 220 µL x 10 µL = 9545 cells/mL.

Concentration %(v/v)	Water Quality pH 0 h	Water Quality Temp (°C) 0 h	Incubator Temperature (°C) 0 h	24 h	48 h	72 h	Microplates rotated 2X per day? 0 h	24 h	48 h	72 h
Control	7.0	23.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
100%(v/v) FR-UFR1 (site) ①	8.2	23.0	↓	↓	↓	↓	✓	✓	✓	✓
100%(v/v) GH_ER2 (site) ②	8.2	23.0					✓	✓	✓	✓
100%(v/v) FR_FRCP1 ①	8.2	23.0					✓	✓	✓	✓
100%(v/v) GH_FR1 ①	8.2	23.0					✓	✓	✓	✓
100%(v/v) GH_ERC ①	8.2	23.0					✓	✓	✓	✓
100%(v/v) EV_HC1 ①	8.3	23.0					✓	✓	✓	✓
100%(v/v) EV_MC2 ①	8.2	23.0					✓	✓	✓	✓
100%(v/v) CM_MC2 ①	8.2	23.0					✓	✓	✓	✓
Initials	MLT	MLT	MLT	A	A	MLT	MLT	A	A	MLT

Initial control pH: Well 1: 7.0 Well 2: 7.0

Final control pH: Well 1: 6.8 Well 2: 6.8

Light intensity (lux): 3810 | Date measured: April 29/16

Instruments: Thermometer 4 | pH meter 2 | Light meter 1

Sample Description: ① clear, colourless, some debris, odourless ② clear, colourless, odourless, no particula

Comments:

Reviewed: JGL | Date reviewed: May 29/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal
Start Date/Time: Apr 29/16 @ 1525h
Work Order #: 16480
Termination Date: Apr May 2/16 @ 1525h
Sample ID: various
Test set up by: ML

%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	38					ML
	B	32					
	C	33					
	D	37					
	E	34					
	F	33					
	G	39					
	H	37					
100%(v/v) FR_UFR1 (site)	A	106					
	B	108					
	C	103					
	D	117					
	E Apr	112					
	F B	109					
	G C	113					
	H D	103					
100%(v/v) GH_ER2 (site)	A	95					
	B	97					
	C	100					
	D	112					
	E Apr	96					
	F B	101					
	G C	98					
	H D	99					
100%(v/v) FR_FRCP1	A	80					
	B	81					
	C	81					
	D	77					
100%(v/v) GH_FR1	A	105					
	B	97					
	C	107					
	D	95					
100%(v/v) GH_ERC	A	98					
	B	97					
	C	114					
	D	110					

Comments:

Reviewed by: JGu
Date Reviewed: May 24/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal | Start Date/Time: April 29/16 @ 1525h
Work Order #: 16480 | Termination Date: May 2/16 @ 1525h
Sample ID: various | Test set up by: MG
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control / MG	A						MG
	B						
	C						
	D						
	E						
	F						
	G						
	H						
100%(v/v) EV_HC1	A	114					
	B	113					
	C	115					
	D	116					
100%(v/v) EV_MC2	A	120					
	B	114					
	C	115					
	D	101					
100%(v/v) CM_MC2	A	90					
	B	99					
	C	98					
	D	93					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: JCL | Date Reviewed: May 29/16

Pseudokirchneriella subcapitata Algal Counts

Client: Teck Coal
WO#: 16480
Sample ID: Teck Coal samples pass/fail

Start Date/Time: 29-Apr-16 @ 1525h
Termination Date: 02-May-16 @ 1525h

Initial Cell Density: 9545 cell/mL

210000
0.22
0.01
9545.455

Concentration	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		
Control Lab Water	A	38				38	37.0	mean	34.4
	B	32				32	31.0	SD	2.66927
	C	33				33	32.0	CV	7.754893
	D	37				37	36.0		
	E	34				34	33.0		
	F	33				33	32.0		
	G	39				39	38.0		
	H	37				37	36.0		
Control Site Water (FR_UFR1) **100% (v/v)**	A	106				106	105.0	mean	107.9
	B	108				108	107.0	SD	4.94072
	C	103				103	102.0	CV	4.578113
	D	117				117	116.0		
	E	112				112	111.0		
	F	109				109	108.0		
	G	113				113	112.0		
	H	103				103	102.0		
Control Site Water (GH_ER2) **100% (v/v)**	A	95				95	94.0	mean	98.8
	B	97				97	96.0	SD	5.338539
	C	100				100	99.0	CV	5.403628
	D	112				112	111.0		
	E	96				96	95.0		
	F	101				101	100.0		
	G	98				98	97.0		
	H	99				99	98.0		
FR_FRCP1 **100% (v/v)**	A	80				80	79.0		
	B	81				81	80.0		
	C	81				81	80.0		
	D	77				77	76.0		
GH_FR1 **100% (v/v)**	A	105				105	104.0		
	B	97				97	96.0		
	C	107				107	106.0		
	D	95				95	94.0		
GH_ERC **100% (v/v)**	A	98				98	97.0		
	B	97				97	96.0		
	C	114				114	113.0		
	D	110				110	109.0		
EV_HC1 **100% (v/v)**	A	114				114	113.0		
	B	113				113	112.0		
	C	115				115	114.0		
	D	116				116	115.0		
EV_MC2 **100% (v/v)**	A	120				120	119.0		
	B	114				114	113.0		
	C	115				115	114.0		
	D	101				101	100.0		
CM_MC2 **100% (v/v)**	A	90				90	89.0		
	B	99				99	98.0		
	C	98				98	97.0		
	D	93				93	92.0		

JGh
May 24/16

CETIS Summary Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Batch ID:	08-2062-4047	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:25	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	13-1589-0002	29 Apr-16	29 Apr-16	15h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	54h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	52h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	49h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	56h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	53h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	53h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
(1) Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

(1) Lab Control = Deionized water w/ nutrients
FR_UFR1 = site control
GH_ER2 = site control

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	8	34.38	32.14	36.61	31	38	0.9437	2.669	7.77%	0.0%
FR_UFR1	8	107.9	103.7	112	102	116	1.747	4.941	4.58%	-213.8%
GH_ER2	8	98.75	94.29	103.2	94	111	1.887	5.339	5.41%	-187.3%
FR_FRCP1	4	78.75	75.74	81.76	76	80	0.9465	1.893	2.4%	-129.1%
GH_FR1	4	100	90.63	109.4	94	106	2.944	5.888	5.89%	-190.9%
GH_ERC	4	103.8	90.16	117.3	96	113	4.27	8.539	8.23%	-201.8%
EV_HC1	4	113.5	111.4	115.6	112	115	0.6455	1.291	1.14%	-230.2%
EV_MC2	4	111.5	98.61	124.4	100	119	4.052	8.103	7.27%	-224.4%
CM_MC2	4	94	87.25	100.8	89	98	2.121	4.243	4.51%	-173.5%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	37	31	32	36	33	32	38	36
FR_UFR1	105	107	102	116	111	108	112	102
GH_ER2	94	96	99	111	95	100	97	98
FR_FRCP1	79	80	80	76				
GH_FR1	104	96	106	94				
GH_ERC	97	96	113	109				
EV_HC1	113	112	114	115				
EV_MC2	119	113	114	100				
CM_MC2	89	98	97	92				

CETIS Analytical Report

Test Code: 16480 | 14-2309-9385

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	03-2840-5948	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 15:02	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	08-2062-4047	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:25	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	13-1589-0002	29 Apr-16	29 Apr-16	15h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	54h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	52h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	49h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	56h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	53h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	53h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.29%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		Lab Control	28.89	2.523	6.419	14	<0.0001	CDF	Significant Effect
		GH_ER2	3.587	2.523	6.419	14	0.0034	CDF	Significant Effect
		FR_FRCP1	9.347	2.523	7.861	10	<0.0001	CDF	Significant Effect
		GH_FR1	2.527	2.523	7.861	10	0.0495	CDF	Significant Effect
		GH_ERC	1.324	2.523	7.861	10	0.4014	CDF	Non-Significant Effect
		EV_HC1	-1.805	2.523	7.861	10	0.9999	CDF	Non-Significant Effect
		EV_MC2	-1.163	2.523	7.861	10	0.9987	CDF	Non-Significant Effect
		CM_MC2	4.453	2.523	7.861	10	0.0003	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.9049	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	33702.17	4212.771	8	162.7	<0.0001	Significant Effect
Error	1009.75	25.89103	39			
Total	34711.92		47			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.68	20.09	0.0472	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9922	0.9345	0.9858	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 03-2840-5948 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 12 May-16 15:02 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

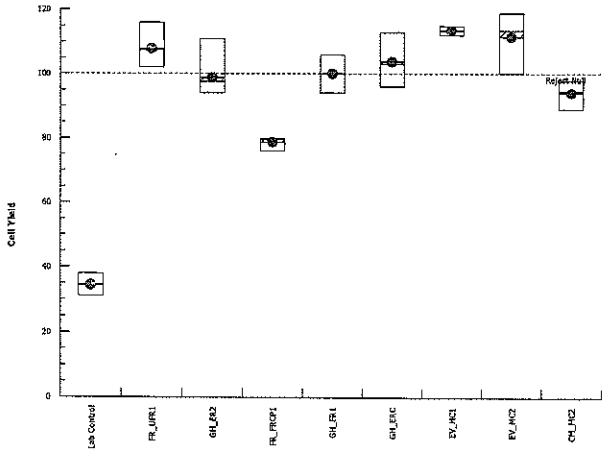
Cell Yield Summary

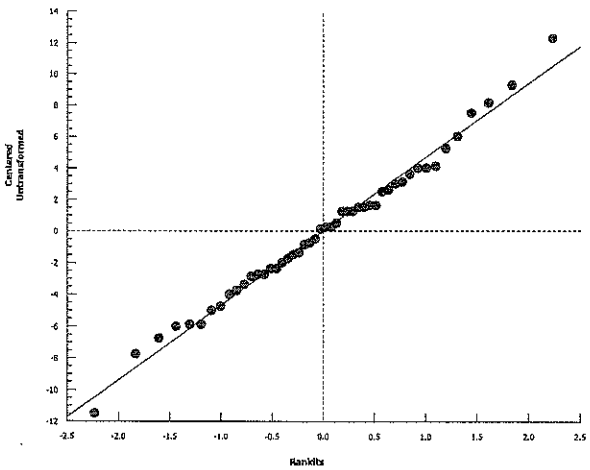
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	34.38	32.14	36.61	34.5	31	38	0.9437	7.77%	0.0%
FR_UFR1	8	107.9	103.7	112	107.5	102	116	1.747	4.58%	-213.8%
GH_ER2	8	98.75	94.29	103.2	97.5	94	111	1.887	5.41%	-187.3%
FR_FRCP1	4	78.75	75.74	81.76	79.5	76	80	0.9465	2.4%	-129.1%
GH_FR1	4	100	90.63	109.4	100	94	106	2.944	5.89%	-190.9%
GH_ERC	4	103.8	90.16	117.3	103	96	113	4.27	8.23%	-201.8%
EV_HC1	4	113.5	111.4	115.6	113.5	112	115	0.6455	1.14%	-230.2%
EV_MC2	4	111.5	98.61	124.4	113.5	100	119	4.052	7.27%	-224.4%
CM_MC2	4	94	87.25	100.8	94.5	89	98	2.121	4.51%	-173.5%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	37	31	32	36	33	32	38	36
FR_UFR1	105	107	102	116	111	108	112	102
GH_ER2	94	96	99	111	95	100	97	98
FR_FRCP1	79	80	80	76				
GH_FR1	104	96	106	94				
GH_ERC	97	96	113	109				
EV_HC1	113	112	114	115				
EV_MC2	119	113	114	100				
CM_MC2	89	98	97	92				

Graphics





CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	09-2208-9222	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 15:02	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	08-2062-4047	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:25	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	13-1589-0002	29 Apr-16	29 Apr-16	15h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	54h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	52h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	49h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	56h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	53h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	53h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.96%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
GH_ER2		Lab Control	25.3	2.523	6.419	14	<0.0001	CDF	Significant Effect
		FR_UFR1	-3.587	2.523	6.419	14	1.0000	CDF	Non-Significant Effect
		FR_FRCP1	6.419	2.523	7.861	10	<0.0001	CDF	Significant Effect
		GH_FR1	-0.4012	2.523	7.861	10	0.9777	CDF	Non-Significant Effect
		GH_ERC	-1.605	2.523	7.861	10	0.9998	CDF	Non-Significant Effect
		EV_HC1	-4.734	2.523	7.861	10	1.0000	CDF	Non-Significant Effect
		EV_MC2	-4.092	2.523	7.861	10	1.0000	CDF	Non-Significant Effect
		CM_MC2	1.524	2.523	7.861	10	0.3096	CDF	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.3987	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	33702.17	4212.771	8	162.7	<0.0001	Significant Effect
Error	1009.75	25.89103	39			
Total	34711.92		47			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.68	20.09	0.0472	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9922	0.9345	0.9858	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 09-2208-9222 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 12 May-16 15:02 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

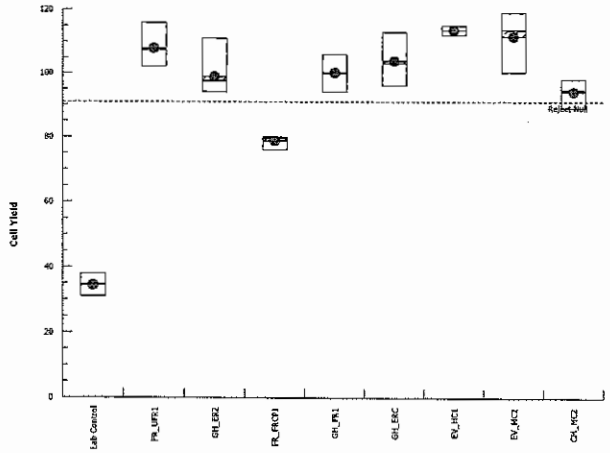
Cell Yield Summary

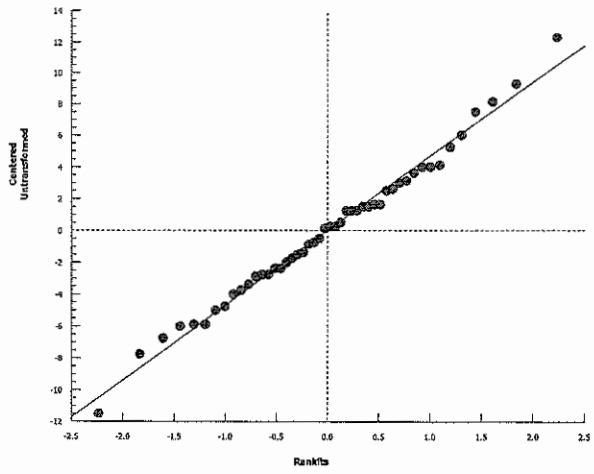
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	34.38	32.14	36.61	34.5	31	38	0.9437	7.77%	0.0%
FR_UFR1	8	107.9	103.7	112	107.5	102	116	1.747	4.58%	-213.8%
GH_ER2	8	98.75	94.29	103.2	97.5	94	111	1.887	5.41%	-187.3%
FR_FRCP1	4	78.75	75.74	81.76	79.5	76	80	0.9465	2.4%	-129.1%
GH_FR1	4	100	90.63	109.4	100	94	106	2.944	5.89%	-190.9%
GH_ERC	4	103.8	90.16	117.3	103	96	113	4.27	8.23%	-201.8%
EV_HC1	4	113.5	111.4	115.6	113.5	112	115	0.6455	1.14%	-230.2%
EV_MC2	4	111.5	98.61	124.4	113.5	100	119	4.052	7.27%	-224.4%
CM_MC2	4	94	87.25	100.8	94.5	89	98	2.121	4.51%	-173.5%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	37	31	32	36	33	32	38	36
FR_UFR1	105	107	102	116	111	108	112	102
GH_ER2	94	96	99	111	95	100	97	98
FR_FRCP1	79	80	80	76				
GH_FR1	104	96	106	94				
GH_ERC	97	96	113	109				
EV_HC1	113	112	114	115				
EV_MC2	119	113	114	100				
CM_MC2	89	98	97	92				

Graphics





EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	16-2108-2489	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 15:15	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	08-2062-4047	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:25	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	13-1589-0002	29 Apr-16	29 Apr-16	15h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	54h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	52h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	49h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	56h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	53h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	53h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	22.9%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	28.89	2.523	6.419	14	<0.0001	CDF	Significant Effect
		GH_ER2	25.3	2.523	6.419	14	<0.0001	CDF	Significant Effect
		FR_FRCP1	14.24	2.523	7.861	10	<0.0001	CDF	Significant Effect
		GH_FR1	21.06	2.523	7.861	10	<0.0001	CDF	Significant Effect
		GH_ERC	22.26	2.523	7.861	10	<0.0001	CDF	Significant Effect
		EV_HC1	25.39	2.523	7.861	10	<0.0001	CDF	Significant Effect
		EV_MC2	24.75	2.523	7.861	10	<0.0001	CDF	Significant Effect
		CM_MC2	19.14	2.523	7.861	10	<0.0001	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.7232	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	33702.17	4212.771	8	162.7	<0.0001	Significant Effect
Error	1009.75	25.89103	39			
Total	34711.92		47			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.68	20.09	0.0472	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9922	0.9345	0.9858	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 16-2108-2489 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 11 May-16 15:15 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

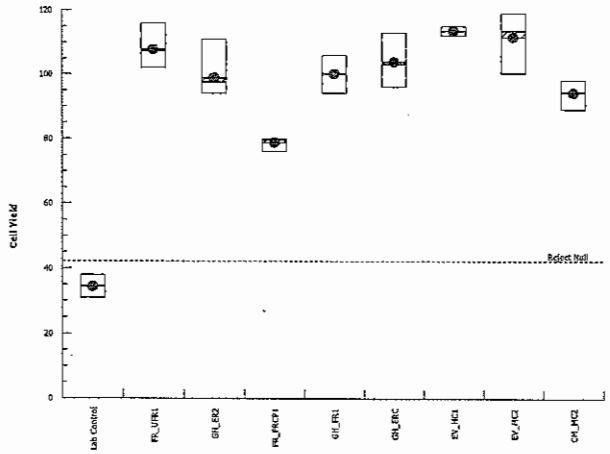
Cell Yield Summary

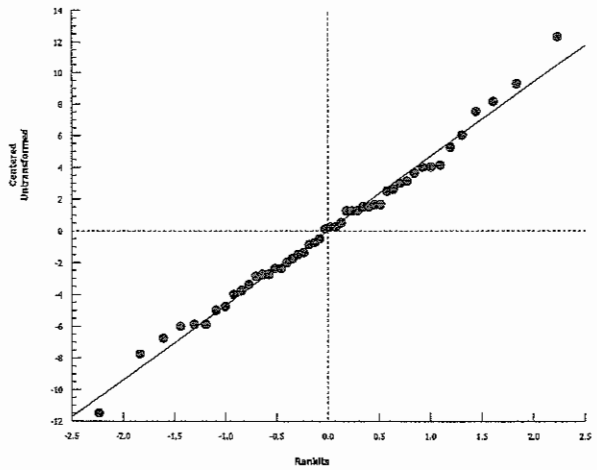
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	34.38	32.14	36.61	34.5	31	38	0.9437	7.77%	0.0%
FR_UFR1	8	107.9	103.7	112	107.5	102	116	1.747	4.58%	-213.8%
GH_ER2	8	98.75	94.29	103.2	97.5	94	111	1.887	5.41%	-187.3%
FR_FRCP1	4	78.75	75.74	81.76	79.5	76	80	0.9465	2.4%	-129.1%
GH_FR1	4	100	90.63	109.4	100	94	106	2.944	5.89%	-190.9%
GH_ERC	4	103.8	90.16	117.3	103	96	113	4.27	8.23%	-201.8%
EV_HC1	4	113.5	111.4	115.6	113.5	112	115	0.6455	1.14%	-230.2%
EV_MC2	4	111.5	98.61	124.4	113.5	100	119	4.052	7.27%	-224.4%
CM_MC2	4	94	87.25	100.8	94.5	89	98	2.121	4.51%	-173.5%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	37	31	32	36	33	32	38	36
FR_UFR1	105	107	102	116	111	108	112	102
GH_ER2	94	96	99	111	95	100	97	98
FR_FRCP1	79	80	80	76				
GH_FR1	104	96	106	94				
GH_ERC	97	96	113	109				
EV_HC1	113	112	114	115				
EV_MC2	119	113	114	100				
CM_MC2	89	98	97	92				

Graphics





CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	12-6347-9803	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 15:02	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	08-2062-4047	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:25	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	13-1589-0002	29 Apr-16	29 Apr-16	15h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	54h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	52h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	49h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	56h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	53h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	53h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	7.29%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		Lab Control	-28.89	2.523	6.419	14	1.0000	CDF	Non-Significant Effect
		GH_ER2	-3.587	2.523	6.419	14	1.0000	CDF	Non-Significant Effect
		FR_FRCP1	-9.347	2.523	7.861	10	1.0000	CDF	Non-Significant Effect
		GH_FR1	-2.527	2.523	7.861	10	1.0000	CDF	Non-Significant Effect
		GH_ERC	-1.324	2.523	7.861	10	0.9993	CDF	Non-Significant Effect
		EV_HC1	1.805	2.523	7.861	10	0.2021	CDF	Non-Significant Effect
		EV_MC2	1.163	2.523	7.861	10	0.4806	CDF	Non-Significant Effect
		CM_MC2	-4.453	2.523	7.861	10	1.0000	CDF	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.9049	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	33702.17	4212.771	8	162.7	<0.0001	Significant Effect
Error	1009.75	25.89103	39			
Total	34711.92		47			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.68	20.09	0.0472	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9922	0.9345	0.9858	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 12-6347-9803 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 12 May-16 15:02 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

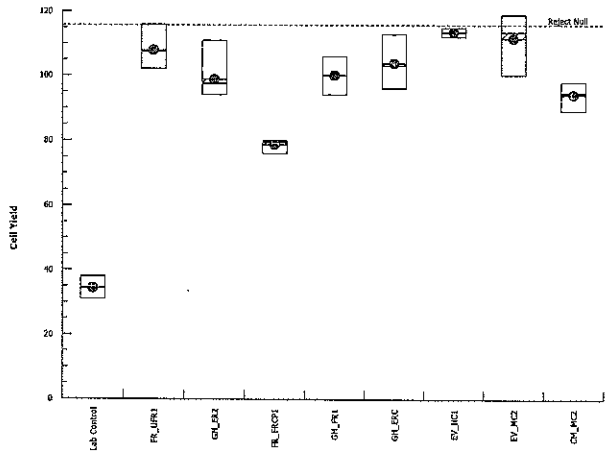
Cell Yield Summary

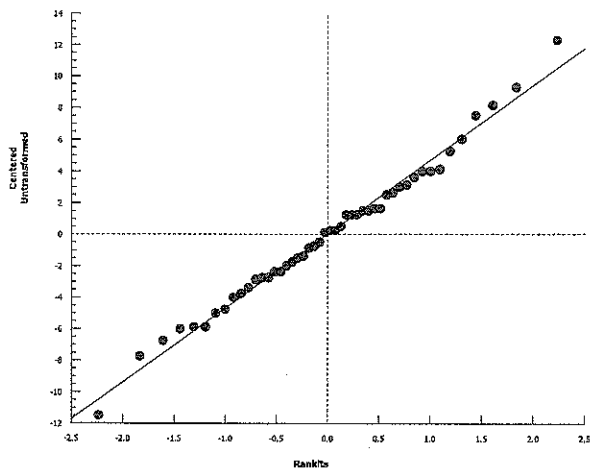
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	34.38	32.14	36.61	34.5	31	38	0.9437	7.77%	0.0%
FR_UFR1	8	107.9	103.7	112	107.5	102	116	1.747	4.58%	-213.8%
GH_ER2	8	98.75	94.29	103.2	97.5	94	111	1.887	5.41%	-187.3%
FR_FRCP1	4	78.75	75.74	81.76	79.5	76	80	0.9465	2.4%	-129.1%
GH_FR1	4	100	90.63	109.4	100	94	106	2.944	5.89%	-190.9%
GH_ERC	4	103.8	90.16	117.3	103	96	113	4.27	8.23%	-201.8%
EV_HC1	4	113.5	111.4	115.6	113.5	112	115	0.6455	1.14%	-230.2%
EV_MC2	4	111.5	98.61	124.4	113.5	100	119	4.052	7.27%	-224.4%
CM_MC2	4	94	87.25	100.8	94.5	89	98	2.121	4.51%	-173.5%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	37	31	32	36	33	32	38	36
FR_UFR1	105	107	102	116	111	108	112	102
GH_ER2	94	96	99	111	95	100	97	98
FR_FRCP1	79	80	80	76				
GH_FR1	104	96	106	94				
GH_ERC	97	96	113	109				
EV_HC1	113	112	114	115				
EV_MC2	119	113	114	100				
CM_MC2	89	98	97	92				

Graphics





EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	14-6155-7116	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 15:02	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	08-2062-4047	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:25	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:25	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	13-1589-0002	29 Apr-16	29 Apr-16	15h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	54h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	52h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	49h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	63h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	56h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	53h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	53h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	7.96%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
GH_ER2		Lab Control	-25.3	2.523	6.419	14	1.0000	CDF	Non-Significant Effect
		FR_UFR1	3.587	2.523	6.419	14	0.0034	CDF	Significant Effect
		FR_FRCP1	-6.419	2.523	7.861	10	1.0000	CDF	Non-Significant Effect
		GH_FR1	0.4012	2.523	7.861	10	0.8264	CDF	Non-Significant Effect
		GH_ERC	1.605	2.523	7.861	10	0.2762	CDF	Non-Significant Effect
		EV_HC1	4.734	2.523	7.861	10	0.0001	CDF	Significant Effect
		EV_MC2	4.092	2.523	7.861	10	0.0008	CDF	Significant Effect
		CM_MC2	-1.524	2.523	7.861	10	0.9997	CDF	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.3987	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	33702.17	4212.771	8	162.7	<0.0001	Significant Effect
Error	1009.75	25.89103	39			
Total	34711.92		47			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.68	20.09	0.0472	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9922	0.9345	0.9858	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	14-6155-7116	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 15:02	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

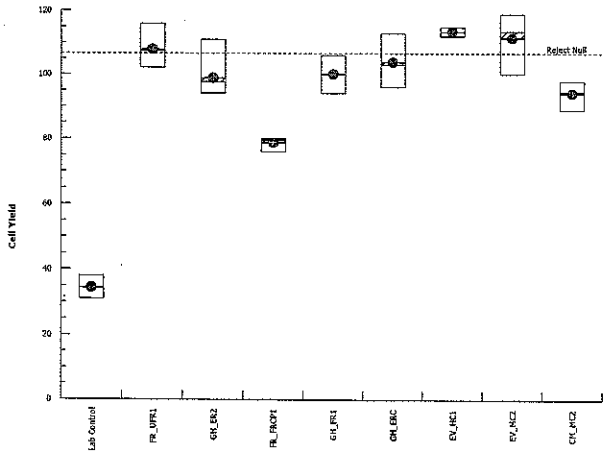
Cell Yield Summary

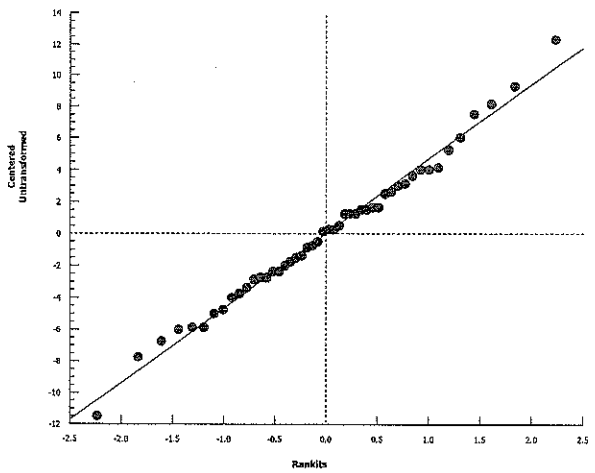
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	34.38	32.14	36.61	34.5	31	38	0.9437	7.77%	0.0%
FR_UFR1	8	107.9	103.7	112	107.5	102	116	1.747	4.58%	-213.8%
GH_ER2	8	98.75	94.29	103.2	97.5	94	111	1.887	5.41%	-187.3%
FR_FRCP1	4	78.75	75.74	81.76	79.5	76	80	0.9465	2.4%	-129.1%
GH_FR1	4	100	90.63	109.4	100	94	106	2.944	5.89%	-190.9%
GH_ERC	4	103.8	90.16	117.3	103	96	113	4.27	8.23%	-201.8%
EV_HC1	4	113.5	111.4	115.6	113.5	112	115	0.6455	1.14%	-230.2%
EV_MC2	4	111.5	98.61	124.4	113.5	100	119	4.052	7.27%	-224.4%
CM_MC2	4	94	87.25	100.8	94.5	89	98	2.121	4.51%	-173.5%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	37	31	32	36	33	32	38	36
FR_UFR1	105	107	102	116	111	108	112	102
GH_ER2	94	96	99	111	95	100	97	98
FR_FRCP1	79	80	80	76				
GH_FR1	104	96	106	94				
GH_ERC	97	96	113	109				
EV_HC1	113	112	114	115				
EV_MC2	119	113	114	100				
CM_MC2	89	98	97	92				

Graphics





CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	13-1768-2017	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	18 Aug-16 10:05	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes
Batch ID:	18-6669-7151	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 14:35	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 14:35	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	54h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	10.4%	Passes cell yield

Equal Variance t Two-Sample Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		95.2	-32.71	1.812	3.29	10	1.0000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	9401.042	9401.042	1	1070	<0.0001	Significant Effect
Error	87.875	8.7875	10			
Total	9488.917		11			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	7.983	10.88	0.0233	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9915	0.8025	0.9999	Normal Distribution

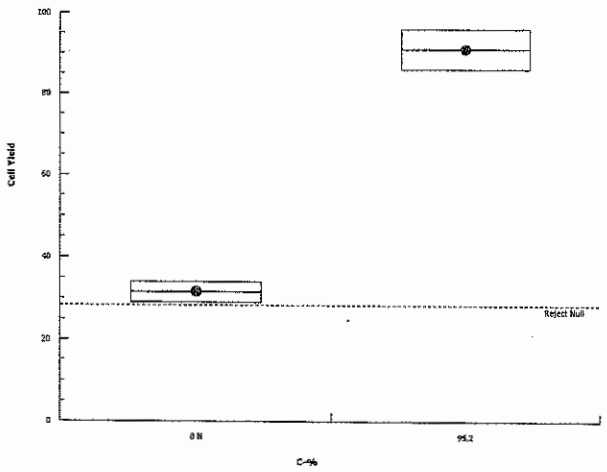
Cell Yield Summary

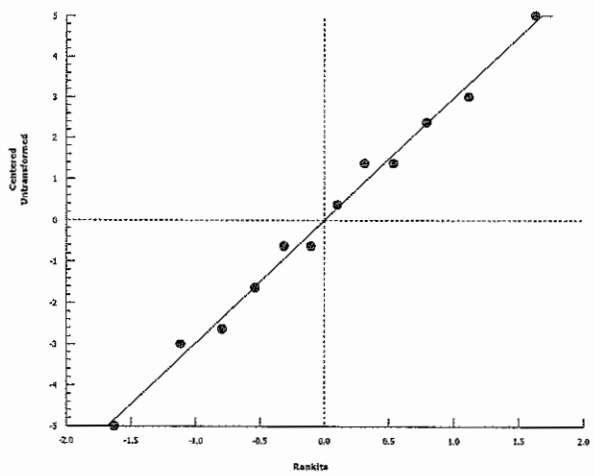
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	8	31.63	30.22	33.03	31.5	29	34	0.5957	5.33%	0.0%
95.2		4	91	83.42	98.58	91	86	96	2.38	5.23%	-187.7%

Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	34	31	33	30	31	32	33	29
95.2		94	96	88	86				

Graphics





APPENDIX C – *Hyalella azteca* Toxicity Test Data

Hyalella azteca Test Summary Sheet

Client: Teck
Work Order No.: 16476

Start Date: 28-Apr-16
Set up by: KJL

Sample Information:

Sample ID: Various - See Below
Sample Date: Apr 27, May 4, 11, 18, 2016
Date Received: Apr 28, May 5, 12, 19, 2016
Sample Volume: 1x 20L per refresh

Test Organism Information:

Species: *Hyalella azteca*
Supplier: Aquatic Research Organisms, NH
Date received: 28-Apr-16
Age or size (Day 0): 8-days

NaCl Reference Toxicant Results:

Reference Toxicant ID: HA110
Stock Solution ID: n/a
Date Initiated: 28-Apr-16

96-h LC50 (95% CL): 5.2 (4.3 - 6.4) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 5.4 (4.7 - 6.3) g/L NaCl CV (%): 8

Test Results:

Sample ID	Survival ± SD (%)	Average Dry Wt. ± SD (mg)
Control	100 ± 0.0	0.87 ± 0.07
FR_UFR1	98.0 ± 4.5	0.91 ± 0.08
GH_FR1	98.0 ± 4.5	0.52 ± 0.18 *, 1
FR_FRCP1	98.0 ± 4.5	0.44 ± 0.11 *, 1
CM_MC2	94.0 ± 8.9	0.26 ± 0.06 *, 1

* Samples that are significantly different from Control.

1 Samples that are significantly different from reference site FR_UFR1

Reviewed by: JGR

Date reviewed: June 9/16

Chronic *H. azteca* Toxicity Test Data Sheet

Freshwater Water Quality

Client: Teck
WO #: 164976
Sample ID: See below

Start Date: 28-Apr-16
Termination Date: ~~28-May-16~~ 26-May-16
Test Organism: *H. azteca*

Temperature (°C)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	22.0	22.0	22.5	22.5	22.5	22.5	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
FR_UFR1	23.0	22.0	22.5	22.5	22.5	22.5	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
GH_FR1	23.0	22.0	22.5	22.5	22.5	22.5	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
FR_FRCP1	23.0	22.0	22.5	22.5	22.5	22.5	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
CM_MC2	23.0	22.0	22.5	22.5	22.5	22.5	22.5	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
Technician Initials	KJL	KLP	A	A	KJL	KJL	KJL	KJL	KL	A	A	KL	KJL	KL	KJL

Conductivity (µS)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	432	440	436	439	458	453	461	448	444	443	438	460	450	450	434
FR_UFR1	311	325	318	323	337	333	330	333	333	329	335	344	343	341	331
GH_FR1	644	660	648	652	679	674	677	675	684	675	679	701	706	701	681
FR_FRCP1	621	635	631	634	665	664	654	655	643	647	642	647	648	645	622
CM_MC2	617	629	624	628	659	651	652	658	624	595	602	622	620	618	605
Technician Initials	KJL	KLP	A	A	KJL	KJL	KJL	KJL	KL	A	A	KL	KJL	KL	KJL

Dissolved oxygen (mg/L)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	8.6	6.7	6.7	6.4	6.6	6.6	6.8	6.5	5.0	5.8	6.2	6.4	6.2	5.9	6.4
FR_UFR1	8.5	6.6	6.6	6.5	6.7	6.5	6.7	6.6	5.0	6.0	6.2	6.0	6.1	6.0	6.3
GH_FR1	8.5	6.7	6.8	6.4	6.7	6.6	6.9	6.4	5.2	6.1	6.1	5.8	6.5	5.8	6.5
FR_FRCP1 8-6	~~6.21~~	6.7	6.7	6.4	6.6	6.5	6.7	6.5	5.4	6.0	6.2	5.8	6.6	5.9	6.9
CM_MC2	8.3	6.8	6.7	6.5	6.7	6.6	6.8	6.5	5.6	6.1	6.2	6.1	6.3	5.9	6.8
Technician Initials	KJL	KLP	A	A	KJL	KJL	KJL	KJL	KL	A	A	KL	KJL	KL	KJL

pH

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	7.7	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.2	7.7	7.6	7.3	7.1	7.2	7.1
FR_UFR1	8.0	7.7	7.9	7.8	7.8	7.6	7.6	7.4	7.5	7.9	7.8	7.5	7.4	7.5	7.2
GH_FR1	8.0	7.9	8.1	7.9	7.9	7.7	7.7	7.7	7.8	8.0	8.0	7.8	7.7	7.7	7.6
FR_FRCP1	7.9	7.9	8.0	8.0	7.9	7.7	7.7	7.7	7.7	7.9	8.0	7.8	7.7	7.7	7.6
CM_MC2	7.9	7.9	8.0	8.0	7.9	7.7	7.9	7.6	7.3	7.8	7.9	7.7	7.6	7.8	7.6
Technician Initials	KJL	KLP	A	A	KJL	KJL	KJL	KJL	KL	A	A	KL	KJL	KL	KJL

Comments:

Reviewed by: JKL

Date Reviewed: June 8/16

Chronic *H. azteca* Toxicity Test Data Sheet

Freshwater Water Quality

Client: Teck
WO #: 164976
Sample ID: See below

Start Date: 28-Apr-16
Termination Date: 12-May-16
Test Organism: *H. azteca*

Temperature (°C)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
FR_UFR1	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
GH_FR1	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
FR_FRCP1	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
CM_MC2	22.0	22.5	22.5	22.0	22.0	22.0	22.0	22.0	22.5	22.5	22.0	22.0	22.0	22.0
Technician Initials	KL	AS	AS	KL	KL	KL	JW	KL	AS	AS	JW	KL	KL	KL

Conductivity (µS)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	433	428	433	442	439	440	439	440	433	442	452	443	442	444
FR_UFR1	329	327	340	341	336	341	338	347	345	375	368	354	353	360
GH_FR1	670	650	663	673	680	684	680	716	705	728	728	723	724	734
FR_FRCP1	675	673	681	688	690	696	706	679	667	676	690	676	676	682
CM_MC2	658	660	652	661	663	668	670	624	603	605	621	611	613	622
Technician Initials	KL	AS	AS	KL	KL	KL	JW	KL	AS	AS	JW	KL	KL	KL

Dissolved oxygen (mg/L)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	6.1	6.3	6.1	5.6	6.1	6.2	5.6	6.0	6.4	6.2	5.1	5.4	4.8	5.4
FR_UFR1	6.0	6.2	6.0	5.4	5.4	5.5	5.9	5.3	6.5	6.0	4.4	5.7	5.1	5.5
GH_FR1	6.1	6.4	6.0	5.4	5.4	5.4	4.7	6.0	6.5	6.3	4.9	5.9	5.0	4.7
FR_FRCP1	6.1	6.3	6.1	5.7	5.7	6.0	5.6	5.6	6.4	6.3	4.4	5.6	5.0	4.6
CM_MC2	6.1	6.3	6.0	5.9	5.7	5.8	5.1	5.4	6.3	6.1	5.3	5.7	5.1	4.6
Technician Initials	KL	AS	AS	KL	KL	KL	JW	KL	AS	AS	JW	KL	KL	KL

pH

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	7.2	7.4	7.3	7.0	7.1	7.2	6.9	7.0	7.4	7.2	6.8	7.0	7.0	7.1
FR_UFR1	7.5	7.7	7.6	7.3	7.3	7.4	7.3	7.4	7.8	7.6	7.2	7.3	7.3	7.2
GH_FR1	7.6	7.8	7.7	7.4	7.4	7.6	7.4	7.5	7.8	7.7	7.5	7.7	7.6	7.4
FR_FRCP1	7.7	7.8	7.8	7.6	7.6	7.8	7.6	7.5	7.8	7.8	7.4	7.6	7.5	7.4
CM_MC2	7.6	7.7	7.6	7.6	7.6	7.7	7.4	7.5	7.8	7.8	7.5	7.6	7.5	7.4
Technician Initials	KL	AS	AS	KL	KL	KL	JW	KL	AS	AS	JW	KL	KL	KL

Comments:

Reviewed by: JGH

Date Reviewed: June 8/16

H. azteca Toxicity Test Data Sheet

28-d Survival and Weight

Client: TECK
Work Order No: 16476
Sample ID: See below

Start Date: Apr 28/16
Termination Date: May 26/16
Test Organism: *Hyalella azteca*

Sample ID	Pan No. (brown)	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	17	A	10	0	0	KJL	1019.76	1029.30	10	KJL
	18	B	10	0	0		1008.11	1016.92	10	
	19	C	10	0	0		1006.86	1014.84	10	
	20	D	10	0	0		1031.59	1040.62	10	
	21	E	10	0	0		1031.71	1039.75	10	
FR_UFR1	22	A	10	0	0		1010.25	1020.12	10	
	23	B	10	0	0		999.42	1008.10	10	
	24	C	10	0	0		999.36	1008.40	10	
	25	D	9	0	1		999.35	1008.17	9	
	26	E	10	0	0		1022.91	1030.96	10	
GH_FR1	27	A	~~9~~ 10	0	0		1008.57	1012.80	10	
	28	B	10	0	0		1018.10	1021.40	10	
L blue	20	C	~~8~~ 9	0	~~2~~ 1		1015.33	1019.45	9	
	21	D	10	0	0		1020.56	1026.69	10	
	22	E	10	0	0		1013.50	1021.37	10	
FR_FRCP1	23	A	10	0	0		1011.79	1015.24	10	
	24	B	10	0	0		1012.69	1019.00	10	
	25	C	10	0	0		1000.31	1004.83	10	
	26	D	10	0	0		1009.49	1013.37	10	
	27	E	9	0	1		1019.23	1022.75	9	

Comments: Reweighed pans: 18 - 1016.90 28 - 1021.32

Reviewed by: JOL

Date Reviewed: June 8/16

H. azteca Toxicity Test Data Sheet

28-d Survival and Weight

Client: TECK
Work Order No: 16476
Sample ID: See below

Start Date: Apr 28/16
Termination Date: May 26/16
Test Organism: *Hyalella azteca*

Sample ID	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
CM_MC2 blue	28	A	10	0	0	KJL	1015.67	1017.9688	10	KJL
H red	36	B	~~10~~ 9	1	0		1032.11	1034.26	9	
	41	C	10	0	0		1008.21	1010.51	10	
	47	D	8	0	2		1030.54	1033.47	8	
E purple	35	E	10	0	0		1012.65	1015.01	10	
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								

Comments:

Reviewed by: JGu

Date Reviewed: June 8/16

CETIS Summary Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Batch ID:	05-0339-5922	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	28 Apr-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	
Ending Date:	26 May-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	14h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	10h (7.5 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	13h (8 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	14h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
01-8849-9335	Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	5	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	5	0.98	0.9245	1	0.9	1	0.02	0.04472	4.56%	2.0%
GH_FR1	5	0.98	0.9245	1	0.9	1	0.02	0.04472	4.56%	2.0%
FR_FRCP1	5	0.98	0.9245	1	0.9	1	0.02	0.04472	4.56%	2.0%
CM_MC2	5	0.94	0.8289	1	0.8	1	0.04	0.08944	9.52%	6.0%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	1	1	1	1	1
FR_UFR1	1	1	1	0.9	1
GH_FR1	1	1	0.9	1	1
FR_FRCP1	1	1	1	1	0.9
CM_MC2	1	0.9	1	0.8	1

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	10/10	10/10	10/10	10/10	10/10
FR_UFR1	10/10	10/10	10/10	9/10	10/10
GH_FR1	10/10	10/10	9/10	10/10	10/10
FR_FRCP1	10/10	10/10	10/10	10/10	9/10
CM_MC2	10/10	9/10	10/10	8/10	10/10

CETIS Analytical Report

Test Code: 16476 | 01-0029-1604

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	01-8849-9335	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	03 Jun-16 10:12	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	05-0339-5922	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	28 Apr-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	
Ending Date:	26 May-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	14h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	10h (7.5 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	13h (8 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	14h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.5	1.0000	Exact	Non-Significant Effect
Control		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
Control		FR_FRCP1	0.5	1.0000	Exact	Non-Significant Effect
Control		CM_MC2	0.1212	0.4848	Exact	Non-Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	50	0	50	1	0	0.0%
FR_UFR1		49	1	50	0.98	0.02	2.0%
GH_FR1		49	1	50	0.98	0.02	2.0%
FR_FRCP1		49	1	50	0.98	0.02	2.0%
CM_MC2		47	3	50	0.94	0.06	6.0%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	1	1	1	1	1
FR_UFR1	1	1	1	0.9	1
GH_FR1	1	1	0.9	1	1
FR_FRCP1	1	1	1	1	0.9
CM_MC2	1	0.9	1	0.8	1

Survival Rate Binomials

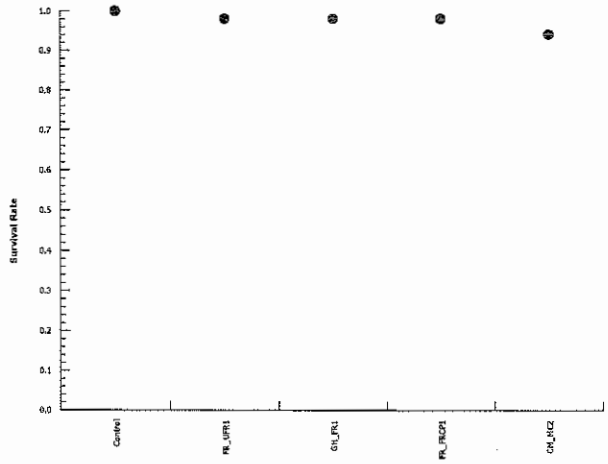
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	10/10	10/10	10/10	10/10	10/10
FR_UFR1	10/10	10/10	10/10	9/10	10/10
GH_FR1	10/10	10/10	9/10	10/10	10/10
FR_FRCP1	10/10	10/10	10/10	10/10	9/10
CM_MC2	10/10	9/10	10/10	8/10	10/10

Analyst:_____ QA: JCH 8/16

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	01-8849-9335	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	03 Jun-16 10:12	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	15-5151-5961	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	03 Jun-16 10:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	05-0339-5922	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	28 Apr-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	
Ending Date:	26 May-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	14h (8 °C)	Teck Coal	
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	10h (7.5 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	13h (8 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	14h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_FR1	0.7525	1.0000	Exact	Non-Significant Effect
FR_UFR1		FR_FRCP1	0.7525	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.3087	0.9260	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Reference Sed	49	1	50	0.98	0.02	0.0%
GH_FR1		49	1	50	0.98	0.02	0.0%
FR_FRCP1		49	1	50	0.98	0.02	0.0%
CM_MC2		47	3	50	0.94	0.06	4.08%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1	1	1	1	0.9	1
GH_FR1	1	1	0.9	1	1
FR_FRCP1	1	1	1	1	0.9
CM_MC2	1	0.9	1	0.8	1

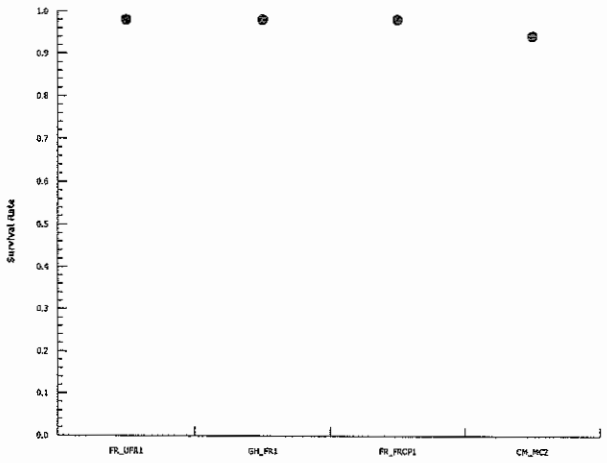
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1	10/10	10/10	10/10	9/10	10/10
GH_FR1	10/10	10/10	9/10	10/10	10/10
FR_FRCP1	10/10	10/10	10/10	10/10	9/10
CM_MC2	10/10	9/10	10/10	8/10	10/10

Hyalella 28-d Survival and Growth Sediment Test **Nautilus Environmental**

Analysis ID:	15-5151-5961	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	03 Jun-16 10:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Summary Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Batch ID:	05-0339-5922	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	28 Apr-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	
Ending Date:	26 May-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	14h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	10h (7.5 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	13h (8 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	14h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	5	0.868	0.7852	0.9508	0.798	0.954	0.02982	0.06668	7.68%	0.0%
FR_UFR1	5	0.9088	0.8133	1.004	0.805	0.987	0.03439	0.07689	8.46%	-4.7%
GH_FR1	5	0.5222	0.2989	0.7454	0.33	0.787	0.0804	0.1798	34.43%	39.84%
FR_FRCP1	5	0.4414	0.3016	0.5813	0.345	0.631	0.05037	0.1126	25.51%	49.14%
CM_MC2	5	0.2584	0.1831	0.3337	0.221	0.3662	0.02713	0.06066	23.47%	70.23%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	0.954	0.881	0.798	0.903	0.804
FR_UFR1	0.987	0.868	0.904	0.98	0.805
GH_FR1	0.423	0.33	0.4578	0.613	0.787
FR_FRCP1	0.345	0.631	0.452	0.388	0.3911
CM_MC2	0.221	0.2389	0.23	0.3662	0.236

CETIS Analytical Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	19-2572-8548	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	03 Jun-16 10:12	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	05-0339-5922	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	28 Apr-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	
Ending Date:	26 May-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	14h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	10h (7.5 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	13h (8 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	14h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	18.2%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	-0.5936	2.305	0.158	8	0.9363	CDF	Non-Significant Effect
		GH_FR1	5.032	2.305	0.158	8	0.0001	CDF	Significant Effect
		FR_FRCP1	6.207	2.305	0.158	8	<0.0001	CDF	Significant Effect
		CM_MC2	8.869	2.305	0.158	8	<0.0001	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.575309	0.3938273	4	33.35	<0.0001	Significant Effect
Error	0.2361764	0.01180882	20			
Total	1.811486		24			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	6.387	13.28	0.1721	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9473	0.8877	0.2178	Normal Distribution

Mean Dry Weight-mg Summary

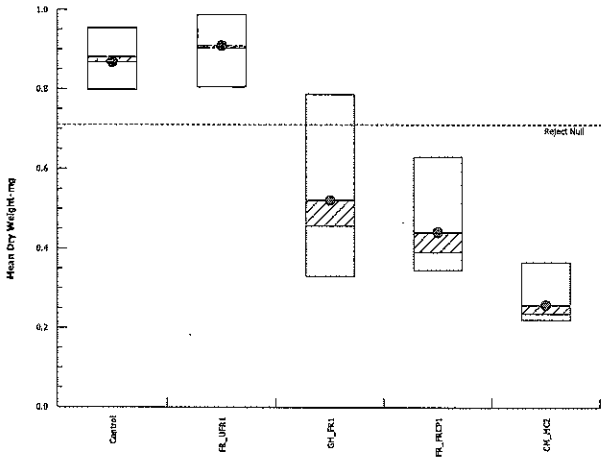
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	5	0.868	0.7852	0.9508	0.881	0.798	0.954	0.02982	7.68%	0.0%
FR_UFR1	5	0.9088	0.8133	1.004	0.904	0.805	0.987	0.03439	8.46%	-4.7%
GH_FR1	5	0.5222	0.2989	0.7454	0.4578	0.33	0.787	0.0804	34.43%	39.84%
FR_FRCP1	5	0.4414	0.3016	0.5813	0.3911	0.345	0.631	0.05037	25.51%	49.14%
CM_MC2	5	0.2584	0.1831	0.3337	0.236	0.221	0.3662	0.02713	23.47%	70.23%

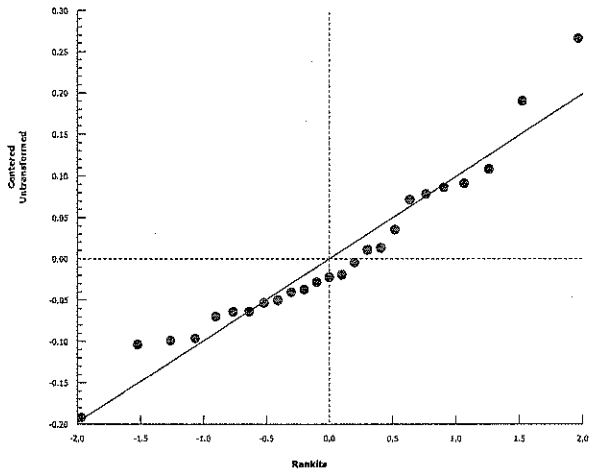
Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	0.954	0.881	0.798	0.903	0.804
FR_UFR1	0.987	0.868	0.904	0.98	0.805
GH_FR1	0.423	0.33	0.4578	0.613	0.787
FR_FRCP1	0.345	0.631	0.452	0.388	0.3911
CM_MC2	0.221	0.2389	0.23	0.3662	0.236

Analysis ID:	19-2572-8548	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	03 Jun-16 10:12	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	11-0047-1307	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	03 Jun-16 10:13	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	05-0339-5922	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	28 Apr-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	
Ending Date:	26 May-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	14h (8 °C)	Teck Coal	
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	10h (7.5 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	13h (8 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	14h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	18.1%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_FR1	5.233	2.227	0.165	8	0.0001	CDF	Significant Effect
		FR_FRCP1	6.325	2.227	0.165	8	<0.0001	CDF	Significant Effect
		CM_MC2	8.802	2.227	0.165	8	<0.0001	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.125601	0.3752002	3	27.49	<0.0001	Significant Effect
Error	0.2183907	0.01364942	16			
Total	1.343991		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.923	11.34	0.1775	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9393	0.866	0.2326	Normal Distribution

Mean Dry Weight-mg Summary

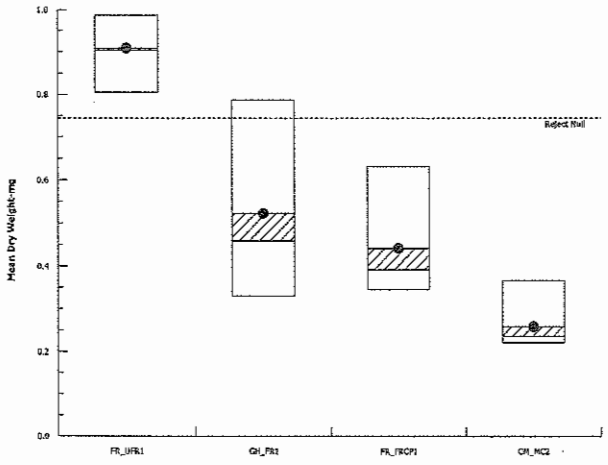
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	5	0.9088	0.8133	1.004	0.904	0.805	0.987	0.03439	8.46%	0.0%
GH_FR1	5	0.5222	0.2989	0.7454	0.4578	0.33	0.787	0.0804	34.43%	42.54%
FR_FRCP1	5	0.4414	0.3016	0.5813	0.3911	0.345	0.631	0.05037	25.51%	51.43%
CM_MC2	5	0.2584	0.1831	0.3337	0.236	0.221	0.3662	0.02713	23.47%	71.56%

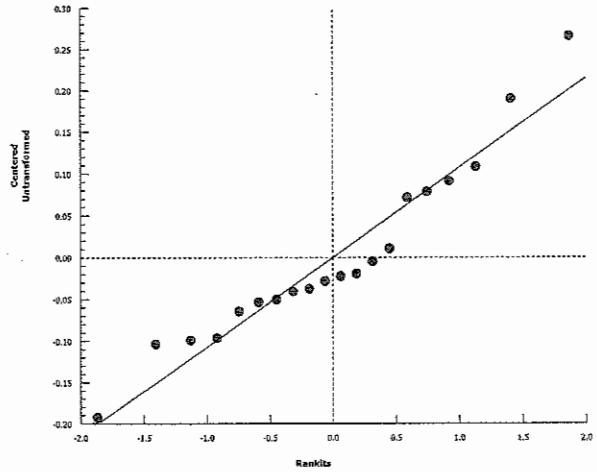
Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1	0.987	0.868	0.904	0.98	0.805
GH_FR1	0.423	0.33	0.4578	0.613	0.787
FR_FRCP1	0.345	0.631	0.452	0.388	0.3911
CM_MC2	0.221	0.2389	0.23	0.3662	0.236

Analysis ID:	11-0047-1307	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	03 Jun-16 10:13	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Client: Teck

W.O.#: 164716

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
MHW 042816	Apr 28/16	50	3.2	3.4	60		50	6.0	120	EC
FR_UFR1	↓	↓	5.4	5.5	106		↓	~~11.4~~ 5.7	114	KL
GIL FR1			7.7	7.8	152			14.1	282	↓
FR_FRCP1			7.8	7.9	154			13.6	272	
CM_MC2	↓	↓	7.2	7.4	140		↓	13.3	266	↓
MHW 051416	May 14/16	50	3.0	3.1	58		50	7.0	140	KL
FR_UFR1	May 26/16	↓	5.9	6.1	114		↓	6.7	134	↓
GIL_FR1	↓		8.5	8.7	166			16.9	338	
FR_FRCP1			7.9	8.1	154			14.4	288	
CM_MC2	↓	↓	7.0	7.2	136		↓	12.9	258	↓
Control	↓	50	2.9	3.0	56		↓	6.5	130	

Notes:

Reviewed by: JGh

Date Reviewed: June 8/16

APPENDIX D – *Pimephales promelas* Toxicity Test Data

Nautilus Environmental

ATTN: Krysta Pearcy
Nautilus Environmental
8664 Commerce Court
Burnaby , BC
Canada , V5A 4N7

Received: various dates
Report Date: 2016/06/27
Version: REVISION 2

HydroQual Test Report

Client: NAU104
Reference: 16-0488
Client Reference: CM_MC2_WS
GH_FR1_WS
FR_FRCP1_Q
FR_UFR1_QR
Untreated Report

Billing: not given

Jacklyn Poole

Senior Verifier

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0488

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw Courier		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	4.8, 6, 12, 13, 10

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	CM_MC2_WS_20160427_N	CM_MC2_WS_20160504_N	CM_MC2_WS_20160511_N	CM_MC2_WS_20160518_N	CM_MC2_WS_20160525_N	**CM_MC2_WS**
collection date:	2016/04/27	2016/05/04	2016/05/11	2016/05/18	2016/05/25	
collection time:	1000	not given	not given	1040	1010	
pH:	7.7	8.0	7.8	8.1	8.0	
EC (µS/cm):	515	508	593	534	514	
DO (mg/L):	7.4	9.5	9.8	10.2	10.0	
temp (°C):	13.3	14.9	15.7	14.6	14.4	
hardness:	219	253	268	235	232	
alkalinity:	164	129	145	126	132	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	odourless	odourless	odourless	odourless	odourless	

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/04/29
ended:	2016/05/31
prelim made:	-
prelim sent:	-
reported:	2016/06/01

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0489

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw Courier		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	5.8, 8, 11.6, 12, 10

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	GH_FR1_WS_2016_04_27_N	GH_FR1_WS_2016_05_04_N	GH_FR1_WS_2016_05_11_N	GH_FR1_WS_2016_05_18_N	GH_FR1_WS_2016_05_25_N	**GH_FR1_WS**
collection date:	2016/04/27	2016/05/04	2016/05/11	2016/05/18	2016/05/25	
collection time:	1406	1155	1000	0945	0930	
pH:	8.0	8.0	7.7	8.0	7.9	
EC (µS/cm):	547	591	618	660	620	
DO (mg/L):	9.3	9.4	9.5	9.6	9.6	
temp (°C):	11.4	15.9	16.1	15.3	15.2	
hardness:	303	387	291	325	298	
alkalinity:	212	116	163	164	170	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	odourless	odourless	odourless	odourless	odourless	

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/04/29
ended:	2016/05/31
prelim made:	-
prelim sent:	-
reported:	2016/06/01

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0490

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw Courier		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	5.3, 10, 12, 16, 10

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_FRCP1_Q_04042016_N	FR_FRCP1_QR_11042016_N	FR_FRCP1_QR_11042016_N	FR_FRCP1_QR_18042016_N	FR_FRCP1_QR_02052016_N	**FR_FRCP1_Q**
collection date:	2016/04/27	2016/05/04	2016/05/11	2016/05/18	2016/05/25	
collection time:	1100	1018	1040	0850	0955	

pH:	7.9	8.0	8.1	8.0	7.9
EC (µS/cm):	514	534	627	609	564
DO (mg/L):	9.2	9.0	9.5	9.4	9.3
temp (°C):	12.1	14.9	16.2	15.6	16.6
hardness:	198	270	320	280	287
alkalinity:	198	153	169	139	156
colour:	colourless	colourless	colourless	colourless	colourless
odour:	odourless	odourless	odourless	odourless	odourless

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/04/29
ended:	2016/05/31
prelim made:	-
prelim sent:	-
reported:	2016/06/01

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Nautilus Environmental Internal Tracking Sheet

Client:	NAU104
Reference:	16-0491

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw Courier		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	5.3, 10, 12, 16, 10

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_UFR1_Q_04 042016_N	FR_UFR1_QR _11042016_N	FR_UFR1_QR_ 11042016_N	FR_UFR1_QR _18042016_N	FR_UFR1_QR _02052016_N	**FR_UFR1_QR**
collection date:	2016/04/27	2016/05/04	2016/05/11	2016/05/18	2016/05/25	
collection time:	0930	0848	0900	1048	0847	

pH:	8.0	8.1	8.1	8.1	7.9
EC (µS/cm):	228	244	248	282	263
DO (mg/L):	9.3	9.8	9.4	9.8	9.4
temp (°C):	12.2	14.6	17.1	14.9	17.1
hardness:	109	149	117	116	124
alkalinity:	215	116	115	112	110
colour:	colourless	colourless	colourless	colourless	colourless
odour:	odourless	odourless	odourless	odourless	odourless

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/04/29
ended:	2016/05/31
prelim made:	-
prelim sent:	-
reported:	2016/06/01

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Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

Organism Information

Source: Aquatox Batch: 20160429FMELS Egg Stage: 15 somites Organisms Received in Good Condition: **Yes**

Test Log

Date	Day	Time	Technicians	Chem Cart Used	Fed		Feeding Rate (mL)	Sample Pre-Aeration Time (min)	Bench Sheet Review	
					AM	PM			First	Second
2016/04/29	0	1500	HS/EP/CQ/JW	2	-	-	-	30	HS	EP
2016/04/30	1	1400	HS	2	-	-	-	45	HS	EP
2016/05/01	2	1130	JN/JW	2	-	-	-	45	JN	JW
2016/05/02	3	1430	JN/JW	2	-	-	-	40	JN	JW
2016/05/03	4	1030	HS/EP	2	-	✓	-	40	EP	HS
2016/05/04	5	1130	JW/JN	2	✓	✓	1	40	JN	JW
2016/05/05	6	1130	JN/BH	2	✓	✓	1	50	JN	HS
2016/05/06	7	1130	JW/BH	2	✓	✓	1	40	JW	CQ
2016/05/07	8	1145	EP/HS	2	✓	✓	1	40	EP	HS
2016/05/08	9	1400	HS/BH	2	✓	✓	1	40	HS	BH
2016/05/09	10	1130	JN/JW/KLO	2	✓	✓	1	40	JW	JN
2016/05/10	11	1400	ML/EP	2	✓	✓	1.5	40	ML	EP
2016/05/11	12	1415	ML/EP/CB	2	✓	✓	1.5	40	EP	JP
2016/05/12	13	1030	JW/BH	2	✓	✓	1.5	40	JW	JN
2016/05/13	14	1200	CB/EP/KLO	2	✓	✓	1.5	40	HS	BH
2016/05/14	15	1140	JN/KLO	2	✓	✓	1.5	45	JN	KLO
2016/05/15	16	1220	JW/KLO	2	✓	✓	1.5	40	JW	ML
2016/05/16	17	1400	EP/CB	2	✓	✓	1.5	40	EP	JW
2016/05/17	18	1335	JN/HS	2	✓	✓	1.5	40	HS	JN
2016/05/18	19	1115	HS/KLO/CB	2	✓	✓	1.5	40	HS	EP
2016/05/19	20	1030	JW/KLO	2	✓	✓	2.0	40	JW	JN
2016/05/20	21	1330	KLO/JN	2	✓	✓	2.0	40	JN	KLO
2016/05/21	22	1000	BH/CB	2	✓	✓	2.0	40	BH	JN
2016/05/22	23	1100	JW/KLO	2	✓	✓	2.0	40	ML	JW
2016/05/23	24	1030	JN/KLO	2	✓	✓	2.0	40	JN	HS
2016/05/24	25	1115	JW/BH	2	✓	✓	2.0	40	JW	HS
2016/05/25	26	1030	JW/BH	2	✓	✓	2.0	40	JW	HS
2016/05/26	27	1015	JW/ML	2	✓	✓	2.0	40	JW	EP
2016/05/27	28	1045	KLO/BH	2	✓	✓	2.0	40	JP	HS
2016/05/28	29	1100	JN/BH	2	✓	✓	2.5	40	JN	BH
2016/05/29	30	1130	JW/ML	2	✓	✓	2.5	40	JW	ML
2016/05/30	31	1130	JW/EP	2	✓	✓	2.5	40	JW	HS
2016/05/31	32	1020	ML/JW	2	-	-	-	-	ML	JW

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

Control hatching success must be >66% (≥10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

	CTL-Tap		CTL-MHRW		16-0488		16-0489		16-0490		16-0491	
	Day 1		Day 1		Day 1		Day 1		Day 1		Day 1	
replicate	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos
a	14	1	15	0	14	1	15	0	15	0	14	1
b	15	0	15	0	15	0	13	2	14	1	15	0
c	14	1	14	1	15	0	14	1	15	0	14	1
d	15	0	14	1	13	2	14	1	14	1	15	0
e	28	2	28	2	28	2	28	2	28	2	27	3
f	30	0	30	0	28	2	26	4	29	1	28	2

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

	CTL-Tap			CTL-MHRW			16-0488			16-0489		
	Day 2			Day 2			Day 2			Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	13	1	15	14	1	15	13	1	15	14	1	15
b	15	0	15	14	1	15	12	3	15	12	1	15
c	14	0	15	13	1	15	11	4	15	13	1	15
d	15	0	15	14	0	15	12	1	15	11	3	15
e	25	3		24	4		26	2		26	2	
f	26	4		27	3		25	3		24	2	

	16-0490			16-0491		
	Day 2			Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	14	1	15	13	1	15
b	13	1	15	15	0	15
c	14	1	15	13	1	15
d	13	1	15	13	2	15
e	27	1		25	2	
f	25	4		26	2	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2

Comments/Observations:

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

Number of Alive Embryos and Hatched Organisms

	CTL-Tap		CTL-MHRW		16-0488		16-0489		16-0490		16-0491	
	Day 3		Day 3		Day 3		Day 3		Day 3		Day 3	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	10	5	10	5	12	3	12	3	11	4	13	2
b	11	4	13	2	12	3	10	5	10	5	12	3
c	13	2	14	1	11	4	10	5	8	7	12	3
d	9	6	12	3	14	1	12	2*	10	5	13	2

Comments/Observations: *1 hatched minnow was dead

	CTL-Tap		CTL-MHRW		16-0488		16-0489		16-0490		16-0491	
	Day 4		Day 4		Day 4		Day 4		Day 4		Day 4	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	1	14	0	15	1	14	0	15	2	13	2*	12
b	0	15	2	13	1	14	2	13	0	15	1	14
c	4	11	1	14	1	14	1	14	0	15	0	15
d	2	13	1	14	2	13	2	12	2	13	3	12

Comments/Observations: *dead organism was an embryo

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 5	Day 5	Day 5	Day 5	Day 5	Day 5
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15*	15	14**	15	14**	14
b	15	15	15	13***	15	15
c	15	15	15	15	15	15
d	15	15	15	14	13**	14**

Comments/Observations: *fish not fully hatched, **dead organisms were hatched, ***dead organisms were embryos

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 6	Day 6	Day 6	Day 6	Day 6	Day 6
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14*	15	14	15	14	14
b	14	15	15 (1)	13	15	15
c	15	15	15	15	15	14
d	15	15	15 (1)	13	13 (1)	14 (1)

Comments/Observations: *dead organism not fully hatched, bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 7	Day 7	Day 7	Day 7	Day 7	Day 7
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (1)*	15	14**	15	14	14 (1)
b	14	15	14 (1)**	12	15	15
c	15	15	15	14	15	14
d	15	15	12**	13	13 (1)	14

Comments/Observations: *one organism has a bent tail, **dead organisms were caught in debris/mold, bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 8	Day 8	Day 8	Day 8	Day 8	Day 8
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (2)	15	13*	13*	14	14 (1)
b	14	15	14 (1)	12	15	15
c	15	15	15	14	15	14
d	15	15	12	13	13 (1)	14

Comments/Observations: *dead organsims tangled in white debris, bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 9	Day 9	Day 9	Day 9	Day 9	Day 9
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (2)	15	13	12	14	14
b	14	15	14	12	14	14
c	15	15	15	13	15	13
d	15	15	12	12	13	14

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 10	Day 10	Day 10	Day 10	Day 10	Day 10
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (1)	15	12	12	11	14 (1)
b	14	15 (1)	14	12	14	14
c	15 (1)	15	15	13	15	13
d	15	15	12	11	13	14

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 11	Day 11	Day 11	Day 11	Day 11	Day 11
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (1)	15	12	12	11	14 (1)
b	14	14	14	12	14	14
c	15 (1)	15	15	12	14	13
d	15	15	12	11	13 (1)	14 (1)

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 12	Day 12	Day 12	Day 12	Day 12	Day 12
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	12	12	11	14 (1)
b	14	14	14	12	14	14
c	15 (1)	15	15	12	14	13
d	15	15	12	11	13	14

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 13	Day 13	Day 13	Day 13	Day 13	Day 13
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)*	15	15	12	14	13
d	15	15	12	11	13	13**

Comments/Observations: *one organism has a bent tail, **dead organsim was moldy, bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 14	Day 14	Day 14	Day 14	Day 14	Day 14
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	15	12	14	13
d	15	15	12	11	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 15	Day 15	Day 15	Day 15	Day 15	Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)*	15	15	12	14	13
d	15	15	12	11	13	13

Comments/Observations: *one organism had a bent tail, bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 16	Day 16	Day 16	Day 16	Day 16	Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	15	12	14	13
d	15	15	12	11	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 17	Day 17	Day 17	Day 17	Day 17	Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	15	12	14	13
d	15	15	12	11	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 18	Day 18	Day 18	Day 18	Day 18	Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15	15	15	12	14	13
d	15	15	12	11	13	13

Comments/Observations:

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 19	Day 19	Day 19	Day 19	Day 19	Day 19
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	15	12	14	13
d	15	15	12	11	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 20	Day 20	Day 20	Day 20	Day 20	Day 20
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	14	12	14	13
d	15	15	12	11	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 21	Day 21	Day 21	Day 21	Day 21	Day 21
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	14	12	14	13
d	15	15	12	11 (1)	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 22	Day 22	Day 22	Day 22	Day 22	Day 22
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	14	12	14	13
d	15	15	12	9	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 23	Day 23	Day 23	Day 23	Day 23	Day 23
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	14	12	14	13
d	15	15	12	9	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 24	Day 24	Day 24	Day 24	Day 24	Day 24
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	14	12	14	13
d	15	15	12	9	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 25	Day 25	Day 25	Day 25	Day 25	Day 25
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	14	12	14	13
d	15	15	12	9	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 26	Day 26	Day 26	Day 26	Day 26	Day 26
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14 (1)	12	14	14
c	15 (1)	15	14	12	14	13
d	15	15	12	9	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 27	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	12	12	11	13
b	14	14	14	12	14	14
c	15 (1)	15	14	12	14	14
d	15	15	12	9	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 28	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	11	12	11	13
b	14	14	14	12	14	14
c	14	15	14	12	14	14
d	14	15	12	9	13	13

Comments/Observations:

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 29	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	11	12	11	13
b	14	14	14	12	14	14
c	14	15	14	12	14	14
d	14	15	12	9	13	13

Comments/Observations:

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 30	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	11	12	11	13
b	14	14	14 (1)	12	14	14
c	14	15	14	12	14	14
d	14	15	12	9	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 31	Day 31	Day 31	Day 31	Day 31	Day 31
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	11	12	11	13
b	14	14	14 (1)	12	14	14
c	14	15	14	12	14	14
d	14	15	12	9	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491
	Day 32	Day 32	Day 32	Day 32	Day 32	Day 32
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	11	12	11	13
b	14	14	13	12	14	14
c	14	15	14	12	14	14
d	14	15	12	9	13	13

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

New Solutions

Conc. (%) / Day	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491	
pH (units)							
0	8.2	8.1	8.3	8.3	8.3	8.2	
1	8.3	8.2	8.3	8.3	8.2	8.2	
2	8.1	7.9	8.2	8.2	8.2	8.1	
3	8.1	8.0	8.1	8.1	8.0	8.0	
4	8.2	8.0	8.1	8.1	8.1	8.1	
5	8.1	8.0	8.2	8.2	8.2	8.1	
6	8.2	8.0	8.2	8.2	8.2	8.1	
7	8.2	8.1	8.2	8.2	8.2	8.2	
8	8.1	8.1	8.1	8.1	8.1	8.1	
Conductance (µS/cm)							
0	364	294	546	550	533	243	
1	360	306	532	557	524	240	
2	360	307	519	537	490	232	
3	329	309	525	550	535	240	
4	344	306	533	539	538	241	
5	335	309	520	548	535	238	
6	323	321	540	535	515	240	
7	390	305	506	571	511	241	
8	385	322	508	585	530	250	
Dissolved Oxygen (mg/L) (60-100% saturation)							
0	7.3	7.3	7.3	7.3	7.3	7.3	
1	7.3	7.3	7.3	7.3	7.3	7.3	
2	7.3	7.2	7.3	7.2	7.3	7.2	
3	7.3	7.3	7.2	7.2	7.2	7.2	
4	7.3	7.2	7.2	7.2	7.2	7.2	
5	7.2	7.2	7.2	7.2	7.1	7.1	
6	7.3	7.3	7.3	7.2	7.2	7.2	
7	7.2	7.2	7.2	7.2	7.3	7.3	
8	7.2	7.1	7.2	7.2	7.2	7.2	
Temperature (°C)							
0	24	24	24	24	24	24	
1	24	24	24	24	24	24	
2	24	25	24	25	24	25	
3	24	24	25	25	25	25	
4	24	25	25	25	25	25	
5	25	24	25	25	26	26	
6	24	24	24	25	25	25	
7	25	25	25	25	24	24	
8	25	25	25	25	25	25	

Old Solutions

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491	
pH (units)							
0							
1	8.3	8.0	8.4	8.3	8.3	8.1	
2	7.9	7.8	8.0	8.1	8.0	8.0	
3	8.1	7.9	8.2	8.2	8.2	8.1	
4	7.9	8.0	8.2	8.2	8.1	8.0	
5	8.0	8.0	8.2	8.2	8.1	8.0	
6	7.9	7.8	8.1	8.1	8.0	8.1	
7	7.6	7.6	8.1	8.1	8.1	8.0	
8	7.9	7.6	8.1	8.1	8.0	7.9	
Conductance (µS/cm)							
0							
1	375	291	550	559	517	251	
2	355	310	530	559	535	237	
3	349	312	536	542	528	241	
4	321	340	540	560	530	249	
5	336	329	528	563	553	235	
6	334	322	532	516	553	241	
7	353	329	532	550	514	237	
8	380	330	530	575	528	259	
Dissolved Oxygen (mg/L) (60-100% saturation)							
0							
1	7.2	7.1	7.0	7.0	7.1	7.0	
2	7.0	7.0	7.0	7.0	7.0	7.0	
3	7.0	6.9	6.9	7.1	7.3	7.2	
4	6.8	6.9	7.1	7.1	7.2	7.1	
5	6.8	7.0	7.0	6.9	6.9	7.2	
6	6.5	6.3	6.3	6.7	6.7	6.5	
7	6.2	6.2	6.1	6.1	6.3	6.5	
8	6.0	6.0	6.1	5.9	5.7	5.7	
Temperature (°C)							
0							
1	24	24	24	24	24	24	
2	24	24	24	24	24	24	
3	24	24	24	24	24	24	
4	24	24	24	24	24	24	
5	24	24	24	24	24	24	
6	24	24	24	24	24	24	
7	24	24	24	24	24	24	
8	24	24	24	24	24	24	

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C

4.5 to 7.2 mg/L at 25°C

4.3 to 7.1 mg/L at 26°C

Comments:

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

New Solutions

Conc. (%) / Day	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491	
pH (units)							
9	8.2	8.1	8.3	8.1	8.3	8.3	
10	8.1	7.9	8.2	8.2	8.2	8.2	
11	8.1	8.0	8.2	8.2	8.2	8.1	
12	8.1	7.9	8.1	8.1	8.2	8.1	
13	7.8	7.8	8.0	8.0	8.1	8.0	
14	8.1	8.0	8.2	8.2	8.3	8.2	
15	8.2	8.0	8.2	8.2	8.3	8.2	
16	8.2	8.1	8.2	8.2	8.3	8.2	
17	8.1	7.9	8.2	8.2	8.3	8.2	
Conductance (µS/cm)							
9	373	326	502	586	521	252	
10	351	319	504	580	526	247	
11	357	320	507	586	527	249	
12	377	342	538	615	549	262	
13	393	347	542	625	564	267	
14	377	345	594	611	627	264	
15	361	331	600	618	631	266	
16	359	357	587	604	613	265	
17	361	335	591	613	623	264	
Dissolved Oxygen (mg/L) (60-100% saturation)							
9	7.3	7.3	7.2	7.2	7.2	7.2	
10	7.3	7.1	7.3	7.2	7.2	7.1	
11	7.3	7.2	7.3	7.2	7.2	7.2	
12	7.2	7.2	7.2	7.2	7.3	7.3	
13	7.2	7.3	7.2	7.3	7.2	7.2	
14	7.3	7.2	7.3	7.3	7.3	7.2	
15	7.2	7.2	7.2	7.2	7.3	7.2	
16	7.3	7.3	7.2	7.2	7.1	7.2	
17	7.2	7.2	7.2	7.3	7.3	7.2	
Temperature (°C)							
9	24	24	25	25	25	25	
10	24	25	24	25	25	26	
11	24	25	24	25	25	25	
12	25	25	25	25	24	24	
13	25	24	25	24	25	25	
14	24	25	24	24	24	25	
15	25	25	25	25	24	25	
16	24	24	25	25	26	25	
17	25	25	25	24	24	25	

Old Solutions

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491	
pH (units)							
9	7.9	7.7	8.2	8.1	8.1	7.7	
10	7.9	7.6	7.9	8.1	8.0	7.9	
11	7.8	7.6	8.1	8.1	8.1	7.9	
12	7.8	7.5	8.0	8.0	8.0	7.9	
13	7.5	7.5	7.6	7.9	7.9	7.8	
14	7.6	7.5	8.1	8.1	8.1	8.0	
15	7.9	7.9	8.1	8.1	8.3	8.1	
16	7.5	7.4	7.8	8.1	8.0	7.9	
17	7.3	7.4	8.0	8.0	8.1	7.8	
Conductance (µS/cm)							
9	382	330	525	584	521	258	
10	373	316	515	589	512	240	
11	375	333	522	592	533	254	
12	395	364	563	628	563	269	
13	392	356	545	633	577	262	
14	381	352	557	633	561	275	
15	390	360	580	612	601	270	
16	380	359	595	620	622	275	
17	373	364	613	635	625	282	
Dissolved Oxygen (mg/L) (60-100% saturation)							
9	6.9	6.9	5.8	5.8	5.5	5.4	
10	6.6	6.5	6.1	6.1	6.3	6.3	
11	6.6	6.8	6.5	6.6	6.4	6.5	
12	6.5	6.3	6.4	6.6	6.5	6.5	
13	6.1	6.2	5.2	6.1	6.0	6.2	
14	6.2	5.9	5.9	6.5	6.6	6.8	
15	6.6	6.5	6.9	6.7	6.5	6.8	
16	5.3	5.5	5.0	5.2	5.0	6.2	
17	4.4	5.3	5.6	5.2	5.6	5.0	
Temperature (°C)							
9	24	24	24	24	24	24	
10	24	24	24	24	24	24	
11	24	24	24	24	24	24	
12	24	24	24	24	24	24	
13	24	24	24	24	24	25	
14	24	24	24	24	24	24	
15	24	24	24	24	24	24	
16	24	24	24	24	24	24	
17	24	24	24	24	24	24	

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

New Solutions

Conc. (%) / Day	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491	
pH (units)							
18	7.8	7.8	8.0	8.0	8.0	8.0	
19	7.9	7.8	8.0	8.0	8.1	8.0	
20	8.1	8.0	8.2	8.0	8.2	8.1	
21	7.9	7.8	8.0	7.9	8.0	8.0	
22	7.9	7.7	8.1	8.1	8.2	8.2	
23	8.1	8.0	8.2	8.1	8.2	8.1	
24	8.1	8.0	8.2	8.1	8.2	8.2	
25	8.1	8.0	8.2	8.1	8.3	8.2	
26	8.0	8.0	8.2	8.2	8.2	8.2	
Conductance (µS/cm)							
18	364	336	600	614	631	274	
19	359	342	598	613	632	266	
20	353	334	586	613	619	261	
21	359	347	548	665	618	285	
22	365	344	515	659	613	279	
23	347	346	552	660	616	285	
24	353	360	551	663	615	284	
25	343	368	532	615	597	273	
26	335	323	524	626	570	267	
Dissolved Oxygen (mg/L) (60-100% saturation)							
18	7.2	7.1	7.1	7.2	7.2	7.2	
19	7.1	7.1	7.1	7.2	7.0	7.0	
20	7.2	7.3	7.1	7.3	7.1	7.1	
21	7.2	7.3	7.2	7.2	7.2	7.2	
22	7.1	7.1	7.1	7.0	7.2	7.2	
23	7.2	7.2	7.2	7.2	7.1	7.1	
24	7.2	7.2	7.2	7.2	7.1	7.1	
25	7.1	7.3	7.2	7.3	7.1	7.1	
26	7.2	7.2	7.3	7.3	7.1	7.1	
Temperature (°C)							
18	25	24	25	25	25	25	
19	25	25	26	25	26	26	
20	25	24	26	24	26	26	
21	25	24	25	25	25	25	
22	25	24	25	25	25	25	
23	25	24	25	25	26	26	
24	25	25	25	25	26	26	
25	26	24	25	24	25	26	
26	25	25	24	24	26	26	

Old Solutions

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491	
pH (units)							
18	7.5	7.4	7.9	7.9	8.0	7.7	
19	7.3	7.3	7.7	7.9	7.7	7.6	
20	7.4	7.5	7.8	7.9	7.9	7.9	
21	7.4	7.2	7.8	7.9	7.8	7.5	
22	7.2	7.2	7.8	7.9	7.8	7.5	
23	7.8	7.8	8.3	8.3	8.2	8.1	
24	8.0	7.9	8.2	8.3	8.2	8.0	
25	7.8	7.8	8.1	7.9	8.2	8.3	
26	7.8	7.8	8.3	8.0	8.2	8.0	
Conductance (µS/cm)							
18	379	358	614	627	617	285	
19	373	351	612	628	628	279	
20	358	350	594	621	639	308	
21	365	350	602	608	629	270	
22	364	354	597	665	629	291	
23	369	355	581	663	621	292	
24	352	369	565	663	617	291	
25	355	364	559	684	659	295	
26	333	354	553	655	599	287	
Dissolved Oxygen (mg/L) (60-100% saturation)							
18	5.8	5.9	5.6	5.2	5.8	6.0	
19	5.1	5.1	5.3	5.0	4.9	5.6	
20	5.9	5.9	5.7	5.5	5.2	5.5	
21	5.1	5.1	5.7	5.6	5.6	5.4	
22	5.1	5.1	5.6	5.8	5.3	4.6	
23	6.9	6.9	7.3	7.2	7.1	6.9	
24	7.3	7.3	7.3	7.3	7.2	7.2	
25	7.0	7.0	7.1	6.9	6.8	7.0	
26	6.9	6.8	6.8	6.0	7.0	6.8	
Temperature (°C)							
18	24	24	24	24	24	24	
19	24	24	24	24	24	24	
20	24	24	24	24	24	24	
21	24	24	24	24	24	24	
22	24	24	24	25	24	24	
23	24	24	24	24	24	24	
24	24	24	24	24	24	24	
25	24	24	24	24	24	24	
26	24	24	24	24	24	24	

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments: On day 22, all test vessels were put on aeration

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

New Solutions

Conc. (%) / Day	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491	
pH (units)							
27	8.1	8.0	8.2	8.3	8.2	8.2	
28	8.1	8.0	8.2	8.2	8.3	8.2	
29	8.2	8.1	8.3	8.3	8.3	8.2	
30	7.9	7.8	8.2	8.0	8.0	7.9	
31	8.0	7.8	8.2	8.2	8.2	8.2	
32							
Conductance (µS/cm)							
27	313	301	497	586	565	263	
28	335	317	506	620	566	261	
29	326	326	509	609	559	267	
30	329	320	503	587	556	261	
31	335	324	499	605	549	261	
32							
Dissolved Oxygen (mg/L) (60-100% saturation)							
27	7.2	7.1	7.1	7.1	7.2	7.2	
28	7.2	7.2	7.2	7.1	7.1	7.1	
29	7.2	7.2	7.2	7.2	7.2	7.1	
30	7.2	7.1	7.2	7.3	7.1	7.1	
31	7.2	7.1	7.2	7.2	7.3	7.2	
32							
Temperature (°C)							
27	25	26	26	26	25	25	
28	25	25	25	26	26	26	
29	25	25	25	25	25	25	
30	24	25	25	24	26	26	
31	24	25	25	25	24	25	
32							

Old Solutions

	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491	
pH (units)							
27	7.8	7.8	8.2	8.0	8.0	8.0	
28	7.9	7.9	8.2	8.3	8.3	8.2	
29	8.0	8.0	8.2	8.2	8.4	8.2	
30	7.6	7.6	8.0	7.8	8.0	7.7	
31	7.8	7.9	8.2	8.3	8.2	8.1	
32	7.9	7.9	8.3	8.3	8.3	8.1	
Conductance (µS/cm)							
27	337	343	554	652	595	287	
28	339	338	528	640	603	279	
29	337	321	506	609	587	264	
30	342	337	540	646	567	281	
31	335	339	534	640	568	285	
32	334	335	537	628	569	280	
Dissolved Oxygen (mg/L) (60-100% saturation)							
27	7.2	7.2	6.9	6.5	6.9	7.1	
28	6.9	6.8	6.9	7.0	7.0	7.1	
29	7.2	7.2	7.2	7.2	7.4	7.2	
30	6.9	6.6	6.6	5.9	6.9	6.7	
31	7.1	7.2	7.2	7.2	7.3	7.2	
32	7.2	7.1	7.3	7.3	7.3	7.1	
Temperature (°C)							
27	24	24	24	24	24	24	
28	25	25	25	25	25	25	
29	25	25	25	25	25	25	
30	24	24	24	24	24	24	
31	24	24	24	24	24	24	
32	24	24	24	24	24	24	

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

Test Termination

For normal/abnormal column, use the following notation:
N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

CTL-Tap

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	10	N	1	9	N	1	7	N	1	9	N
2	11	N	2	9	N	2	10	N	2	10	N
3	11	N	3	11	N	3	11	N	3	10	N
4	12	N	4	11	N	4	9	N	4	11	N
5	9	N	5	9	N	5	9	N	5	9	N
6	12	N	6	10	N	6	9	N	6	11	N
7	12	N	7	9	N	7	9	N	7	9	N
8	8	N	8	10	N	8	11	N	8	12	N
9	11	N	9	11	N	9	9	N	9	9	N
10	11	N	10	10	N	10	13	N	10	12	N
11	11	N	11	9	N	11	12	N	11	11	N
12	10	N	12	9	N	12	9	N	12	11	N
13	7	AH	13	9	N	13	11	N	13	9	N
14	-	-	14	11	N	14	11	N	14	8	N
15	-	-	15	-	-	15	-	-	15	-	-

Comments

CTL-MHRW

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	8	N	1	9	N	1	11	N	1	9	N
2	9	N	2	11	N	2	10	N	2	10	N
3	10	N	3	9	N	3	10	N	3	10	N
4	11	N	4	12	N	4	9	N	4	11	N
5	10	N	5	11	N	5	10	N	5	8	N
6	9	N	6	10	N	6	9	N	6	12	N
7	9	N	7	11	N	7	10	N	7	11	N
8	10	N	8	11	N	8	9	N	8	9	N
9	8	N	9	9	N	9	10	N	9	10	N
10	9	N	10	10	N	10	12	N	10	10	N
11	9	N	11	10	N	11	12	N	11	9	N
12	9	N	12	11	N	12	8	N	12	9	N
13	9	N	13	9	N	13	8	N	13	12	N
14	11	N	14	9	N	14	9	N	14	9	N
15	10	N	15	-	-	15	10	N	15	9	N

Comments:

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. **16-0488**

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	11	N	1	11	N	1	10	N	1	11	N
2	12	N	2	10	N	2	11	N	2	11	N
3	12	N	3	12	N	3	10	N	3	11	N
4	12	N	4	10	N	4	11	N	4	11	N
5	11	N	5	9	N	5	9	N	5	12	N
6	12	N	6	11	N	6	10	N	6	9	N
7	10	N	7	9	AS	7	11	N	7	12	N
8	12	N	8	9	N	8	10	N	8	13	N
9	10	N	9	12	N	9	10	N	9	11	N
10	10	N	10	13	N	10	11	N	10	12	N
11	11	N	11	10	N	11	10	N	11	10	N
12	-	-	12	12	N	12	10	N	12	11	N
13	-	-	13	10	N	13	11	N	13	-	-
14	-	-	14	-	-	14	9	N	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

16-0489

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	11	N	1	9	N	1	12	N	1	10	N
2	12	N	2	9	N	2	10	N	2	12	N
3	12	N	3	11	N	3	10	N	3	10	N
4	11	N	4	8	N	4	10	N	4	12	N
5	12	N	5	12	N	5	10	N	5	12	N
6	11	N	6	10	N	6	9	N	6	11	N
7	12	N	7	11	N	7	11	N	7	13	N
8	10	N	8	9	N	8	10	N	8	12	N
9	10	N	9	10	N	9	10	N	9	11	N
10	11	N	10	9	N	10	12	N	10	-	-
11	12	N	11	10	N	11	13	N	11	-	-
12	9	N	12	13	N	12	11	N	12	-	-
13	-	-	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments:

Nautilus Environmental

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491

Test Termination

For normal/abnormal column, use the following notation:
N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. **16-0490**

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	12	N	1	9	N	1	9	N	1	7	N
2	12	N	2	11	N	2	9	N	2	8	N
3	11	N	3	11	N	3	10	N	3	10	N
4	11	N	4	11	N	4	11	N	4	13	N
5	11	N	5	10	N	5	10	N	5	9	N
6	11	N	6	9	N	6	9	N	6	10	N
7	10	N	7	12	N	7	11	N	7	10	N
8	11	N	8	9	N	8	9	N	8	14	N
9	11	N	9	10	N	9	10	N	9	9	N
10	12	N	10	9	N	10	9	N	10	11	N
11	12	N	11	9	N	11	12	N	11	12	N
12	-	-	12	12	N	12	8	N	12	11	N
13	-	-	13	10	N	13	11	N	13	12	N
14	-	-	14	11	N	14	11	N	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

16-0491

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	N	1	10	N	1	7	N	1	11	N
2	10	N	2	11	N	2	8	N	2	7	N
3	9	N	3	10	N	3	8	N	3	10	N
4	8	N	4	8	N	4	8	N	4	9	N
5	11	N	5	10	N	5	10	N	5	10	N
6	9	N	6	11	N	6	10	N	6	11	N
7	12	N	7	12	N	7	11	N	7	10	N
8	9	N	8	9	N	8	11	N	8	10	N
9	11	N	9	9	N	9	10	N	9	9	N
10	10	N	10	13	N	10	9	N	10	10	N
11	10	N	11	12	N	11	10	N	11	10	N
12	10	N	12	11	N	12	12	N	12	10	N
13	12	N	13	12	N	13	9	N	13	10	N
14	-	-	14	10	N	14	10	N	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

Nautilus Environmental

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Initial Weight (mg) (dried pan)

			Date:	2016/05/17	Initials:	JW	Balance:	Mettler #1
Conc.	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491		
Replicate								
a	919.47	946.2	1007.59	935.49	939.55	939.41		
b	993.83	989.6	1000.42	935.72	1014.53	1017.47		
c	1002.9	952.16	930.26	937.72	998.55	1024.16		
d	996.23	984.55	924.3	942.42	1007.79	978.2		
e								

Final Weight (mg) (dried pan+organisms)

			Date:	2016/06/02	Initials:	BH	Balance:	Mettler #1
Conc.	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491		
Replicate								
a	947.17	968.9	1039.03	963.19	970.23	964.49		
b	1019.23	1012.63	1029.76	960.09	1045.05	1050.29		
c	1031.27	978.56	958.63	966.4	1026.48	1057.53		
d	1025.73	1011.9	961.17	973.01	1039.36	1012.25		
e								

Nautilus Environmental

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Organism weight per replicate (mg)

Dose	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491		
replicate								
a	27.7	22.7	31.44	27.7	30.68	25.08		
b	25.4	23.03	29.34	24.37	30.52	32.82		
c	28.37	26.4	28.37	28.68	27.93	33.37		
d	29.5	27.35	36.87	30.59	31.57	34.05		
e								

Dry Weight per Fish (mg)

Dose	CTL-Tap	CTL-MHRW	16-0488	16-0489	16-0490	16-0491		
replicate								
a	2.13	1.51	2.86	2.31	2.79	1.93		
b	1.81	1.64	2.26	2.03	2.18	2.34		
c	2.03	1.76	2.03	2.39	2.00	2.38		
d	2.11	1.82	3.07	3.40	2.43	2.62		
Average	2.02	1.69	2.55	2.53	2.35	2.32		

Nautilus Environmental

32 Day Fathead Minnow Data Summary

Method FMD 32 Day ELS Client NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Concentration: CTL-Tap

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	93%	93%	87%	10	2.13	8%
b	100%	93%	93%	10	1.81	0%
c	100%	93%	93%	10	2.03	0%
d	100%	93%	93%	10	2.11	0%
Average	**98%**	**93%**	**92%**	**10**	**2.02**	**2%**

Concentration: CTL-MHRW

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	100%	100%	9	1.51	0%
b	100%	93%	93%	10	1.64	0%
c	100%	100%	100%	10	1.76	0%
d	100%	100%	100%	10	1.82	0%
Average	**100%**	**98%**	**98%**	**10**	**1.69**	**0%**

Concentration: 16-0488

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	73%	73%	11	2.86	0%
b	100%	87%	87%	11	2.26	8%
c	100%	93%	93%	10	2.03	0%
d	100%	80%	80%	11	3.07	0%
Average	**100%**	**83%**	**83%**	**11**	**2.55**	**2%**

Concentration: 16-0489

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	80%	80%	11	2.31	0%
b	87%	92%	80%	10	2.03	0%
c	100%	80%	80%	11	2.39	0%
d	100%	60%	60%	11	3.40	0%
Average	**97%**	**78%**	**75%**	**11**	**2.53**	**0%**

Nautilus Environmental

32 Day Fathead Minnow Data Summary

Concentration: 16-0490

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	73%	73%	11	2.79	0%
b	100%	93%	93%	10	2.18	0%
c	100%	93%	93%	10	2.00	0%
d	100%	87%	87%	10	2.43	0%
Average	**100%**	**87%**	**87%**	**10**	**2.35**	**0%**

Concentration: 16-0491

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	93%	93%	87%	10	1.93	0%
b	100%	93%	93%	11	2.34	0%
c	100%	93%	93%	10	2.38	0%
d	100%	87%	87%	10	2.62	0%
Average	**98%**	**92%**	**90%**	**10**	**2.32**	**0%**

Nautilus Environmental

Warning Chart
Fathead minnow

Test Method: 7 days Fathead minnow Survival and Growth Test (7 treatments plus a control)
HydroQual Test Method: WTR-ME-046
Reference: Biological Test Method: Test of Larval Growth and Survival Using Fathead minnows. Environment Canada, EPS 1/RM/22, Second Edition, February 2011.

Test Organism:

test species:	*Pimephales promelas*
culture source:	Aquatox (Arkansas, USA)
temp of breeding aquaria:	23 - 26 ^{o}C
food type:	newly-hatched brine shrimp nauplii
frequency of feeding:	daily
breeding colony mortality:	<1% (last 7 days)
age of test organisms:	<24 hours
condition prior to test initiation:	normal
batch number:	20160429FM

Test Design:

test type:	static renewal
toxicant:	sodium chloride
test vessel:	polypropylene cups, 11 x 9 cm
volume of test vessel (ml):	500
test volume (ml):	250
depth of test solution:	>3 cm
replicates per treatment:	4 replicates
organisms per replicate:	10
feeding:	twice daily
temperature (^{o}C):	24-26
photoperiod:	16 hours light: 8 hours dark
light level (surface):	100-500 lux (full spectrum)

Control/Dilution Water:

source:	dechlorinated City of Calgary tap water no chemicals were added to the dilution water
pH (units):	7.2
conductance (µS/cm):	425
dissolved oxygen (mg/L):	7.0
NH_4^+ (mg/L):	<0.1
hardness (mg $CaCO_3$/L):	198
alkalinity (mg $CaCO_3$/L):	149
total residual chlorine (mg/L):	<0.01

Comments: None

The test data and results are authorized and verified correct.

Senior Verifier

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

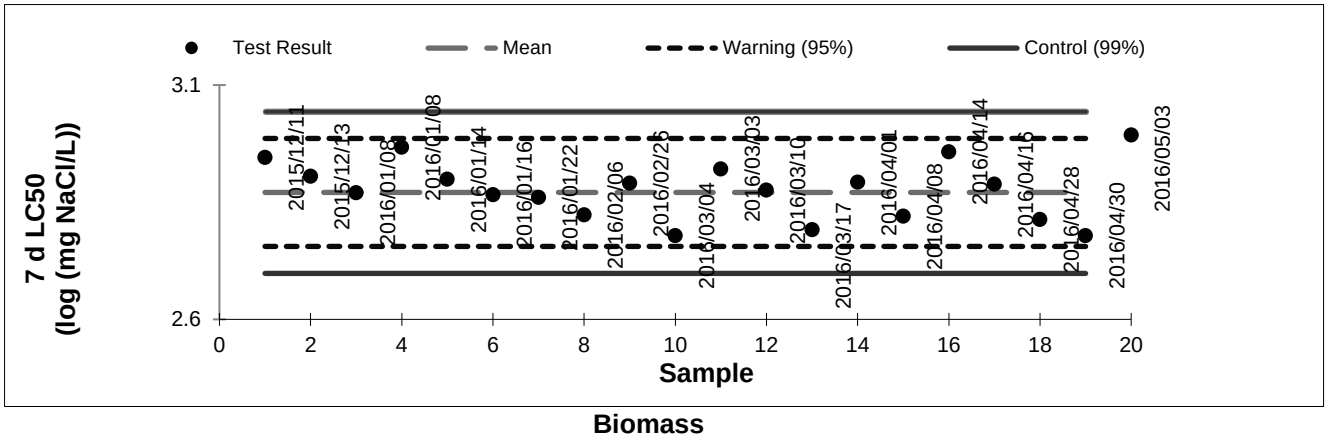
Mortality

Current Test

toxicant	Sodium Chloride (NaCl)				
started on	2016/05/03	ended on	2016/05/10		
Result (7 d LC50):	2.99	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.89	upper	3.09	

Historical Values

mean	2.87	sd	0.06	cv(%):	8.8
	lower	upper			
warning limits (±2 sd)	2.76	2.99	(95% confidence limits)		
control limits (±3 sd)	2.70	3.04	(99% confidence limits)		

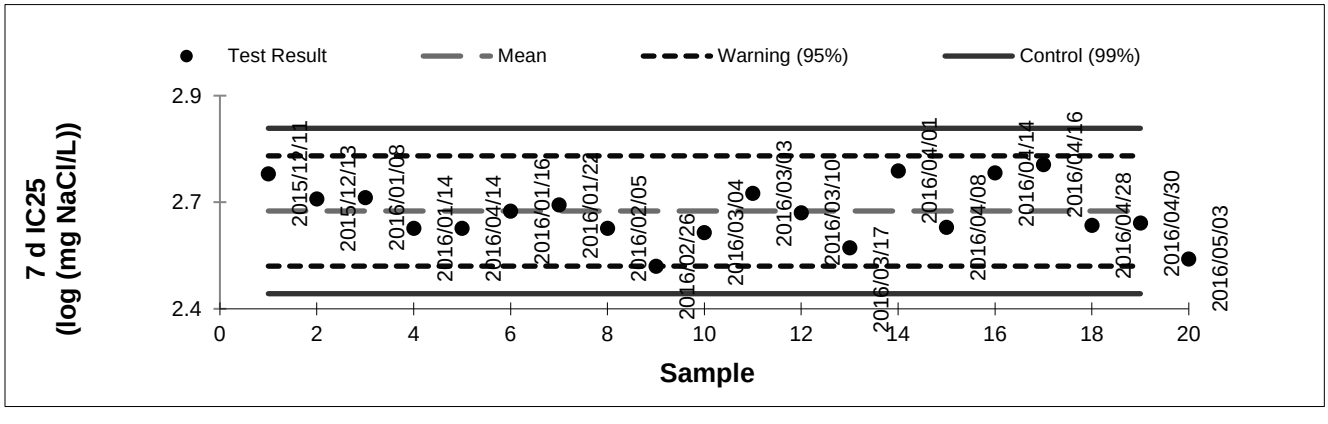


Biomass

started on	2016/05/03	ended on	2016/05/10		
Result (7 d IC25):	2.52	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.37	upper	2.61	

Historical Values

mean	2.63	sd	0.06	cv(%):	9.8
	lower	upper			
warning limits (±2 sd)	2.50	2.76	(95% confidence limits)		
control limits (±3 sd)	2.44	2.82	(99% confidence limits)		



notes: sd, standard deviation; cv, coefficient of variance; N/A, could not be calculated

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA		
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control MHW	4	1	1	1	1	1	0	0	0.0%	0.0%
Control Tap	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	1.67%
FR_UFR1	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	1.67%
FR_FRCP1	4	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	4	0.9667	0.8606	1	0.8667	1	0.03333	0.06667	6.9%	3.33%
CM_MC2	4	1	1	1	1	1	0	0	0.0%	0.0%

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control MHW	4	9.802	9.315	10.29	9.4	10.14	0.1533	0.3067	3.13%	0.0%
Control Tap	4	10.06	9.666	10.46	9.786	10.39	0.124	0.2479	2.46%	-2.63%
FR_UFR1	4	9.96	9.235	10.69	9.5	10.57	0.2279	0.4557	4.58%	-1.61%
FR_FRCP1	4	10.47	9.549	11.39	9.929	11.27	0.2891	0.5782	5.52%	-6.8%
GH_FR1	4	10.82	9.889	11.75	10.08	11.44	0.2923	0.5846	5.4%	-10.37%
CM_MC2	4	10.79	10.05	11.54	10.21	11.18	0.2342	0.4684	4.34%	-10.12%

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control MHW	4	1.658	1.409	1.907	1.513	1.823	0.07838	0.1568	9.45%	0.0%
Control Tap	4	1.849	1.666	2.033	1.693	1.967	0.05764	0.1153	6.23%	-11.55%
FR_UFR1	4	2.089	1.643	2.534	1.672	2.27	0.1399	0.2798	13.4%	-25.98%
FR_FRCP1	4	2.012	1.846	2.178	1.862	2.105	0.05221	0.1044	5.19%	-21.33%
GH_FR1	4	1.856	1.58	2.132	1.625	2.039	0.08677	0.1735	9.35%	-11.92%
CM_MC2	4	2.1	1.697	2.503	1.891	2.458	0.1266	0.2533	12.06%	-26.68%

Proportion Normal Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control MHW	4	1	1	1	1	1	0	0	0.0%	0.0%
Control Tap	4	0.9808	0.9196	1	0.9231	1	0.01923	0.03846	3.92%	1.92%
FR_UFR1	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	4	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	4	1	1	1	1	1	0	0	0.0%	0.0%
CM_MC2	4	0.9808	0.9196	1	0.9231	1	0.01923	0.03846	3.92%	1.92%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control MHW	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
Control Tap	4	0.9167	0.8636	0.9697	0.8667	0.9333	0.01667	0.03333	3.64%	6.78%
FR_UFR1	4	0.9	0.8388	0.9612	0.8667	0.9333	0.01925	0.03849	4.28%	8.48%
FR_FRCP1	4	0.8667	0.7166	1	0.7333	0.9333	0.04714	0.09428	10.88%	11.86%
GH_FR1	4	0.75	0.5909	0.9091	0.6	0.8	0.05	0.1	13.33%	23.73%
CM_MC2	4	0.8333	0.6964	0.9703	0.7333	0.9333	0.04303	0.08607	10.33%	15.25%

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1	1	1	1
Control Tap	0.9333	1	1	1
FR_UFR1	0.9333	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	0.8667	1	1
CM_MC2	1	1	1	1

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	9.4	10.14	9.8	9.867
Control Tap	10.39	9.786	10	10.07
FR_UFR1	10	10.57	9.5	9.769
FR_FRCP1	11.27	10.21	9.929	10.46
GH_FR1	11.08	10.08	10.67	11.44
CM_MC2	11.18	10.61	10.21	11.17

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1.513	1.535	1.76	1.823
Control Tap	1.847	1.693	1.891	1.967
FR_UFR1	1.672	2.188	2.225	2.27
FR_FRCP1	2.045	2.035	1.862	2.105
GH_FR1	1.847	1.625	1.912	2.039
CM_MC2	2.096	1.956	1.891	2.458

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1	1	1	1
Control Tap	0.9231	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	0.9231	1	1

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1	0.9333	1	1
Control Tap	0.8667	0.9333	0.9333	0.9333
FR_UFR1	0.8667	0.9333	0.9333	0.8667
FR_FRCP1	0.7333	0.9333	0.9333	0.8667
GH_FR1	0.8	0.8	0.8	0.6
CM_MC2	0.7333	0.8667	0.9333	0.8

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	15/15	15/15	15/15	15/15
Control Tap	14/15	15/15	15/15	15/15
FR_UFR1	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	15/15
GH_FR1	15/15	13/15	15/15	15/15
CM_MC2	15/15	15/15	15/15	15/15

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	15/15	14/14	15/15	15/15
Control Tap	12/13	14/14	14/14	14/14
FR_UFR1	13/13	14/14	14/14	13/13
FR_FRCP1	11/11	14/14	14/14	13/13
GH_FR1	12/12	12/12	12/12	9/9
CM_MC2	11/11	12/13	14/14	12/12

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	15/15	14/15	15/15	15/15
Control Tap	13/15	14/15	14/15	14/15
FR_UFR1	13/15	14/15	14/15	13/15
FR_FRCP1	11/15	14/15	14/15	13/15
GH_FR1	12/15	12/15	12/15	9/15
CM_MC2	11/15	13/15	14/15	12/15

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	17-8229-9389	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:24	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA		
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control MHW		Control Tap	0.5	1.0000	Exact	Non-Significant Effect
Control MHW		FR_UFR1	0.5	1.0000	Exact	Non-Significant Effect
Control MHW		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Control MHW		GH_FR1	0.2479	1.0000	Exact	Non-Significant Effect
Control MHW		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control MHW	Negative Contr	60	0	60	1	0	0.0%
Control Tap		59	1	60	0.9833	0.01667	1.67%
FR_UFR1		59	1	60	0.9833	0.01667	1.67%
FR_FRCP1		60	0	60	1	0	0.0%
GH_FR1		58	2	60	0.9667	0.03333	3.33%
CM_MC2		60	0	60	1	0	0.0%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1	1	1	1
Control Tap	0.9333	1	1	1
FR_UFR1	0.9333	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	0.8667	1	1
CM_MC2	1	1	1	1

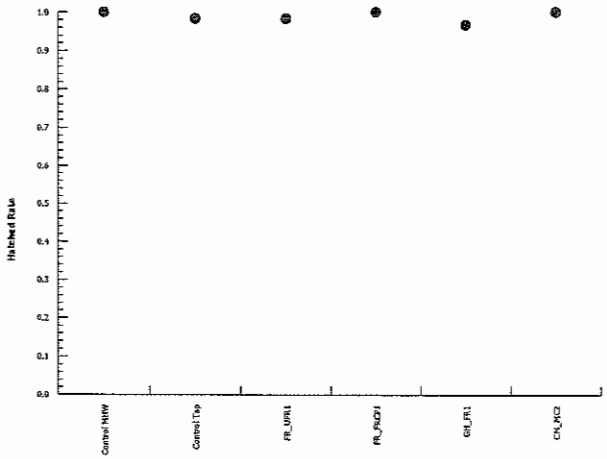
Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	17-8229-9389	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:24	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	15/15	15/15	15/15	15/15
Control Tap	14/15	15/15	15/15	15/15
FR_UFR1	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	15/15
GH_FR1	15/15	13/15	15/15	15/15
CM_MC2	15/15	15/15	15/15	15/15

Graphics



 Analyst:_____ QA: June 23/16

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-4415-1259	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:27	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	0.7521	1.0000	Exact	Non-Significant Effect
Control Tap		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Control Tap		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
Control Tap		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control Tap	Lab Water	59	1	60	0.9833	0.01667	0.0%
FR_UFR1		59	1	60	0.9833	0.01667	0.0%
FR_FRCP1		60	0	60	1	0	-1.7%
GH_FR1		58	2	60	0.9667	0.03333	1.7%
CM_MC2		60	0	60	1	0	-1.7%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	0.9333	1	1	1
FR_UFR1	0.9333	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	0.8667	1	1
CM_MC2	1	1	1	1

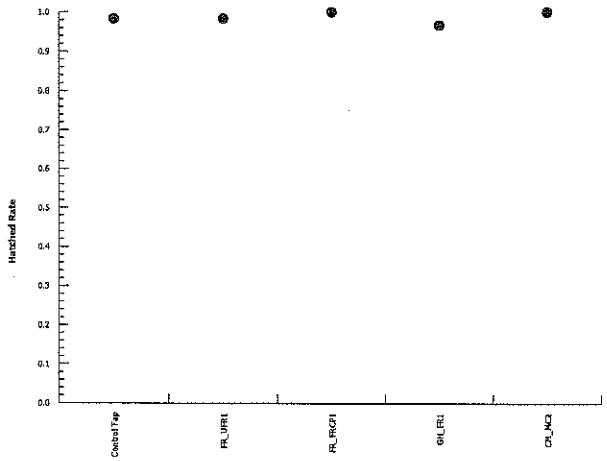
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	14/15	15/15	15/15	15/15
FR_UFR1	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	15/15
GH_FR1	15/15	13/15	15/15	15/15
CM_MC2	15/15	15/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	08-4415-1259	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:27	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGu June 23/16

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-0552-6760	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:26	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	59	1	60	0.9833	0.01667	0.0%
FR_FRCP1		60	0	60	1	0	-1.7%
GH_FR1		58	2	60	0.9667	0.03333	1.7%
CM_MC2		60	0	60	1	0	-1.7%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.9333	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	0.8667	1	1
CM_MC2	1	1	1	1

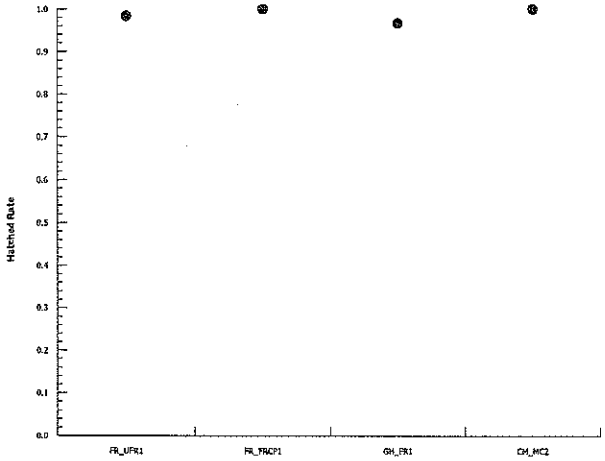
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	15/15
GH_FR1	15/15	13/15	15/15	15/15
CM_MC2	15/15	15/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	02-0552-6760	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:26	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGu June 23/16

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	05-8054-9622	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:25	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA		
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control MHW		Control Tap	0.1034	0.1034	Exact	Non-Significant Effect
Control MHW		FR_UFR1	0.05699	0.1140	Exact	Non-Significant Effect
Control MHW		FR_FRCP1	0.0161	0.0483	Exact	Significant Effect
Control MHW		GH_FR1	0.0001076	0.0005	Exact	Significant Effect
Control MHW		CM_MC2	0.004193	0.0168	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control MHW	Negative Contr	59	1	60	0.9833	0.01667	0.0%
Control Tap		55	5	60	0.9167	0.08333	6.78%
FR_UFR1		54	6	60	0.9	0.1	8.48%
FR_FRCP1		52	8	60	0.8667	0.1333	11.86%
GH_FR1		45	15	60	0.75	0.25	23.73%
CM_MC2		50	10	60	0.8333	0.1667	15.25%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1	0.9333	1	1
Control Tap	0.8667	0.9333	0.9333	0.9333
FR_UFR1	0.8667	0.9333	0.9333	0.8667
FR_FRCP1	0.7333	0.9333	0.9333	0.8667
GH_FR1	0.8	0.8	0.8	0.6
CM_MC2	0.7333	0.8667	0.9333	0.8

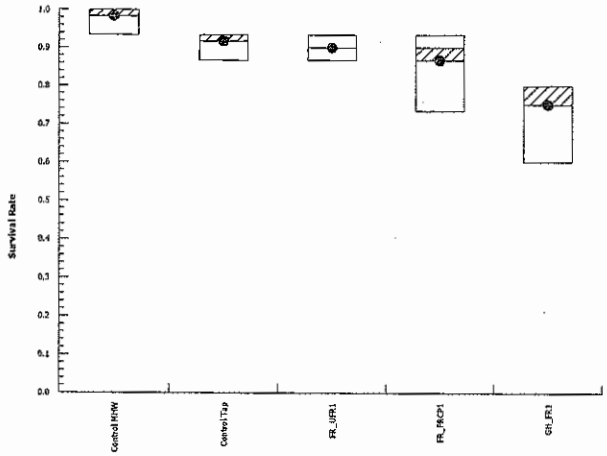
Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	05-8054-9622	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:25	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	15/15	14/15	15/15	15/15
Control Tap	13/15	14/15	14/15	14/15
FR_UFR1	13/15	14/15	14/15	13/15
FR_FRCP1	11/15	14/15	14/15	13/15
GH_FR1	12/15	12/15	12/15	9/15
CM_MC2	11/15	13/15	14/15	12/15

Graphics



Analyst:_____ QA: 20 Jun 16

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	05-9748-4976	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	0.5	0.5000	Exact	Non-Significant Effect
Control Tap		FR_FRCP1	0.2792	0.5585	Exact	Non-Significant Effect
Control Tap		GH_FR1	0.01285	0.0514	Exact	Non-Significant Effect
Control Tap		CM_MC2	0.1347	0.4040	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control Tap	Lab Water	55	5	60	0.9167	0.08333	0.0%
FR_UFR1		54	6	60	0.9	0.1	1.82%
FR_FRCP1		52	8	60	0.8667	0.1333	5.46%
GH_FR1		45	15	60	0.75	0.25	18.18%
CM_MC2		50	10	60	0.8333	0.1667	9.09%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	0.8667	0.9333	0.9333	0.9333
FR_UFR1	0.8667	0.9333	0.9333	0.8667
FR_FRCP1	0.7333	0.9333	0.9333	0.8667
GH_FR1	0.8	0.8	0.8	0.6
CM_MC2	0.7333	0.8667	0.9333	0.8

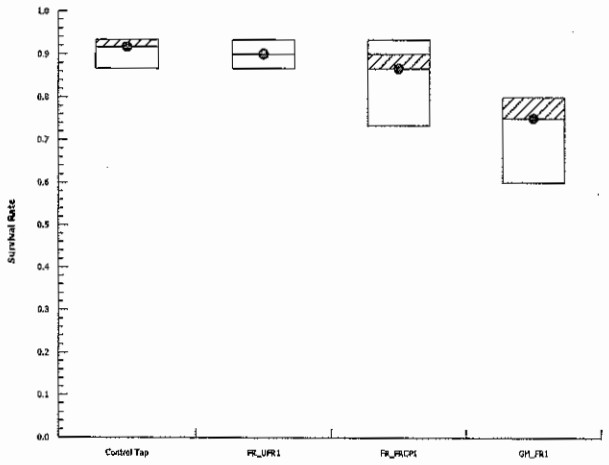
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	13/15	14/15	14/15	14/15
FR_UFR1	13/15	14/15	14/15	13/15
FR_FRCP1	11/15	14/15	14/15	13/15
GH_FR1	12/15	12/15	12/15	9/15
CM_MC2	11/15	13/15	14/15	12/15

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	05-9748-4976	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-1993-0090	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:26	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.3886	0.3886	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.02641	0.0792	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.2106	0.4213	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	54	6	60	0.9	0.1	0.0%
FR_FRCP1		52	8	60	0.8667	0.1333	3.7%
GH_FR1		45	15	60	0.75	0.25	16.67%
CM_MC2		50	10	60	0.8333	0.1667	7.41%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.8667	0.9333	0.9333	0.8667
FR_FRCP1	0.7333	0.9333	0.9333	0.8667
GH_FR1	0.8	0.8	0.8	0.6
CM_MC2	0.7333	0.8667	0.9333	0.8

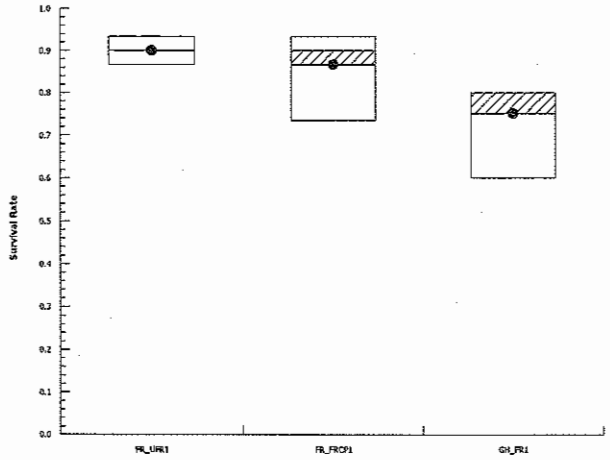
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	13/15	14/15	14/15	13/15
FR_FRCP1	11/15	14/15	14/15	13/15
GH_FR1	12/15	12/15	12/15	9/15
CM_MC2	11/15	13/15	14/15	12/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	01-1993-0090	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:26	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	18-3249-6098	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:25	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA		
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	19.7%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control MHW		Control Tap	-1.41	2.407	0.327	6	0.9946	CDF	Non-Significant Effect
		FR_UFR1	-3.171	2.407	0.327	6	1.0000	CDF	Non-Significant Effect
		FR_FRCP1	-2.604	2.407	0.327	6	0.9999	CDF	Non-Significant Effect
		GH_FR1	-1.456	2.407	0.327	6	0.9953	CDF	Non-Significant Effect
		CM_MC2	-3.257	2.407	0.327	6	1.0000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.5872138	0.1174428	5	3.184	0.0312	Significant Effect
Error	0.6639623	0.0368868	18			
Total	1.251176		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.097	15.09	0.5356	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9671	0.884	0.5974	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control MHW	4	1.658	1.409	1.907	1.648	1.513	1.823	0.07838	9.45%	0.0%
Control Tap	4	1.849	1.666	2.033	1.869	1.693	1.967	0.05764	6.23%	-11.55%
FR_UFR1	4	2.089	1.643	2.534	2.206	1.672	2.27	0.1399	13.4%	-25.98%
FR_FRCP1	4	2.012	1.846	2.178	2.04	1.862	2.105	0.05221	5.19%	-21.33%
GH_FR1	4	1.856	1.58	2.132	1.879	1.625	2.039	0.08677	9.35%	-11.92%
CM_MC2	4	2.1	1.697	2.503	2.026	1.891	2.458	0.1266	12.06%	-26.68%

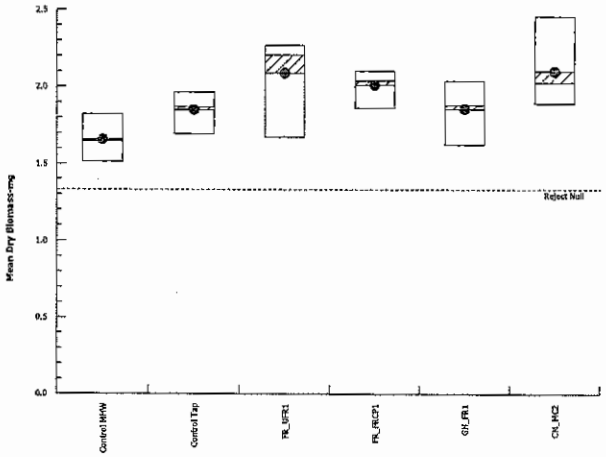
Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

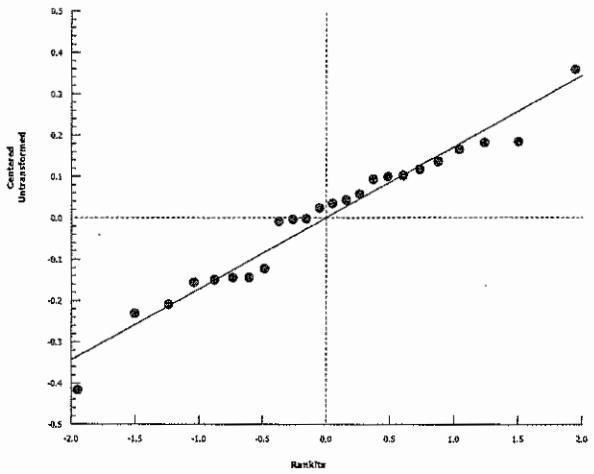
Analysis ID:	18-3249-6098	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:25	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1.513	1.535	1.76	1.823
Control Tap	1.847	1.693	1.891	1.967
FR_UFR1	1.672	2.188	2.225	2.27
FR_FRCP1	2.045	2.035	1.862	2.105
GH_FR1	1.847	1.625	1.912	2.039
CM_MC2	2.096	1.956	1.891	2.458

Graphics





Analyst:_____ QA: June 20/16

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	12-4650-6084	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:28	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	17.9%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	-1.705	2.356	0.331	6	0.9962	CDF	Non-Significant Effect
		FR_FRCP1	-1.156	2.356	0.331	6	0.9832	CDF	Non-Significant Effect
		GH_FR1	-0.04398	2.356	0.331	6	0.8139	CDF	Non-Significant Effect
		CM_MC2	-1.788	2.356	0.331	6	0.9970	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2390936	0.0597734	4	1.519	0.2467	Non-Significant Effect
Error	0.5902472	0.03934982	15			
Total	0.8293408		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	3.863	13.28	0.4248	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9654	0.866	0.6568	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control Tap	4	1.849	1.666	2.033	1.869	1.693	1.967	0.05764	6.23%	0.0%
FR_UFR1	4	2.089	1.643	2.534	2.206	1.672	2.27	0.1399	13.4%	-12.93%
FR_FRCP1	4	2.012	1.846	2.178	2.04	1.862	2.105	0.05221	5.19%	-8.77%
GH_FR1	4	1.856	1.58	2.132	1.879	1.625	2.039	0.08677	9.35%	-0.33%
CM_MC2	4	2.1	1.697	2.503	2.026	1.891	2.458	0.1266	12.06%	-13.56%

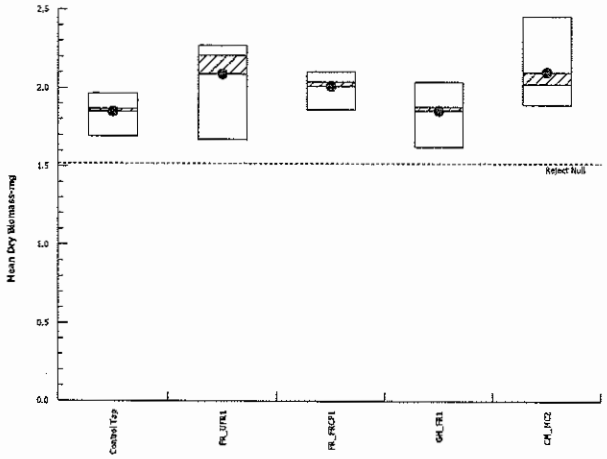
Mean Dry Biomass-mg Detail

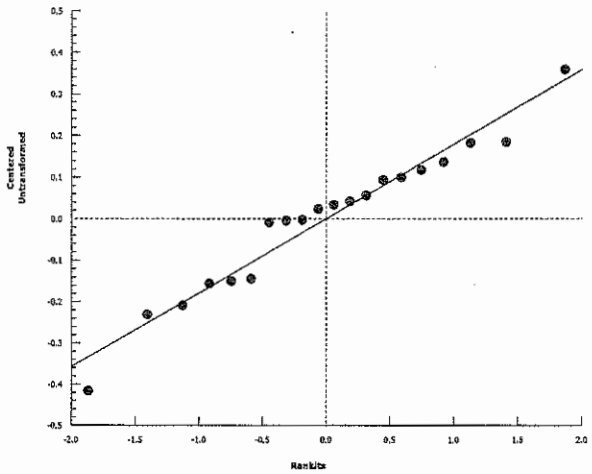
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	1.847	1.693	1.891	1.967
FR_UFR1	1.672	2.188	2.225	2.27
FR_FRCP1	2.045	2.035	1.862	2.105
GH_FR1	1.847	1.625	1.912	2.039
CM_MC2	2.096	1.956	1.891	2.458

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	12-4650-6084	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:28	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	10-7114-4433	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	16.6%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.5085	2.287	0.346	6	0.5421	CDF	Non-Significant Effect
		GH_FR1	1.539	2.287	0.346	6	0.1656	CDF	Non-Significant Effect
		CM_MC2	-0.07704	2.287	0.346	6	0.7766	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1524114	0.05080381	3	1.108	0.3841	Non-Significant Effect
Error	0.5503724	0.04586437	12			
Total	0.7027838		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	2.6	11.34	0.4575	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9709	0.8408	0.8535	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	2.089	1.643	2.534	2.206	1.672	2.27	0.1399	13.4%	0.0%
FR_FRCP1	4	2.012	1.846	2.178	2.04	1.862	2.105	0.05221	5.19%	3.69%
GH_FR1	4	1.856	1.58	2.132	1.879	1.625	2.039	0.08677	9.35%	11.16%
CM_MC2	4	2.1	1.697	2.503	2.026	1.891	2.458	0.1266	12.06%	-0.56%

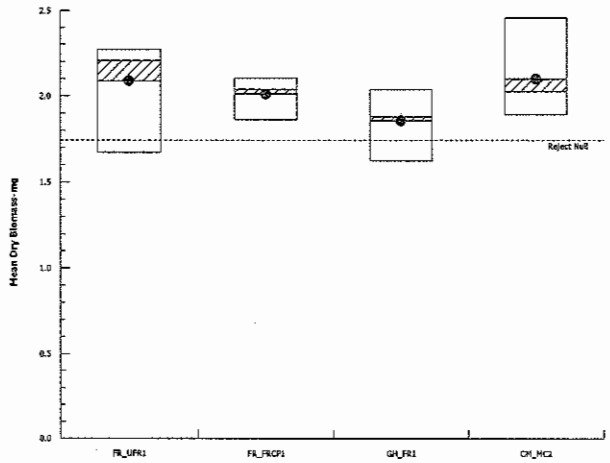
Mean Dry Biomass-mg Detail

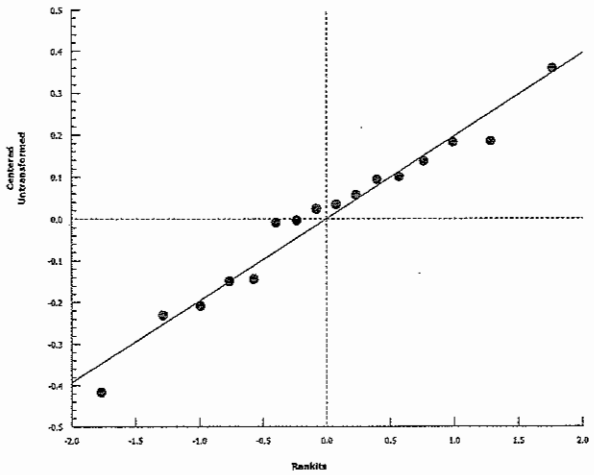
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1.672	2.188	2.225	2.27
FR_FRCP1	2.045	2.035	1.862	2.105
GH_FR1	1.847	1.625	1.912	2.039
CM_MC2	2.096	1.956	1.891	2.458

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	10-7114-4433	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-5609-7964	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:24	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA		
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.95%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control MHW		Control Tap	-0.7966	2.407	0.78	6	0.9705	CDF	Non-Significant Effect
		FR_UFR1	-0.4863	2.407	0.78	6	0.9377	CDF	Non-Significant Effect
		FR_FRCP1	-2.06	2.407	0.78	6	0.9993	CDF	Non-Significant Effect
		GH_FR1	-3.139	2.407	0.78	6	1.0000	CDF	Non-Significant Effect
		CM_MC2	-3.063	2.407	0.78	6	1.0000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3.845865	0.7691729	5	3.667	0.0183	Significant Effect
Error	3.775859	0.20977	18			
Total	7.621724		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	2.764	15.09	0.7363	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9798	0.884	0.8917	Normal Distribution

Length-mm Summary

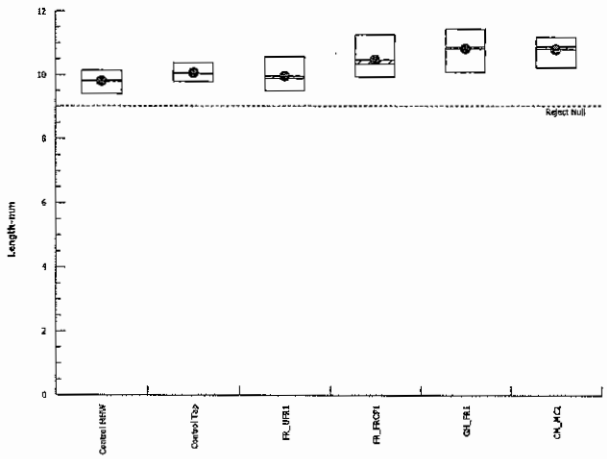
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control MHW	4	9.802	9.315	10.29	9.833	9.4	10.14	0.1533	3.13%	0.0%
Control Tap	4	10.06	9.666	10.46	10.04	9.786	10.39	0.124	2.46%	-2.63%
FR_UFR1	4	9.96	9.235	10.69	9.885	9.5	10.57	0.2279	4.58%	-1.61%
FR_FRCP1	4	10.47	9.549	11.39	10.34	9.929	11.27	0.2891	5.52%	-6.8%
GH_FR1	4	10.82	9.889	11.75	10.88	10.08	11.44	0.2923	5.4%	-10.37%
CM_MC2	4	10.79	10.05	11.54	10.89	10.21	11.18	0.2342	4.34%	-10.12%

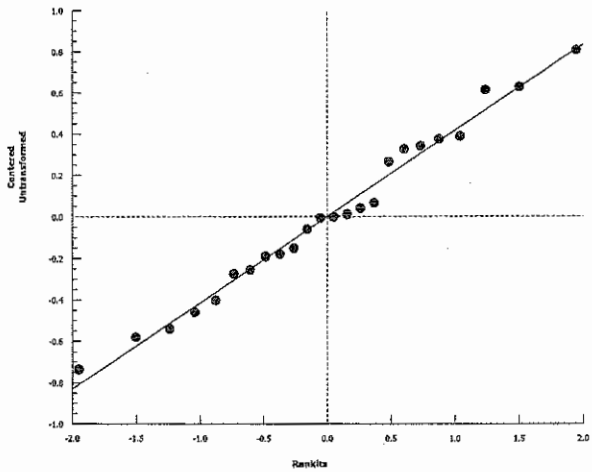
Analysis ID: 02-5609-7964 **Endpoint:** Length-mm **CETIS Version:** CETISv1.8.7
Analyzed: 10 Jun-16 16:24 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	9.4	10.14	9.8	9.867
Control Tap	10.39	9.786	10	10.07
FR_UFR1	10	10.57	9.5	9.769
FR_FRCP1	11.27	10.21	9.929	10.46
GH_FR1	11.08	10.08	10.67	11.44
CM_MC2	11.18	10.61	10.21	11.17

Graphics





CETIS Analytical Report

Test Code: 16477a | 02-6457-3210

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	07-9564-4511	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:28	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.99%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	0.2945	2.356	0.804	6	0.6919	CDF	Non-Significant Effect
		FR_FRCP1	-1.198	2.356	0.804	6	0.9849	CDF	Non-Significant Effect
		GH_FR1	-2.223	2.356	0.804	6	0.9991	CDF	Non-Significant Effect
		CM_MC2	-2.151	2.356	0.804	6	0.9989	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.571753	0.6429383	4	2.76	0.0667	Non-Significant Effect
Error	3.493746	0.2329164	15			
Total	6.065499		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	2.017	13.28	0.7327	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9728	0.866	0.8132	Normal Distribution

Length-mm Summary

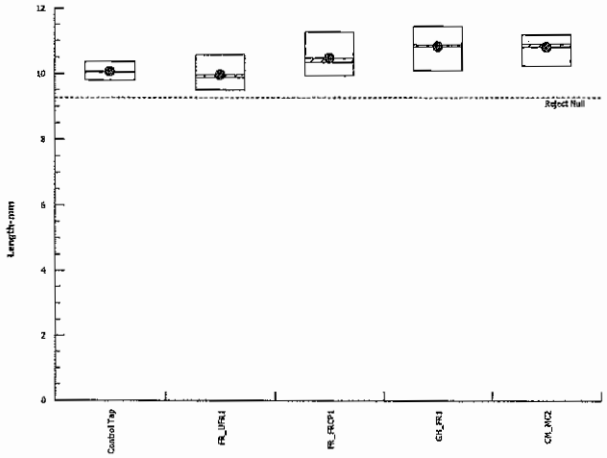
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control Tap	4	10.06	9.666	10.46	10.04	9.786	10.39	0.124	2.46%	0.0%
FR_UFR1	4	9.96	9.235	10.69	9.885	9.5	10.57	0.2279	4.58%	1.0%
FR_FRCP1	4	10.47	9.549	11.39	10.34	9.929	11.27	0.2891	5.52%	-4.07%
GH_FR1	4	10.82	9.889	11.75	10.88	10.08	11.44	0.2923	5.4%	-7.54%
CM_MC2	4	10.79	10.05	11.54	10.89	10.21	11.18	0.2342	4.34%	-7.3%

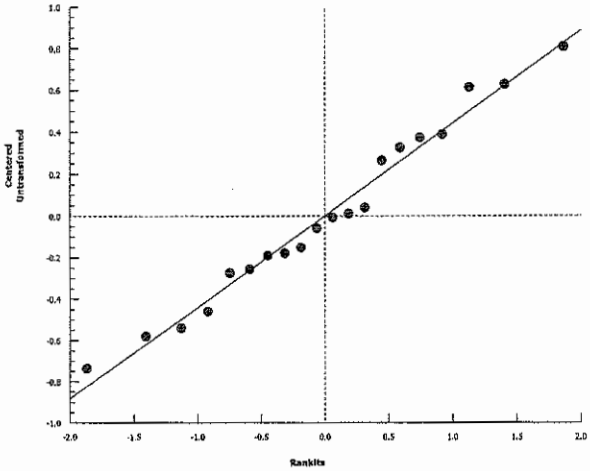
Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	10.39	9.786	10	10.07
FR_UFR1	10	10.57	9.5	9.769
FR_FRCP1	11.27	10.21	9.929	10.46
GH_FR1	11.08	10.08	10.67	11.44
CM_MC2	11.18	10.61	10.21	11.17

Analysis ID:	07-9564-4511	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:28	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	13-2241-8258	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	8.53%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	-1.372	2.287	0.849	6	0.9832	CDF	Non-Significant Effect
		GH_FR1	-2.314	2.287	0.849	6	0.9983	CDF	Non-Significant Effect
		CM_MC2	-2.247	2.287	0.849	6	0.9980	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.922854	0.6409512	3	2.324	0.1266	Non-Significant Effect
Error	3.309325	0.2757771	12			
Total	5.232179		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	0.2779	11.34	0.9641	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9596	0.8408	0.6545	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	9.96	9.235	10.69	9.885	9.5	10.57	0.2279	4.58%	0.0%
FR_FRCP1	4	10.47	9.549	11.39	10.34	9.929	11.27	0.2891	5.52%	-5.12%
GH_FR1	4	10.82	9.889	11.75	10.88	10.08	11.44	0.2923	5.4%	-8.63%
CM_MC2	4	10.79	10.05	11.54	10.89	10.21	11.18	0.2342	4.34%	-8.38%

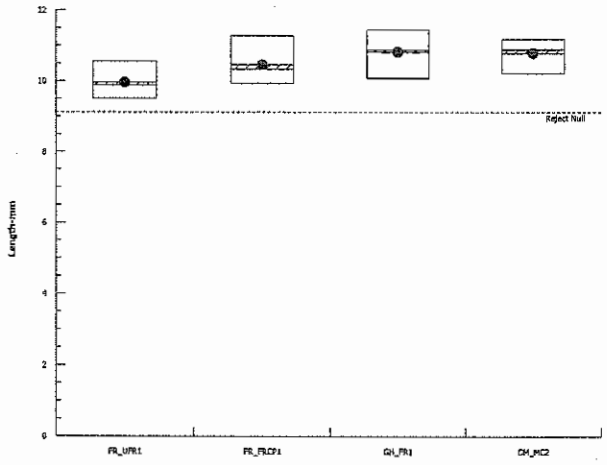
Length-mm Detail

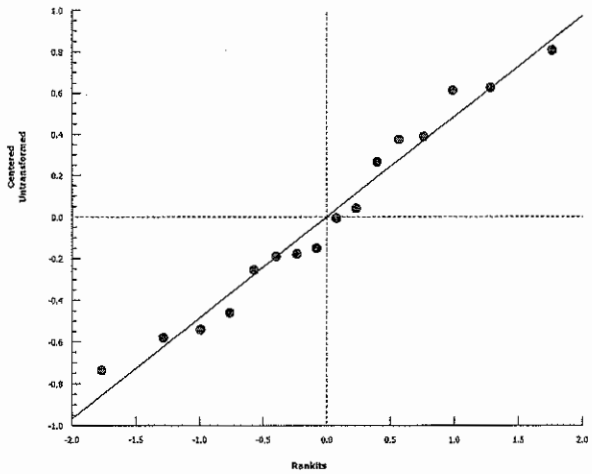
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	10	10.57	9.5	9.769
FR_FRCP1	11.27	10.21	9.929	10.46
GH_FR1	11.08	10.08	10.67	11.44
CM_MC2	11.18	10.61	10.21	11.17

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	13-2241-8258	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	12-8555-9006	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:25	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA		
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control MHW		Control Tap	0.4825	1.0000	Exact	Non-Significant Effect
Control MHW		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Control MHW		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Control MHW		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Control MHW		CM_MC2	0.4587	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control MHW	Negative Contr	59	0	59	1	0	0.0%
Control Tap		54	1	55	0.9818	0.01818	1.82%
FR_UFR1		54	0	54	1	0	0.0%
FR_FRCP1		52	0	52	1	0	0.0%
GH_FR1		45	0	45	1	0	0.0%
CM_MC2		49	1	50	0.98	0.02	2.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1	1	1	1
Control Tap	0.9231	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	0.9231	1	1

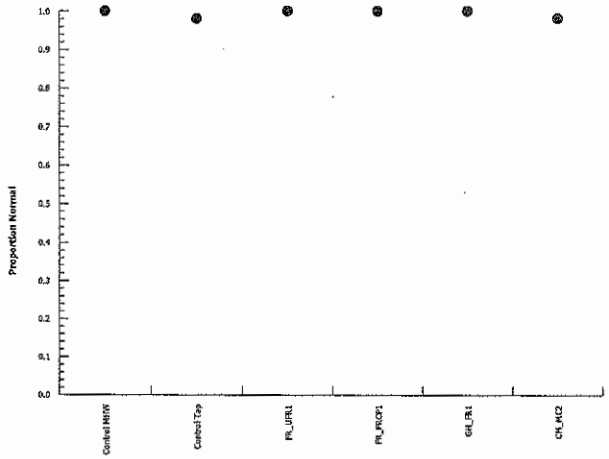
Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	12-8555-9006	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:25	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	15/15	14/14	15/15	15/15
Control Tap	12/13	14/14	14/14	14/14
FR_UFR1	13/13	14/14	14/14	13/13
FR_FRCP1	11/11	14/14	14/14	13/13
GH_FR1	12/12	12/12	12/12	9/9
CM_MC2	11/11	12/13	14/14	12/12

Graphics



Analyst:_____ QA: < 6/6 < June 20/16

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	03-9082-3636	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	06-6411-3352	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Control Tap		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Control Tap		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Control Tap		CM_MC2	0.728	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control Tap	Lab Water	54	1	55	0.9818	0.01818	0.0%
FR_UFR1		54	0	54	1	0	-1.85%
FR_FRCP1		52	0	52	1	0	-1.85%
GH_FR1		45	0	45	1	0	-1.85%
CM_MC2		49	1	50	0.98	0.02	0.19%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	0.9231	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	0.9231	1	1

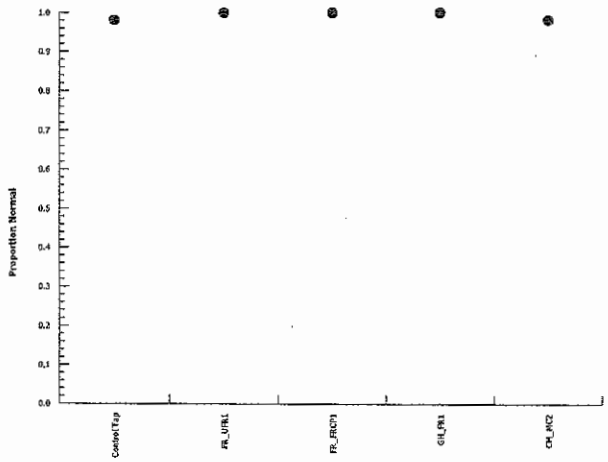
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	12/13	14/14	14/14	14/14
FR_UFR1	13/13	14/14	14/14	13/13
FR_FRCP1	11/11	14/14	14/14	13/13
GH_FR1	12/12	12/12	12/12	9/9
CM_MC2	11/11	12/13	14/14	12/12

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	03-9082-3636	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 16:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: 21/16

CETIS Analytical Report

Test Code: 16477a | 02-6457-3210

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	03-1982-7899	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.4808	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	54	0	54	1	0	0.0%
FR_FRCP1		52	0	52	1	0	0.0%
GH_FR1		45	0	45	1	0	0.0%
CM_MC2		49	1	50	0.98	0.02	2.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	0.9231	1	1

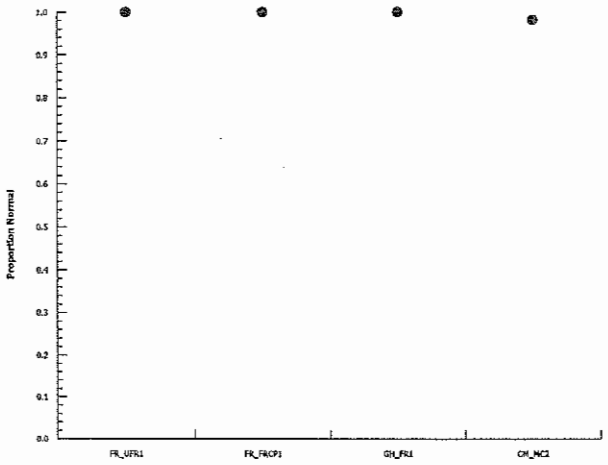
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	13/13	14/14	14/14	13/13
FR_FRCP1	11/11	14/14	14/14	13/13
GH_FR1	12/12	12/12	12/12	9/9
CM_MC2	11/11	12/13	14/14	12/12

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	03-1982-7899	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:28	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGL June 23/16

Nautilus Environmental

ATTN: Krysta Pearcy
Nautilus Environmental
8664 Commerce Court
Burnaby , BC
Canada , V5A 4N7

Received: various dates
Report Date: 2016/06/09
Version: FINAL

HydroQual Test Report

Client: NAU104
Reference: 16-0488; 16-0489; 16-0490; 16-0491
Client Reference: CM_MC2_WS
GH_FR1_WS
FR_FRCP1_Q
FR_UFR1_QR
Copper (10 ug/L) Treated Report
Billing: not given

Senior Verifier

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0488

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw Courier		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	4.8, 6, 12, 13, 10

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	CM_MC2_WS_20160427_N	CM_MC2_WS_20160504_N	CM_MC2_WS_20160511_N	CM_MC2_WS_20160518_N	CM_MC2_WS_20160525_N	**CM_MC2_WS**
collection date:	2016/04/27	2016/05/04	2016/05/11	2016/05/18	2016/05/25	
collection time:	1000	not given	not given	1040	1010	

pH:	7.7	8.0	7.8	8.1	8.0
EC (µS/cm):	515	508	593	534	514
DO (mg/L):	7.4	9.5	9.8	10.2	10.0
temp (°C):	13.3	14.9	15.7	14.6	14.4
hardness:	219	253	268	235	232
alkalinity:	164	129	145	126	132
colour:	colourless	colourless	colourless	colourless	colourless
odour:	odourless	odourless	odourless	odourless	odourless

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/04/29
ended:	2016/05/31
prelim made:	-
prelim sent:	-
reported:	2016/06/01

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0489

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw Courier		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	5.8, 8, 11.6, 12, 10

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	GH_FR1_WS_2016_04_27_N	GH_FR1_WS_2016_05_04_N	GH_FR1_WS_2016_05_11_N	GH_FR1_WS_2016_05_18_N	GH_FR1_WS_2016_05_25_N	**GH_FR1_WS**
collection date:	2016/04/27	2016/05/04	2016/05/11	2016/05/18	2016/05/25	
collection time:	1406	1155	1000	0945	0930	

pH:	8.0	8.0	7.7	8.0	7.9
EC (µS/cm):	547	591	618	660	620
DO (mg/L):	9.3	9.4	9.5	9.6	9.6
temp (°C):	11.4	15.9	16.1	15.3	15.2
hardness:	303	387	291	325	298
alkalinity:	212	116	163	164	170
colour:	colourless	colourless	colourless	colourless	colourless
odour:	odourless	odourless	odourless	odourless	odourless

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/04/29
ended:	2016/05/31
prelim made:	-
prelim sent:	-
reported:	2016/06/01

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0490

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw Courier		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	5.3, 10, 12, 16, 10

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_FRCP1_Q_04042016_N	FR_FRCP1_QR_11042016_N	FR_FRCP1_QR_11042016_N	FR_FRCP1_QR_18042016_N	FR_FRCP1_QR_02052016_N	**FR_FRCP1_Q**
collection date:	2016/04/27	2016/05/04	2016/05/11	2016/05/18	2016/05/25	
collection time:	1100	1018	1040	0850	0955	

pH:	7.9	8.0	8.1	8.0	7.9
EC (µS/cm):	514	534	627	609	564
DO (mg/L):	9.2	9.0	9.5	9.4	9.3
temp (°C):	12.1	14.9	16.2	15.6	16.6
hardness:	198	270	320	280	287
alkalinity:	198	153	169	139	156
colour:	colourless	colourless	colourless	colourless	colourless
odour:	odourless	odourless	odourless	odourless	odourless

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/04/29
ended:	2016/05/31
prelim made:	-
prelim sent:	-
reported:	2016/06/01

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.nautilusenvironmental.ca

Internal Tracking Sheet

Client:	NAU104
Reference:	16-0491

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.com

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw Courier		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	5.3, 10, 12, 16, 10

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_UFR1_Q_04 042016_N	FR_UFR1_QR _11042016_N	FR_UFR1_QR_ 11042016_N	FR_UFR1_QR _18042016_N	FR_UFR1_QR _02052016_N	**FR_UFR1_QR**
collection date:	2016/04/27	2016/05/04	2016/05/11	2016/05/18	2016/05/25	
collection time:	0930	0848	0900	1048	0847	
pH:	8.0	8.1	8.1	8.1	7.9	
EC (µS/cm):	228	244	248	282	263	
DO (mg/L):	9.3	9.8	9.4	9.8	9.4	
temp (°C):	12.2	14.6	17.1	14.9	17.1	
hardness:	109	149	117	116	124	
alkalinity:	215	116	115	112	110	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	odourless	odourless	odourless	odourless	odourless	

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/04/29
ended:	2016/05/31
prelim made:	-
prelim sent:	-
reported:	2016/06/01

Nautilus Environmental (Calgary), #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
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Nautilus Environmental

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Organism Information

Source: Aquatox Batch: 20160429FMELS Egg Stage: 15 somites Organisms Received in Good Condition: **Yes**

Test Log

Date	Day	Time	Technicians	Chem Cart Used	Fed		Feeding Rate (mL)	Sample Pre-Aeration Time (min)	Bench Sheet Review	
					AM	PM			First	Second
2016/04/29	0	1500	HS/EP/CQ/JW	2	-	-	-	30	HS	EP
2016/04/30	1	1400	HS	2	-	-	-	45	HS	EP
2016/05/01	2	1130	JN/JW	2	-	-	-	45	JN	JW
2016/05/02	3	1430	JN/JW	2	-	-	-	40	JN	JW
2016/05/03	4	1030	HS/EP	2	-	✓	1	40	EP	HS
2016/05/04	5	1130	JW/JN	2	✓	✓	1	40	JN	JW
2016/05/05	6	1130	JN/BH	2	✓	✓	1	50	JN	HS
2016/05/06	7	1130	JW/BH	2	✓	✓	1	40	JW	CQ
2016/05/07	8	1145	EP/HS	2	✓	✓	1	40	EP	HS
2016/05/08	9	1400	HS/BH	2	✓	✓	1	40	HS	BH
2016/05/09	10	1130	JN/JW/KLO	2	✓	✓	1	40	JW	JN
2016/05/10	11	1400	ML/EP	2	✓	✓	1.5	40	ML	EP
2016/05/11	12	1415	ML/EP/CB	2	✓	✓	1.5	40	EP	JP
2016/05/12	13	1030	JW/BH	2	✓	✓	1.5	40	JW	JN
2016/05/13	14	1200	CB/EP/KLO	2	✓	✓	1.5	40	HS	BH
2016/05/14	15	1140	JN	2	✓	✓	1.5	45	JN	KLO
2016/05/15	16	1220	JW/KLO	2	✓	✓	1.5	40	JW	ML
2016/05/16	17	1400	EP/CB	2	✓	✓	1.5	40	EP	JW
2016/05/17	18	1330	JN/HS	2	✓	✓	1.5	40	JN	HS
2016/05/18	19	1115	HS/CB/KLO	2	✓	✓	1.5	40	HS	EP
2016/05/19	20	1030	JW/KLO	2	✓	✓	2.0	40	JW	JN
2016/05/20	21	1335	JN/KLO	2	✓	✓	2.0	40	JN	KLO
2016/05/21	22	1000	BH/CB	2	✓	✓	2.0	40	JN	BH
2016/05/22	23	1100	JW/KLO	2	✓	✓	2.0	40	ML	JW
2016/05/23	24	1030	JN/KLO	2	✓	✓	2.0	40	JN	HS
2016/05/24	25	1115	JW/BH	2	✓	✓	2.0	40	JW	HS
2016/05/25	26	1030	JW/BH	2	✓	✓	2.0	40	JW	HS
2016/05/26	27	1015	JW/ML	2	✓	✓	2.0	40	JW	EP
2016/05/27	28	1100	KLO/BH	2	✓	✓	2.0	40	JP	HS
2016/05/28	29	1130	JN/BH	2	✓	✓	2.5	40	JN	BH
2016/05/29	30	1130	JW/ML	2	✓	✓	2.5	40	JW	ML
2016/05/30	31	1130	JW/EP	2	✓	✓	2.5	40	JW	HS
2016/05/31	32	1020	ML/JW	2	-	-	-	-	ML	JW

Nautilus Environmental

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Control hatching success must be >66% (≥10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

	CTL-Tap		16-0488		16-0489		16-0490		16-0491	
	Day 1		Day 1		Day 1		Day 1		Day 1	
replicate	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos
a	15	0	15	0	15	0	15	0	15	0
b	15	0	15	0	14	1	14	1	15	0
c	15	0	15	0	15	0	15	0	15	0
d	15	0	15	0	14	1	15	0	15	0
e	28	2	30	0	30	0	28	2	29	1
f	29	1	30	0	30	0	29	1	30	0

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

	CTL-Tap			16-0488			16-0489			16-0490		
	Day 2			Day 2			Day 2			Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	14	1	15	12	3	15	11	4	15	15	0	15
b	13	2	15	13	2	15	9	5	15	11	3	15
c	12	3	15	13	2	15	12	3	15	12	3	15
d	14	1	15	12	3	15	10	4	15	14	1	15
e	25	3		26	4		27	3		23	5	
f	26	3		25	5		28	2		26	3	

	16-0491		
	Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15
a	14	1	15
b	14	1	15
c	12	3	15
d	13	2	15
e	26	3	
f	25	5	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2

Comments/Observations:

Nautilus Environmental

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Number of Alive Embryos and Hatched Organisms

	CTL-Tap		16-0488		16-0489		16-0490		16-0491	
	Day 3		Day 3		Day 3		Day 3		Day 3	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	14	1	9	6	12	3	12	3	11	4
b	15	0	10	5	14	1	9	6	13	2
c	11	4	13	2	10	5	10	5	14	1
d	15	0	13	2	10	5	13	2	14	1

Comments/Observations:

	CTL-Tap		16-0488		16-0489		16-0490		16-0491	
	Day 4		Day 4		Day 4		Day 4		Day 4	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	1	14	1	14	2	13	1	14	2	13
b	-	15	1	14	1	14	-	15	-	15
c	-	15	1	14	1	14	-	15	1	14
d	1	14	2	13	1	14	-	14*	-	15

Comments/Observations: *organism that was dead was an embryo

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 5	Day 5	Day 5	Day 5	Day 5
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	13*	15	15
b	15	15	15	15	15
c	15	15	15	15	15
d	15	15	15	14	15

Comments/Observations: *2 organisms that were dead were embryos

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 6	Day 6	Day 6	Day 6	Day 6
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	13	15	15
b	15	15	15	15	14
c	15	15	14	15	15
d	15	15	15	14	15

Comments/Observations:

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 7	Day 7	Day 7	Day 7	Day 7
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	13	15	15
b	15	15 (1)	15	15	14
c	15	15	14	15	15
d	15	15	15	14	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 8	Day 8	Day 8	Day 8	Day 8
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	13	15	14
b	15	15	15	15	15
c	15	15	14	15	15
d	15	15	15	14	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 9	Day 9	Day 9	Day 9	Day 9
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15 (1)	15	13	15	14
b	15	15 (1)	15	15	14
c	15 (1)	15 (1)	14	14	15
d	15	15	15	14	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 10	Day 10	Day 10	Day 10	Day 10
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15 (1)	15	12	15	14
b	15	15 (1)	15	15	14
c	15 (1)	15 (1)	14	14	15
d	15	15	15	13	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 11	Day 11	Day 11	Day 11	Day 11
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15 (1)	15	12	15	14
b	15	15 (1)	15	15	14
c	15 (1)	15	14	14	15
d	15	15	15	13	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 12	Day 12	Day 12	Day 12	Day 12
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15 (1)	15	12	15	14
b	15	15 (1)	15	15	14
c	14	15	14	14	15
d	15	15	15	13	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 13	Day 13	Day 13	Day 13	Day 13
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15 (1)	15	12	15	14
b	15	15 (1)	15	15	14
c	14	15	14	14	15
d	15	15	15	13	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 14	Day 14	Day 14	Day 14	Day 14
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	12	15	14
b	15	15 (1)	15	15	14
c	14	15	14	14	15
d	15	15	15	13	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 15	Day 15	Day 15	Day 15	Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	12	15	14
b	15	15	15	15	14
c	14	15	14	14	15
d	15	15	15	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 16	Day 16	Day 16	Day 16	Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	11	15	14
b	14	15	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 17	Day 17	Day 17	Day 17	Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	11	15	14
b	14	15	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 18	Day 18	Day 18	Day 18	Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	11	15	14
b	14	15	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

Nautilus Environmental

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 19	Day 19	Day 19	Day 19	Day 19
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	11	15	14
b	14	14	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 20	Day 20	Day 20	Day 20	Day 20
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	11	15	14
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 21	Day 21	Day 21	Day 21	Day 21
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	11	15	13
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 22	Day 22	Day 22	Day 22	Day 22
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14 (1)	15	11	15	13
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 23	Day 23	Day 23	Day 23	Day 23
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	11	15	13
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 24	Day 24	Day 24	Day 24	Day 24
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	11	15	13*
b	14	13	15	15	14
c	14	15*	14	14	15
d	15	15	14	13	15

Comments/Observations: *in both 16-0488C and 16-0491A, one organism was smaller than rest

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 25	Day 25	Day 25	Day 25	Day 25
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	11	15	12
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 26	Day 26	Day 26	Day 26	Day 26
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	15	11	15	12
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	15	11	15	12
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	15	11	15	12
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	15	11	15	12
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	15	11	15	12
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Number of Alive Embryos and Hatched Organisms

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 31	Day 31	Day 31	Day 31	Day 31
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	15	11	14	12
b	14	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations:

	CTL-Tap	16-0488	16-0489	16-0490	16-0491
	Day 32	Day 32	Day 32	Day 32	Day 32
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	15	11	14	12
b	13*	13	15	15	14
c	14	15	14	14	15
d	15	15	14	13	15

Comments/Observations: *dead organism was quite small in CTL-Tap replicate B, overall the organisms in CTL-tap rep B were smaller than those organisms in the other replicates within the concentration

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

	New Solutions								Old Solutions							
Conc. (%)	CTL-Tap	16-0488	16-0489	16-0490	16-0491	-	-		CTL-Tap	16-0488	16-0489	16-0490	16-0491	-	-
Day															
	pH (units)								pH (units)						
0	8.4	8.2	8.2	8.2	8.0			0							
1	8.4	8.4	8.4	8.3	8.2			1	8.3	8.3	8.3	8.3	8.3		
2	8.0	8.3	8.2	8.2	8.1			2	8.0	8.1	8.1	8.1	8.0		
3	8.2	8.2	8.2	8.1	8.1			3	8.2	8.3	8.3	8.2	8.2		
4	8.1	8.2	8.1	8.1	8.1			4	8.2	8.1	8.2	8.2	8.1		
5	8.1	8.2	8.2	8.2	8.2			5	8.0	8.2	8.2	8.1	8.0		
6	8.1	8.2	8.2	8.1	8.2			6	7.8	7.9	8.0	8.1	7.9		
7	8.2	8.3	8.2	8.2	8.2			7	7.8	8.1	8.2	8.1	7.9		
8	8.1	8.2	8.1	8.0	8.0			8	7.8	8.1	8.1	8.0	7.8		
	Conductance (µS/cm)								Conductance (µS/cm)						
0	366	521	548	524	235			0							
1	359	527	552	512	239			1	379	526	554	530	260		
2	347	529	554	537	241			2	357	501	524	512	239		
3	355	573	558	539	236			3	361	528	543	538	245		
4	345	528	553	534	242			4	363	538	559	527	251		
5	355	540	562	534	240			5	343	514	549	530	245		
6	340	535	561	542	246			6	356	536	553	530	245		
7	329	506	585	527	251			7	337	533	566	519	238		
8	317	498	581	529	253			8	386	527	573	532	265		
	Dissolved Oxygen (mg/L) (**60-100% saturation**)								Dissolved Oxygen (mg/L) (**60-100% saturation**)						
0	7.2	7.2	7.2	7.2	7.1			0							
1	7.3	7.3	7.3	7.3	7.3			1	7.3	7.2	7.3	7.1	7.2		
2	7.2	7.2	7.2	7.2	7.2			2	7.1	7.1	7.1	7.1	7.1		
3	7.2	7.1	7.1	7.1	7.1			3	7.3	7.1	7.2	7.3	7.3		
4	7.2	7.1	7.2	7.2	7.2			4	7.0	6.9	7.0	7.0	7.2		
5	7.3	7.2	7.2	7.1	7.1			5	7.1	7.1	7.0	7.1	7.0		
6	7.3	7.2	7.2	7.2	7.2			6	6.0	6.0	6.0	6.4	6.3		
7	7.3	7.2	7.1	7.2	7.3			7	5.4	5.6	6.0	6.6	6.7		
8	7.1	7.2	7.3	7.2	7.2			8	5.6	6.0	5.9	5.5	5.5		
	Temperature (°C)								Temperature (°C)						
0	25	24	25	25	25			0							
1	24	24	24	24	24			1	24	24	24	24	24		
2	25	25	25	25	25			2	24	24	24	24	24		
3	25	26	26	26	26			3	24	24	24	24	24		
4	25	25	25	25	25			4	24	24	24	24	24		
5	24	25	25	26	26			5	24	24	24	24	24		
6	24	25	25	25	25			6	24	24	24	24	24		
7	24	25	26	25	24			7	24	24	24	24	24		
8	24	25	24	25	25			8	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C

4.5 to 7.2 mg/L at 25°C

4.3 to 7.1 mg/L at 26°C

Comments:

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

New Solutions

Conc. (%)	CTL-Tap	16-0488	16-0489	16-0490	16-0491	-	-
Day							
	pH (units)						
9	8.1	8.3	8.3	8.3	8.3		
10	8.1	8.2	8.1	8.2	8.1		
11	8.1	8.3	8.2	8.2	8.1		
12	8.1	8.2	8.2	8.1	8.1		
13	7.9	8.1	8.1	8.1	8.0		
14	8.2	8.3	8.3	8.2	8.2		
15	8.2	8.3	8.1	8.2	8.2		
16	8.1	8.3	8.3	8.2	8.3		
17	8.2	8.3	8.1	8.2	8.1		
	Conductance (µS/cm)						
9	319	508	585	527	249		
10	318	505	586	530	251		
11	319	503	588	529	253		
12	344	539	625	565	267		
13	347	532	606	552	260		
14	343	599	618	732	269		
15	346	599	621	634	267		
16	348	598	616	632	278		
17	349	596	615	635	270		
	Dissolved Oxygen (mg/L) (**60-100% saturation**)						
9	7.3	7.2	7.2	7.2	7.2		
10	7.3	7.1	7.3	7.1	7.2		
11	7.3	7.2	7.3	7.2	7.3		
12	7.2	7.2	7.2	7.2	7.2		
13	7.3	7.3	7.2	7.3	7.2		
14	7.3	7.3	7.3	7.3	7.2		
15	7.2	7.2	7.2	7.2	7.2		
16	7.3	7.1	7.1	7.1	7.1		
17	7.3	7.2	7.3	7.3	7.3		
	Temperature (°C)						
9	24	25	25	25	25		
10	24	26	24	26	25		
11	24	25	24	25	24		
12	25	25	25	25	25		
13	24	24	25	24	25		
14	24	24	24	24	25		
15	24	25	25	25	25		
16	24	26	26	26	26		
17	24	25	24	24	24		

Old Solutions

	CTL-Tap	16-0488	16-0489	16-0490	16-0491	-	-
	pH (units)						
9	7.9	8.1	8.1	8.1	7.9		
10	7.6	8.0	8.0	8.2	7.9		
11	7.7	8.0	8.1	8.1	7.9		
12	7.7	8.0	8.0	8.0	7.8		
13	7.6	7.8	8.0	7.9	7.7		
14	7.7	8.1	8.2	8.1	8.0		
15	7.7	8.0	8.1	8.2	8.1		
16	7.5	8.0	8.0	8.1	7.8		
17	7.5	7.9	7.9	8.0	7.8		
	Conductance (µS/cm)						
9	335	523	585	524	263		
10	319	503	585	511	248		
11	321	509	592	531	255		
12	344	548	627	568	276		
13	334	552	629	562	282		
14	351	554	632	573	274		
15	342	587	614	606	272		
16	355	599	631	616	274		
17	357	612	627	643	278		
	Dissolved Oxygen (mg/L) (**60-100% saturation**)						
9	5.9	6.2	6.0	6.0	6.1		
10	5.8	5.8	5.8	6.0	6.1		
11	6.2	5.6	5.6	6.2	6.3		
12	5.8	5.8	5.8	6.0	5.9		
13	5.6	6.1	6.0	5.8	5.7		
14	6.6	6.5	6.5	6.5	6.5		
15	5.7	5.8	5.8	5.9	6.0		
16	4.5	5.2	5.1	5.4	5.2		
17	5.2	5.4	4.9	5.3	5.4		
	Temperature (°C)						
9	24	24	24	24	24		
10	24	24	24	24	24		
11	24	24	24	24	24		
12	24	24	24	24	24		
13	24	24	24	24	24		
14	24	24	24	24	24		
15	26	26	26	25	25		
16	24	24	24	24	24		
17	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

	New Solutions								Old Solutions						
Conc. (%)	CTL-Tap	16-0488	16-0489	16-0490	16-0491	-	-		CTL-Tap	16-0488	16-0489	16-0490	16-0491	-	-
Day															
	pH (units)								pH (units)						
18	7.9	8.1	7.9	7.9	7.9			18	7.4	7.9	7.9	7.9	7.7		
19	8.0	8.1	8.0	8.0	8.0			19	7.4	7.9	7.9	7.8	7.7		
20	8.1	8.3	8.1	8.1	8.1			20	7.6	8.0	8.1	8.1	7.9		
21	7.9	8.0	7.9	8.0	7.9			21	7.1	7.6	7.7	7.6	7.5		
22	7.9	8.2	8.1	8.2	8.1			22	7.2	7.5	7.6	7.7	7.4		
23	8.1	8.2	8.1	8.2	8.1			23	8.1	7.8	8.2	8.2	8.1		
24	8.0	8.2	8.2	8.2	8.1			24	8.0	8.1	8.2	8.3	8.0		
25	8.0	8.2	8.2	8.2	8.2			25	8.1	8.1	8.3	8.2	8.0		
26	8.1	8.3	8.2	8.2	8.1			26	8.1	8.2	8.3	8.3	8.2		
	Conductance (µS/cm)								Conductance (µS/cm)						
18	348	599	622	637	270			18	349	610	626	619	279		
19	342	595	615	634	269			19	330	608	626	617	281		
20	333	596	616	631	268			20	341	590	620	645	259		
21	339	563	670	622	293			21	341	592	603	618	273		
22	342	554	666	621	290			22	347	581	654	646	298		
23	346	553	670	622	292			23	339	582	656	606	299		
24	358	551	664	620	291			24	352	559	663	612	286		
25	356	551	664	617	289			25	350	578	678	601	300		
26	340	527	636	630	278			26	332	546	635	590	286		
	Dissolved Oxygen (mg/L) (**60-100% saturation**)								Dissolved Oxygen (mg/L) (**60-100% saturation**)						
18	7.2	7.1	7.2	7.2	7.1			18	5.3	5.9	6.0	6.1	5.8		
19	7.1	7.1	7.1	7.2	7.1			19	5.4	5.7	5.5	5.5	5.6		
20	7.2	7.1	7.2	7.1	7.1			20	5.4	5.6	5.8	5.8	6.0		
21	7.2	7.1	7.2	7.1	7.2			21	5.3	5.0	5.2	5.4	5.4		
22	7.1	7.1	7.1	7.1	7.1			22	5.0	4.4	4.4	4.4	4.8		
23	7.3	7.1	7.1	7.1	7.1			23	7.2	4.8	6.9	6.9	7.0		
24	7.2	7.2	7.1	7.1	7.1			24	7.2	7.0	6.6	6.9	7.1		
25	7.2	7.1	7.1	7.1	7.1			25	7.2	7.0	7.0	6.7	7.0		
26	7.2	7.1	7.1	7.1	7.1			26	7.0	6.4	6.8	6.8	6.8		
	Temperature (°C)								Temperature (°C)						
18	25	25	25	25	25			18	24	24	24	24	24		
19	25	26	26	25	26			19	24	24	24	24	24		
20	25	26	25	26	26			20	24	24	24	24	24		
21	25	26	25	26	25			21	24	24	24	24	24		
22	25	25	26	25	25			22	24	24	24	24	24		
23	24	25	26	26	26			23	24	24	24	24	24		
24	25	25	26	26	26			24	24	24	24	24	24		
25	25	26	26	26	26			25	24	24	24	24	24		
26	25	26	26	26	26			26	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments: On day 22, all test vessels were put on aeration

Nautilus Environmental

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

New Solutions

Conc. (%)	CTL-Tap	16-0488	16-0489	16-0490	16-0491	-	-
Day							
pH (units)							
27	7.9	8.3	8.2	8.2	8.2		
28	8.1	8.2	8.2	8.3	8.2		
29	8.2	8.3	8.2	8.2	8.2		
30	8.0	8.0	8.0	8.0	8.0		
31	8.1	8.2	8.2	8.2	8.1		
32							
Conductance (µS/cm)							
27	320	536	634	588	277		
28	332	509	635	571	272		
29	337	511	637	563	264		
30	341	512	635	573	268		
31	332	511	635	572	267		
32							
Dissolved Oxygen (mg/L) (60-100% saturation)							
27	7.3	7.2	7.2	7.1	7.1		
28	7.1	7.1	7.1	7.1	7.1		
29	7.2	7.1	7.2	7.2	7.2		
30	7.2	7.1	7.1	7.1	7.1		
31	7.3	7.2	7.2	7.2	7.1		
32							
Temperature (°C)							
27	24	25	25	26	26		
28	25	25	26	26	26		
29	25	25	25	25	25		
30	24	26	26	26	26		
31	24	25	26	25	26		
32							

Old Solutions

	CTL-Tap	16-0488	16-0489	16-0490	16-0491	-	-
pH (units)							
27	8.0	8.2	8.2	8.2	8.1		
28	8.0	8.1	8.3	8.0	7.9		
29	8.0	8.0	8.3	7.9	8.1		
30	7.8	8.1	8.0	7.6	7.9		
31	7.7	8.1	8.0	7.8	8.0		
32	8.1	8.3	8.1	8.3	8.2		
Conductance (µS/cm)							
27	335	541	618	590	288		
28	348	530	647	599	290		
29	343	519	642	592	264		
30	346	533	638	595	283		
31	336	533	641	566	280		
32	346	560	639	580	280		
Dissolved Oxygen (mg/L) (60-100% saturation)							
27	7.2	6.9	6.9	6.9	7.2		
28	7.0	6.9	6.4	5.0	6.7		
29	7.1	7.0	6.6	5.0	7.2		
30	6.9	6.6	6.5	6.9	6.9		
31	6.0	6.2	5.3	6.0	6.7		
32	7.3	7.3	7.3	7.3	7.3		
Temperature (°C)							
27	24	24	24	24	24		
28	25	25	25	25	25		
29	25	25	25	25	25		
30	24	24	24	24	24		
31	24	24	24	24	24		
32	24	24	24	24	24		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

CTL-Tap

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	12	N	1	7	N	1	10	N	1	10	N
2	11	N	2	9	N	2	12	N	2	10	N
3	11	N	3	8	N	3	11	N	3	10	N
4	12	N	4	9	N	4	10	N	4	10	N
5	10	N	5	10	N	5	11	N	5	8	N
6	10	N	6	10	N	6	10	N	6	9	N
7	9	N	7	9	N	7	9	N	7	10	N
8	9	N	8	11	N	8	11	N	8	9	N
9	8	N	9	7	N	9	11	N	9	10	N
10	7	N	10	10	N	10	10	N	10	11	N
11	9	N	11	9	N	11	10	N	11	9	N
12	9	N	12	8	N	12	11	N	12	9	N
13	-	-	13	8	N	13	11	N	13	10	N
14	-	-	14	-	-	14	10	N	14	10	N
15	-	-	15	-	-	15	-	-	15	11	N

Comments

16-0488

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	8	N	1	12	N	1	10	N	1	9	N
2	9	N	2	9	N	2	10	N	2	9	N
3	10	N	3	7	N	3	10	N	3	9	N
4	11	N	4	9	N	4	9	N	4	9	N
5	10	N	5	8	N	5	9	N	5	9	N
6	7	N	6	10	N	6	9	N	6	11	N
7	11	N	7	11	N	7	10	N	7	6	N
8	9	N	8	12	N	8	11	N	8	10	N
9	10	N	9	7	N	9	11	N	9	10	N
10	7	N	10	10	N	10	9	N	10	8	N
11	12	N	11	9	N	11	10	N	11	9	N
12	7	N	12	9	N	12	10	N	12	9	N
13	10	N	13	11	N	13	9	N	13	11	N
14	9	N	14	-	-	14	9	N	14	10	N
15	9	N	15	-	-	15	9	N	15	10	N

Comments:

Nautilus Environmental

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Test Termination

For normal/abnormal column, use the following notation:
N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

16-0489

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	11	N	1	7	N	1	9	N	1	11	N
2	12	N	2	7	N	2	10	N	2	12	N
3	10	N	3	8	N	3	9	N	3	10	N
4	9	N	4	9	N	4	10	N	4	9	N
5	8	N	5	8	N	5	11	N	5	8	N
6	8	N	6	9	N	6	10	N	6	8	N
7	10	N	7	10	N	7	12	N	7	8	N
8	10	N	8	9	N	8	10	N	8	9	N
9	10	N	9	10	N	9	10	N	9	11	N
10	10	N	10	9	N	10	10	N	10	11	N
11	10	N	11	9	N	11	9	N	11	10	N
12	-	-	12	9	N	12	9	N	12	9	N
13	-	-	13	9	N	13	10	N	13	10	N
14	-	-	14	10	N	14	10	N	14	10	N
15	-	-	15	9	N	15	-	-	15	-	-

Comments

16-0490

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	10	N	1	9	N	1	8	N	1	11	N
2	10	N	2	8	N	2	10	N	2	10	N
3	9	N	3	10	N	3	11	N	3	9	N
4	8	N	4	10	N	4	10	N	4	9	N
5	8	N	5	8	N	5	9	N	5	9	N
6	9	N	6	7	N	6	11	N	6	9	N
7	9	N	7	8	N	7	8	N	7	10	N
8	9	N	8	7	N	8	10	N	8	11	N
9	9	N	9	11	N	9	9	N	9	9	N
10	10	N	10	9	N	10	10	N	10	10	N
11	9	N	11	9	N	11	8	N	11	10	N
12	9	N	12	8	N	12	9	N	12	9	N
13	8	N	13	11	N	13	11	N	13	10	N
14	9	N	14	10	N	14	11	N	14	-	-
15	-	-	15	10	N	15	-	-	15	-	-

Comments:

Nautilus Environmental

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-0488, 16-0489, 16-0490, 16-0491 Cu

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. **16-0491**

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	N	1	11	N	1	9	N	1	9	N
2	9	N	2	6	AS	2	9	N	2	9	N
3	8	N	3	9	N	3	10	N	3	8	N
4	11	N	4	9	N	4	8	N	4	9	N
5	9	N	5	8	N	5	11	N	5	9	N
6	9	N	6	9	N	6	8	N	6	11	N
7	10	N	7	9	N	7	10	N	7	10	N
8	10	N	8	9	N	8	9	N	8	10	N
9	9	N	9	10	N	9	9	N	9	7	N
10	9	N	10	9	N	10	11	N	10	9	N
11	9	N	11	8	N	11	11	N	11	10	N
12	9	N	12	9	N	12	7	N	12	11	N
13	-	-	13	11	N	13	9	N	13	10	N
14	-	-	14	7	N	14	9	N	14	10	N
15	-	-	15	-	-	15	9	N	15	10	N

Comments

Nautilus Environmental

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491 Cu

Initial Weight (mg) (dried pan)

Date: 2016/05/17 Initials: JW Balance: Mettler #1

Conc.	CTL-Tap	16-0488	16-0489	16-0490	16-0491			
Replicate								
a	1014.60	1001.07	1012.63	1017.44	1021.61			
b	1011.50	1003.73	1020.31	1023.92	1020.91			
c	984.61	1011.89	1008.87	1023.44	996.25			
d	1003.62	932.04	1027.38	1035.20	954.88			
e								

Final Weight (mg) (dried pan+organisms)

Date: 2016/06/02 Initials: BH Balance: Mettler #1

Conc.	CTL-Tap	16-0488	16-0489	16-0490	16-0491			
Replicate								
a	1045.05	1032.02	1041.56	1041.13	1051.32			
b	1038.72	1039.09	1045.76	1052.23	1049.89			
c	1024.94	1044.90	1040.97	1053.99	1028.91			
d	1037.69	963.48	1062.89	1066.94	988.34			
e								

Nautilus Environmental

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491 Cu

Organism weight per replicate (mg)

Dose	CTL-Tap	16-0488	16-0489	16-0490	16-0491			
replicate								
a	30.45	30.95	28.93	23.69	29.71			
b	27.22	35.36	25.45	28.31	28.98			
c	40.33	33.01	32.10	30.55	32.66			
d	34.07	31.44	35.51	31.74	33.46			
e								

Dry Weight per Fish (mg)

Dose	CTL-Tap	16-0488	16-0489	16-0490	16-0491			
replicate								
a	2.54	2.06	2.63	1.69	2.48			
b	2.09	2.72	1.70	1.89	2.07			
c	2.88	2.20	2.29	2.18	2.18			
d	2.27	2.10	2.54	2.44	2.23			
Average	2.45	2.27	2.29	2.05	2.24			

Nautilus Environmental

32 Day Fathead Minnow Data Summary

Method FMD 32 Day ELS Client NAU104 Reference: 16-0488, 16-0489, 16-0490, 16-0491

Concentration: CTL-Tap

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	80%	80%	10	2.54	0%
b	100%	87%	87%	9	2.09	0%
c	100%	93%	93%	11	2.88	0%
d	100%	100%	100%	10	2.27	0%
Average	**100%**	**90%**	**90%**	**10**	**2.45**	**0%**

Concentration: 16-0488

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	100%	100%	9	2.06	0%
b	100%	87%	87%	10	2.72	0%
c	100%	100%	100%	10	2.20	0%
d	100%	100%	100%	9	2.10	0%
Average	**100%**	**97%**	**97%**	**9**	**2.27**	**0%**

Concentration: 16-0489

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	87%	85%	73%	10	2.63	0%
b	100%	100%	100%	9	1.70	0%
c	100%	93%	93%	10	2.29	0%
d	100%	93%	93%	10	2.54	0%
Average	**97%**	**93%**	**90%**	**10**	**2.29**	**0%**

Concentration: 16-0490

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	93%	93%	9	1.69	0%
b	100%	100%	100%	9	1.89	0%
c	100%	93%	93%	10	2.18	0%
d	93%	93%	87%	10	2.44	0%
Average	**98%**	**95%**	**93%**	**9**	**2.05**	**0%**

32 Day Fathead Minnow Data Summary

Concentration: 16-0491

replicate	Hatching Success	Post Hatch Survival	Cumulative Survival	Average Length (mm)	Dry Weight per fish (mg)	Incidence of Deformities
a	100%	80%	80%	9	2.48	0%
b	100%	93%	93%	9	2.07	7%
c	100%	100%	100%	9	2.18	0%
d	100%	100%	100%	9	2.23	0%
Average	**100%**	**93%**	**93%**	**9**	**2.24**	**2%**

Nautilus Environmental

Warning Chart
Fathead minnow

Test Method: 7 days Fathead minnow Survival and Growth Test (7 treatments plus a control)
HydroQual Test Method: WTR-ME-046
Reference: Biological Test Method: Test of Larval Growth and Survival Using Fathead minnows. Environment Canada, EPS 1/RM/22, Second Edition, February 2011.

Test Organism:

test species:	*Pimephales promelas*
culture source:	Aquatox (Arkansas, USA)
temp of breeding aquaria:	23 - 26 ^{o}C
food type:	newly-hatched brine shrimp nauplii
frequency of feeding:	daily
breeding colony mortality:	<1% (last 7 days)
age of test organisms:	<24 hours
condition prior to test initiation:	normal
batch number:	20160429FM

Test Design:

test type:	static renewal
toxicant:	sodium chloride
test vessel:	polypropylene cups, 11 x 9 cm
volume of test vessel (ml):	500
test volume (ml):	250
depth of test solution:	>3 cm
replicates per treatment:	4 replicates
organisms per replicate:	10
feeding:	twice daily
temperature (^{o}C):	24-26
photoperiod:	16 hours light: 8 hours dark
light level (surface):	100-500 lux (full spectrum)

Control/Dilution Water:

source:	dechlorinated City of Calgary tap water no chemicals were added to the dilution water
pH (units):	7.2
conductance (µS/cm):	425
dissolved oxygen (mg/L):	7.0
NH_4^+ (mg/L):	<0.1
hardness (mg $CaCO_3$/L):	198
alkalinity (mg $CaCO_3$/L):	149
total residual chlorine (mg/L):	<0.01

Comments: None

The test data and results are authorized and verified correct.

Senior Verifier

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

Warning Chart
Fathead minnow

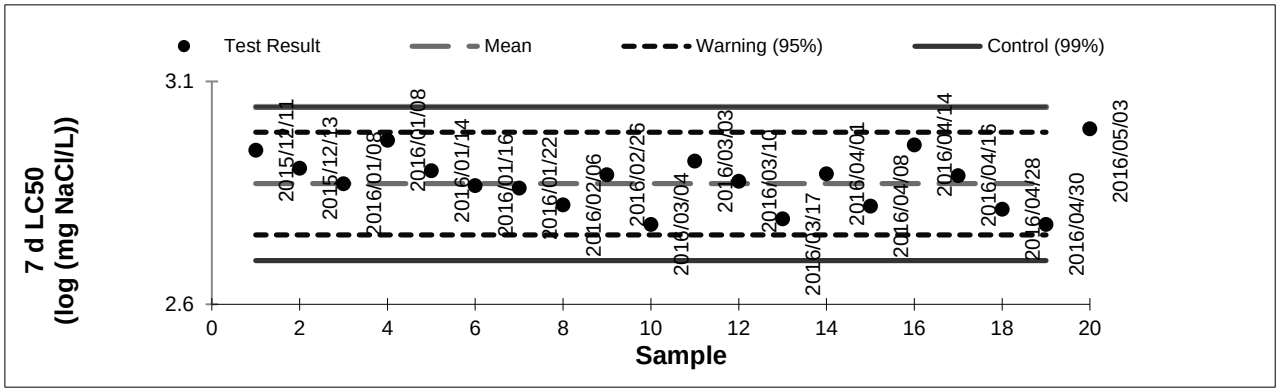
Mortality

Current Test

toxicant	Sodium Chloride (NaCl)				
started on	2016/05/03	ended on	2016/05/10		
Result (7 d LC50):	2.99	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.89	upper	3.09	

Historical Values

mean	2.87	sd	0.06	cv(%):	8.8
	lower	upper			
warning limits (±2 sd)	2.76	2.99	(95% confidence limits)		
control limits (±3 sd)	2.70	3.04	(99% confidence limits)		

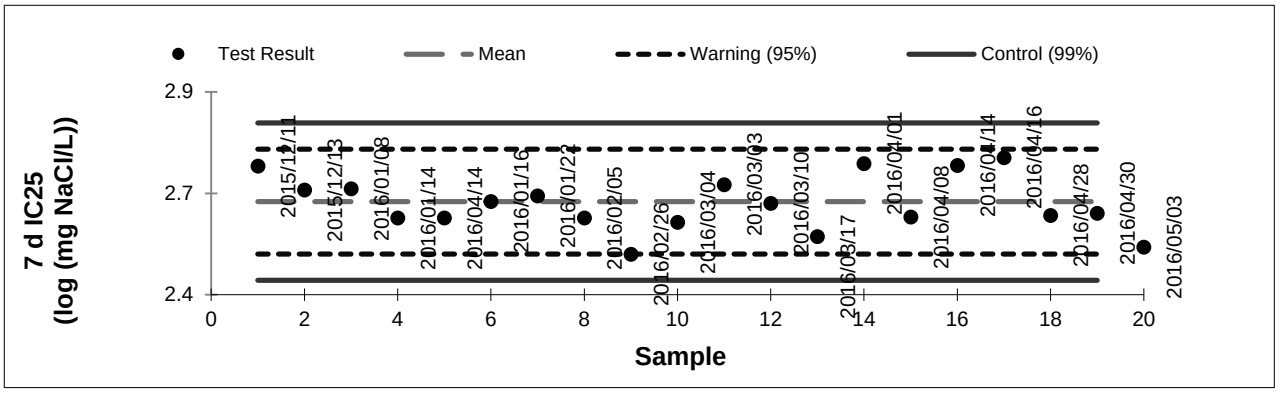


Biomass

started on	2016/05/03	ended on	2016/05/10		
Result (7 d IC25):	2.52	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.37	upper	2.61	

Historical Values

mean	2.63	sd	0.06	cv(%):	9.8
	lower	upper			
warning limits (±2 sd)	2.50	2.76	(95% confidence limits)		
control limits (±3 sd)	2.44	2.82	(99% confidence limits)		



notes: sd, standard deviation; cv, coefficient of variance; N/A, could not be calculated

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

Fathead Minnow 32-d Survival and Growth Test — Nautilus Environmental

Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Cu Control	control	Copper Control			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Hatched Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Cu Control	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	1.67%
GH_FR1	4	0.9667	0.8606	1	0.8667	1	0.03333	0.06667	6.9%	3.33%
CM_MC2	4	1	1	1	1	1	0	0	0.0%	0.0%

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Cu Control	4	9.707	8.631	10.78	8.846	10.5	0.3382	0.6764	6.97%	0.0%
FR_UFR1	4	9.21	8.804	9.616	8.857	9.467	0.1276	0.2553	2.77%	5.12%
FR_FRCP1	4	9.334	8.72	9.948	9	9.692	0.193	0.3859	4.13%	3.85%
GH_FR1	4	9.565	8.742	10.39	8.8	9.929	0.2588	0.5177	5.41%	1.46%
CM_MC2	4	9.435	9.115	9.754	9.267	9.667	0.1004	0.2007	2.13%	2.81%

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Cu Control	4	2.201	1.605	2.797	1.815	2.689	0.1874	0.3747	17.02%	0.0%
FR_UFR1	4	2.08	1.848	2.312	1.932	2.231	0.073	0.146	7.02%	5.5%
FR_FRCP1	4	1.905	1.528	2.282	1.579	2.116	0.1184	0.2368	12.43%	13.46%
GH_FR1	4	2.033	1.576	2.49	1.697	2.367	0.1435	0.2871	14.12%	7.63%
CM_MC2	4	2.179	1.969	2.39	2.063	2.357	0.06617	0.1323	6.07%	0.99%

Proportion Normal Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Cu Control	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	4	0.9821	0.9253	1	0.9286	1	0.01786	0.03571	3.64%	1.79%
FR_FRCP1	4	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	4	1	1	1	1	1	0	0	0.0%	0.0%
CM_MC2	4	1	1	1	1	1	0	0	0.0%	0.0%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Cu Control	4	0.9	0.763	1	0.8	1	0.04303	0.08607	9.56%	0.0%
FR_UFR1	4	0.9333	0.7833	1	0.8	1	0.04714	0.09428	10.1%	-3.7%
FR_FRCP1	4	0.9333	0.8467	1	0.8667	1	0.02722	0.05443	5.83%	-3.7%
GH_FR1	4	0.9	0.7163	1	0.7333	1	0.05774	0.1155	12.83%	0.0%
CM_MC2	4	0.9667	0.8606	1	0.8667	1	0.03333	0.06667	6.9%	-7.41%

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	0.9333
GH_FR1	0.8667	1	1	1
CM_MC2	1	1	1	1

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	9.75	8.846	10.5	9.733
FR_UFR1	9.25	8.857	9.267	9.467
FR_FRCP1	9	9	9.643	9.692
GH_FR1	9.818	8.8	9.929	9.714
CM_MC2	9.267	9.538	9.667	9.267

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	2.03	1.815	2.689	2.271
FR_UFR1	1.981	1.932	2.177	2.231
FR_FRCP1	1.579	1.887	2.037	2.116
GH_FR1	1.929	1.697	2.14	2.367
CM_MC2	2.063	2.357	2.201	2.096

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	1	1	1	1
FR_UFR1	1	0.9286	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	0.8	0.8667	0.9333	1
FR_UFR1	0.8	0.9333	1	1
FR_FRCP1	0.9333	1	0.9333	0.8667
GH_FR1	0.7333	1	0.9333	0.9333
CM_MC2	1	0.8667	1	1

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	15/15	15/15	15/15	15/15
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	14/15
GH_FR1	13/15	15/15	15/15	15/15
CM_MC2	15/15	15/15	15/15	15/15

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	12/12	13/13	14/14	15/15
FR_UFR1	12/12	13/14	15/15	15/15
FR_FRCP1	14/14	15/15	14/14	13/13
GH_FR1	11/11	15/15	14/14	14/14
CM_MC2	15/15	13/13	15/15	15/15

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	12/15	13/15	14/15	15/15
FR_UFR1	12/15	14/15	15/15	15/15
FR_FRCP1	14/15	15/15	14/15	13/15
GH_FR1	11/15	15/15	14/15	14/15
CM_MC2	15/15	13/15	15/15	15/15

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	00-0569-4839	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:44	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Cu Control	control	Copper Control			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Cu Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Cu Control		FR_FRCP1	0.5	1.0000	Exact	Non-Significant Effect
Cu Control		GH_FR1	0.2479	0.9916	Exact	Non-Significant Effect
Cu Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Cu Control	Negative Contr	60	0	60	1	0	0.0%
FR_UFR1		60	0	60	1	0	0.0%
FR_FRCP1		59	1	60	0.9833	0.01667	1.67%
GH_FR1		58	2	60	0.9667	0.03333	3.33%
CM_MC2		60	0	60	1	0	0.0%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	0.9333
GH_FR1	0.8667	1	1	1
CM_MC2	1	1	1	1

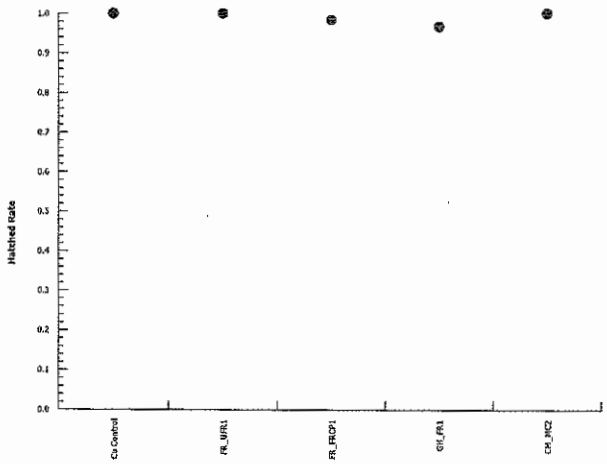
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	15/15	15/15	15/15	15/15
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	14/15
GH_FR1	13/15	15/15	15/15	15/15
CM_MC2	15/15	15/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	00-0569-4839	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:44	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: 21/16

Fathead Minnow 32-d Survival and Growth Test — Nautilus Environmental

Analysis ID:	16-3177-3863	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:39	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.2479	0.7437	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	60	0	60	1	0	0.0%
FR_FRCP1		59	1	60	0.9833	0.01667	1.67%
GH_FR1		58	2	60	0.9667	0.03333	3.33%
CM_MC2		60	0	60	1	0	0.0%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	0.9333
GH_FR1	0.8667	1	1	1
CM_MC2	1	1	1	1

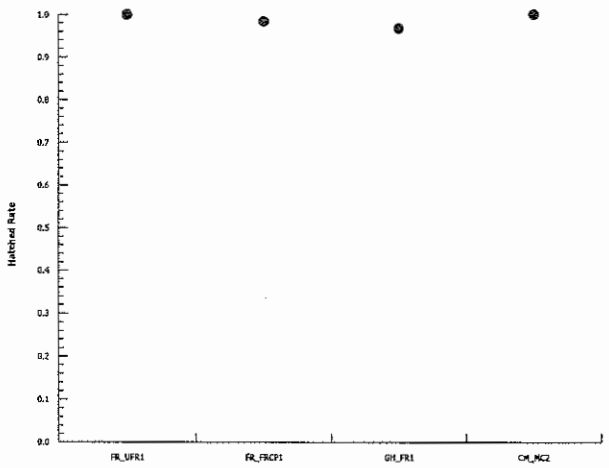
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	14/15
GH_FR1	13/15	15/15	15/15	15/15
CM_MC2	15/15	15/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	16-3177-3863	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:39	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



 Analyst:_____ QA: June 21/16

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	11-7155-0719	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:40	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Cu Control	control	Copper Control			

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control MHW		Cu Control	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control MHW	Negative Contr	60	0	60	1	0	0.0%
Cu Control	Dilution Water	60	0	60	1	0	0.0%

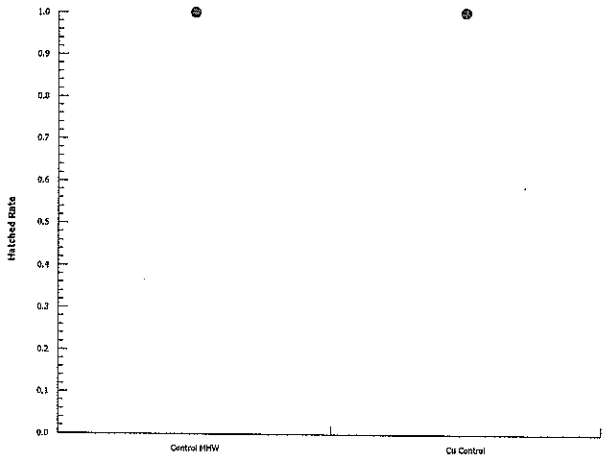
Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1	1	1	1
Cu Control	1	1	1	1

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	15/15	15/15	15/15	15/15
Cu Control	15/15	15/15	15/15	15/15

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	17-5205-0158	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:45	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Cu Control	control	Copper Control			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Cu Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Cu Control		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Cu Control		GH_FR1	0.6189	1.0000	Exact	Non-Significant Effect
Cu Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Cu Control	Negative Contr	54	6	60	0.9	0.1	0.0%
FR_UFR1		56	4	60	0.9333	0.06667	-3.7%
FR_FRCP1		56	4	60	0.9333	0.06667	-3.7%
GH_FR1		54	6	60	0.9	0.1	0.0%
CM_MC2		58	2	60	0.9667	0.03333	-7.41%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	0.8	0.8667	0.9333	1
FR_UFR1	0.8	0.9333	1	1
FR_FRCP1	0.9333	1	0.9333	0.8667
GH_FR1	0.7333	1	0.9333	0.9333
CM_MC2	1	0.8667	1	1

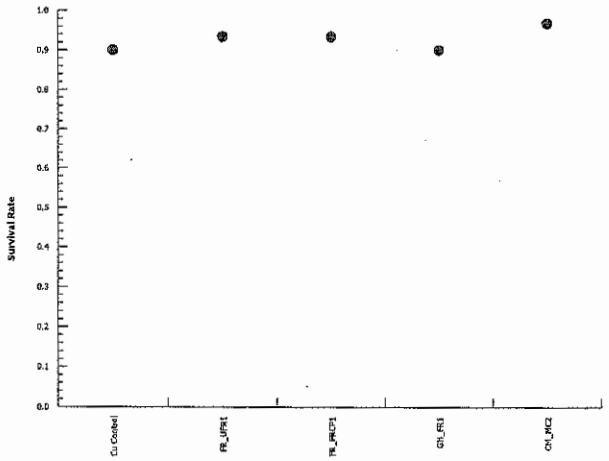
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	12/15	13/15	14/15	15/15
FR_UFR1	12/15	14/15	15/15	15/15
FR_FRCP1	14/15	15/15	14/15	13/15
GH_FR1	11/15	15/15	14/15	14/15
CM_MC2	15/15	13/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	17-5205-0158	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:45	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



 Analyst:_____ QA: 6/11/16

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	07-6162-9267	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:40	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.6415	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.3715	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	56	4	60	0.9333	0.06667	0.0%
FR_FRCP1		56	4	60	0.9333	0.06667	0.0%
GH_FR1		54	6	60	0.9	0.1	3.57%
CM_MC2		58	2	60	0.9667	0.03333	-3.57%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.8	0.9333	1	1
FR_FRCP1	0.9333	1	0.9333	0.8667
GH_FR1	0.7333	1	0.9333	0.9333
CM_MC2	1	0.8667	1	1

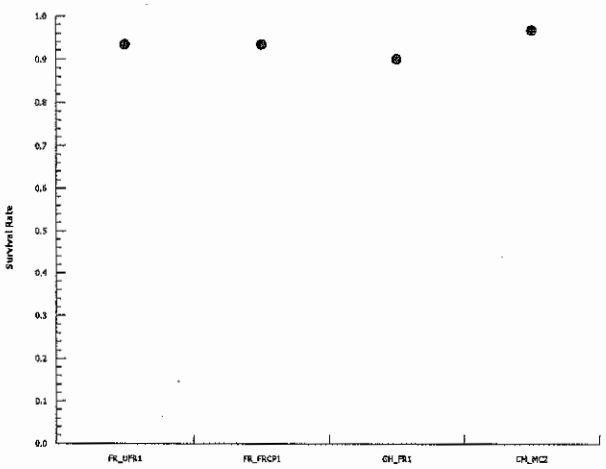
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	12/15	14/15	15/15	15/15
FR_FRCP1	14/15	15/15	14/15	13/15
GH_FR1	11/15	15/15	14/15	14/15
CM_MC2	15/15	13/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	07-6162-9267	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:40	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGL June 21/16

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-2973-9373	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:41	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Cu Control	control	Copper Control			

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control MHW		Cu Control	0.05699	0.0570	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control MHW	Negative Contr	59	1	60	0.9833	0.01667	0.0%
Cu Control	Dilution Water	54	6	60	0.9	0.1	8.48%

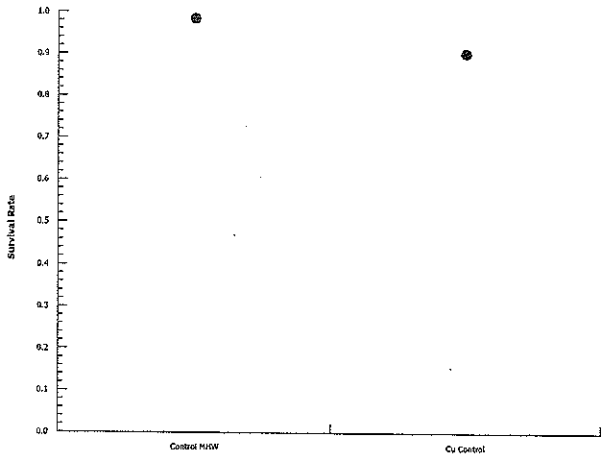
Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1	0.9333	1	1
Cu Control	0.8	0.8667	0.9333	1

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	15/15	14/15	15/15	15/15
Cu Control	12/15	13/15	14/15	15/15

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-3266-3995	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:44	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Cu Control	control	Copper Control			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	19.1%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Cu Control		FR_UFR1	0.6788	2.356	0.42	6	0.5244	CDF	Non-Significant Effect
		FR_FRCP1	1.662	2.356	0.42	6	0.1603	CDF	Non-Significant Effect
		GH_FR1	0.9425	2.356	0.42	6	0.4076	CDF	Non-Significant Effect
		CM_MC2	0.1225	2.356	0.42	6	0.7580	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2296989	0.05742473	4	0.9037	0.4865	Non-Significant Effect
Error	0.9532004	0.06354669	15			
Total	1.182899		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	3.847	13.28	0.4271	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9778	0.866	0.9026	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Cu Control	4	2.201	1.605	2.797	2.151	1.815	2.689	0.1874	17.02%	0.0%
FR_UFR1	4	2.08	1.848	2.312	2.079	1.932	2.231	0.073	7.02%	5.5%
FR_FRCP1	4	1.905	1.528	2.282	1.962	1.579	2.116	0.1184	12.43%	13.46%
GH_FR1	4	2.033	1.576	2.49	2.034	1.697	2.367	0.1435	14.12%	7.63%
CM_MC2	4	2.179	1.969	2.39	2.148	2.063	2.357	0.06617	6.07%	0.99%

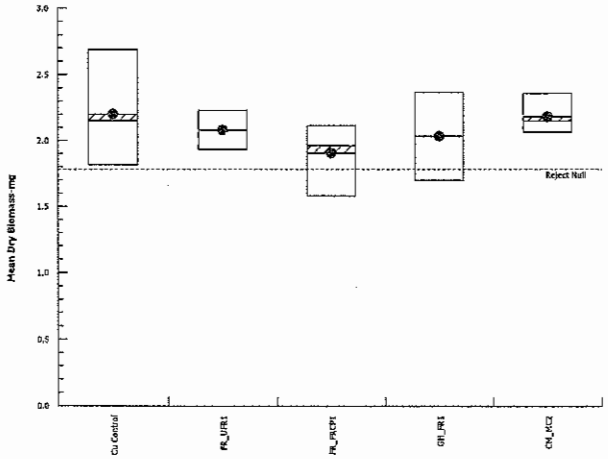
Mean Dry Biomass-mg Detail

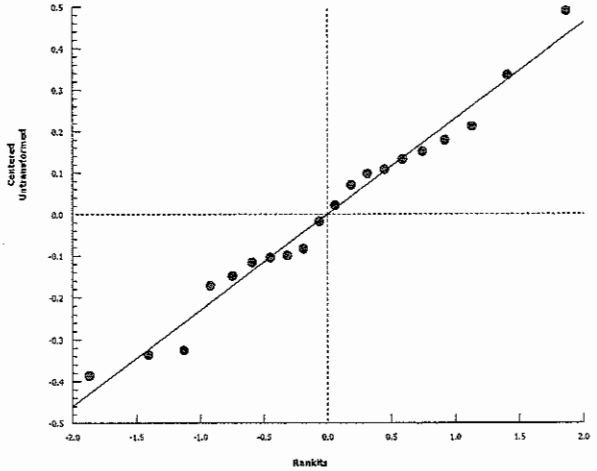
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	2.03	1.815	2.689	2.271
FR_UFR1	1.981	1.932	2.177	2.231
FR_FRCP1	1.579	1.887	2.037	2.116
GH_FR1	1.929	1.697	2.14	2.367
CM_MC2	2.063	2.357	2.201	2.096

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	08-3266-3995	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:44	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	19-5734-3490	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:40	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	16.4%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1.178	2.287	0.341	6	0.2704	CDF	Non-Significant Effect
		GH_FR1	0.3157	2.287	0.341	6	0.6257	CDF	Non-Significant Effect
		CM_MC2	-0.6661	2.287	0.341	6	0.9205	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1559699	0.05198997	3	1.173	0.3608	Non-Significant Effect
Error	0.5319442	0.04432868	12			
Total	0.6879141		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	2.122	11.34	0.5474	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9639	0.8408	0.7327	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	2.08	1.848	2.312	2.079	1.932	2.231	0.073	7.02%	0.0%
FR_FRCP1	4	1.905	1.528	2.282	1.962	1.579	2.116	0.1184	12.43%	8.43%
GH_FR1	4	2.033	1.576	2.49	2.034	1.697	2.367	0.1435	14.12%	2.26%
CM_MC2	4	2.179	1.969	2.39	2.148	2.063	2.357	0.06617	6.07%	-4.77%

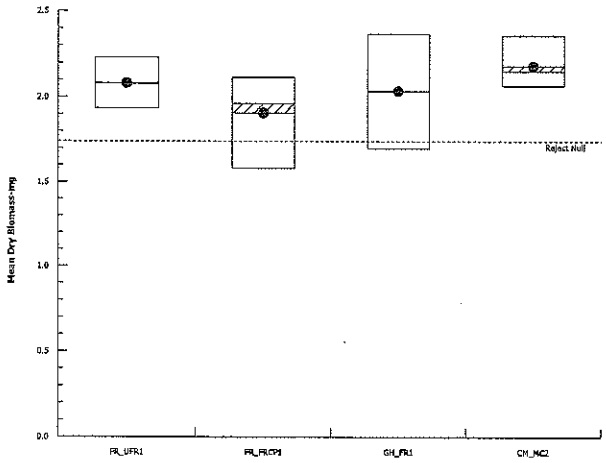
Mean Dry Biomass-mg Detail

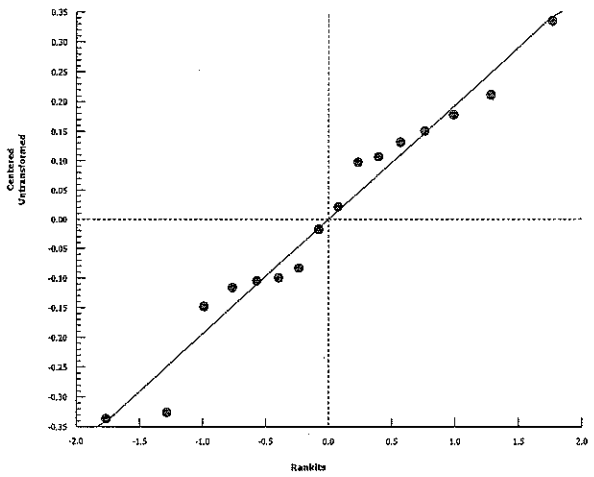
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1.981	1.932	2.177	2.231
FR_FRCP1	1.579	1.887	2.037	2.116
GH_FR1	1.929	1.697	2.14	2.367
CM_MC2	2.063	2.357	2.201	2.096

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	19-5734-3490	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:40	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	07-0258-6674	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Cu Control	control	Copper Control			

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	23.8%	

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control MHW		Cu Control	-2.674	1.943	0.395	6	0.9816	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.5900543	0.5900543	1	7.153	0.0368	Significant Effect
Error	0.4949714	0.08249523	6			
Total	1.085026		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	5.715	47.47	0.1862	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.96	0.6451	0.8105	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control MHW	4	1.658	1.409	1.907	1.648	1.513	1.823	0.07838	9.45%	0.0%
Cu Control	4	2.201	1.605	2.797	2.151	1.815	2.689	0.1874	17.02%	-32.76%

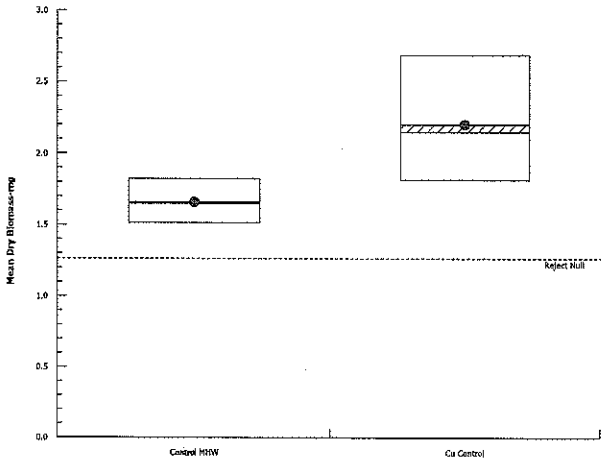
Mean Dry Biomass-mg Detail

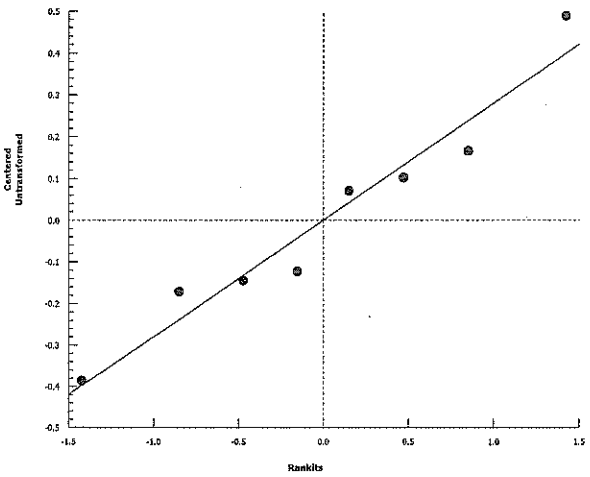
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1.513	1.535	1.76	1.823
Cu Control	2.03	1.815	2.689	2.271

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	07-0258-6674	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-6141-0632	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:44	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Cu Control	control	Copper Control			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.6%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Cu Control		FR_UFR1	1.588	2.356	0.738	6	0.1793	CDF	Non-Significant Effect
		FR_FRCP1	1.193	2.356	0.738	6	0.3062	CDF	Non-Significant Effect
		GH_FR1	0.4536	2.356	0.738	6	0.6248	CDF	Non-Significant Effect
		CM_MC2	0.8705	2.356	0.738	6	0.4388	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.6027454	0.1506864	4	0.7689	0.5620	Non-Significant Effect
Error	2.939769	0.1959846	15			
Total	3.542515		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.756	13.28	0.3132	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9487	0.866	0.3481	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Cu Control	4	9.707	8.631	10.78	9.741	8.846	10.5	0.3382	6.97%	0.0%
FR_UFR1	4	9.21	8.804	9.616	9.259	8.857	9.467	0.1276	2.77%	5.12%
FR_FRCP1	4	9.334	8.72	9.948	9.321	9	9.692	0.1929	4.13%	3.85%
GH_FR1	4	9.565	8.742	10.39	9.766	8.8	9.929	0.2588	5.41%	1.46%
CM_MC2	4	9.435	9.115	9.754	9.403	9.267	9.667	0.1004	2.13%	2.81%

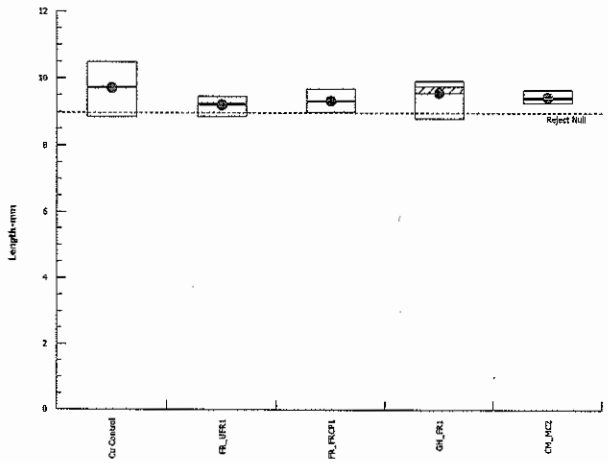
Length-mm Detail

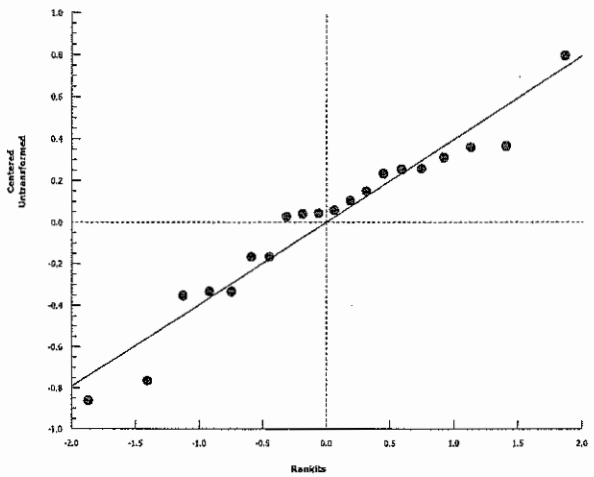
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	9.75	8.846	10.5	9.733
FR_UFR1	9.25	8.857	9.267	9.467
FR_FRCP1	9	9	9.643	9.692
GH_FR1	9.818	8.8	9.929	9.714
CM_MC2	9.267	9.538	9.667	9.267

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	08-6141-0632	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:44	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	13-2680-6365	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:39	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	6.35%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	-0.4833	2.287	0.585	6	0.8870	CDF	Non-Significant Effect
		GH_FR1	-1.389	2.287	0.585	6	0.9838	CDF	Non-Significant Effect
		CM_MC2	-0.8786	2.287	0.585	6	0.9487	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2725007	0.09083357	3	0.6956	0.5723	Non-Significant Effect
Error	1.567074	0.1305895	12			
Total	1.839575		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	2.689	11.34	0.4421	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9036	0.8408	0.0917	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	9.21	8.804	9.616	9.259	8.857	9.467	0.1276	2.77%	0.0%
FR_FRCP1	4	9.334	8.72	9.948	9.321	9	9.692	0.1929	4.13%	-1.34%
GH_FR1	4	9.565	8.742	10.39	9.766	8.8	9.929	0.2588	5.41%	-3.85%
CM_MC2	4	9.435	9.115	9.754	9.403	9.267	9.667	0.1004	2.13%	-2.44%

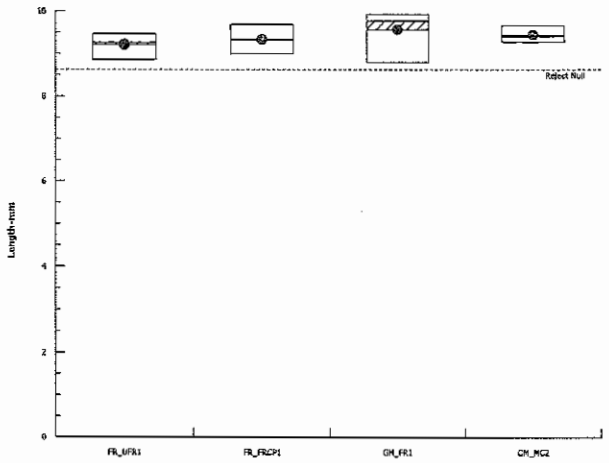
Length-mm Detail

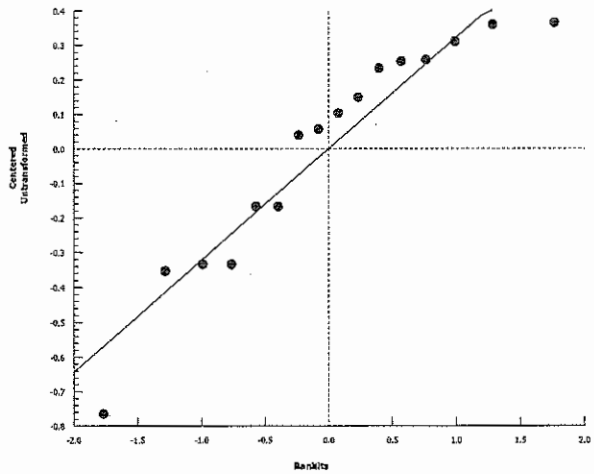
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	9.25	8.857	9.267	9.467
FR_FRCP1	9	9	9.643	9.692
GH_FR1	9.818	8.8	9.929	9.714
CM_MC2	9.267	9.538	9.667	9.267

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	13-2680-6365	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:39	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	09-0339-8496	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Cu Control	control	Copper Control			

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.36%	

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control MHW		Cu Control	0.2565	1.943	0.722	6	0.4031	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.01814508	0.01814508	1	0.06579	0.8061	Non-Significant Effect
Error	1.654808	0.2758014	6			
Total	1.672953		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	4.866	47.47	0.2264	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9419	0.6451	0.6300	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control MHW	4	9.802	9.315	10.29	9.833	9.4	10.14	0.1533	3.13%	0.0%
Cu Control	4	9.707	8.631	10.78	9.741	8.846	10.5	0.3382	6.97%	0.97%

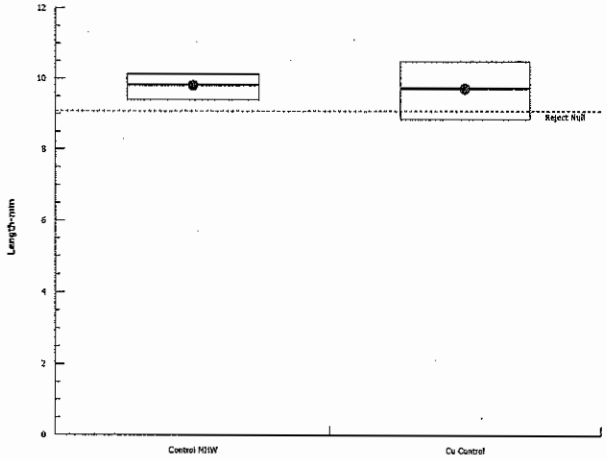
Length-mm Detail

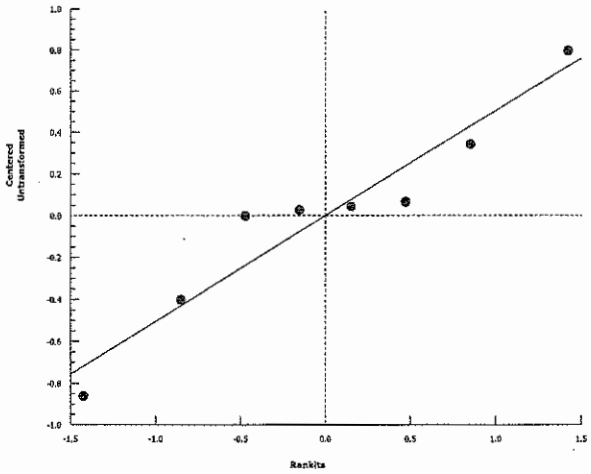
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	9.4	10.14	9.8	9.867
Cu Control	9.75	8.846	10.5	9.733

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	09-0339-8496	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	03-3764-2480	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:44	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Cu Control	control	Copper Control			
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Cu Control		FR_UFR1	0.5091	1.0000	Exact	Non-Significant Effect
Cu Control		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Cu Control		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Cu Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Cu Control	Negative Contr	54	0	54	1	0	0.0%
FR_UFR1		55	1	56	0.9821	0.01786	1.79%
FR_FRCP1		56	0	56	1	0	0.0%
GH_FR1		54	0	54	1	0	0.0%
CM_MC2		58	0	58	1	0	0.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	1	1	1	1
FR_UFR1	1	0.9286	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

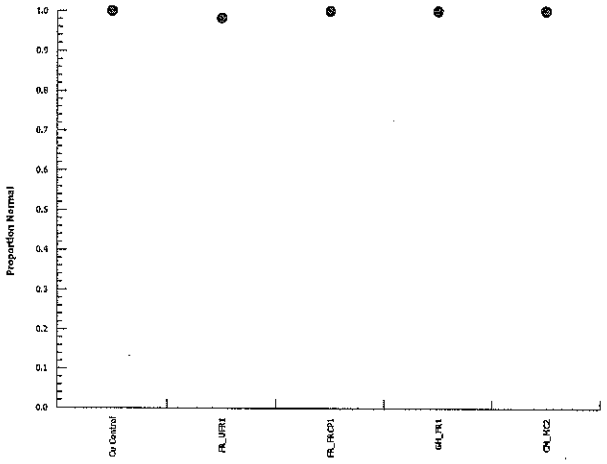
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Cu Control	12/12	13/13	14/14	15/15
FR_UFR1	12/12	13/14	15/15	15/15
FR_FRCP1	14/14	15/15	14/14	13/13
GH_FR1	11/11	15/15	14/14	14/14
CM_MC2	15/15	13/13	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	03-3764-2480	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:44	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	03-2411-5624	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:40	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	10-6389-4140	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	38h (8 °C)	Teck Coal	
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	37h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	34h (7.5 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	38h (6.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	55	1	56	0.9821	0.01786	0.0%
FR_FRCP1		56	0	56	1	0	-1.82%
GH_FR1		54	0	54	1	0	-1.82%
CM_MC2		58	0	58	1	0	-1.82%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	0.9286	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

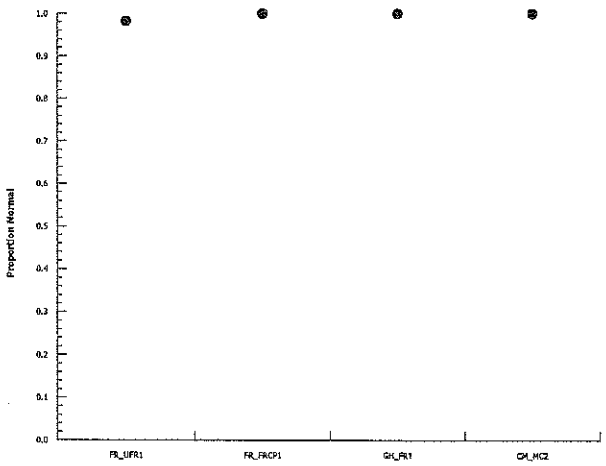
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	12/12	13/14	15/15	15/15
FR_FRCP1	14/14	15/15	14/14	13/13
GH_FR1	11/11	15/15	14/14	14/14
CM_MC2	15/15	13/13	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	03-2411-5624	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 12:40	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



 Analyst:_____ QA: JCu 21/16

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	17-0855-7555	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	23 Jun-16 13:41	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	11-2629-3097	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	29 Apr-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	31 May-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control MHW	04-7656-8534	29 Apr-16	29 Apr-16	NA	Teck Coal	
Cu Control	04-9149-4424	29 Apr-16	29 Apr-16	NA		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control MHW	control	Control MHW			
Cu Control	control	Copper Control			

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control MHW		Cu Control	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control MHW	Negative Contr	59	0	59	1	0	0.0%
Cu Control	Dilution Water	54	0	54	1	0	0.0%

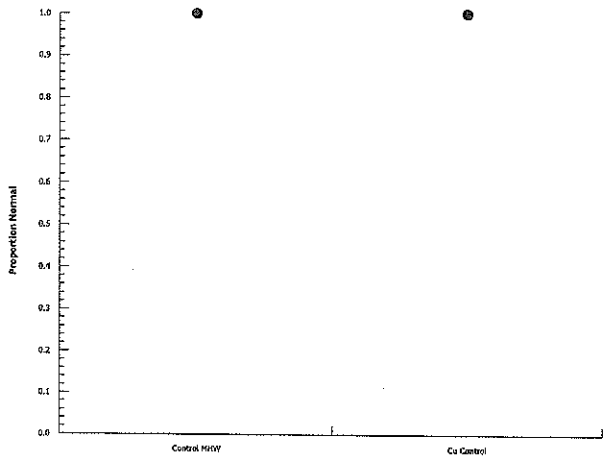
Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	1	1	1	1
Cu Control	1	1	1	1

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control MHW	15/15	14/14	15/15	15/15
Cu Control	12/12	13/13	14/14	15/15

Graphics



APPENDIX E – *Oncorhynchus mykiss* Toxicity Test Data

Embryo-Alevin Test Summary Sheet

Client: Teck
Work Order No.: 16473
Test Date: April 28 - May 25, 2016
Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: Various - see table below
Sample Date: April 27, May 4, May 11, & May 18, 2016
Date Received: April 28, May 5, May 12, & May 19, 2016
Sample Volume: (1 - 8) x 20 L per refresh

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L CaCO3): 8 - 10
Alkalinity (mg/L CaCO3): 5 - 8

Test Organism Information:

Batch No: 042816
Source: Ted's Trout Farm (Campbell Lake)
Loading Density: 1.14 g / L
Number male broodstock used: 4
Number female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE84
Stock Solution ID: 15S03
Date Initiated: April 28, 2016
7-d EC50 (95% CL): 5.5 (5.0 - 5.8) mg/L SDS

Reference Toxicant Mean and Range: 4.1 (2.1 - 8.0) mg/L SDS
Reference Toxicant CV (%): 40

Test Results:

Sample ID	Survival (%) (Mean ± SD)	Viability (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet weight (mg) (Mean ± SD)
Control	82.1 ± 8.8	77.0 ± 10.1	19.1 ± 0.5	94.6 ± 5.3
FR_UFR1	69.2 ± 15.5 *§	62.5 ± 11.3 *§	19.7 ± 0.4	97.6 ± 2.0
GH_ER2	84.8 ± 6.5	77.9 ± 5.9	19.8 ± 0.2	97.1 ± 3.4
FR_FRCP1	66.1 ± 10.4 *§	61.1 ± 6.4 *§	19.0 ± 0.4 †§	96.6 ± 4.7
GH_FR1	62.7 ± 10.3 *§	59.3 ± 10.7 *§	19.9 ± 0.2	95.8 ± 6.5
GH_ERC	66.1 ± 8.7 *§	59.5 ± 6.7 *§	19.5 ± 0.5	102.1 ± 7.3
EV_HC1	70.5 ± 7.1 §	62.6 ± 8.8 *§	19.5 ± 0.2	105.0 ± 3.0
EV_MC2	55.8 ± 3.9 *§	50.8 ± 2.8 *§	20.1 ± 0.5	106.7 ± 12.4
CM_MC2	60.2 ± 9.0 *§	56.1 ± 6.3 *§	19.5 ± 0.3	95.8 ± 7.5
LC_LCDSSLCC	69.0 ± 7.2 *§	61.6 ± 7.0 *§	19.8 ± 0.3	97.7 ± 3.5

* Indicates results that were significantly lower relative to laboratory control
† Indicates results that were significantly lower relative to site control FR_UFR1
§ Indicates results that were significantly lower relative to site control GH_ER2

Reviewed by: [signature]
Date reviewed: June 14/16

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (Various)
Work Order #: 16473

Start Date & Time: April 25/16 @1640h
Stop Date & Time: May 25/16 @1300h
Test Species: *Oncorhynchus mykiss*

0% (UW) Control

	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	15.0	15.0	15.5	15.0	15.0	15.0	15.0	15.0	14.5	15.0	15.0	15.0
DO (mg/L)	10.0	9.9	9.5	10.1	9.8	10.1	9.8	10.1	10.0	9.9	9.3	10.0	9.9
pH	7.0	7.0	7.2	7.0	7.1	7.0	6.9	7.0	7.1	6.6	6.7	6.9	7.0
Cond. (µS/cm)	29	29		27		28		29		27		26	
Initials	KL	KL		AS		AS		KL		KL		KL	

① **FR_UFR1 Concentration 100**

	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	15.0	15.0
DO (mg/L)	10.2	9.7	9.6	10.0	9.9	10.1	9.9	10.1	10.0	9.5	9.5	9.9	9.9
pH	8.1 KL	8.0	8.2	8.1	8.1	8.1	8.2	8.2	8.2	7.6	7.5	8.0	7.9
Cond. (µS/cm)	232	230		231		233		230		235		229	
Initials	KL	KL		AS		AS		KL		KL		KL	

② **GH_ER2 Concentration 100**

	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0
DO (mg/L)	9.9	9.8	9.6	10.0	9.8	10.0	9.8	10.1	10.1	9.5	9.5	9.9	9.7
pH	8.1	8.1	8.3	8.1	8.2	8.1	8.1	8.1	8.3	7.6	7.7	8.2	8.3
Cond. (µS/cm)	301	292		292		293		293		300		292	
Initials	KL	KL		AS		AS		KL		KL		KL	

③ **FR_FRCP1 Concentration 100**

	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0
DO (mg/L)	10.0	9.9	9.7	10.1	9.8	10.0	9.8	10.1	10.0	9.6	9.5	9.8	9.8
pH	8.2	8.2	8.3	8.2	8.3	8.2	8.2	8.2	8.4	7.6	7.8	8.0	8.3
Cond. (µS/cm)	555	542		540		542		545		560		542	
Initials	KL	KL		AS		AS		KL		KL		KL	

Thermometer: Temp-2 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	Control	FR_UFR1	GH_ER2	FR_FRCP1
Hardness*	10	114	136	272
Alkalinity*	5	106	138	154

* mg/L as CaCO3

Analysts: KL, YYL, AS

Reviewed by: JBL

Date reviewed: June 7/16

Sample Description: ① KL clear, colourless, some debris, no odour ② clear, colourless, no ppt, no odour ③ clear, colourless, some debris, no odour

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (Various)
Work Order #: 16473

Start Date & Time: April 25/16 @1640h
Stop Date & Time: May 25/16 @ 1300h KL
Test Species: *Oncorhynchus mykiss*

GH-FR1 100

% (v/v) Concentration ~~Control~~	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0
DO (mg/L)	10.2	10.0	9.8	10.0	9.8	10.1	9.9	10.1	10.0	9.8	9.5	9.9	9.9
pH	8.2	8.2	8.3	8.2	8.3	8.2	8.3	8.2	8.3	7.8	7.8	8.1	8.3
Cond. (µS/cm)	580	565		562		560		564		581		562	
Initials	KL	KL		AS		AS		KL		KL		YYL	

⑤

GH_ERC Concentration 100	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0
DO (mg/L)	10.2	10.0	9.8	10.1	9.9	10.0	9.8	10.1	10.0	9.5	9.3	9.8	9.9
pH	8.0	8.0	8.1	8.1	8.2	8.1	8.2	8.2	8.4	7.8	7.9	8.0	8.2
Cond. (µS/cm)	344	336		337		337		337		346		336	
Initials	KL	KL		AS		AS		KL		KL		KL	

⑥

EV_HC1 Concentration 100	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0
DO (mg/L)	10.0	10.0	9.8	10.0	9.8	10.1	9.9	10.0	10.0	9.3	9.3	9.8	9.8
pH	8.2	8.1	8.4	8.2	8.3	8.1	8.2	8.3	8.2	7.9	7.9	8.2	8.3
Cond. (µS/cm)	~~592~~ 565	547		548		547		549		566		547	
Initials	KL	KL		AS		AS		KL		KL		KL	

⑦

EV_MC2 Concentration 100	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	~~14.0~~ 15.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0
DO (mg/L)	10.0	10.0	9.8	10.1	9.9	10.1	9.8	10.1	9.9	9.6	9.2	9.8	9.7
pH	8.0	7.9	8.2	8.1	8.3	8.1	8.2	8.2	8.3	7.9	8.0	7.9	8.1
Cond. (µS/cm)	271	265		269		270		265		272		265	
Initials	KL	KL		AS		AS		KL		KL		KL	

Thermometer: Temp-2 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	GH-FR1 ~~Control~~	GH-ERC	EV_HC1	EV_MC2
Hardness*	282	164	272	140
Alkalinity*	152	150	182	94

* mg/L as CaCO3

Analysts: KL, YYL, AS
Reviewed by: JGU
Date reviewed: June 7/16

Sample Description: ④⑤⑥⑦ clear, colourless, some debris, no odour

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (Various)
Work Order #: 16473

Start Date & Time: April 25 / 16 @ 1640h
Stop Date & Time: May 25 / 16 @ 1300h
Test Species: *Oncorhynchus mykiss*

CM_MC2 ③ 100

Concentration 0/0 (JJ) Control	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	14.5	15.0	15.3 / 15.3	15.0	15.2	15.0	15.0	15.0	14.5	14.5	15.0	15.0
DO (mg/L)	10.3	10.0	9.8	10.0	9.9	10.1	9.9	10.0	10.0	9.5	9.5	9.8	9.7
pH	8.1 (Lab)	8.1	8.3	8.1	8.3	8.1	8.1	8.3	8.2	7.9	7.9	8.0	8.2
Cond. (µS/cm)	550	537		540		543		540		545		538	
Initials	KL	KL		AS		AS		KL		KL		KL	

⑨ LC_LCOSSLCC Concentration 100

	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.2	15.5	15.0	15.0	15.0	14.5	15.0	15.0
DO (mg/L)	9.7	10.2	9.8	10.0	9.8	10.1	9.8	10.1	10.0	9.6	9.5	9.8	9.7
pH	8.1	8.1 (Lab)	8.3	8.1	8.3	8.1	8.2	8.2	8.3	7.9	7.9	7.9	8.2
Cond. (µS/cm)	568	549		540		539		544		556		542	
Initials	KL	KL		AS		AS		KL		KL		KL	

Concentration	Days												
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)													
DO (mg/L)													
pH													
Cond. (µS/cm)													
Initials													

Concentration	Days												
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)													
DO (mg/L)													
pH													
Cond. (µS/cm)													
Initials													

Thermometer: Temp-2 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	~~Control~~	CM_MC2	LC_LCOSSLCC	
Hardness*	~~266~~ KL	266	282	
Alkalinity*	~~140~~ KL	140	160	

* mg/L as CaCO3

Analysts: KL YYL AS
Reviewed by: JSH
Date reviewed: June 7/16

Sample Description: ③ ⑨ clear, colourless, some debris, no odour

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

% (v/v) Concentration control	Day 7 new	Day 7 old	Day 8 new	Day 8 old	Day 9 new	Day 9 old	Day 10 new	Day 10 old	Day 11 new	Day 11 old	Day 12 new	Day 12 old	Day 13 new	Day 13 old
Temperature (°C)	14.5	15.0	14.5	14.0	15.0	15.0	15.0	15.0	15.0	~~14.~~ 15.0	15.0	15.0	14.5	14.5
DO (mg/L)	9.9	9.9	10.0	10.0	9.9	9.8	9.8	9.8	10.0	9.9	10.1	10.1	10.0	10.1
pH	~~8.4~~ 7.0	~~8.7~~ 8.4	7.0	7.1	6.8	7.0	6.9	7.0	7.0	7.1	7.0	7.1	7.0	7.0
Cond. (µS/cm)	26		8. 26		27		28		28		27		27	
Initials	KL		KL		A		AD		KL		YML		KL	

①

FR_UFR1 Concentration 100	Day 7 new	Day 7 old	Day 8 new	Day 8 old	Day 9 new	Day 9 old	Day 10 new	Day 10 old	Day 11 new	Day 11 old	Day 12 new	Day 12 old	Day 13 new	Day 13 old
Temperature (°C)	15.0	~~14.5~~ 15.0	14.5	14.0	15.0	15.0	15.0	15.0	14.5	15.0	15.0	15.0	14.5	14.5
DO (mg/L)	9.9	9.9	10.0	9.9	9.9	9.9	10.0	9.8	10.0	9.9	10.1	9.9	9.9	10.0
pH	~~7.3~~ 8.0	~~7.8~~ 8.3	8.1	7.2	8.1	8.1	8.1	8.2	8.1	8.1	8.0	8.0	8.0	8.0
Cond. (µS/cm)	231		236		236		237		237		238		237	
Initials	KL		KL		AD		AD		KL		YML		KL	

②

GH ERZ Concentration 100	Day 7 new	Day 7 old	Day 8 new	Day 8 old	Day 9 new	Day 9 old	Day 10 new	Day 10 old	Day 11 new	Day 11 old	Day 12 new	Day 12 old	Day 13 new	Day 13 old
Temperature (°C)	15.0	15.0	14.5	14.0	15.0	15.0	15.0	15.0	14.5	15.0	15.0	15.0	14.5	14.5
DO (mg/L)	9.8	9.9	10.0	9.9	10.1	9.9	10.0	9.9	10.0	9.9	10.0	9.8	9.9	10.0
pH	~~7.5~~ 8.1	8.2 ~~7.4~~	8.2	7.1	8.1	8.2	8.0	8.1	8.2	8.3	8.0	8.2	8.0	8.2
Cond. (µS/cm)	KL ~~293~~ 293		293		293		292		293		293		294	
Initials	KL		KL		A		AD		KL		YML		KL	

③

FR_FRCP1 Concentration 100	Day 7 new	Day 7 old	Day 8 new	Day 8 old	Day 9 new	Day 9 old	Day 10 new	Day 10 old	Day 11 new	Day 11 old	Day 12 new	Day 12 old	Day 13 new	Day 13 old
Temperature (°C)	15.0	15.0	14.5	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5
DO (mg/L)	9.9	9.9	10.0	9.9	10.1	9.8	10.0	9.8	10.0	10.0	10.1	9.9	10.0	10.0
pH	~~7.2~~ 8.1	8.0	8.2	7.1	8.1	8.2	8.1	8.2	8.2	8.3	8.1	8.2	8.0	8.2
Cond. (µS/cm)	KL ~~528~~ 542		531		528		530		530		530		530	
Initials	KL		KL		A		AD		KL		YML		KL	

Thermometer: temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control	FR_UFR1-100	GH_ERZ-100	FR_FRCP1-100
Hardness*	10	122	154	286
Alkalinity*	8	112	138	152

* mg/L as CaCO3

Analysts: YML, KL, AWD

Reviewed by: JOK
Date reviewed: June 7/16

Sample Description: ①②③ clear, colourless, some ~~debris~~ KL debris, no odour.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

④ ~~GH_FRI (1/4)~~ KL %(v/v)

Concentration 100	Day 7		Day 8		Day 9		Day 10		Day 11		Day 12		Day 13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5
DO (mg/L)	9.9	9.9	10.0	9.9	10.1	9.9	10.0	9.8	10.0	10.0	9.9	10.0	10.0	10.0
pH	8.1	8.3	8.3	7.2	8.1	8.1	8.2	8.3	8.2	8.4	8.1	8.2	8.1	8.2
Cond. (µS/cm)	562		588		590		592		589		590		590	
Initials	KL		KL		AD		AD		KL		YML		KL	

⑤ GH_ERC

Concentration 100	Day 7		Day 8		Day 9		Day 10		Day 11		Day 12		Day 13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5
DO (mg/L)	9.9	9.9	10.0	9.9	10.1	9.8	10.0	9.9	10.0	10.0	9.8	10.0	10.0	10.0
pH	8.1	8.3	8.3	7.0	8.1	8.2	8.1	8.2	8.1	8.4	8.1	8.2	8.1	8.2
Cond. (µS/cm)	335		328		328		330		329		331		329	
Initials	KL		KL		AD		AD		KL		YML		KL	

⑥ EV_HCl

Concentration 100	Day 7		Day 8		Day 9		Day 10		Day 11		Day 12		Day 13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5
DO (mg/L)	9.9	9.9	10.0	9.9	10.1	9.9	10.0	9.9	10.0	10.0	9.9	10.0	10.0	10.0
pH	8.2	8.3	8.4	7.2	8.2	8.3	8.2	8.2	8.3	8.4	8.1	8.3	8.1	8.3
Cond. (µS/cm)	549		520		527		521		524		521		522	
Initials	KL		KL		AD		AD		KL		YML		KL	

⑦ EV_MCl

Concentration 100	Day 7		Day 8		Day 9		Day 10		Day 11		Day 12		Day 13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5
DO (mg/L)	9.9	9.9	10.0	9.9	10.1	9.8	10.1	9.8	10.0	10.0	10.0	10.1	10.0	10.0
pH	8.0	8.1	8.0	7.0	8.1	8.2	8.2	8.2	8.0	8.2	8.0	8.0	7.9	8.30
Cond. (µS/cm)	264		248		249		250		250		249		250	KL
Initials	KL		KL		AD		AD		KL		YML		KL	

Thermometer: temp-3 **DO meter:** DO-113 **pH meter:** pH-113 **Conductivity meter:** C-113

	Control	GH_FRI 100	GH_ERC 100	EV_HCl 100	EV_MCl 100
Hardness*	316	190	284	140	
Alkalinity*	164	150	168	90	

* mg/L as CaCO3

Analysts: YML, KL, AWD

Reviewed by: JOh

Date reviewed: June 7/16

Sample Description: ④⑤⑥ Clear, colourless, some debris, no odour ⑦ clear, light yellow, some debris, no odour

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID:
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

(8)

CM_MCZ %(v/v) Concentration 100	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5
DO (mg/L)	9.9	9.9	10.0	9.9	10.0	9.8	10.1	9.8	10.0	10.0	9.9	10.1	9.9	10.0
pH	8.1	8.2	8.2	7.2	8.1	8.1	8.2	8.2	8.2	8.3	8.1	8.1	8.0	8.2
Cond. (µS/cm)	539		505		504		503		505		506		506	
Initials	KL		KL		A		A		KL		MML		KL	

(9)

LC_LCDSSLCC Concentration 100	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.0 KL	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5
DO (mg/L)	9.9	9.9	10.0	9.9	10.1	9.8	10.0	9.9	10.0	10.0	10.0	10.1	9.9	10.0
pH	8.1	8.3	8.3 KL	7.2	8.1	8.1	8.2	8.2	8.3	8.4	8.1	8.2	8.1	8.2
Cond. (µS/cm)	543		533 ~~545~~ KL		530		533		534		534		535	
Initials	KL		KL		A		A		KL		MML		KL	

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: temp-3 **DO meter:** DO-113 **pH meter:** pH-113 **Conductivity meter:** C-113

	Control MML	CM-MCZ 100	LC_LCDSSLCC 100	
Hardness*		248	270	
Alkalinity*		136	146	

* mg/L as CaCO3

Analysts: MML, KL, AWD
Reviewed by: JGH
Date reviewed: June 7/16

Sample Description: KL (8) clear, colourless, some debris, no odour (9) clear, ~~light~~ yellowish-brown, debris, no odour

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	14.0	14.0	14.0	14.6	14.6	14.5	14.6	15.0	15.0	15.0	15.0	15.0	15.00
DO (mg/L)	10.2	9.9	10.2	10.3	10.1	9.9	10.1	9.8	9.9	9.8	10.1	10.0	10.1	9.9
pH	7.0	7.1	7.0	7.0	7.1	7.1	7.1	7.2	7.1	7.1	7.1	7.1	7.0	~~8.1~~ 7.1
Cond. (µS/cm)	27		27		28		28		28		27		27	
Initials	KL		EL		A		A		KL		KL		KL	

① FR_UFR1 Concentration 100

	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	14.5	14.5	14.5	~~14.3~~ 14.5	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	10.0	10.0	10.3	10.3	10.2	9.9	10.1	9.9	9.8	9.8	9.9	9.9	9.9	9.9
pH	8.1	8.1	8.1	8.0	8.1	8.2	8.0	8.1	8.2	8.2	8.1	8.1	8.0	~~8.2~~
Cond. (µS/cm)	235		236		237		239		236		236		236	
Initials	KL		EL		A		A		KL		KL		KL	

② GH-ER2 Concentration 100

	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	14.5	14.5	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	10.0	10.0	10.3	10.3	10.1	9.8	10.2	9.8	9.8	9.8	9.9	9.9	9.9	9.9
pH	8.0	8.2	8.1	8.1	8.1	8.2	8.1	8.1	~~8.2~~ 8.3	8.3	8.1	8.3	8.1	~~8.2~~ 8.3
Cond. (µS/cm)	290		277		276		278		278		278		277	
Initials	KL		EL		A		A		KL		KL		KL	

③ FR_FRCP1 Concentration 100

	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	14.5	14.5	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	10.0	10.2	10.3	10.3	10.1	9.9	10.1	9.8	9.8	9.8	9.9	9.9	9.9	9.9
pH	8.1	8.2	8.1	8.1	8.11	8.2	8.1	8.2	~~8.1~~ 8.3	8.3	8.1	8.3	8.1	~~8.2~~ 8.3
Cond. (µS/cm)	525		595		591		591		KL 8.2 592		591		592	
Initials	KL		KL		A		A		KL		KL		KL	

Thermometer: temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control	FR-UFR1-100	GH-ER2-100	FR-FRCP1-100
Hardness*	9	126	146	308
Alkalinity*	8	116	130	160

* mg/L as CaCO3

Analysts: EC, AND, KL

Reviewed by: JCL

Date reviewed: June 7/16

Sample Description: ①②③ clear, colourless, no odour, no ppt

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (Various)
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

④ GH-FR1 100 — Concentration (% v/v)

	Day 14		Day 15		Day 16		Day 17		Day 18		Day 19		Day 20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	14.5	14.5	14.5	14.6	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	10.0	10.2	10.3	10.3	10.1	9.8	10.0	9.8	9.8	9.8	10.0	10.0	9.9	9.9
pH	8.2	8.2	8.1	8.2	8.1	8.1	8.0	8.1	8.3	8.3	8.2	8.3	8.2	~~8.5~~ KL 8.3
Cond. (µS/cm)	583		571		575		577		576		576		575	
Initials	KL		EL		A		A		KL		KL		KL	

⑤ GH-ERC 100 — Concentration

	Day 14		Day 15		Day 16		Day 17		Day 18		Day 19		Day 20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	14.5	14.5	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	10.1	10.3	10.3	10.3	9.9	9.8	10.1	9.9	9.8	9.8	9.9	10.0	9.9	10.0
pH	8.1	8.2	8.0	8.2	8.1	8.2	8.0	8.1	8.2	8.3	8.1	8.2	8.1	8.3
Cond. (µS/cm)	326		308		309		308		307		308		308	
Initials	KL		EL		A		A		KL		KL		KL	

⑥ EV_HC1 100 — Concentration

	Day 14		Day 15		Day 16		Day 17		Day 18		Day 19		Day 20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	14.5	14.5	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	10.0	10.3	10.3	10.3	10.1	9.8	10.0	9.8	9.8	9.8	9.9	10.0	9.9	10.0
pH	8.2	~~8.5~~ KL 8.2	8.2	8.2	8.1	8.3	8.1	~~8.2~~ KL 8.3	~~8.3~~ KL 8.4	8.4	8.2	8.3	8.2	8.4
Cond. (µS/cm)	518		523		523		523		524		524		523	
Initials	KL		EL		A		A		KL		KL		KL	

⑦ EV_MC2 100 — Concentration

	Day 14		Day 15		Day 16		Day 17		Day 18		Day 19		Day 20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	14.5	14.5	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	10.0	10.3	10.3	10.3	10.0	9.9	10.1	9.9	9.8	9.8	9.9	10.0	9.9	10.0
pH	7.9	~~8.2~~ KL 8.0	7.9	8.0	8.0	8.1	8.0	8.1	8.1	8.1	8.0	~~8.3~~ KL 8.1	8.0	8.2
Cond. (µS/cm)	246		295		294		294		295		295 KL		296	
Initials	KL		EL		A		A		KL		KL		KL	

Thermometer: temp-3 (GH-FR1-100) **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control KL ~~326~~ 304	GH-ERC-100	EV_HC1-100	EV_MC2-100
Hardness*	KL ~~326~~ 304	160	286	156
Alkalinity*	KL ~~130~~ 158	142	164	98

* mg/L as CaCO3

Analysts: ALW, EC, KL
Reviewed by: JGH
Date reviewed: June 7/16

Sample Description: ④⑤⑥~~⑦~~ KL clear, colourless, no odour, no ppt, ⑦ clear, slightly yellowish, no odour, no ppt

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (Various)
Work Order #: 16473

Start Date & Time: April 28 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

⑧

CM-MC2 100 Concentration (% v/v)	Days 14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	14.5	14.5	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	10.0	10.3	10.3	10.3	10.1	9.8	10.1	9.7	9.8	9.8	9.9	10.0	9.9	10.0
pH	8.1	8.2	8.2	8.0	8.2	8.3	8.1	8.1	8.3	8.3	8.2	8.3	8.2	8.3
Cond. (µS/cm)	499		555		555		557		559		556		556	
Initials	KL		EL		A		A		KL		KL		KL	

⑨

LC-LCDSSLCC 100 Concentration	Days 14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	14.5	14.5	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	10.0	10.3	10.3	10.3	10.1	9.8	10.1	9.8	9.8	9.8	9.8	10.0	9.8	10.0
pH	8.1	8.2	8.1	8.2	8.1	8.2	8.0	8.1	8.3	8.3	8.2	8.3	8.1	8.3
Cond. (µS/cm)	529		553		552		553		553		554		554	
Initials	KL		EL		A		A		KL		KL		KL	

Concentration	Days 14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days 14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control (Hyd)	CM-MC2-100	LC-LCDSSLCC (100)	
Hardness*		286	284	
Alkalinity*		144	152	

* mg/L as CaCO3

Analysts: AWD, EC, KL

Reviewed by: JOH

Date reviewed: June 7/16

Sample Description: ⑧ Clear, slightly yellowish, no odour, no ppt, ⑨ clear, colourless, no odour, no ppt.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 28 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Control Concentration (%v/v)	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.8	9.5	10.0	10.1	10.0	9.8	10.0	9.9	9.7	9.6	9.9	9.6	9.7	9.5
pH	7.0	7.1	7.0	7.0	7.1	7.2	7.1	7.0	7.2	7.3	7.2	7.2	7.2	7.2
Cond. (µS/cm)	27		27		27		27		28		27		27	
Initials	KL		KL		A		A		JW		KL		KL	

① FR_UFR1 Concentration 100

	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.5	9.4	10.1	10.0	10.0	9.9	10.1	9.8	9.7	9.5	9.7	9.7	9.5	9.5
pH	8.1	8.2	8.2	8.1	8.1	8.2	8.1	8.0	8.2	8.2	8.3	8.2	8.2	8.2
Cond. (µS/cm)	236		255		255		256		256		254		255	
Initials	KL		KL		A		A		JW		KL		KL	

② GH_ER2 Concentration 100

	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.5	9.4	10.1	9.9	9.9	9.9	9.9	9.7	9.6	9.5	9.7	9.7	9.5	9.5
pH	8.1	8.3	~~8.0~~ 8.0	8.2	8.1	8.1	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.2
Cond. (µS/cm)	277		284		283		283		283		282		283	
Initials	KL		KL		A		A		JW		KL		KL	

③ FR_FRCP1 Concentration 100

	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.5	9.4	10.1	9.9	10.0	9.8	10.0	9.8	9.7	9.5	9.7	9.7	9.5	9.5
pH	8.1	8.3	8.1	8.2	8.1	8.2	8.1	8.1	8.2	8.2	8.3	8.3	8.2	8.3
Cond. (µS/cm)	590		579		578		578		579		577		579	
Initials	KL		KL		A		A		JW		KL		KL	

Thermometer: temp-3 **DO meter:** DO-113 **pH meter:** pH-113 **Conductivity meter:** C-113

	Control	FR_UFR1	GH_ER2	FR_FRCP1
Hardness*	8	130	148	290
Alkalinity*	6	110	132	156

* mg/L as CaCO3

Analysts: AWD, JW, KL
Reviewed by: JW
Date reviewed: June 7/16

Sample Description: ① and ② clear, colourless, some debris ~~no ppt~~ KL, no odour. ③ clear, colourless, no odour, no ppt

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 28 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

④ GH-FR1 100 Concentration (% v/v)

	Days 21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.5	9.4	10.1	9.9	10.0	9.8	10.0	9.8	9.9	9.6	9.7	9.7	9.5	9.5
pH	8.1	8.3	8.0	8.3	8.1	8.2	8.0	8.2	8.2	8.4	8.3	8.4	8.2	8.4
Cond. (µS/cm)	575		627		622		627		628		626		626	
Initials	KL		KL		A		A		JW		KL		KL	

⑤ GH-ERC Concentration 100

	Days 21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.4	9.4	10.1	9.9	10.0	9.8	10.1	9.7	9.6	9.7	9.7	9.7	9.5	9.6
pH	8.1	8.3	8.0	8.2	8.0	8.1	8.0	8.1	8.2	8.3	8.2	8.3	8.2	8.3
Cond. (µS/cm)	308		313		312		313		312		312		314	
Initials	KL		KL		A		A		JW		KL		KL	

⑥ EV-HCl Concentration 100

	Days 21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.4	9.4	10.1	9.9	9.9	9.8	9.8	9.8	9.7	9.6	9.7	9.7	9.5	9.6
pH	8.2	8.4	8.2	8.3	8.1	8.1	8.1	8.1	8.3	8.3	8.3	8.4	8.3	8.4
Cond. (µS/cm)	523		567		566		567		570		566		567	
Initials	KL		KL		A		A		JW		KL		KL	

⑦ EV-MC2 Concentration 100

	Days 21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.5	9.4	10.1	9.9	10.0	9.9	10.0	9.9	9.7	9.6	9.7	9.7	9.5	9.6
pH	8.0	8.2	7.9	8.1	8.0	8.1	8.0	8.1	8.1	8.2	8.1	8.1	8.1	8.1
Cond. (µS/cm)	298		319		319		318		319		318		320	
Initials	KL		KL		A		A		JW		KL		KL	

Thermometer: temp-3 DO meter: DO-113 pH meter: pH-113 Conductivity meter: C-113

	~~Control~~ GH-FR1	GH-ERC	EV-HCl	EV-MC2
Hardness*	326	158	298	160
Alkalinity*	170	136	170	106

* mg/L as CaCO3

Analysts: AWO, JW, KL

Reviewed by: JGL

Date reviewed: June 7/16

Sample Description: ④⑤⑥ clear, colourless, no ppt, no odour ⑦ slight yellowish, clear, some debris, no odour

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

⑧ CM_MC2 100 Concentration (% v/v)

	Days 21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.4	9.4	10.4	9.9	10.2	9.8	10.2	9.6	9.7	9.6	9.7	9.7	9.5	9.6
pH	8.2	8.3	8.2	8.2	8.1	8.2	8.1	8.1	8.2	8.1	8.3	8.2	8.2	8.2
Cond. (µS/cm)	557		514		513		512		516		513		514	
Initials	KL		KL		AW		AW		JW		KL		KL	

⑨ LC_LCDSSLCC Concentration 100

	Days 21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
DO (mg/L)	9.3	9.4	10.1	9.9	10.1	9.8	10.0	9.7	9.7	9.5	9.6	9.7	9.5	9.6
pH	8.2	8.3	8.1	8.2	8.1	8.1	8.1	8.2	8.2	8.2	8.3	8.3	8.3	8.3
Cond. (µS/cm)	553		596		595		595		597		595		595	
Initials	KL		KL		AW		AW		JW		KL		KL	

Concentration	Days 21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days 21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: temp-3 (KL) DO meter: DO-113 pH meter: pH-113 Conductivity meter: C-113

	~~Control~~	CM_MC2	LC_LCDSSLCC	
Hardness*		272	294	
Alkalinity*		132	154	

* mg/L as CaCO3

Analysts: AWD, JW, KL
Reviewed by: JW
Date reviewed: June 7/16

Sample Description: ⑧⑨ Clear, colourless, no odour, no oil

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: Various
Work Order #: (16473)

Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

% (v/v) Concentration Control	Days													
	Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.6												
pH		7.2												
Cond. (µS/cm)	30													
Initials	KL													

① Concentration FR-UFR1 100	Days													
	Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.6												
pH		~~8.2~~ KL 8.2												
Cond. (µS/cm)	259													
Initials	KL													

② GH_ER2 Concentration 100	Days													
	Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.7												
pH		8.2												
Cond. (µS/cm)	288													
Initials	KL													

③ FR_FRCP1 Concentration 100	Days													
	Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.7												
pH		8.4												
Cond. (µS/cm)	579													
Initials	KL													

Thermometer: temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control			
Hardness*				
Alkalinity*				

* mg/L as CaCO3

Analysts: KL

Reviewed by: JGL
Date reviewed: June 7/16

Sample Description:

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: Various
Work Order #: (16473)

Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

④ GH_FR1 % (v/v)

Concentration 100	Days Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.8												
pH		8.4												
Cond. (µS/cm)	627													
Initials	KL													

⑤

GH_ERC Concentration 100	Days Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.8												
pH		8.4												
Cond. (µS/cm)	317													
Initials	KL													

⑥

EV_HC1 Concentration 100	Days Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.9												
pH		8.4												
Cond. (µS/cm)	570													
Initials	KL													

⑦

EV_MC2 Concentration 100	Days Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.9												
pH		8.2												
Cond. (µS/cm)	322													
Initials	KL													

Thermometer: temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control			
Hardness*				
Alkalinity*				

* mg/L as CaCO3

Analysts: KL
Reviewed by: [signature]
Date reviewed: June 7/16

Sample Description:

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: Various
Work Order #: (16473)

Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

(8)

% (v/v) Concentration AMMC2 100	Days Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.9												
pH		8.2												
Cond. (µS/cm)	518													
Initials	KL													

(9)

LCLC0SLCC Concentration 100	Days Final													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.9												
pH		8.3												
Cond. (µS/cm)	597													
Initials	KL													

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials	~~KL~~													

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials	~~KL~~ KL													

Thermometer: Temp-3 DO meter: DO-1/3 pH meter: pH-1/3 Conductivity meter: C-1/3

	Control			
Hardness*				
Alkalinity*				

* mg/L as CaCO3

Analysts: KL
Reviewed by: JGL
Date reviewed: June 7/16

Sample Description:

Comments:

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 20/16 @ 1640h.
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration % (v/v)	Rep	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Total Dead Eggs/Embryos/ Alevins
Control	1	0	0	0	0	0	2	2	0	1	0	0	0	5
	2					0	1	1		1	0			3
	3					0	0	0		0	0			0
	4					1	0	1		1	0			3
100 FR-UFR1	1					1	2	2	1	1	0	1		8
	2					0	2	1	0	0	1	0		4
	3					1	1	1	0	0	1			4
	4				2	2	3	1	2	1	0			11
GH_ER2 100	1				0	0	0	0	0	0	0			0
	2					0	1	1						2
	3					0	0	0				1		1
	4					1	3 0	0				0		4
FR_FRCP1 100	1					0	0	2				0		2
	2					0	1	3				2		6
	3				2	0	0	1				0		3
	4				1	0	0 8	1				0		2
GH_FR1 100	1			0	0	5	2	1	6		1	0		15
	2			0	0	0	1	0	0		0	3		4
	3			0	0	1	0	2	2		0	0		5
	4			1	0	3	0	0	1		0			5
GH_ERC 100	1			0	0	0	2	1	1		3		1	8
	2					2	4	1	0		0		0	7
	3					2	0	2	0		0		1	5
	4					1	1	0	0	1	2	1	0	6
EV_HC1 100	1					1	4	1	1	0	0	0	0	7
	2				1	1	2	0	0		0		0	4
	3				0	1	1	1	0		0		0	3
	4				0	1	0	1	0		1		0	3
EV_MC2 100	1				0	0	2	1	0		0		1	4
	2				0	2	5	0	1				1	9
	3				0	1	4	0	0				0	5
	4				1	1	6	2	0			1	0	11
Tech Initials		KL	A	A	KL	KL	KL	KL	KL	AD	A	KL	MM	KL

Comments:

Reviewed by: JCH **Date reviewed:** June 7/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 20/16 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration % (v/v)	Rep	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Total Dead Eggs/Embryos/Alevins
MMC2 ~~Control~~ 4ML	1	0	0	0	2	3	4	1	0	0	0	0	0	10
100	2	↓	↓	↓	1	2	4	2	1	0	↓	1	↓	11
	3	↓	↓	↓	0	0	3	0	0	0	↓	0	↓	3
	4	↓	↓	↓	0	1	1	1	1	1	↓	↓	↓	5
100	1	↓	↓	↓	1	1	0	3	2	0	↓	↓	↓	7
LC_LCDSSLCC	2	↓	↓	↓	0	0	5	1	0	0	↓	↓	↓	6
	3	↓	↓	↓	0	1	3	1	0	0	↓	↓	1	~~8~~ 6
	4	↓	↓	↓	1	2	0	1	0	0	↓	↓	0	4
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		KC	A	A	KL	KL	KC	A	KC	A	A	KL	MW	KC

Comments:

Reviewed by: JCh **Date reviewed:** June 7/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1500h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		① 13	14	15	16	17	18	② 19	20	②③ 21	④ 22	23	24	
Control	1	0	0	1	0	0	0	1	0	0	0	0	0	2
	2	↓	↓	0	↓	↓	0	0	0	0	↓	1	↓	1
	3	↓	↓	0	↓	↓	1	0	0	0	↓	0	↓	1
	4	↓	↓	0	↓	↓	0	0	wp 1	0	↓	0	↓	1
FR_UFR1 100	1	1	0	0	↓	↓	0	0	1	0	1	0	↓	3
	2	0	0	0	↓	↓	0	1	0	0	0	0	↓	1
	3	↓	0	1	↓	↓	1	0	0	0	0	0	↓	2
	4	↓	1	0	↓	↓	0	0	1	0	0	1	1	4
GH_ER2 100	1	↓	0	↓	↓	↓	0	0	1	1	1	1	1	5
	2	↓	↓	↓	↓	↓	0	0	1	0	0	0	0	1
	3	0	↓	↓	↓	↓	0	0	0	0	1	0	0	2
	4	0	↓	↓	↓	↓	1	1	0	0	0	0	1	3
FR_FRCP1 100	1	0	↓	↓	↓	↓	0	1	1	6	2	0	0	10
	2	0	1	↓	↓	↓	2	4	0	0	0	↓	↓	7
	3	0	0	↓	↓	↓	2	2	0	0	0	↓	↓	4
	4	1	0	↓	↓	↓	0	0	0	1	2	↓	↓	4
GH_FR1 100	1	0	0	↓	↓	+	0	0	0	0	0	0	0	0
	2	2	1	↓	↓	2	1	0	0	0	1	↓	↓	7
	3	0	0	↓	↓	0	1	1	1	0	0	↓	↓	3
	4	1	0	1	↓	↓	1	0	0	3	0	↓	↓	5
GH_ERC 100	1	↓	0	0	—	↓	3	0	1	0	1	↓	↓	5
	2	↓	0	↓	1	↓	0	1	1	0	0	↓	↓	3
	3	↓	0	↓	0	↓	↓	1	1	1	0	↓	↓	3
	4	↓	2	↓	0	↓	↓	1	0	0	0	—	—	3
EV_HC1 100	1	↓	0	1	0	↓	↓	0	0	1	0	0	0	2
	2	↓	1	0	1	↓	↓	1	1	1	1	0	0	6
	3	↓	0	↓	0	↓	↓	0	4	1	0	1	0	6
	4	↓	1	↓	0	↓	1	0	0	0	1	0	0	3
EV_MC2 100	1	↓	0	↓	0	↓	2	3	0	0	1	0	1	7
	2	↓	1	↓	0	⊥	0	0	1	1	wp 3	0	0	6
	3	↓	0	↓	1	↑	3	0	1	1	0	0	0	7
	4	↓	0	↓	0	1	0	0	0	0	0	0	0	1
Tech Initials		KL	KL	KL	AT	AT	KL	KL	KL	KL	KL	AT	AT	KL

Comments: ① at eyed stage ③ KL >50% hatched in control ② start to hatch

Reviewed by: JOL
Date reviewed: June 7/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (Various)
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities ① 13	14	15	16	17	18	② 19	20	③ 21	22	23	24	Total Dead Eggs/Embryos/ Alevins
CM_MC2	1	0	0	0	1	0	0	0	1	0	3	0	0	5
100	2	0	0	|	0	|	|	|	1	1	0	0	0	2
	3	1	0	|	|	|	|	|	1	1	3	0	0	6
	4	0	1	|	|	|	↓	↓	2	0	1	1	0	5
LC-LCDSSLCC	1	1	0	|	|	|	1	1	0	0	1	1	1	5
100	2	0	1	|	|	|	0	0	0	0	2	0	|	3
	3	0	0	|	|	|	2	0	0	0	1	0	|	3
	4	0	0	↓	|	|	0	2	1	0	0	0	|	3
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		KL	KL	KL	A	A	KL	KL	KL	KL	KL	A	m	KL

Comments: ① at eyed stage KL ③ >50% hatched in control ② start to hatch

Reviewed by: JGL **Date reviewed:** June 7/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Embryos/ Alevins	Total Undeveloped/ Unhatched (Abnormal)	Total No. Alevins (Normal)	Total Exposed Eggs
		25	26	27	28							
Control	1	0	0	1	1				2	2	18	29
	2	↓	0	0	0				0	1	25	30
	3		2	1	0				3	2	24	30
	4		0	0	0				0	1	24	29
FR_UFR1 100	1		0	↓	0				0	0	19	30
	2		↓		0				0	3	22	30
	3				0				0	4	20	30
	4				0				0	1	14	30
GH_ER2 100	1				0				0	0	26	31
	2				0				0	5	22	30
	3				0				0	2	23	28
	4		↓		0				0	1	KL 3 21	29
FR_FRCP1 100	1		1		0				1	0	17	30
	2		1	↓	0				1	1	18	33
	3		0	1	0				1	2	20	30
	4		1	0	0				1	3	30	30
GH_FR1 100	1		0	↓	0				0	0	14	29
	2		0		0				0	3	16	30
	3		0		0				0	0	21	29
	4		0		0				0	1	19	30
~~EV_HCP1~~ GH_ERC 100	1		1		0				1	1	15	30
	2		0		0				0	2	19	31
	3		↓		0				0	2	19	29
	4				0				0	3	19	31
EV_HC1 100	1				0				0	2	19	30
	2				0				0	3	14	27
	3				0				0	2	18	29
	4		↓		0				0	2	22	30
EV_MC2 100	1		1		0				1	3	15	30
	2		0		0				0	1	15	31
	3		1	↓	0				1	1	17	31
	4	↓	1	1	0				2	1	15	30
Tech Initials		JW	KL	KL	KL				KL	KL	KL	KL

Comments:

Reviewed by: JW **Date reviewed:** June 7/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (various)
Work Order #: 16473

Start Date & Time: April 28, 2016 @ 1640h
Stop Date & Time: May 25/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities 25	26	27	28				Total Dead Embryos/ Alevins	Total Undeveloped/ Unhatched (Abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
CM-MC2	1	0	0	0	0				0	0	14	29
100	2	↓	↓	↓	0				0	1	17	~~30~~ 31
	3	↓	↓	↓	1				1	1	19	30
	4	↓	↓	↓	0				0	3	18	31
LC-LCDSSLCC	1	↓	1	↓	0				1	2	17	32
100	2	↓	0	↓	0				0	2	19	30
	3	↓	0	↓	0				0	3	18	30
	4	↓	0	↓	0				0	2	21	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		JW	KL	KL	KL				KL	KL	KL	KL

Comments:

Reviewed by: JDH

Date reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **Control**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
KL ~~100A~~ Ctrl	1	20.0	✓		
	2	19.0	✓		
	3	19.0	✓		
	4	18.0	✓		
	5	20.0	✓		
	6	18.0	✓		
	7	20.0	✓		
	8	21.0	✓		
	9	20.0	✓		
	10	20.0	✓		
	11	19.0	✓		
	12	19.0	✓		
	13	19.0	✓		
	14	18.0	✓		
	15	18.0	✓		
	16	18.0		✓	lordosis, deformed jaw
	17	20.0	✓		
	18	18.0	✓		
	19	19.5	✓		
	20	19.5		✓	lordosis
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 3.01 g

Number of survivors: 20

Number of deformed/have difficulty swimming: KL 2/2

Initials: KL/MC

Reviewed by: JGL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: Teck

Sample ID: Control

Work Order No.: 16473

Start Date: April 28, 2016

Termination Date: May 25, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
KL 100% Ctrl	1	19.0	✓		
	2	17.5	✓		
	3	19.0	✓		
	4	18.5	✓		
	5	19.5	✓		
	6	19.0	✓		
	7	19.5	✓		
	8	17.5	✓		
	9	18.5	✓		
	10	17.0	✓		
	11	18.5	✓		
	12	18.5	✓		
	13	20.0	✓		
	14	21.0	✓		
	15	17.5	✓		
	16	16.0	✓		
	17	19.5	✓		
	18	18.5	✓		
	19	18.5	✓		
	20	19.0	✓		
	21	19.0	✓		
	22	19.0	✓		
	23	18.5	✓		
	24	17.5	✓		
	25	18.0	✓		
	26	17.0		a ✗ ✓	eye deformity.
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.29 g

Number of survivors: 26

Number of deformed/have difficulty swimming: 1/0

Initials: KL/YUL

Reviewed by: [signature]

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **Control**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
KL ~~100~~ C Ctrl	1	19.5	✓		
	2	21.0	✓		
	3	19.5	✓		
	4	21.0	✓		
	5	20.0	✓		
	6	18.5	✓		
	7	21.5	✓		
	8	21.5	✓		
	9	20.0	✓		
	10	20.5	✓		
	11	18.5	✓		
	12	19.0	✓		
	13	19.5	✓		
	14	19.0	✓		
	15	20.0	✓		
	16	20.0	✓		
	17	19.0	✓		
	18	20.5	✓		
	19	21.5	✓		
	20	19.0	✓		
	21	19.0	✓		
	22	18.0	✓		
	23	20.5	✓		
	24	20.0	✓		
	25	21.0	~~✓~~ KL	X	lordosis
	26	14.0	~~✓~~ KL	X	lordosis, deformed eye, yolk sac edema, shortened tail fin
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.42 g

Number of survivors: 26

Number of deformed/have difficulty swimming: KL 2

Initials: KL/NML

Reviewed by: JCh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **Control**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
~~1000~~ ctrl	1	20.0	✓		
	2	20.0	✓		
	3	19.0	✓		
	4	20.5	✓		
	5	20.0	✓		
	6	19.0	✓		
	7	20.0	✓		
	8	18.0	✓		
	9	19.0		X	eye deforming
	10	20.5	✓		
	11	19.5	✓		
	12	19.0	✓		
	13	20.0	✓		
	14	20.5	✓		
	15	19.0	✓		
	16	18.0	✓		
	17	18.5	✓		
	18	16.5	✓		
	19	18.5 ~~18.5~~	✓		
	20	19.0	✓		
	21	19.5	✓		
	22	20.0	✓		
	23	19.0	✓		
	24	17.0	✓		
	25	19.0	✓		
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.42g

Number of survivors: 25

Number of deformed/have difficulty swimming: 1/0

Initials: KL/NuL

Reviewed by: JBL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **FR_UFR1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	21.0	✓		
	2	19.5	✓		
	3	20.0	✓		
	4	19.5	✓		
	5	21.0	✓		
	6	21.0	✓		
	7	19.0	✓		
	8	21.0	✓		
	9	21.0	✓		
	10	19.0	✓		
	11	19.0	✓		
	12	20.5	✓		
	13	20.0	✓		
	14	20.0	✓		
	15	19.5	✓		
	16	21.5	✓		
	17	20.5	✓		
	18	20.5	✓		
	19	20.0	✓		
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.81 g

Number of survivors: 19

Number of deformed/have difficulty swimming: 0

Initials: KL/NU

Reviewed by: JCh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **FR_UFR1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100%	1	21.0	✓		
	2	19.5	✓		
	3	20.5	✓		
	4	18.0	✓		
	5	22.0	✓		
	6	19.0	✓		
	7	22.0	✓		
	8	18.5	✓		
	9	19.5	✓		
	10	19.5	✓		
	11	21.0	✓		
	12	19.5	✓		
	13	20.5	✓		
	14	18.5	✓		
	15	19.0	✓		
	16	19.5	✓		
	17	20.0	✓		
	18	19.0	✓		
	19	18.0	✓		
	20	20.0	✓		
	21	20.0	✓		
	22	17.0	✓		
	23	18.0		X	deformed eye, shortened tail fin
	24	19.5		X	deformed eye and jaw
	25	15.0		X	lordosis
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.47 g

Number of survivors: 25

Number of deformed/have difficulty swimming: ~~0~~ 3 | 1

Initials: KL MW

Reviewed by: JM

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **FR_UFR1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100C	1	19.0	✓		
	2	21.0	✓		
	3	20.5	✓		
	4	21.5	✓		
	5	20.0	✓		
	6	21.0	✓		
	7	18.0	✓		
	8	19.5	✓		
	9	19.0	✓		
	10	22.0	✓		
	11	19.0	✓		
	12	20.0	✓		
	13	20.0	✓		
	14	19.0	✓		
	15	20.0	✓		
	16	19.5	✓		
	17	20.5	✓		
	18	18.0	✓		
	19	20.0	✓		
	20	19.5	✓		
	21	19.5		X	deformed eye and jaw
	22	17.0		X	lordosis
	23	16.0		X	lordosis, deformed jaw & shortened tail fin
	24	16.0		X	lordosis, deformed jaw
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.39 g

Number of survivors: 24

Number of deformed/have difficulty swimming: 4/3

Initials: KL MvL

Reviewed by: JGL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **FR_UFR1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100%D KL	1	19.5	✓		
	2	20.5	✓		
	3	20.5	✓		
	4	21.0	✓		
	5	21.0	✓		
	6	18.0	✓		
	7	20.5	✓		
	8	20.5	✓		
	9	19.5	✓		
	10	19.0	✓		
	11	20.0	✓		
	12	21.0	✓		
	13	19.5	✓		
	14	17.5	✓		
	15	18.0		X	deformed jaw.
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.45g

Number of survivors: 15

Number of deformed/have difficulty swimming: 1/0

Initials: KL/MC

Reviewed by: JCh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_ER2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100A	1	21.0	✓		
	2	22.0	✓		
	3	19.0	✓		
	4	21.0	✓		
	5	19.5	✓		
	6	21.0	✓		
	7	20.0	✓		
	8	20.5	✓		
	9	20.0	✓		
	10	22.0	✓		
	11	21.0	✓		
	12	20.0	✓		
	13	19.5	✓		
	14	20.0	✓		
	15	18.0	✓		
	16	20.0	✓		
	17	22.5	✓		
	18	18.0	✓		
	19	20.0	✓		
	20	20.0	✓		
	21	19.0	✓		
	22	18.0	✓		
	23	19.0	✓		
	24	20.0	✓		
	25	20.0	✓		
	26	19.0	✓		
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): ~~2.12g~~ ~~2.55g~~ 2.55g.

Number of survivors: 26

Number of deformed/have difficulty swimming: 0

Initials:

Reviewed by:

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_ER2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100B	1	20.5	~~X~~ ✓		
	2	21.5	✓		
	3	20.0	✓		
	4	20.5	✓		
	5	20.5	✓		
	6	19.0	✓		
	7	20.5	✓		
	8	23.0	✓		
	9	22.5	✓		
	10	19.0	✓		
	11	19.5	✓		
	12	19.5	✓		
	13	21.0	✓		
	14	20.5	✓		
	15	22.0	✓		
	16	19.5	✓		
	17	20.0	✓		
	18	20.0	✓		
	19	20.0	✓		
	20	18.5	✓		
	21	17.0		X	shortened tail fin
	22	19.0	✓		
	23	16.0	✓		
	24	18.0		X	deformed eyes and jaw, lordosis
	25	18.5		X	deformed eyes ~~and jaw~~ KE
	26	19.5		X	deformed eyes
	27	19.0		X	lordosis, deformed eyes
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.61 g

Number of survivors: 27

Number of deformed/have difficulty swimming: 5/2

Initials: KE/yuu

Reviewed by: JGh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_ER2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100C	1	22.0	✓		
	2	20.5	✓		
	3	21.0	✓		
	4	20.0	✓		
	5	19.0	✓		
	6	19.5	✓		
	7	18.5	✓		
	8	20.0	✓		
	9	20.0	✓		
	10	19.5	✓		
	11	18.0	✓		
	12	20.0	✓		
	13	19.0	✓		
	14	19.0	✓		
	15	19.0	✓		
	16	19.0	✓		
	17	22.0	✓		
	18	20.5	✓		
	19	19.0	✓		
	20	20.5	✓		
	21	21.0	✓		
	22	20.0	✓		
	23	20.5	✓		
	24	15.5		X	lordosis, deformed eyes
	25	20.5		X	deformed eyes
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2329 ~~25~~ KL

Number of survivors: 25

Number of deformed/have difficulty swimming: 2/1

Initials: KL/YYL

Reviewed by: JOL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_ER2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
1000	1	20.5	✓		
	2	21.0	✓		
	3	20.0	✓		
	4	21.0	✓		
	5	19.0	✓		
	6	19.5	✓		
	7	19.0	✓		
	8	20.5	✓		
	9	21.5	✓		
	10	19.0	✓		
	11	19.0	✓		
	12	19.5	✓		
	13	19.0	✓		
	14	20.5	✓		
	15	18.5	✓		
	16	20.0	✓		
	17	18.0	✓		
	18	19.5	✓		
	19	19.0	✓		
	20	18.0	✓		
	21	18.5	✓		
	22	18.0		×	Shortened tail fin
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.20 g

Number of survivors: 22

Number of deformed/have difficulty swimming: 1/0

Initials: KLMC

Reviewed by: JBL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **FR_FRCP1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
WOA	1	18.5	✓		
	2	19.0	✓		
	3	19.5	✓		
	4	19.0	✓		
	5	20.0	✓		
	6	18.5	✓		
	7	18.5	✓		
	8	20.0	✓		
	9	19.0	✓		
	10	19.5	✓		
	11	18.0	✓		
	12	21.0	✓		
	13	20.0	✓		
	14	21.5	✓		
	15	20.0	✓		
	16	16.5	✓		
	17	19.0	✓		
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.56 g

Number of survivors: 17

Number of deformed/have difficulty swimming: 0

Initials: KL/YML

Reviewed by: JGr

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **FR_FRCP1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100B	1	20.5	✓		
	2	19.0	✓		
	3	21.5	✓		
	4	19.5	✓		
	5	19.0	✓		
	6	19.0	✓		
	7	20.5	✓		
	8	18.0	✓		
	9	18.5	✓		
	10	19.0	✓		
	11	18.5	✓		
	12	19.5	✓		
	13	20.0	✓		
	14	19.0	✓		
	15	20.5	✓		
	16	18.0	✓		
	17	19.0	✓		
	18	18.0	✓		
	19	14.0		X	deformed eyes and jaw, lordosis.
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.899

Number of survivors: 19

Number of deformed/have difficulty swimming: 1/1

Initials: KL/MnL

Reviewed by: JOL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **FR_FRCP1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
10 OC	1	20.0	✓		
	2	16.5	✓		
	3	18.0	✓		
	4	18.5	✓		
	5	18.5	✓		
	6	19.0	✓		
	7	19.5	✓		
	8	19.0	✓		
	9	20.5	✓		
	10	19.5	✓		
	11	18.5	✓		
	12	19.5	✓		
	13	20.5	✓		
	14	18.5	✓		
	15	19.5	✓		
	16	17.5	✓		
	17	17.0	✓		
	18	17.5	✓		
	19	15.0	✓		
	20	19.5	✓		
	21	16.0		X	yolk sac edema
	22	16.0		X	yolk sac edema
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.06 g

Number of survivors: 22

Number of deformed/have difficulty swimming: 2/0

Initials: KL/MC

Reviewed by: JCh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **FR_FRCP1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100D	1	20.5	✓		
	2	20.5	✓		
	3	19.0	✓		
	4	20.5	✓		
	5	19.0	✓		
	6	21.0	✓		
	7	18.0	✓		
	8	19.0	✓		
	9	20.5	✓		
	10	19.5	✓		
	11	18.0	✓		
	12	18.0	✓		
	13	19.5	✓		
	14	19.0	✓		
	15	19.0	✓		
	16	18.0	✓		
	17	18.5	✓		
	18	19.5	✓		
	19	20.5	✓		
	20	18.0	✓		
	21	20.5		X	~~KL~~ deformed jaw & eyes
	22	20.5		X	deformed jaw & eyes
	23	18.0		X	lordosis, deformed eyes & jaw
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.349

Number of survivors: 23

Number of deformed/have difficulty swimming: 3/1

Initials: KL/MC

Reviewed by: JCL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 16473

Start Date: April 28, 2016
Termination Date: May 25, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100A	1	20.5	✓		
	2	19.0	✓		
	3	20.5	✓		
	4	20.0	✓		
	5	19.5	✓		
	6	20.0	✓		
	7	20.0	✓		
	8	20.0	✓		
	9	20.0	✓		
	10	21.0	✓		
	11	20.5	✓		
	12	21.0	✓		
	13	20.0	✓		
	14	20.5	✓		
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.43 g
Number of survivors: 14
Number of deformed/have difficulty swimming: 0
Initials: KC/MYC

Reviewed by: JBu

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_FR1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100B	1	20.5	✓		
	2	19.5	✓		
	3	20.0	✓		
	4	21.0	✓		
	5	21.0	✓		
	6	21.0	✓		
	7	19.5	✓		
	8	19.0	✓		
	9	21.0	✓		
	10	19.5	✓		
	11	17.0	✓		
	12	19.0	✓		
	13	20.5	✓		
	14	19.5	✓		
	15	20.5	✓		
	16	20.0	✓		
	17	19.0		X	deformed eyes & jaw
	18	19.5		X	deformed eyes
	19	17.0		X	shortened tail, deformed jaw
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.91 g

Number of survivors: 19

Number of deformed/have difficulty swimming: 3/10

Initials: RL/YL

Reviewed by: JOL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_FR1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100C	1	20.0	✓		
	2	20.0	✓		
	3	19.5	✓		
	4	18.5	✓		
	5	20.5	✓		
	6	21.0	✓		
	7	20.5	✓		
	8	21.0	✓		
	9	21.5	✓		
	10	20.5	✓		
	11	20.0	✓		
	12	19.0	✓		
	13	20.5	✓		
	14	18.0	✓		
	15	20.0	✓		
	16	21.0	✓		
	17	21.5	✓		
	18	21.5	✓		
	19	20.0	✓		
	20	19.0	✓		
	21	16.0	✓		
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.88g

Number of survivors: 21

Number of deformed/have difficulty swimming: 0

Initials: KL/MC

Reviewed by: JOL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_FR1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100D	1	20.5	✓		
	2	20.5	✓		
	3	19.0	✓		
	4	20.5	✓		
	5	20.0	✓		
	6	21.0	✓		
	7	20.0	✓		
	8	20.0	✓		
	9	18.0	✓		
	10	20.0	✓		
	11	20.0		X	deformed eye & jaw
	12	20.0	✓		
	13	19.5	✓		
	14	19.5	✓		
	15	20.0	✓		
	16	20.5	✓		
	17	20.0	✓		
	18	19.0	✓		
	19	20.0	✓		
	20	20.0	✓		
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.829

Number of survivors: 20

Number of deformed/have difficulty swimming: 1/0

Initials: KJML

Reviewed by: JGu

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_ERC**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100A	1	20.0	✓		
	2	18.0	✓		
	3	19.0	✓		
	4	20.5	✓		
	5	20.5	✓		
	6	19.5	✓		
	7	20.0	✓		
	8	21.5	✓		
	9	21.0	✓		
	10	20.5	✓		
	11	21.0	✓		
	12	20.5	✓		
	13	19.5	✓		
	14	19.5	✓		
	15	21.5	✓		
	16	19.5		x	shortened tail fin
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.47 g

Number of survivors: 16

Number of deformed/have difficulty swimming: 1/0

Initials: KL/YH

Reviewed by: JGn

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_ERC**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100B	1	19.0 ~~5~~	✓		
	2	19.0	✓		
	3	19.5	✓		
	4	21.0	✓		
	5	20.0	✓		
	6	21.5	✓		
	7	18.5	✓		
	8	21.0	✓		
	9	19.0	✓		
	10	20.0	✓		
	11	20.0	✓		
	12	20.5	✓		
	13	20.5	✓		
	14	20.0	✓		
	15	20.0	✓		
	16	18.0	✓		
	17	19.0	✓		
	18	20.0	✓		
	19	20.5	✓		
	20	18.0		X	deformed eyes and jaw
	21	15.0		X	shortened tail fin
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): ~~1.46~~ 2.16 g

Number of survivors: 21

Number of deformed/have difficulty swimming: 2/0

Initials: KL/YL

Reviewed by: JOL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: April 28, 2016

Sample ID: GH_ERC

Termination Date: May 25, 2016

Work Order No.: 16473

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100C	1	19.0	✓		
	2	19.0	✓		
	3	20.5	✓		
	4	21.0	✓		
	5	19.0	✓		
	6	16.0	✓		
	7	22.0	✓		
	8	20.0	✓		
	9	19.5	✓		
	10	19.0	✓		
	11	19.0	✓		
	12	19.0	✓		
	13	19.0	✓		
	14	19.5	✓		
	15	20.0	✓		
	16	19.0	✓		
	17	19.0	✓		
	18	18.0		X	scoliosis
	19	17.0		X	scoliosis, shortened tail fin
	20	17.0	✓		
	21	20.0	✓		
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2-20g

Number of survivors: 21

Number of deformed/have difficulty swimming: 2/2

Initials: KL/MM

Reviewed by: JCh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **GH_ERC**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
1000	1	20.0	✓		
	2	18.5	✓		
	3	18.0	✓		
	4	19.5	✓		
	5	19.5.	✓		
	6	20.0	✓		
	7	18.0	✓		
	8	19.0	✓		
	9	18.0	✓		
	10	19.0	✓		
	11	19.0	✓		
	12	20.0	✓		
	13	20.5	✓		
	14	20.0	✓		
	15	19.5.	✓		
	16	18.0	✓		
	17	20.0	✓		
	18	18.5	✓		
	19	18.5.	✓		
	20	19.0		X	deformed eyes & jaws
	21	19.5.		X	deformed eyes & jaw
	22	17.5		X	lordosis,
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.40 g

Number of survivors: 22

Number of deformed/have difficulty swimming: 3/1

Initials: KL/YYL

Reviewed by: JGh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: April 28, 2016

Sample ID: EV_HC1

Termination Date: May 25, 2016

Work Order No.: 16473

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100A	1	17.0	✓		
	2	22.5	✓		
	3	20.0	✓		
	4	19.5	✓		
	5	19.5	✓		
	6	19.5	✓		
	7	19.5	✓		
	8	21.0	✓		
	9	21.5	✓		
	10	19.0	✓		
	11	20.0	✓		
	12	20.0	✓		
	13	18.0	✓		
	14	19.5	✓		
	15	19.5	✓		
	16	18.0	✓		
	17	20.0	✓		
	18	18.0	✓		
	19	19.5	✓		
	20	16.0		X	lordosis, shortened tail fin and deformed jaw
	21	15.0		X	deformed eyes and jaw, shortened tail fin, pale colouration
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.269

Number of survivors: 21

Number of deformed/have difficulty swimming: 2/1

Initials: RJ/YM

Reviewed by: JOL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **EV_HC1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	20.5	✓		
	2	21.0	✓		
	3	20.5	✓		
	4	19.5	✓		
	5	20.5	✓		
	6	19.5	✓		
	7	19.0	✓		
	8	20.5	✓		
	9	20.5	✓		
	10	20.0	✓		
	11	20.5	✓		
	12	18.0	✓		
	13	20.5	✓		
	14	17.0		X	lordosis, shortened tail fin, deformed jaw
	15	20.5	✓		
	16	17.5		X	deformed eyes
	17	19.0		X	deformed jaw.
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 17 1.82g

Number of survivors: 17

Number of deformed/have difficulty swimming: 3/1

Initials: KL/YH

Reviewed by: JBL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: Teck

Sample ID: EV_HC1

Work Order No.: 16473

Start Date: April 28, 2016

Termination Date: May 25, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100C	1	21.5	✓		
	2	19.5	✓		
	3	20.0	✓		
	4	20.0	✓		
	5	19.0	✓		
	6	19.5	✓		
	7	21.0	✓		
	8	19.0	✓		
	9	20.5	✓		
	10	19.5	✓		
	11	20.0	✓		
	12	20.5	✓		
	13	20.5	✓		
	14	20.0	✓		
	15	19.5	✓		
	16	18.5	✓		
	17	KC ~~18.0~~ 17.5	✓		
	18	16.5	✓		
	19	19.0		X	deformed jaw and eyes
	20	18.0		X	KC ~~lordosis~~, growth on head
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.02g

Number of survivors: 20

Number of deformed/have difficulty swimming: 2 / ~~1~~ KC 0

Initials: KC / MM

Reviewed by: JGB

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **EV_HC1**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
1000	1	19.0	✓		
	2	19.5	✓		
	3	20.0	✓		
	4	19.5	✓		
	5	19.0	✓		
	6	20.5	✓		
	7	20.0	✓		
	8	20.5	✓		
	9	20.5	✓		
	10	19.5	✓		
	11	18.5	✓		
	12	20.0	✓		
	13	21.0	✓		
	14	20.0	✓		
	15	20.5	✓		
	16	20.0	✓		
	17	19.0	✓		
	18	20.0	✓		
	19	19.5	✓		
	20	19.0	✓		
	21	18.5	✓		
	22	19.0	✓		
	23	21.0		X	deformed eye
	24	17.5		X	yolk sac edema, lordosis,
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.50g

Number of survivors: 24

Number of deformed/have difficulty swimming: 2/1

Initials: KL/YM

Reviewed by: JGa

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **EV_MC2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100A	1	19.5	✓		
	2	20.5	✓		
	3	21.0	✓		
	4	21.0	✓		
	5	21.0	✓		
	6	20.0	✓		
	7	22.0	✓		
	8	20.0	✓		
	9	20.5	✓		
	10	17.0	✓		
	11	19.0	✓		
	12	21.0	✓		
	13	20.5	✓		
	14	20.0	✓		
	15	20.5	✓		
	16	17.5		X	yolk sac edema
	17	18.5		X	lordosis
	18	18.0		X	lordosis, deformed eye and jaw.
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.979

Number of survivors: 18

Number of deformed/have difficulty swimming: 3/2

Initials: KA/MM

Reviewed by: JOh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **EV_MC2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	19.0	✓		
	2	20.0	✓		
	3	19.5	✓		
	4	19.5	✓		
	5	19.5	✓		
	6	20.0	✓		
	7	20.5	✓		
	8	21.0	✓		
	9	20.0	✓		
	10	18.5	✓		
	11	19.5	✓		
	12	19.5	✓		
	13	20.5	✓		
	14	19.0	✓		
	15	~~19.5~~ RE 20.0	✓		
	16	16.5		X	yolk sac edema, shortened tail fin
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.45 g

Number of survivors: 16

Number of deformed/have difficulty swimming: 1/0

Initials: RE/MC

Reviewed by: JGL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **EV_MC2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100C	1	20-5	✓		
	2	20-5	✓		
	3	22-0	✓		
	4	21-0	✓		
	5	20-5	✓		
	6	18-5	✓		
	7	20-0	✓		
	8	20-5	✓		
	9	22-0	✓		
	10	20-0	✓		
	11	21-0	✓		
	12	20-0	✓		
	13	21-0	✓		
	14	20-0	✓		
	15	22-0	✓		
	16	20-0	✓		
	17	20-0	✓		
	18	19-0		X	yolk sac edema
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.91g

Number of survivors: ~~18~~ 18

Number of deformed/have difficulty swimming: 1/0

Initials: KL/YM

Reviewed by: JGu

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: Teck
Sample ID: EV_MC2
Work Order No.: 16473

Start Date: April 28, 2016
Termination Date: May 25, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
1000	1	21.5	✓		
	2	19.5	✓		
	3	22.0	✓		
	4	20.5	✓		
	5	22.5	✓		
	6	21.0	✓		
	7	21.5	✓		
	8	21.5	✓		
	9	20.5	✓		
	10	20.0	✓		
	11	19.5	✓		
	12	19.5	✓		
	13	20.0	✓		
	14	19.5	✓		
	15	22.5	✓		
	16	17.5		X	yolk sac ~~endama~~ edema
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.93 g
Number of survivors: 16
Number of deformed/have difficulty swimming: 1/0
Initials: KL/MUL

Reviewed by: JOu

Date Reviewed: June 7/16

Issued: July 17, 2006; Ver. 1.0

Nautilus Environmental

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **CM_MC2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	19.5	✓		
	2	21.0	✓		
	3	20.0 ~~21.0~~ EL	✓		
	4	20.0	✓		
	5	20.5	✓		
	6	19.5	✓		
	7	19.0	✓		
	8	19.0	✓		
	9	21.0	✓		
	10	~~20.0~~ 20.0	✓		
	11	20.0	✓		
	12	19.5	✓		
	13	19.5	✓		
	14	20.0	✓		
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.19 g

Number of survivors: 14

Number of deformed/have difficulty swimming: 0/0

Initials: KL/ML

Reviewed by: JOL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **CM_MC2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100%	1	19.0	✓		
	2	21.0	✓		
	3	21.5	✓		
	4	19.5	✓		
	5	19.5	✓		
	6	19.5	✓		
	7	19.5	✓		
	8	18.5	✓		
	9	19.3	✓		
	10	20.0	✓		
	11	18.0	✓		
	12	21.0	✓		
	13	22.0	✓		
	14	18.0	✓		
	15	18.0	✓		
	16	18.0	✓		
	17	18.0	✓		
	18	16.5		✓	Yolk ~~sac~~ sac edema
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.76 g

Number of survivors: 18

Number of deformed/have difficulty swimming: 1/0

Initials: KLMM

Reviewed by: JOL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **CM_MC2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	20.0	✓		
	2	20.0	✓		
	3	21.0	✓		
	4	20.5	✓		
	5	19.5	✓		
	6	19.5	✓		
	7	20.5	✓		
	8	19.0	✓		
	9	19.0	✓		
	10	19.5	✓		
	11	18.5	✓		
	12	18.0	✓		
	13	21.0	✓		
	14	17.5	✓		
	15	19.5	✓		
	16	21.0	✓		
	17	20.0	✓		
	18	17.5	✓		
	19	20.0	✓		
	20	15.0		~~ex~~ ✓	Yolk sac edema, ~~Scol~~ EL scoliosis
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.96 g

Number of survivors: 20

Number of deformed/have difficulty swimming: 1/1

Initials: KL/MC

Reviewed by: JGu

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **CM_MC2**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100%	1	19.0	✓		
	2	20.0	✓		
	3	20.5	✓		
	4	21.0	✓		
	5	20.0	✓		
	6	20.0	✓		
	7	19.0	✓		
	8	20.5	✓		
	9	20.5	✓		
	10	20.5	✓		
	11	20.0	✓		
	12	20.5	✓		
	13	19.0	✓		
	14	~~20~~ 21.5	✓		
	15	20.5	✓		
	16	18.0	✓		
	17	19.0	✓		
	18	18.0		EL * ✓	Deformed Jaw
	19	17.0	✓		
	20	20.5		✓	Lordosis
	21	17.0		✓	Lordosis
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.15 g

Number of survivors: 21

Number of deformed/have difficulty swimming: 3/2

Initials: KL MC

Reviewed by: JOL

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **LC_LCDSSLCC**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100A	1	18.0	✓		
	2	18.0	✓		
	3	21.0	✓		
	4	20.0	✓		
	5	~~22.0~~ 22.0	✓		
	6	20.0	✓		
	7	18.5	✓		
	8	19.5	✓		
	9	20.0	✓		
	10	20.0	✓		
	11	19.0	✓		
	12	19.5	✓		
	13	21.0	✓		
	14	20.0	✓		
	15	20.0	✓		
	16	19.0	✓		
	17	17.5	✓		
	18	18.0		✓	Yolk sac edema
	19	17.5		✓	Lordosis, facial Deformity
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.76 g

Number of survivors: 19

Number of deformed/have difficulty swimming: 2/1

Initials: KL/YYL

Reviewed by: JOh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **LC_LCDSSLCC**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100%	1	20.5	✓		
	2	21.0	✓		
	3	19.5	✓		
	4	20.5	✓		
	5	21.0	✓		
	6	19.5	✓		
	7	20.0	✓		
	8	19.5	✓		
	9	20.0	✓		
	10	20.0	✓		
	11	21.0	✓		
	12	21.0	✓		
	13	21.0	✓		
	14	21.0	✓		
	15	19.5	✓		
	16	20.5	✓		
	17	20.0	✓		
	18	20.0	✓		
	19	20.5	✓		
	20	20.5		✓	growth on head
	21	16.5		✓	facial ~~to~~ deformity, missing tail fin, lordosis
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.11 g

Number of survivors: 21

Number of deformed/have difficulty swimming: 2/1

Initials: KLMC

Reviewed by: JCh

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **LC_LCDSSLCC**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100C	1	21.0	✓		
	2	20.0	✓		
	3	18.5	✓		
	4	19.5	✓		
	5	19.5	✓		
	6	19.5	✓		
	7	19.0	✓		
	8	18.0	✓		
	9	19.0	✓		
	10	20.5	✓		
	11	21.5	✓		
	12	19.5	✓		
	13	19.5	✓		
	14	22.5	✓		
	15	20.5	✓		
	16	20.0	✓		
	17	20.0	✓		
	18	17.5	✓		
	19	19.0		✓	facial deformity
	20	19.5		✓	facial deformity
	21	20.0		✓	Lordosis
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.08 g

Number of survivors: 21

Number of deformed/have difficulty swimming: 3/1

Initials: KLMML

Reviewed by: JGH

Date Reviewed: June 7/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **April 28, 2016**

Sample ID: **LC_LCDSSLCC**

Termination Date: **May 25, 2016**

Work Order No.: **16473**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
1000	1	20.5	✓		
	2	21.5	✓		
	3	19.5	✓		
	4	20.0	✓		
	5	21.0	✓		
	6	19.0	✓		
	7	19.5	✓		
	8	~~20.1~~ 21.0	✓		
	9	20.5	✓		
	10	20.5	✓		
	11	20.5	✓		
	12	~~21.1~~ 21.0	✓		
	13	18.5	✓		
	14	19.0	✓		
	15	20.5	✓		
	16	22.0	✓		
	17	19.0	✓		
	18	18.5	✓		
	19	21.0	✓		
	20	19.0	✓		
	21	18.0		X	Yolk sac edema
	22	~~18.5~~ 20.5		X	shorten tail fin
	23	21.0	✓	X	
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.27g

Number of survivors: 23

Number of deformed/have difficulty swimming: 2/0

Initials: KL/YM

Reviewed by: JGL

Date Reviewed: June 7/16

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Batch ID:	05-5107-6371	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	17h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Proportion Normal Summary (Validity)

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	0.7704	0.6099	0.9309	0.6207	0.8333	0.05043	0.1009	13.09%	0.0%
FR_UFR1	4	0.625	0.4445	0.8055	0.4667	0.7333	0.05672	0.1134	18.15%	18.87%
GH_ER2	4	0.7794	0.6854	0.8734	0.7241	0.8387	0.02952	0.05905	7.58%	-1.17%
FR_FRCP1	4	0.6114	0.5088	0.7139	0.5455	0.6667	0.03222	0.06444	10.54%	20.64%
GH_FR1	4	0.5934	0.4227	0.7641	0.4828	0.7241	0.05365	0.1073	18.08%	22.98%
GH_ERC	4	0.5952	0.4893	0.7011	0.5	0.6552	0.03327	0.06655	11.18%	22.74%
EV_HC1	4	0.6265	0.4867	0.7663	0.5185	0.7333	0.04393	0.08785	14.02%	18.68%
EV_MC2	4	0.5081	0.4636	0.5525	0.4839	0.5484	0.01397	0.02794	5.5%	34.05%
CM_MC2	4	0.5613	0.4611	0.6615	0.4828	0.6333	0.03149	0.06298	11.22%	27.14%
LC LCDSSLCC	4	0.6161	0.5044	0.7279	0.5313	0.7	0.03511	0.07023	11.4%	20.02%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	0.8213	0.6816	0.9609	0.6897	0.8667	0.04388	0.08777	10.69%	0.0%
FR_UFR1	4	0.6917	0.4453	0.9381	0.5	0.8333	0.07743	0.1549	22.39%	15.78%
GH_ER2	4	0.8475	0.7436	0.9514	0.7586	0.9	0.03265	0.0653	7.7%	-3.2%
FR_FRCP1	4	0.6606	0.4948	0.8264	0.5667	0.7667	0.05209	0.1042	15.77%	19.56%
GH_FR1	4	0.6267	0.4628	0.7907	0.4828	0.7241	0.05152	0.103	16.44%	23.69%
GH_ERC	4	0.6611	0.522	0.8002	0.5333	0.7241	0.04371	0.08742	13.22%	19.5%
EV_HC1	4	0.7048	0.5924	0.8172	0.6296	0.8	0.03532	0.07063	10.02%	14.18%
EV_MC2	4	0.5575	0.495	0.6201	0.5161	0.6	0.01966	0.03932	7.05%	32.11%
CM_MC2	4	0.6019	0.4579	0.7458	0.4828	0.6774	0.04523	0.09045	15.03%	26.71%
LC LCDSSLCC	4	0.6901	0.5763	0.8039	0.5938	0.7667	0.03576	0.07151	10.36%	15.97%

Salmonid Embryo-Alevin Survival and Development Test **Nautilus Environmental**

Proportion Normal Detail (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.6207	0.8333	0.8	0.8276
FR_UFR1	0.6333	0.7333	0.6667	0.4667
GH_ER2	0.8387	0.7333	0.8214	0.7241
FR_FRCP1	0.5667	0.5455	0.6667	0.6667
GH_FR1	0.4828	0.5333	0.7241	0.6333
GH_ERC	0.5	0.6129	0.6552	0.6129
EV_HC1	0.6333	0.5185	0.6207	0.7333
EV_MC2	0.5	0.4839	0.5484	0.5
CM_MC2	0.4828	0.5484	0.6333	0.5806
LC LCDSSLCC	0.5313	0.6333	0.6	0.7

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.6897	0.8667	0.8667	0.8621
FR_UFR1	0.6333	0.8333	0.8	0.5
GH_ER2	0.8387	0.9	0.8929	0.7586
FR_FRCP1	0.5667	0.5758	0.7333	0.7667
GH_FR1	0.4828	0.6333	0.7241	0.6667
GH_ERC	0.5333	0.6774	0.7241	0.7097
EV_HC1	0.7	0.6296	0.6897	0.8
EV_MC2	0.6	0.5161	0.5806	0.5333
CM_MC2	0.4828	0.5806	0.6667	0.6774
LC LCDSSLCC	0.5938	0.7	0.7	0.7667

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	18/29	25/30	24/30	24/29
FR_UFR1	19/30	22/30	20/30	14/30
GH_ER2	26/31	22/30	23/28	21/29
FR_FRCP1	17/30	18/33	20/30	20/30
GH_FR1	14/29	16/30	21/29	19/30
GH_ERC	15/30	19/31	19/29	19/31
EV_HC1	19/30	14/27	18/29	22/30
EV_MC2	15/30	15/31	17/31	15/30
CM_MC2	14/29	17/31	19/30	18/31
LC LCDSSLCC	17/32	19/30	18/30	21/30

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	20/29	26/30	26/30	25/29
FR_UFR1	19/30	25/30	24/30	15/30
GH_ER2	26/31	27/30	25/28	22/29
FR_FRCP1	17/30	19/33	22/30	23/30
GH_FR1	14/29	19/30	21/29	20/30
GH_ERC	16/30	21/31	21/29	22/31
EV_HC1	21/30	17/27	20/29	24/30
EV_MC2	18/30	16/31	18/31	16/30
CM_MC2	14/29	18/31	20/30	21/31
LC LCDSSLCC	19/32	21/30	21/30	23/30

CETIS Analytical Report

Test Code: 16473a | 01-3601-2645

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	05-7191-9709	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 15:26	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	05-5107-6371	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	17h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.01393	0.0418	Exact	Significant Effect
Control		GH_ER2	1	1.0000	Exact	Non-Significant Effect
Control		FR_FRCP1	0.002907	0.0174	Exact	Significant Effect
Control		GH_FR1	0.000624	0.0044	Exact	Significant Effect
Control		GH_ERC	0.00342	0.0171	Exact	Significant Effect
Control		EV_HC1	0.02701	0.0540	Exact	Non-Significant Effect
Control		EV_MC2	7.323E-06	<0.0001	Exact	Significant Effect
Control		CM_MC2	0.0001471	0.0012	Exact	Significant Effect
Control		LC LCDSSLCC	0.01188	0.0475	Exact	Significant Effect

Samples FR_UFR1 + GH_ER2 are Site controls

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	97	21	118	0.822	0.178	0.0%
FR_UFR1		83	37	120	0.6917	0.3083	15.86%
GH_ER2		100	18	118	0.8475	0.1525	-3.09%
FR_FRCP1		81	42	123	0.6585	0.3415	19.89%
GH_FR1		74	44	118	0.6271	0.3729	23.71%
GH_ERC		80	41	121	0.6612	0.3388	19.57%
EV_HC1		82	34	116	0.7069	0.2931	14.01%
EV_MC2		68	54	122	0.5574	0.4426	32.2%
CM_MC2		73	48	121	0.6033	0.3967	26.61%
LC LCDSSLCC		84	38	122	0.6885	0.3115	16.24%

Analyst:_____ QA: June 13/16

Analysis ID: 05-7191-9709 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 10 Jun-16 15:26 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

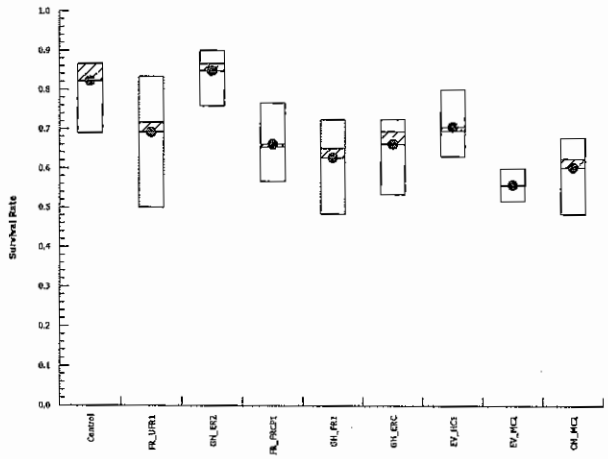
Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.6897	0.8667	0.8667	0.8621
FR_UFR1	0.6333	0.8333	0.8	0.5
GH_ER2	0.8387	0.9	0.8929	0.7586
FR_FRCP1	0.5667	0.5758	0.7333	0.7667
GH_FR1	0.4828	0.6333	0.7241	0.6667
GH_ERC	0.5333	0.6774	0.7241	0.7097
EV_HC1	0.7	0.6296	0.6897	0.8
EV_MC2	0.6	0.5161	0.5806	0.5333
CM_MC2	0.4828	0.5806	0.6667	0.6774
LC LCDSSLCC	0.5938	0.7	0.7	0.7667

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	20/29	26/30	26/30	25/29
FR_UFR1	19/30	25/30	24/30	15/30
GH_ER2	26/31	27/30	25/28	22/29
FR_FRCP1	17/30	19/33	22/30	23/30
GH_FR1	14/29	19/30	21/29	20/30
GH_ERC	16/30	21/31	21/29	22/31
EV_HC1	21/30	17/27	20/29	24/30
EV_MC2	18/30	16/31	18/31	16/30
CM_MC2	14/29	18/31	20/30	21/31
LC LCDSSLCC	19/32	21/30	21/30	23/30

Graphics



CETIS Analytical Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	05-8940-3631	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 15:27	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	05-5107-6371	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)	Teck Coal	
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		FR_FRCP1	0.3395	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.1804	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_ERC	0.3563	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_HC1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_MC2	0.02135	0.1708	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.09662	0.6763	Exact	Non-Significant Effect
FR_UFR1		LC LCDSSLCC	0.5344	1.0000	Exact	Non-Significant Effect

Samples FR_UFR1 + GH-ER2 are site controls

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	83	37	120	0.6917	0.3083	0.0%
GH_ER2		100	18	118	0.8475	0.1525	-22.52%
FR_FRCP1		81	42	123	0.6585	0.3415	4.79%
GH_FR1		74	44	118	0.6271	0.3729	9.33%
GH_ERC		80	41	121	0.6612	0.3388	4.41%
EV_HC1		82	34	116	0.7069	0.2931	-2.2%
EV_MC2		68	54	122	0.5574	0.4426	19.42%
CM_MC2		73	48	121	0.6033	0.3967	12.78%
LC LCDSSLCC		84	38	122	0.6885	0.3115	0.45%

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	05-8940-3631	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 15:27	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

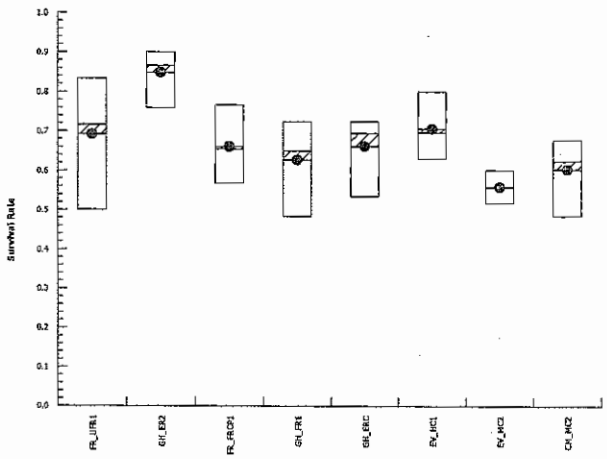
Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.6333	0.8333	0.8	0.5
GH_ER2	0.8387	0.9	0.8929	0.7586
FR_FRCP1	0.5667	0.5758	0.7333	0.7667
GH_FR1	0.4828	0.6333	0.7241	0.6667
GH_ERC	0.5333	0.6774	0.7241	0.7097
EV_HC1	0.7	0.6296	0.6897	0.8
EV_MC2	0.6	0.5161	0.5806	0.5333
CM_MC2	0.4828	0.5806	0.6667	0.6774
LC LCDSSLCC	0.5938	0.7	0.7	0.7667

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	19/30	25/30	24/30	15/30
GH_ER2	26/31	27/30	25/28	22/29
FR_FRCP1	17/30	19/33	22/30	23/30
GH_FR1	14/29	19/30	21/29	20/30
GH_ERC	16/30	21/31	21/29	22/31
EV_HC1	21/30	17/27	20/29	24/30
EV_MC2	18/30	16/31	18/31	16/30
CM_MC2	14/29	18/31	20/30	21/31
LC LCDSSLCC	19/32	21/30	21/30	23/30

Graphics



CETIS Analytical Report

Test Code: 16473a | 01-3601-2645

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	04-8789-4287	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Jun-16 10:21	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	05-5107-6371	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)	Teck Coal	
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
GH_ER2		FR_UFR1	0.003318	0.0066	Exact	Significant Effect
GH_ER2		FR_FRCP1	0.0005318	0.0027	Exact	Significant Effect
GH_ER2		GH_FR1	9.363E-05	0.0006	Exact	Significant Effect
GH_ER2		GH_ERC	0.0006453	0.0026	Exact	Significant Effect
GH_ER2		EV_HC1	0.007355	0.0074	Exact	Significant Effect
GH_ER2		EV_MC2	6.55E-07	<0.0001	Exact	Significant Effect
GH_ER2		CM_MC2	1.826E-05	0.0001	Exact	Significant Effect
GH_ER2		LC LCDSSLCC	0.002736	0.0082	Exact	Significant Effect

samples FR_UFR1 + GH_ER2 are site controls

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1		83	37	120	0.6917	0.3083	18.38%
GH_ER2	Receiving Wate	100	18	118	0.8475	0.1525	0.0%
FR_FRCP1		81	42	123	0.6585	0.3415	22.29%
GH_FR1		74	44	118	0.6271	0.3729	26.0%
GH_ERC		80	41	121	0.6612	0.3388	21.98%
EV_HC1		82	34	116	0.7069	0.2931	16.59%
EV_MC2		68	54	122	0.5574	0.4426	34.23%
CM_MC2		73	48	121	0.6033	0.3967	28.81%
LC LCDSSLCC		84	38	122	0.6885	0.3115	18.75%

Salmonid Embryo-Alevin Survival and Development Test | **Nautilus Environmental**

Analysis ID:	04-8789-4287	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Jun-16 10:21	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

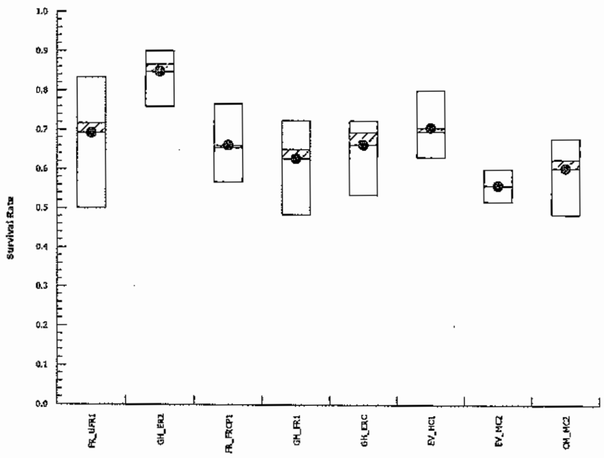
Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.6333	0.8333	0.8	0.5
GH_ER2	0.8387	0.9	0.8929	0.7586
FR_FRCP1	0.5667	0.5758	0.7333	0.7667
GH_FR1	0.4828	0.6333	0.7241	0.6667
GH_ERC	0.5333	0.6774	0.7241	0.7097
EV_HC1	0.7	0.6296	0.6897	0.8
EV_MC2	0.6	0.5161	0.5806	0.5333
CM_MC2	0.4828	0.5806	0.6667	0.6774
LC LCDSSLCC	0.5938	0.7	0.7	0.7667

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	19/30	25/30	24/30	15/30
GH_ER2	26/31	27/30	25/28	22/29
FR_FRCP1	17/30	19/33	22/30	23/30
GH_FR1	14/29	19/30	21/29	20/30
GH_ERC	16/30	21/31	21/29	22/31
EV_HC1	21/30	17/27	20/29	24/30
EV_MC2	18/30	16/31	18/31	16/30
CM_MC2	14/29	18/31	20/30	21/31
LC LCDSSLCC	19/32	21/30	21/30	23/30

Graphics



CETIS Analytical Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	10-8752-8422	**Endpoint:**	Proportion Normal (Mability)	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 15:26	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	05-5107-6371	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	17h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.01016	0.0305	Exact	Significant Effect
Control		GH_ER2	1	1.0000	Exact	Non-Significant Effect
Control		FR_FRCP1	0.00498	0.0249	Exact	Significant Effect
Control		GH_FR1	0.002499	0.0175	Exact	Significant Effect
Control		GH_ERC	0.00258	0.0155	Exact	Significant Effect
Control		EV_HC1	0.01281	0.0256	Exact	Significant Effect
Control		EV_MC2	1.755E-05	0.0002	Exact	Significant Effect
Control		CM_MC2	0.0004686	0.0037	Exact	Significant Effect
Control		LC LCDSSLCC	0.006334	0.0253	Exact	Significant Effect

Samples FR_UFR1 + GH_ER2 are site controls

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	91	27	118	0.7712	0.2288	0.0%
FR_UFR1		75	45	120	0.625	0.375	18.96%
GH_ER2		92	26	118	0.7797	0.2203	-1.1%
FR_FRCP1		75	48	123	0.6098	0.3902	20.93%
GH_FR1		70	48	118	0.5932	0.4068	23.08%
GH_ERC		72	49	121	0.595	0.405	22.84%
EV_HC1		73	43	116	0.6293	0.3707	18.4%
EV_MC2		62	60	122	0.5082	0.4918	34.1%
CM_MC2		68	53	121	0.562	0.438	27.13%
LC LCDSSLCC		75	47	122	0.6148	0.3852	20.28%

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	10-8752-8422	**Endpoint:**	Proportion Normal (viability)	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 15:26	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

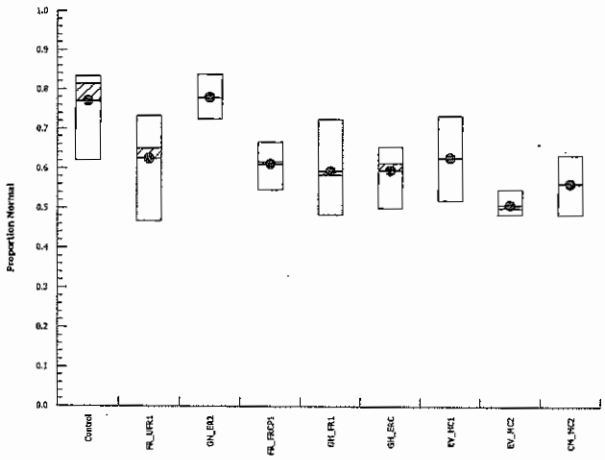
Proportion Normal Detail (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.6207	0.8333	0.8	0.8276
FR_UFR1	0.6333	0.7333	0.6667	0.4667
GH_ER2	0.8387	0.7333	0.8214	0.7241
FR_FRCP1	0.5667	0.5455	0.6667	0.6667
GH_FR1	0.4828	0.5333	0.7241	0.6333
GH_ERC	0.5	0.6129	0.6552	0.6129
EV_HC1	0.6333	0.5185	0.6207	0.7333
EV_MC2	0.5	0.4839	0.5484	0.5
CM_MC2	0.4828	0.5484	0.6333	0.5806
LC LCDSSLCC	0.5313	0.6333	0.6	0.7

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	18/29	25/30	24/30	24/29
FR_UFR1	19/30	22/30	20/30	14/30
GH_ER2	26/31	22/30	23/28	21/29
FR_FRCP1	17/30	18/33	20/30	20/30
GH_FR1	14/29	16/30	21/29	19/30
GH_ERC	15/30	19/31	19/29	19/31
EV_HC1	19/30	14/27	18/29	22/30
EV_MC2	15/30	15/31	17/31	15/30
CM_MC2	14/29	17/31	19/30	18/31
LC LCDSSLCC	17/32	19/30	18/30	21/30

Graphics



CETIS Analytical Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	06-8908-4852	**Endpoint:**	Proportion Normal (viability)	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 15:27	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	05-5107-6371	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)	Teck Coal	
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		FR_FRCP1	0.4553	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.3559	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_ERC	0.3652	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_HC1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_MC2	0.04413	0.3531	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.1936	1.0000	Exact	Non-Significant Effect
FR_UFR1		LC LCDSSLCC	0.4874	1.0000	Exact	Non-Significant Effect

Samples FR_UFR1 + GH_ER2 are site controls

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	75	45	120	0.625	0.375	0.0%
GH_ER2		92	26	118	0.7797	0.2203	-24.75%
FR_FRCP1		75	48	123	0.6098	0.3902	2.44%
GH_FR1		70	48	118	0.5932	0.4068	5.09%
GH_ERC		72	49	121	0.595	0.405	4.79%
EV_HC1		73	43	116	0.6293	0.3707	-0.69%
EV_MC2		62	60	122	0.5082	0.4918	18.69%
CM_MC2		68	53	121	0.562	0.438	10.08%
LC LCDSSLCC		75	47	122	0.6148	0.3852	1.64%

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	06-8908-4852	**Endpoint:**	Proportion Normal (viability)	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jun-16 15:27	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

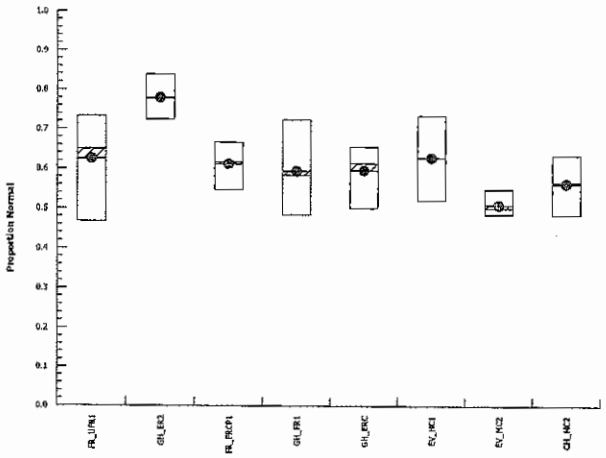
Proportion Normal Detail (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.6333	0.7333	0.6667	0.4667
GH_ER2	0.8387	0.7333	0.8214	0.7241
FR_FRCP1	0.5667	0.5455	0.6667	0.6667
GH_FR1	0.4828	0.5333	0.7241	0.6333
GH_ERC	0.5	0.6129	0.6552	0.6129
EV_HC1	0.6333	0.5185	0.6207	0.7333
EV_MC2	0.5	0.4839	0.5484	0.5
CM_MC2	0.4828	0.5484	0.6333	0.5806
LC LCDSSLCC	0.5313	0.6333	0.6	0.7

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	19/30	22/30	20/30	14/30
GH_ER2	26/31	22/30	23/28	21/29
FR_FRCP1	17/30	18/33	20/30	20/30
GH_FR1	14/29	16/30	21/29	19/30
GH_ERC	15/30	19/31	19/29	19/31
EV_HC1	19/30	14/27	18/29	22/30
EV_MC2	15/30	15/31	17/31	15/30
CM_MC2	14/29	17/31	19/30	18/31
LC LCDSSLCC	17/32	19/30	18/30	21/30

Graphics



CETIS Analytical Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	11-4977-8653	**Endpoint:**	Proportion Normal (Hatch%)	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Jun-16 10:22	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	05-5107-6371	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)	Teck Coal	
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
GH_ER2		FR_UFR1	0.006671	0.0133	Exact	Significant Effect
GH_ER2		FR_FRCP1	0.00315	0.0126	Exact	Significant Effect
GH_ER2		GH_FR1	0.001538	0.0092	Exact	Significant Effect
GH_ER2		GH_ERC	0.001586	0.0079	Exact	Significant Effect
GH_ER2		EV_HC1	0.008542	0.0085	Exact	Significant Effect
GH_ER2		EV_MC2	8.952E-06	<0.0001	Exact	Significant Effect
GH_ER2		CM_MC2	0.0002683	0.0019	Exact	Significant Effect
GH_ER2		LC LCDSSLCC	0.004057	0.0122	Exact	Significant Effect

samples FR_UFR1 + GH_ER2 are the controls

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1		75	45	120	0.625	0.375	19.84%
GH_ER2	Receiving Wate	92	26	118	0.7797	0.2203	0.0%
FR_FRCP1		75	48	123	0.6098	0.3902	21.79%
GH_FR1		70	48	118	0.5932	0.4068	23.91%
GH_ERC		72	49	121	0.595	0.405	23.68%
EV_HC1		73	43	116	0.6293	0.3707	19.28%
EV_MC2		62	60	122	0.5082	0.4918	34.82%
CM_MC2		68	53	121	0.562	0.438	27.92%
LC LCDSSLCC		75	47	122	0.6148	0.3852	21.15%

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	11-4977-8653	**Endpoint:**	Proportion Normal (viability)	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Jun-16 10:22	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

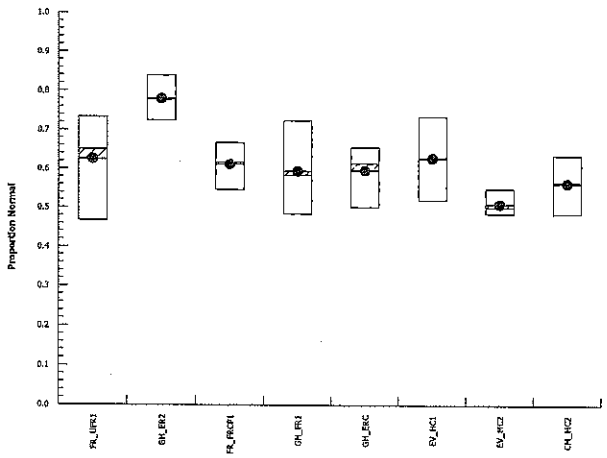
Proportion Normal Detail (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.6333	0.7333	0.6667	0.4667
GH_ER2	0.8387	0.7333	0.8214	0.7241
FR_FRCP1	0.5667	0.5455	0.6667	0.6667
GH_FR1	0.4828	0.5333	0.7241	0.6333
GH_ERC	0.5	0.6129	0.6552	0.6129
EV_HC1	0.6333	0.5185	0.6207	0.7333
EV_MC2	0.5	0.4839	0.5484	0.5
CM_MC2	0.4828	0.5484	0.6333	0.5806
LC LCDSSLCC	0.5313	0.6333	0.6	0.7

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	19/30	22/30	20/30	14/30
GH_ER2	26/31	22/30	23/28	21/29
FR_FRCP1	17/30	18/33	20/30	20/30
GH_FR1	14/29	16/30	21/29	19/30
GH_ERC	15/30	19/31	19/29	19/31
EV_HC1	19/30	14/27	18/29	22/30
EV_MC2	15/30	15/31	17/31	15/30
CM_MC2	14/29	17/31	19/30	18/31
LC LCDSSLCC	17/32	19/30	18/30	21/30

Graphics



Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Batch ID:	19-0744-9008	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	17h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	19.12	18.36	19.88	18.5	19.67	0.2397	0.4794	2.51%	0.0%
FR_UFR1	4	19.67	19.06	20.27	19.36	20.18	0.1899	0.3798	1.93%	-2.86%
GH_ER2	4	19.75	19.41	20.1	19.48	20	0.1072	0.2144	1.09%	-3.32%
FR_FRCP1	4	18.99	18.28	19.69	18.36	19.33	0.2209	0.4418	2.33%	0.69%
GH_FR1	4	19.93	19.61	20.26	19.68	20.18	0.1034	0.2068	1.04%	-4.26%
GH_ERC	4	19.47	18.69	20.25	19.07	20.13	0.2457	0.4914	2.52%	-1.82%
EV_HC1	4	19.49	19.12	19.87	19.17	19.68	0.1169	0.2339	1.2%	-1.96%
EV_MC2	4	20.11	19.32	20.89	19.53	20.56	0.2468	0.4936	2.46%	-5.15%
CM_MC2	4	19.53	19.08	19.98	19.28	19.89	0.1415	0.283	1.45%	-2.14%
LC LCDSSLCC	4	19.83	19.28	20.38	19.39	20.14	0.1736	0.3472	1.75%	-3.7%

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	94.61	86.17	103.1	88.08	100.5	2.654	5.308	5.61%	0.0%
FR_UFR1	4	97.58	94.44	100.7	95.26	99.58	0.9876	1.975	2.02%	-3.13%
GH_ER2	4	97.11	91.75	102.5	92.8	100.9	1.687	3.373	3.47%	-2.64%
FR_FRCP1	4	96.65	89.14	104.2	91.76	101.7	2.36	4.719	4.88%	-2.16%
GH_FR1	4	95.8	85.53	106.1	89.52	102.1	3.227	6.455	6.74%	-1.25%
GH_ERC	4	102.1	90.49	113.8	91.88	109.1	3.664	7.327	7.17%	-7.96%
EV_HC1	4	105	100.1	109.8	101	107.6	1.522	3.043	2.9%	-10.94%
EV_MC2	4	106.7	86.99	126.4	90.63	120.6	6.193	12.39	11.61%	-12.78%
CM_MC2	4	95.79	83.86	107.7	85	102.4	3.749	7.499	7.83%	-1.24%
LC LCDSSLCC	4	97.71	92.19	103.2	92.63	100.5	1.737	3.474	3.56%	-3.28%

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test **Nautilus Environmental**

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	19.15	18.5	19.67	19.16
FR_UFR1	20.18	19.36	19.4	19.73
GH_ER2	20	19.8	19.74	19.48
FR_FRCP1	19.26	19	18.36	19.33
GH_FR1	20.18	19.68	19.98	19.9
GH_ERC	20.13	19.55	19.12	19.07
EV_HC1	19.17	19.68	19.48	19.65
EV_MC2	19.86	19.53	20.47	20.56
CM_MC2	19.89	19.28	19.33	19.62
LC LCDSSLCC	19.39	20.14	19.71	20.07

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	100.5	88.08	93.08	96.8
FR_UFR1	95.26	98.8	99.58	96.67
GH_ER2	98.08	96.67	92.8	100.9
FR_FRCP1	91.76	99.47	93.64	101.7
GH_FR1	102.1	100.5	89.52	91
GH_ERC	91.88	102.9	104.8	109.1
EV_HC1	107.6	107.1	101	104.2
EV_MC2	109.4	90.63	106.1	120.6
CM_MC2	85	97.78	98	102.4
LC LCDSSLCC	92.63	100.5	99.05	98.7

CETIS Analytical Report

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	16-7888-8340	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 Jun-16 14:55	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	19-0744-9008	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	17h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	3.51%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	-2.071	2.537	0.671	6	0.9999	CDF	Non-Significant Effect
		GH_ER2	-2.401	2.537	0.671	6	1.0000	CDF	Non-Significant Effect
		FR_FRCP1	0.5011	2.537	0.671	6	0.7472	CDF	Non-Significant Effect
		GH_FR1	-3.082	2.537	0.671	6	1.0000	CDF	Non-Significant Effect
		GH_ERC	-1.314	2.537	0.671	6	0.9978	CDF	Non-Significant Effect
		EV_HC1	-1.418	2.537	0.671	6	0.9985	CDF	Non-Significant Effect
		EV_MC2	-3.725	2.537	0.671	6	1.0000	CDF	Non-Significant Effect
		CM_MC2	-1.551	2.537	0.671	6	0.9991	CDF	Non-Significant Effect
		LC LCDSSLCC	-2.676	2.537	0.671	6	1.0000	CDF	Non-Significant Effect

Samples FR_UFR1 + GH_ER2 ave SR controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	4.341658	0.4824064	9	3.45	0.0050	Significant Effect
Error	4.195096	0.1398365	30			
Total	8.536754		39			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	5.291	21.67	0.8082	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9792	0.9236	0.6608	Normal Distribution

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test **Nautilus Environmental**

Analysis ID: 16-7888-8340 **Endpoint:** Length-mm **CETIS Version:** CETISv1.8.7
Analyzed: 09 Jun-16 14:55 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

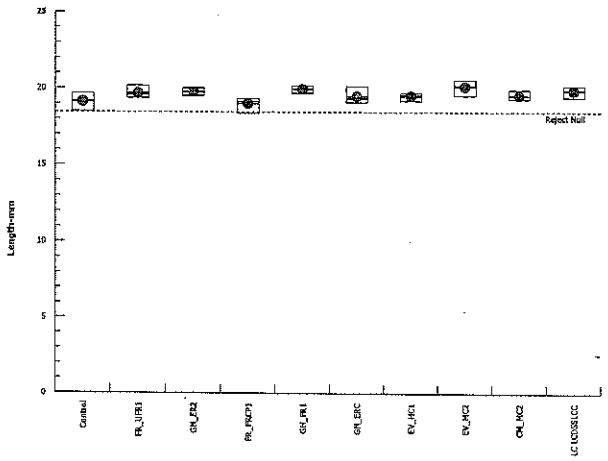
Length-mm Summary

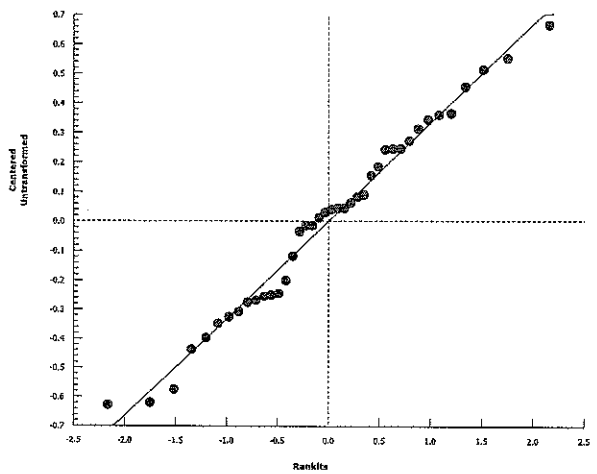
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	19.12	18.36	19.88	19.15	18.5	19.67	0.2397	2.51%	0.0%
FR_UFR1	4	19.67	19.06	20.27	19.56	19.36	20.18	0.1899	1.93%	-2.86%
GH_ER2	4	19.75	19.41	20.1	19.77	19.48	20	0.1072	1.09%	-3.32%
FR_FRCP1	4	18.99	18.28	19.69	19.13	18.36	19.33	0.2209	2.33%	0.69%
GH_FR1	4	19.93	19.61	20.26	19.94	19.68	20.18	0.1034	1.04%	-4.26%
GH_ERC	4	19.47	18.69	20.25	19.33	19.07	20.13	0.2457	2.52%	-1.82%
EV_HC1	4	19.49	19.12	19.87	19.56	19.17	19.68	0.1169	1.2%	-1.96%
EV_MC2	4	20.11	19.32	20.89	20.17	19.53	20.56	0.2468	2.46%	-5.15%
CM_MC2	4	19.53	19.08	19.98	19.48	19.28	19.89	0.1415	1.45%	-2.14%
LC LCDSSLCC	4	19.83	19.27	20.38	19.89	19.39	20.14	0.1736	1.75%	-3.7%

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	19.15	18.5	19.67	19.16
FR_UFR1	20.18	19.36	19.4	19.73
GH_ER2	20	19.8	19.74	19.48
FR_FRCP1	19.26	19	18.36	19.33
GH_FR1	20.18	19.68	19.98	19.9
GH_ERC	20.13	19.55	19.12	19.07
EV_HC1	19.17	19.68	19.48	19.65
EV_MC2	19.86	19.53	20.47	20.56
CM_MC2	19.89	19.28	19.33	19.62
LC LCDSSLCC	19.39	20.14	19.71	20.07

Graphics





CETIS Analytical Report

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	05-3851-0886	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 Jun-16 14:55	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	19-0744-9008	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)	Teck Coal	
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	3.25%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	-0.3434	2.511	0.64	6	0.9493	CDF	Non-Significant Effect
		FR_FRCP1	2.669	2.511	0.64	6	0.0360	CDF	Significant Effect
		GH_FR1	-1.05	2.511	0.64	6	0.9933	CDF	Non-Significant Effect
		GH_ERC	0.7849	2.511	0.64	6	0.6052	CDF	Non-Significant Effect
		EV_HC1	0.677	2.511	0.64	6	0.6541	CDF	Non-Significant Effect
		EV_MC2	-1.717	2.511	0.64	6	0.9993	CDF	Non-Significant Effect
		CM_MC2	0.5396	2.511	0.64	6	0.7132	CDF	Non-Significant Effect
		LC LCDSSLCC	-0.628	2.511	0.64	6	0.9761	CDF	Non-Significant Effect

Samples FR_UFR1 to GH_ER2 are sig control

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3.364053	0.4205067	8	3.239	0.0103	Significant Effect
Error	3.505696	0.1298406	27			
Total	6.869749		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.829	20.09	0.7756	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.981	0.9166	0.7774	Normal Distribution

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	05-3851-0886	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 Jun-16 14:55	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

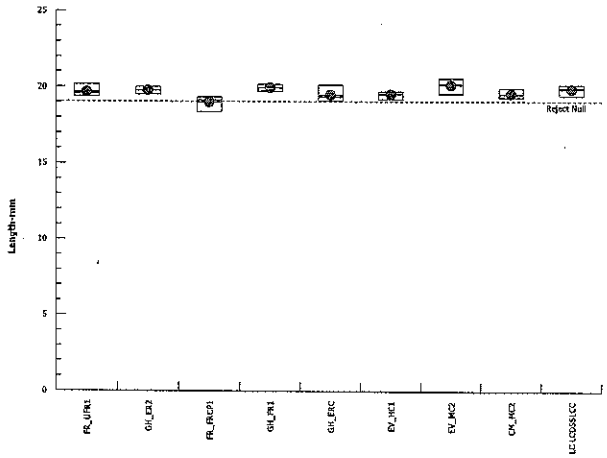
Length-mm Summary

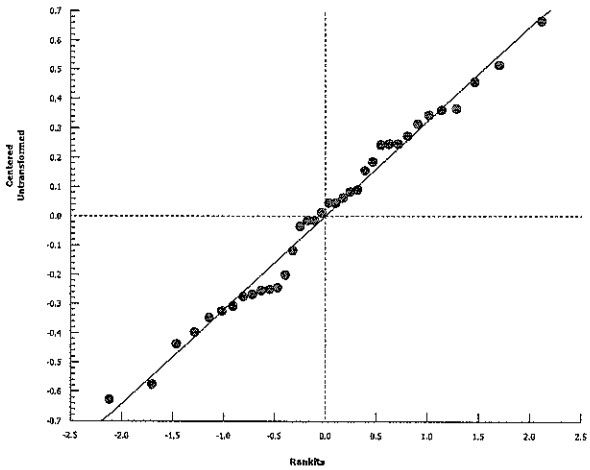
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	19.67	19.06	20.27	19.56	19.36	20.18	0.1899	1.93%	0.0%
GH_ER2	4	19.75	19.41	20.1	19.77	19.48	20	0.1072	1.09%	-0.44%
FR_FRCP1	4	18.99	18.28	19.69	19.13	18.36	19.33	0.2209	2.33%	3.46%
GH_FR1	4	19.93	19.61	20.26	19.94	19.68	20.18	0.1034	1.04%	-1.36%
GH_ERC	4	19.47	18.69	20.25	19.33	19.07	20.13	0.2457	2.52%	1.02%
EV_HC1	4	19.49	19.12	19.87	19.56	19.17	19.68	0.1169	1.2%	0.88%
EV_MC2	4	20.11	19.32	20.89	20.17	19.53	20.56	0.2468	2.46%	-2.22%
CM_MC2	4	19.53	19.08	19.98	19.48	19.28	19.89	0.1415	1.45%	0.7%
LC LCDSSLCC	4	19.83	19.27	20.38	19.89	19.39	20.14	0.1736	1.75%	-0.81%

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	20.18	19.36	19.4	19.73
GH_ER2	20	19.8	19.74	19.48
FR_FRCP1	19.26	19	18.36	19.33
GH_FR1	20.18	19.68	19.98	19.9
GH_ERC	20.13	19.55	19.12	19.07
EV_HC1	19.17	19.68	19.48	19.65
EV_MC2	19.86	19.53	20.47	20.56
CM_MC2	19.89	19.28	19.33	19.62
LC LCDSSLCC	19.39	20.14	19.71	20.07

Graphics





CETIS Analytical Report

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	10-3187-2157	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Jun-16 10:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	19-0744-9008	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)	Teck Coal	
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	3.24%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
GH_ER2		FR_UFR1	0.3434	2.511	0.64	6	0.7885	CDF	Non-Significant Effect
		FR_FRCP1	3.012	2.511	0.64	6	0.0168	CDF	Significant Effect
		GH_FR1	-0.7065	2.511	0.64	6	0.9809	CDF	Non-Significant Effect
		GH_ERC	1.128	2.511	0.64	6	0.4441	CDF	Non-Significant Effect
		EV_HC1	1.02	2.511	0.64	6	0.4946	CDF	Non-Significant Effect
		EV_MC2	-1.374	2.511	0.64	6	0.9977	CDF	Non-Significant Effect
		CM_MC2	0.8831	2.511	0.64	6	0.5594	CDF	Non-Significant Effect
		LC LCDSSLCC	-0.2845	2.511	0.64	6	0.9414	CDF	Non-Significant Effect

Re ~~Samples~~ Samples FR_UFR1 & GH-ER2 are site controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3.364053	0.4205067	8	3.239	0.0103	Significant Effect
Error	3.505696	0.1298406	27			
Total	6.869749		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.829	20.09	0.7756	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.981	0.9166	0.7774	Normal Distribution

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	10-3187-2157	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Jun-16 10:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

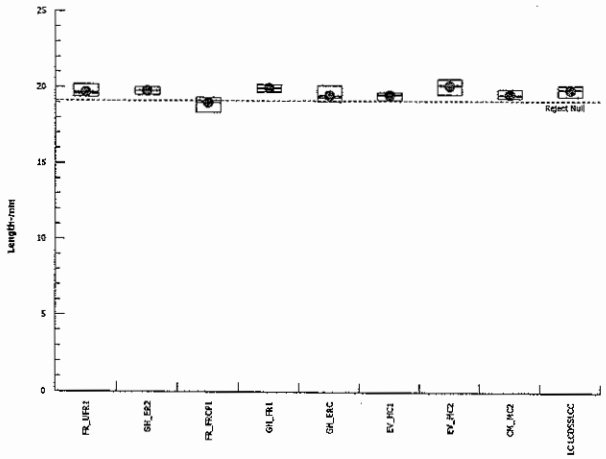
Length-mm Summary

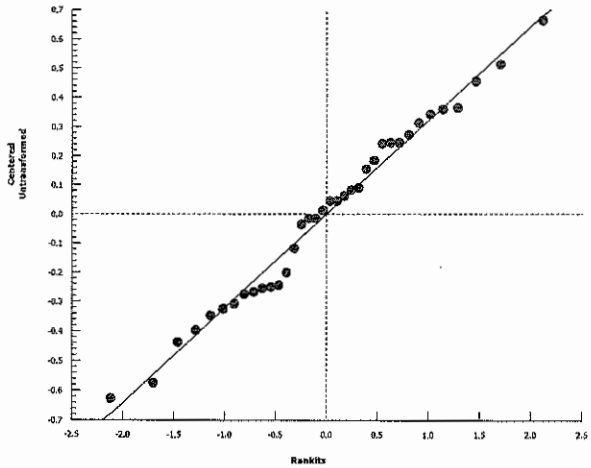
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	19.67	19.06	20.27	19.56	19.36	20.18	0.1899	1.93%	0.0%
GH_ER2	4	19.75	19.41	20.1	19.77	19.48	20	0.1072	1.09%	-0.44%
FR_FRCP1	4	18.99	18.28	19.69	19.13	18.36	19.33	0.2209	2.33%	3.46%
GH_FR1	4	19.93	19.61	20.26	19.94	19.68	20.18	0.1034	1.04%	-1.36%
GH_ERC	4	19.47	18.69	20.25	19.33	19.07	20.13	0.2457	2.52%	1.02%
EV_HC1	4	19.49	19.12	19.87	19.56	19.17	19.68	0.1169	1.2%	0.88%
EV_MC2	4	20.11	19.32	20.89	20.17	19.53	20.56	0.2468	2.46%	-2.22%
CM_MC2	4	19.53	19.08	19.98	19.48	19.28	19.89	0.1415	1.45%	0.7%
LC LCDSSLCC	4	19.83	19.27	20.38	19.89	19.39	20.14	0.1736	1.75%	-0.81%

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	20.18	19.36	19.4	19.73
GH_ER2	20	19.8	19.74	19.48
FR_FRCP1	19.26	19	18.36	19.33
GH_FR1	20.18	19.68	19.98	19.9
GH_ERC	20.13	19.55	19.12	19.07
EV_HC1	19.17	19.68	19.48	19.65
EV_MC2	19.86	19.53	20.47	20.56
CM_MC2	19.89	19.28	19.33	19.62
LC LCDSSLCC	19.39	20.14	19.71	20.07

Graphics





CETIS Analytical Report

Salmonid Embryo-Alevin-~~Fry~~ Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	06-3248-9835	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 Jun-16 14:55	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	19-0744-9008	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7021-7132	28 Apr-16	28 Apr-16	17h	Teck Coal	
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)		
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	11.9%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	-0.6696	2.537	11.23	6	0.9820	CDF	Non-Significant Effect
		GH_ER2	-0.5646	2.537	11.23	6	0.9756	CDF	Non-Significant Effect
		FR_FRCP1	-0.4608	2.537	11.23	6	0.9675	CDF	Non-Significant Effect
		GH_FR1	-0.2676	2.537	11.23	6	0.9463	CDF	Non-Significant Effect
		GH_ERC	-1.701	2.537	11.23	6	0.9995	CDF	Non-Significant Effect
		EV_HC1	-2.337	2.537	11.23	6	1.0000	CDF	Non-Significant Effect
		EV_MC2	-2.73	2.537	11.23	6	1.0000	CDF	Non-Significant Effect
		CM_MC2	-0.2657	2.537	11.23	6	0.9460	CDF	Non-Significant Effect
		LC LCDSSLCC	-0.7	2.537	11.23	6	0.9836	CDF	Non-Significant Effect

samples FR_UFR1 talt_ER are site contro

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	628.8084	69.8676	9	1.782	0.1136	Non-Significant Effect
Error	1176.138	39.20461	30			
Total	1804.947		39			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	13.26	21.67	0.1511	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9566	0.9236	0.1283	Normal Distribution

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	06-3248-9835	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 Jun-16 14:55	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

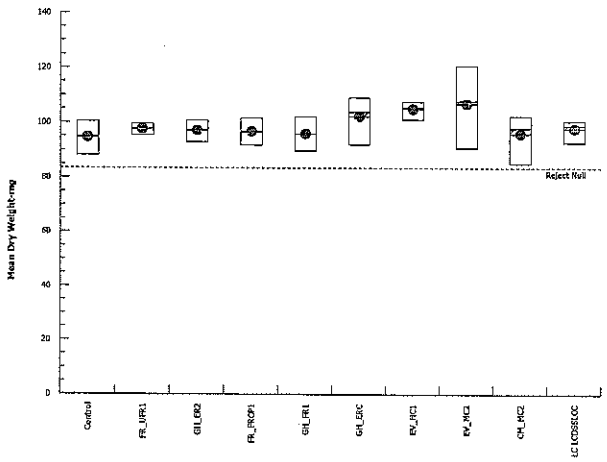
Mean Dry Weight-mg Summary

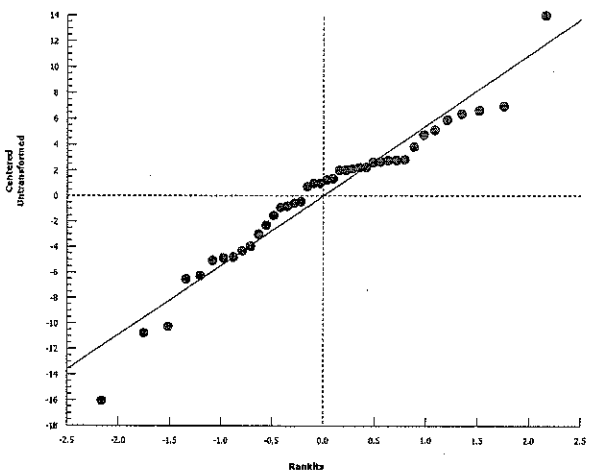
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	94.61	86.17	103.1	94.94	88.08	100.5	2.654	5.61%	0.0%
FR_UFR1	4	97.58	94.44	100.7	97.73	95.26	99.58	0.9876	2.02%	-3.13%
GH_ER2	4	97.11	91.75	102.5	97.37	92.8	100.9	1.687	3.47%	-2.64%
FR_FRCP1	4	96.65	89.14	104.2	96.56	91.76	101.7	2.36	4.88%	-2.16%
GH_FR1	4	95.8	85.53	106.1	95.76	89.52	102.1	3.227	6.74%	-1.25%
GH_ERC	4	102.1	90.49	113.8	103.8	91.88	109.1	3.664	7.17%	-7.96%
EV_HC1	4	105	100.1	109.8	105.6	101	107.6	1.522	2.9%	-10.94%
EV_MC2	4	106.7	86.99	126.4	107.8	90.63	120.6	6.193	11.61%	-12.78%
CM_MC2	4	95.79	83.86	107.7	97.89	85	102.4	3.749	7.83%	-1.24%
LC LCDSSLCC	4	97.71	92.19	103.2	98.87	92.63	100.5	1.737	3.56%	-3.28%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	100.5	88.08	93.08	96.8
FR_UFR1	95.26	98.8	99.58	96.67
GH_ER2	98.08	96.67	92.8	100.9
FR_FRCP1	91.76	99.47	93.64	101.7
GH_FR1	102.1	100.5	89.52	91
GH_ERC	91.88	102.9	104.8	109.1
EV_HC1	107.6	107.1	101	104.2
EV_MC2	109.4	90.63	106.1	120.6
CM_MC2	85	97.78	98	102.4
LC LCDSSLCC	92.63	100.5	99.05	98.7

Graphics





CETIS Analytical Report

Salmonid Embryo-Alevin-~~Fry~~ Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	07-0857-3010	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 Jun-16 14:55	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	19-0744-9008	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)	Teck Coal	
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	11.6%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	0.1034	2.511	11.29	6	0.8631	CDF	Non-Significant Effect
		FR_FRCP1	0.2057	2.511	11.29	6	0.8338	CDF	Non-Significant Effect
		GH_FR1	0.3959	2.511	11.29	6	0.7695	CDF	Non-Significant Effect
		GH_ERC	-1.016	2.511	11.29	6	0.9926	CDF	Non-Significant Effect
		EV_HC1	-1.642	2.511	11.29	6	0.9991	CDF	Non-Significant Effect
		EV_MC2	-2.029	2.511	11.29	6	0.9998	CDF	Non-Significant Effect
		CM_MC2	0.3978	2.511	11.29	6	0.7688	CDF	Non-Significant Effect
		LC LCDSSLCC	-0.02991	2.511	11.29	6	0.8956	CDF	Non-Significant Effect

Samples FR_UFR1 + GH_ER2 are site controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	546.8856	68.3607	8	1.691	0.1464	Non-Significant Effect
Error	1091.619	40.43032	27			
Total	1638.504		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	13.11	20.09	0.1083	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.95	0.9166	0.1049	Normal Distribution

Salmonid Embryo-Alevin-~~Fry~~ Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	07-0857-3010	**Endpoint:**	Mean ~~Dry~~ KL wet Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 Jun-16 14:55	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

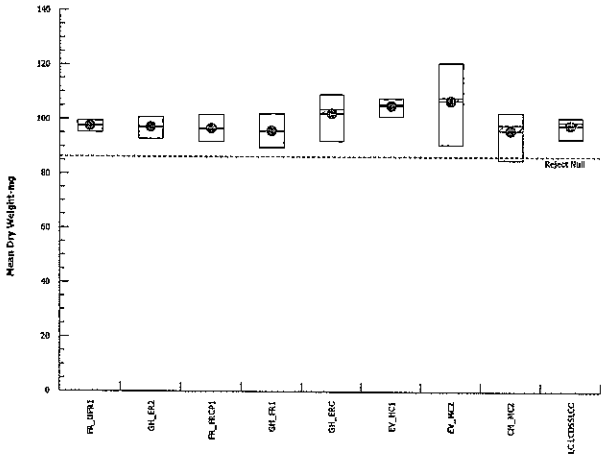
Mean ~~Dry~~ KL wet Weight-mg Summary

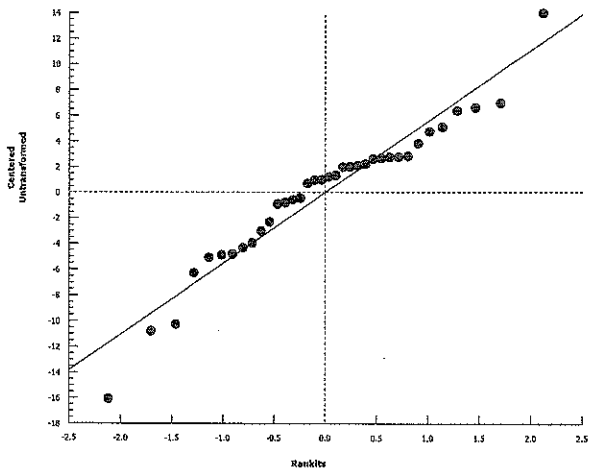
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	97.58	94.44	100.7	97.73	95.26	99.58	0.9876	2.02%	0.0%
GH_ER2	4	97.11	91.75	102.5	97.37	92.8	100.9	1.687	3.47%	0.48%
FR_FRCP1	4	96.65	89.14	104.2	96.56	91.76	101.7	2.36	4.88%	0.95%
GH_FR1	4	95.8	85.53	106.1	95.76	89.52	102.1	3.227	6.74%	1.82%
GH_ERC	4	102.1	90.49	113.8	103.8	91.88	109.1	3.664	7.17%	-4.68%
EV_HC1	4	105	100.1	109.8	105.6	101	107.6	1.522	2.9%	-7.57%
EV_MC2	4	106.7	86.99	126.4	107.8	90.63	120.6	6.193	11.61%	-9.35%
CM_MC2	4	95.79	83.86	107.7	97.89	85	102.4	3.749	7.83%	1.83%
LC LCDSSLCC	4	97.71	92.19	103.2	98.87	92.63	100.5	1.737	3.56%	-0.14%

Mean ~~Dry~~ KL wet Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	95.26	98.8	99.58	96.67
GH_ER2	98.08	96.67	92.8	100.9
FR_FRCP1	91.76	99.47	93.64	101.7
GH_FR1	102.1	100.5	89.52	91
GH_ERC	91.88	102.9	104.8	109.1
EV_HC1	107.6	107.1	101	104.2
EV_MC2	109.4	90.63	106.1	120.6
CM_MC2	85	97.78	98	102.4
LC LCDSSLCC	92.63	100.5	99.05	98.7

Graphics





Analyst:_____ QA: JCle 6/June 10/16

CETIS Analytical Report

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	17-8158-4040	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Jun-16 10:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	19-0744-9008	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	25 May-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	26d 20h	**Source:**	Campbel Lake	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	20-5103-9195	27 Apr-16 09:30	28 Apr-16 10:50	31h (8 °C)	Teck Coal	
GH_ER2	20-2527-1456	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
FR_FRCP1	11-3524-6354	27 Apr-16 11:00	28 Apr-16 10:50	30h (8 °C)		
GH_FR1	02-7973-9027	27 Apr-16 14:06	28 Apr-16 10:50	27h (7.5 °C)		
GH_ERC	19-0486-5913	27 Apr-16	28 Apr-16 10:50	41h (8 °C)		
EV_HC1	08-5296-9635	27 Apr-16 07:50	28 Apr-16 10:50	33h (8.5 °C)		
EV_MC2	16-4901-9744	27 Apr-16 10:00	28 Apr-16 10:50	31h (7 °C)		
CM_MC2	06-7207-0177	27 Apr-16 10:00	28 Apr-16 10:50	31h (6.5 °C)		
LC LCDSSLCC	02-5177-7083	27 Apr-16 08:18	28 Apr-16 10:50	32h (8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_04042016_N (site c		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016_04_27_N (sit		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_04042016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_04_27_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_04_27_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-04-27_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-04-27_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160427_N		
LC LCDSSLCC	Water Sample	Teck Coal	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	11.6%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
GH_ER2		FR_UFR1	-0.1034	2.511	11.29	6	0.9110	CDF	Non-Significant Effect
		FR_FRCP1	0.1022	2.511	11.29	6	0.8634	CDF	Non-Significant Effect
		GH_FR1	0.2925	2.511	11.29	6	0.8061	CDF	Non-Significant Effect
		GH_ERC	-1.119	2.511	11.29	6	0.9947	CDF	Non-Significant Effect
		EV_HC1	-1.745	2.511	11.29	6	0.9994	CDF	Non-Significant Effect
		EV_MC2	-2.133	2.511	11.29	6	0.9999	CDF	Non-Significant Effect
		CM_MC2	0.2944	2.511	11.29	6	0.8054	CDF	Non-Significant Effect
		LC LCDSSLCC	-0.1334	2.511	11.29	6	0.9167	CDF	Non-Significant Effect

samples FR_UFR1 + GH_ER2 are site controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	546.8856	68.3607	8	1.691	0.1464	Non-Significant Effect
Error	1091.619	40.43032	27			
Total	1638.504		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	13.11	20.09	0.1083	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.95	0.9166	0.1049	Normal Distribution

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	17-8158-4040	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Jun-16 10:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

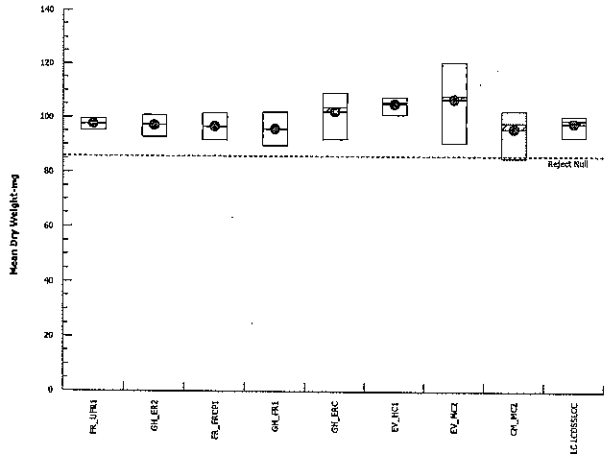
Mean Dry Weight-mg Summary

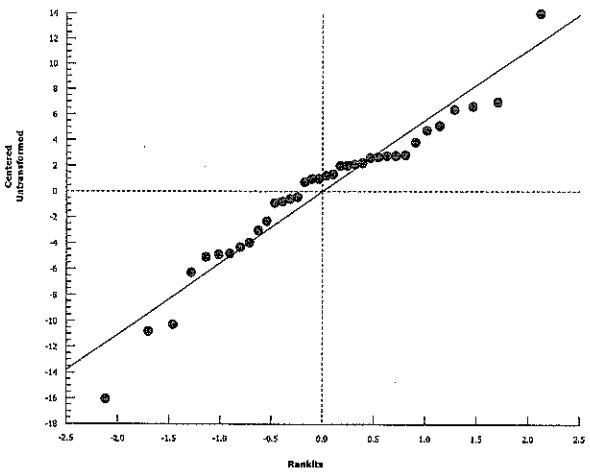
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	97.58	94.44	100.7	97.73	95.26	99.58	0.9876	2.02%	0.0%
GH_ER2	4	97.11	91.75	102.5	97.37	92.8	100.9	1.687	3.47%	0.48%
FR_FRCP1	4	96.65	89.14	104.2	96.56	91.76	101.7	2.36	4.88%	0.95%
GH_FR1	4	95.8	85.53	106.1	95.76	89.52	102.1	3.227	6.74%	1.82%
GH_ERC	4	102.1	90.49	113.8	103.8	91.88	109.1	3.664	7.17%	-4.68%
EV_HC1	4	105	100.1	109.8	105.6	101	107.6	1.522	2.9%	-7.57%
EV_MC2	4	106.7	86.99	126.4	107.8	90.63	120.6	6.193	11.61%	-9.35%
CM_MC2	4	95.79	83.86	107.7	97.89	85	102.4	3.749	7.83%	1.83%
LC LCDSSLCC	4	97.71	92.19	103.2	98.87	92.63	100.5	1.737	3.56%	-0.14%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	95.26	98.8	99.58	96.67
GH_ER2	98.08	96.67	92.8	100.9
FR_FRCP1	91.76	99.47	93.64	101.7
GH_FR1	102.1	100.5	89.52	91
GH_ERC	91.88	102.9	104.8	109.1
EV_HC1	107.6	107.1	101	104.2
EV_MC2	109.4	90.63	106.1	120.6
CM_MC2	85	97.78	98	102.4
LC LCDSSLCC	92.63	100.5	99.05	98.7

Graphics





Analyst:_____ QA: JCu 14/16

Client: Teck

W.O.#: 16473

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/L CaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
QH_ER2	Apr 27/16	50	7.1	7.3	138		50	6.8	136	JS
QH_FR1	↓	↓	7.7	7.8	152		↓	14.1	282	↓
QH_ERC			7.6	7.7	150			8.2	164	
FR_FRCP1			7.8	7.9	154			13.6	272	
FR_UFR1			5.4	5.5	106			5.7 ~~5.6~~ KL	114	
EV_HC1			9.3	9.5	182			13.8 ~~13.6~~ KL	272	
EV_MC2			4.8	4.9	94			7.0	140	
CM_MC2			7.2	7.4	140			13.3	266	↓
LC_LCDSSLCC	↓	↓	8.1 ~~8.6~~ KL	8.2	160		↓	14.1	282	KL
Dechlor	Apr 28/16	100	0.6	0.7	5		100	1.0	10	
QH_ER2	May 4/16	50	7.1	7.3	138		50	7.7	154	
QH_FR1			8.4	8.6	164			15.8	316	
QH_ERC			KL ~~8~~ 7.6	7.7	150			9.5	190	
FR_FRCP1			7.7	7.8	152			14.3	286	
FR_UFR1			5.7	5.8	112			6.1	122	
EV_HC1			8.6	8.8	168			14.2	284	
EV_MC2			4.7	4.9	90			7.0	140	
CM_MC2			6.9	7.0	136			12.4	248	
LC_LCDSSLCC	↓	↓	7.4 ~~7.6~~ KL	KL ~~7.2~~ 7.5	146 ~~160~~ KL		↓	13.5	270	↓
Dechlor	May 5/16	100	1.0	1.2	8		100	1.0	10	EC

Notes:

Reviewed by: JGr

Date Reviewed: June 6/16

Client: Teck

W.O.#: 164783 KL

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
QM-ER2	May 11/16	50	6.7	6.9	130		50	7.3	146	KL
QM-FR1	↓	↓	8.1	8.3	158		↓	15.2	304	↓
QM-ERC			7.1 KL2	7.3	142			8.0	160	
FR_FRCP1			8.2	8.4	160			15.4	308	
FR_UFR1			5.9	6.0	116			6.8 KL3	126	
EV_HC1			8.4	8.6	164			14.3	286	
EV_MC2			5.0	5.1	98			7.8	156	
QM_MC2			7.3	7.4	144			14.3	286	
LC_LCDSSLCC	↓	↓	7.7	7.8	152		↓	14.2	284	
Dechlor	May 11/16	600	0.9	1.0	8		100	0.9	9	↓
QM_ER2	May 18/16	50	6.8	7.0	132		50	7.4	148	KL
QM_FR1	May 18/16	50	8.6	8.7	170		50	16.3	326	KL
QM_ERC	↓	↓	6.9	7.0	136		↓	7.9	158	↓
FR_FRCP1			7.9	8.0	156			14.5	290	
FR_UFR1			5.7	5.9	110			6.5	130	
EV_HC1			8.7	8.9	170			14.9	298	
EV_MC2			5.4	5.5	106			8.0	160	
LC_LCDSSLCC	↓	↓	7.9	8.1	154		↓	14.7	294	
Dechlor	May 19/16	100	0.7	0.8	6		100	0.8	8	↓
QM_MC2	May 18/16	50	6.8	7.0	132		50	13.6	272	KL

Notes:

Reviewed by: JR

Date Reviewed: June 6/16

APPENDIX F – Analytical Chemistry

All analytical chemistry for Q2 chronic toxicity has been uploaded to EMS.

APPENDIX G – Chain-of-Custody Forms

Teck

COC ID:	20160427-1233	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered - F; Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV.	ANALYSIS: 28 Day H. azteca Pass/Fail	7 D C. Dubia Pass/Fail	72 hr P. subcapitata Pass/Fail	30 Day Rainbow trout embryo alevin Pass/Fail	30d FHM P/F Test conducted in Calgary	Temp
① FR_FRCP1_Q_04042016_N 3X20L	FR_FRCP1	WS		2016/04/27	11:00	G			x	x	x		x	8.0
① FR_UFR1_Q_04042016_N 3X20L	FR_UFR1	WS		2016/04/27	09:30	G			x	x	x		x	8.0
① FR_FRCP1_SA_04042016_N 1X20L	FR_FRCP1	WS		2016/04/27	11:00	G						x		8.0
① FR_UFR1_SA_04042016_N 1X20L	FR_UFR1	WS		2016/04/27	09:30	G						x		8.0
WO #									164476	164478	164480	164473	164477	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Sample description ① clear, colourless, odourless, some debris		Apr 27/2016	Nautilus NY - Nan Yamamoto	Apr. 28/16 @ 10:50

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default)	X	Sampler's Name		Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	Apr 27 2016.
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

Page 1 of 1

COC ID:	20160427-1325	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY		OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual	Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson	Email 1	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com	Email 2	Mell.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address		Email 3	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number		
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country				
Phone Number	1-250-865-5289			Phone Number	403-253-7121					

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered: F: Field, L: Lab, FL: Field & Lab, N: None)

16-0490

Week 1

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS: 30 Day Fathead Minnow	PRESERV.	FIL.
FR_FRCP1_Q_04042016_N (1)	FR_FRCP1	WS		2016/04/27	11:00	G		x		
FR_UFR1_Q_04042016_N (1)	FR_UFR1	WS		2016/04/27	09:30	G		x		

16-0491

2016/04/28
1130 Bears paw Carrier
Good condition NO S/I
8 x 20 L cubays
5.3°C
MC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
(1) Sample description: clear, colourless, odourless, some debris	Lee Wilm Apr 27/16	1330		

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default) X	Sampler's Name	Lee Wilm	Mobile #	250-433-1554	
Priority (2-3 business days) - 50% surcharge	Sampler's Signature		Date/Time	Apr 27/16	1330
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	Dec Monthly East	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commence Court				Yes PDF	Yes Excel	
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	jim.thorner@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	Zahir.jina@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS / ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
									96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fial)	48 hr daphnia @ 10 deg C (pass/fial)	7 day C dubia pass fail	7day embryo (pass Fail)	72 hr P Subcapitata pass fail	30 day RT early life stage pass fail	28 day H azteca P/F	30-d FHM of conducted in Calgary			Temp
(20) GH_ER2_WS_2016_04_27_N (2)	GH_ER2	WS	N	27-Apr		G	6					X	X	X	X					8.0
(20) GH_FR1_WS_2016_04_27_N (1)	GH_FR1	WS	N	27-Apr	14:06	G	4					X		X	X	X	X			7.8
(20) GH_ERC_WS_2016_04_27_N (1)	GH_ERC	WS	N	27-Apr		G	3					X		X	X					8.0
											20 #	16478	16475	16480	16473	16476	16477			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Jessica Whitehead	April 27/16	14:30	Nautilus	Apr 28/16	10:50
				NY - Wan Yamamoto		

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Jessica Whitehead	Mobile #	250.425.9532
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	Apr 27/16 14:30
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Sample description

(2) ~~(1)~~ clear, no precipitate or particulate, odourless, colourless

(1) ~~(2)~~ clear, no precipitate, some particulate, odourless, colourless

Chain Of Custody Record

COC ID:

Page: 1 of 1

Turnaround Time:

Rush:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Greenhills Operation			Lab Name	HydroQual Laboratories Ltd.			Send Invoice To	
Project Number				Contact Name	Jacklyn Pool			Address	
Contact Name	Leigh Stickney			Address	#4, 6125 - 12th Street S.E				
Address	P.O. BOX 5000							City	State
				City	Calgary	State	AB	Postal Code	Country
City	Elkford	State	BC	Postal Code	T2H2K1	Country	Canada	Task Code	
Postal Code	V0B1H0	Country	Canada	Phone Number	403.253.7121			Shipping Company	
Phone Number	250-865-3274			Email Address				Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To	

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
		Week 1				ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail				
16-04189 Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
GH_FR1_WS_2016_04_27_N (1)	WS	4/27/2016	[illegible]	G	4		X									

2016/04/28
1130 Bears paw Courier
5.8°C no S/I
Good Condition
4 x 20 L Carboy
MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
For both permit requirments and water for special treatment testing	Jevin Wolchuk	Apr 27/16	14:30				Y / N	Y / N	Y / N	
							Y / N	Y / N	Y / N	
sample description: colourless, odourless clear, some debris							Y / N	Y / N	Y / N	
							Y / N	Y / N	Y / N	

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470	Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	April 27/16 1430				

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO					LABORATORY					OTHER INFO			
Facility Name	Coal Mountain Operation				Lab Name	Nautilus Environmental				Send Invoice To			
Contact Name	Carla Romero				Contact Name	Krysta Pearcy				Address			
Address	2261 Corbin Rd.				Address	8664 commerce Court							
City	Sparwood	Prov.	BC							City		State	
Postal Code	V0B 2G0	Country	Canada		City	Burnaby	State	BC		Postal Code		Country	
Phone Number	250 425 7350				Postal Code	V5A 4N7	Country	Canada		Task Code			
Email EDD To	Rick.Magliocco@teck.com				Phone Number	604-420-8773				Shipping Company			
	Don.Sacino@teck.com				Email Address	krysta@nautilusenvironmental.ca				Tracking Number			
	Carla.Romero@teck.com				PO Number					CC Hardcopy To			
										CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED									ADDITIONAL INFORMATION
						PRESERV.									
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30d Rbt EA P/F	7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F That conducted in Calgary			Temp	
x20L CM_MC2_WS_20160427_N (1)	WS	27-Apr-16	10:00	G	4		X	x	x	x	X			6.5	
							16473	16478	16480	16476	16477				
							WO#								

sample description
① clear, odourless, some debris, odourless

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
2 coolers				Nautilus NY - Nan Yamamoto	Apr 28/16	10:50		Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Jeremy Enns	Mobile #	2504257350	Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	27-Apr-16				

Chain Of Custody Record

COC ID: 20140902-1509

Turnaround Time:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Coal Mountain Operation	Lab Name	Hydroqual Laboratories	Send Invoice To	
Contact Name	Carla Romero	Contact Name	Jacklyn Pool	Address	
Address	2261 Corbin Rd.	Address	#4, 6125-12th Street S.E.		
City	Sparwood Prov. BC			City	State
Postal Code	V0B 2G0 Country Canada	City	Calgary State AB	Postal Code	Country
Phone Number	250 425 7350	Postal Code	T2H 2K1 Country Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com	Phone Number	403-253-7121	Shipping Company	
	Don.Sacino@teck.com	Email Address		Tracking Number	
	Carla.Romero@teck.com	PO Number		CC Hardcopy To	
				CC Hardcopy To	

SAMPLE DETAILS / **ANALYSIS REQUESTED** / **ADDITIONAL INFORMATION**

16-0488 Week 1

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30-d P. promelas (pass/fail)	ADDITIONAL INFORMATION
CM_MC2_WS_20160427_N (1)	WS	April 27 2016	10:00	G	4		x	

2016/04/28 Bears paw Carrier
4130
Good Condition
4.8°C
4 x 20 L carboys
no S/I
MC

sample description:
(1) clear, colourless, odourless,
some debris

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
2 coolers								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
							Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name	Jeremy Enns	Mobile #	250 425 7350
Sampler's Signature	[signature]	Date/Time	April 27 2016

Teck

Page __ of __

COC ID: 20160427 | **TURNAROUND TIME:** | **RUSH:**

PROJECT/CLIENT INFO			
Facility Name / Job#	Elkview Operations: Chronic Toxicity Sampling		
Project Manager	Michael Moore		
Email	Michael.Moore@teck.com		
Address	RR#1 HWY# 3		
City	Sparwood	Province	BC
Postal Code	V1C 4C3	Country	Canada
Phone Number	1-250-865-5289		

LABORATORY			
Lab Name	Nautilus Environmental		
Lab Contact	Krysta Pearcy		
Email	krysta@nautilusenvironmental.ca		
Address	8664 Commerce Court		
	Imperial Square Lake City		
City	Burnaby	Province	BC
Postal Code	V5A 4N7	Country	Canada
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	Michael.Moore@teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Casandra.Knoopihulzen@teck.com	X	X	X
Email 4:	James.Boldt@teck.com	X	X	X
Email 5:	Cameron.Griffin@teck.com	X	X	X
PO number	418927			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered: F: Field, L: Lab, FL: Field & Lab, N: None

	Sample ID		Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Toxicity 7-Day/72-Hr Pass/Fail	Toxicity 30-Day Pass/Fail	30d Rbt EAP/F	7d cerio P/F	72H P. Subcap. P/F	~~28d Hyalella P/F~~ NY	~~30d EHM P/F~~ Test conducted [illegible] NY	Temp °C
3x20L	EV_HC1_WS_2016-04-27_N	(1)	EV_HC1	WS	N	2016/04/27	7:50	G	3	1	2	x x	x x	x x	~~x x~~	~~x x~~	8.5
3x20L	EV_MC2_WS_2016-04-27_N	(1)	EV_MC2	WS	N	2016/04/27	10:00	G	3	1	3	x	x	x	~~x~~	~~x~~	7.0
WO#												16473	16478	16480			

(1) sample description: clear, odourless, some debris, odourless

Received by NY - [illegible] - Nautilus
Apr 28/16 @ 10:50

Total: 6

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Toxicity 30-Day Pass/Fail= Rainbow trout embyro-alevin Toxicity 7-Day/72-Hr Pass/ Fail =7 d C. dubia and 72 h P. subcapitata				

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default) X	Sampler's Name	JAMES BOLDT	Mobile #	
Priority (2-3 business days) - 50% surcharge	Sampler's Signature	[illegible]	Date/Time	APRIL 27 2016 13:45
Emergency (1 Business Day) - 100% surcharge				
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Teck

Page 1 of 1

COC ID:	20160427-0941	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Line Creek Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	
Email	jay.jones@teck.com			Email	Krysta@NautilusEnvironmental.ca			Email 2:	tim.chala@teck.com	x	x	
Address	Box 2003			Address	8664 commerce Court			Email 3:	teckcoal@equisonline.com			x
	15km North Hwy 43							Email 4:	carl.rood@teck.com	x	x	x
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	PO number				
Phone Number	250-425-6111			Phone Number	604-420-8773							

SAMPLE DETAILS								ANALYSIS REQUESTED										Preserved - F: Field, L: Lab, FL: Field & Lab, N: None
								ANALYSIS										
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	7-d C. dubia dilution series	72-h P. subcapitata dilution series	7-d L. minor plant growth dilution series	7-d O. mykiss development dilution series	30-d O. mykiss embryo-alevin (semi-annual) pass/fail						
								Bottle #	16479	16481	16482	16474	16473					
LC_LC5_WS_2016-04-25_N (1) 5x20L	LC_LC5	WS	N	2016/04/27	06:50	G	5	X	X	X	X							6.6
LC_LCDSSLCC_WS_2016-04-25_N (1) 8x20L	LC_LCDSSLCC	WS	N	2016/04/27	08:18	G	8	X	X	X	X	X						8.0
LC_DC1_WS_2016-04-26_N (1) 5x20L	LC_DC1	WS	N	2016/04/27	08:30	G	5	X	X	X	X							7.5
LC_DCDS_WS_2016-04-26_N (1) 3x20L	LC_DCDS	WS	N	2016/04/27	07:58	G	5	X	X	X	X							6.0
LC_FRDSDC_WS_2016-04-26_N (1) 3x20L	LC_FRDSDC	WS	N	2016/04/27	09:04	G	5	X	X	X	X							8.0

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	T. Phillips/ Nupqu	April 27, 2016	Nautilus NY - Nan Yamamoto	Apr 28/16 @ 10:50.
	G.Abott/ Nupqu			
	J. Jones/ Teck			

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	T. Phillips/ G. Abbott/ J. Jones	Mobile #	(250) 919-0965
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	April 27, 2016
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

sample description
① clear, colourless, some debris, odourless

Teck

COC ID:	20160427-Chronic Toxicity	TURNAROUND TIME:	REGULAR	RUSH:	No

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	WLC AWTF			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF
Project Manager	Thomas Davidson			Lab Contact	Krysta Pearcy			Email 1:	thomas.davidson@teck.com	X	X
Email	Thomas.Davidson@gmail.com			Email	Krysta@NautilusEnvironmental.com			Email 2:	teckcoal@equisonline.com		
Address	15 Km North HWY 43			Address	8664 commerce Court			Email 3:	tmckenna@epcor.com	X	X
								Email 4:	greg.ross@teck.com	X	X
City	Sparwood	Province	BC	City	Burnaby	Province	BC	Email 5:	Colin.Lynch@teck.com		
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada				
Phone Number	250.603.9417			Phone Number	604-420-8773			PO 411634			

SAMPLE DETAILS								ANALYSIS REQUESTED												
								FIC	N	N										
								PRESERV	N	N										
								ANALYSIS	NAUT_Chronic Toxicity Test	7-d C.dubia dilution	72-h P.subcapitata dilution	7-d L.minor dilution	7-d embryo dilution							
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.													
3x2dL LC_WTF_OUT_WS_20160427_N (1)	LC_WTF_OUT	WS	N	27-Apr-16	0900	G	5		X	X	X	X	X						10.2 °C	
										WO# 164479	164481	164482	164474							

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
			Nautilus. NY - Nan Yamamoto	Apr 28/16 @ 10:50

NB OF BOTTLES RETURNED/DESCRIPTION	
Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jocelyn Traverse	Mobile #	
Sampler's Signature	Jocelyn Traverse	Date/Time	27-April-16

Sample description: (1) clear, colourless, some brown debris, hydrocarbon smell

~~clear, no precipitate, no particulate, odourless~~

Teck

COC ID:	20160504-1312	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS: 28 Day H. azteca Pass/Fail	30 Day Rainbow trout embryo alevin Pass/Fail	30d FHM P/F conducted in Calgary								Temp
FR_FRCP1_QR_11042016_N 2x20L	FR_FRCP1	WS	2x20L FC	2016/05/04	10:18	G		x		x x								11.0°C
FR_UFR1_QR_11042016_N 2x20L	FR_UFR1	WS		2016/05/04	08:48	G		x		x								10.0°C
FR_FRCP1_SA_11042016_N 2x20L	FR_FRCP1	WS		2016/05/04	10:18	G			x									11.2°C
FR_UFR1_SA_11042016_N 2x20L	FR_UFR1	WS		2016/05/04	08:48	G			x									10.0°C

WO # 164476 164478 164477

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
			Nautilus NY - Nan Yamamoto = refresh sample =	May05/16 - 08:10

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name		Mobile #	
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	20160504-1317	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country						
Phone Number	1-250-865-5289			Phone Number	403-253-7121							

SAMPLE DETAILS / ANALYSIS REQUESTED — Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

16-0490 week 2

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont	30 Day Fathead Minnow
FR_FRCP1_QR_11042016_N	FR_FRCP1	WS		2016/05/04	10:18	G		x
FR_UFR1_QR_11042016_N	FR_UFR1	WS		2016/05/04	08:48	G		x

16-0491 week 2

2016/05/05
1130
8× 20L Cubys
10°C
Good Condition

Bears Paw Courier
10 5/2 MC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name		Mobile #	
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	May 4, 2016 Refresh	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commence Court				Yes PDF	Yes	Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS / ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, B/N)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS: 96 hr Rainbow trout (pass/fail) #N/A	48 hr daphnia (pass/fial) #N/A	48 hr daphnia @ 10 deg C (pass/fial) #N/A	7 day C dubia #N/A	7day embryo (pass Fail) #N/A	72 hr P Subcapitata #N/A	30 day RT early life stage P/F #N/A	28 day H azteca P/F #N/A	30d FHM P/F conducted in Calgary #N/A	#N/A	#N/A	Temp #N/A
					09:45														
GH_ER2_WS_2016_05_04_N	GH_ER2	WS	N	4-May-16	~~11:14~~ NY	G	3					X		X					9.3°c 3x20L
GH_FR1_WS_2016_05_04_N	GH_FR1	WS	N	4-May-16	11:55	G	4				X		X	X	X	X			10.1°c 4x20L
GH_ERC_WS_2016_05_04_N	GH_ERC	WS	N	4-May-16	09:12	G	3				X		X	X					9.1°c 3x20L
													wo #	16473	16476	16477			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Jevin Wolchuk	May 4/16	13:20	Nautilus NY - Nan Yamamoto	May 05/16	08:10
				= refresh sample =		

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Jevin Wolchuk	Mobile #	250 910 5470
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	May 4/16 13:20
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Chain Of Custody Record

COC ID: May 4, 2016 Refresh | Page: 1 of 1

Turnaround Time: | **Rush:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	HydroQual Laboratories Ltd.			Send Invoice To			
Project Number				Contact Name	Jacklyn Pool			Address			
Contact Name	Leigh Stickney			Address	#4, 6125 - 12th Street S.E						
Address	P.O. BOX 5000							City		State	
				City	Calgary	State	AB	Postal Code		Country	
City	Elkford	State	BC	Postal Code	T2H2K1	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number	403.253.7121			Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
16-0489 week 2						ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyalella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail				
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
GH_FR1_WS_2016_05_04_N	WS	4-May-16	1155	G	4		X									
2d6/05/05	8°C															
1130																
Good Condition																
no S/S																
4 x 20 L Carboys																
Bears paw Courier																
MC																

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
For both permit requirments and water for special treatment testing	Jevin Wolchuk	May 4/16	1235					Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470	Temp in °C	Samples on ice? / Sample intact? / Trip Blank?
Sampler's Signature	Jevin Wolchuk	Date/Time	May 4/16 1235		

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com			Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED									ADDITIONAL INFORMATION
						PRESERV									
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS		7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F conducted in Calgary	30d Rbt EA P/F			
CM_MC2_WS_20160504_N	WS	May 4 2016		G	4					x	X	X			Refresh 4x20L 8° Temp
										WO # 164776	164777	164778			

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
	J. Enns (Wapa)	04-May-16	12:00	Nautilus NY- Nan Yamamoto	May 05/16	08:10		Y / N	Y / N	Y / N
				= Refresh sample =				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Jeremy Enns	Mobile #		Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	May 4 2016				

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Coal Mountain Operation			Lab Name	Hydroqual Laboratories			Send Invoice To	
Contact Name	Carla Romero			Contact Name	Jacklyn Pool			Address	
Address	2261 Corbin Rd.			Address	#4, 6125-12th Street S.E.				
City	Sparwood	Prov.	BC					City	State
Postal Code	V0B 2G0	Country	Canada	City	Calgary	State	AB	Postal Code	Country
Phone Number	250 425 7350			Postal Code	T2H 2K1	Country	Canada	Task Code	
Email EDD To	Rick.Maglocco@teck.com			Phone Number	403-253-7121			Shipping Company	
	Don.Sacuno@teck.com			Email Address				Tracking Number	
	Carla.Romero@teck.com			PO Number				CC Hardcopy To	
								CC Hardcopy To	

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
						ANALYSIS	30-d P. promelas (pass/fail)									
16-0488 week 2																
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20160504_N	WS	May 4 2016		G	4		x									Refresh
2016/05/05 1130 Bears paw Courier Good Condition 6°C 4 x 20 L Carboys 10 S/S Me																

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time
	I. Evans	4-May-16	1200			

Sample Receipt Conditions			
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name	Jeremy Evans	Mobile #	
Sampler's Signature		Date/Time	May 4 2016

Teck

Page 1 of

COC ID:	20160504	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO			
Facility Name / Job#	Elkview Operations/ Chronic Toxicity Sampling		
Project Manager	Michael Moore		
Email	Michael.Moore@teck.com		
Address	RR#1 HWY# 3		
City	Sparwood	Province	BC
Postal Code	V1C 4C3	Country	Canada
Phone Number	1-250-865-5289		

LABORATORY			
Lab Name	Nautilus Environmental		
Lab Contact	Krysta Pearcy		
Email	krysta@nautilusenvironmental.ca		
Address	8664 Commerce Court		
	Imperial Square Lake City		
City	Burnaby	Province	BC
Postal Code	V5A 4N7	Country	Canada
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	Michael.Moore@teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Casandra.Knooihuizen@teck.com	X	X	X
Email 4:	James.Boldt@teck.com	X	X	X
Email 5:	Cameron.Griffin@teck.com	X	X	X
PO number	418927			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Toxicity 30-Day Pass/Fail - Rbt EA PA	Temp(°C)
EV_HC1_WS_2016-05-04_N	EV_HC1	WS	N	2016/05/04	7:20	G	3	3	8.0
EV_MC2_WS_2016-05-04_N	EV_MC2	WS	N	2016/05/04	6:45	G	3	3	8.0
					Total	6			

3x20L
3x20L

WO # 16473

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Toxicity 30-Day Pass/Fail= Rainbow trout embyro-alevin Toxicity 7-Day/72-Hr Pass/ Fail =7 d C. dubia and 72 h P. subcapitata			Nautilus NY - Nan Yamamoto	May 05/16 - 08:10

= refresh sample =

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default) X Priority (2-3 business days) - 50% surcharge Emergency (1 Business Day) - 100% surcharge For Emergency <1 Day, ASAP or Weekend - Contact ALS	Sampler's Name	Mike Moore	Mobile #	
	Sampler's Signature	[signature]	Date/Time	May 4, 2016 12:30

Teck

Page 1 of 1

COC ID:	tox week 2 refresh Q2, 2016	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	
Email	jay.jones@teck.com			Email	Krysta@NautilusEnvironmental.ca			Email 2:	tim.chala@teck.com	x	x	
Address	Box 2003			Address	8664 commerce Court			Email 3:	teckcoal@equisonline.com			x
	15km North Hwy 43							Email 4:	cait.good@teck.com	x	x	x
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	PO number				
Phone Number	250-425-6111			Phone Number	604-420-8773							

SAMPLE DETAILS								ANALYSIS REQUESTED												Filtered - F; Field, L; Lab, FL; Field & Lab, N; None
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.					30-d *O. mykiss* embryo-alevin (semi-annual) pass/fail								
LC_LCDSSLCC__WS_2016-05-02_N	LC_LCDSSLCC	WS	N	May 4 2016	7:20	G	3					X								

WO # 16473

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
			Nautilus NY - Alan Yamamoto	May 05/16 @ 08:10
			4X20L	Temp - 8.1°C

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Tyler Phillips	Mobile #	
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

= refresh sample =

Teck

COC ID:	20160511-1244	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered: F, Field: L, Lab: FL, Field & Lab: N, None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	48 hr single conc Daphnia m. @ 10 deg cel	48 HR SINGLE CONCENTRATION - DAPNIA M.	96HR SINGLE CONCENTRATION - R.TROUT	30 DAY RAINBOW TROUT EMBRYO ALEVIN P/F	48 hr Daphnia Sinlge Conc. Pass/Fail	96 Hr Rainbow Trout Single Conc. Pass/Fail	28 Day H. azteca Pass/Fail	30d FHM P/F conducted in Calgary				Temp °C
20d FR_CC1_Q_04042016_N	(2) FR_CC1	WS		2016/05/10	10:42	G	1					X	1						9.2
20d FR_EC1_Q_04042016_N	(3) FR_EC1	WS		2016/05/10	11:00	G	1					X	1						9.0
20d FR_SP1_Q_04042016_N	(4) FR_SP1	WS		2016/05/10	09:15	G	2	1				X	1						8.5
20d GH_CC1_Q_04042016_N	(5) GH_CC1	WS		2016/05/10	09:25	G	2	1	X	1									8.0
20d GH_SC1_Q_04042016_N	(6) GH_SC1	WS		2016/05/10	09:55	G	1	X	X	1									8.0
20d FR_FRCP1_QR_11042016_N	(1) FR_FRCP1	WS		2016/05/11	10:40	G	4				3			1	x				8.3
20d FR_UFR1_QR_11042016_N	(1) FR_UFR1	WS		2016/05/11	09:00	G	4				3			1	x				6.9
								WO # 16541		16542	16473	16541	16542	16476	16477				

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
(1) refresh sample		May 11 2016	Nautilus N4 - Nan Yamamoto	May 12/16 @ 08:00

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name		Mobile #	250 [illegible] 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	MAY 12 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Sample Description:
(2) Slightly yellow, clear, odourless, no particulates
(3) Slightly yellow, clear, odourless, no particulates.
(4) Slightly yellow, clear, odourless, no particulates
(5) Slightly yellow, clear, odourless, no particulates.

Teck

COC ID:	20160511-1306	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY		OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual	Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson	Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com	Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address		Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number		
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country				
Phone Number	1-250-865-5289			Phone Number	403-253-7121					

SAMPLE DETAILS								ANALYSIS REQUESTED													Filtered - F, Field - Fi, Lab - FL, Field & Lab - N, None
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont	30 Day Fathead Minnow Refresh													
FR_FRCP1_QR_11042016_N	FR_FRCP1	WS		2016/05/11	10:40	G	4	4													
FR_UFRI_QR_11042016_N	FR_UFRI	WS		2016/05/11	09:00	G	4	4													

~~16-048~~ mc
16-0490
Week 3
16-0491
12°C
2016/05/12
8 x 20 L Cabys
1045
~~4 x 20~~ mc
Good condition
Dress paw
no St mc

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	N MacDonald	May 11 2016		

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default)	X	Sampler's Name	N MacDonald	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	2:30 May 11 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	May 11, 2016 Refresh	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GH0
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commence Court				Yes PDF	Yes Excel	
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS / ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, FP)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fial)	48 hr daphnia @ 10 deg C (pass/fial)	7 day C dubia	7day embryo (pass Fail)	72 hr P Subcapitata	30 day RT early life stage P/F	28 day H azteca P/F	30d FHM P/F conducted in Calgary			Receiving Temp. (°C)
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
20L GH_ER2_WS_2016_05_11_N 3 x 20L	GH_ER2	WS	N	11-May-16	12:45	G	3					X		X					7.2
20L GH_FR1_WS_2016_05_11_N 4 x 20L	GH_FR1	WS	N	11-May-16	10:00	G	4				X		X	X	X	X			6.9
20L GH_ERC_WS_2016_05_11_N 3 x 20L	GH_ERC	WS	N	11-May-16	11:15	G	3				X		X	X					6.8
														WO# 164773	164776	164777			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Jevin Wolchuk	May 11/16	11:30	Nautilus NY - Nan Yamamoto	May 12/16	08:00
				= refresh sample =		

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Jevin Wolchuk	Mobile #	250.425.5310
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	May 11, 2016 11:30
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Chain Of Custody Record

COC ID: May 11, 2016 Refresh | Page: 1 of 1

Turnaround Time: | **Rush:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	HydroQual Laboratories Ltd.			Send Invoice To			
Project Number				Contact Name	Jacklyn Pool			Address			
Contact Name	Leigh Stickney			Address	#4, 6125 - 12th Street S.E						
Address	P.O. BOX 5000							City		State	
				City	Calgary	State	AB	Postal Code		Country	
City	Elkford	State	BC	Postal Code	T2H2K1	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number	403.253.7121			Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyalella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail				
GH_FR1_WS_2016_05_11_N	WS	11-May-16	10:00	G	4		X									

16-0489 Week 3

2016/05/12 11.6°C
1045
4 x 20 L Calgary
Good Condition
Bears Paw
No S/I
MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions
For both permit requirments and water for special treatment testing	Jevin Wolchuk	May/16	10:30				Y / N Y / N Y / N
							Y / N Y / N Y / N
							Y / N Y / N Y / N
							Y / N Y / N Y / N

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470	Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	May/16 10:30				

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Maglocco@teck.com			Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV										
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F conducted in Calgary	30d Rbt EA P/F			
CM_MC2_WS_20160511_N	WS	May 11 2016		G	4						x	X	X		6.0	Refresh
											16476	16477	16473			
											WO#					

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
				Nautilus	May 12/16	08:00		Y / N	Y / N	Y / N
				NY - Nan Yamamoto				Y / N	Y / N	Y / N
				# refresh sample =				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name		Mobile #		Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	May 11 2016				

1 of 2

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Hydroqual Laboratories			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Jacklyn Pool			Address			
Address	2261 Corbin Rd.			Address	#4, 6125-12th Street S.E.			City		State	
City	Sparwood	Prov.	BC	City	Calgary	State	AB	Postal Code		Country	
Postal Code	V0B 2G0	Country	Canada	Postal Code	T2H 2K1	Country	Canada	Task Code			
Phone Number	250 425 7350			Phone Number	403-253-7121			Shipping Company			
Email EDD To	Rick.Magnocco@teck.com			Email Address				Tracking Number			
	Don.Sacino@teck.com			PO Number				CC Hardcopy To			
	Carla.Romero@teck.com							CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
						ANALYSIS	30-d F. promedias (pass/fail)									
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20160511_N	WS	May 11 2016		G	4		x									Refresh

16-0488

Week 3

2016/05/12

1645

12°C

4 x 20 L Carboys

Good Condition

Bears Paw Courier

no S/I.

MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name		Mobile #		Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	May 11 2016				

Teck

Page 1 of

COC ID: 20160511 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Elkview Operations/ Chronic Toxicity Sampling			Lab Name	Nautilus Environmental			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Michael Moore			Lab Contact	Krysta Peavy			Email 1: Michael.Moore@teck.com	X	X	X
Email	Michael.Moore@teck.com			Email	krysta@nautilusenvironmental.ca			Email 2: teckcoal@equisonline.com			X
Address	RR#1 HWY# 3			Address	8664 Commerce Court			Email 3: Casandra.Knoshuken@teck.com	X	X	X
					Imperial Square Lake City			Email 4: James.Boldt@teck.com	X	X	X
								Email 5: Cameron.Griffin@teck.com	X	X	X
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number	418927		
Postal Code	V1C 4C3	Country	Canada	Postal Code	V5A 4N7	Country	Canada				
Phone Number	1-250-865-5289			Phone Number							

SAMPLE DETAILS / ANALYSIS REQUESTED

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Toxicity 30-Day Pass/Fail	Receiving Temp (°C)	
EV_HC1_WS_2016-05-11_N	EV_HC1	WS	N	2016/05/11	7:30	G	3	3	7.3	3x20L
EV_MC2_WS_2016-05-11_N	EV_MC2	WS	N	2016/05/11	9:00	G	3	3	6.5	3x20L
								WO # 16473		
								= refresh sample =		
					Total		6			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Toxicity 30-Day Pass/Fail= Rainbow trout embyro-alevin			Nautilus N4 - Ran Yamamoto	May 12/16 @ 08:00

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default) X	Sampler's Name	JAMES BOLDT	Mobile #		
Priority (2-3 business days) - 50% surcharge	Sampler's Signature		Date/Time	MAY 11 2016 9:50	
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID: tox week 3 refresh Q2, 2016 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	
Email	jay.jones@teck.com			Email	Krysta@NautilusEnvironmental.ca			Email 2:	tim.chala@teck.com	x	x	
Address	Box 2003			Address	8664 commerce Court			Email 3:	teckcoal@equisonline.com			x
	15km North Hwy 43							Email 4:	cait.good@teck.com	x	x	x
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	PO number				
Phone Number	250-425-6111			Phone Number	604-420-8773							

SAMPLE DETAILS | ANALYSIS REQUESTED (Filtered (F), Field, Lab, FL, FNR & Lab Ns: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30-d O. *mykiss* embryo-alevin (semi-annual) pass/fail
LC_LCDSSLCC__WS_2016-05-09_N	LC_LCDSSLCC	WS	N	11-May-16	11:45	G	3	X

5.5

WO # 16473

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	M-Calabrese / Nupqu	May 11th/16 14:00	Nautilus NY - Ken Yamamoto	May 12/16 @ 08:00
			= refresh sample	=

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	~~Tyler Phillips~~ Marang Calabrese	Mobile #	647-244-7245
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	M Calab	Date/Time	May 11/16 14:00
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

2x20L + 4x10L } approx. 60L

Teck

COC ID: 20160518-1241 | **TURNAROUND TIME:** | **RUSH:**

PROJECT/CLIENT INFO

Facility Name / Job#	Fording River Operation
Project Manager	Lee Wilm
Email	
Address	PO Box 100
City	Elkford
Province	BC
Postal Code	V0B 1H0
Country	Canada
Phone Number	1-250-865-5289

LABORATORY

Lab Name	Nautilus Environmental
Lab Contact	
Email	
Address	8664 Commerce Court
City	Burnaby
Province	BC
Postal Code	V5A 4N7
Country	Canada
Phone Number	604-420-8773

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	Lee.Wilm@teck.com	x	x	x
Email 2:	Neil.Macdonald@teck.com	x	x	x
Email 3:	teckcoal@equisonline.com			x

PO number

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered: F- Field, L- Lab, FL- Field & Lab, N- None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL	PRESERV	ANALYSIS: 30 Day Rainbow Trout embryo alevin P/F	ANALYSIS: 28 Day H. azteca Pass/Fail	ANALYSIS: 30d FHM P/F conducted in Calgary	Temp °C	
FR_FRCP1_QR_18042016_N	FR_FRCP1	WS		2016/05/18	08:50	G	4			3	1	X	10.4	4X20L
FR_UFR1_QR_18042016_N	FR_UFR1	WS		2016/05/18	10:48	G	4			3	1	X	9.3	4X20L
										16473	16476	16477		
										WO#				

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION

K. HERAUF

DATE/TIME

18 MAY 2016

ACCEPTED BY/AFFILIATION

Nautilus
NY - Nan Yamamoto
= refresh sample

DATE/TIME

May 19/16 @ 08:00
=

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	K. HERAUF	Mobile #	250-425-5204
Sampler's Signature		Date/Time	18 MAY 2016

Teck

COC ID:	20160518-1236	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country						
Phone Number	1-250-865-5289			Phone Number	403-253-7121							

SAMPLE DETAILS — ANALYSIS REQUESTED — Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS: 30 Day Fathead Minnow	PRESERV.	FIELD
FR_FRCP1_QR_18042016_N	FR_FRCP1	WS		2016/05/18	08:50	G	4	4		
FR_UFR1_QR_18042016_N	FR_UFR1	WS		2016/05/18	10:48	G	4	4		

16-0490 Week 4

16-0491 week 4 2016/05/19 1030 16C
Good Condition
8 x 20 L Cubays
No S/I Bears Paw
MC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	K. HERAUF	18 MAY 2016		

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	K. HERAUF	Mobile #	250-425-5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	18 MAY 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	May 18, 2016 Refresh	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commence Court				Yes PDF	Yes	Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS

ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7 day C dubia	7day embryo (pass Fail)	72 hr P Subcapitata	30 day RT early life stage P/F	28 day H azteca P/F	30d FHM conducted in Calgary			Temp °C	
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
GH_ER2_WS_2016_05_18_N	GH_ER2	WS	N	18-May-16	11:50	G	3					X		X					10.3	3x20L
GH_FR1_WS_2016_05_18_N	GH_FR1	WS	N	18-May-16	09:45	G	4				X		X	X	X	X			9.5	4x20L
GH_ERC_WS_2016_05_18_N	GH_ERC	WS	N	18-May-16	10:50	G	3				X		X	X					9.7	3x20
													WO#	164773	164776	164777				

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Jevin Wolchuk	May 18/16	11:00	Nautilus NY - Nan Yamamoto	May 19/16	08:00
				= refresh sample =		

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Jevin Wolchuk	Mobile #	250.425.5310
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	Jevin Wolchuk	Date/Time	May 18/16 11:00
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Chain Of Custody Record

COC ID: May 18, 2016 Refresh | Page: 1 of 1

Turnaround Time: | Rush:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Greenhills Operation	Lab Name	HydroQual Laboratories Ltd.	Send Invoice To	
Project Number		Contact Name	Jacklyn Pool	Address	
Contact Name	Leigh Stickney	Address	#4, 6125 - 12th Street S.E		
Address	P.O. BOX 5000			City	State
		City	Calgary State AB	Postal Code	Country
City	Elkford State BC	Postal Code	T2H2K1 Country Canada	Task Code	
Postal Code	V0B1H0 Country Canada	Phone Number	403.253.7121	Shipping Company	
Phone Number	250-865-3274	Email Address		Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com	Quote Number		CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com			CC Hardcopy To	

16-0489 week 4

SAMPLE DETAILS / ANALYSIS REQUESTED / ADDITIONAL INFORMATION

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail					Initial - PASS/FAIL
GH_FR1_WS_2016_05_18_N	WS	18-May-16	09:45	G	4		X										

2016/05/19
1030 12°C
Good Condition
4 × 20 L Carboys
no S/I
Bears Paw
MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions		
For both permit requirments and water for special treatment testing	Jevin Wolchuk	May 18/16	10:30				Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470
Sampler's Signature	Jevin Wolchuk	Date/Time	May 18/16

Temp in °C | Samples on ice? | Sample intact? | Trip Blank?

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com			Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED									ADDITIONAL INFORMATION
						PRESERV									
						ANALYSIS		7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F conducted in Calgary	30d Rbt EA P/F			
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.									Temp °C	
CM_MC2_WS_20160518_N	WS	May 18 2016	10:40	G	4					x	X	X		8.7	4X20L Refresh
									WO #	16476	16477	16473			

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions
	J. Evans (Nautilus)	18-May-16	11:45	Nautilus	May 19/16	08:00	Y / N Y / N Y / N
				JY- Nau Yamamoto			Y / N Y / N Y / N
				= refresh sample =			Y / N Y / N Y / N
							Y / N Y / N Y / N

					Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Jeremy Evans	Mobile #						
Sampler's Signature		Date/Time	May 18 2016					

Chain Of Custody Record

COC ID: 20140902-1509

Turnaround Time:

Page: 1 of 2

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Hydroqual Laboratories			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Jacklyn Pool			Address			
Address	2261 Corbin Rd.			Address	#4, 6125-12th Street S.E.						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Calgary	State	AB	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	T2H 2K1	Country	Canada	Task Code			
Email EDD To	Rick.Maglio.co@teck.com			Phone Number	403-253-7121			Shipping Company			
	Don.Sacino@teck.com			Email Address				Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

16-0488 Week 4

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30-d P. promelas (pass/fail)								ADDITIONAL INFORMATION
CM_MC2_WS_20160518_N	WS	May 18 2016	10:40	G	4		x								Refresh

2016/05/19 1030
Good Condition
13°C
no S/F 4x20L CuBoys
BearPaw
ML

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions
	J. Evans (Nupqu)	18-May-16	11:45				

Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

Sampler's Name	Jeremy Evans	Mobile #	
Sampler's Signature	[signature]	Date/Time	May 18 2016

Teck

COC ID:	20160518	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO				
Facility Name / Job#	Elkview Operations/ Chronic Toxicity Sampling	Lab Name	Nautilus Environmental	Report Format / Distribution		Excel	PDF	EDD
Project Manager	Michael Moore	Lab Contact	Krysta Pearcy	Email 1:	Michael.Moore@teck.com	X	X	X
Email	Michael.Moore@teck.com	Email	krysta@nautilusenvironmental.ca	Email 2:	teckcoal@aquisonline.com			X
Address	RR#1 HWY# 3	Address	8664 Commerce Court	Email 3:	Casandra.Knopphulren@teck.com	X	X	X
			Imperial Square Lake City	Email 4:	James.Boldt@teck.com	X	X	X
				Email 5:	Cameron.Griffin@teck.com	X	X	X
City	Sparwood / Province BC	City	Burnaby / Province BC	PO number	418927			
Postal Code	V1C 4C3 / Country Canada	Postal Code	V5A 4N7 / Country Canada					
Phone Number	1-250-865-5289	Phone Number						

SAMPLE DETAILS — **ANALYSIS REQUESTED**

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Toxicity 30-Day Pass/Fail (R+ EA)	Temp °C	
EV_HC1_WS_2016-05-18_N	EV_HC1	WS	N	2016/05/18	7:30	G	3	3	8.5	3x20L
EV_MC2_WS_2016-05-18_N	EV_MC2	WS	N	2016/05/18	9:00	G	3	3	8.3	3x20L
						Total	6			

WO # 16473

= refresh sample =

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Toxicity 30-Day Pass/Fail= Rainbow trout embyro-alevin Toxicity 7-Day/72-Hr Pass/ Fail =7 d C. dubia and 72 h P. subcapitata			Nautilus NY-Nan Yamamoto	May 19/16 @ 08:00

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default) X	Sampler's Name	JAMES BOLDT	Mobile #	
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature	J-B-T	Date/Time	MAY 18 2016 10:00
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Teck

COC ID:	tox week 4 refresh Q2, 2016	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO

Facility Name / Job#	Line Creek Operation
Project Manager	Jay Jones
Email	jay.jones@teck.com
Address	Box 2003
	15km North Hwy 43
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	250-425-6111

LABORATORY

Lab Name	Nautilus Environmental
Lab Contact	Krysta Pearcy
Email	Krysta@NautilusEnvironmental.ca
Address	8664 commerce Court
City	Burnaby
Province	BC
Postal Code	V5A 4N7
Country	Canada
Phone Number	604-420-8773

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	jay.jones@teck.com	x	x	
Email 2:	tim.chala@teck.com	x	x	
Email 3:	teckcoal@equisonline.com			x
Email 4:	cait.good@teck.com	x	x	x
PO number				
PO number				

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30-d *O. mykiss* embryo-alevin (semi-annual) pass/fail	Temp °C
LC_LCDSSLCC__WS_2016-05-16_N	LC_LCDSSLCC	WS	N	18-May-16	12:20	G	3	X	6.8 3x2L

WO # 16473

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
			Nautilus NY - Nan Yamamoto	May 19/16 @ 08:00
			= refresh sample =	

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jay Jones	Mobile #	250 423-3004
Sampler's Signature		Date/Time	

Teck

COC ID:	20160525-1133	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country						
Phone Number	1-250-865-5289			Phone Number	403-253-7121							

SAMPLE DETAILS								ANALYSIS REQUESTED												
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30 Day Fathead Minnow												
FR_FRCP1_QR_02052016_N	FR_FRCP1	WS		2016/05/25	09:55	G	4	4												
FR_UFR1_QR_02052016_N	FR_UFR1	WS		2016/05/25	08:47	G	4	4												

16-0490 week 5

16-0491 week 5

2016/05/26

1200

10°C

Good Condition

8 x 80 L Cubays

No S/T

Bears paw Cooler

me

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Dylan Beaun	May 25		

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Dylan Beaun	Mobile #	250 865 5273
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	May 25, 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Chain Of Custody Record

COC ID: May 25, 2016 Refresh | Page: 1 of 1

Turnaround Time: | Rush:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Greenhills Operation			Lab Name	HydroQual Laboratories Ltd.			Send Invoice To	
Project Number				Contact Name	Jacklyn Pool			Address	
Contact Name	Leigh Stickney			Address	#4, 6125 - 12th Street S.E				
Address	P.O. BOX 5000							City	State
				City	Calgary	State	AB	Postal Code	Country
City	Elkford	State	BC	Postal Code	T2H2K1	Country	Canada	Task Code	
Postal Code	V0B1H0	Country	Canada	Phone Number	403.253.7121			Shipping Company	
Phone Number	250-865-3274			Email Address				Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To	

SAMPLE DETAILS

16-0489 week 5

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.
GH_FR1_WS_2016_05_25_N	WS	25-May-16	0930	G	4

2016/05/26
1200 10C
Good Condition
4 x 20 L Cubcys
Bears Paw Cooler
MC

ANALYSIS REQUESTED

ANALYSIS	PRESERV.	30 d early life stage, fathead minnow Pass/Fail	28 d Hyalella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail				
GH_FR1_WS_2016_05_25_N		X									

ADDITIONAL INFORMATION

Initial - PASS/FAIL

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time
For both permit requirments and water for special treatment testing						

Sample Receipt Conditions			
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470
Sampler's Signature		Date/Time	May 25/16 16:30

Chain Of Custody Record

COC ID: 20140902-1509 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Coal Mountain Operation			Lab Name	Hydroqual Laboratories			Send Invoice To	
Contact Name	Carla Romero			Contact Name	Jacklyn Pool			Address	
Address	2261 Corbin Rd.			Address	#4, 6125-12th Street S.E.				
City	Sparwood	Prov.	BC					City	State
Postal Code	V0B 2G0	Country	Canada	City	Calgary	State	AB	Postal Code	Country
Phone Number	250 425 7350			Postal Code	T2H 2K1	Country	Canada	Task Code	
Email EDD To	Rick.Maglocco@teck.com			Phone Number	403-253-7121			Shipping Company	
	Don.Sacino@teck.com			Email Address				Tracking Number	
	Carla.Romero@teck.com			PO Number				CC Hardcopy To	
								CC Hardcopy To	

16-0488 Week 5

SAMPLE DETAILS						ANALYSIS REQUESTED									ADDITIONAL INFORMATION
						PRESERV.									
						ANALYSIS	30-d P. promelas (pass/fail)								
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.										
CM_MC2_WS_20160525_N	WS	May 25 2016	10:10	G	4		x								Refresh

2016/05/26
1200
Good Condition
4 + 20 L Carboys
Bears ptw Cooler
no S/I
MC
10C

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
	J. Ems (Nufarm)	25May	11:00					Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Jeremy Ems	Mobile #	250 419-4387	Temp in °C	Trip Blank?
Sampler's Signature		Date/Time	May 25 2016	Samples on ice?	
				Sample intact?	

Appendix B-3 Third Quarter 2016 Results: Toxicity testing on Elk Valley samples with *Ceriodaphnia dubia, Pseudokirchneriella subcapitata, Hyalella azteca* and *Pimephales promelas*

Toxicity testing on Elk Valley samples with *Ceriodaphnia dubia*, *Pseudokirchneriella subcapitata*, *Hyalella azteca* and *Pimephales promelas*

Third Quarter 2016 Results

Final Report

January 27, 2017

Submitted to: **Teck Coal Ltd.**
Sparwood, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

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SIGNATURE PAGE

Report By:
Krysta Pearcy, R.P.Bio.
Laboratory Coordinator

Reviewed By:
James Elphick, R.P.Bio.
Environmental Toxicologist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Summaries of sample information and test results from the toxicity tests conducted on samples collected from the Elk Valley to meet requirements of the quarterly toxicity testing program required under BC Ministry of Environment permit number 107517 in the third quarter of 2016 are provided in the tables below.

Sample and Test Type Information

Sample ID	FR_UFR1 (site control), FR_FRCP1, GH_FR1, GH_ERC, EV_MC2, EV_HC1, CM_MC2 and LC_LCDSSLCC
Sample collection dates	August 23, August 30, September 6, September 13 and September 20, 2016
Sample receipt dates	August 24, August 31, September 7, September 14 and September 21, 2016
Sample receipt temperatures	Ranged from 7.2 to 15.0°C
Test types	*Ceriodaphnia dubia* survival and reproduction *Pseudokirchneriella subcapitata* growth inhibition *Hyalella azteca* survival and growth *Pimephales promelas* survival and growth

Summary of Results

Endpoint	Mean ± SD								
	Laboratory Control	FR_UFR1 (Site Control)	FR_FRCP1	GH_FR1	GH_ERC	EV_MC2	EV_HC1	CM_MC2	LC_LCDSSLCC
C. dubia									
Survival (%)	100	100	100	100	100	100	100	100	100
Reproduction	26.2 ± 2.5	25.9 ± 1.7	17.6 ± 7.4$^{*\,\alpha}$	26.2 ± 3.2	24.9 ± 2.2	25.1 ± 2.2	23.3 ± 7.9	19.1 ± 4.7$^{*\,\alpha}$	21.8 ± 5.6
P. subcapitata									
Cell Yield (x 104 cells/mL)	35.6 ± 2.3	121.1 ± 6.5	124.5 ± 4.8	118.0 ± 9.2	121.3 ± 6.6	120.0 ± 5.7	120.5 ± 6.6	107.5 ± 2.1$^{\alpha}$	119.5 ± 5.5
H. azteca									
Survival (%)	98.0 ± 4.5	100 ± 0.0	98.0 ± 4.5	96.0 ± 5.5	NT	NT	NT	98.0 ± 4.5	NT
Dry weight (mg)	0.79 ± 0.07	0.87 ± 0.02	0.74 ± 0.10$^{\alpha}$	0.77 ± 0.05$^{\alpha}$	NT	NT	NT	0.89 ± 0.04	NT
***P. promelas* (untreated)**									
Hatch (%)	98.3 ± 3.3	98.3 ± 3.3	98.3 ± 3.3	98.3 ± 3.3	NT	NT	NT	95.0 ± 6.4	NT
Survival (%)	95.0 ± 3.3	41.7 ± 24.6*	36.7 ± 26.9*	38.3 ± 22.0*	NT	NT	NT	46.7 ± 30.3*	NT
Biomass (mg)	0.8 ± 0.1	0.6 ± 0.1*	0.6 ± 0.4	0.7 ± 0.0	NT	NT	NT	0.8 ± 0.1	NT
Length (mm)	8.3 ± 0.4	9.7 ± 1.3	9.4 ± 0.8	10.2 ± 2.6	NT	NT	NT	9.7 ± 1.6	NT
Normal development (%)	100 ± 0.0	100 ± 0.0	100 ± 0.0	100 ± 0.0	NT	NT	NT	100 ± 0.0	NT

Summary of Results (continued)

Endpoint	Mean ± SD								
	Laboratory Control	**FR_UFR1 (Site Control)**	**FR_FRCP1**	**GH_FR1**	**GH_ERC**	**EV_MC2**	**EV_HC1**	**CM_MC2**	**LC_LCDSSLCC**
***P. promelas* (copper amended)**									
Hatch (%)	91.7 ± 12.6	98.3 ± 3.3	96.7 ± 6.7	98.3 ± 3.3	NT	NT	NT	86.7 ± 10.9[α]	NT
Survival (%)	86.7 ± 9.4	83.3 ± 6.7	80.0 ± 10.9	88.3 ± 8.4	NT	NT	NT	63.3 ± 24.6[* α]	NT
Biomass (mg)	0.9 ± 0.2	0.9 ± 0.1	1.0 ± 0.1	0.8 ± 0.1	NT	NT	NT	0.8 ± 0.2	NT
Length (mm)	8.7 ± 0.6	8.9 ± 0.2	9.1 ± 0.3	8.8 ± 0.6	NT	NT	NT	9.2 ± 0.9	NT
Normal development (%)	100 ± 0.0	100 ± 0.0	100 ± 0.0	100 ± 0.0	NT	NT	NT	100 ± 0.0	NT

SD = Standard Deviation, NT = Not Tested

[*] Result was significantly lower than the laboratory control

[α] Result was significantly lower than the site control FR_UFR1

1.0 INTRODUCTION

Nautilus Environmental conducted toxicity tests for Teck Coal Ltd. on samples collected from various locations in the Elk Valley as part of a quarterly toxicity testing program required under BC Ministry of Environment permit number 107517. Test species required to be tested quarterly included a cladoceran (*Ceriodaphnia dubia*), a unicellular green alga (*Pseudokirchneriella subcapitata*), an amphipod (*Hyalella azteca*), and the fathead minnow (*Pimephales promelas*). Tests are also required on a semi-annual basis (in alignment with second and forth quarterly testing) using rainbow trout (*Oncorhynchus mykiss*).

Water samples used for testing were transported in 20-L plastic containers in coolers containing ice packs. Samples were received at temperatures ranging from 7.2 to 15.0°C and were stored in the dark at 4 ± 2°C prior to testing. Table 1 summarizes the toxicity tests that were conducted on each sample as well as sample collection dates. Samples were collected weekly on the dates shown in Table 1 for the duration of the *H. azteca* and *P. promelas* tests. The *P. promelas* test was conducted at the Nautilus Environmental laboratory in Calgary, AB; the other toxicity tests were conducted at the Burnaby, BC location.

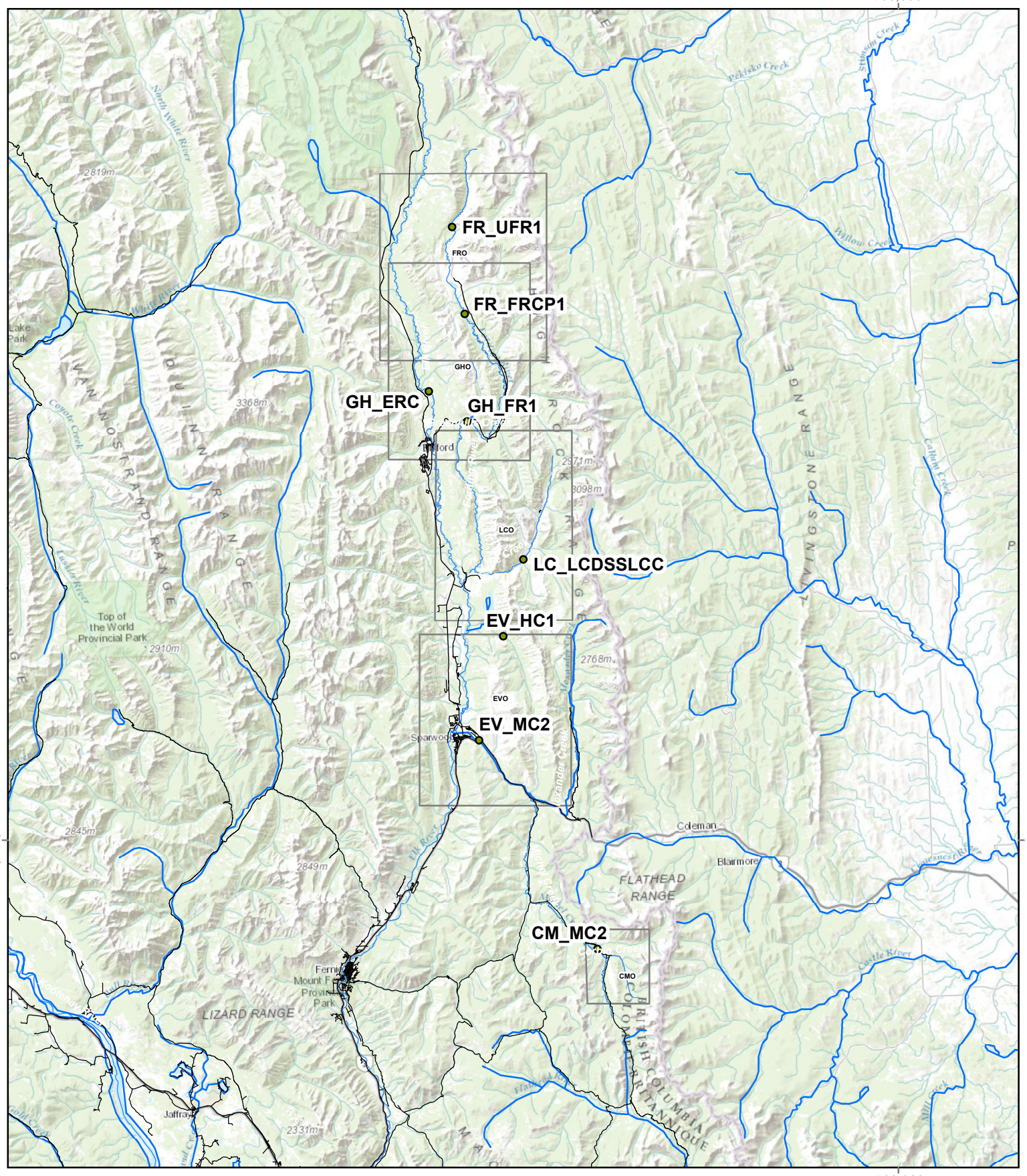
This report presents the results of the toxicity tests. Copies of laboratory data sheets and printouts of statistical analyses are provided in Appendices A through D. The chain-of-custody forms are provided in Appendix E. Results of analytical chemistry performed on the samples tested in this program are uploaded by Teck to the Environmental Management System database. These samples were collected by Teck personnel at the same time the samples were collected for toxicity testing.

Table 1. Summary of toxicity testing program.

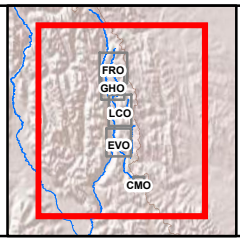
Sample ID	EMS Location ID	Species Tested	Sample Collection Dates
FR_UFR1*	E216777	*C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* †	August 23, August 30, September 6, September 13 and September 20, 2016
FR_FRCP1	E300071	*C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* †	August 23, August 30, September 6, September 13 and September 20, 2016
GH_FR1	0200378	*C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* †	August 23, August 30, September 6, September 13 and September 20, 2016
GH_ERC	E300090	*C. dubia* and *P. subcapitata*	August 23, 2016
EV_MC2	E300091	*C. dubia* and *P. subcapitata*	August 23, 2016
EV_HC1	E102682	*C. dubia* and *P. subcapitata*	August 23, 2016
CM_MC2	E258937	*C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* †	August 23, August 30, September 6, September 13 and September 20, 2016
LC_LCDSSLCC	E297110	*C. dubia* and *P. subcapitata*	August 23, 2016

* Site water control

† *P. promelas* tests were conducted on untreated and copper-amended samples



Teck



Chronic Toxicity Monitoring Locations

- Roads
- Rivers
- Monitoring Locations

N

0 4,000 8,000 16,000 Meters

DATE:	MINE OPERATION:
7/24/2015	Elk Valley
SCALE:	COORDINATE SYSTEM:
1:550,000	NAD 1983 UTM Zone 11N

Document Path: \\teckcominco.loc\CGO\Groups\TCGIS\Data\Operations\SPO\Dan_Vasiga\BaseLandscape_letter.mxd

2.0 METHODS

Methods for the toxicity tests using *C. dubia*, *P. subcapitata*, *H. azteca* and *P. promelas* are summarized in Tables 2 through 5. Laboratory control water was 20% Perrier water prepared with deionized water for *C. dubia*; City of Calgary dechlorinated municipal tap water for *P. promelas*; and moderately hard water prepared by addition of reagent grade salts to dechlorinated municipal tap water for *H. azteca* according to a recipe provided in Environment Canada (2013).

For the *H. azteca* tests, all of the site waters were supplemented with 25 mg/L chloride and 0.02 mg/L bromide using NaCl and NaBr, respectively, according to recommendations of the *Hyalella* Advisory Group (chaired by Chris Ingersoll, USGS) (Norberg-King et al., 2014), since low concentrations of these halides are known to impair growth of this species. The laboratory control water contained approximately 75 mg/L chloride and 0.8 mg/L bromide, respectively.

Fathead minnows are known to be susceptible to adverse effects caused by fungi and microbes (Grothe and Johnson, 1996; Ksoz et al., 2997; Downey et al. 2000). Results of toxicity tests and Toxicity Identification Evaluation efforts conducted in 2015 indicated that artefactual toxicity (i.e., adverse effects that were not associated with toxicants in the sample) had occurred in fathead minnow tests using ambient water samples from the Elk Valley and amendment of the samples with a low dose of copper appeared to counteract the adverse effect. Consequently, the *P. promelas* tests were tested on both untreated samples, as well as following addition of 10 µg/L copper, in order to reduce the potential adverse effects caused by fungi and microbes in the samples. A copper-amended control water treatment was also evaluated to test whether the copper itself caused any adverse response.

Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013), and involved comparison of results to both the laboratory and site water controls.

Table 2. Test conditions: *Ceriodaphnia dubia* survival and reproduction test.

Test species	*Ceriodaphnia dubia*
Organism source	In-house culture
Organism age	<24 hour old neonates, produced within a 12 hour window
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20-mL glass test tube
Test volume	15 mL
Test solution depth	10 cm
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	10 per treatment
Number of organisms	1 per replicate
Control/dilution water	20% Perrier water and 80% deionized water + 5 µg/L Se and 2 µg/L vitamin B12
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	Daily with *Pseudokirchneriella subcapitata* and YCT (3:1 ratio)
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival and reproduction checked daily
Test protocol	Environment Canada (2007a), EPS 1/RM/21
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods; no ephippia present
Reference toxicant	Sodium chloride (NaCl)

Table 3. Test conditions: *Pseudokirchneriella subcapitata* growth inhibition test.

Test species	*Pseudokirchneriella subcapitata*, strain UTCC# 37
Organism source	In-house axenic culture, obtained from Canadian Phycological Culture Center, and originally isolated from Nivelta River, Norway.
Organism age	3-to 7-day old culture in logarithmic growth phase
Test type	Static
Test duration	72 hours
Test vessel	Microplate
Test volume	220 µL
Test concentrations	95.2% (v/v), plus laboratory control
Test replicates	4 per treatment; 8 for laboratory control
Number of organisms	10,000 cells/mL
Control/dilution water	Deionized water supplemented with nutrients
Test solution renewal	None
Test temperature	24 ± 2°C
Feeding	None
Light intensity	3600 to 4400 lux
Photoperiod	24 hours light
Aeration	None
Test measurements	Test area temperature measured daily; temperature and pH measured at test initiation; pH of two control wells measured at test termination
Test protocol	Environment Canada (2007b), EPS 1/RM/25
Statistical software	CETIS Version 1.8.7
Test endpoints	Algal cell growth inhibition
Test acceptability criteria for controls	>16-fold increase in number of algal cells; CV ≤ 20%; no trend when analyzed using Mann-Kendall test
Reference toxicant	Zinc (added as $ZnCl_2$)

Table 4. Test conditions: *Hyalella azteca* survival and growth test.

Test species	*Hyalella azteca*
Organism source	Aquatic Research Organisms, NH
Organism age	7- to 8-days old
Test type	Static-renewal
Test duration	28 days
Test vessel	375-mL glass container
Test volume	300 mL
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	5 per treatment
Number of organisms	10 per replicate
Control/dilution water	Reconstituted water containing ~75 mg/L Cl and 0.8 mg/L Br prepared according to the recipe provided in Environment Canada (2013). The samples were supplemented with 25 mg/L Cl and 0.02 mg/L Br.
Test solution renewal	Twice daily (~80% renewal)
Test temperature	23 ± 1°C
Feeding	1 mL of YCT daily to each container. Tetramin daily, with amounts increasing weekly: Week 1: 0.25 mg, Week 2: 0.5 mg, Week 3: 1 mg, Week 4: 1.5 mg in each test container.
Light intensity	500 to 1000 lux at water surface
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured upon arrival; total ammonia measured at test initiation and termination
Test protocol	Modified from US EPA (2000), as described in Norberg-King et al. (2014)
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival and dry weight
Test acceptability criteria for controls	Mean control survival of ≥80% survival
Reference toxicant	Sodium chloride (NaCl)

Table 5. Test conditions: *Pimephales promelas* survival and growth test.

Test species	*Pimephales promelas*
Organism source	Aquatox, Hot Springs, AR
Organism age	<24 hours
Test type	Static-renewal
Test duration	28 days post hatch
Test vessel	1-L plastic container
Test volume	1 L
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	4 per treatment
Number of organisms	10 per replicate
Control/dilution water	Dechlorinated City of Calgary municipal tapwater
Test solution renewal	Daily (80% renewal)
Test temperature	25 ± 1°C
Feeding	Twice a day, after hatch, with newly hatched brine shrimp (*Artemia* nauplii)
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	Provided post hatch (<100 bubbles/min)
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity measured upon arrival; survival checked daily
Test protocol	US EPA (1996) and ASTM (2013)
Statistical software	CETIS Version 1.8.7
Test endpoints	Hatch, survival, length, biomass, normal development (which assesses incidence of deformities)
Test acceptability criteria for controls	>66% hatch, ≥70% post-hatch survival
Reference toxicant	Sodium chloride (NaCl)

3.0 RESULTS

Results of the toxicity tests using *C. dubia* are provided in Table 6. The site water and laboratory water controls performed similarly for this species, indicating that there was no adverse effect associated with the upstream Fording River station. No adverse effect was observed on survival of *C. dubia*; survival was 100% in all samples. Compared to the site water and laboratory water controls, a statistically significant reduction in *C. dubia* reproduction was observed in two samples (FR_FRCP1 and CM_MC2). Compared to the site water control, percent reduction was 32% for FR_FRCP1 and 26% for CM_MC2. Percent reduction compared to the laboratory control was 33 and 27% for FR_FRCP1 and CM_MC2, respectively.

Results of the toxicity tests using *P. subcapitata* are provided in Table 7. In these tests, the site water control produced 3.4-fold greater growth than the laboratory water control. This finding is not unusual, since the higher ionic strength associated with the site water controls would be expected to stimulate cell growth of this species relative to the very low ionic strength associated with the laboratory control water. Similarly, the other samples also exhibited a stimulation of cell growth relative to the laboratory water control; none of the samples exhibited a statistically significant reduction in cell growth relative to the laboratory water control. Compared to the site water control, a statistically significant reduction in cell yield was observed only for CM_MC2; percent reduction compared to the site water control was 11%.

Results of the toxicity tests using *H. azteca* are provided in Table 8. Survival and dry weight in the site water and laboratory water controls were similar for this species, indicating that there was no adverse effects associated with the sample from the upstream Fording River station. No adverse effect was observed on survival of *H. azteca*; survival ranged from 96 to 100% in all samples. Compared to the site water control, a statistically significant reduction in dry weight was observed for two samples (FR_FRCP1 and GH_FR1); percent reduction compared to the site water control was 15% for FR_FRCP1 and 12% for GH_FR1. There was no adverse effect on dry weight in the samples compared to the laboratory control.

Results of the untreated and copper-amended toxicity tests using *P. promelas* are provided in Tables 9 and 10, respectively. Survival in the untreated site control was statistically significantly lower than the laboratory control (56% reduction). Biomass in the untreated site control was statistically significantly lower than the laboratory control (31% reduction). Hatch, length and normal development were similar in the untreated site control, and laboratory control for this species, indicating that there was no adverse or stimulatory effects associated with the upstream Fording River station for these endpoints.

A statistically significant reduction in *P. promelas* survival was observed in the three untreated samples (FR_FRCP1, GH_FR1 and CM_MC2) compared to the laboratory control; percent reduction ranged from 51 to 61%. There was no adverse effect on survival in any of the untreated samples compared to the untreated site water control. There were no adverse effects on hatch, biomass, length, or normal development (i.e., incidence of deformities) in the untreated samples compared to the untreated site water and laboratory controls.

The effects that were observed on fathead minnows in the untreated tests were primarily restricted to mortalities, and occurred predominantly between days 6 and 12 of the tests. Fathead minnows are known to be susceptible to adverse effects caused by fungi and microbes (Grothe and Johnson, 1996; Ksoz et al., 2997; Downey et al. 2000). These effects have been termed "sporadic mortality phenomenon", and are associated with mortalities that generally occur beginning on day 4 of the 7-day test with this species (Downey et al. 2000); this age is equivalent to day 6 of the 32-day test, which starts with an earlier life-stage. Effects associated with this phenomenon are generally associated with a high degree of between-replicate variability, as was in these 32-day tests. Thus, the pattern of effects observed with the samples tested here is consistent with effects caused by sporadic mortality phenomenon.

The samples and the control water were also tested with the addition of 10 µg/L Cu to reduce fungal and microbial growth in the samples in the test (Table 10). A statistically significant reduction in survival was observed in one of the copper-amended samples (CM_MC2) compared to the copper-amended site water and laboratory controls; percent reductions were 24% and 27% compared to the copper-amended site and laboratory water controls, respectively. Hatch was also statistically significantly reduced in copper-amended sample CM_MC2, but only when compared to the copper-amended site water control (12% reduction). Reduced survival in CM_MC2 was largely associated with one of the replicates (replicate A), and occurred primarily between day 6 and 12 of exposure. Thus, the pattern of effects observed in this copper-amended sample was consistent with an effect caused by microbial activity (i.e., sporadic mortality phenomenon), suggesting that the 10 µg/L Cu amendment may have been insufficient to fully control microbial effects in this case. Excluding replicate A, the remaining replicates for sample CM_MC2 produced a survival of 75.6 ± 3.8%, which was not statistically significantly different from the control or site water control.

There were no adverse effects on biomass, length or normal development (i.e., incidence of deformities) in copper-amended CM_MC2 compared to the copper-amended site and laboratory water controls. There were no adverse effects on any of the endpoints for the remaining copper-amended samples compared to the copper-amended site and laboratory water controls.

Table 6. Results: *Ceriodaphnia dubia* survival and reproduction test.

Sample ID	Survival (%)	Reproduction (Mean ± SD)
Laboratory Control	100	26.2 ± 2.5
FR_UFR1 (Site Control)	100	25.9 ± 1.7
FR_FRCP1	100	17.6 ± 7.4 * α
GH_FR1	100	26.2 ± 3.2
GH_ERC	100	24.9 ± 2.2
EV_MC2	100	25.1 ± 2.2
EV_HC1	100	23.3 ± 7.9
CM_MC2	100	19.1 ± 4.7 * α
LC_LCDSSLCC	100	21.8 ± 5.6

SD = Standard Deviation
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control, FR_UFR1

Table 7. Results: *Pseudokirchneriella subcapitata* growth inhibition test.

Sample ID	Cell Yield (x 10^4 cells/mL) (Mean ± SD)	Stimulation relative to laboratory control (%)
Laboratory Control	35.6 ± 2.3	-
FR_UFR1 (Site Control)	121.1 ± 6.5	240.0
FR_FRCP1	124.5 ± 4.8	249.5
GH_FR1	118.0 ± 9.2	231.2
GH_ERC	121.3 ± 6.6	240.4
EV_MC2	120.0 ± 5.7	236.8
EV_HC1	120.5 ± 6.6	238.2
CM_MC2	107.5 ± 2.1 α	201.8
LC_LCDSSLCC	119.5 ± 5.5	235.4

SD = Standard Deviation
α Result was significantly lower than the site control, FR_UFR1

Table 8. Results: *Hyalella azteca* survival and growth test.

Sample ID	Mean ± SD	
	Survival (%)	Dry Weight (mg)
Laboratory Control	98.0 ± 4.5	0.79 ± 0.07
FR_UFR1 (Site Control)	100 ± 0.0	0.87 ± 0.02
FR_FRCP1	98.0 ± 4.5	0.74 ± 0.10 [α]
GH_FR1	96.0 ± 5.5	0.77 ± 0.05 [α]
CM_MC2	98.0 ± 4.5	0.89 ± 0.04

SD = Standard Deviation
[α] Result was significantly lower than the site control, FR_UFR1

Table 9. Results: *Pimephales promelas* survival and growth test (untreated).

Sample ID	Mean ± SD				
	Hatch (%)	Survival (%)	Biomass (mg)	Length (mm)	Normal development (%)
Laboratory Control	98.3 ± 3.3	95.0 ± 3.3	0.8 ± 0.1	8.3 ± 0.4	100 ± 0.0
FR_UFR1 (Site Control)	98.3 ± 3.3	41.7 ± 24.6 [*]	0.6 ± 0.1 [*]	9.7 ± 1.3	100 ± 0.0
FR_FRCP1	98.3 ± 3.3	36.7 ± 26.9 [*]	0.6 ± 0.4	9.4 ± 0.8	100 ± 0.0
GH_FR1	98.3 ± 3.3	38.3 ± 22.0 [*]	0.7 ± 0.0	10.2 ± 2.6	100 ± 0.0
CM_MC2	95.0 ± 6.4	46.7 ± 30.3 [*]	0.8 ± 0.1	9.7 ± 1.6	100 ± 0.0

SD = Standard Deviation
[*] Result was significantly lower than the laboratory control
[α] Result was significantly lower than the site control, FR_UFR1

Table 10. Results: *Pimephales promelas* survival and growth test (copper-amended).

Sample ID	Mean ± SD				
	Hatch (%)	Survival (%)	Biomass (mg)	Length (mm)	Normal development (%)
Laboratory Control [+Cu]	91.7 ± 12.6	86.7 ± 9.4	0.9 ± 0.2	8.7 ± 0.6	100 ± 0.0
FR_UFR1 (Site Control) [+Cu]	98.3 ± 3.3	83.3 ± 6.7	0.9 ± 0.1	8.9 ± 0.2	100 ± 0.0
FR_FRCP1 [+Cu]	96.7 ± 6.7	80.0 ± 10.9	1.0 ± 0.1	9.1 ± 0.3	100 ± 0.0
GH_FR1 [+Cu]	98.3 ± 3.3	88.3 ± 8.4	0.8 ± 0.1	8.8 ± 0.6	100 ± 0.0
CM_MC2 [+Cu]	86.7 ± 10.9 α	63.3 ± 24.6 * α	0.8 ± 0.2	9.2 ± 0.9	100 ± 0.0

SD = Standard Deviation

* Result was significantly lower than the copper amended laboratory control

α Result was significantly lower than the copper amended site control, FR_UFR1

4.0 QA/QC

The health histories of the test organisms used in the exposures were acceptable and met the requirements of the test protocols. The tests met all control acceptability criteria. There were no deviations from the test methodologies other than the planned modification to the *H. azteca* method and addition of copper in the *P. promelas* tests, as described in Section 2.0. Uncertainty associated with these tests is best described by the standard deviations around the means.

All water quality parameters remained within ranges specified in the protocols throughout the tests, with the exception of dissolved oxygen in the *P. promelas* test. Dissolved oxygen in the *P. promelas* untreated laboratory control was recorded as 51% saturation on day 28, which is below the minimum of 60% saturation required by the protocol. On day 29 the dissolved oxygen in the untreated laboratory control returned to within the acceptable range for the remainder of the test, and there was no effect on survival associated with this water quality deviation. All control acceptability criteria were met for this test and the decrease in dissolved oxygen concentration would not be expected to affect the test results.

Growth results for fathead minnows were identified as being unusually high for four individual replicates in the untreated fathead minnow tests (site water control replicate D, GH_FR1 replicate D, CM_MC2 replicates B and D), and in one replicate in the copper-amended fathead minnow test (FR_FRCP1 replicate C). The fish in these replicates were re-weighed after removing the fish from the weigh pans, since it was suspected that the pan weights may have been recorded incorrectly; however, data for these replicates were excluded from the statistical analysis since they were handled differently from the remainder of the test replicates.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 11. Results for these tests fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in these tests was appropriate. The reference toxicant tests were performed under the same conditions as those used for the samples.

Table 11. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
C. dubia	Survival (LC50): 2.0 g/L NaCl	2.0 (1.8 – 2.2)	5	September 1, 2016
	Reproduction (IC50): 1.6 g/L NaCl	1.6 (1.2 – 2.0)	13	
P. subcapitata	Growth (IC50): 32.3 µg/L Zn	33.6 (25.0 – 45.2)	16	August 19, 2016
H. azteca	Survival (LC50): 6.0 g/L NaCl	5.6 (5.0 – 6.2)	5	August 24, 2016
P. promelas	Survival (LC50): 0.7 g/L NaCl	0.6 (0.5 – 0.9)	12	August 29, 2016
	Biomass (IC25): 0.5 g/L NaCl	0.4 (0.2 – 0.8)	20	

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration, EC = Effect Concentration

5.0 REFERENCES

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APPENDIX A – *Ceriodaphnia dubia* Toxicity Test Data

Ceriodaphnia dubia Summary Sheet

Client: Teck Coal
Work Order No.: 16885

Start Date/Time: August 24/16 @ 1030h
Set up by: MLT/EMM

Sample Information:

Sample ID: various, see results table for IDs
Sample Date: August 23/16
Date Received: August 24/16
Sample Volume: various

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 081716A
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 27
Mortality (%) in previous 7 d: 0
Individual female # used ≥8 young on test day: 1,2,3,6,7,9,11,14,15

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd148
Stock Solution ID: ~~MLT16NA02~~ 16NA01
Date Initiated: ~~AMG~~ September 1/16

7-d LC50 (95% CL): 2.0 (1.7-2.3) g/L NaCl
7-d IC50 (95% CL): 1.6 (1.3-1.9) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCl CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.6 (1.2-2.0) g/L NaCl CV (%): 13

Test Results:

100% (v/v)	Survival (%)	Reproduction (Mean ± SD)
Negative Control	100	26.2 ± 2.5
FR_UFR1_QR_01082016_N ①	100	25.9 ± 1.7
FR_FRCP1_QR_01082016_N	100	17.6 ± 7.4 *a
GH_FR1_WS_2016_08_23_N	100	26.2 ± 3.2
GH_ERC_WS_2016_08_23_N	100	24.9 ± 2.2
EV_MC2_WS_2016-08-23_N	100	25.1 ± 2.2
EV_HC1_WS_2016-08-23_N	100	23.3 ± 7.9
EN_MC2_WS_20160823_N	100	19.1 ± 4.7 *a
LC_LCDSSLCC_WS_2016-08-23_N	100	21.8 ± 5.6

a. Reproduction was significantly less than site control FR_UFR1

① site control * Reproduction was significantly less than the lab control

Reviewed by: JPa
Date reviewed: Sep. 14/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck Coal
Sample ID: various pass/fails
Work Order #: 16885

Start Date & Time: Aug 24/16 @ 1030h
Stop Date & Time: Aug 31/16 @ 1030h
Test Species: *Ceriodaphnia dubia*

% (v/v) Concentration: Control	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	25.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.0	7.2	8.0	7.5	8.0	7.4	8.0	7.5	8.0	7.2	8.0	7.2
pH	8.0	7.8	8.0	7.7	8.0	7.7	7.9	7.7	8.1	7.7	8.1	7.5	8.0	7.5
Cond. (µS/cm)	215	224		224		214		214		214		222		213
Initials	MLT	MLT		EMM		AD		AD		MLT		JS		JS

FR_UFR1 Concentration: 100% (v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.0	7.3	8.2	7.4	8.1	7.4	8.0	7.5	8.3	6.9	8.1	7.1
pH	8.0	7.9	8.1	7.9	8.1	8.0	8.1	8.1	8.1	7.7	8.1	7.7	8.2	7.7
Cond. (µS/cm)	332	333		333		326		328		327		337		324
Initials	MLT	MLT		EMM		AD		AD		MLT		JS		JS

FR_FRCP1 Concentration: 100% (v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.0	7.3	8.2	7.5	8.1	7.5	8.1	7.5	8.3	7.1	8.3	7.1
pH	8.0	7.8	8.1	8.0	8.1	8.0	8.1	8.0	8.1	7.8	8.1	7.7	8.1	7.8
Cond. (µS/cm)	820	823		822		803		805		793		805		774
Initials	MLT	MLT		EMM		AD		AD		MLT		JS		JS

GH_FR1 Concentration: 100% (v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.0	7.3	8.2	7.5	8.1	7.6	8.0	7.5	8.3	7.1	8.3	7.2
pH	8.0	7.9	8.1	8.0	8.1	8.1	8.1	8.0	8.2	7.8	8.1	7.8	8.0	7.8
Cond. (µS/cm)	691	718		709		684		691		683		688		662
Initials	MLT	MLT		EMM		AD		AD		MLT		JS		JS

Thermometer: 4 **DO meter:** 1 **pH meter:** 2 **Conductivity meter:** 1

	Control	FR_UFR1	FR_FRCP1 (100% (v/v))	GH_FR1
Hardness*	100	174	456	244
Alkalinity*	96	164	196	202

* mg/L as CaCO3

Analysts: MLT, EMM, AWD, JS, KL
Reviewed by: JSH
Date reviewed: Sept 14/16

Sample Description: clear, colourless, odourless, no particulates (all samples)

Comments: **Broodboard Used:** ~~081116~~ 081716A (Cts 1,2,3,6,7,8,9,11,14,15)

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck Coal
Sample ID: various pass/fails
Work Order #: 16885

Start Date & Time: Aug 29/16 @ 1030h
Stop Date & Time: Aug 31/16 @ 1030h
Test Species: *Ceriodaphnia dubia*

GH_ERC — Concentration 100% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.5	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.0	7.3	8.2	7.5	8.0	7.5	8.1	7.5	8.3	7.1	8.2	7.1
pH	7.9	7.8	8.0	7.9	8.1	8.0	8.1	8.0	8.1	8.0	8.1	7.8	8.1	7.7
Cond. (µS/cm)	305	305		305		300		302		297		299		300
Initials	MLT	MLT		EMM						MLT		JS		JS

EV_MC2 — Concentration 100% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.0	7.3	8.2	7.4	8.1	7.5	8.1	7.6	8.3	6.9	8.2	7.1
pH	7.9	7.8	7.9	7.9	8.0	8.1	8.1	8.0	8.1	8.1	8.0	7.7 ①	8.0	7.9
Cond. (µS/cm)	651	656		655		639		641		637		JS 643		626
Initials	MLT	MLT		EMM						MLT		JS		JS

① 7.9

EV_HC1 — Concentration 100% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.0	7.3	8.2	7.5	8.1	7.5	8.1	7.6	8.2	7.2	8.2	7.2
pH	8.1	7.9	8.1	8.0	8.1	8.1	8.1	8.1	8.0	8.1	8.1	7.9	8.1	7.8
Cond. (µS/cm)	645	653		657		645		641		635		638		628
Initials	MLT	MLT		EMM						MLT		JS		JS

CM_MC2 — Concentration 100% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.0	7.4	8.2	7.5	8.1	7.5	8.0	7.6	8.2	7.2	8.2	7.2
pH	8.2	7.9	8.2	8.1	8.2	8.0	8.2	8.2	8.2	8.0	8.0	7.8	8.0	7.8
Cond. (µS/cm)	858	850		852		833		831		818		830		803
Initials	MLT	MLT		EMM						MLT		JS		JS

Thermometer: 4 **DO meter:** 1 **pH meter:** 2 **Conductivity meter:** 1

	Control	GH_ERC	EV_MC2 (100% v/v)	EV_HC1
Hardness*	100	168	250	362
Alkalinity*	96	146	194	196

* mg/L as CaCO3

Analysts: MLT, EMM, AWD, JS, KL
Reviewed by: JOL
Date reviewed: Sep-14/16

Sample Description: clear, colourless, odourless, no particulates (all samples)

Comments: **Broodboard Used:** ~~D8776~~ 08716A (1st 1,2,3,6,7,9,11,14,15)

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck Coal
Sample ID: various pass/fails
Work Order #: 16885

Start Date & Time: Aug 24/16 @ 1030h
Stop Date & Time: Aug 31/16 @ 1030h
Test Species: *Ceriodaphnia dubia*

LC_LCDSSLCC Concentration 100% (v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.8	8.0	7.4	8.2	7.5	8.1	7.5	8.0	8.0	8.2	7.1	8.2	7.2
pH	8.0	7.8	8.1	8.0	8.1	8.1	8.1	8.0	8.1	8.0	8.0	7.9	8.0	7.8
Cond. (µS/cm)	718	720		728		713		711		705		708		705
Initials	MLT	MLT		EMM		[illegible]		[illegible]		MLT		JS		JS

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: 4 **DO meter:** 1 **pH meter:** 2 **Conductivity meter:** 1

	Control	100% (v/v) CM_MC2	LC_LCDSSLCC	
Hardness*	100	470	312	
Alkalinity*	96	208	196	

* mg/L as CaCO3

Analysts: MLT, EMM, AWD, JS, KL
Reviewed by: JWG
Date reviewed: Sep 14/16

Sample Description: clear, colourless, odourless, no particulates (all samples)

Comments: **Broodboard Used:** ~~08H16~~ 08H16A (# 1,2,3,6,7,9,11,14,15)

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck Coal
Sample ID: various pass/fails
Work Order: 16885

100% CV/IV)

Start Date & Time: August 24/16 @ 1030h
Stop Date & Time: August 31/16 @ 1030h
Set up by: MLT/EMM

Days	Concentration: Control										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	AD
4	3	2	3	2	3	2	3	4	3	3	AD
5	10	7	7	9	9	10	9	10	8	9	MLT
6	15	13	✓	✓	✓	✓	15	16	13	✓	JS
7	✓	✓	15	15	12	15	✓	✓	✓	17	JS
8											
Total	28	22	25	26	24	27	27	30	24	29	JS

Days	Concentration: FR_UFR1 (site control)										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	AD
4	2	2	3	2	3	3	4	2	2	3	AD
5	8	7	9	9	9	9	10	9	10	8	MLT
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
7	14	14	16	15	13	15	13	15	13	17	JS
8						JS					
Total	24	23	28	26	25	27 (~~28~~)	27	26	25	28	JS

Days	Concentration: FR_FRCP1										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	AD
4	3	2	3	2	2	✓	✓	2	3	3	AD
5	8	7	7	4	6	6	✓	7	5	8	MLT
6	9Z	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
7	✓JS	11	13	6	14	7	✓	13	11	14	JS
8											
Total	20	20	23	12	22	13	0	22	19	25	JS

Days	Concentration: GH_FR1										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	AD
4	3	2	3	3	3	2	2	3	2	3	AD
5	8	9	9	10	10	9	8	7	9	10	MLT
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
7	10	16	13	18	16	17	14	12	17	14	JS
8											
Total	21	27	25	31	29	28	24	22	28	27	JS

Days	Concentration: GH_FRC										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	AD
4	3	3	2	3	3	2	2	3	3	3	AD
5	8	9	8	7	9	10	8	7	7	6	MLT
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
7	14	17	14	14	13	16	13	16	12	14	JS
8											
Total	25	29	24	24	25	28	23	26	22	23	JS

Days	Concentration: EV_MC2										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	AD
4	3	4	3	—	3	3	3	2	3	2	AD
5	10	7	10	10	8	9	9	6	9	7	MLT
6	✓	✓	✓	11	✓	✓	✓	✓	✓	✓	JS
7	10	15	16	✓	15	14	12	16	15	16	JS
8											
Total	23	26	29	21	26	26	24	24	27	25	JS

Days	Concentration: EV_HC1										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	AD
4	3	3	2	3	3	2	2	3	2	—	AD
5	7	10	9	8	8	9	12	11	9	4	AD
6	10	✓	✓	12	9	9	✓	✓	✓	✓	JS
7	✓	16	18	✓	JS 11	✓	17	12	18	✓	JS
8								JS			
Total	20	29	29	23	22	20	31	~~29~~ 26	29	4	JS

Days	Concentration: CM_MC2										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	AD
4	2	2	2	2	✓	3	2	2	✓	2	AD
5	9	6	7	11	6	8	8	7	6	9	MLT
6	11	✓	✓	✓	✓	✓	✓	✓	6	✓	JS
7	✓	✓	8	12	11	11	12	9	8	9	JS
8											
Total	22	8	17	25	17	22	22	18	20	20	JS

Days	Concentration: LC_LCDSS_CC										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2											
3	—	—	—	—	—	—	—	—	—	—	AD
4	✓	2	3	3	2	2	2	3	2	2	AD
5	3	6	10	9	10	8	10	10	11	12	MLT
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
7	5	10	10	11	10	13	15	12	13	13	JS
8											
Total	8	18	23	23	22	23	27	21	26	27	JS

Notes: X = mortality.

Sample Description: clear, colourless, odourless, no particulates (all samples)

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JSh

Date reviewed: Sep. 14/16

CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Batch ID:	05-1722-8408	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	24 Aug-16 10:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	31 Aug-16 10:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 0h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	10h	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	26h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	24h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	26h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	24h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	25h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	26h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	21h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	24h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

① Lab control = 20% Perrier lab water

FR_UFR1 = site control

7d Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	10	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1 (site)	10	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	10	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	10	1	1	1	1	1	0	0	0.0%	0.0%
GH_ERC	10	1	1	1	1	1	0	0	0.0%	0.0%
EV_MC2	10	1	1	1	1	1	0	0	0.0%	0.0%
EV_HC1	10	1	1	1	1	1	0	0	0.0%	0.0%
CM_MC2	10	1	1	1	1	1	0	0	0.0%	0.0%
LC_LCDSSLCC	10	1	1	1	1	1	0	0	0.0%	0.0%

7d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
FR_UFR1 (site)	1	1	1	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	1	1	1	1
GH_ERC	1	1	1	1	1	1	1	1	1	1
EV_MC2	1	1	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1
LC_LCDSSLCC	1	1	1	1	1	1	1	1	1	1

Ceriodaphnia 7-d Survival and Reproduction Test **Nautilus Environmental**

7d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_UFR1 (site)	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ERC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
LC_LCDSSLCC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	09-3085-9568	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 14:24	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	05-1722-8408	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	24 Aug-16 10:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	31 Aug-16 10:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 0h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	10h	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	26h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	24h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	26h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	24h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	25h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	26h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	21h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	24h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1 (site)	1	1.0000	Exact	Non-Significant Effect
Lab Control		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_ERC	1	1.0000	Exact	Non-Significant Effect
Lab Control		EV_MC2	1	1.0000	Exact	Non-Significant Effect
Lab Control		EV_HC1	1	1.0000	Exact	Non-Significant Effect
Lab Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect
Lab Control		LC_LCDSSLCC	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Negative Contr	10	0	10	1	0	0.0%
FR_UFR1 (site)		10	0	10	1	0	0.0%
FR_FRCP1		10	0	10	1	0	0.0%
GH_FR1		10	0	10	1	0	0.0%
GH_ERC		10	0	10	1	0	0.0%
EV_MC2		10	0	10	1	0	0.0%
EV_HC1		10	0	10	1	0	0.0%
CM_MC2		10	0	10	1	0	0.0%
LC_LCDSSLCC		10	0	10	1	0	0.0%

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	09-3085-9568	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 14:24	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

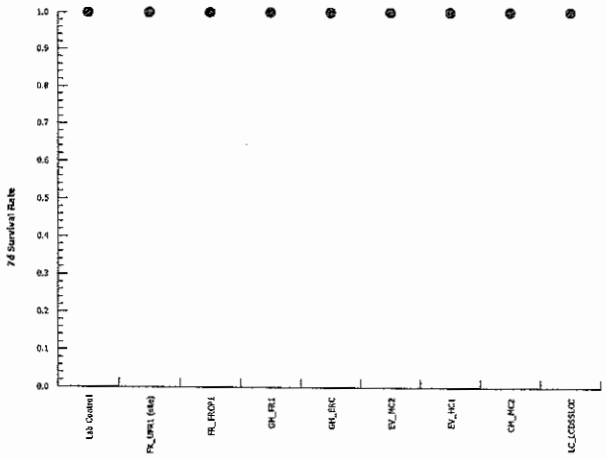
7d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
FR_UFR1 (site)	1	1	1	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	1	1	1	1
GH_ERC	1	1	1	1	1	1	1	1	1	1
EV_MC2	1	1	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1
LC_LCDSSLCC	1	1	1	1	1	1	1	1	1	1

7d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_UFR1 (site)	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ERC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
LC_LCDSSLCC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



Analyst:_____ QA: JGL Jan - 14/16

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	12-3973-6090	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 14:28	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	05-1722-8408	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	24 Aug-16 10:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	31 Aug-16 10:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 0h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	10h	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	26h (11.8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1 (site)	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Negative Contr	10	0	10	1	0	0.0%
FR_UFR1 (site)	Upstream Contr	10	0	10	1	0	0.0%

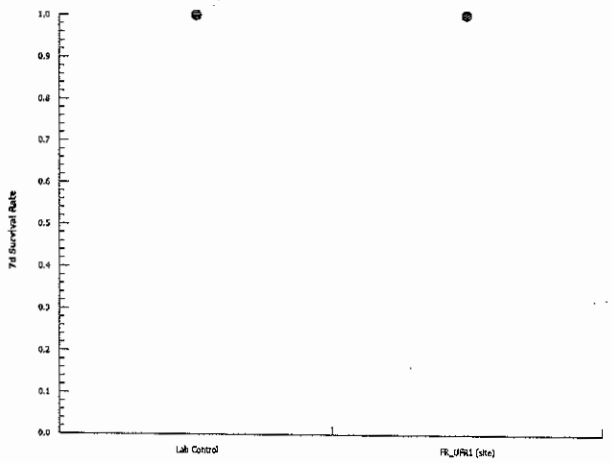
7d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
FR_UFR1 (site)	1	1	1	1	1	1	1	1	1	1

7d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_UFR1 (site)	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Batch ID:	05-1722-8408	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	24 Aug-16 10:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	31 Aug-16 10:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 0h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	10h	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	26h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	24h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	26h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	24h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	25h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	26h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	21h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	24h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

① Lab control = 20% Perrier lab water

FR_UFR1 = site control

Reproduction Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	10	26.2	24.42	27.98	22	30	0.786	2.486	9.49%	0.0%
FR_UFR1 (site)	10	25.9	24.71	27.09	23	28	0.526	1.663	6.42%	1.15%
FR_FRCP1	10	17.6	12.28	22.92	0	25	2.353	7.442	42.28%	32.82%
GH_FR1	10	26.2	23.94	28.46	21	31	0.9978	3.155	12.04%	0.0%
GH_ERC	10	24.9	23.3	26.5	22	29	0.7063	2.234	8.97%	4.96%
EV_MC2	10	25.1	23.5	26.7	21	29	0.7063	2.234	8.9%	4.2%
EV_HC1	10	23.3	17.66	28.94	4	31	2.495	7.889	33.86%	11.07%
CM_MC2	10	19.1	15.77	22.43	8	25	1.472	4.654	24.36%	27.1%
LC_LCDSSLCC	10	21.8	17.8	25.8	8	27	1.769	5.594	25.66%	16.79%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	28	22	25	26	24	27	27	30	24	29
FR_UFR1 (site)	24	23	28	26	25	27	27	26	25	28
FR_FRCP1	20	20	23	12	22	13	0	22	19	25
GH_FR1	21	27	25	31	29	28	24	22	28	27
GH_ERC	25	29	24	24	25	28	23	26	22	23
EV_MC2	23	26	29	21	26	26	24	24	27	25
EV_HC1	20	29	29	23	22	20	31	26	29	4
CM_MC2	22	8	17	25	17	22	22	18	20	20
LC_LCDSSLCC	8	18	23	23	22	23	27	21	26	27

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	04-5861-0040	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 14:24	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	05-1722-8408	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	24 Aug-16 10:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	31 Aug-16 10:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 0h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	10h	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	26h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	24h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	26h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	24h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	25h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	26h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	21h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	24h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	19.5%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1 (site)	101	73	5	18	0.8021	Asymp	Non-Significant Effect
		FR_FRCP1	60.5	73	2	18	0.0028	Asymp	Significant Effect
		GH_FR1	106.5	73	6	18	0.9132	Asymp	Non-Significant Effect
		GH_ERC	89	73	6	18	0.3999	Asymp	Non-Significant Effect
		EV_MC2	91.5	73	5	18	0.4898	Asymp	Non-Significant Effect
		EV_HC1	96.5	73	3	18	0.6676	Asymp	Non-Significant Effect
		CM_MC2	60	73	2	18	0.0024	Asymp	Significant Effect
		LC_LCDSSLCC	75	73	3	18	0.0653	Asymp	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	817.4222	102.1778	8	4.611	0.0001	Significant Effect
Error	1794.9	22.15926	81			
Total	2612.322		89			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	42.09	20.09	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8522	0.962	<0.0001	Non-normal Distribution

Analysis ID: 04-5861-0040 **Endpoint:** Reproduction **CETIS Version:** CETISv1.8.7
Analyzed: 31 Aug-16 14:24 **Analysis:** Nonparametric-Control vs Treatments **Official Results:** Yes

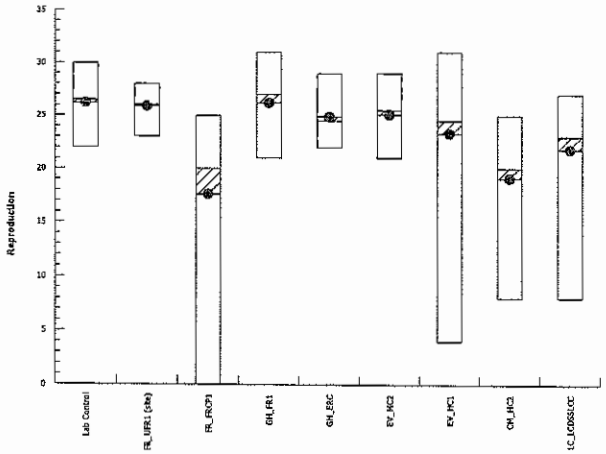
Reproduction Summary

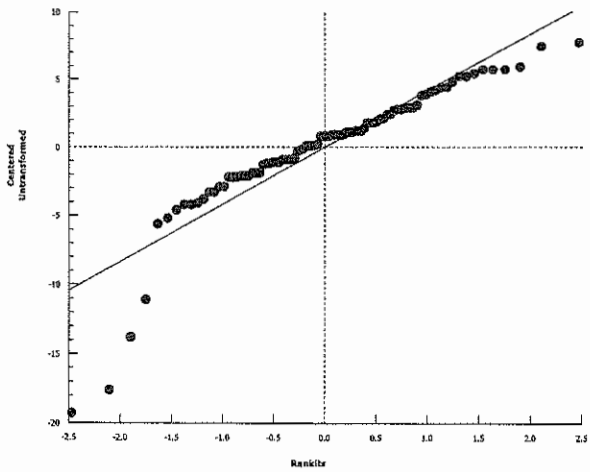
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	26.2	24.42	27.98	26.5	22	30	0.786	9.49%	0.0%
FR_UFR1 (site)	10	25.9	24.71	27.09	26	23	28	0.526	6.42%	1.15%
FR_FRCP1	10	17.6	12.28	22.92	20	0	25	2.353	42.28%	32.82%
GH_FR1	10	26.2	23.94	28.46	27	21	31	0.9978	12.04%	0.0%
GH_ERC	10	24.9	23.3	26.5	24.5	22	29	0.7063	8.97%	4.96%
EV_MC2	10	25.1	23.5	26.7	25.5	21	29	0.7063	8.9%	4.2%
EV_HC1	10	23.3	17.66	28.94	24.5	4	31	2.495	33.86%	11.07%
CM_MC2	10	19.1	15.77	22.43	20	8	25	1.472	24.36%	27.1%
LC_LCDSSLCC	10	21.8	17.8	25.8	23	8	27	1.769	25.66%	16.79%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	28	22	25	26	24	27	27	30	24	29
FR_UFR1 (site)	24	23	28	26	25	27	27	26	25	28
FR_FRCP1	20	20	23	12	22	13	0	22	19	25
GH_FR1	21	27	25	31	29	28	24	22	28	27
GH_ERC	25	29	24	24	25	28	23	26	22	23
EV_MC2	23	26	29	21	26	26	24	24	27	25
EV_HC1	20	29	29	23	22	20	31	26	29	4
CM_MC2	22	8	17	25	17	22	22	18	20	20
LC_LCDSSLCC	8	18	23	23	22	23	27	21	26	27

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	05-0309-7344	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 14:28	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	05-1722-8408	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	24 Aug-16 10:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	31 Aug-16 10:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 0h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	26h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	24h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	26h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	24h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	25h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	26h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	21h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	24h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	20.3%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	58.5	74	2	18	0.0014	Asymp	Significant Effect
		GH_FR1	111.5	74	5	18	0.9602	Asymp	Non-Significant Effect
		GH_ERC	89	74	6	18	0.3774	Asymp	Non-Significant Effect
		EV_MC2	93.5	74	5	18	0.5381	Asymp	Non-Significant Effect
		EV_HC1	100.5	74	2	18	0.7690	Asymp	Non-Significant Effect
		CM_MC2	58	74	1	18	0.0012	Asymp	Significant Effect
		LC_LCDSSLCC	75.5	74	3	18	0.0647	Asymp	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	725.6875	103.6696	7	4.292	0.0005	Significant Effect
Error	1739.3	24.15694	72			
Total	2464.988		79			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	37	18.48	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8503	0.9579	<0.0001	Non-normal Distribution

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	05-0309-7344	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 14:28	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

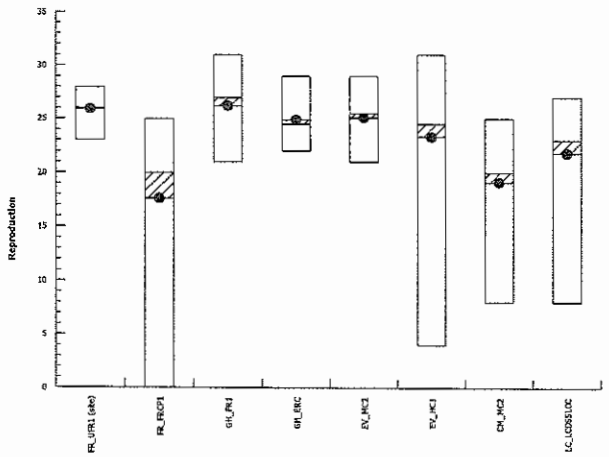
Reproduction Summary

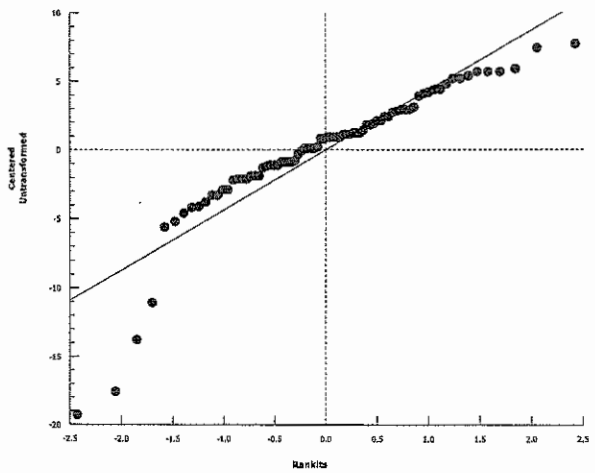
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1 (site)	10	25.9	24.71	27.09	26	23	28	0.526	6.42%	0.0%
FR_FRCP1	10	17.6	12.28	22.92	20	0	25	2.353	42.28%	32.05%
GH_FR1	10	26.2	23.94	28.46	27	21	31	0.9978	12.04%	-1.16%
GH_ERC	10	24.9	23.3	26.5	24.5	22	29	0.7063	8.97%	3.86%
EV_MC2	10	25.1	23.5	26.7	25.5	21	29	0.7063	8.9%	3.09%
EV_HC1	10	23.3	17.66	28.94	24.5	4	31	2.495	33.86%	10.04%
CM_MC2	10	19.1	15.77	22.43	20	8	25	1.472	24.36%	26.25%
LC_LCDSSLCC	10	21.8	17.8	25.8	23	8	27	1.769	25.66%	15.83%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
FR_UFR1 (site)	24	23	28	26	25	27	27	26	25	28
FR_FRCP1	20	20	23	12	22	13	0	22	19	25
GH_FR1	21	27	25	31	29	28	24	22	28	27
GH_ERC	25	29	24	24	25	28	23	26	22	23
EV_MC2	23	26	29	21	26	26	24	24	27	25
EV_HC1	20	29	29	23	22	20	31	26	29	4
CM_MC2	22	8	17	25	17	22	22	18	20	20
LC_LCDSSLCC	8	18	23	23	22	23	27	21	26	27

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	07-1415-5372	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 14:29	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	05-1722-8408	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	24 Aug-16 10:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	31 Aug-16 10:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 0h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	26h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	24h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	26h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	24h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	25h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	26h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	21h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	24h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	20.3%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	151.5	74	2	18	1.0000	Asymp	Non-Significant Effect
		GH_FR1	98.5	74	5	18	0.7096	Asymp	Non-Significant Effect
		GH_ERC	121	74	6	18	0.9959	Asymp	Non-Significant Effect
		EV_MC2	116.5	74	5	18	0.9868	Asymp	Non-Significant Effect
		EV_HC1	109.5	74	2	18	0.9415	Asymp	Non-Significant Effect
		CM_MC2	152	74	1	18	1.0000	Asymp	Non-Significant Effect
		LC_LCDSSLCC	134.5	74	3	18	1.0000	Asymp	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	725.6875	103.6696	7	4.292	0.0005	Significant Effect
Error	1739.3	24.15694	72			
Total	2464.988		79			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	37	18.48	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8503	0.9579	<0.0001	Non-normal Distribution

Ceriodaphnia 7-d Survival and Reproduction Test **Nautilus Environmental**

Analysis ID: 07-1415-5372 **Endpoint:** Reproduction **CETIS Version:** CETISv1.8.7
Analyzed: 31 Aug-16 14:29 **Analysis:** Nonparametric-Control vs Treatments **Official Results:** Yes

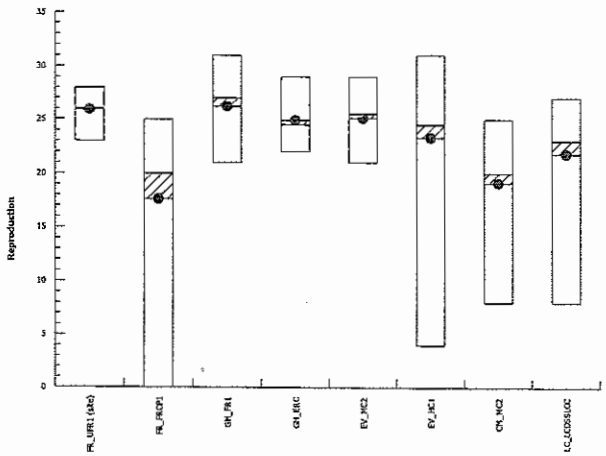
Reproduction Summary

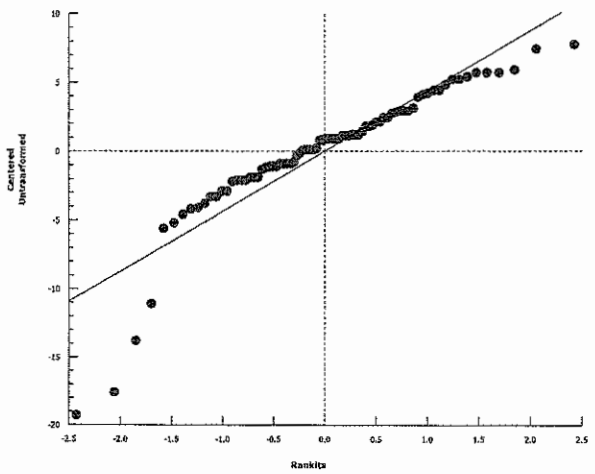
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1 (site)	10	25.9	24.71	27.09	26	23	28	0.526	6.42%	0.0%
FR_FRCP1	10	17.6	12.28	22.92	20	0	25	2.353	42.28%	32.05%
GH_FR1	10	26.2	23.94	28.46	27	21	31	0.9978	12.04%	-1.16%
GH_ERC	10	24.9	23.3	26.5	24.5	22	29	0.7063	8.97%	3.86%
EV_MC2	10	25.1	23.5	26.7	25.5	21	29	0.7063	8.9%	3.09%
EV_HC1	10	23.3	17.66	28.94	24.5	4	31	2.495	33.86%	10.04%
CM_MC2	10	19.1	15.77	22.43	20	8	25	1.472	24.36%	26.25%
LC_LCDSSLCC	10	21.8	17.8	25.8	23	8	27	1.769	25.66%	15.83%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
FR_UFR1 (site)	24	23	28	26	25	27	27	26	25	28
FR_FRCP1	20	20	23	12	22	13	0	22	19	25
GH_FR1	21	27	25	31	29	28	24	22	28	27
GH_ERC	25	29	24	24	25	28	23	26	22	23
EV_MC2	23	26	29	21	26	26	24	24	27	25
EV_HC1	20	29	29	23	22	20	31	26	29	4
CM_MC2	22	8	17	25	17	22	22	18	20	20
LC_LCDSSLCC	8	18	23	23	22	23	27	21	26	27

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	18-0790-3631	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 14:28	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes
Batch ID:	05-1722-8408	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Mimi Tran
Start Date:	24 Aug-16 10:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	31 Aug-16 10:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 0h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	10h	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	26h (11.8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	6.26%	

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1 (site)	0.3172	1.734	1.64	18	0.3774	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.45	0.45	1	0.1006	0.7547	Non-Significant Effect
Error	80.5	4.472222	18			
Total	80.95		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.233	6.541	0.2472	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.987	0.866	0.9912	Normal Distribution

Reproduction Summary

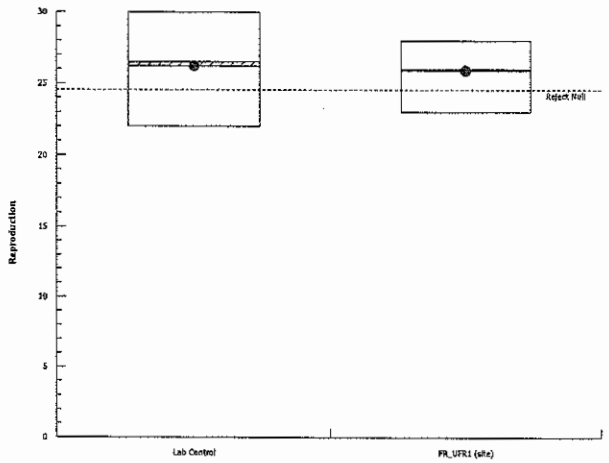
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	26.2	24.42	27.98	26.5	22	30	0.786	9.49%	0.0%
FR_UFR1 (site)	10	25.9	24.71	27.09	26	23	28	0.526	6.42%	1.15%

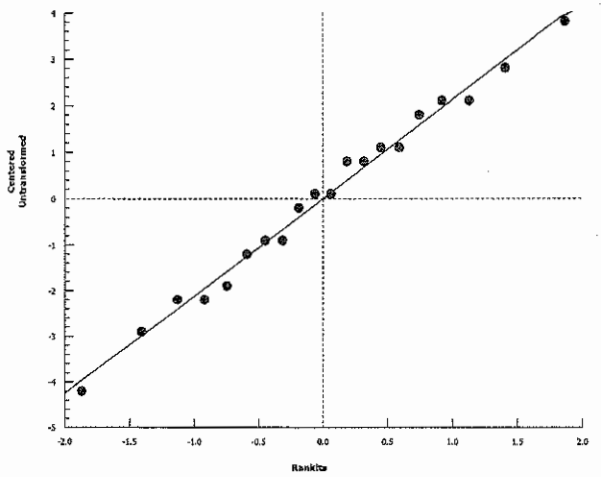
Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	28	22	25	26	24	27	27	30	24	29
FR_UFR1 (site)	24	23	28	26	25	27	27	26	25	28

Analysis ID:	18-0790-3631	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 14:28	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Graphics





Client: Teck coal

W.O.#: 16885

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
~~FR-FRCP1~~	~~Aug24/16~~	~~Aug24/16~~	50	10.0	10.2	196	~~100~~ 50	~~45.0~~ 22.8	456	JS
FR-UFR1				8.4	8.6	164	50	8.7	174	
CM-MC2				10.6	10.8	208	50	23.5	470	
GH-FR1				10.3	10.5	202	50	12.2	244	
GH-ERC				7.5	7.7	146	50	8.4	168	
LC-LCDESLCC				10.0	10.2	196	50	15.6	312	
EV-MC2				9.9	10.1	194	50	12.5	250	
EV-HC1	↓	↓	↓	10.0	10.2	196	50	18.1	362	↓
20% Perrier	Aug24/16	Aug24/16	50	4.9	5.0	96	50	5.0	100	MH

Notes:

Reviewed by: JCh Date Reviewed: Sep. 14/16

APPENDIX B – *Pseudokirchneriella subcapitata* Toxicity Test Data

Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 16886

Start Date: August 26/16
Set up by: MLT

Sample Information:

Sample ID: various, see results table for ID's
Sample Date: August 23/16
Date Received: August 24/16
Sample Volume: various

Test Organism Information:

Culture Date: August 19/16
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC145
Stock Solution ID: 167n01
Date Initiated: August 19/16

72-h IC50 (95% CL): 32.3 (27.0 - 37.3) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 33.6 (25.0 - 45.2) ug/L Zn CV (%): 16

Test Results:

	Cell Yield (Mean± SD)
Negative Control	35.6 ± 2.3
FR_UFR1_QR_01082016_N ①	121.1 ± 6.5 *
FR_FRCP1_QR_01082016_N	124.5 ± 4.8 *
GH_FR1_WS_2016_08_23_N	118.0 ± 9.2 *
GH_ERC_WS_2016_08_23_N	121.3 ± 6.6 *
EV_MC2_WS_2016-08-23_N	120.0 ± 5.7 *
EV_HCl_WS_2016-08-23_N	120.5 ± 6.6 *
CM_MC2_WS_20160823_N	107.5 ± 2.1 *a.
LC_LCDSSLCC_WS_2016-08-23_N	119.5 ± 5.5 *

a. indicates cell yield that were significant less than the site control FR_UFR1

① site control *indicates cell yield that were significantly greater than the lab control

Reviewed by: JCL
Date reviewed: Sep. 15/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Teck Coal **Setup by:** MLT

Sample ID: various **Test Date/Time:** August 26/16 @ 0740h

Work Order No.: 16886 **Test Species:** *Pseudokirchneriella subcapitata*

Culture Date: August 19/16 **Age of Culture:** 7d **Culture Health:** Good

Culture Count: 1 2602 292 **Average:** 276 **Culture Cell Density (c1):** 276 x 10⁴ cells/mL

v1 = 220,000 cells/ml x 100 ml / (c1) 276 x 10⁴ cells/ml = 7.97 mL

Time Zero Counts: 1 22 2 24 **Average:** 23

No. of Cells/mL: 23 x 10⁴ **Initial Density:** # cells/mL ÷ 220 µL x 10 µL = 10455 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	6.9	23.0	25.0	25.5	25.5	25.0	✓	✓	✓	✓
FR_UFR1 (Sitereconstitution)	8.0	23.0	↓	↓	↓	↓	✓	✓	✓	✓
FR_FRCP1	8.1	23.0					✓	✓	✓	✓
GH_FR1	8.1	23.0					✓	✓	✓	✓
GH_ERC	8.0	23.0					✓	✓	✓	✓
EV_MC2	8.0	23.0					✓	✓	✓	✓
EV_HC1	8.2	23.0					✓	✓	✓	✓
CM_MC2	8.2	23.0					✓	✓	✓	✓
LCR_LCDSILCC	8.1	23.0					✓	✓	✓	✓
Initials	MLT	MLT	MLT	AD	AD	MLT	MLT	AD	AD	MLT

Initial control pH: Well 1: 6.9 Well 2: 6.9

Final control pH: Well 1: 6.8 Well 2: 6.8

Light intensity (lux): 4000 **Date measured:** August 26/16

Instruments: Thermometer 4 pH meter 2 Light meter 1

Sample Description: clear, colourless, odourless, no particulates (all samples)

Comments:

Reviewed: JGL **Date reviewed:** Sep. 15/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal | Start Date/Time: August 26/16 @ 0740h
Work Order #: 16886 | Termination Date: August 29/16 @ 0740h
Sample ID: various | Test set up by: MLT

%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	34					MLT
	B	40					
	C	37					
	D	36					
	E	39					
	F	34					
	G	35					
	H	38					
FR_UFR1 (site) 100% (v/v)	A	114					
	B	120					
	C	124					
	D	120					
~~FR~~ MLT	~~E~~ A	129					
	~~F~~ B MLT	124					
	~~G~~ C	132					
	~~H~~ D	114					
FR_FRCP1 100% (v/v)	A	120					
	B	130					
	C	123					
	D	129					
GH_FR1 100% (v/v)	A	113					
	B	110					
	C	130					
	D	123					
GH_ERC 100% (v/v)	A	120					
	B	127					
	C	128					
	D	114					
EV_MC2 100% (v/v)	A	113					
	B	126					
	C	124					
	D	121					
EV_HC1 100% (v/v)	A	118					
	B	115					
	C	123					
	D	130					↓

Comments:

Reviewed by: JBL | Date Reviewed: Sept-15/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal — Start Date/Time: August 26/16 @ 0740h
Work Order #: 16886 — Termination Date: August 29/16 @ 0740h
Sample ID: various — Test set up by: MLT
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
~~Control~~ MLT	A						
	B						
	C						
	D						
	E						
	F						
	G						
	H						
CM_MC2	A	109					MLT
	B	106					↓
100% (v/v)	C	108					
	D	111					
LC_LEDSSLee	A	115					
	B	123					
100% (v/v)	C	127					↓
	D	117					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: JCh — Date Reviewed: Sept. 15/16

Pseudokirchneriella subcapitata Algal Counts

Client: Teck Coal
WO#: 16886
Sample ID: Teck Coal samples pass/fail

Start Date/Time: 26-Aug-16 @ 0740h
Termination Date: 29-Aug-16 @ 0740h

Initial Cell Density: 10455 cell/mL

230000
0.22
0.01
10454.5

Concentration	Rep	Count 1 ($x 10^4$)	Count 2 ($x 10^4$)	Count 3 ($x 10^4$)	Count 4 ($x 10^4$)	Mean ($x 10^4$)	Cell Yield ($x 10^4$) cell/mL		
Control	A	34				34	33.0	mean	35.6
Lab Water	B	40				40	39.0	SD	2.26385
	C	37				37	36.0	CV	6.36277
	D	36				36	35.0		
	E	39				39	38.0		
	F	34				34	33.0		
	G	35				35	34.0		
	H	38				38	37.0		
Control	A	114				114	113.0	mean	121.1
Site Water	B	120				120	119.0	SD	6.46833
(FR_UFRI)	C	124				124	123.0	CV	5.34221
100% (v/v)	D	120				120	119.0		
	E	129				129	128.0		
	F	124				124	123.0		
	G	132				132	131.0		
	H	114				114	113.0		
FR_FRCPI	A	120				120	119.0		
100% (v/v)	B	130				130	129.0		
	C	123				123	122.0		
	D	129				129	128.0		
GH_FRI	A	113				113	112.0		
100% (v/v)	B	110				110	109.0		
	C	130				130	129.0		
	D	123				123	122.0		
GH_ERC	A	120				120	119.0		
100% (v/v)	B	127				127	126.0		
	C	128				128	127.0		
	D	114				114	113.0		
EV_MC2	A	113				113	112.0		
100% (v/v)	B	126				126	125.0		
	C	124				124	123.0		
	D	121				121	120.0		
EV_HC1	A	118				118	117.0		
100% (v/v)	B	115				115	114.0		
	C	123				123	122.0		
	D	130				130	129.0		
CM_MC2	A	109				109	108.0		
100% (v/v)	B	106				106	105.0		
	C	108				108	107.0		
	D	111				111	110.0		
LC_LCDSSLCC	A	115				115	114.0		
100% (v/v)	B	123				123	122.0		
	C	127				127	126.0		
	D	117				117	116.0		

JOL
Sep. 15/16

CETIS Summary Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Batch ID:	06-5127-0129	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	26 Aug-16 07:40	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	29 Aug-16 07:40	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	15-9957-7983	26 Aug-16	26 Aug-16	8h	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	71h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	69h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	71h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	69h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	70h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	72h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	67h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	69h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
① Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

① Lab control = D1 w/nutrients
FR_UFR1 = site control

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	8	35.63	33.73	37.52	33	39	0.8004	2.264	6.36%	0.0%
FR_UFR1 (site)	8	121.1	115.7	126.5	113	131	2.287	6.468	5.34%	-240.0%
FR_FRCP1	4	124.5	116.9	132.1	119	129	2.398	4.796	3.85%	-249.5%
GH_FR1	4	118	103.4	132.6	109	129	4.601	9.201	7.8%	-231.2%
GH_ERC	4	121.3	110.8	131.7	113	127	3.276	6.551	5.4%	-240.4%
EV_MC2	4	120	110.9	129.1	112	125	2.858	5.715	4.76%	-236.8%
EV_HC1	4	120.5	110.1	130.9	114	129	3.279	6.557	5.44%	-238.2%
CM_MC2	4	107.5	104.2	110.8	105	110	1.041	2.082	1.94%	-201.8%
LC_LCDSSLCC	4	119.5	110.7	128.3	114	126	2.754	5.508	4.61%	-235.4%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	33	39	36	35	38	33	34	37
FR_UFR1 (site)	113	119	123	119	128	123	131	113
FR_FRCP1	119	129	122	128				
GH_FR1	112	109	129	122				
GH_ERC	119	126	127	113				
EV_MC2	112	125	123	120				
EV_HC1	117	114	122	129				
CM_MC2	108	105	107	110				
LC_LCDSSLCC	114	122	126	116				

CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	18-7913-2204	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 13:55	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	06-5127-0129	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	26 Aug-16 07:40	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	29 Aug-16 07:40	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	15-9957-7983	26 Aug-16	26 Aug-16	8h	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	71h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	69h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	71h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	69h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	70h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	72h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	67h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	69h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	24.6%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1 (site)	30.34	2.541	7.161	14	<0.0001	CDF	Significant Effect
		FR_FRCP1	25.75	2.541	8.77	10	<0.0001	CDF	Significant Effect
		GH_FR1	23.87	2.541	8.77	10	<0.0001	CDF	Significant Effect
		GH_ERC	24.81	2.541	8.77	10	<0.0001	CDF	Significant Effect
		EV_MC2	24.45	2.541	8.77	10	<0.0001	CDF	Significant Effect
		EV_HC1	24.59	2.541	8.77	10	<0.0001	CDF	Significant Effect
		CM_MC2	20.83	2.541	8.77	10	<0.0001	CDF	Significant Effect
		LC_LCDSSLCC	24.31	2.541	8.77	10	<0.0001	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.9049	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	46525.3	5815.662	8	183.1	<0.0001	Significant Effect
Error	1111.5	31.75714	35			
Total	47636.8		43			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	11.81	20.09	0.1601	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9783	0.9295	0.5662	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 18-7913-2204 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 31 Aug-16 13:55 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

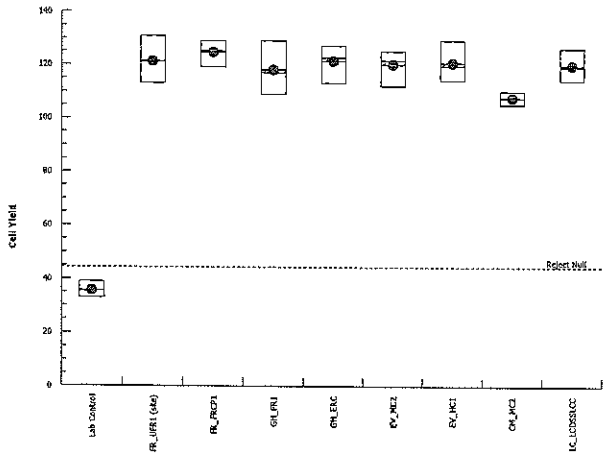
Cell Yield Summary

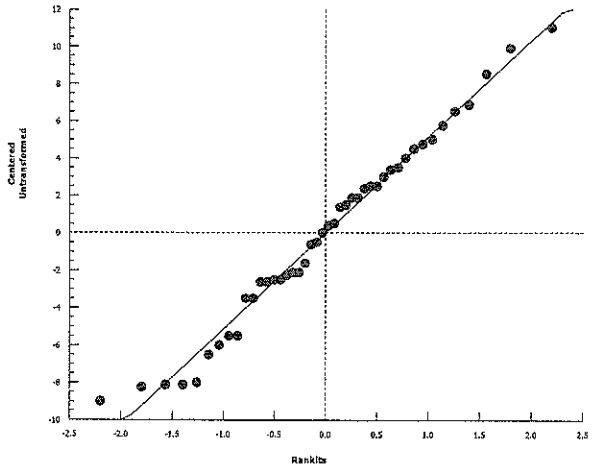
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	35.63	33.73	37.52	35.5	33	39	0.8004	6.36%	0.0%
FR_UFR1 (site)	8	121.1	115.7	126.5	121	113	131	2.287	5.34%	-240.0%
FR_FRCP1	4	124.5	116.9	132.1	125	119	129	2.398	3.85%	-249.5%
GH_FR1	4	118	103.4	132.6	117	109	129	4.601	7.8%	-231.2%
GH_ERC	4	121.3	110.8	131.7	122.5	113	127	3.276	5.4%	-240.4%
EV_MC2	4	120	110.9	129.1	121.5	112	125	2.858	4.76%	-236.8%
EV_HC1	4	120.5	110.1	130.9	119.5	114	129	3.279	5.44%	-238.2%
CM_MC2	4	107.5	104.2	110.8	107.5	105	110	1.041	1.94%	-201.8%
LC_LCDSSLCC	4	119.5	110.7	128.3	119	114	126	2.754	4.61%	-235.4%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	33	39	36	35	38	33	34	37
FR_UFR1 (site)	113	119	123	119	128	123	131	113
FR_FRCP1	119	129	122	128				
GH_FR1	112	109	129	122				
GH_ERC	119	126	127	113				
EV_MC2	112	125	123	120				
EV_HC1	117	114	122	129				
CM_MC2	108	105	107	110				
LC_LCDSSLCC	114	122	126	116				

Graphics





EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	03-7081-7893	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 13:58	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	06-5127-0129	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	26 Aug-16 07:40	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	29 Aug-16 07:40	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	71h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	69h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	71h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	69h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	70h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	72h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	67h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	69h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.92%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	-0.8892	2.526	9.588	10	0.9957	CDF	Non-Significant Effect
		GH_FR1	0.8233	2.526	9.588	10	0.6395	CDF	Non-Significant Effect
		GH_ERC	-0.03293	2.526	9.588	10	0.9328	CDF	Non-Significant Effect
		EV_MC2	0.2964	2.526	9.588	10	0.8542	CDF	Non-Significant Effect
		EV_HC1	0.1647	2.526	9.588	10	0.8909	CDF	Non-Significant Effect
		CM_MC2	3.59	2.526	9.588	10	0.0040	CDF	Significant Effect
		LC_LCDSSLCC	0.4281	2.526	9.588	10	0.8101	CDF	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.5651	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	721.5972	103.0853	7	2.683	0.0293	Significant Effect
Error	1075.625	38.41518	28			
Total	1797.222		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	5.054	18.48	0.6534	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9662	0.9166	0.3300	Normal Distribution

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 03-7081-7893 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 31 Aug-16 13:58 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

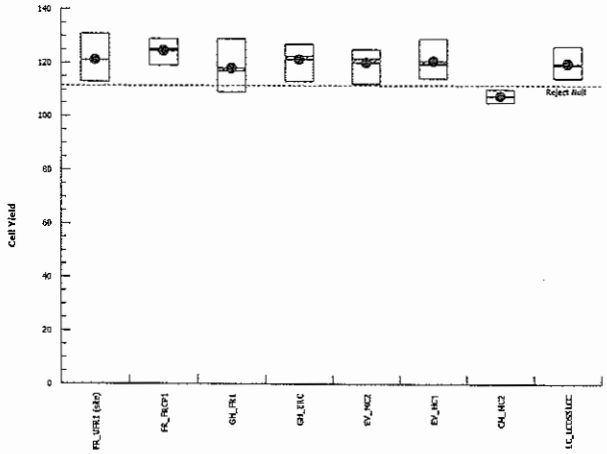
Cell Yield Summary

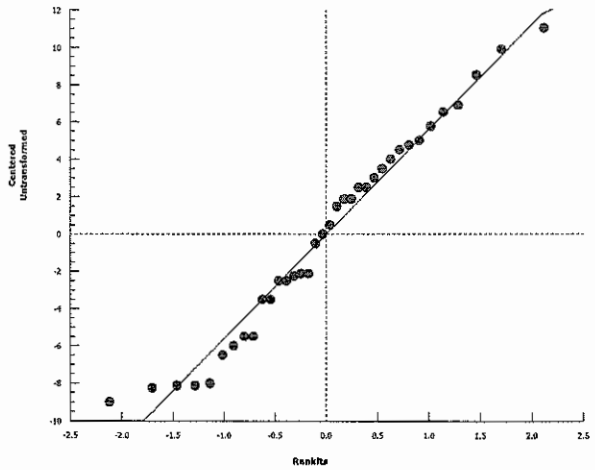
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1 (site)	8	121.1	115.7	126.5	121	113	131	2.287	5.34%	0.0%
FR_FRCP1	4	124.5	116.9	132.1	125	119	129	2.398	3.85%	-2.79%
GH_FR1	4	118	103.4	132.6	117	109	129	4.601	7.8%	2.58%
GH_ERC	4	121.3	110.8	131.7	122.5	113	127	3.276	5.4%	-0.1%
EV_MC2	4	120	110.9	129.1	121.5	112	125	2.858	4.76%	0.93%
EV_HC1	4	120.5	110.1	130.9	119.5	114	129	3.279	5.44%	0.52%
CM_MC2	4	107.5	104.2	110.8	107.5	105	110	1.041	1.94%	11.25%
LC_LCDSSLCC	4	119.5	110.7	128.3	119	114	126	2.754	4.61%	1.34%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
FR_UFR1 (site)	113	119	123	119	128	123	131	113
FR_FRCP1	119	129	122	128				
GH_FR1	112	109	129	122				
GH_ERC	119	126	127	113				
EV_MC2	112	125	123	120				
EV_HC1	117	114	122	129				
CM_MC2	108	105	107	110				
LC_LCDSSLCC	114	122	126	116				

Graphics





EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID:	09-5650-8682	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 13:57	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes
Batch ID:	06-5127-0129	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	26 Aug-16 07:40	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	29 Aug-16 07:40	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	15-9957-7983	26 Aug-16	26 Aug-16	8h	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	71h (11.8 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	12.0%	

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1 (site)	35.29	1.761	4.268	14	<0.0001	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.9049	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	29241	29241	1	1245	<0.0001	Significant Effect
Error	328.75	23.48214	14			
Total	29569.75		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	8.164	8.885	0.0128	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.953	0.8408	0.5390	Normal Distribution

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	35.63	33.73	37.52	35.5	33	39	0.8004	6.36%	0.0%
FR_UFR1 (site)	8	121.1	115.7	126.5	121	113	131	2.287	5.34%	-240.0%

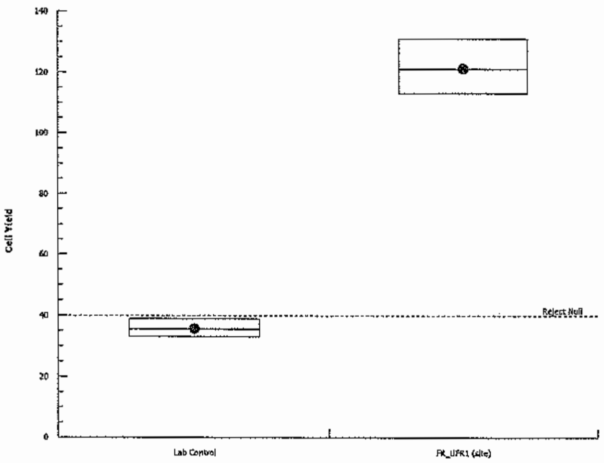
Cell Yield Detail

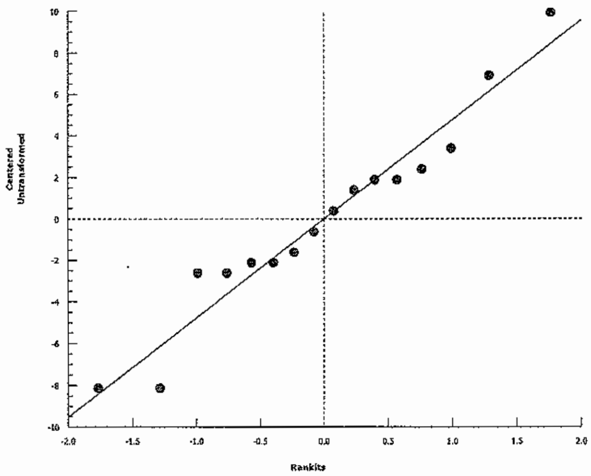
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	33	39	36	35	38	33	34	37
FR_UFR1 (site)	113	119	123	119	128	123	131	113

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	09-5650-8682	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 13:57	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Graphics





EC Alga Growth Inhibition Test

Nautilus Environmental

Analysis ID:	13-6271-0656	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 13:58	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	06-5127-0129	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	26 Aug-16 07:40	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	29 Aug-16 07:40	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	71h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	69h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	71h (11.9 °C)		
GH_ERC	17-2886-5097	23 Aug-16 10:15	24 Aug-16 08:00	69h (11.9 °C)		
EV_MC2	13-7547-7774	23 Aug-16 09:15	24 Aug-16 08:00	70h (11.8 °C)		
EV_HC1	08-9457-3106	23 Aug-16 08:00	24 Aug-16 08:00	72h (9.5 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	67h (9.1 °C)		
LC_LCDSSLCC	08-7164-6687	23 Aug-16 10:30	24 Aug-16 08:00	69h (10 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016_08_23_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-08-23_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-08-23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-08-23		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	7.92%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	0.8892	2.526	9.588	10	0.6070	CDF	Non-Significant Effect
		GH_FR1	-0.8233	2.526	9.588	10	0.9945	CDF	Non-Significant Effect
		GH_ERC	0.03293	2.526	9.588	10	0.9205	CDF	Non-Significant Effect
		EV_MC2	-0.2964	2.526	9.588	10	0.9679	CDF	Non-Significant Effect
		EV_HC1	-0.1647	2.526	9.588	10	0.9530	CDF	Non-Significant Effect
		CM_MC2	-3.59	2.526	9.588	10	1.0000	CDF	Non-Significant Effect
		LC_LCDSSLCC	-0.4281	2.526	9.588	10	0.9786	CDF	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.5651	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	721.5972	103.0853	7	2.683	0.0293	Significant Effect
Error	1075.625	38.41518	28			
Total	1797.222		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	5.054	18.48	0.6534	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9662	0.9166	0.3300	Normal Distribution

EC Alga Growth Inhibition Test — Nautilus Environmental

Analysis ID:	13-6271-0656	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	31 Aug-16 13:58	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

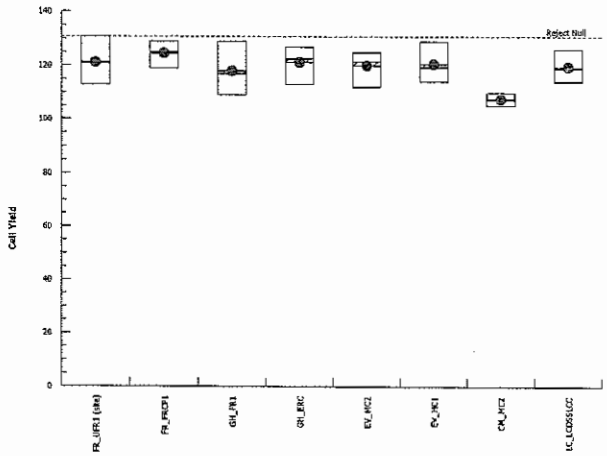
Cell Yield Summary

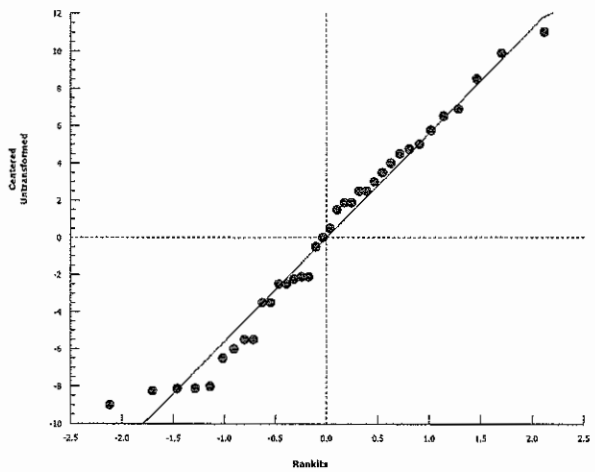
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1 (site)	8	121.1	115.7	126.5	121	113	131	2.287	5.34%	0.0%
FR_FRCP1	4	124.5	116.9	132.1	125	119	129	2.398	3.85%	-2.79%
GH_FR1	4	118	103.4	132.6	117	109	129	4.601	7.8%	2.58%
GH_ERC	4	121.3	110.8	131.7	122.5	113	127	3.276	5.4%	-0.1%
EV_MC2	4	120	110.9	129.1	121.5	112	125	2.858	4.76%	0.93%
EV_HC1	4	120.5	110.1	130.9	119.5	114	129	3.279	5.44%	0.52%
CM_MC2	4	107.5	104.2	110.8	107.5	105	110	1.041	1.94%	11.25%
LC_LCDSSLCC	4	119.5	110.7	128.3	119	114	126	2.754	4.61%	1.34%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
FR_UFR1 (site)	113	119	123	119	128	123	131	113
FR_FRCP1	119	129	122	128				
GH_FR1	112	109	129	122				
GH_ERC	119	126	127	113				
EV_MC2	112	125	123	120				
EV_HC1	117	114	122	129				
CM_MC2	108	105	107	110				
LC_LCDSSLCC	114	122	126	116				

Graphics





APPENDIX C – *Hyalella azteca* Toxicity Test Data

Hyalella azteca Test Summary Sheet

Client: Teck
Work Order No.: 16884

Start Date: 24-Aug-16
Set up by: KJL

Sample Information:

Sample ID: Various - See Below
Sample Date: Aug 23, 30, Sept 6, 13, 2016
Date Received: Aug 24, 31, Sept 7, 14, 2016
Sample Volume: 1x 20L per refresh

Test Organism Information:

Species: *Hyalella azteca*
Supplier: Aquatic Research Organisms, NH
Date received: 24-Aug-16
Age or size (Day 0): 8-days

NaCl Reference Toxicant Results:

Reference Toxicant ID: HA114
Stock Solution ID: n/a
Date Initiated: 24-Aug-16

96-h LC50 (95% CL): 6.0 (4.8 - 7.5) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 5.6 (5.0 - 6.2) CV (%): 5

Test Results:

Sample ID	Survival ± SD (%)	Average Dry Wt. ± SD (mg)
Control	98 ± 4.5	0.79 ± 0.07
FR_UFR1	100.0 ± 0.0	0.87 ± 0.02
GH_FR1	96.0 ± 5.5	0.77 ± 0.05 *
FR_FRCP1	98.0 ± 4.5	0.74 ± 0.10 *
CM_MC2	98.0 ± 4.5	0.89 ± 0.04

* Samples that are significantly different from reference site FR_UFR1.

Reviewed by: JCL

Date reviewed: Oct. 5/16

Chronic *H. azteca* Toxicity Test Data Sheet

Freshwater Water Quality

Client: Teck
WO #: 16884
Sample ID: See below

Start Date: Aug 24/16
Termination Date: Sept 21/16
Test Organism: *H. azteca*

Temperature (°C)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	22.0	23.0	23.0	23.0	23.0	22.5	23.0	23.0	23.0	22.5	22.5	22.5	23.0	23.0	23.0
FR_UFR1	22.0	23.0	23.0	23.0	23.0	22.5	23.0	23.0	23.0	22.5	22.5	22.5	23.0	23.0	23.0
GH_FR1	22.0	23.0	23.0	23.0	23.0	22.5	23.0	23.0	23.0	22.5	22.5	22.5	23.0	23.0	23.0
FR_FRCP1	22.0	23.0	23.0	23.0	23.0	22.5	23.0	23.0	23.0	22.5	22.5	22.5	23.0	23.0	23.0
CM_MC2	23.0	23.0	23.0	23.0	23.0	22.5	23.0	23.0	23.0	22.5	22.5	22.5	23.0	23.0	23.0
Technician Initials	KL	KL	KL	AS	AS	JW	KL	KL	KL	KL	AS	AS	KL	KL	KL

Conductivity (µS)

Sample ID	Day														
	0	①1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	426	430	433	420	420	424	420	419	418	415	420	414	416	420	418
FR_UFR1	423	394	426	417	415	420	417 KL	418	411	410	419	417	420	423	417
GH_FR1	780	~~755~~	783	763	754	762	754	758	764	763	766	770	774 KL	764	763
FR_FRCP1	902	881	905	878	865	882	865 ①	863	914	925	927	933	936 KL	926	919
CM_MC2	932	908	929	908	904	902	888 ①	885	914	911	907	914	919	909	904
Technician Initials	KL	KL	KL	AS	AS	JW	KL	KL	KJL	KL	AS	AS	KL	KL	KL

Dissolved oxygen (mg/L)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	8.5	7.1	7.3	7.5	6.9	6.3	6.5	7.2	7.2	6.5	7.2	6.3	6.4	6.6	6.5
FR_UFR1	8.6	7.2	7.4	7.4	7.0	6.5	6.5	6.9	6.9	6.3	7.0	6.5	6.4	6.3	6.6
GH_FR1	8.4	7.2	7.4	7.3	6.8	6.5	6.7	6.9	7.0	6.4	6.9	6.4	6.2	6.4	6.6
FR_FRCP1	8.3	7.3	7.3	7.4	6.8	6.5	6.8	6.9	6.9	6.6	6.8	6.4	6.5	6.3	6.6
CM_MC2	8.6	7.1	6.9	7.1	6.6	6.4	6.7	6.9	7.0	6.3	6.8	6.4	6.3	6.6	6.7
Technician Initials	KL	KL	KL	AS	AS	JW	KL	KL	KJL	KL	AS	AS	KL	KL	KL

pH

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	7.6	7.4	7.3	7.6	7.7	7.3	7.3	7.4	7.2	7.2	7.4	7.4	7.3	7.3	7.4
FR_UFR1	7.8	7.8	7.8	7.9	7.9	7.8	7.7	7.8	7.6	7.7	7.9	7.8	7.8	7.8	7.9
GH_FR1	7.9	7.9	8.0	8.0	8.0	8.0	7.9	7.9	7.8	7.9	8.0	8.0	7.9	7.9	8.0
FR_FRCP1	8.0	8.0	8.0	8.0	8.0	7.9	7.9	7.8	7.8	7.9	8.0	8.0	7.9	7.8	7.9
CM_MC2	8.1	8.0	8.0	8.0	8.0	7.9	7.9	7.8	7.8	7.9	8.0	8.0	8.0	7.9	8.0
Technician Initials	KL	KL	KL	AS	AS	JW	KL	KL	KJL	KL	AS	AS	KL	KL	KL

Comments: ① checked w/ another ~~EOD~~ KL conductivity meter, gives similar ~~same~~ reading KL

Reviewed by: JOL

Date Reviewed: Oct-3/16

Chronic *H. azteca* Toxicity Test Data Sheet

Water Quality

Client: Teck
WO #: 16884
Sample ID: see below

Start Date: Aug 24/16
Termination Date: Sept 21/16
Test Organism: *H. azteca*

Temperature (°C)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	22.5	22.5	23.0	23.0	22.5	22.5	22.5	22.5	23.0	22.5	22.5	22.5	22.5	22.0
FR_UFR1	22.5	22.5	23.0	23.0	22.5	22.5	22.5	22.5	23.0	22.5	22.5	22.5	22.5	22.0
GH_FR1	22.5	22.5	23.0	23.0	22.5	22.5	22.5	22.5	23.0	22.5	22.5	22.5	22.5	22.0
FR_FRCP1	22.5	22.5	23.0	23.0	22.5	22.5	22.5	22.5	23.0	22.5	22.5	22.5	22.5	22.0
CM_MC2	22.5	22.5	23.0	23.0	22.5	22.5	22.5	22.5	23.0	22.5	22.5	22.5	22.5	22.0
Technician Initials	KL	KL			KL	KL	KJL	KJL	KL/KJL	KL	MML	KJL	KJL	EMM

Conductivity (µS)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	417	416	423	428	425	424	422	422	424	422	424	424	426	432
FR_UFR1	409	408	418	418	416	414	416	417	420	420	422	422	415	422
GH_FR1	~~776~~ ①	775	774	790	782	772	776	773	783	784	791	795	791	793
FR_FRCP1	948	943	945	960	964	961	957	960	964	958	961	947	956	962
CM_MC2	954	957	951	965	955	949	952	955	972	974	973	962	961	975
Technician Initials	KL	KL			KL	KL	KJL	KJL	KL/KJL	KL	MML	KJL	KJL	EMM

① 776

Dissolved oxygen (mg/L)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	6.3	6.3	6.2	6.3	5.6	6.0	5.9	6.1	5.3	5.5	5.6	5.8	6.3	6.3
FR_UFR1	6.5	6.3	6.3	6.1	6.1	6.3	5.9	6.2	6.0	6.3	5.8	5.9	6.2	6.3
GH_FR1	6.6	6.8	6.2	6.3	6.0	6.3	6.0	6.2	6.3	6.4	6.1	5.8	6.3	6.3
FR_FRCP1	6.5	6.2	6.4	6.2	6.0	6.3	6.1	6.2	6.6	6.4	6.2	5.8	6.1	6.2
CM_MC2	6.7	6.4	6.3	6.3	6.0	6.5	6.0	6.2	6.5	6.4	6.2	5.8	6.2	6.3
Technician Initials	KL	KL			KL	KL	KJL	KJL	KL/KJL	KL	MML	KJL	KJL	EMM

pH

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	7.3	7.2	7.5	7.4	7.4	7.2	7.1	7.0	7.1	7.2	7.1	7.2	7.0	7.1
FR_UFR1	7.8	7.6	7.7	7.8	7.9	7.7	7.5	7.5	7.7	7.7	7.6	7.6	7.6	7.7
GH_FR1	7.9	7.9	8.0	7.9	8.0	7.8	7.7	7.7	7.8	7.8	7.8	7.9	7.8	7.8
FR_FRCP1	7.9	7.8	7.9	7.9	8.0	7.8	7.7	7.8	7.7	7.7	7.7	7.7	7.6	7.7
CM_MC2	8.0	7.8	7.9	8.0	8.1	7.8	7.6	7.8	7.9	7.7	7.8	7.8	7.8	7.8
Technician Initials	KL	KL			KL	KL	KJL	KJL	KL/KJL	KL	MML	KJL	KJL	EMM

Comments:

Reviewed by: JCL

Date Reviewed: Oct 3/16

H. azteca ~~Sediment~~ Toxicity Test Data Sheet

Freshwater ~~Sediment~~ ~~14~~ 28-d Survival and Weight

Client: Teck
Work Order No: 16884
Sample ID: See below

Start Date: Aug 24/16
Termination Date: Sept 21/16
Test Organism: *Hyalella azteca*

Sample ID	TC3 Pan No. green	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control ~~Sediment~~ KJL	1	A	10 (23)	0	0	EMW	1022.93	1031.04	10	KL NY
	2	B	10 (34)	0	0		998.08	1004.79	10	
	3	C	9 (12)	0	1		1002.00	1009.07	9	
	4	D	10 (26)	0	0		992.77	1001.48	10	
	5	E	10 (18)	0	0		1018.64 KL 62	1026.64	10	
FR_UFR1	6	A	10 (6)	0	0		1021.31	1030.04	10	
	7	B	10 (8)	0	0		1022.68	1031.36	10	
	8	C	10	0	0		1023.28	1031.66	10	
	9	D	10 (22)	0	0		1025.38 KL 41	1034.05	10	
	10	E	10	0	0		1013.89	1022.84	10	
GH_FR1	11	A	9	0	1		1011.35	1018.43	9	
	12	B	9	0	1		1014.97	1021.67	9	
	13	C	10 (11)	0	0		989.68	997.99	10	
	14	D	10	0	0		1009.04	1015.95	10	
	15	E	10 (6)	0	0		1002.80	1010.66	10	
FR_FRCP1	16	A	9	0	1		1022.22	1029.22	9	
	17	B	10 (14)	0	0		1017.78	1023.59	10	
	18	C	10 (8)	0	0		1021.20	1028.68	10	
	19	D	10	0	0		1015.28	1022.96	9 ①	
	20	E	10 (2)	0	0	↓	1025.59	1032.78	10	↓ NY

Comments: ① 1 organism lost in transfer. Numbers in brackets are young found on day 28.
10% re-weighed pans: 8 - 1031.60
17 - 1023.51
23 - 1037.13

Reviewed by: JGH

Date Reviewed: Oct. 3/16

H. azteca ~~Sediment~~ Toxicity Test Data Sheet

Freshwater ~~Sediment~~ ~~14~~ 28 d Survival and Weight

Client: Teck

Work Order No: 16884

Sample ID: See below

Start Date: Aug 24/16

Termination Date: Sept 21/16

Test Organism: *Hyalella azteca*

Sample ID	Pan No.	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
CM_me2	21	A	10	0	0	mm	1015.66	1024.25	10	JL NT
	22	B	10	0	0	↓	1022.8 (96)	1031.47	10	↓ ↓
	23	C	10	0	0		1028.02	1037.25	10	
	24	D	9 (13)	0	1		1014.56	1023.13	9	
	25	E	10	0	0		1030.86	1039.55	10	
	26	A								
	27	B								
	28	C								
	29	D								
	30	E								
	31	A								
	32	B								
	33	C								
	34	D								
	35	E								
	36	A								
	37	B								
	38	C								
	39	D								
	40	E								

Comments:

Reviewed by: JOL

Date Reviewed: Oct. 3/16

CETIS Summary Report

Test Code: 16884 | 01-3371-8782

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Batch ID:	18-5246-0793	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	24 Aug-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	21 Sep-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	15h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	15h (11.9 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	14h (11.8 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	11h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
10-0271-7238	Survival Rate	Control Resp	0.98	0.8 - NL	Yes	Passes Acceptability Criteria

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	5	0.98	0.9245	1	0.9	1	0.02	0.04472	4.56%	0.0%
FR_UFR1 (site)	5	1	1	1	1	1	0	0	0.0%	-2.04%
GH_FR1	5	0.96	0.892	1	0.9	1	0.02449	0.05477	5.71%	2.04%
FR_FRCP1	5	0.98	0.9245	1	0.9	1	0.02	0.04472	4.56%	0.0%
CM_MC2	5	0.98	0.9245	1	0.9	1	0.02	0.04472	4.56%	0.0%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Lab Control	1	1	0.9	1	1
FR_UFR1 (site)	1	1	1	1	1
GH_FR1	0.9	0.9	1	1	1
FR_FRCP1	0.9	1	1	1	1
CM_MC2	1	1	1	0.9	1

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Lab Control	10/10	10/10	9/10	10/10	10/10
FR_UFR1 (site)	10/10	10/10	10/10	10/10	10/10
GH_FR1	9/10	9/10	10/10	10/10	10/10
FR_FRCP1	9/10	10/10	10/10	10/10	10/10
CM_MC2	10/10	10/10	10/10	9/10	10/10

Hyalella 28-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID:	10-0271-7238	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	28 Sep-16 14:53	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	18-5246-0793	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	24 Aug-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	21 Sep-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	15h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	15h (11.9 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	14h (11.8 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	11h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1 (site)	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
Lab Control		FR_FRCP1	0.7525	1.0000	Exact	Non-Significant Effect
Lab Control		CM_MC2	0.7525	1.0000	Exact	Non-Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.98	0.8 - NL	Yes	Passes Acceptability Criteria

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Negative Contr	49	1	50	0.98	0.02	0.0%
FR_UFR1 (site)		50	0	50	1	0	-2.04%
GH_FR1		48	2	50	0.96	0.04	2.04%
FR_FRCP1		49	1	50	0.98	0.02	0.0%
CM_MC2		49	1	50	0.98	0.02	0.0%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Lab Control	1	1	0.9	1	1
FR_UFR1 (site)	1	1	1	1	1
GH_FR1	0.9	0.9	1	1	1
FR_FRCP1	0.9	1	1	1	1
CM_MC2	1	1	1	0.9	1

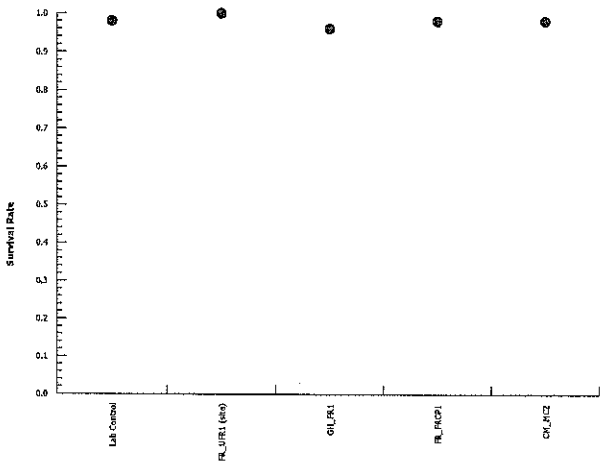
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Lab Control	10/10	10/10	9/10	10/10	10/10
FR_UFR1 (site)	10/10	10/10	10/10	10/10	10/10
GH_FR1	9/10	9/10	10/10	10/10	10/10
FR_FRCP1	9/10	10/10	10/10	10/10	10/10
CM_MC2	10/10	10/10	10/10	9/10	10/10

Hyalella 28-d Survival and Growth Sediment Test **Nautilus Environmental**

Analysis ID:	10-0271-7238	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	28 Sep-16 14:53	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	14-1280-1918	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	28 Sep-16 15:08	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	18-5246-0793	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	24 Aug-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	21 Sep-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	15h (11.8 °C)	Teck Coal	
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	15h (11.9 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	14h (11.8 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	11h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		GH_FR1	0.2475	0.7424	Exact	Non-Significant Effect
FR_UFR1 (site)		FR_FRCP1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		CM_MC2	0.5	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1 (siteReference Sed	50	0	50	1	0	0.0%
GH_FR1	48	2	50	0.96	0.04	4.0%
FR_FRCP1	49	1	50	0.98	0.02	2.0%
CM_MC2	49	1	50	0.98	0.02	2.0%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1 (site)	1	1	1	1	1
GH_FR1	0.9	0.9	1	1	1
FR_FRCP1	0.9	1	1	1	1
CM_MC2	1	1	1	0.9	1

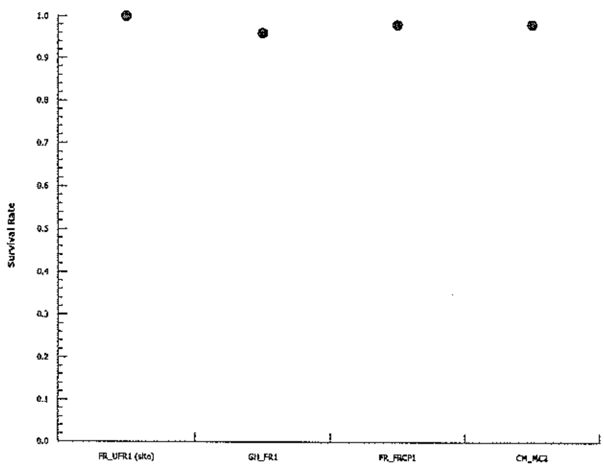
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1 (site)	10/10	10/10	10/10	10/10	10/10
GH_FR1	9/10	9/10	10/10	10/10	10/10
FR_FRCP1	9/10	10/10	10/10	10/10	10/10
CM_MC2	10/10	10/10	10/10	9/10	10/10

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	14-1280-1918	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	28 Sep-16 15:08	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Summary Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Batch ID:	18-5246-0793	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	24 Aug-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	21 Sep-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	15h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	15h (11.9 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	14h (11.8 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	11h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	5	0.7881	0.6975	0.8787	0.671	0.871	0.03264	0.07299	9.26%	0.0%
FR_UFR1 (site)	5	0.8676	0.8422	0.893	0.838	0.895	0.009136	0.02043	2.36%	-10.09%
GH_FR1	5	0.7678	0.7023	0.8333	0.691	0.831	0.02358	0.05274	6.87%	2.57%
FR_FRCP1	5	0.7358	0.6117	0.8599	0.581	0.8533	0.0447	0.09996	13.59%	6.63%
CM_MC2	5	0.8908	0.8357	0.946	0.851	0.9522	0.01985	0.04438	4.98%	-13.04%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Lab Control	0.811	0.671	0.7856	0.871	0.802
FR_UFR1 (site)	0.873	0.868	0.838	0.864	0.895
GH_FR1	0.7867	0.7444	0.831	0.691	0.786
FR_FRCP1	0.7778	0.581	0.748	0.8533	0.719
CM_MC2	0.859	0.851	0.923	0.9522	0.869

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	10-8582-0645	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	28 Sep-16 14:54	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	18-5246-0793	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	24 Aug-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	21 Sep-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-4769-4123	24 Aug-16	24 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	15h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	15h (11.9 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	14h (11.8 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	11h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Lab Control	Teck Coal	Lab Control		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	11.8%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1 (site)	-1.963	2.305	0.093	8	0.9985	CDF	Non-Significant Effect
		GH_FR1	0.5011	2.305	0.093	8	0.6032	CDF	Non-Significant Effect
		FR_FRCP1	1.292	2.305	0.093	8	0.2667	CDF	Non-Significant Effect
		CM_MC2	-2.538	2.305	0.093	8	0.9997	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.08806945	0.02201736	4	5.373	0.0042	Significant Effect
Error	0.08195336	0.004097668	20			
Total	0.1700228		24			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	8.183	13.28	0.0851	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9516	0.8877	0.2726	Normal Distribution

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	5	0.7881	0.6975	0.8787	0.802	0.671	0.871	0.03264	9.26%	0.0%
FR_UFR1 (site)	5	0.8676	0.8422	0.893	0.868	0.838	0.895	0.009136	2.36%	-10.09%
GH_FR1	5	0.7678	0.7023	0.8333	0.786	0.691	0.831	0.02358	6.87%	2.57%
FR_FRCP1	5	0.7358	0.6117	0.8599	0.748	0.581	0.8533	0.0447	13.59%	6.63%
CM_MC2	5	0.8908	0.8357	0.946	0.869	0.851	0.9522	0.01985	4.98%	-13.04%

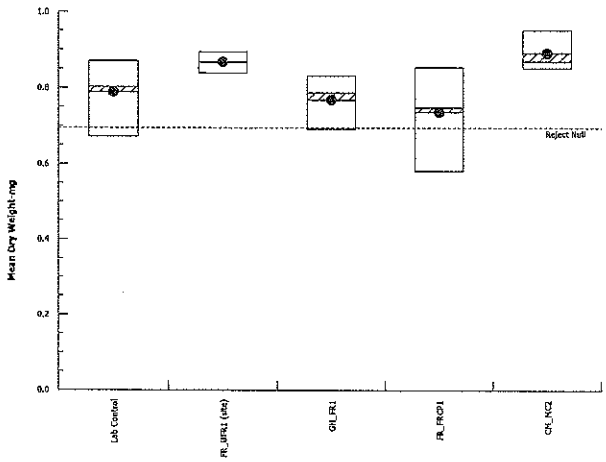
Mean Dry Weight-mg Detail

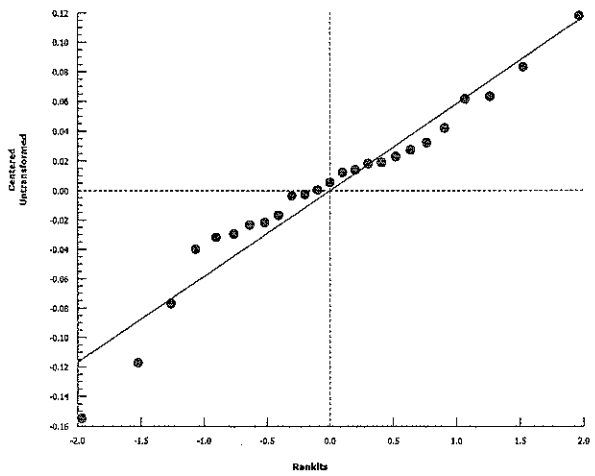
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Lab Control	0.811	0.671	0.7856	0.871	0.802
FR_UFR1 (site)	0.873	0.868	0.838	0.864	0.895
GH_FR1	0.7867	0.7444	0.831	0.691	0.786
FR_FRCP1	0.7778	0.581	0.748	0.8533	0.719
CM_MC2	0.859	0.851	0.923	0.9522	0.869

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	10-8582-0645	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	28 Sep-16 14:54	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	17-3546-1979	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	28 Sep-16 15:09	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	18-5246-0793	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	24 Aug-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	21 Sep-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	15h (11.8 °C)	Teck Coal	
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	15h (11.9 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	14h (11.8 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	11h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	10.0%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		GH_FR1	2.563	2.227	0.087	8	0.0265	CDF	Significant Effect
		FR_FRCP1	3.384	2.227	0.087	8	0.0051	CDF	Significant Effect
		CM_MC2	-0.597	2.227	0.087	8	0.9100	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0850637	0.02835457	3	7.481	0.0024	Significant Effect
Error	0.06064391	0.003790244	16			
Total	0.1457076		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	7.973	11.34	0.0466	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.948	0.866	0.3372	Normal Distribution

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1 (site)	5	0.8676	0.8422	0.893	0.868	0.838	0.895	0.009136	2.36%	0.0%
GH_FR1	5	0.7678	0.7023	0.8333	0.786	0.691	0.831	0.02358	6.87%	11.5%
FR_FRCP1	5	0.7358	0.6117	0.8599	0.748	0.581	0.8533	0.0447	13.59%	15.19%
CM_MC2	5	0.8908	0.8357	0.946	0.869	0.851	0.9522	0.01985	4.98%	-2.68%

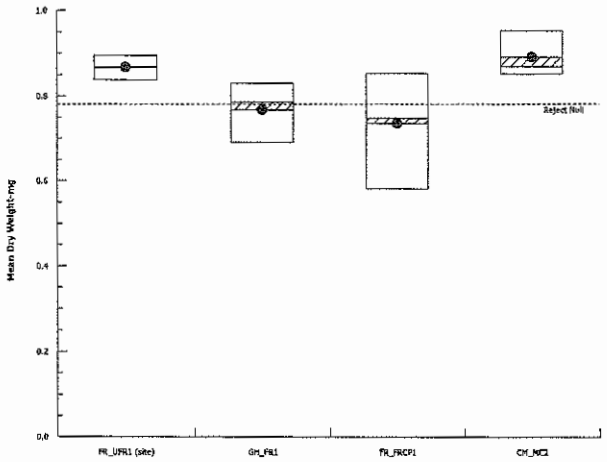
Mean Dry Weight-mg Detail

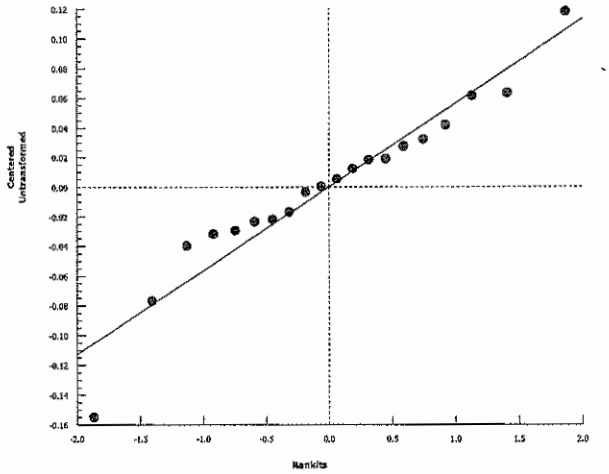
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1 (site)	0.873	0.868	0.838	0.864	0.895
GH_FR1	0.7867	0.7444	0.831	0.691	0.786
FR_FRCP1	0.7778	0.581	0.748	0.8533	0.719
CM_MC2	0.859	0.851	0.923	0.9522	0.869

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	17-3546-1979	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	28 Sep-16 15:09	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Client: Teck

W.O.#: 16884

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/L CaCO_3$)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L CaCO_3$)	Technician
Hyay MHW 082216	Aug24/16	Aug24/16	50	3.4	3.6	64	50	6.2	124	KL
				~~7.8~~ KL	~~8.0~~ KL			~~8.1~~ KL		
FR_UFR1	Aug24/16			7.8 ~~10.0~~ KL	~~8.0~~ KL	152		~~19~~ 8.1 KL	162	
CM_FR1				10.0	10.1	198		19.0	380	
FR_FRCP1				10.1	10.3	198		21.0	420	
CM_MC2				9.8	10.0	192		21.8	436	
FR_UFR1	Aug31/16	Sept1/16	50	~~7.4~~	~~7.8~~ KL 7	142	50	9.6	192	KL
CM_FR1				9.2	9.6	176		17.6	352	
FR_FRCP1				9.2	9.5	178		22.4	448	
CM_MC2				8.9	9.2	172		21.6	432	
FR_UFR1	Sept7/16	Sept7/16	50	7.8	8.0	152	50	8.1 ~~12.5~~ KL	162	KL
CM_FR1				10.1	10.3	198		19.6	392	
FR_FRCP1				11.0	11.2	216		26.9	538	
CM_MC2				10.9	11.1	214		24.4	488	
FR_UFR1	Sept14/16	Sept14/16	50	8.0	8.2	156	50	~~9.3~~ KL 9.3	186	KJL
CM_FR1				10.2	10.4	200	100 ①	~~5.9~~ KL 3.0	300	
FR_FRCP1				10.6	10.8	208	100 ①	5.0	500	
CM_MC2				11.1	11.3	218		5.9	590	

Notes: ① diluted 10mL in 100mL DI

Reviewed by: JGL

Date Reviewed: Oct. 3/16

Client: Teck

W.O.#: 16884

Hardness and Alkalinity Datasheet

Day 28

	Alkalinity							Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
Control	Sept 21/16	Oct 7/16	50	3.7	3.8	72		50	6.9	138	JAB
FR_UFR1	"	"	50	8.6	8.8	168		50	9.1	182	JAB
GH_FR1	"	"	50	10.3	10.6	200		10①	4.0	400	JS
FR_FRCP1	"	"	50	10.3	10.5	202		10①	5.8	580	JS
CM_MC2	↓	↓	50	10.3	10.7	198		10①	4.6	460	JS
								~~10①~~ JS			

Notes: ① Diluted to 100mL w/ D.I. water

Reviewed by: JGW Date Reviewed: Oct. 12/16

APPENDIX D – *Pimephales promelas* Toxicity Test Data

NAUTILUS ENVIRONMENTAL

Internal Tracking Sheet

Client:	NAU104
Reference:	16-1051

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.ca

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	12, 13, 12, 15, 11

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_FRCP1_QR_01082016_N	FR_FRCP1_QR_04072016_N	FR_FRCP1_QR_11072016_N	FR_FRCP1_QR_18072016_N	FR_FRCP1_QR_25072016_N	**FR_FRCP1**
collection date:	2016/08/23	2016/08/30	2016/09/06	2016/09/13	2016/09/20	
collection time:	1013	1149	1115	1155	1120	
pH:	8.1	8.1	8.2	8.1	8.2	
EC (µS/cm):	749	896	942	1001	894	
DO (mg/L):	8.6	8.1	8.9	9.0	8.8	
temp (°C):	18.9	19.4	17.1	17.7	19.0	
hardness:	480	450	485	492	333	
alkalinity:	180	160	190	180	230	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/08/25
ended:	2016/09/26
prelim made:	-
prelim sent:	-
reported:	2016/10/05

Internal Tracking Sheet

Client:	NAU104
Reference:	16-1052

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.ca

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	12, 13, 12, 15, 11

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_UFR1_QR_01082016_N	FR_UFR1_Q_04072016_N	FR_UFR1_QR_11072016_N	FR_UFR1_QR_18072016_N	FR_UFR1_QR_25072016_N	**FR_UFR1**
collection date:	2016/08/23	2016/08/30	2016/09/06	2016/09/13	2016/09/20	
collection time:	0851	1045	1210	1000	0950	

pH:	8.0	8.0	8.3	8.1	8.2
EC (µS/cm):	314	358	383	372	355
DO (mg/L):	8.5	8.0	8.9	8.9	8.7
temp (°C):	18.8	19.5	16.6	18.8	18.6
hardness:	187	248	220	177	158
alkalinity:	186	139	204	149	152
colour:	colourless	colourless	colourless	colourless	colourless
odour:	-	-	-	-	-

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/08/25
ended:	2016/09/26
prelim made:	-
prelim sent:	-
reported:	2016/10/05

Internal Tracking Sheet

Client:	NAU104
Reference:	16-1053

Client:

Client: Nautilus Environmental
Address: 8664 Commerce Court
City: Burnaby
Province: BC
Country: Canada
Postal Code: V5A 4N7

Operation: Burnaby
Billing: not given
Contact: Krysta Pearcy
Tel: 604 420 8773
Fax: not given
Email: krysta@nautilusenvironmental.ca

Sample:

type: water — collection method: grab
collected: various dates — at: various times — by: not given
shipped: various dates — by: Bears Paw
received: various dates — at: various times — by: MC
signed-in: various dates — at: various times — by: MC
container: 4 x 20 L carboys — sample condition: good condition
seals present: no — initials on seals: no
storage: 4 ± 2°C in darkness — initial temperature (°C): 12, 12, 12, 13, 11
Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	GH_FRT_WS_2016_08_23_N	GH_FRT_WS_2016_08_30_N	GH_FRT_WS_2016_09_06_N	GH_FRT_WS_2016_09_13_N	GH_FRT_WS_2016_09_20_N	**GH_FR1**
collection date:	2016/08/23	2016/08/30	2016/09/06	2016/09/13	2016/0920	
collection time:	not given	0905	0930	0725	0950	
pH:	7.9	7.9	8.1	7.9	8.1	
EC (µS/cm):	629	687	786	800	732	
DO (mg/L):	8.6	7.8	8.8	9.1	8.5	
temp (°C):	18.7	19.8	16.7	17.0	18.6	
hardness:	400	407	400	371	360	
alkalinity:	198	211	208	174	180	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils
Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/08/25
ended:	2016/09/26
prelim made:	-
prelim sent:	-
reported:	2016/10/05

Internal Tracking Sheet

Client:	NAU104
Reference:	16-1054

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.ca

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	12, 13, 12, 13, 11

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	CM_MC2_WS_20160823_N	CM_MC2_WS_20160830_N	CM_MC2_WS_20160906_N	CM_MC2_WS_20160913_N	CM_MC2_WS_20160920_N	**CM_MC2**
collection date:	2016/08/23	2016/08/30	2016/09/06	2016/09/13	2016/09/20	
collection time:	not given	not given	1025	1025	not given	
pH:	7.0	8.0	8.2	8.0	8.2	
EC (µS/cm):	820	911	984	1023	770	
DO (mg/L):	7.7	6.0	8.2	9.2	8.8	
temp (°C):	20.3	18.9	17.8	16.5	18.0	
hardness:	330	349	390	524	430	
alkalinity:	165	205	236	188	176	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/08/25
ended:	2016/09/26
prelim made:	-
prelim sent:	-
reported:	2016/10/05

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Control hatching success must be >66% (≥10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

	CTL- TAP		CTL-MHRW		16-1051		16-1052		16-1053		16-1054	
	Day 1		Day 1		Day 1		Day 1		Day 1		Day 1	
replicate	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos
a	13	2	12	3	15	0	15	0	14	1	13	2
b	15	0	15	0	13	2	15	0	14	1	11	4
c	14	1	15	0	15	0	15	0	15	0	12	3
d	15	0	14	1	15	0	15	0	10	5	11	4
e	29	1	29	1	29	1	30	0	30	0	30	0
f	29	1	29	1	28	2	29	1	30	0	30	0

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

	CTL- TAP			CTL-MHRW			16-1051			16-1052		
	Day 2			Day 2			Day 2			Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	13	0	15	12	0	15	14	1	15	15	0	15
b	15	0	15	15	0	15	13	0	15	14	1	15
c	14	0	15	15	0	15	14	1	15	15	0	15
d	15	0	15	13	1	15	10	5	15	13	2	15
e	29	0		29	0		29	0		29	1	
f	29	0		28	1		28	0		29	0	

	16-1053			16-1054		
	Day 2			Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	13	1	15	13	0	15
b	13	1	15	11	0	15
c	13	2	15	12	0	15
d	10	0	15	11	0	15
e	30	0		30	0	
f	30	0		30	0	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Number of Alive Embryos and Hatched Organisms

	CTL- TAP		CTL-MHRW		16-1051		16-1052		16-1053		16-1054	
	Day 3		Day 3		Day 3		Day 3		Day 3		Day 3	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	15	0	14	1	13	2	13	2	13	2	14	1
b	15	0	15	0	9*	5	15	0	14	1	14	1
c	14	1	15	0	7	8	15	0	13	2	15	0
d	14	1	14	1	5	10	13	2	14	1	13	1**

Comments/Observations: *1051B- one dead embryo; **1054D - one dead hatched

	CTL- TAP		CTL-MHRW		16-1051		16-1052		16-1053		16-1054	
	Day 4		Day 4		Day 4		Day 4		Day 4		Day 4	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	-	15	-	15	-	15	2	13	-	15	3	12
b	-	15	-	15	-	14	-	15	1	14	3	12
c	-	14*	-	15	-	15	-	15	-	15	3	12
d	-	15	-	15	-	15	1	14	-	15	1*	12

Comments/Observations: CTL- TAP C - one partially hatched embryo dead; 1054D- one partially hatched embryo dead

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 5	Day 5	Day 5	Day 5	Day 5	Day 5
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	15	14	14	15
b	15	15	13	15	13*	14*
c	14	15	15	15	15	15
d	15	15	15	15	14	13

Comments/Observations: 1052A- one dead embryo; 1053B- one dead embryo, 1 dead hatched; 1054B - one still unhatched

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 6	Day 6	Day 6	Day 6	Day 6	Day 6
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	14 (3)	11	13	15
b	15	15	13 (1)	14 (1)	13	14*
c	14	15	14 (1)	12	14	15
d	15	15	14 (1)	13 (1)	12 (1)	13

Comments/Observations: 1054B- one dead embryo, bracketed # indicates number of fish displaying atypical swimming behaviour

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-1051, 16-1052, 16-1053, 16-1054

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 7	Day 7	Day 7	Day 7	Day 7	Day 7
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	6*	9	11	14
b	15	15	11*	13	10	12
c	14	15	14 (2)*	12	11	15
d	15	15	10*	10	4	11 (1)

Comments/Observations: Organsims that dies were covered in clumped food, bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 8	Day 8	Day 8	Day 8	Day 8	Day 8
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	6	6	9	14
b	15	15	11	13	9	10 (2)
c	14	15	13	6	8	14
d	15	15	9	5	2	10

Comments/Observations: All jars fed 1 mL for the AM feeding; PM feeding: CTL ABCD=1.5 mL; 1051 ABCD=1 mL; 1052 ACD=0.5 mL, B=1.5 mL; 1053 ABC=1 mL, D=0.5 mL; 1054 ABCD=1.5 mL, bracketed # indicates number of fish displaying atypical swimming behaviour

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 9	Day 9	Day 9	Day 9	Day 9	Day 9
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	6	6	9	11
b	15	15	10	12	9	8
c	14	15	13	6	8	14
d	15	15	9	5	2	9

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 10	Day 10	Day 10	Day 10	Day 10	Day 10
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	6	6	8	8
b	15	15	9	11	8	3
c	14	14	0	6	8	13
d	15	14	8	4	1	7

Comments/Observations: New feeding reigime started at PM feeding: CTL=1.5 mL; 1051=1 mL; 1052 ACD=0.5 mL, B=1.5 mL; 1053 ABC=1 mL, D=0.25 mL; 1054 AD=1 mL, B=0.5 mL, C=1.5 mL

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 11	Day 11	Day 11	Day 11	Day 11	Day 11
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	6	6	8	7
b	15	15	9	11	8	2
c	14	14	0	6	8	13
d	15	14	8	9	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 12	Day 12	Day 12	Day 12	Day 12	Day 12
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	5	6	8	7
b	15	15	9	11	8	2
c	14	13	0	6	8	13
d	15	14	8	4	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 13	Day 13	Day 13	Day 13	Day 13	Day 13
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	4	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 14	Day 14	Day 14	Day 14	Day 14	Day 14
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	15	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	4 (1)	1	7

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 15	Day 15	Day 15	Day 15	Day 15	Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	3	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 16	Day 16	Day 16	Day 16	Day 16	Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	3	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 17	Day 17	Day 17	Day 17	Day 17	Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	3	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 18	Day 18	Day 18	Day 18	Day 18	Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 19	Day 19	Day 19	Day 19	Day 19	Day 19
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 20	Day 20	Day 20	Day 20	Day 20	Day 20
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 21	Day 21	Day 21	Day 21	Day 21	Day 21
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations: New feeding regime started: CTL=2 mL; 1051 A=1 mL, BD=1.5 mL; 1052 AC=1 mL, B=1.5 mL, D=0.5 mL; 1053 ABC=1.5 mL, D=0.25 mL; 1054 AD=1 mL, B=0.5 mL, C=2 mL

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 22	Day 22	Day 22	Day 22	Day 22	Day 22
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 23	Day 23	Day 23	Day 23	Day 23	Day 23
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations: all test vessels put on aeration

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 24	Day 24	Day 24	Day 24	Day 24	Day 24
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 25	Day 25	Day 25	Day 25	Day 25	Day 25
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 26	Day 26	Day 26	Day 26	Day 26	Day 26
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 27	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	14	8	2	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 28	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	11	8	2	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 29	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	11	8	2	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 30	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	11	8	2	1	7

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 31	Day 31	Day 31	Day 31	Day 31	Day 31
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	8	7
b	15	15	9	11	8	2
c	14	12	0	6	8	13
d	15	11	8	2	1	7

Comments/Observations:

	CTL- TAP	CTL-MHRW	16-1051	16-1052	16-1053	16-1054
	Day 32	Day 32	Day 32	Day 32	Day 32	Day 32
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	5	6	6	7
b	14	15	9	11	8	2
c	14	12	0	6	8	13
d	14	10	8	2	1	6

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

New Solutions

pH (units)

Conc. (%) / Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
0	8.4	8.1	8.2	8.2	8.2	8.3
1	8.5	8.5	8.3	8.4	8.4	8.4
2	8.3	8.1	8.2	8.2	8.2	8.2
3	8.4	8.2	8.2	8.3	8.3	8.2
4	8.3	8.1	8.1	8.3	8.3	8.2
5	8.1	8.0	8.0	8.2	8.1	8.0
6	8.2	7.9	8.0	7.2	8.1	8.1
7	8.2	8.0	8.1	8.3	8.2	8.1
8	8.4	8.3	8.2	8.5	8.4	8.3

Conductance (µS/cm)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
0	398	296	752	324	641	795
1	395	400	760	322	654	785
2	386	300	765	330	655	794
3	360	303	752	314	628	749
4	355	302	746	324	645	788
5	330	297	748	308	627	770
6	364	301	777	318	650	787
7	367	297	841	325	672	824
8	358	291	835	321	675	819

Dissolved Oxygen (mg/L) (**60-100% saturation**)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
0	7.2	7.2	7.2	7.2	7.2	7.2
1	7.2	7.2	7.2	7.2	7.2	7.3
2	7.1	7.1	7.1	7.1	7.1	7.1
3	7.0	7.1	7.3	7.2	7.2	7.2
4	7.2	7.2	7.2	7.2	7.1	7.1
5	7.1	7.1	7.2	7.2	7.2	7.2
6	7.1	7.1	7.2	7.1	7.1	7.2
7	7.1	7.1	7.1	7.2	7.1	7.1
8	7.1	7.1	6.8	7.0	7.1	7.1

Temperature (°C)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
0	25	25	25	25	25	25
1	25	25	25	25	25	24
2	25	25	26	25	25	25
3	25	25	24	25	25	25
4	25	25	25	25	26	26
5	24	25	25	25	25	25
6	26	25	25	26	26	25
7	26	25	26	25	26	26
8	26	26	25	26	26	26

Old Solutions

pH (units)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
0						
1	8.5	8.0	8.3	8.3	8.3	8.4
2	8.3	8.2	8.1	8.3	8.2	8.2
3	8.4	8.2	8.1	8.4	8.3	8.2
4	8.3	8.0	8.0	8.3	8.1	8.0
5	8.0	7.7	7.9	8.1	8.0	7.9
6	7.9	7.7	7.9	8.1	8.0	7.9
7	7.8	7.6	7.9	8.1	7.9	7.9
8	8.1	7.7	8.1	8.3	8.1	8.1

Conductance (µS/cm)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
0						
1	405	293	764	329	651	793
2	419	308	746	346	638	783
3	390	305	727	357	630	773
4	393	301	753	328	635	778
5	358	284	731	348	625	769
6	352	306	734	351	617	775
7	360	298	701	349	636	787
8	364	302	792	327	670	825

Dissolved Oxygen (mg/L) (**60-100% saturation**)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
0						
1	6.9	6.8	7.0	7.0	6.9	6.9
2	6.4	6.4	6.4	6.7	6.5	6.6
3	6.9	6.9	7.0	6.9	6.9	6.9
4	6.9	7.0	7.0	7.1	7.0	7.1
5	6.6	6.6	6.7	6.7	6.7	6.7
6	6.0	6.1	6.0	6.1	6.1	6.2
7	5.1	5.1	5.4	5.4	5.6	5.6
8	6.1	6.2	6.0	6.0	6.0	5.7

Temperature (°C)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
0						
1	24	24	24	24	24	24
2	24	24	24	24	24	24
3	24	24	24	24	24	24
4	24	24	24	24	24	24
5	24	24	24	24	24	24
6	24	24	24	24	24	24
7	24	24	24	24	24	24
8	24	24	24	24	24	24

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C

4.5 to 7.2 mg/L at 25°C

4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

	New Solutions						Old Solutions					
Conc. (%)	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
Day												
	pH (units)						pH (units)					
9	8.3	8.2	8.1	8.4	8.3	8.2	7.5	7.6	8.1	8.2	8.1	8.1
10	8.3	8.2	8.2	8.3	8.3	8.2	8.0	7.5	8.1	8.1	8.1	8.1
11	8.2	8.2	8.1	8.2	8.3	8.3	8.0	7.6	8.1	8.2	8.2	8.0
12	8.3	8.2	8.2	8.4	8.3	8.2	8.1	7.8	8.1	8.2	8.2	8.1
13	8.2	8.0	8.0	8.2	8.1	8.0	7.2	7.5	7.9	8.1	8.0	7.9
14	8.3	8.2	8.1	8.4	8.2	8.1	8.0	7.8	8.1	8.3	8.1	8.2
15	8.3	8.2	8.1	8.5	8.3	8.2	7.9	7.6	8.0	8.3	8.1	8.1
16	8.4	8.2	8.2	8.5	8.3	8.3	8.0	7.7	8.0	8.4	8.1	8.1
17	8.4	8.2	8.1	8.4	8.3	8.2	8.0	7.7	8.1	8.4	8.1	8.1
	Conductance (µS/cm)						Conductance (µS/cm)					
9	357	299	841	322	674	818	397	312	808	337	646	816
10	344	301	820	337	667	814	362	302	823	330	680	817
11	360	305	828	335	669	813	360	302	825	335	672	822
12	350	307	831	328	649	800	341	308	811	346	652	803
13	394	347	950	372	756	926	438	357	924	382	724	911
14	391	346	969	369	781	988	390	351	902	415	745	911
15	382	324	975	373	745	948	398	335	929	399	756	946
16	367	334	986	371	765	971	393	344	919	368	735	945
17	366	331	947	369	766	973	382	328	953	376	754	968
	Dissolved Oxygen (mg/L) (**60-100% saturation**)						Dissolved Oxygen (mg/L) (**60-100% saturation**)					
9	7.2	7.2	7.1	7.2	7.1	7.1	5.4	5.4	5.4	5.9	6.0	6.0
10	7.0	7.1	7.1	7.1	7.2	7.1	5.9	5.9	6.5	6.5	6.5	6.4
11	7.2	7.2	7.2	7.2	7.2	7.1	5.8	5.9	6.5	6.5	6.4	6.4
12	7.0	7.2	7.1	7.1	7.1	7.1	6.2	6.1	6.3	6.8	6.8	6.9
13	7.2	7.2	7.1	7.1	7.1	7.1	6.1	6.2	6.4	6.8	6.9	6.9
14	7.2	7.1	7.1	7.1	7.1	7.1	6.1	6.1	6.1	6.1	6.3	6.3
15	7.2	7.3	7.3	7.2	7.1	7.2	6.1	5.5	6.1	6.1	6.1	6.3
16	7.3	7.2	7.1	7.1	7.1	7.2	6.1	6.1	6.2	6.2	6.4	6.3
17	7.1	7.2	7.2	7.2	7.2	7.2	6.1	6.1	6.5	6.8	6.3	6.5
	Temperature (°C)						Temperature (°C)					
9	25	25	26	25	26	26	24	24	24	24	24	24
10	25	25	26	26	25	26	24	24	24	24	24	24
11	25	25	25	25	25	26	24	24	24	24	24	24
12	25	24	26	26	26	26	24	24	24	24	24	24
13	25	25	26	26	26	26	24	24	24	24	24	24
14	25	26	26	26	26	26	24	24	24	24	24	24
15	24	24	24	25	26	25	24	24	24	24	24	24
16	24	25	26	26	26	25	24	24	24	24	24	24
17	26	25	25	25	25	25	24	24	24	24	24	24

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

	New Solutions						Old Solutions					
Conc. (%)	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
Day												
	pH (units)						pH (units)					
18	8.0	8.1	8.0	8.2	8.1	8.1	7.9	7.6	8.0	8.2	8.0	8.0
19	8.1	8.0	8.0	8.2	8.1	8.2	7.7	7.5	7.9	8.2	7.9	7.9
20	8.2	8.1	8.0	8.3	8.2	8.1	7.8	7.6	7.9	8.2	8.0	8.0
21	8.2	8.0	8.0	8.3	8.1	8.1	7.7	7.4	7.9	8.1	7.9	7.9
22	8.2	8.1	8.1	8.4	8.2	8.2	7.7	7.5	7.9	8.1	7.9	7.9
23	8.2	8.1	8.0	8.3	8.2	8.1	7.6	7.2	7.8	8.1	7.9	7.9
24	8.3	8.1	8.1	8.4	8.3	8.2	8.2	7.8	8.2	8.4	8.3	8.2
25	8.1	8.0	8.0	8.3	8.1	8.0	8.0	8.0	8.1	8.3	8.2	8.1
26	8.2	8.1	8.1	8.4	8.3	8.2	8.2	8.0	8.1	8.4	8.3	8.2
	Conductance (µS/cm)						Conductance (µS/cm)					
18	368	331	995	367	776	975	410	336	963	375	740	974
19	376	338	980	375	760	965	372	344	946	375	772	971
20	367	320	913	371	721	927	346	330	890	380	714	904
21	349	307	944	348	750	951	350	329	905	388	738	919
22	350	299	932	352	749	930	353	335	892	394	731	924
23	367	324	922	346	744	953	356	333	927	373	739	932
24	364	315	925	355	749	960	367	319	805	361	686	887
25	356	308	936	355	748	946	330	361	847	363	674	865
26	355	324	920	362	753	965	365	330	861	382	673	881
	Dissolved Oxygen (mg/L) (**60-100% saturation**)						Dissolved Oxygen (mg/L) (**60-100% saturation**)					
18	7.2	7.2	7.2	7.2	7.2	7.2	6.1	6.0	6.6	6.5	6.6	6.6
19	7.1	7.1	7.2	7.1	7.1	7.2	5.5	5.5	5.5	5.5	5.6	5.7
20	7.2	7.2	7.3	7.3	7.3	7.3	5.8	5.8	5.7	5.9	6.1	6.0
21	7.1	7.3	7.3	7.1	7.3	7.3	5.3	5.3	5.3	5.4	5.5	5.4
22	7.1	7.2	7.2	7.2	7.1	7.1	5.3	5.2	5.2	5.3	5.2	5.2
23	7.1	7.2	7.1	7.1	7.1	7.1	5.7	4.4	4.4	4.5	5.3	5.3
24	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.3	7.3	7.3	7.2	7.2
25	7.2	7.1	7.1	7.2	7.2	7.2	7.1	7.1	7.3	7.1	7.2	7.2
26	7.2	7.2	7.2	7.2	7.2	7.1	7.0	7.0	7.1	7.1	7.1	7.2
	Temperature (°C)						Temperature (°C)					
18	25	25	25	25	25	25	24	24	24	24	24	24
19	25	25	25	26	25	25	24	24	24	24	24	24
20	25	25	24	24	24	24	24	24	24	24	24	24
21	25	24	24	26	24	24	24	24	24	24	24	24
22	25	25	25	25	26	26	24	24	24	24	24	24
23	26	25	26	26	26	26	24	24	24	24	24	24
24	26	26	26	26	26	26	24	24	24	24	24	24
25	25	26	26	25	25	25	24	24	24	24	24	24
26	25	25	25	25	25	26	25	25	25	25	25	25

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments: Day 23- all test vessels put on aeration

NAUTILUS ENVIRONMENTAL

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

New Solutions

pH (units)

Conc. (%) / Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
27	8.3	8.1	8.2	8.3	8.3	8.1
28	8.2	8.1	8.1	8.2	8.2	8.2
29	8.2	8.0	8.0	8.2	8.0	8.1
30	8.2	8.1	8.2	8.3	8.2	8.2
31	8.3	7.9	8.2	8.4	8.2	8.2
32						

Conductance (µS/cm)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
27	353	323	947	360	756	964
28	354	324	945	364	762	805
29	361	324	941	371	756	800
30	350	332	926	353	741	796
31	330	332	947	366	758	795
32						

Dissolved Oxygen (mg/L) (**60-100% saturation**)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
27	7.1	7.1	7.1	7.2	7.1	7.1
28	7.2	7.2	7.1	7.1	7.1	7.1
29	7.0	7.1	7.1	7.2	7.1	7.1
30	7.2	7.2	7.1	7.1	7.1	7.2
31	7.2	7.0	7.2	7.2	7.2	7.2
32						

Temperature (°C)

Day	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
27	25	25	26	25	26	26
28	25	25	26	26	26	26
29	25	25	26	25	26	26
30	24	25	26	26	26	25
31	25	25	25	25	25	25
32						

Old Solutions

pH (units)

	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
27	8.2	8.1	8.2	8.3	8.3	8.3
28	7.9	7.2	8.1	8.4	8.2	8.2
29	8.1	7.2	8.2	8.2	8.2	8.2
30	8.2	8.1	8.2	8.4	8.3	8.2
31	8.2	7.9	8.2	8.4	8.4	8.3
32	8.1	7.9	8.0	8.3	8.3	8.2

Conductance (µS/cm)

	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
27	361	336	876	368	699	897
28	373	341	874	392	703	886
29	366	358	827	320	703	760
30	346	335	822	409	696	769
31	360	332	800	367	674	747
32	346	333	817	369	631	753

Dissolved Oxygen (mg/L) (**60-100% saturation**)

	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
27	6.8	7.0	7.1	7.1	7.0	7.0
28	7.3	3.7*	6.8	7.1	7.1	7.2
29	6.9	6.9	6.9	7.0	6.9	7.1
30	7.2	7.2	7.2	7.2	7.2	7.2
31	7.2	7.2	7.2	7.2	7.2	7.2
32	7.2	7.2	7.2	7.2	7.2	7.2

Temperature (°C)

	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054
27	25	25	25	25	25	25
28	25	25	25	25	25	25
29	25	25	25	25	25	25
30	25	25	25	25	25	25
31	25	25	25	25	25	25
32	25	25	25	25	25	25

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments: *DO lower than 60% saturation

NAUTILUS ENVIRONMENTAL

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

CTL- TAP

Replicate # _____A_____			Replicate # _____B_____			Replicate # _____C_____			Replicate # _____D_____		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	8	N	1	7	N	1	10	N	1	8	N
2	8	N	2	8	N	2	9	N	2	9	N
3	9	N	3	7	N	3	8	N	3	9	N
4	8	N	4	7	N	4	9	N	4	9	N
5	8	N	5	7	N	5	8	N	5	8	N
6	8	N	6	8	N	6	8	N	6	8	N
7	9	N	7	11	N	7	8	N	7	9	N
8	8	N	8	8	N	8	8	N	8	9	N
9	8	N	9	7	N	9	8	N	9	9	N
10	8	N	10	8	N	10	7	N	10	10	N
11	8	N	11	7	N	11	8	N	11	9	N
12	8	N	12	8	N	12	9	N	12	9	N
13	8	N	13	8	N	13	8	N	13	8	N
14	10	N	14	8	N	14	9	N	14	9	N
15	9	N	15	-	-	15	-	-	15	-	-

Comments

CTL- MHRW

Replicate # _____A_____			Replicate # _____B_____			Replicate # _____C_____			Replicate # _____D_____		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	10	N	1	7	N	1	9	N	1	10	N
2	10	N	2	8	N	2	10	N	2	8	N
3	11	N	3	9	N	3	9	N	3	8	N
4	8	N	4	9	N	4	12	N	4	9	N
5	10	N	5	9	N	5	10	N	5	8	N
6	9	N	6	10	N	6	9	N	6	9	N
7	8	N	7	10	N	7	9	N	7	7	N
8	9	N	8	9	N	8	10	N	8	8	N
9	8	N	9	9	N	9	10	N	9	9	N
10	9	N	10	10	N	10	8	N	10	8	N
11	11	N	11	11	N	11	11	N	11	-	-
12	7	N	12	7	N	12	8	N	12	-	-
13	9	N	13	9	N	13	-	-	13	-	-
14	8	N	14	7	N	14	-	-	14	-	-
15	-	-	15	9	N	15	-	-	15	-	-

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

16-1051

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	10	N	1	10	N	1	-	-	1	11	N
2	10	N	2	9	N	2	-	-	2	9	N
3	12	N	3	8	N	3	-	-	3	10	N
4	9	N	4	9	N	4	-	-	4	10	N
5	11	N	5	10	N	5	-	-	5	8	N
6	-	-	6	8	N	6	-	-	6	9	N
7	-	-	7	8	N	7	-	-	7	7	N
8	-	-	8	9	N	8	-	-	8	8	N
9	-	-	9	9	N	9	-	-	9	-	-
10	-	-	10	-	-	10	-	-	10	-	-
11	-	-	11	-	-	11	-	-	11	-	-
12	-	-	12	-	-	12	-	-	12	-	-
13	-	-	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

16-1052

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	N	1	9	N	1	10	N	1	11	N
2	10	N	2	9	N	2	8	N	2	12	N
3	9	N	3	10	N	3	10	N	3	-	-
4	10	N	4	9	N	4	9	N	4	-	-
5	9	N	5	8	N	5	9	N	5	-	-
6	10	N	6	8	N	6	9	N	6	-	-
7	-	-	7	8	N	7	-	-	7	-	-
8	-	-	8	8	N	8	-	-	8	-	-
9	-	-	9	8	N	9	-	-	9	-	-
10	-	-	10	8	N	10	-	-	10	-	-
11	-	-	11	9	N	11	-	-	11	-	-
12	-	-	12	-	-	12	-	-	12	-	-
13	-	-	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051, 16-1052, 16-1053, 16-1054

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

16-1053

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	8	N	1	9	N	1	8	N	1	14	N
2	9	N	2	10	N	2	8	N	2	-	-
3	9	N	3	8	N	3	8	N	3	-	-
4	11	N	4	10	N	4	7	N	4	-	-
5	11	N	5	8	N	5	9	N	5	-	-
6	9	N	6	9	N	6	11	N	6	-	-
7	-	-	7	8	N	7	7	N	7	-	-
8	-	-	8	7	N	8	10	N	8	-	-
9	-	-	9	-	-	9	-	-	9	-	-
10	-	-	10	-	-	10	-	-	10	-	-
11	-	-	11	-	-	11	-	-	11	-	-
12	-	-	12	-	-	12	-	-	12	-	-
13	-	-	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

16-1054

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	N	1	12	N	1	10	N	1	10	N
2	8	N	2	12	N	2	9	N	2	10	N
3	10	N	3	-	-	3	8	N	3	8	N
4	9	N	4	-	-	4	8	N	4	10	N
5	10	N	5	-	-	5	8	N	5	8	N
6	10	N	6	-	-	6	8	N	6	11	N
7	7	N	7	-	-	7	8	N	7	-	-
8	-	-	8	-	-	8	8	N	8	-	-
9	-	-	9	-	-	9	8	N	9	-	-
10	-	-	10	-	-	10	8	N	10	-	-
11	-	-	11	-	-	11	10	N	11	-	-
12	-	-	12	-	-	12	9	N	12	-	-
13	-	-	13	-	-	13	7	N	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

NAUTILUS ENVIRONMENTAL

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-1051, 16-1052, 16-1053, 16-1054

Initial Weight (mg) (dried pan)

			Date:	9/7/2016	Initials:	EP	Balance:	Mettler #1
Conc.	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054		
Replicate								
a	1010.46	993.32	1019.16	997.50	1016.00	1005.80		
b	1007.29	999.82	1020.98	988.55	1011.36	1014.19		
c	1011.31	1010.18	985.23	990.79	999.70	997.89		
d	1002.91	1021.40	1005.21	987.86	996.08	1027.23		
e								

Final Weight (mg) (dried pan+organisms)

			Date:	9/29/2016	Initials:	EP	Balance:	Mettler #1
Conc.	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054		
Replicate								
a	1022.87	1010.74	1029.21	1005.38	1027.07	1016.20		
b	1017.96	1016.81	1031.78	998.29	1021.23	1025.26		
c	1023.62	1040.23	985.23	998.50	1009.71	1010.49		
d	1016.24	1030.36	1018.60	1005.60	1004.35	1044.26		
e								

Comments:

Weight Checks- organisms removed from pan and reweighed, as initital caluclations did not make sense

MHRW C 17.03 mg
1051A good
1052D 7.87mg
1053D 6.27mg
1054B 9.64mg
1054D 8.01mg

NAUTILUS ENVIRONMENTAL

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-1051, 16-1052, 16-1053, 16-1054

Organism weight per replicate (mg)

Dose	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054		
replicate								
a	12.41	17.42	10.05	7.88	11.07	10.40		
b	10.67	16.99	10.80	9.74	9.87	9.64		
c	12.31	17.03	0.00	7.71	10.01	12.60		
d	13.33	8.96	13.39	7.87	6.27	8.01		
e								

***CTL MHRWC, 1052D, 1053D, 1054B, 1054D organisms were removed from pan and weighed separately, as initial dry weight calculations did not make sense**

Dry Weight per Fish (mg)

Dose	CTL- TAP	CTL- MHRW	16-1051	16-1052	16-1053	16-1054		
replicate								
a	0.83	1.24	2.01	1.31	1.84	1.49		
b	0.76	1.13	1.20	0.89	1.23	4.82		
c	0.88	1.42	0.00	1.29	1.25	0.97		
d	0.95	0.90	1.67	3.94	6.27	1.34		
Average	0.86	1.17	1.22	1.85	2.65	2.15		

Warning Chart
Fathead minnow

Test Method: 7 days Fathead minnow Survival and Growth Test (7 treatments plus a control)
HydroQual Test Method: WTR-ME-046
Reference: Biological Test Method: Test of Larval Growth and Survival Using Fathead minnows. Environment Canada, EPS 1/RM/22, Second Edition, February 2011.

Test Organism:

test species:	*Pimephales promelas*
culture source:	Aquatox (Arkansas, USA)
temp of breeding aquaria:	23 - 26 °C
food type:	newly-hatched brine shrimp nauplii
frequency of feeding:	daily
breeding colony mortality:	<1% (last 7 days)
age of test organisms:	<24 hours
condition prior to test initiation:	normal
batch number:	20160829FM

Test Design:

test type:	static renewal
toxicant:	sodium chloride
test vessel:	polypropylene cups, 11 x 9 cm
volume of test vessel (ml):	500
test volume (ml):	250
depth of test solution:	>3 cm
replicates per treatment:	4 replicates
organisms per replicate:	10
feeding:	twice daily
temperature (°C):	24-26
photoperiod:	16 hours light: 8 hours dark
light level (surface):	100-500 lux (full spectrum)

Control/Dilution Water:

source:	dechlorinated City of Calgary tap water no chemicals were added to the dilution water
pH (units):	7.2
conductance (µS/cm):	381
dissolved oxygen (mg/L):	6.5
NH_4^+ (mg/L):	<0.1
hardness (mg $CaCO_3$/L):	194
alkalinity (mg $CaCO_3$/L):	137
total residual chlorine (mg/L):	<0.01

Comments: None

The test data and results are authorized and verified correct.

Senior Verifier

Warning Chart
Fathead minnow

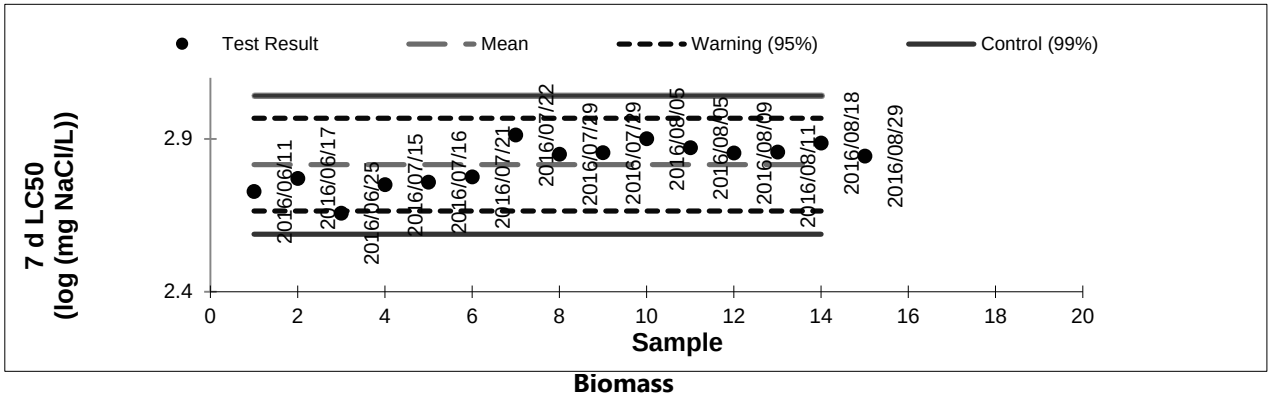
Mortality

Current Test

toxicant	Sodium Chloride (NaCl)				
started on	2016/08/29	ended on	2016/09/05		
Result (7 d LC50):	2.84	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.80	upper	2.89	

Historical Values

mean	2.82	sd	0.08	cv(%):	11.6
	lower	upper			
warning limits (±2 sd)	2.66	2.97	(95% confidence limits)		
control limits (±3 sd)	2.59	3.04	(99% confidence limits)		

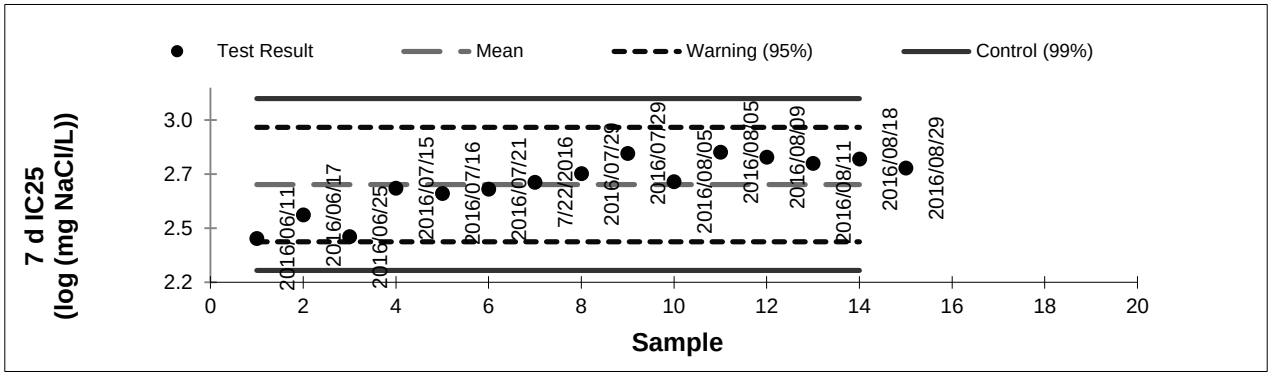


Biomass

started on	2016/08/29	ended on	2016/09/05		
Result (7 d IC25):	2.73	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.69	upper	2.76	

Historical Values

mean	2.65	sd	0.13	cv(%):	20.3
	lower	upper			
warning limits (±2 sd)	2.39	2.92	(95% confidence limits)		
control limits (±3 sd)	2.26	3.05	(99% confidence limits)		



notes: sd, standard deviation; cv, coefficient of variance; N/A, could not be calculated

CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA		
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Hatched Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Ctrl-Tap	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
Ctrl-MHW	4	1	1	1	1	1	0	0	0.0%	-1.7%
FR_UFR1 (site)	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
FR_FRCP1	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
GH_FR1	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
CM_MC2	4	0.95	0.8484	1	0.8667	1	0.03191	0.06383	6.72%	3.39%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	1	1	0.9333	1
Ctrl-MHW	1	1	1	1
FR_UFR1 (site)	0.9333	1	1	1
FR_FRCP1	1	0.9333	1	1
GH_FR1	1	0.9333	1	1
CM_MC2	1	0.9333	1	0.8667

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	15/15	15/15	14/15	15/15
Ctrl-MHW	15/15	15/15	15/15	15/15
FR_UFR1 (site)	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	15/15
GH_FR1	15/15	14/15	15/15	15/15
CM_MC2	15/15	14/15	15/15	13/15

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	01-3206-1924	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:16	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Ctrl-Tap		FR_UFR1 (site)	0.7521	1.0000	Exact	Non-Significant Effect
Ctrl-Tap		FR_FRCP1	0.7521	1.0000	Exact	Non-Significant Effect
Ctrl-Tap		GH_FR1	0.7521	1.0000	Exact	Non-Significant Effect
Ctrl-Tap		CM_MC2	0.3093	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Ctrl-Tap	Negative Contr	59	1	60	0.9833	0.01667	0.0%
FR_UFR1 (site)		59	1	60	0.9833	0.01667	0.0%
FR_FRCP1		59	1	60	0.9833	0.01667	0.0%
GH_FR1		59	1	60	0.9833	0.01667	0.0%
CM_MC2		57	3	60	0.95	0.05	3.39%

Hatched Rate Detail

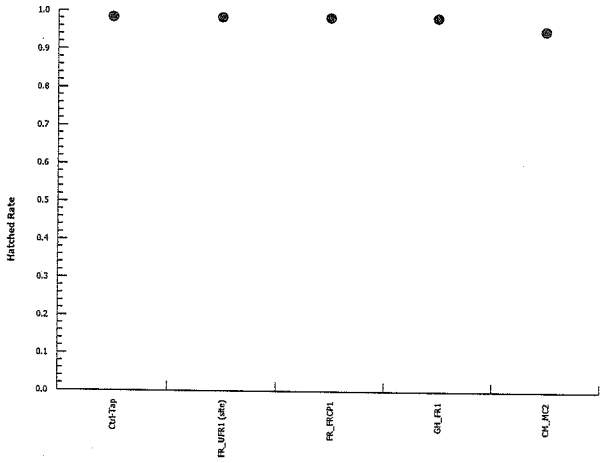
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	1	1	0.9333	1
FR_UFR1 (site)	0.9333	1	1	1
FR_FRCP1	1	0.9333	1	1
GH_FR1	1	0.9333	1	1
CM_MC2	1	0.9333	1	0.8667

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	15/15	15/15	14/15	15/15
FR_UFR1 (site)	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	15/15
GH_FR1	15/15	14/15	15/15	15/15
CM_MC2	15/15	14/15	15/15	13/15

Analysis ID:	01-3206-1924	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:16	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	11-7045-5232	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:17	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Ctrl-MHW		FR_UFR1 (site)	0.5	1.0000	Exact	Non-Significant Effect
Ctrl-MHW		FR_FRCP1	0.5	1.0000	Exact	Non-Significant Effect
Ctrl-MHW		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
Ctrl-MHW		CM_MC2	0.1218	0.4874	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Ctrl-MHW	Lab Water	60	0	60	1	0	0.0%
FR_UFR1 (site)		59	1	60	0.9833	0.01667	1.67%
FR_FRCP1		59	1	60	0.9833	0.01667	1.67%
GH_FR1		59	1	60	0.9833	0.01667	1.67%
CM_MC2		57	3	60	0.95	0.05	5.0%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-MHW	1	1	1	1
FR_UFR1 (site)	0.9333	1	1	1
FR_FRCP1	1	0.9333	1	1
GH_FR1	1	0.9333	1	1
CM_MC2	1	0.9333	1	0.8667

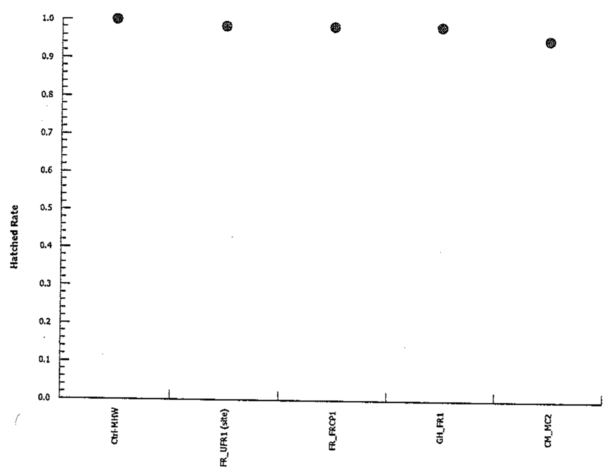
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-MHW	15/15	15/15	15/15	15/15
FR_UFR1 (site)	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	15/15
GH_FR1	15/15	14/15	15/15	15/15
CM_MC2	15/15	14/15	15/15	13/15

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	11-7045-5232	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:17	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	10-4488-9429	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:20	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	0.7521	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		GH_FR1	0.7521	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		CM_MC2	0.3093	0.9279	Exact	Non-Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1 (site)Upstream Contr	59	1	60	0.9833	0.01667	0.0%
FR_FRCP1	59	1	60	0.9833	0.01667	0.0%
GH_FR1	59	1	60	0.9833	0.01667	0.0%
CM_MC2	57	3	60	0.95	0.05	3.39%

Hatched Rate Detail

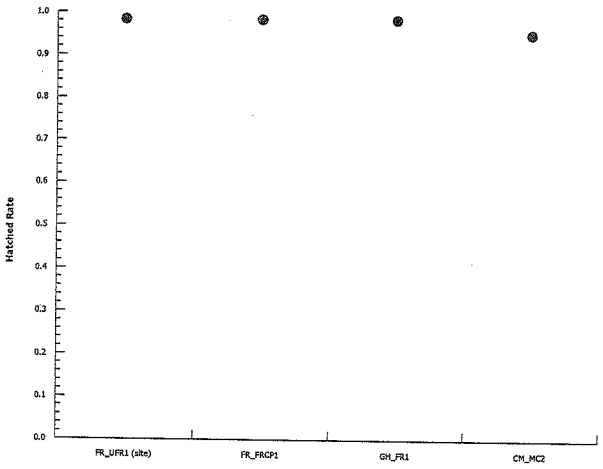
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	0.9333	1	1	1
FR_FRCP1	1	0.9333	1	1
GH_FR1	1	0.9333	1	1
CM_MC2	1	0.9333	1	0.8667

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	15/15
GH_FR1	15/15	14/15	15/15	15/15
CM_MC2	15/15	14/15	15/15	13/15

Analysis ID: 10-4488-9429 **Endpoint:** Hatched Rate **CETIS Version:** CETISv1.8.7
Analyzed: 14 Oct-16 15:20 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

Graphics



CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA		
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Ctrl-Tap	4	0.95	0.897	1	0.9333	1	0.01667	0.03333	3.51%	0.0%
Ctrl-MHW	4	0.85	0.6148	1	0.6667	1	0.07391	0.1478	17.39%	10.53%
FR_UFR1 (site)	4	0.4167	0.0257	0.8076	0.1333	0.7333	0.1229	0.2457	58.97%	56.14%
FR_FRCP1	4	0.3667	0	0.7954	0	0.6	0.1347	0.2694	73.48%	61.4%
GH_FR1	4	0.3833	0.03284	0.7338	0.06667	0.5333	0.1101	0.2203	57.46%	59.65%
CM_MC2	4	0.4667	0	0.9489	0.1333	0.8667	0.1515	0.3031	64.94%	50.88%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	1	0.9333	0.9333	0.9333
Ctrl-MHW	0.9333	1	0.8	0.6667
FR_UFR1 (site)	0.4	0.7333	0.4	0.1333
FR_FRCP1	0.3333	0.6	0	0.5333
GH_FR1	0.4	0.5333	0.5333	0.06667
CM_MC2	0.4667	0.1333	0.8667	0.4

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	15/15	14/15	14/15	14/15
Ctrl-MHW	14/15	15/15	12/15	10/15
FR_UFR1 (site)	6/15	11/15	6/15	2/15
FR_FRCP1	5/15	9/15	0/15	8/15
GH_FR1	6/15	8/15	8/15	1/15
CM_MC2	7/15	2/15	13/15	6/15

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	19-5545-9074	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:16	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Ctrl-Tap		FR_UFR1 (site)	0	<0.0001	Exact	Significant Effect
Ctrl-Tap		FR_FRCP1	0	<0.0001	Exact	Significant Effect
Ctrl-Tap		GH_FR1	0	<0.0001	Exact	Significant Effect
Ctrl-Tap		CM_MC2	0	<0.0001	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Ctrl-Tap	Negative Contr	57	3	60	0.95	0.05	0.0%
FR_UFR1 (site)		25	35	60	0.4167	0.5833	56.14%
FR_FRCP1		22	38	60	0.3667	0.6333	61.4%
GH_FR1		23	37	60	0.3833	0.6167	59.65%
CM_MC2		28	32	60	0.4667	0.5333	50.88%

Survival Rate Detail

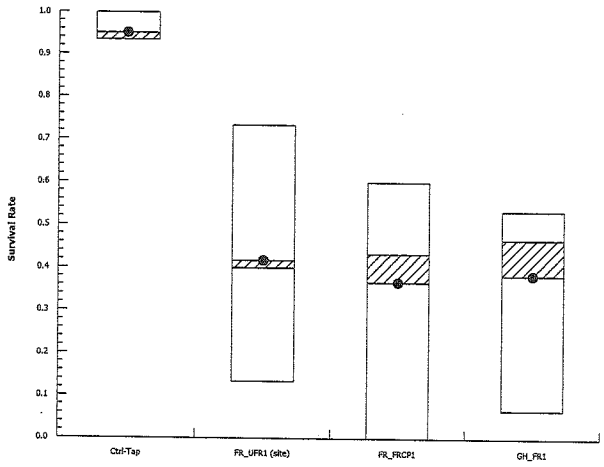
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	1	0.9333	0.9333	0.9333
FR_UFR1 (site)	0.4	0.7333	0.4	0.1333
FR_FRCP1	0.3333	0.6	0	0.5333
GH_FR1	0.4	0.5333	0.5333	0.06667
CM_MC2	0.4667	0.1333	0.8667	0.4

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	15/15	14/15	14/15	14/15
FR_UFR1 (site)	6/15	11/15	6/15	2/15
FR_FRCP1	5/15	9/15	0/15	8/15
GH_FR1	6/15	8/15	8/15	1/15
CM_MC2	7/15	2/15	13/15	6/15

Analysis ID:	19-5545-9074	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:16	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	11-3941-9330	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:16	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Ctrl-MHW		FR_UFR1 (site)	6.515E-07	<0.0001	Exact	Significant Effect
Ctrl-MHW		FR_FRCP1	0	<0.0001	Exact	Significant Effect
Ctrl-MHW		GH_FR1	0	<0.0001	Exact	Significant Effect
Ctrl-MHW		CM_MC2	0.000008	<0.0001	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Ctrl-MHW	Lab Water	51	9	60	0.85	0.15	0.0%
FR_UFR1 (site)		25	35	60	0.4167	0.5833	50.98%
FR_FRCP1		22	38	60	0.3667	0.6333	56.86%
GH_FR1		23	37	60	0.3833	0.6167	54.9%
CM_MC2		28	32	60	0.4667	0.5333	45.1%

Survival Rate Detail

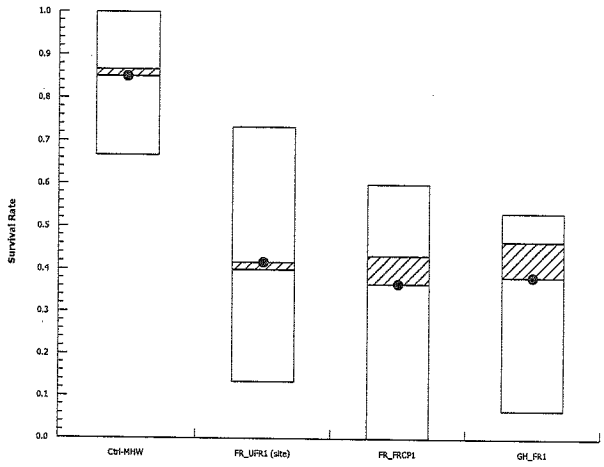
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-MHW	0.9333	1	0.8	0.6667
FR_UFR1 (site)	0.4	0.7333	0.4	0.1333
FR_FRCP1	0.3333	0.6	0	0.5333
GH_FR1	0.4	0.5333	0.5333	0.06667
CM_MC2	0.4667	0.1333	0.8667	0.4

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-MHW	14/15	15/15	12/15	10/15
FR_UFR1 (site)	6/15	11/15	6/15	2/15
FR_FRCP1	5/15	9/15	0/15	8/15
GH_FR1	6/15	8/15	8/15	1/15
CM_MC2	7/15	2/15	13/15	6/15

Analysis ID:	11-3941-9330	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:16	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	00-6587-5275	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:20	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	0.3543	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		GH_FR1	0.4262	0.8523	Exact	Non-Significant Effect
FR_UFR1 (site)		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1 (site) Upstream Contr	25	35	60	0.4167	0.5833	0.0%
FR_FRCP1	22	38	60	0.3667	0.6333	12.0%
GH_FR1	23	37	60	0.3833	0.6167	8.0%
CM_MC2	28	32	60	0.4667	0.5333	-12.0%

Survival Rate Detail

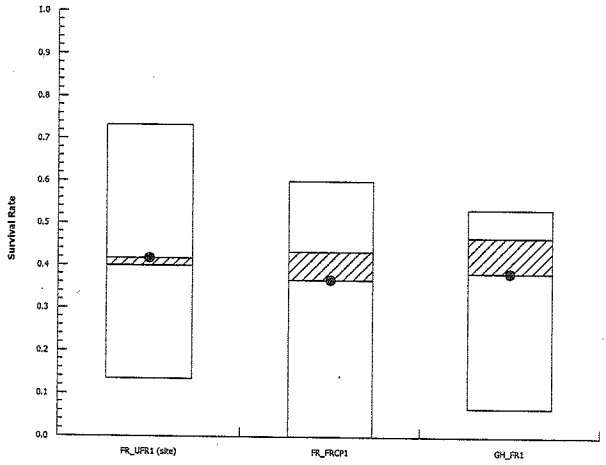
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	0.4	0.7333	0.4	0.1333
FR_FRCP1	0.3333	0.6	0	0.5333
GH_FR1	0.4	0.5333	0.5333	0.06667
CM_MC2	0.4667	0.1333	0.8667	0.4

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	6/15	11/15	6/15	2/15
FR_FRCP1	5/15	9/15	0/15	8/15
GH_FR1	6/15	8/15	8/15	1/15
CM_MC2	7/15	2/15	13/15	6/15

Analysis ID:	00-6587-5275	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 15:20	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA		
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Ctrl-Tap	4	0.812	0.6946	0.9294	0.7113	0.8887	0.03688	0.07376	9.08%	0.0%
Ctrl-MHW	3	0.9638	0.1746	1.753	0.5973	1.161	0.1834	0.3177	32.96%	-18.69%
FR_UFR1 (site)	3	0.5629	0.3764	0.7494	0.514	0.6493	0.04335	0.07508	13.34%	30.68%
FR_FRCP1	4	0.5707	-0.05344	1.195	0	0.8927	0.1961	0.3922	68.73%	29.72%
GH_FR1	3	0.6878	0.5791	0.7964	0.658	0.738	0.02525	0.04374	6.36%	15.3%
CM_MC2	2	0.7667	-0.1651	1.698	0.6933	0.84	0.07333	0.1037	13.53%	5.58%

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	0.8273	0.7113	0.8207	0.8887
Ctrl-MHW	1.161	1.133	0.5973	
FR_UFR1 (site)	0.5253	0.6493	0.514	
FR_FRCP1	0.67	0.72	0	0.8927
GH_FR1	0.738	0.658	0.6673	
CM_MC2	0.6933	0.84		

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	06-0939-3057	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Dec-16 16:04	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed	NA	C > T	NA	NA	

Nemenyi-Damico-Wolfe Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Ctrl-Tap		FR_UFR1 (site)	111	95.15	0		0.0198	Asymp	Significant Effect
		FR_FRCP1	45	88.09	0		0.3432	Asymp	Non-Significant Effect
		GH_FR1	59	95.15	0		0.2468	Asymp	Non-Significant Effect
		CM_MC2	15	107.9	0		0.7144	Asymp	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Treatment Effect	Fligner-Wolfe	117		0.0390	Significant Overall Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1736042	0.04340106	4	0.9478	0.4727	Non-Significant Effect
Error	0.5036867	0.0457897	11			
Total	0.6772909		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	12.14	13.28	0.0164	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7995	0.8408	0.0027	Non-normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Ctrl-Tap	4	0.812	0.6946	0.9294	0.824	0.7113	0.8887	0.03688	9.08%	0.0%
FR_UFR1 (site)	3	0.5629	0.3764	0.7494	0.5253	0.514	0.6493	0.04335	13.34%	30.68%
FR_FRCP1	4	0.5707	-0.05344	1.195	0.695	0	0.8927	0.1961	68.73%	29.72%
GH_FR1	3	0.6878	0.5791	0.7964	0.6673	0.658	0.738	0.02525	6.36%	15.3%
CM_MC2	2	0.7667	-0.1651	1.698	0.7667	0.6933	0.84	0.07333	13.53%	5.58%

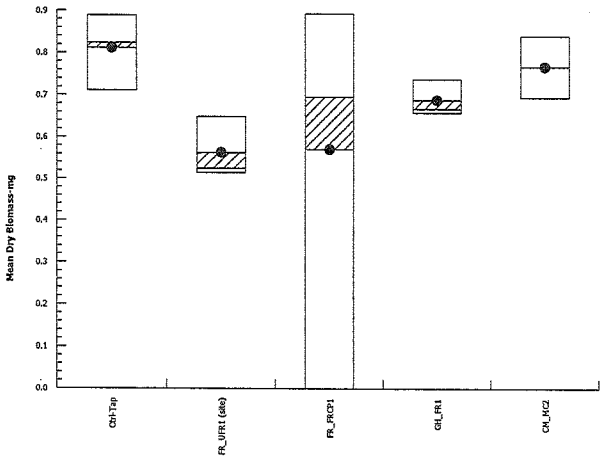
Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

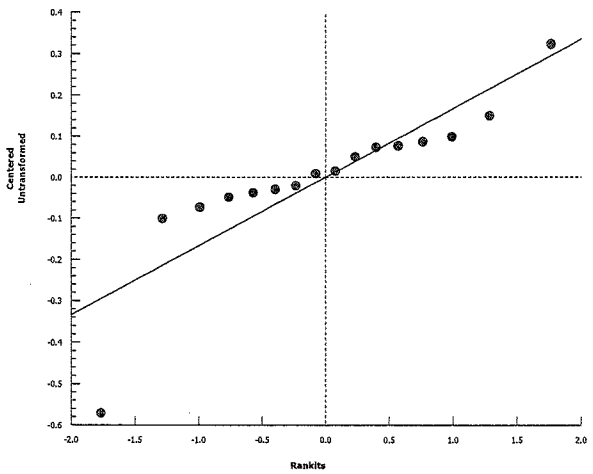
Analysis ID:	06-0939-3057	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Dec-16 16:04	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	0.8273	0.7113	0.8207	0.8887
FR_UFR1 (site)	0.5253	0.6493	0.514	
FR_FRCP1	0.67	0.72	0	0.8927
GH_FR1	0.738	0.658	0.6673	
CM_MC2	0.6933	0.84		

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	14-0040-6618	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 10:25	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	61.4%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Ctrl-MHW		FR_UFR1 (site)	1.87	2.469	0.529	4	0.1268	CDF	Non-Significant Effect
		FR_FRCP1	1.961	2.469	0.495	5	0.1108	CDF	Non-Significant Effect
		GH_FR1	1.288	2.469	0.529	4	0.2809	CDF	Non-Significant Effect
		CM_MC2	0.8225	2.469	0.592	3	0.4662	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.3412673	0.08531684	4	1.238	0.3554	Non-Significant Effect
Error	0.6891999	0.06891999	10			
Total	1.030467		14			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	8.847	13.28	0.0651	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8754	0.8328	0.0406	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Ctrl-MHW	3	0.9638	0.1746	1.753	1.133	0.5973	1.161	0.1834	32.96%	0.0%
FR_UFR1 (site)	3	0.5629	0.3764	0.7494	0.5253	0.514	0.6493	0.04335	13.34%	41.6%
FR_FRCP1	4	0.5707	-0.05344	1.195	0.695	0	0.8927	0.1961	68.73%	40.79%
GH_FR1	3	0.6878	0.5791	0.7964	0.6673	0.658	0.738	0.02525	6.36%	28.64%
CM_MC2	2	0.7667	-0.1651	1.698	0.7667	0.6933	0.84	0.07333	13.53%	20.45%

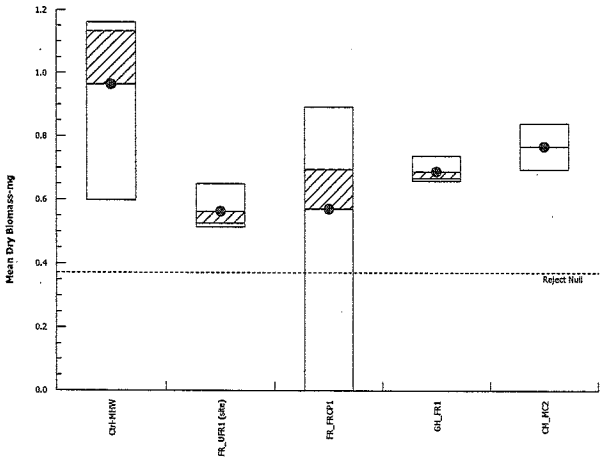
Mean Dry Biomass-mg Detail

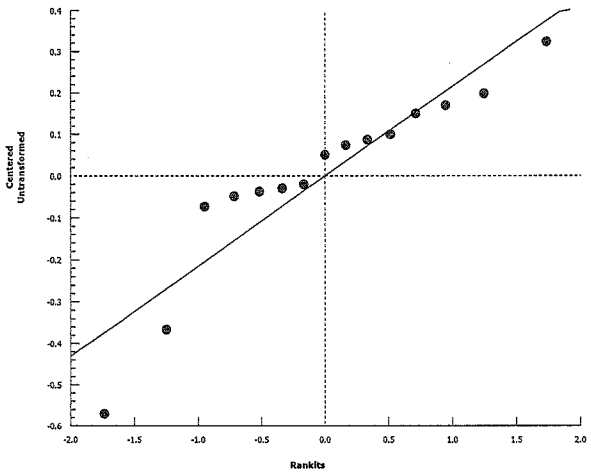
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-MHW	1.161	1.133	0.5973	
FR_UFR1 (site)	0.5253	0.6493	0.514	
FR_FRCP1	0.67	0.72	0	0.8927
GH_FR1	0.738	0.658	0.6673	
CM_MC2	0.6933	0.84		

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	14-0040-6618	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 10:25	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	10-7078-6036	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Dec-16 16:15	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	96.9%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	-0.04126	2.421	0.456	5	0.7678	CDF	Non-Significant Effect
		GH_FR1	-0.6197	2.421	0.488	4	0.9130	CDF	Non-Significant Effect
		CM_MC2	-0.9044	2.421	0.545	3	0.9504	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.07495806	0.02498602	3	0.4101	0.7502	Non-Significant Effect
Error	0.4873654	0.06092068	8			
Total	0.5623235		11			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	8.542	11.34	0.0361	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8114	0.8025	0.0127	Normal Distribution

Mean Dry Biomass-mg Summary

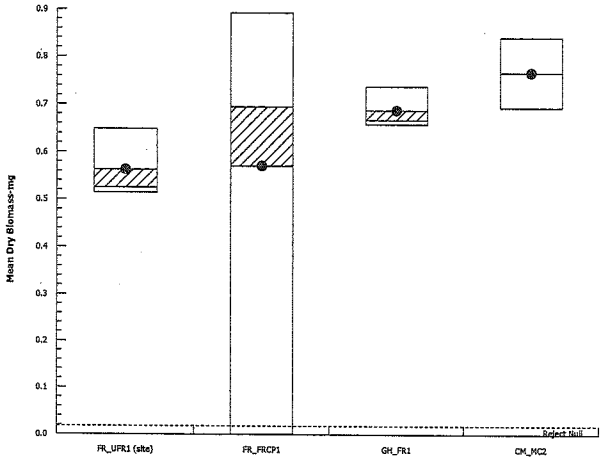
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1 (site)	3	0.5629	0.3764	0.7494	0.5253	0.514	0.6493	0.04335	13.34%	0.0%
FR_FRCP1	4	0.5707	-0.05344	1.195	0.695	0	0.8927	0.1961	68.73%	-1.38%
GH_FR1	3	0.6878	0.5791	0.7964	0.6673	0.658	0.738	0.02525	6.36%	-22.19%
CM_MC2	2	0.7667	-0.1651	1.698	0.7667	0.6933	0.84	0.07333	13.53%	-36.2%

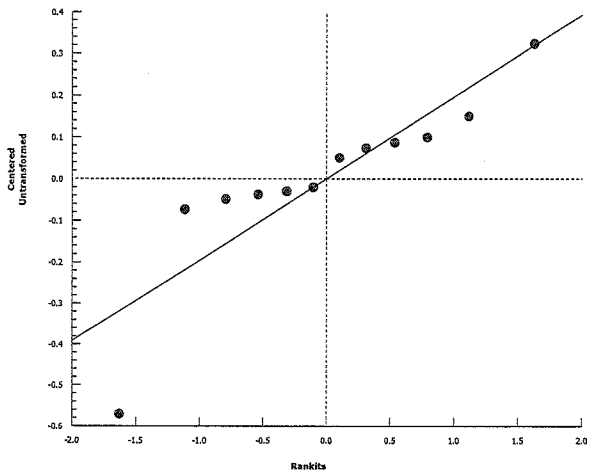
Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	0.5253	0.6493	0.514	
FR_FRCP1	0.67	0.72	0	0.8927
GH_FR1	0.738	0.658	0.6673	
CM_MC2	0.6933	0.84		

Analysis ID:	10-7078-6036	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Dec-16 16:15	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA		
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Ctrl-Tap	4	8.316	7.663	8.968	7.786	8.786	0.2049	0.4098	4.93%	0.0%
Ctrl-MHW	4	8.98	8.2	9.76	8.4	9.583	0.2451	0.4903	5.46%	-7.99%
FR_UFR1 (site)	4	9.678	7.645	11.71	8.545	11.5	0.6388	1.278	13.2%	-16.39%
FR_FRCP1	3	9.43	7.338	11.52	8.889	10.4	0.4862	0.8422	8.93%	-13.4%
GH_FR1	4	10.16	6.018	14.29	8.5	14	1.3	2.601	25.61%	-22.14%
CM_MC2	4	9.721	7.197	12.25	8.385	12	0.7931	1.586	16.32%	-16.91%

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	8.333	7.786	8.357	8.786
Ctrl-MHW	9.071	8.867	9.583	8.4
FR_UFR1 (site)	9.5	8.545	9.167	11.5
FR_FRCP1	10.4	8.889		9
GH_FR1	9.5	8.625	8.5	14
CM_MC2	9	12	8.385	9.5

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	21-0981-2675	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 10:01	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	31.8%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Ctrl-Tap		FR_UFR1 (site)	-1.225	2.378	2.646	6	0.9868	CDF	Non-Significant Effect
		FR_FRCP1	-0.9271	2.378	2.858	5	0.9719	CDF	Non-Significant Effect
		GH_FR1	-1.655	2.378	2.646	6	0.9959	CDF	Non-Significant Effect
		CM_MC2	-1.264	2.378	2.646	6	0.9881	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	7.644382	1.911095	4	0.772	0.5612	Non-Significant Effect
Error	34.65881	2.47563	14			
Total	42.3032		18			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	7.637	13.28	0.1058	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8676	0.8605	0.0131	Normal Distribution

Length-mm Summary

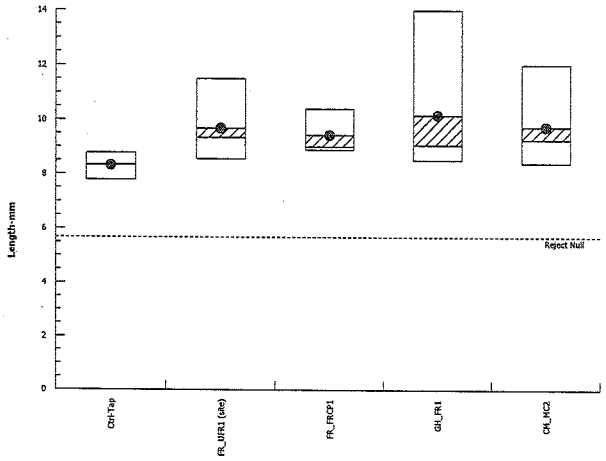
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Ctrl-Tap	4	8.316	7.663	8.968	8.345	7.786	8.786	0.2049	4.93%	0.0%
FR_UFR1 (site)	4	9.678	7.645	11.71	9.333	8.545	11.5	0.6388	13.2%	-16.39%
FR_FRCP1	3	9.43	7.338	11.52	9	8.889	10.4	0.4862	8.93%	-13.4%
GH_FR1	4	10.16	6.018	14.29	9.063	8.5	14	1.3	25.61%	-22.14%
CM_MC2	4	9.721	7.197	12.25	9.25	8.385	12	0.7931	16.32%	-16.91%

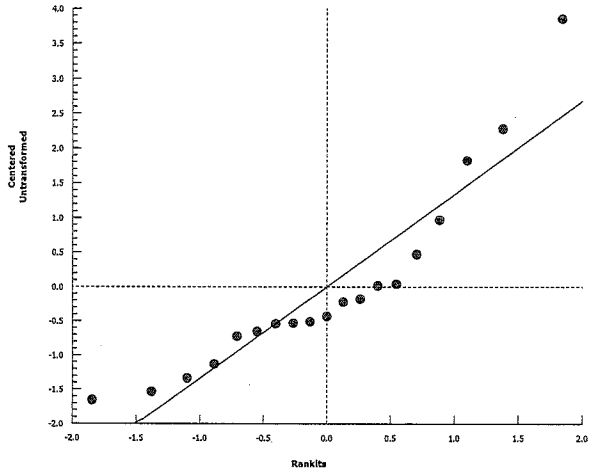
Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	8.333	7.786	8.357	8.786
FR_UFR1 (site)	9.5	8.545	9.167	11.5
FR_FRCP1	10.4	8.889	9	
GH_FR1	9.5	8.625	8.5	14
CM_MC2	9	12	8.385	9.5

Analysis ID:	21-0981-2675	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 10:01	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	00-8930-9247	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 10:05	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	29.6%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Ctrl-MHW		FR_UFR1 (site)	-0.6252	2.378	2.654	6	0.9428	CDF	Non-Significant Effect
		FR_FRCP1	-0.3728	2.378	2.867	5	0.9021	CDF	Non-Significant Effect
		GH_FR1	-1.054	2.378	2.654	6	0.9795	CDF	Non-Significant Effect
		CM_MC2	-0.6639	2.378	2.654	6	0.9476	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.944146	0.7360365	4	0.2955	0.8761	Non-Significant Effect
Error	34.87611	2.49115	14			
Total	37.82025		18			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	6.775	13.28	0.1482	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8685	0.8605	0.0136	Normal Distribution

Length-mm Summary

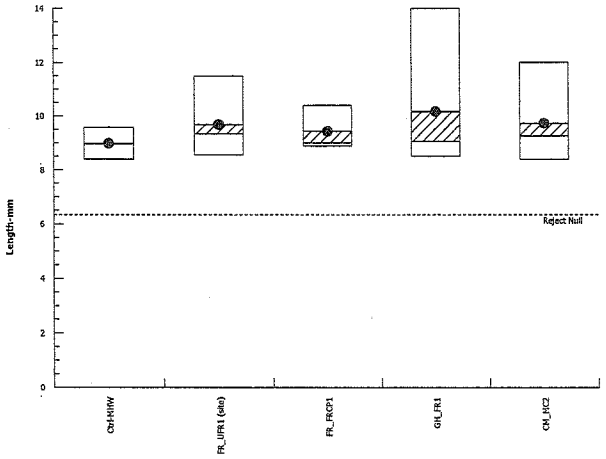
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Ctrl-MHW	4	8.98	8.2	9.76	8.969	8.4	9.583	0.2451	5.46%	0.0%
FR_UFR1 (site)	4	9.678	7.645	11.71	9.333	8.545	11.5	0.6388	13.2%	-7.77%
FR_FRCP1	3	9.43	7.338	11.52	9	8.889	10.4	0.4862	8.93%	-5.01%
GH_FR1	4	10.16	6.018	14.29	9.063	8.5	14	1.3	25.61%	-13.1%
CM_MC2	4	9.721	7.197	12.25	9.25	8.385	12	0.7931	16.32%	-8.25%

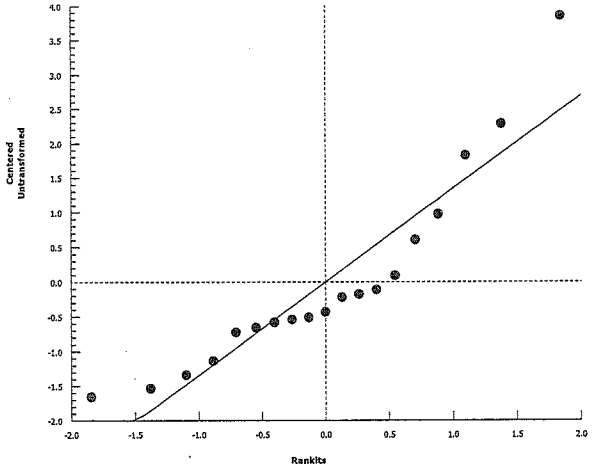
Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-MHW	9.071	8.867	9.583	8.4
FR_UFR1 (site)	9.5	8.545	9.167	11.5
FR_FRCP1	10.4	8.889	9	
GH_FR1	9.5	8.625	8.5	14
CM_MC2	9	12	8.385	9.5

Analysis ID:	00-8930-9247	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 10:05	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-9096-3522	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 10:07	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	29.8%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	0.1845	2.318	3.119	5	0.6870	CDF	Non-Significant Effect
		GH_FR1	-0.3838	2.318	2.888	6	0.8698	CDF	Non-Significant Effect
		CM_MC2	-0.03471	2.318	2.888	6	0.7688	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.9874977	0.3291659	3	0.106	0.9548	Non-Significant Effect
Error	34.15504	3.105004	11			
Total	35.14254		14			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	2.748	11.34	0.4322	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.851	0.8328	0.0179	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1 (site)	4	9.678	7.645	11.71	9.333	8.545	11.5	0.6388	13.2%	0.0%
FR_FRCP1	3	9.43	7.338	11.52	9	8.889	10.4	0.4862	8.93%	2.57%
GH_FR1	4	10.16	6.018	14.29	9.063	8.5	14	1.3	25.61%	-4.94%
CM_MC2	4	9.721	7.197	12.25	9.25	8.385	12	0.7931	16.32%	-0.45%

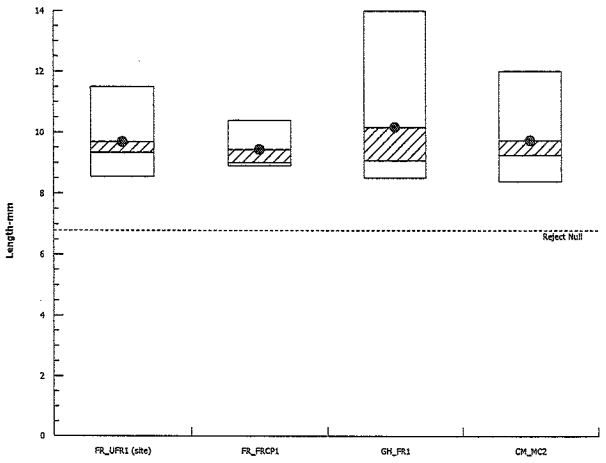
Length-mm Detail

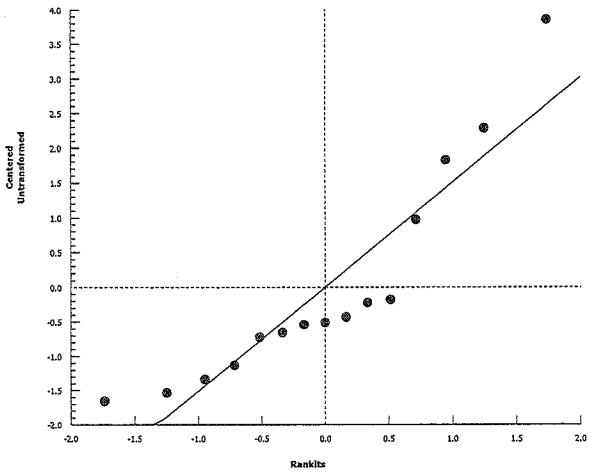
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	9.5	8.545	9.167	11.5
FR_FRCP1	10.4	8.889	9	
GH_FR1	9.5	8.625	8.5	14
CM_MC2	9	12	8.385	9.5

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	20-9096-3522	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 10:07	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA		
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	15/15	14/14	14/14	14/14
Ctrl-MHW	14/14	15/15	12/12	10/10
FR_UFR1 (site)	6/6	11/11	6/6	2/2
FR_FRCP1	5/5	9/9	8/8	0/0
GH_FR1	6/6	8/8	8/8	1/1
CM_MC2	7/7	2/2	13/13	6/6

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	12-5564-1480	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 11:33	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-Tap	06-2776-2105	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-Tap	Ctrl-Tap	Teck Coal	Ctrl-Tap		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Ctrl-Tap		FR_UFR1 (site)	1	1.0000	Exact	Non-Significant Effect
Ctrl-Tap		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Ctrl-Tap		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Ctrl-Tap		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Ctrl-Tap	Negative Contr	57	0	57	1	0	0.0%
FR_UFR1 (site)		25	0	25	1	0	0.0%
FR_FRCP1		22	0	22	1	0	0.0%
GH_FR1		23	0	23	1	0	0.0%
CM_MC2		28	0	28	1	0	0.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	1	1	1	1
FR_UFR1 (site)	1	1	1	1
FR_FRCP1	1	1	1	
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

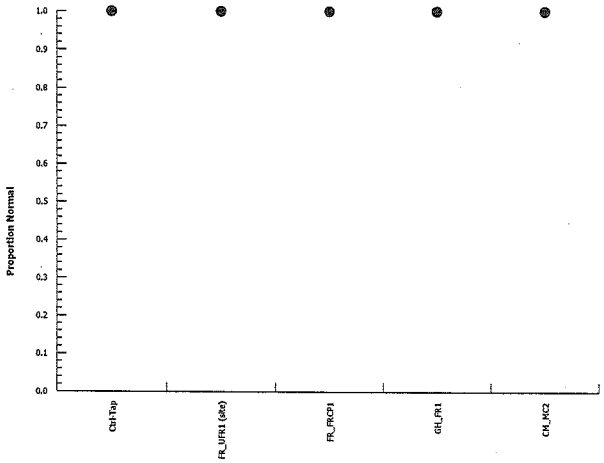
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-Tap	15/15	14/14	14/14	14/14
FR_UFR1 (site)	6/6	11/11	6/6	2/2
FR_FRCP1	5/5	9/9	8/8	
GH_FR1	6/6	8/8	8/8	1/1
CM_MC2	7/7	2/2	13/13	6/6

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	12-5564-1480	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 11:33	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA:_____

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	15-0868-4504	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 11:33	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Ctrl-MHW	15-3579-7236	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Ctrl-MHW	Ctrl-MHW	Teck Coal	Ctrl-MHW		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Ctrl-MHW		FR_UFR1 (site)	1	1.0000	Exact	Non-Significant Effect
Ctrl-MHW		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Ctrl-MHW		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Ctrl-MHW		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Ctrl-MHW	Lab Water	51	0	51	1	0	0.0%
FR_UFR1 (site)		25	0	25	1	0	0.0%
FR_FRCP1		22	0	22	1	0	0.0%
GH_FR1		23	0	23	1	0	0.0%
CM_MC2		28	0	28	1	0	0.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-MHW	1	1	1	1
FR_UFR1 (site)	1	1	1	1
FR_FRCP1	1	1	1	
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

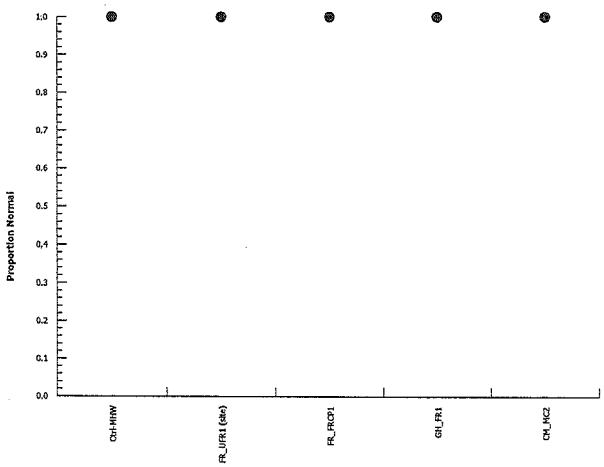
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Ctrl-MHW	14/14	15/15	12/12	10/10
FR_UFR1 (site)	6/6	11/11	6/6	2/2
FR_FRCP1	5/5	9/9	8/8	
GH_FR1	6/6	8/8	8/8	1/1
CM_MC2	7/7	2/2	13/13	6/6

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	15-0868-4504	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 11:33	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-5418-5606	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 11:35	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	14-5006-6056	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1 (site)Upstream Contr	25	0	25	1	0	0.0%
FR_FRCP1	22	0	22	1	0	0.0%
GH_FR1	23	0	23	1	0	0.0%
CM_MC2	28	0	28	1	0	0.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	1	1	1	1
FR_FRCP1	1	1	1	
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

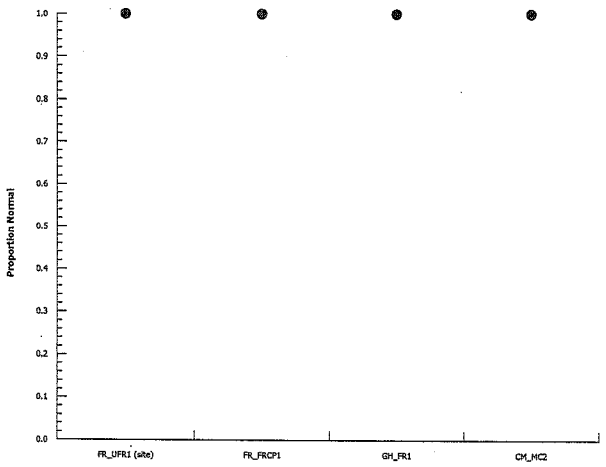
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	6/6	11/11	6/6	2/2
FR_FRCP1	5/5	9/9	8/8	
GH_FR1	6/6	8/8	8/8	1/1
CM_MC2	7/7	2/2	13/13	6/6

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	02-5418-5606	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 11:35	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



NAUTILUS ENVIRONMENTAL

Internal Tracking Sheet

Client:	NAU104
Reference:	16-1051

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.ca

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	12, 13, 12, 15, 11

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_FRCP1_QR_01082016_N	FR_FRCP1_QR_04072016_N	FR_FRCP1_QR_11072016_N	FR_FRCP1_QR_18072016_N	FR_FRCP1_QR_25072016_N	**FR_FRCP1**
collection date:	2016/08/23	2016/08/30	2016/09/06	2016/09/13	2016/09/20	
collection time:	1013	1149	1115	1155	1120	
pH:	8.1	8.1	8.2	8.1	8.2	
EC (µS/cm):	749	896	942	1001	894	
DO (mg/L):	8.6	8.1	8.9	9.0	8.8	
temp (°C):	18.9	19.4	17.1	17.7	19.0	
hardness:	480	450	485	492	333	
alkalinity:	180	160	190	180	230	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils
Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/08/25
ended:	2016/09/26
prelim made:	-
prelim sent:	-
reported:	2016/10/05

Internal Tracking Sheet

Client:	NAU104
Reference:	16-1052

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.ca

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	12, 13, 12, 15, 11

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	FR_UFR1_QR_01082016_N	FR_UFR1_Q_04072016_N	FR_UFR1_QR_11072016_N	FR_UFR1_QR_18072016_N	FR_UFR1_QR_25072016_N	**FR_UFR1**
collection date:	2016/08/23	2016/08/30	2016/09/06	2016/09/13	2016/09/20	
collection time:	0851	1045	1210	1000	0950	

pH:	8.0	8.0	8.3	8.1	8.2
EC (µS/cm):	314	358	383	372	355
DO (mg/L):	8.5	8.0	8.9	8.9	8.7
temp (°C):	18.8	19.5	16.6	18.8	18.6
hardness:	187	248	220	177	158
alkalinity:	186	139	204	149	152
colour:	colourless	colourless	colourless	colourless	colourless
odour:	-	-	-	-	-

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/08/25
ended:	2016/09/26
prelim made:	-
prelim sent:	-
reported:	2016/10/05

Internal Tracking Sheet

Client:	NAU104
Reference:	16-1053

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.ca

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	12, 12, 12, 13, 11

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	GH_FR1_WS_2016_08_23_N	GH_FR1_WS_2016_08_30_N	GH_FR1_WS_2016_09_06_N	GH_FR1_WS_2016_09_13_N	GH_FR1_WS_2016_09_20_N	**GH_FR1**
collection date:	2016/08/23	2016/08/30	2016/09/06	2016/09/13	2016/0920	
collection time:	not given	0905	0930	0725	0950	
pH:	7.9	7.9	8.1	7.9	8.1	
EC (µS/cm):	629	687	786	800	732	
DO (mg/L):	8.6	7.8	8.8	9.1	8.5	
temp (°C):	18.7	19.8	16.7	17.0	18.6	
hardness:	400	407	400	371	360	
alkalinity:	198	211	208	174	180	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/08/25
ended:	2016/09/26
prelim made:	-
prelim sent:	-
reported:	2016/10/05

Internal Tracking Sheet

Client:	NAU104
Reference:	16-1054

Client:

Client:	Nautilus Environmental	Operation:	Burnaby
Address:	8664 Commerce Court	Billing:	not given
City:	Burnaby	Contact:	Krysta Pearcy
Province:	BC	Tel:	604 420 8773
Country:	Canada	Fax:	not given
Postal Code:	V5A 4N7	Email:	krysta@nautilusenvironmental.ca

Sample:

type:	water			collection method:	grab
collected:	various dates	at:	various times	by:	not given
shipped:	various dates	by:	Bears Paw		
received:	various dates	at:	various times	by:	MC
signed-in:	various dates	at:	various times	by:	MC
container:	4 x 20 L carboys			sample condition:	good condition
seals present:	no			initials on seals:	no
storage:	4 ± 2°C in darkness			initial temperature (°C):	12, 13, 12, 13, 11

Samples are disposed following PERS-SWI-004

Chemical and Physical Measurements at Sample Receipt:

sample:	01	02	03	04	05	
client code:	CM_MC2_WS_20160823_N	CM_MC2_WS_20160830_N	CM_MC2_WS_20160906_N	CM_MC2_WS_20160913_N	CM_MC2_WS_20160920_N	**CM_MC2**
collection date:	2016/08/23	2016/08/30	2016/09/06	2016/09/13	2016/09/20	
collection time:	not given	not given	1025	1025	not given	
pH:	7.0	8.0	8.2	8.0	8.2	
EC (µS/cm):	820	911	984	1023	770	
DO (mg/L):	7.7	6.0	8.2	9.2	8.8	
temp (°C):	20.3	18.9	17.8	16.5	18.0	
hardness:	330	349	390	524	430	
alkalinity:	165	205	236	188	176	
colour:	colourless	colourless	colourless	colourless	colourless	
odour:	-	-	-	-	-	

Meter/Probe Used: chem cart 1/chem cart 2/**chem cart 3**/product/soils

Each sampling container EC checked (initials): _____

Test Log:

test code:	FM-32D
started:	2016/08/25
ended:	2016/09/26
prelim made:	-
prelim sent:	-
reported:	2016/10/05

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Organism Information

Source: Aquatox Batch: 20160825FMELS Egg Stage: 13 somites Organisms Received in Good Condition: **Yes** or No

Test Log

Date	Day	Time	Technicians	Chem Cart Used	Fed AM	Fed PM	Feeding Rate (mL)	Sample Pre-Aeration Time	Bench Sheet Review First	Bench Sheet Review Second
8/25/2016	0	1500	ML/JW/HS/EP	2	-	-	-	60 min	ML	JN
8/26/2016	1	1000	EP/LC	2	-	-	-	60 min	EP	HS
8/27/2016	2	1300	HS/LC	2	-	-	-	60 min	HS	LC
8/28/2016	3	1140	JN/JW	2	-	-	-	60 min	JN	JW
8/29/2016	4	1400	ML/EP	2	-	✓	1	30 min	JN	JW
8/30/2016	5	1330	JW/EP	2	✓	✓	1	30 min	HS	JN
8/31/2016	6	1000	JN/HS	2	✓	✓	1	45 min	JN	HS
9/1/2016	7	1130	HS/LC	2	✓	✓	1	45 min	HS	LC
9/2/2016	8	1030	EP/ML	2	✓	✓	1	45 min	ML	HS
9/3/2016	9	1330	ML/HS	2	✓	✓	0.5-1.5*	30 min	HS	ML
9/4/2016	10	1330	EP/ML	2	✓	✓	0.5-1.5*	45 min	ML	EP
9/5/2016	11	1330	EP/ML	2	✓	✓	0.5-1.5*	45 min	EP	ML
9/6/2016	12	1315	ML/HS	2	✓	✓	0.5-1.5*	45 min	HS	JW
9/7/2016	13	1100	LC/HS	2	✓	✓	0.5-1.5*	30 min	HS	LC
9/8/2016	14	1215	EP/LC	2	✓	✓	0.5-1.5*	45 min	JN	-
9/9/2016	15	1200	JW/LC	2	✓	✓	0.5-1.5*	30 min	JW	JN
9/10/2016	16	1230	JW/JN	2	✓	✓	0.5-1.5*	30 min	JN	JW
9/11/2016	17	1300	EP/ML	2	✓	✓	0.5-1.5*	30 min	ML	EP
9/12/2016	18	1200	EP/LC	2	✓	✓	0.5-1.5*	30 min	EP	LC
9/13/2016	19	1030	JW/HS	2	✓	✓	0.5-1.5*	30 min	HS	JW
9/14/2016	20	1130	LC/EP	2	✓	✓	0.5-1.5*	30 min	JN	HS
9/15/2016	21	1040	LC/JW	2	✓	✓	0.5-2*	30 min	JN	HS
9/16/2016	22	1100	JW/JN	2	✓	✓	0.5-2*	30 min	JN	HS
9/17/2016	23	1300	JW/JN	2	✓	✓	0.5-2*	30 min	JN	JW
9/18/2016	24	1400	ML/EP	2	✓	✓	0.5-2*	45 min	ML	EP
9/19/2016	25	1400	ML/CQ	2	✓	✓	0.5-2*	40 min	ML	LC
9/20/2016	26	1215	JN/LC	2	✓	✓	0.5-2*	50 min	JN	JW
9/21/2016	27	1100	HS/JW	2	✓	✓	0.5-2*	50 min	HS	JW
9/22/2016	28	1100	EP/LC	2	✓	✓	0.5-2*	45 min	JN	JW
9/23/2016	29	1015	HS/JN	2	✓	✓	0.5-2*	45 min	JN	HS
9/24/2016	30	1230	JN/JW	2	✓	✓	0.5-2*	45 min	JN	JW
9/25/2016	31	1300	EP/ML	2	✓	✓	0.5-2*	45 min	-	-
9/26/2016	32	0830	JW/EP/LC	2	-	-	-	-	JP	JN

*see comments for detailed feeding regime

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Control hatching success must be >66% (≥10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

	LAB CTL		16-1051		16-1052		16-1053		16-1054	
	Day 1		Day 1		Day 1		Day 1		Day 1	
replicate	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos
a	15	0	15	0	15	0	15	0	15	0
b	14	1	15	0	13	2	13	2	13	2
c	14	1	14	1	14	1	14	1	14	1
d	14	1	15	0	15	0	15	0	14	1
e	30	0	30	0	30	0	30	0	29	1
f	30	0	28	2	29	1	30	0	29	1

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

	LAB CTL			16-1051			16-1052			16-1053		
	Day 2			Day 2			Day 2			Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	14	1	15	15	0	15	15	0	15	15	0	15
b	14	0	15	15	0	15	13	0	15	13	0	15
c	13	1	15	14	0	15	14	0	15	12	2	15
d	14	0	15	15	0	15	15	0	15	15	0	15
e	30	0		30	0		29	1		30	0	
f	30	0		28	0		28	1		29	1	

	16-1054		
	Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15
a	14	1	15
b	12	1	15
c	14	0	15
d	12	2	15
e	29	0	
f	28	1	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Number of Alive Embryos and Hatched Organisms

	LAB CTL		16-1051		16-1052		16-1053		16-1054	
	Day 3		Day 3		Day 3		Day 3		Day 3	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	13	2	9	5	11	4	11	4	10	5
b	13	2	8	6	13	2	12	3	15	0
c	14	1	10	5	12	3	5	10	7	8
d	9	5	8	7	13	2	10	5	12	3

Comments/Observations: CTL TAP D- 1 dead embryo; 1051 AB-1 dead embryo

	LAB CTL		16-1051		16-1052		16-1053		16-1054	
	Day 4		Day 4		Day 4		Day 4		Day 4	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	-	15	-	15	1	14	-	15	-	13
b	-	15	-	13	-	15	1	14	-	15
c	1	14	-	15	-	15	-	15	-	13
d	3	11	-	15	2	13	-	15	4	11

Comments/Observations: 1051 B- 1 dead embryo; 1054 A- two dead hatched; 1054C- 2 dead embryos

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 5	Day 5	Day 5	Day 5	Day 5
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15 (1)	14	15	13
b	15	13	15	14	15
c	14 (1)*	15	15 (1)	15	13
d	11	15	15*	15	15*

Comments/Observations: CTL C- one dead partially hatched; CTL D- three dead partially hatched; 1052 A- one partially hatched; 1052 D- two partially hatched; 1053 B- dead embryo, 1054 D- four fish partially unhatched, bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 6	Day 6	Day 6	Day 6	Day 6
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14	14	15	8
b	13	12	14	14	15 (1)
c	14	13 (1)	14	15	13
d	11	14	15	13	11

Comments/Observations: 1054 D- four dead partially hatched, bracketed # indicates number of fish displaying atypical swimming behaviour

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference: 16-1051 16-1052 16-1053 16-1054 Copper Treated

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 7	Day 7	Day 7	Day 7	Day 7
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14	14 (1)	15	6
b	13	12	14	14	15 (1)
c	14	13 (1)	14	15	13
d	11	14	14 (1)	13	11

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 8	Day 8	Day 8	Day 8	Day 8
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14	14 (1)	15	5
b	13	12	14	14	15 (1)
c	14	13 (1)	14	15	13
d	11	14	14 (1)	13	11

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 9	Day 9	Day 9	Day 9	Day 9
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14	13 (1)	15	5
b	13	12	14	14	15
c	14	12(1)	14	15	12
d	11	14	13 (1)	13	11

Comments/Observations: All jars fed 1.5 mL, except 1054 A- 0.5 mL, bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 10	Day 10	Day 10	Day 10	Day 10
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14	12	15	5
b	13	12	14	14	14
c	14	12 (1)	14	15	11
d	11	14	13 (1)	13	11

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 11	Day 11	Day 11	Day 11	Day 11
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	15	5
b	13	12	14	14	13
c	14	12 (1)	14	15	11
d	11	14	13 (1)	13	11

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 12	Day 12	Day 12	Day 12	Day 12
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	15	5 (1)
b	13	12	14	14	13
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 13	Day 13	Day 13	Day 13	Day 13
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	15	5 (1)
b	13	12	14	14	13
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations: bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 14	Day 14	Day 14	Day 14	Day 14
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	15	4
b	13	12	14	14	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 15	Day 15	Day 15	Day 15	Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	14	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 16	Day 16	Day 16	Day 16	Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 17	Day 17	Day 17	Day 17	Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 18	Day 18	Day 18	Day 18	Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 19	Day 19	Day 19	Day 19	Day 19
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 20	Day 20	Day 20	Day 20	Day 20
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 21	Day 21	Day 21	Day 21	Day 21
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	11	14	15	11
d	11	14 (1)	12	13	11

Comments/Observations: New feeding reigime: CTL- 2 mL; 1051- 2 mL; 1052- 2 mL; 1054 BCD- 2 mL, A- 0.5 mL, bracketed # indicates number of fish displaying atypical swimming behaviour

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 22	Day 22	Day 22	Day 22	Day 22
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 23	Day 23	Day 23	Day 23	Day 23
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations: Test vessels put on aeration.

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 24	Day 24	Day 24	Day 24	Day 24
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	11	14	15	11
d	11	14	12	13	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 25	Day 25	Day 25	Day 25	Day 25
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	10	12	15	11
d	11	14	12	13	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 26	Day 26	Day 26	Day 26	Day 26
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	10	12	15	11
d	11	14	12	13	11

Comments/Observations:

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	10	12	15	11
d	11	14	12	12	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	10	12	15	11
d	11	14	12	12	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	10	12	15	11
d	11	14	12	12	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	10	12	15	11
d	11	14	12	12	11

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Biology Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Number of Alive Embryos and Hatched Organisms

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 31	Day 31	Day 31	Day 31	Day 31
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	10	12	15	11
d	11	14	12	12	11

Comments/Observations:

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	Day 32	Day 32	Day 32	Day 32	Day 32
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	12	13	4
b	13	12	14	13	12
c	14	10	12	15	11
d	11	14	12	12	11

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

New Solutions

Conc. (%)	LAB CTL	16-1051	16-1052	16-1053	16-1054
Day					
	pH (units)				
0	8.4	8.3	8.2	8.2	8.2
1	8.2	8.4	8.4	8.4	8.4
2	8.3	8.3	8.2	8.3	8.2
3	8.4	8.3	8.3	8.3	8.2
4	8.3	8.2	8.3	8.3	8.1
5	8.1	8.1	8.1	8.1	8.0
6	8.1	8.1	8.1	8.2	8.0
7	8.2	8.1	8.2	8.2	8.1
8	8.4	8.3	8.4	8.4	8.2
	Conductance (µS/cm)				
0	400	752	324	647	799
1	295	768	331	655	795
2	391	768	341	640	784
3	378	768	328	651	783
4	367	758	329	652	787
5	340	762	360	625	785
6	347	773	322	657	799
7	340	833	336	677	819
8	337	829	341	677	837
	Dissolved Oxygen (mg/L) (**60-100% saturation**)				
0	7.3	7.2	7.2	7.2	7.2
1	7.2	7.2	7.2	7.2	7.2
2	7.0	7.2	7.1	7.1	7.1
3	7.2	7.2	7.2	7.1	7.1
4	7.2	7.1	7.1	7.1	7.1
5	7.1	7.1	7.2	7.2	7.2
6	7.2	7.1	7.1	7.1	7.2
7	7.2	7.0	7.1	7.1	7.1
8	7.1	7.0	7.1	7.1	7.1
	Temperature (°C)				
0	24	25	25	25	25
1	25	25	25	25	25
2	25	25	25	25	25
3	25	25	25	26	26
4	25	26	26	26	26
5	25	26	25	25	25
6	25	25	26	26	25
7	25	26	26	26	26
8	26	26	26	26	26

Old Solutions

	LAB CTL	16-1051	16-1052	16-1053	16-1054
	pH (units)				
0					
1	8.4	8.3	8.3	8.4	8.4
2	8.3	8.2	8.3	8.1	8.1
3	8.3	8.2	8.4	8.2	8.2
4	8.2	8.0	8.3	8.1	8.0
5	8.1	7.9	8.1	7.9	7.8
6	7.9	7.8	8.1	7.9	7.8
7	7.9	7.9	8.0	7.9	7.9
8	8.1	8.2	8.2	8.2	8.1
	Conductance (µS/cm)				
0					
1	401	760	328	649	791
2	419	723	348	627	777
3	397	734	363	625	685
4	386	748	329	618	695
5	372	732	356	625	742
6	380	740	362	623	776
7	364	743	355	630	772
8	350	799	340	649	809
	Dissolved Oxygen (mg/L) (**60-100% saturation**)				
0					
1	7.0	6.9	6.9	7.0	7.0
2	6.4	6.7	6.7	6.8	6.8
3	6.6	6.8	6.8	6.9	6.8
4	6.9	6.9	6.9	6.9	7.0
5	6.6	6.6	6.6	6.6	6.7
6	5.8	6.0	6.3	6.4	6.4
7	5.6	5.6	5.5	5.5	5.6
8	5.8	5.8	5.9	5.8	5.8
	Temperature (°C)				
0					
1	24	24	24	24	24
2	24	24	24	24	24
3	24	24	24	24	24
4	24	24	24	24	24
5	24	24	24	24	24
6	24	24	24	24	24
7	24	24	24	24	24
8	24	24	24	24	24

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

New Solutions

Conc. (%)	LAB CTL	16-1051	16-1052	16-1053	16-1054
Day					
	pH (units)				
9	8.3	8.2	8.3	8.3	8.2
10	8.2	8.2	8.4	8.0	8.2
11	8.3	8.2	8.3	8.3	8.1
12	8.3	8.2	8.3	8.3	8.1
13	8.1	8.1	8.1	8.2	8.0
14	8.3	8.2	8.3	8.3	8.1
15	8.3	8.2	8.3	8.3	8.2
16	8.3	8.3	8.4	8.4	8.2
17	8.3	8.3	8.3	8.3	8.1
	Conductance (µS/cm)				
9	331	834	337	679	819
10	331	831	339	660	814
11	330	829	336	673	812
12	331	830	337	674	812
13	373	940	381	764	919
14	379	979	371	782	979
15	373	972	372	769	964
16	371	969	373	775	966
17	367	970	373	778	968
	Dissolved Oxygen (mg/L) (**60-100% saturation**)				
9	7.2	7.1	7.1	7.1	7.1
10	7.2	7.1	7.1	7.1	7.1
11	7.2	7.2	7.2	7.1	7.1
12	7.2	7.1	7.1	7.1	7.1
13	7.3	7.1	7.1	7.1	7.1
14	7.2	7.1	7.1	7.1	7.1
15	7.2	7.2	7.2	7.2	7.2
16	7.2	7.2	7.2	7.1	7.1
17	7.2	7.2	7.2	7.1	7.2
	Temperature (°C)				
9	25	26	26	26	26
10	25	26	26	26	26
11	25	25	25	26	26
12	25	26	26	26	26
13	24	26	26	26	26
14	25	26	26	26	26
15	24	25	25	25	25
16	25	25	25	26	26
17	25	25	25	26	25

Old Solutions

	CTL	16-1051	16-1052	16-1053	16-1054
	pH (units)				
9	7.9	8.0	8.1	8.0	8.0
10	7.9	8.0	8.1	8.0	8.0
11	7.9	8.0	8.1	8.0	8.1
12	8.0	8.0	8.2	8.1	8.1
13	7.8	6.9	8.0	7.9	7.9
14	7.8	8.0	8.2	8.1	8.1
15	8.1	8.0	8.2	8.1	8.1
16	7.9	8.1	8.2	8.1	8.1
17	8.0	8.0	8.2	8.1	8.1
	Conductance (µS/cm)				
9	350	795	348	681	819
10	363	824	339	660	819
11	339	820	344	637	805
12	338	794	348	651	803
13	396	910	390	726	908
14	374	894	401	740	904
15	417	937	424	750	941
16	379	922	420	745	942
17	384	954	386	755	974
	Dissolved Oxygen (mg/L) (**60-100% saturation**)				
9	5.9	5.9	5.9	6.0	6.0
10	6.3	6.3	6.3	6.4	6.3
11	6.4	6.0	6.0	6.1	6.1
12	6.3	6.3	6.3	6.3	6.4
13	6.2	6.2	6.2	6.2	6.2
14	5.5	5.5	5.6	5.6	5.7
15	6.2	6.3	6.2	6.1	6.0
16	6.2	6.2	6.1	6.1	6.3
17	6.3	6.3	6.2	6.3	6.3
	Temperature (°C)				
9	24	24	24	24	24
10	24	24	24	24	24
11	24	24	24	24	24
12	24	24	24	24	24
13	24	24	24	24	24
14	24	24	24	24	24
15	24	24	24	24	24
16	24	24	24	24	24
17	24	24	24	24	24

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

	New Solutions					Old Solutions				
Conc. (%)	LAB CTL	16-1051	16-1052	16-1053	16-1054	CTL	16-1051	16-1052	16-1053	16-1054
Day										
	pH (units)					pH (units)				
18	8.2	8.2	8.2	8.2	8.0	7.8	7.9	8.1	8.0	7.9
19	8.1	8.1	8.2	8.2	8.0	7.7	7.9	8.0	7.9	7.9
20	8.2	8.2	8.2	8.2	8.0	7.7	7.9	8.1	8.0	8.0
21	8.1	8.1	8.1	8.2	8.0	7.6	7.8	7.9	7.9	7.9
22	8.3	8.2	8.3	8.3	8.1	7.7	7.9	7.9	8.0	8.0
23	8.2	8.2	8.2	8.2	8.1	7.6	7.9	8.0	8.0	7.9
24	8.3	8.3	8.3	8.3	8.1	8.2	8.3	8.4	8.3	8.3
25	8.2	8.1	8.2	8.1	8.0	8.1	8.2	8.3	8.1	8.2
26	8.2	8.3	8.3	8.3	8.1	8.2	8.2	8.4	8.2	8.3
	Conductance (µS/cm)					Conductance (µS/cm)				
18	366	980	375	781	976	357	960	380	756	962
19	371	975	375	776	972	382	948	384	786	967
20	351	934	357	731	920	363	886	407	727	903
21	337	940	364	757	962	355	895	408	725	914
22	373	933	364	756	959	353	918	389	740	948
23	354	921	363	751	957	366	901	399	730	938
24	357	932	365	750	955	359	839	368	677	872
25	352	937	365	758	964	355	836	367	699	879
26	351	930	365	752	962	357	847	395	694	878
	Dissolved Oxygen (mg/L) (**60-100% saturation**)					Dissolved Oxygen (mg/L) (**60-100% saturation**)				
18	7.2	7.1	7.2	7.2	7.2	6.4	6.1	6.3	6.2	6.0
19	7.1	7.2	7.2	7.1	7.1	5.6	5.6	5.6	5.6	5.7
20	7.2	7.3	7.2	7.3	7.2	6.3	6.3	6.2	6.2	6.2
21	7.2	7.1	7.2	7.2	7.3	5.0	5.1	5.1	5.0	5.1
22	7.2	7.1	7.1	7.1	7.1	5.1	5.1	5.2	5.1	5.0
23	7.2	7.1	7.1	7.1	7.1	5.0	4.9	5.1	5.2	5.2
24	7.1	7.2	7.1	7.1	7.1	7.3	7.1	7.1	7.1	7.2
25	7.1	7.2	7.2	7.1	7.1	7.2	7.2	7.2	7.2	7.2
26	7.1	7.2	7.1	7.1	7.1	7.2	7.2	7.2	7.2	7.2
	Temperature (°C)					Temperature (°C)				
18	25	26	25	25	25	24	24	24	24	24
19	25	25	25	26	26	24	24	24	24	24
20	25	24	25	24	25	24	24	24	24	24
21	25	26	25	25	24	24	24	24	24	24
22	25	26	26	26	26	24	24	24	24	24
23	25	26	26	26	26	24	24	24	24	24
24	26	25	26	26	26	24	24	24	24	24
25	26	25	25	26	26	24	24	24	24	24
26	26	25	26	26	26	25	25	25	25	25

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments: Day 23- all jars put on aeration

NAUTILUS ENVIRONMENTAL

Fathead Minnow Chemistry Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

New Solutions

pH (units)

Conc. (%) / Day	LAB CTL	16-1051	16-1052	16-1053	16-1054
27	8.3	8.1	8.2	8.2	8.1
28	8.2	8.1	8.2	8.2	8.2
29	8.1	8.0	8.2	8.1	8.1
30	8.2	8.1	8.3	8.2	8.1
31	8.3	8.2	8.3	8.3	8.3
32					

Conductance (µS/cm)

27	352	950	371	766	972
28	352	949	364	767	802
29	363	943	366	761	801
30	354	948	357	758	796
31	335	949	360	758	789
32					

Dissolved Oxygen (mg/L) (**60-100% saturation**)

27	7.2	7.1	7.1	7.1	7.1
28	7.2	7.1	7.1	7.1	7.1
29	7.1	7.1	7.1	7.1	7.1
30	7.2	7.1	7.1	7.1	7.2
31	7.2	7.2	7.2	7.2	7.2
32					

Temperature (°C)

27	25	26	26	26	26
28	25	26	26	26	26
29	26	26	26	26	26
30	25	26	26	26	25
31	25	25	25	25	25
32					

Old Solutions

pH (units)

	CTL	16-1051	16-1052	16-1053	16-1054
27	8.2	8.3	8.5	8.2	8.3
28	8.1	8.2	8.4	8.2	8.2
29	8.0	8.2	8.3	8.2	8.2
30	8.1	8.2	8.3	8.2	8.2
31	8.1	8.3	8.2	8.2	8.3
32	8.1	8.2	8.3	8.2	8.2

Conductance (µS/cm)

27	375	850	379	722	893
28	383	865	400	690	884
29	369	849	370	713	803
30	356	850	409	705	747
31	374	839	351	512	743
32	336	857	459	629	762

Dissolved Oxygen (mg/L) (**60-100% saturation**)

27	7.1	7.1	7.1	7.2	7.2
28	7.2	7.1	7.2	7.2	7.2
29	7.1	7.0	7.1	7.1	7.1
30	7.2	7.2	7.2	7.2	7.2
31	7.2	7.2	7.2	7.2	7.2
32	7.2	7.2	7.2	7.2	7.2

Temperature (°C)

27	25	25	25	25	25
28	25	25	25	25	25
29	25	25	25	25	25
30	25	25	25	25	25
31	25	25	25	25	25
32	25	25	25	25	25

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Test Termination

For normal/abnormal column, use the following notation:
N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

LAB CTL

Replicate # _____A_____			Replicate # _____B_____			Replicate # _____C_____			Replicate # _____D_____		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	N	1	8	N	1	9	N	1	10	N
2	8	N	2	9	N	2	10	N	2	9	N
3	9	N	3	9	N	3	7	N	3	8	N
4	9	N	4	8	N	4	8	N	4	10	N
5	8	N	5	8	N	5	10	N	5	10	N
6	8	N	6	9	N	6	8	N	6	9	N
7	9	N	7	8	N	7	7	N	7	9	N
8	8	N	8	12	N	8	9	N	8	10	N
9	8	N	9	8	N	9	8	N	9	11	N
10	7	N	10	9	N	10	10	N	10	11	N
11	8	N	11	8	N	11	8	N	11	9	N
12	7	N	12	8	N	12	9	N	12	-	-
13	8	N	13	8	N	13	8	N	13	-	-
14	9	N	14	-	-	14	8	N	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

16-1051

Replicate # _____A_____			Replicate # _____B_____			Replicate # _____C_____			Replicate # _____D_____		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	N	1	7	N	1	10	N	1	10	N
2	10	N	2	8	N	2	8	N	2	7	N
3	10	N	3	9	N	3	8	N	3	11	N
4	7	N	4	9	N	4	9	N	4	10	N
5	9	N	5	8	N	5	9	N	5	7	N
6	8	N	6	10	N	6	8	N	6	7	N
7	9	N	7	9	N	7	10	N	7	10	N
8	9	N	8	8	N	8	10	N	8	9	N
9	10	N	9	9	N	9	8	N	9	11	N
10	9	N	10	9	N	10	8	N	10	6	N
11	11	N	11	8	N	11	-	-	11	10	N
12	9	N	12	9	N	12	-	-	12	9	N
13	-	-	13	-	-	13	-	-	13	9	N
14	-	-	14	-	-	14	-	-	14	8	N
15	-	-	15	-	-	15	-	-	15	-	-

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

16-1052

Replicate # _____A_____			Replicate # _____B_____			Replicate # _____C_____			Replicate # _____D_____		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	N	1	10	N	1	7	N	1	9	N
2	9	N	2	9	N	2	9	N	2	9	N
3	10	N	3	10	N	3	7	N	3	8	N
4	9	N	4	8	N	4	9	N	4	10	N
5	9	N	5	8	N	5	10	N	5	9	N
6	9	N	6	8	N	6	9	N	6	9	N
7	11	N	7	9	N	7	8	N	7	11	N
8	9	N	8	10	N	8	10	N	8	9	N
9	8	N	9	9	N	9	10	N	9	8	N
10	11	N	10	10	N	10	10	N	10	10	N
11	10	N	11	9	N	11	7	N	11	10	N
12	8	N	12	9	N	12	9	N	12	9	N
13	-	-	13	9	N	13	-	-	13	-	-
14	-	-	14	9	N	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

16-1053

Replicate # _____A_____			Replicate # _____B_____			Replicate # _____C_____			Replicate # _____D_____		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	10	N	1	11	N	1	7	N	1	9	N
2	9	N	2	7	N	2	10	N	2	10	N
3	8	N	3	8	N	3	8	N	3	9	N
4	9	N	4	7	N	4	9	N	4	9	N
5	9	N	5	9	N	5	7	N	5	9	N
6	8	N	6	7	N	6	9	N	6	10	N
7	8	N	7	9	N	7	8	N	7	10	N
8	8	N	8	9	N	8	9	N	8	10	N
9	10	N	9	7	N	9	9	N	9	10	N
10	8	N	10	7	N	10	10	N	10	9	N
11	8	N	11	8	N	11	8	N	11	11	N
12	9	N	12	10	N	12	8	N	12	10	N
13	9	N	13	10	N	13	9	N	13	-	-
14	-	-	14	-	-	14	9	N	14	-	-
15	-	-	15	-	-	15	9	N	15	-	-

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Termination Data

Method FMD 32 Day ELS Client NAU104 Reference 16-1051 16-1052 16-1053 16-1054 Copper Treated

Test Termination

For normal/abnormal column, use the following notation:
N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.	Replicate # ____A_____			Replicate # ____B_____			Replicate # ____C_____			Replicate # ____D_____		
16-1054	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
	1	10	N	1	8	N	1	12	N	1	8	N
	2	11	N	2	10	N	2	9	N	2	8	N
	3	10	N	3	8	N	3	10	N	3	11	N
	4	11	N	4	9	N	4	7	N	4	10	N
	5	-	-	5	9	N	5	8	N	5	9	N
	6	-	-	6	9	N	6	9	N	6	9	N
	7	-	-	7	7	N	7	8	N	7	8	N
	8	-	-	8	8	N	8	10	N	8	8	N
	9	-	-	9	8	N	9	9	N	9	10	N
	10	-	-	10	9	N	10	10	N	10	8	N
	11	-	-	11	8	N	11	7	N	11	8	N
	12	-	-	12	9	N	12	-	-	12	-	-
	13	-	-	13	-	-	13	-	-	13	-	-
	14	-	-	14	-	-	14	-	-	14	-	-
	15	-	-	15	-	-	15	-	-	15	-	-

Comments

NAUTILUS ENVIRONMENTAL

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-1051 16-1052 16-1053 16-105

Initial Weight (mg) (dried pan)

Date: 9/8/2016 Initials: JW Balance: Mettler #1

Conc.	LAB CTL	16-1051	16-1052	16-1053	16-1054			
Replicate								
a	1000.16	990.03	1035.72	1000.48	1004.00			
b	1005.25	1009.39	1021.07	1008.63	1003.25			
c	1007.59	998.20	1011.22	1016.99	1016.20			
d	1023.64	992.29	998.27	1023.55	1015.06			
e								

Final Weight (mg) (dried pan+organisms)

Date: 9/28/2016 Initials: JW Balance: Mettler #1

Conc.	CTL- TAP	16-1051	16-1052	16-1053	16-1054			
Replicate								
a	1014.35	1004.27	1050.43	1010.80	1011.72			
b	1018.11	1022.62	1034.99	1019.84	1014.79			
c	1020.04	1015.89	1022.08	1029.42	1031.30			
d	1041.06	1008.01	1012.74	1035.36	1029.74			
e								

Comments:

Weight Checks- organisms removed from pan and reweighed, as initital caluclations did not make sense

CTLD good

1051C 15.95mg

Organism Weights Bench Sheet

Method: FMD 32 Day Client: NAU104 Reference: 16-1051 16-1052 16-1053 16-1054 Copper Treated

Organism weight per replicate (mg)

Dose	LAB CTL	16-1051	16-1052	16-1053	16-1054			
replicate								
a	14.19	14.24	14.71	10.32	7.72			
b	12.86	13.23	13.92	11.21	11.54			
c	12.45	15.95	10.86	12.43	15.10			
d	17.42	15.72	14.47	11.81	14.68			
e								

***1051C organisms were removed from pan and weighed separately, as initial dry weight calculations did not make sense**

Dry Weight per Fish (mg)

Dose	CTL- TAP	16-1051	16-1052	16-1053	16-1054			
replicate								
a	1.01	1.19	1.23	0.79	1.93			
b	0.99	1.10	0.99	0.86	0.96			
c	0.89	1.60	0.91	0.83	1.37			
d	1.58	1.12	1.21	0.98	1.33			
Average	1.12	1.25	1.08	0.87	1.40			

Warning Chart
Fathead minnow

Test Method: 7 days Fathead minnow Survival and Growth Test (7 treatments plus a control)
HydroQual Test Method: WTR-ME-046

Reference: Biological Test Method: Test of Larval Growth and Survival Using Fathead minnows. Environment Canada, EPS 1/RM/22, Second Edition, February 2011.

Test Organism:

test species:	*Pimephales promelas*
culture source:	Aquatox (Arkansas, USA)
temp of breeding aquaria:	23 - 26 °C
food type:	newly-hatched brine shrimp nauplii
frequency of feeding:	daily
breeding colony mortality:	<1% (last 7 days)
age of test organisms:	<24 hours
condition prior to test initiation:	normal
batch number:	20160829FM

Test Design:

test type:	static renewal
toxicant:	sodium chloride
test vessel:	polypropylene cups, 11 x 9 cm
volume of test vessel (ml):	500
test volume (ml):	250
depth of test solution:	>3 cm
replicates per treatment:	4 replicates
organisms per replicate:	10
feeding:	twice daily
temperature (°C):	24-26
photoperiod:	16 hours light: 8 hours dark
light level (surface):	100-500 lux (full spectrum)

Control/Dilution Water:

source:	dechlorinated City of Calgary tap water no chemicals were added to the dilution water
pH (units):	7.2
conductance (µS/cm):	381
dissolved oxygen (mg/L):	6.5
NH_4^+ (mg/L):	<0.1
hardness (mg $CaCO_3$/L):	194
alkalinity (mg $CaCO_3$/L):	137
total residual chlorine (mg/L):	<0.01

Comments: None

The test data and results are authorized and verified correct.

Senior Verifier

Warning Chart
Fathead minnow

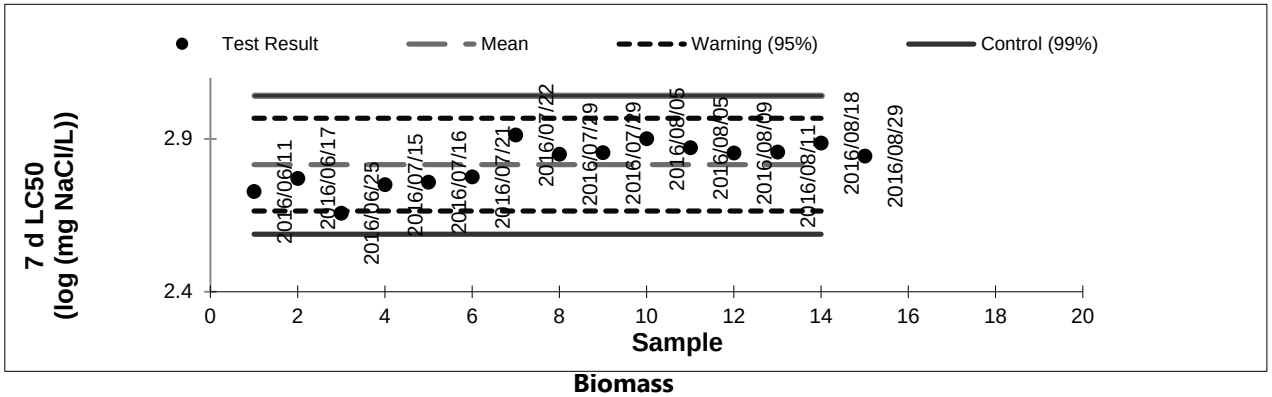
Mortality

Current Test

toxicant	Sodium Chloride (NaCl)				
started on	2016/08/29	ended on	2016/09/05		
Result (7 d LC50):	2.84	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.80	upper	2.89	

Historical Values

mean	2.82	sd	0.08	cv(%):	11.6
	lower	upper			
warning limits (±2 sd)	2.66	2.97	(95% confidence limits)		
control limits (±3 sd)	2.59	3.04	(99% confidence limits)		

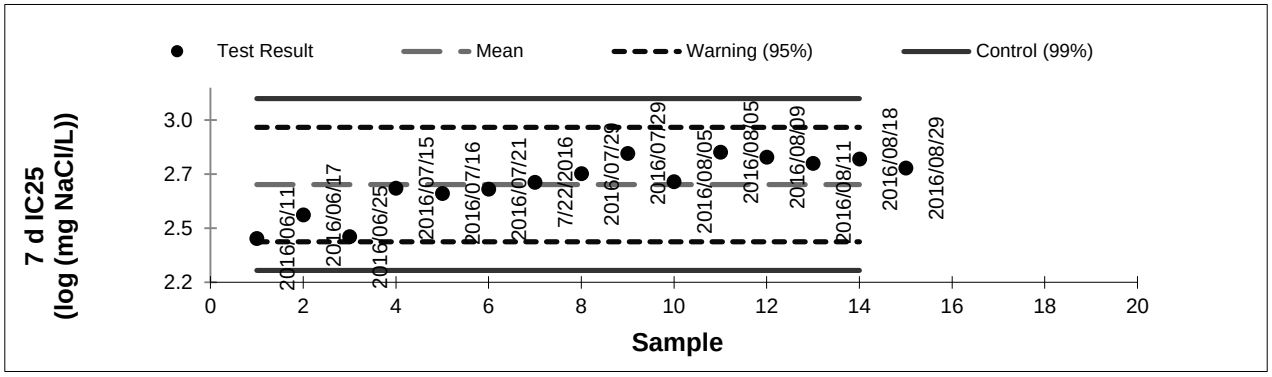


Biomass

started on	2016/08/29	ended on	2016/09/05		
Result (7 d IC25):	2.73	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.69	upper	2.76	

Historical Values

mean	2.65	sd	0.13	cv(%):	20.3
	lower	upper			
warning limits (±2 sd)	2.39	2.92	(95% confidence limits)		
control limits (±3 sd)	2.26	3.05	(99% confidence limits)		



notes: sd, standard deviation; cv, coefficient of variance; N/A, could not be calculated

CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Hatched Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
LAB CTL	4	0.9167	0.7159	1	0.7333	1	0.0631	0.1262	13.77%	0.0%
FR_UFR1 (site)	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	-7.27%
FR_FRCP1	4	0.9667	0.8606	1	0.8667	1	0.03333	0.06667	6.9%	-5.46%
GH_FR1	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	-7.27%
CM_MC2	4	0.8667	0.6934	1	0.7333	1	0.05443	0.1089	12.56%	5.46%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	1	1	0.9333	0.7333
FR_UFR1 (site)	0.9333	1	1	1
FR_FRCP1	1	0.8667	1	1
GH_FR1	1	0.9333	1	1
CM_MC2	0.8667	1	0.8667	0.7333

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	15/15	15/15	14/15	11/15
FR_UFR1 (site)	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	13/15	15/15	15/15
GH_FR1	15/15	14/15	15/15	15/15
CM_MC2	13/15	15/15	13/15	11/15

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-2926-9504	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:12	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
LAB CTL		FR_UFR1 (site)	1	1.0000	Exact	Non-Significant Effect
LAB CTL		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
LAB CTL		GH_FR1	1	1.0000	Exact	Non-Significant Effect
LAB CTL		CM_MC2	0.2792	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
LAB CTL	Negative Contr	55	5	60	0.9167	0.08333	0.0%
FR_UFR1 (site)		59	1	60	0.9833	0.01667	-7.27%
FR_FRCP1		58	2	60	0.9667	0.03333	-5.46%
GH_FR1		59	1	60	0.9833	0.01667	-7.27%
CM_MC2		52	8	60	0.8667	0.1333	5.46%

Hatched Rate Detail

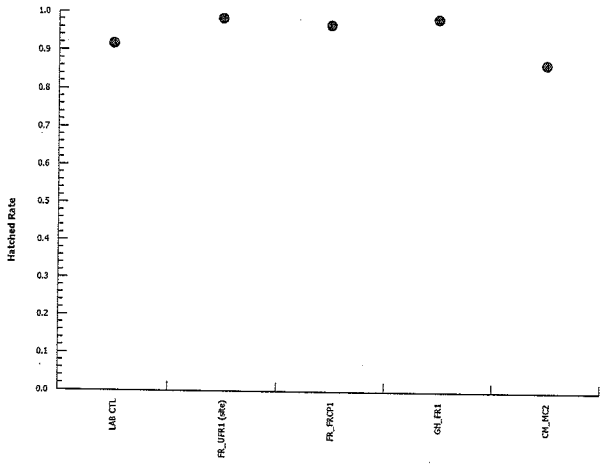
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	1	1	0.9333	0.7333
FR_UFR1 (site)	0.9333	1	1	1
FR_FRCP1	1	0.8667	1	1
GH_FR1	1	0.9333	1	1
CM_MC2	0.8667	1	0.8667	0.7333

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	15/15	15/15	14/15	11/15
FR_UFR1 (site)	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	13/15	15/15	15/15
GH_FR1	15/15	14/15	15/15	15/15
CM_MC2	13/15	15/15	13/15	11/15

Analysis ID:	02-2926-9504	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:12	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-8490-9730	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:18	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		GH_FR1	0.7521	0.7521	Exact	Non-Significant Effect
FR_UFR1 (site)		CM_MC2	0.0161	0.0483	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1 (site)	Upstream Contr	59	1	60	0.9833	0.01667	0.0%
FR_FRCP1		58	2	60	0.9667	0.03333	1.7%
GH_FR1		59	1	60	0.9833	0.01667	0.0%
CM_MC2		52	8	60	0.8667	0.1333	11.86%

Hatched Rate Detail

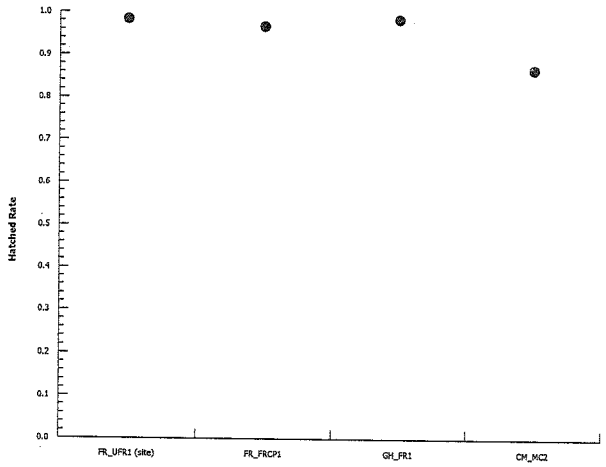
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	0.9333	1	1	1
FR_FRCP1	1	0.8667	1	1
GH_FR1	1	0.9333	1	1
CM_MC2	0.8667	1	0.8667	0.7333

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	14/15	15/15	15/15	15/15
FR_FRCP1	15/15	13/15	15/15	15/15
GH_FR1	15/15	14/15	15/15	15/15
CM_MC2	13/15	15/15	13/15	11/15

Analysis ID:	20-8490-9730	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:18	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
LAB CTL	4	0.8667	0.7166	1	0.7333	0.9333	0.04714	0.09428	10.88%	0.0%
FR_UFR1 (site)	4	0.8333	0.7273	0.9394	0.8	0.9333	0.03333	0.06667	8.0%	3.85%
FR_FRCP1	4	0.8	0.6268	0.9732	0.6667	0.9333	0.05443	0.1089	13.61%	7.69%
GH_FR1	4	0.8833	0.7499	1	0.8	1	0.04194	0.08389	9.5%	-1.92%
CM_MC2	4	0.6333	0.2412	1	0.2667	0.8	0.1232	0.2465	38.91%	26.92%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	0.9333	0.8667	0.9333	0.7333
FR_UFR1 (site)	0.8	0.9333	0.8	0.8
FR_FRCP1	0.8	0.8	0.6667	0.9333
GH_FR1	0.8667	0.8667	1	0.8
CM_MC2	0.2667	0.8	0.7333	0.7333

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	14/15	13/15	14/15	11/15
FR_UFR1 (site)	12/15	14/15	12/15	12/15
FR_FRCP1	12/15	12/15	10/15	14/15
GH_FR1	13/15	13/15	15/15	12/15
CM_MC2	4/15	12/15	11/15	11/15

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	04-0844-0207	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:12	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
LAB CTL		FR_UFR1 (site)	0.3995	0.7989	Exact	Non-Significant Effect
LAB CTL		FR_FRCP1	0.2316	0.6947	Exact	Non-Significant Effect
LAB CTL		GH_FR1	1	1.0000	Exact	Non-Significant Effect
LAB CTL		CM_MC2	0.002791	0.0112	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
LAB CTL	Negative Contr	52	8	60	0.8667	0.1333	0.0%
FR_UFR1 (site)		50	10	60	0.8333	0.1667	3.85%
FR_FRCP1		48	12	60	0.8	0.2	7.69%
GH_FR1		53	7	60	0.8833	0.1167	-1.92%
CM_MC2		38	22	60	0.6333	0.3667	26.92%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	0.9333	0.8667	0.9333	0.7333
FR_UFR1 (site)	0.8	0.9333	0.8	0.8
FR_FRCP1	0.8	0.8	0.6667	0.9333
GH_FR1	0.8667	0.8667	1	0.8
CM_MC2	0.2667	0.8	0.7333	0.7333

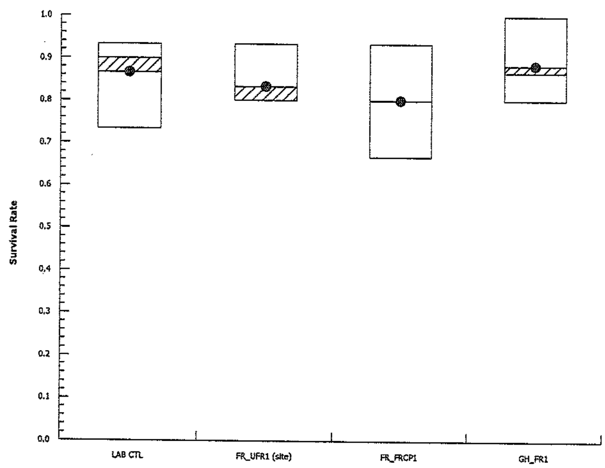
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	14/15	13/15	14/15	11/15
FR_UFR1 (site)	12/15	14/15	12/15	12/15
FR_FRCP1	12/15	12/15	10/15	14/15
GH_FR1	13/15	13/15	15/15	12/15
CM_MC2	4/15	12/15	11/15	11/15

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	04-0844-0207	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:12	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	04-3983-7445	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:18	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	0.407	0.8140	Exact	Non-Significant Effect
FR_UFR1 (site)		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		CM_MC2	0.01116	0.0335	Exact	Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1 (site)Upstream Contr	50	10	60	0.8333	0.1667	0.0%
FR_FRCP1	48	12	60	0.8	0.2	4.0%
GH_FR1	53	7	60	0.8833	0.1167	-6.0%
CM_MC2	38	22	60	0.6333	0.3667	24.0%

Survival Rate Detail

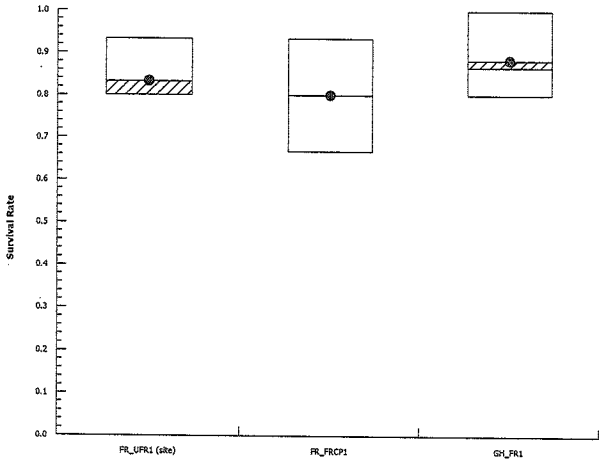
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	0.8	0.9333	0.8	0.8
FR_FRCP1	0.8	0.8	0.6667	0.9333
GH_FR1	0.8667	0.8667	1	0.8
CM_MC2	0.2667	0.8	0.7333	0.7333

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	12/15	14/15	12/15	12/15
FR_FRCP1	12/15	12/15	10/15	14/15
GH_FR1	13/15	13/15	15/15	12/15
CM_MC2	4/15	12/15	11/15	11/15

Analysis ID: 04-3983-7445 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 14 Oct-16 17:18 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

Graphics



CETIS Summary Report

Test Code: 16903b | 11-5464-0295

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
LAB CTL	4	0.9487	0.7097	1.188	0.83	1.161	0.07509	0.1502	15.83%	0.0%
FR_UFR1 (site)	4	0.8993	0.7101	1.089	0.724	0.9807	0.05947	0.1189	13.23%	5.2%
FR_FRCP1	3	0.9598	0.7524	1.167	0.882	1.048	0.0482	0.08349	8.7%	-1.17%
GH_FR1	4	0.7628	0.6675	0.8582	0.688	0.8287	0.02997	0.05993	7.86%	19.59%
CM_MC2	4	0.8173	0.4547	1.18	0.5147	1.007	0.1139	0.2279	27.88%	13.84%

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	0.946	0.8573	0.83	1.161
FR_UFR1 (site)	0.9807	0.928	0.724	0.9647
FR_FRCP1	0.9493	0.882	1.048	
GH_FR1	0.688	0.7473	0.8287	0.7873
CM_MC2	0.5147	0.7693	1.007	0.9787

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	10-1082-2700	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 8:15	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	25.5%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
LAB CTL		FR_UFR1 (site)	0.4842	2.378	0.242	6	0.6180	CDF	Non-Significant Effect
		FR_FRCP1	-0.101	2.378	0.262	5	0.8365	CDF	Non-Significant Effect
		GH_FR1	1.824	2.378	0.242	6	0.1277	CDF	Non-Significant Effect
		CM_MC2	1.289	2.378	0.242	6	0.2760	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1092064	0.0273016	4	1.315	0.3121	Non-Significant Effect
Error	0.2906125	0.02075803	14			
Total	0.3998189		18			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.879	13.28	0.2999	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9762	0.8605	0.8891	Normal Distribution

Mean Dry Biomass-mg Summary

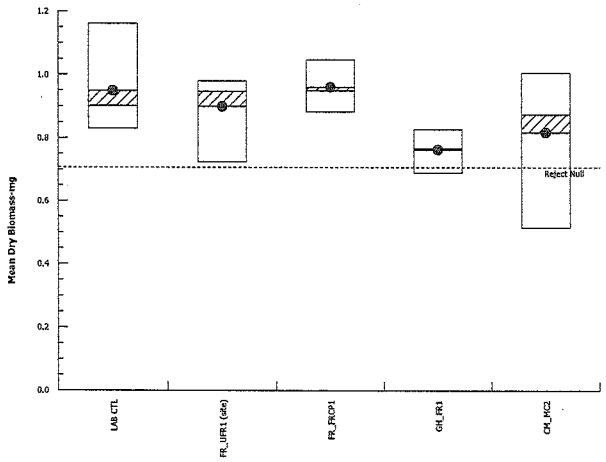
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
LAB CTL	4	0.9487	0.7097	1.188	0.9017	0.83	1.161	0.07509	15.83%	0.0%
FR_UFR1 (site)	4	0.8993	0.7101	1.089	0.9463	0.724	0.9807	0.05947	13.23%	5.2%
FR_FRCP1	3	0.9598	0.7524	1.167	0.9493	0.882	1.048	0.0482	8.7%	-1.17%
GH_FR1	4	0.7628	0.6675	0.8582	0.7673	0.688	0.8287	0.02997	7.86%	19.59%
CM_MC2	4	0.8173	0.4547	1.18	0.874	0.5147	1.007	0.1139	27.88%	13.84%

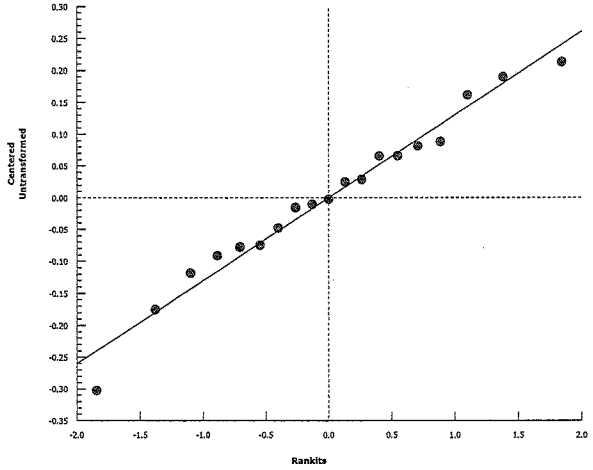
Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	0.946	0.8573	0.83	1.161
FR_UFR1 (site)	0.9807	0.928	0.724	0.9647
FR_FRCP1	0.9493	0.882	1.048	
GH_FR1	0.688	0.7473	0.8287	0.7873
CM_MC2	0.5147	0.7693	1.007	0.9787

Analysis ID:	10-1082-2700	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 8:15	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	19-6255-1042	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 8:26	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	25.9%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	-0.5559	2.318	0.252	5	0.9056	CDF	Non-Significant Effect
		GH_FR1	1.356	2.318	0.233	6	0.2188	CDF	Non-Significant Effect
		CM_MC2	0.8146	2.318	0.233	6	0.4157	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.08039945	0.02679982	3	1.322	0.3167	Non-Significant Effect
Error	0.2229525	0.02026841	11			
Total	0.303352		14			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.826	11.34	0.1850	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9478	0.8328	0.4909	Normal Distribution

Mean Dry Biomass-mg Summary

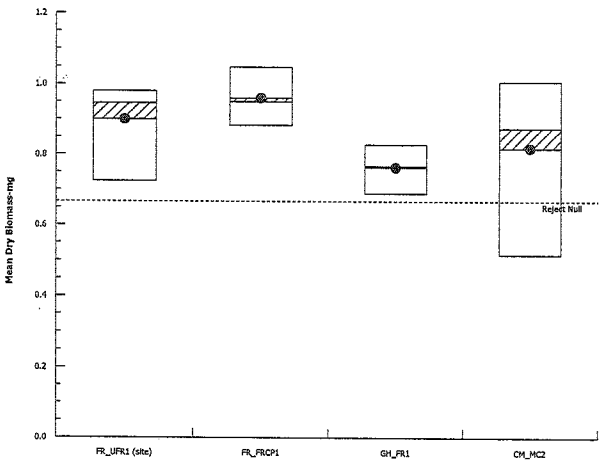
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1 (site)	4	0.8993	0.7101	1.089	0.9463	0.724	0.9807	0.05947	13.23%	0.0%
FR_FRCP1	3	0.9598	0.7524	1.167	0.9493	0.882	1.048	0.0482	8.7%	-6.72%
GH_FR1	4	0.7628	0.6675	0.8582	0.7673	0.688	0.8287	0.02997	7.86%	15.18%
CM_MC2	4	0.8173	0.4547	1.18	0.874	0.5147	1.007	0.1139	27.88%	9.12%

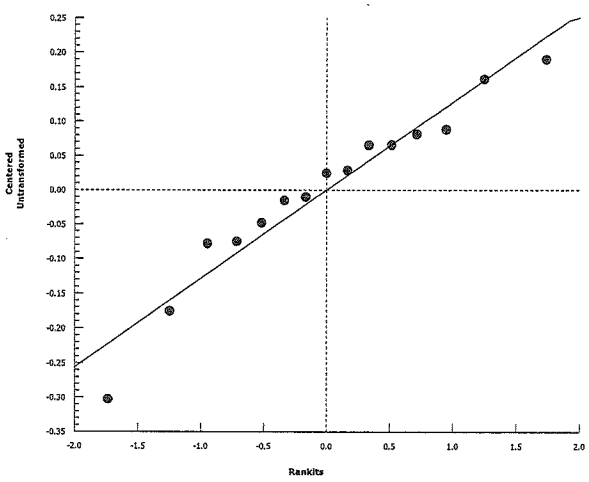
Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	0.9807	0.928	0.724	0.9647
FR_FRCP1	0.9493	0.882	1.048	
GH_FR1	0.688	0.7473	0.8287	0.7873
CM_MC2	0.5147	0.7693	1.007	0.9787

Analysis ID:	19-6255-1042	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Dec-16 8:26	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
LAB CTL	4	8.741	7.755	9.728	8.214	9.636	0.3099	0.6199	7.09%	0.0%
FR_UFR1 (site)	4	8.852	8.468	9.235	8.583	9.167	0.1205	0.241	2.72%	-1.26%
FR_FRCP1	4	9.101	8.69	9.512	8.75	9.333	0.1291	0.2583	2.84%	-4.12%
GH_FR1	4	8.836	7.931	9.741	8.385	9.667	0.2844	0.5687	6.44%	-1.08%
CM_MC2	4	9.204	7.791	10.62	8.5	10.5	0.444	0.888	9.65%	-5.3%

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	8.214	8.615	8.5	9.636
FR_UFR1 (site)	9.167	8.583	8.8	8.857
FR_FRCP1	9.333	9.071	8.75	9.25
GH_FR1	8.692	8.385	8.6	9.667
CM_MC2	10.5	8.5	9	8.818

CETIS Analytical Report

Test Code: 16903b | 11-5464-0295

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	05-0533-1628	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:13	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	10.9%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
LAB CTL		FR_UFR1 (site)	-0.2744	2.356	0.949	6	0.8765	CDF	Non-Significant Effect
		FR_FRCP1	-0.8935	2.356	0.949	6	0.9677	CDF	Non-Significant Effect
		GH_FR1	-0.2353	2.356	0.949	6	0.8671	CDF	Non-Significant Effect
		CM_MC2	-1.151	2.356	0.949	6	0.9830	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.6149954	0.1537488	4	0.4742	0.7541	Non-Significant Effect
Error	4.863388	0.3242258	15			
Total	5.478383		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	5.94	13.28	0.2037	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8885	0.866	0.0252	Normal Distribution

Length-mm Summary

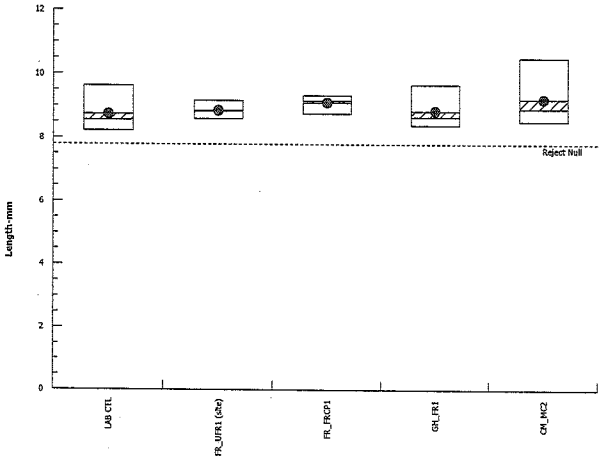
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
LAB CTL	4	8.741	7.755	9.728	8.557	8.214	9.636	0.3099	7.09%	0.0%
FR_UFR1 (site)	4	8.852	8.468	9.235	8.829	8.583	9.167	0.1205	2.72%	-1.26%
FR_FRCP1	4	9.101	8.69	9.512	9.16	8.75	9.333	0.1291	2.84%	-4.12%
GH_FR1	4	8.836	7.931	9.741	8.646	8.385	9.667	0.2844	6.44%	-1.08%
CM_MC2	4	9.204	7.791	10.62	8.909	8.5	10.5	0.444	9.65%	-5.3%

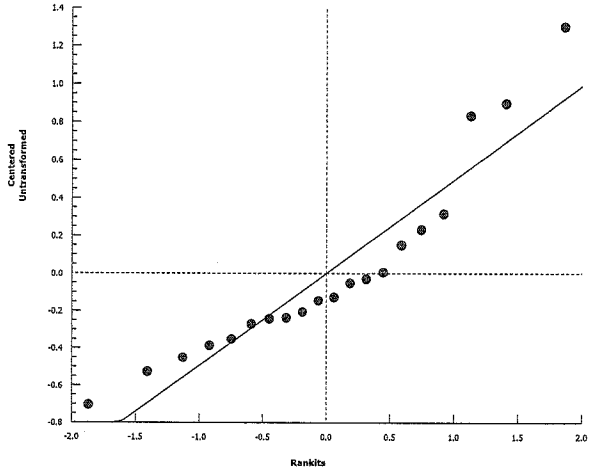
Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	8.214	8.615	8.5	9.636
FR_UFR1 (site)	9.167	8.583	8.8	8.857
FR_FRCP1	9.333	9.071	8.75	9.25
GH_FR1	8.692	8.385	8.6	9.667
CM_MC2	10.5	8.5	9	8.818

Analysis ID:	05-0533-1628	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:13	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-2729-0709	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:18	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	10.2%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	-0.6339	2.287	0.899	6	0.9153	CDF	Non-Significant Effect
		GH_FR1	0.04006	2.287	0.899	6	0.7355	CDF	Non-Significant Effect
		CM_MC2	-0.8971	2.287	0.899	6	0.9507	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.4035352	0.1345118	3	0.435	0.7319	Non-Significant Effect
Error	3.710677	0.3092231	12			
Total	4.114212		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	5.859	11.34	0.1187	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8927	0.8408	0.0614	Normal Distribution

Length-mm Summary

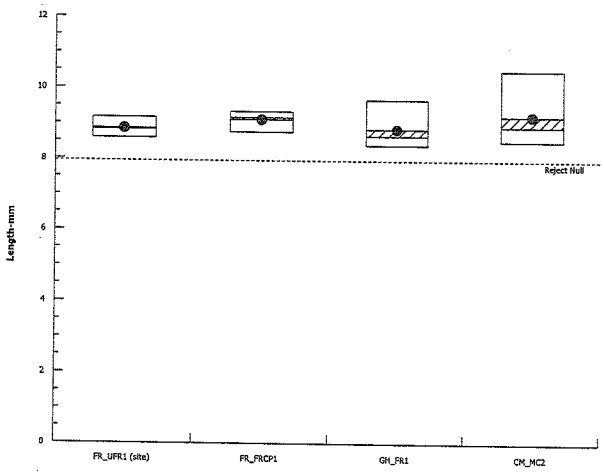
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1 (site)	4	8.852	8.468	9.235	8.829	8.583	9.167	0.1205	2.72%	0.0%
FR_FRCP1	4	9.101	8.69	9.512	9.16	8.75	9.333	0.1291	2.84%	-2.82%
GH_FR1	4	8.836	7.931	9.741	8.646	8.385	9.667	0.2844	6.44%	0.18%
CM_MC2	4	9.204	7.791	10.62	8.909	8.5	10.5	0.444	9.65%	-3.99%

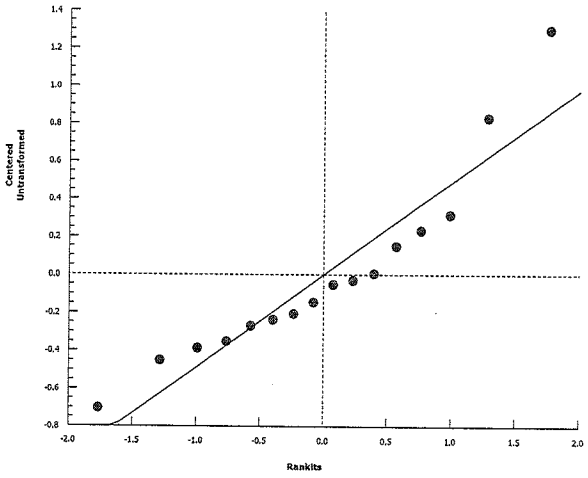
Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	9.167	8.583	8.8	8.857
FR_FRCP1	9.333	9.071	8.75	9.25
GH_FR1	8.692	8.385	8.6	9.667
CM_MC2	10.5	8.5	9	8.818

Analysis ID: 08-2729-0709 **Endpoint:** Length-mm **CETIS Version:** CETISv1.8.7
Analyzed: 14 Oct-16 17:18 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

Graphics





CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Proportion Normal Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
LAB CTL	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1 (site)	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	4	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	4	1	1	1	1	1	0	0	0.0%	0.0%
CM_MC2	4	1	1	1	1	1	0	0	0.0%	0.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	1	1	1	1
FR_UFR1 (site)	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	14/14	13/13	14/14	11/11
FR_UFR1 (site)	12/12	14/14	12/12	12/12
FR_FRCP1	12/12	12/12	10/10	14/14
GH_FR1	13/13	13/13	15/15	12/12
CM_MC2	4/4	12/12	11/11	11/11

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	12-4653-9758	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
LAB CTL	06-7299-1067	25 Aug-16	25 Aug-16	NA	Teck Coal	
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)		
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
LAB CTL	LAB CTL	Teck Coal	LAB CTL		
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
LAB CTL		FR_UFR1 (site)	1	1.0000	Exact	Non-Significant Effect
LAB CTL		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
LAB CTL		GH_FR1	1	1.0000	Exact	Non-Significant Effect
LAB CTL		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
LAB CTL	Negative Contr	52	0	52	1	0	0.0%
FR_UFR1 (site)		50	0	50	1	0	0.0%
FR_FRCP1		48	0	48	1	0	0.0%
GH_FR1		53	0	53	1	0	0.0%
CM_MC2		38	0	38	1	0	0.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	1	1	1	1
FR_UFR1 (site)	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

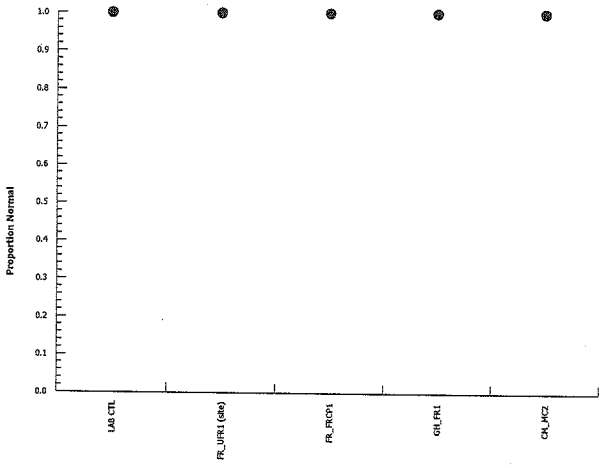
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
LAB CTL	14/14	13/13	14/14	11/11
FR_UFR1 (site)	12/12	14/14	12/12	12/12
FR_FRCP1	12/12	12/12	10/10	14/14
GH_FR1	13/13	13/13	15/15	12/12
CM_MC2	4/4	12/12	11/11	11/11

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	12-4653-9758	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA:_____

CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	18-3082-3337	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:18	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	20-4111-4836	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	25 Aug-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	Dechlorinated Tap Water
Ending Date:	26 Sep-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1 (site)	19-2305-8517	23 Aug-16 08:51	24 Aug-16 08:00	39h (11.8 °C)	Teck Coal	
FR_FRCP1	19-6636-9676	23 Aug-16 10:13	24 Aug-16 08:00	38h (11.8 °C)		
GH_FR1	03-2674-7825	23 Aug-16 08:50	24 Aug-16 08:00	39h (11.9 °C)		
CM_MC2	16-0341-8141	23 Aug-16 13:10	24 Aug-16 08:00	35h (9.1 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1 (site)	Water Sample	Teck Coal	FR_UFR1_QR_01082016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_QR_01082016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016_08_23_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20160823_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1 (site)		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1 (site)		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1 (site)Upstream Contr	50	0	50	1	0	0.0%
FR_FRCP1	48	0	48	1	0	0.0%
GH_FR1	53	0	53	1	0	0.0%
CM_MC2	38	0	38	1	0	0.0%

Proportion Normal Detail

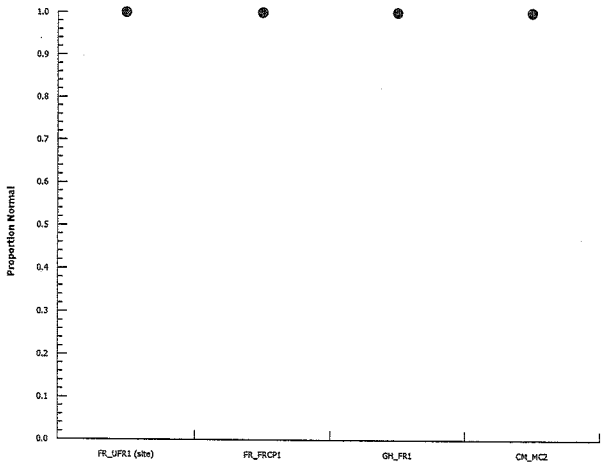
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1 (site)	12/12	14/14	12/12	12/12
FR_FRCP1	12/12	12/12	10/10	14/14
GH_FR1	13/13	13/13	15/15	12/12
CM_MC2	4/4	12/12	11/11	11/11

Analysis ID:	18-3082-3337	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	14 Oct-16 17:18	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGL 10-17-16

APPENDIX E – Chain-of-Custody Forms

Teck

COC ID:	20160823-1330	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL	PRESERV	ANALYSIS: 28 Day H. azteca + Pass/Fail (Q3 Tox.)	7d cerio P/F	72 H P. Subcapitata P/F	30d FHM P/F conducted in Calgary						
FR_FRCP1_QR_01082016_N	FR_FRCP1	WS		2016/08/23	10:13	G	1			1	x	x	xx				1x20L		11.8
FR_UFR1_QR_01082016_N	FR_UFR1	WS		2016/08/23	08:51	G	1			1	x	x	xx				1x20L		11.8
										WO# 16884	16885	16886	16903						

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
		Aug 23 2016	Emma Mans Nautilus Environmental	Aug 23/16 @ 8pm

NB OF BOTTLES RETURNED/DESCRIPTION	
Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name		Mobile #	250 865 5204
Sampler's Signature		Date/Time	Aug 23 2016

Teck

COC ID: 20160823-1237 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY		OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual	Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson	Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com	Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address		Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number		
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country				
Phone Number	1-250-865-5289			Phone Number	403-253-7121					

SAMPLE DETAILS | ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Week 1

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont	FIL	PRESERV	ANALYSIS: 30 Day Fathead Minnow		
FR_FRCP1_QR_01082016_N	FR_FRCP1	WS		2016/08/23	10:13	G	4			4	16-1651	
FR_UFR1_QR_01082016_N	FR_UFR1	WS		2016/08/23	08:51	G	4			4	16-1652	

2016/08/24
800
Bears Paw Carver
NOS/I
Good Condition
8x 20 L Carboys
12°C MC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	N Macdonald	2016/08/23		

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	N Macdonald	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	Aug 23 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID: August 23, 2016 Initial Volume | **TURNAROUND TIME:** regular | **RUSH:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commence Court				Yes PDF	Yes	Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS | **ANALYSIS REQUESTED**

Please indicate below Filtered, Perserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fial)	48 hr daphnia @ 10 deg C (pass/fial)	7 day C dubia P/F	7day embryo (pass Fail)	72 hr P Subcapitata P/F	30 day RT early life stage	28 day H azteca P/F	30d FHM P/F conducted in Calgary			
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
GH_FR1_WS_2016_08_23_N	GH_FR1	WS	N	23-Aug-16	8:50	G	1				X		X		X	X	1X20L		11.9
GH_ERC_WS_2016_08_23_N	GH_ERC	WS	N	23-Aug-16	10:15	G	1				X		X				1X20L		11.9
									WO #		168885		168886		168884	16903			
													168886						

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	J. Enns (Wayfare)	11:30 23-Aug-16		Emma Mans	Aug 24	8:00
				Nautilus Environmental		

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jeremy Enns	Mobile #	250-919-4387
Sampler's Signature		Date/Time	

Chain Of Custody Record

COC ID: August 23, 2016 Initial Volume | Page: 1 of 1

Turnaround Time: | Rush:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Greenhills Operation	Lab Name	HydroQual Laboratories Ltd.	Send Invoice To	
Project Number		Contact Name	Jacklyn Pool	Address	
Contact Name	Leigh Stickney	Address	#4, 6125 - 12th Street S.E		
Address	P.O. BOX 5000			City	State
		City	Calgary State AB	Postal Code	Country
City	Elkford State BC	Postal Code	T2H2K1 Country Canada	Task Code	
Postal Code	V0B1H0 Country Canada	Phone Number	403.253.7121	Shipping Company	
Phone Number	250-865-3274	Email Address		Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com	Quote Number		CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com			CC Hardcopy To	

SAMPLE DETAILS / ANALYSIS REQUESTED / ADDITIONAL INFORMATION

Week 1

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail					ADDITIONAL INFORMATION: Initial - PASS/FAIL
GH_FR1_WS_2016_08_23_N	WS	23-Aug-16		G	4		X										

16-1053

2016/08/24
800
Bears Paw
Carrier
no S/Z
4 x 20 L Carboys
Good Condition
12°C MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
	Jesin Wilchuk	Aug 23/16	09:16					Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
							Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name: Jesin Wilchuk | Mobile #: 250.425.5310

Sampler's Signature: [signature] | Date/Time: Aug 23/16 09:16

Teck

COC ID:	20160823	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO			
Facility Name / Job#	Elkview Operations	Lab Name	Nautilus Environmental	Report Format / Distribution	Excel	PDF	EDD
Job Description	Q3 Chronic Toxicity Sampling	Lab Contact	Krysta Pearcy	Email 1: Michael.Moore@teck.com	X	X	X
Project Manager	Michael Moore	Email	krysta@nautilusenvironmental.ca	Email 2: teckcoal@equisonline.com			X
Email	Michael.Moore@teck.com	Address	8664 Commerce Court	Email 3: James.Boldt@teck.com	X	X	X
Address	RR#1 HWY# 3		Imperial Square Lake City	Email 4: Cameron.Griffin@teck.com	X	X	X
				Email 5:			
City	Sparwood, Province BC	City	Burnaby, Province BC	PO number	418927		
Postal Code	V1C 4C3, Country Canada	Postal Code	V5A 4N7, Country Canada				
Phone Number	1-250-865-5289	Phone Number					

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	7-d C.dupia (pass/fail)	72-h P. subcapitat (pass/fail)	
EV_MC2_WS_2016-08-23_N	EV_MC2	WS	N	2016/08/23	9:15	G	1	1	1	~~9.1~~ 11.8 – 1x20L
EV_HC1_WS_2016-08-23_N	EV_HC1	WS	N	2016/08/23	8:00	G	1	1	1	9.5 – 1x20L
						Total	2			

WO# 16885 16886

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Toxicity 7-Day/72-Hr Pass/ Fail =7 d C. dubia and 72 h P. subcapitata			Emma Marus, Nautilus Environmental	Aug 24/16 @ 08:00

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default) X	Sampler's Name	JAMES BOLDT	Mobile #	
Priority (2-3 business days) - 50% surcharge	Sampler's Signature	[signature]	Date/Time	AUGUST 23 2016
Emergency (1 Business Day) - 100% surcharge				
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Chain Of Custody Record

COC ID: 20160823-0823 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Maglocco@teck.com			Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
						ANALYSIS		7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30cd FHM P/F + conducted in Calgary					
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20160823_N	WS	Aug 23 2016	13:10	G	1			X	X	X	+					9.1°C
																1X20L
							WO #	16885	16886	16884	16903					

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
				Emma Magnus 24 NY Aug 23/16 @ FOA				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Don Sacino	Mobile #		Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	Aug 23 2016 16:00				

Chain Of Custody Record

COC ID: 20160823-0823 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Coal Mountain Operation			Lab Name	Hydroqual Laboratories			Send Invoice To	
Contact Name	Carla Romero			Contact Name	Jacklyn Pool			Address	
Address	2261 Corbin Rd.			Address	#4, 6125-12th Street S.E.				
City	Sparwood	Prov.	BC					City	State
Postal Code	V0B 2G0	Country	Canada	City	Calgary	State	AB	Postal Code	Country
Phone Number	250 425 7350			Postal Code	T2H 2K1	Country	Canada	Task Code	
Email EDD To	Rick.Maghoco@teck.com			Phone Number	403-253-7121			Shipping Company	
	Don.Sacino@teck.com			Email Address				Tracking Number	
	Carla.Romero@teck.com			PO Number				CC Hardcopy To	
								CC Hardcopy To	

SAMPLE DETAILS						ANALYSIS REQUESTED									ADDITIONAL INFORMATION
Week 1						PRESERV.									
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-d P. promelas (pass/fail)								
CM_MC2_WS_20160823_N	WS	Aug 23 2016		G	4		x								
16-1054															
2016/08/24															
800															
Bears Paw Camp															
no S/I															
Good Condition															
4 x 20 L Carboys															
D&C MC															

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions
							Y / N Y / N Y / N
							Y / N Y / N Y / N
							Y / N Y / N Y / N
							Y / N Y / N Y / N

Sampler's Name	Don Sacino	Mobile #		Temp in °C	Samples on ice?
Sampler's Signature		Date/Time	Aug 23 2016 14:50		

Teck

COC ID:	20160823-1217	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Line Creek Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	
Email	jay.jones@teck.com			Email	Krysta@NautilusEnvironmental.ca			Email 2:	tim.chala@teck.com	x	x	
Address	Box 2003			Address	8664 commerce Court			Email 3:	teckcoal@equisonline.com	x	x	x
	15km North Hwy 43											
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number	421598			
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	PO number				
Phone Number	250-425-6111			Phone Number	604-420-8773							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL	PRESERV.	ANALYSIS: 96 hr Rainbow trout Pass/Fail	48 hr Daphnia Pass/Fail	7 d C. dubia P/F	72 h P. subcapitata P/F	30 d fathead minnow	28 d H. Azteca					Temp °C
LC_LCDSSLCC_WS_2016-08-23_N	LC_LCDSSLCC	WS	N	2016/08/23	10:30	G	1					X	X					1X	20L	10.0
											WO #	16885	16886							

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	T Phillips/ NUPQU	August 23, 2016	Nautilus NY - Nan Yamamoto	Aug 24/16 @ 08:00

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Tyler Phillips	Mobile #	(250) 919-0965
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	August 23, 2016
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	20160830-1320	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL	PRESERV	ANALYSIS: 28 Day H. azteca Pass/Fail	7 D C. Dubia Pass/Fail	72 hr P. subcapitata Pass/Fail	30d FHM, P/F conducted in Calgary							Temp °C
FR_FRCP1_Q_04072016_N	FR_FRCP1	WS		2016/08/30	11:49	G	1			1	x	x	x					1X20L		14.8
FR_UFR1_Q_04072016_N	FR_UFR1	WS		2016/08/30	10:45	G	1			1	x	x	x					1X20L		14.8
										wo# 16884			16903							

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
= refresh sample =	Dylan Bagan	Aug 30	Nautilus	Aug 31/16 @ 10:25
			NY - Nair Yamamoto	

NB OF BOTTLES RETURNED/DESCRIPTION	
Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Dylan Bagan	Mobile #	250 865 5273
Sampler's Signature		Date/Time	Aug 30, 2016

Teck

COC ID: 20160830-1317 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country						
Phone Number	1-250-865-5289			Phone Number	403-253-7121							

SAMPLE DETAILS — ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Week 2

Sample ID 16-1051	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL.	PRESERV.	ANALYSIS: 30 Day Fathead Minnow											
FR_FRCP1_Q_04072016_N	FR_FRCP1	WS		2016/08/30	11:49	G	4			4											
FR_UFR1_Q_04072016_N	FR_UFR1	WS		2016/08/30	10:45	G	4			4											
16-1052																					
2016/08/31	1100																				
Good Condition																					
no S/E	8 x 20 L Carboys																				
Bears ptw	13°C																				
MC																					

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Dylan Beaton	Aug 30		

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default) X	Sampler's Name	Dylan Beaton	Mobile #	250 865 5273
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	Aug 30, 2016
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Teck

COC ID:	August 30, 2016 Initial Volume	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:	
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site: leigh.stickney@teck.com	EQuIS: GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution	
Address	PO Box 5000			Address	8664 Commence Court			Yes PDF	Yes Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com
Phone Number	250 865 3274			Phone Number				PO number	359182

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Please indicate below Filtered, Perserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fial)	48 hr daphnia @ 10 deg C (pass/fial)	~~7 day C dubia~~	7day embryo (pass Fail)	~~72 hr P Subcapitata~~	30 day RT early life stage	28 day H azteca P/F	30d FHM P/F conducted in Calgary	#N/A	#N/A	#N/A
GH_FR1_WS_2016_08_30_N	GH_FR1	WS	N	30-Aug-16	9:05	G	1				~~X~~		~~X~~		X	X			12.7

1x20L

WO# 16884   16903

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
= refresh sample =	J. Evans (Nupqu)	30-Aug-16	16:00	Nautilus	Aug 31/16	@ 10:25
				NY - Nari Yamamoto		

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Jeremy Evans	Mobile #	250-919-9387
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	[signature]	Date/Time	
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Chain Of Custody Record

COC ID: August 30, 2016 Initial Volume | Page: 1 of 1

Turnaround Time: | **Rush:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operation			Lab Name	HydroQual Laboratories Ltd.			Send Invoice To			
Project Number				Contact Name	Jacklyn Pool			Address			
Contact Name	Leigh Stickney			Address	#4, 6125 - 12th Street S.E						
Address	P.O. BOX 5000							City		State	
				City	Calgary	State	AB	Postal Code		Country	
City	Elkford	State	BC	Postal Code	T2H2K1	Country	Canada	Task Code			
Postal Code	V0B1H0	Country	Canada	Phone Number	403.253.7121			Shipping Company			
Phone Number	250-865-3274			Email Address				Tracking Number			
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To			
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
Week 2 16-1053 Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail				Initial - PASS/FAIL
GH_FRJ_WS_2016_08_30_N	WS	30-Aug-16	1205	G	4		X									
2016/08/31		1100														
NO S/S	Good Condition															
Bears Paw																
4 x 20 L Carboys																
DS																
MC																

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

				Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name		Mobile #					
Sampler's Signature		Date/Time					

Chain Of Custody Record

COC ID: 20160830-0830 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com			Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
						ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F conducted in Calgary				
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20160830_N	WS	Aug 30 2016		G	1						X	X			14.1	1x20L REFRESH
											wo # 168843	16903				

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
= refresh sample =				Nautilus	Aug 31/16	10:25		Y / N	Y / N	Y / N
				NY- Nan Yamamoto				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

					Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Don Sacino	Mobile #						
Sampler's Signature		Date/Time	Aug 30 2016					

2/2

Chain Of Custody Record

COC ID: 20160830-0830

Turnaround Time:

PROJECT/CLIENT INFO					LABORATORY					OTHER INFO			
Facility Name	Coal Mountain Operation				Lab Name	Hydroqual Laboratories				Send Invoice To			
Contact Name	Carla Romero				Contact Name	Jacklyn Pool				Address			
Address	2261 Corbin Rd.				Address	#4, 6125-12th Street S.E.							
City	Sparwood	Prov.	BC							City		State	
Postal Code	V0B 2G0	Country	Canada		City	Calgary	State	AB		Postal Code	Country		
Phone Number	250 425 7350				Postal Code	T2H 2K1	Country	Canada		Task Code			
Email EDD To	Rick.Magliocco@teck.com				Phone Number	403-253-7121				Shipping Company			
	Don.Sacino@teck.com				Email Address					Tracking Number			
	Carla.Romero@teck.com				PO Number					CC Hardcopy To			
										CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
Week 2						PRESERV.										
16-1054						ANALYSIS		30-d P. promelas (pass/fail)								
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20160830_N	WS	Aug 30 2016		G	4			x								REFRESH
								✓								
2016/08/30	31	1100														
Good	Condition															
no s/E	Bears paw															
4 x 20 L	Cardboys															
	13.0															
	MC															

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Don Sacino	Mobile #		Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	Aug 30 2016				

Teck

COC ID: 20160906-1307 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL	PRESERV.	ANALYSIS: 7 Day C. Dubia	72 hr P. subcapitata	28 Day H. azteca Pass/Fail	30d FHM P/F conducted in Calgary						
FR_FRCP1_QR_11072016_N	FR_FRCP1	WS		2016/09/06	11:15	G	1			x	x	1	x				1x20L		9.8
FR_UFR1_QR_11072016_N	FR_UFR1	WS		2016/09/06	12:10	G	1			x	x	1	x				1x20L		9.8

WO# 168844
169033

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
= refresh sample =	ND Macdonald	2016/09/06	Nautilus	Sept 07/16 @ 10:00
			NY - Nari Yamamoto	

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	N Macdonald	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	Sept 6 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	20160906-1305	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country						
Phone Number	1-250-865-5289			Phone Number	403-253-7121							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered = F; Field, L= Lab, FL= Field & Lab, N= None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL.	PRESERV.	ANALYSIS: 30 Day Fathead Minnow
	Week 3									
16-1051 FR_FRCP1_QR_11072016_N	FR_FRCP1	WS		2016/09/06	11:15	G	4			4
FR_UFR1_QR_11072016_N	FR_UFR1	WS		2016/09/06	12:10	G	4			4
16-1052										
Week 3										
2016/09/07 1200 Good Condition										
no S/I Bears Paw Courier										
4 <20L Cabays 12°C										
MC										

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	N MACDONALD	2016/09/06		

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default) X	Sampler's Name	N MACDONALD	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	Sept 6 2016
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Teck

COC ID:	September 6, 2016 Initial Volume	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commence Court				Yes PDF	Yes	Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS / ANALYSIS REQUESTED

Please indicate below Filtered, Preserved or both (F, P, FP)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	#N/A 96 hr Rainbow trout (pass/fail)	#N/A 48 hr daphnia (pass/fail)	#N/A 48 hr daphnia @ 10 deg C (pass/fail)	#N/A 7 day C dubia	#N/A 7day embryo (pass Fail)	#N/A 72 hr P Subcapitata	#N/A 30 day RT early life stage	#N/A 28 day H azteca P/F	#N/A 30d FHM P/F conducted in Calgary	#N/A	#N/A	#N/A
GH_FR1_WS_2016_09_06_N	GH_FR1	WS	N	6-Sep-16	9:30	G	1					X		X		X	X			10.3 1X20
																16884	16903			
																WO#				

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
= refresh sample =	Jeremy Ems (Nupqu)	6-Sept-16	10:30	Nautilus NY-Nan Yamamoto	Sept07/16	10:00

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Jeremy Ems	Mobile #	250-919-4387
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Chain Of Custody Record

COC ID: September 6, 2016 Initial Volume | Page: 1 of 1

Turnaround Time: | **Rush:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Greenhills Operation			Lab Name	HydroQual Laboratories Ltd.			Send Invoice To	
Project Number				Contact Name	Jacklyn Pool			Address	
Contact Name	Leigh Stickney			Address	#4, 6125 - 12th Street S.E				City / State
Address	P.O. BOX 5000			City	Calgary	State	AB	Postal Code	Country
City	Elkford	State	BC	Postal Code	T2H2K1	Country	Canada	Task Code	
Postal Code	V0B1H0	Country	Canada	Phone Number	403.253.7121			Shipping Company	
Phone Number	250-865-3274			Email Address				Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To	

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail				
16-1053 Week 3																
GH_FR1_WS_2016_09_06_N	WS	6-Sep-16	9:30	G	4		X									
		2016/09/07														
		1200 Good Condition														
		4 x 20 L Carboys														
		no S/Z														
		Bears Paw Lavier														
		12°C MC														

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
	J. Ennis (Nutrien)	6-Sep-16	10:30					Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

				Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Jeremy Ennis	Mobile #					
Sampler's Signature		Date/Time					

Chain Of Custody Record

COC ID: 20160906-0906 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To	
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address	
Address	2261 Corbin Rd.			Address	8664 commerce Court				
City	Sparwood	Prov.	BC					City	State
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code	Country
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com			Phone Number	604-420-8773			Shipping Company	
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number	
	Carla.Romero@teck.com			PO Number				CC Hardcopy To	
								CC Hardcopy To	

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS		7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F conducted in Calgary					
CM_MC2_WS_20160906_N	WS	Sept 6 2016	10:25	G	1					X	X					REFRESH
										WO # 16884	16903					

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
= refresh samples =				Nautilus	Sept 07/16	10:00	8.6	Y / N	Y / N	Y / N
				NY. Nan Yamamoto				Y / N	Y / N	Y / N
					1x20L			Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Don Sacino	Mobile #		Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	Sept 6 2016				

Chain Of Custody Record

COC ID: 20160906-0906

Turnaround Time:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Coal Mountain Operation	Lab Name	Hydroqual Laboratories	Send Invoice To	
Contact Name	Carla Romero	Contact Name	Jacklyn Pool	Address	
Address	2261 Corbin Rd.	Address	#4, 6125-12th Street S.E.		
City	Sparwood Prov. BC			City	State
Postal Code	V0B 2G0 Country Canada	City	Calgary State AB	Postal Code	Country
Phone Number	250 425 7350	Postal Code	T2H 2K1 Country Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com	Phone Number	403-253-7121	Shipping Company	
	Don.Sacino@teck.com	Email Address		Tracking Number	
	Carla.Romero@teck.com	PO Number		CC Hardcopy To	
				CC Hardcopy To	

16-1054 week 3

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30-d P. promelas (pass/fail)	ADDITIONAL INFORMATION
CM_MC2_WS_20160906_N	WS	Sept 6 2016	10:25	G	4	x	REFRESH

2016/09/07 NOS/I
1200 Good Conditions
12°C Bears paw
4 x 20 Lcurboy
, mc

Additional Comments/Special Instructions

Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time

Sampler's Name	Don Sacino	Mobile #	
Sampler's Signature	[signature]	Date/Time	Sept 6 2016

Sample Receipt Conditions

Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

Teck

COC ID: 20160913-1319 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL	PRESERV.	ANALYSIS: 28 Day H. azteca P/F	7 Day C. Dubia	72 hr P. subcapitata	30d FHM P/F conducted in Calgary							Temp °C
FR_FRCP1_QR_18072016_N	FR_FRCP1	WS		2016/09/13	11:55	G	1			X	X	1	X							9.8
FR_UFR1_QR_18072016_N	FR_UFR1	WS		2016/09/13	10:00	G	1			X	X	1	X							9.8
										wo# 16884			16903							

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS: =refresh sample=

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Sept 16/09/13	Nautilus NY - Nan Yamamoto 2x20L	Sept 14/16 @ 07:30

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name		Mobile #	250 865-5204
Sampler's Signature		Date/Time	Sept 13 2016

Teck

COC ID: 20160913-1322 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1: Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2: Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3: teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number			
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country					
Phone Number	1-250-865-5289			Phone Number	403-253-7121						

Week 4

16-1051

SAMPLE DETAILS								ANALYSIS REQUESTED														Filtered - F: Field, L: Lab, FL: Field & Lab, N: None
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont	FIL	PRESERV	ANALYSIS	30 Day Fathead Minnow											
FR_FRCP1_QR_18072016_N	FR_FRCP1	WS		2016/09/13	11:55	G	4				4											
FR_UFR1_QR_18072016_N	FR_UFR1	WS		2016/09/13	10:00	G	4				4											
16-1052																						
2016/09/14	1130																					
Good	Condition																					
no ste	bears paw																					
8 x 20 L	Carboys 15°C																					
	MC																					

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	N MacDonald -	2016/09/13		

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	N MacDonald	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	Sept 13 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID: September 13, 2016 Refresh

TURNAROUND TIME: regular **RUSH:**

PROJECT/CLIENT INFO

Facility Name	Greenhills Operations
Project Manager	Leigh Stickney
Email	leigh.stickney@teck.com
Address	PO Box 5000
City	Elkford
Province	BC
Postal Code	V0B 1H0
Country	Canada
Phone Number	250 865 3274

LABORATORY

Lab Name	Nautilus Environmental
Lab Contact	Krysta Pearcy
Email	
Address	8664 Commence Court Imperial Square Lake City
City	Burnaby
Province	BC
Postal Code	V5A 4N7
Country	Can
Phone Number	

OTHER INFO

EDD delivery: Site: leigh.stickney@teck.com EQuIS: GHO

Report Format / Distribution: Yes PDF Yes Excel

Email 1:	leigh.stickney@teck.com
Email 2:	sean.beswick@teck.com
Email 3:	jevin.wolchuk@teck.com
PO number	359182

SAMPLE DETAILS

ANALYSIS REQUESTED

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7 day C dubia	7day embryo (pass Fail)	72 hr P Subcapitata	30 day RT early life stage	28 day H azteca P/F	30d FHM P/F conducted in Calgary			Temp °C
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
GH_FR1_WS_2016_09_13_N	GH_FR1	WS	N	13-Sep-16	7:25	G	1				X		X		X	X			9.6

wo# 16884 16903

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

= Refresh Sample =

RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
T. Enns (Dufferin)	13-Sept-16	8:30	Nautilus NY - Nan Yamamoto 1x20L	Sept 14/16	07:30

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name		**Mobile #**	250-919-4387
Sampler's Signature		**Date/Time**	

Chain Of Custody Record

COC ID: September 13, 2016 Refresh | Page: 1 of 1

Turnaround Time: | **Rush:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Greenhills Operation			Lab Name	HydroQual Laboratories Ltd.			Send Invoice To	
Project Number				Contact Name	Jacklyn Pool			Address	
Contact Name	Leigh Stickney			Address	#4, 6125 - 12th Street S.E				
Address	P.O. BOX 5000							City	State
				City	Calgary	State	AB	Postal Code	Country
City	Elkford	State	BC	Postal Code	T2H2K1	Country	Canada	Task Code	
Postal Code	V0B1H0	Country	Canada	Phone Number	403.253.7121			Shipping Company	
Phone Number	250-865-3274			Email Address				Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com			Quote Number				CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com							CC Hardcopy To	

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										Initial - PASS/FAIL
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail				
16-1053	Week 4															
GH_FR1_WS_2016_09_13_N	WS	13-Sep-16	7:25	G	4		X									
							✓									
2016/09/14 1130																
Good Condition																
no S/E Bears Paw																
4 < 20 L Carboys																
13°C																
	MK															

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
	S. Emms	13 Sept 16	8:30					Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	S. Emms	Mobile #		Temp in °C	Samples on ice	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time					

Chain Of Custody Record

COC ID: 20160913-0913 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO					LABORATORY					OTHER INFO			
Facility Name	Coal Mountain Operation				Lab Name	Nautilus Environmental				Send Invoice To			
Contact Name	Carla Romero				Contact Name	Krysta Pearcy				Address			
Address	2261 Corbin Rd.				Address	8664 commerce Court							
City	Sparwood	Prov.	BC							City		State	
Postal Code	V0B 2G0	Country	Canada		City	Burnaby	State	BC		Postal Code		Country	
Phone Number	250 425 7350				Postal Code	V5A 4N7	Country	Canada		Task Code			
Email EDD To	Rick.Magliocco@teck.com				Phone Number	604-420-8773				Shipping Company			
	Don.Sacino@teck.com				Email Address	krysta@nautilusenvironmental.ca				Tracking Number			
	Carla.Romero@teck.com				PO Number					CC Hardcopy To			
										CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	30d FHM P/F conducted in Calgary			Temp °C	
CM_MC2_WS_20160913_N	WS	Sept 13 2016	16:25	G	1						X	X			7.2	REFRESH
											wo # 168884	16903				

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
= refresh sample =				Nautilus	~~Sept 13 NY~~			Y / N	Y / N	Y / N
				NY - Nair Yamamoto	Sept 14/16	07:30		Y / N	Y / N	Y / N
					1x20L			Y / N	Y / N	Y / N

Sampler's Name	Don Sacino	Mobile #		Temp in °C	Samples on ice?
Sampler's Signature		Date/Time	Sept 13 2016 14:00		Sample intact? / Trip Blank?

Chain Of Custody Record

COC ID: 20160913-0913 | Page: 1 of 2

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Coal Mountain Operation			Lab Name	Hydroqual Laboratories			Send Invoice To	
Contact Name	Carla Romero			Contact Name	Jacklyn Pool			Address	
Address	2261 Corbin Rd.			Address	#4, 6125-12th Street S.E.				
City	Sparwood	Prov.	BC					City	State
Postal Code	V0B 2G0	Country	Canada	City	Calgary	State	AB	Postal Code	Country
Phone Number	250 425 7350			Postal Code	T2H 2K1	Country	Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com			Phone Number	403-253-7121			Shipping Company	
	Don.Sacino@teck.com			Email Address				Tracking Number	
	Carla.Romero@teck.com			PO Number				CC Hardcopy To	
								CC Hardcopy To	

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
10-1054 week 4						ANALYSIS		30-d P. prometas (pass/fail)								
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20160913_N	WS	Sept 13 2016	10:25	G	4			x								REFRESH
2016/09/14																
1130																
Good Condition																
No S/I																
Bears paw																
13°C																
4 <20 L Carboys																
MC																

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

Sampler's Name	Don Sacino	Mobile #		Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	Sept 13 2016 14:00				

Teck

COC ID:	20160920-1326	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country						
Phone Number	1-250-865-5289			Phone Number	403-253-7121							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

16-1051 week 5

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont	FIL	PRESERV	ANALYSIS: 30 Day Fathead Minnow
FR_FRCP1_QR_25072016_N	FR_FRCP1	WS		2016/09/20	11:20	G	4			4
FR_UFR1_QR_25072016_N	FR_UFR1	WS		2016/09/20	09:50	G	4			4

16-1052
Week 5
2016/09/21
4 x 20L Carboys
1200
Received via Courier
Good Condition
11°C
NO STE MC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Dylan Begin	Sept 20		

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Dylan Begin	Mobile #	250 865 5273
Sampler's Signature		Date/Time	Sept 20, 2016

Chain Of Custody Record

COC ID: September 20, 2016 Refresh | Page: 1 of 1

Turnaround Time: | Rush:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Greenhills Operation	Lab Name	HydroQual Laboratories Ltd.	Send Invoice To	
Project Number		Contact Name	Jacklyn Pool	Address	
Contact Name	Leigh Stickney	Address	#4, 6125 - 12th Street S.E		
Address	P.O. BOX 5000			City	State
		City	Calgary State AB	Postal Code	Country
City	Elkford State BC	Postal Code	T2H2K1 Country Canada	Task Code	
Postal Code	V0B1H0 Country Canada	Phone Number	403.253.7121	Shipping Company	
Phone Number	250-865-3274	Email Address		Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com	Quote Number		CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com			CC Hardcopy To	

Week 5

16-1053

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/fail				ADDITIONAL INFORMATION Initial - PASS/FAIL
GH_FR1_WS_2016_09_20_N	WS	20-Sep-16	05:50	G	4		X									

2016/09/21
1200
Good Condition
no S/I
4 x 20 L Carboys
11°C
Beorsptw ME

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
	Jon Fitzwilliam	Sept 21/16	09:10					Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
							Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name: Jon Fitzwilliam | Mobile #: 250.425.5310

Sampler's Signature: [signature] | Date/Time: Sept 21/16 09:10

Chain Of Custody Record

COC ID: 20160920-0920 | Page: 1

Turnaround Time:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Coal Mountain Operation	Lab Name	Hydroqual Laboratories	Send Invoice To	
Contact Name	Carla Romero	Contact Name	Jacklyn Pool	Address	
Address	2261 Corbin Rd.	Address	#4, 6125-12th Street S.E.		
City	Sparwood Prov. BC			City	State
Postal Code	V0B 2G0 Country Canada	City	Calgary State AB	Postal Code	Country
Phone Number	250 425 7350	Postal Code	T2H 2K1 Country Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com	Phone Number	403-253-7121	Shipping Company	
	Don.Sacino@teck.com	Email Address		Tracking Number	
	Carla.Romero@teck.com	PO Number		CC Hardcopy To	
				CC Hardcopy To	

SAMPLE DETAILS | **ANALYSIS REQUESTED** | **ADDITIONAL INFOR**

16-1054 Week 5

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30-d P. promelas (pass/fail)	Additional Info
CM_MC2_WS_20160920_N	WS	Sept 20 2016		G	4	x	REFRESH

2016/09/21
1200
Bearspaw Carrier
no S/T
4 x 20 L Cubags
11°C
Good Condition
MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Condition		
								Y / N	Y / N
								Y / N	Y / N
								Y / N	Y / N
								Y / N	Y / N
							Temp in °C	Samples on ice?	Sample intact?

Sampler's Name	Carla Romero	Mobile #	
Sampler's Signature	[signature]	Date/Time	Sept 20 2016 1:00pm

END OF REPORT

Appendix B-4 Fourth Quarter 2016 Results: Toxicity testing on Elk Valley samples with *Ceriodaphnia dubia, Pseudokirchneriella subcapitata, Hyalella azteca* and *Pimephales promelas*

Toxicity testing on Elk Valley samples with *Ceriodaphnia dubia*, *Pseudokirchneriella subcapitata*, *Hyalella azteca*, *Pimephales promelas* and *Oncorhynchus mykiss*

Fourth Quarter 2016 Results

Final Report

March 29, 2017

Submitted to: **Teck Coal Ltd.**
Sparwood, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

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SIGNATURE PAGE

Report By:
Krysta Pearcy, R.P.Bio.
Laboratory Coordinator

Reviewed By:
James Elphick, R.P.Bio.
Environmental Toxicologist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Summaries of sample information and test results from the toxicity tests conducted on samples collected from the Elk Valley to meet requirements of the quarterly toxicity testing program required under BC Ministry of Environment permit number 107517 in the fourth quarter of 2016 are provided in the tables below.

Sample and Test Type Information

Sample IDs	FR_UFR1 (site control), GH_ER2 (site control)*, FR_FCP1, GH_FR1, GH_ERC*, EV_MC2*, EV_HC1*, CM_MC2 and LC_LCDSSLCC*
Sample collection dates	October 17, 25 and November 1, 8 and 15, 2016
Sample receipt dates	October 18, 26 and November 2, 9 and 16, 2016
Sample receipt temperatures	Ranged from 2.0 to 13.0°C
Test types	*Ceriodaphnia dubia* 7-d survival and reproduction
	Pseudokirchneriella subcapitata 72-h growth inhibition
	Hyalella azteca 28-d survival and growth
	Pimephales promelas survival and growth
	Oncorhynchus mykiss (rainbow trout) embryo-alevin development

* Tested with *C. dubia, P. subcapitata* and *O. mykiss* only

Summary of Results

Endpoint	Mean ± SD									
	Laboratory Control	FR_UFR1 (Site Control)	GH_ER2 (Site Control)	FR_FRCP1	GH_FR1	GH_ERC	EV_MC2	EV_HC1	CM_MC2	LC_LCDSSLCC
C. dubia										
Survival (%)	100	100	100	100	100	100	100	100	100	100
Reproduction	22.5 ± 2.7	20.7 ± 2.5	21.3 ± 3.9	14.1 ± 4.5* $^{\alpha\beta}$	18.6 ± 2.8	18.9 ± 4.0	14.9 ± 5.4* $^{\alpha\beta}$	19.8 ± 2.9	15.3 ± 4.5* $^{\alpha\beta}$	21.2 ± 4.0
P. subcapitata										
Cell Yield (x 10^4 cells/mL)	30.9 ± 1.5	154.3 ± 9.5	152.0 ± 8.1	141.0 ± 2.9 $^{\alpha\beta}$	158.5 ± 1.9	156.8 ± 10.4	166.3 ± 2.2	157.8 ± 2.2	156.0 ± 10.1	156.0 ± 4.5
H. azteca										
Survival (%)	98.0 ± 4.5	94.0 ± 5.5	NT	94.0 ± 8.9	86.0 ± 20.7	NT	NT	NT	98.0 ± 4.5	NT
Dry weight (mg)	0.63 ± 0.03	0.71 ± 0.07	NT	0.60 ± 0.08 $^{\alpha}$	0.58 ± 0.23	NT	NT	NT	0.71 ± 0.05	NT
***P. promelas* (untreated)**										
Hatch (%)	100 ± 0.0	100 ± 0.0	NT	100 ± 0.0	98.3 ± 3.3	NT	NT	NT	100 ± 0.0	NT
Survival (%)	90.0 ± 3.8	25.0 ± 10.0 *	NT	16.7 ± 17.6 *	35.0 ± 16.7 *	NT	NT	NT	76.7 ± 11.6 *	NT
Biomass (mg)	0.71 ± 0.02	0.28 ± 0.02 *	NT	0.24 ± 0.17 *	0.44 ± 0.13 *	NT	NT	NT	0.65 ± 0.03	NT
Length (mm)	8.1 ± 0.2	9.2 ± 1.2	NT	10.6 ± 3.0	9.3 ± 0.8	NT	NT	NT	8.4 ± 0.4	NT
Normal development (%)	100 ± 0.0	91.7 ± 16.7	NT	100 ± 0.0	100 ± 0.0	NT	NT	NT	95.4 ± 9.1	NT

SD = Standard Deviation, NT = Not Tested
* Result was significantly lower than the laboratory control
$^{\alpha}$ Result was significantly lower than the site control FR_UFR1
$^{\beta}$ Result was significantly lower than the site control GH_ER2

Summary of Results (continued)

Endpoint	Mean ± SD									
	Laboratory Control	FR_UFR1 (Site Control)	GH_ER2 (Site Control)	FR_FRCP1	GH_FR1	GH_ERC	EV_MC2	EV_HC1	CM_MC2	LC_LCDSSLCC
***P. promelas* (copper amended)**										
Hatch (%)	100 ± 0.0	100 ± 0.0	NT	96.7 ± 3.8	98.3 ± 3.3	NT	NT	NT	100 ± 0.0	NT
Survival (%)	91.7 ± 3.3	53.3 ± 9.4 *	NT	80.0 ± 9.4	81.7 ± 8.4	NT	NT	NT	96.7 ± 3.8	NT
Biomass (mg)	0.73 ± 0.02	0.42 ± 0.07 *	NT	0.69 ± 0.06	0.67 ± 0.06	NT	NT	NT	0.67 ± 0.03	NT
Length (mm)	7.7 ± 0.2	7.5 ± 0.2	NT	7.9 ± 0.4	7.8 ± 0.2	NT	NT	NT	7.9 ± 0.1	NT
Normal development (%)	98.1 ± 3.8	100 ± 0.0	NT	100 ± 0.0	100 ± 0.0	NT	NT	NT	100 ± 0.0	NT
O. mykiss										
Survival (%)	93.3 ± 6.1	85.0 ± 4.3	89.2 ± 5.0	50.0 ± 6.8 *αβ	41.4 ± 18.3 *αβ	91.7 ± 5.8	81.6 ± 8.5 *	56.3 ± 15.1 *αβ	81.4 ± 14.9 *	64.5 ± 7.4 *αβ
Viability (%)	90.0 ± 6.1	81.7 ± 1.9	87.5 ± 6.3	49.1 ± 5.2 *αβ	41.4 ± 18.3 *αβ	91.7 ± 5.8	79.0 ± 6.5 *	53.0 ± 12.4 *αβ	75.4 ± 13.2 *β	62.8 ± 8.6 *αβ
Length (mm)	19.8 ± 0.2	20.0 ± 0.1	20.0 ± 0.3	19.5 ± 0.3	19.4 ± 0.9	19.2 ± 0.6 α	20.1 ± 0.2	19.3 ± 0.4	20.2 ± 0.2	20.6 ± 0.2
Wet weight (mg)	82.8 ± 0.7	85.0 ± 2.1	85.2 ± 2.6	82.8 ± 2.5	86.8 ± 0.3	85.2 ± 3.5	91.2 ± 3.2	86.3 ± 2.3	90.9 ± 2.1	96.2 ± 8.8

SD = Standard Deviation, NT = Not Tested
* Result was significantly lower than the laboratory control
α Result was significantly lower than the site control FR_UFR1
β Result was significantly lower than the site control GH_ER2

1.0 INTRODUCTION

Nautilus Environmental conducted toxicity tests for Teck Coal Ltd. on samples collected from various locations in the Elk Valley as part of a quarterly toxicity testing program required under BC Ministry of Environment permit number 107517. Test species required to be tested quarterly included a cladoceran (*Ceriodaphnia dubia*), a unicellular green alga (*Pseudokirchneriella subcapitata*), an amphipod (*Hyalella azteca*), and the fathead minnow (*Pimephales promelas*). Tests are also required on a semi-annual basis (in alignment with second and forth quarterly testing) using rainbow trout (*Oncorhynchus mykiss*).

Water samples used for testing were transported in 20-L plastic containers in coolers containing ice packs or in 200-L plastic drums. Samples were received at temperatures ranging from 2.0 to 13.0°C and were stored in the dark at 4 ± 2°C prior to testing. Table 1 summarizes the toxicity tests that were conducted on each sample as well as sample collection dates. Samples were collected weekly on the dates shown in Table 1 for the duration of the *H. Azteca, P. promelas* and *O. mykiss* tests. The *P. promelas* test was conducted at the Nautilus Environmental laboratory in Calgary, AB; the other toxicity tests were conducted at the Burnaby, BC location.

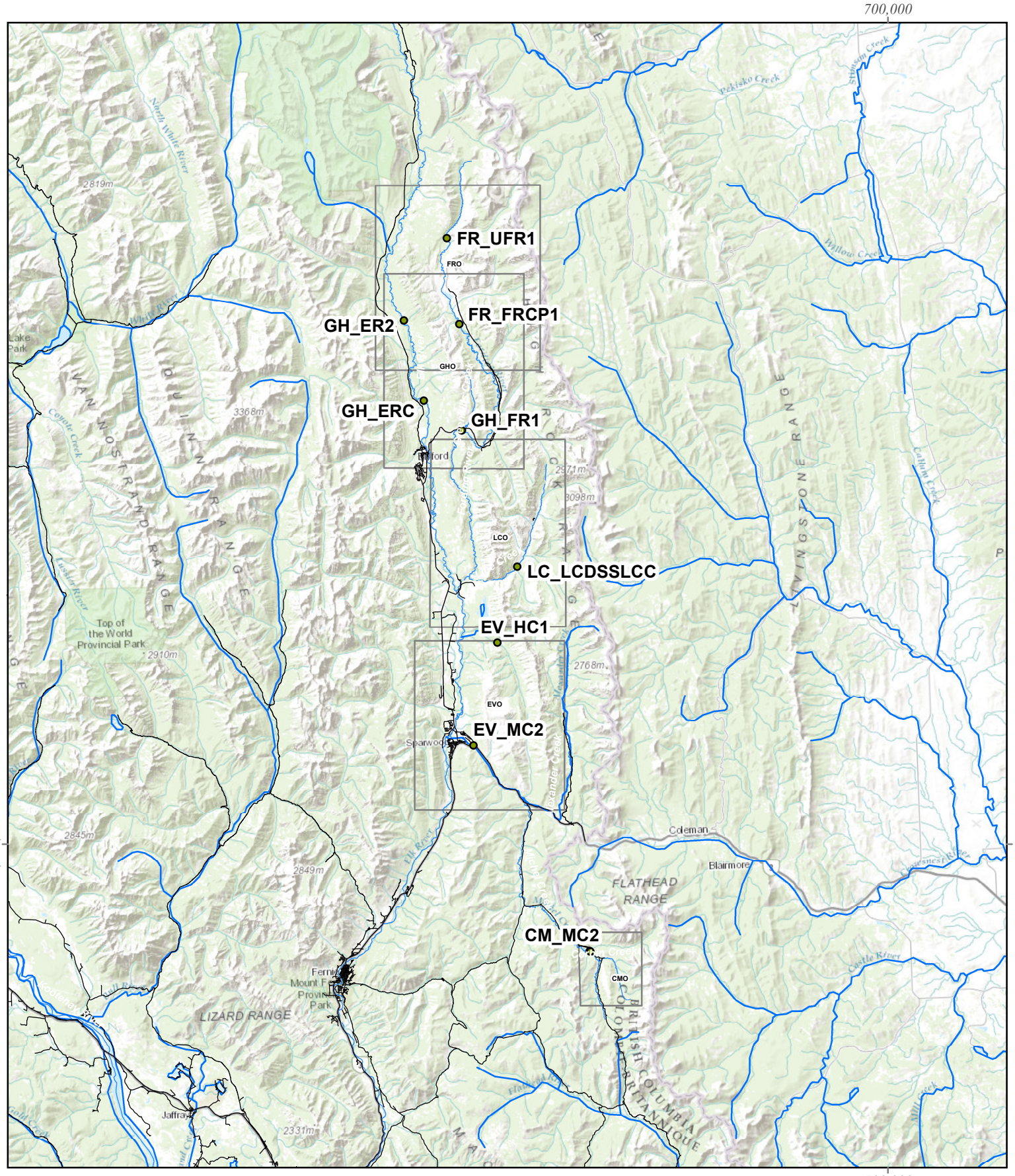
This report presents the results of the toxicity tests. Copies of laboratory data sheets and printouts of statistical analyses are provided in Appendices A through E. Results of analytical chemistry that was performed on the samples tested in this program are uploaded by Teck to the Environmental Management System database. These samples were collected by Teck personnel at the same time the samples were collected for toxicity testing. The chain-of-custody forms are provided in Appendix F.

Table 1. Summary of toxicity testing program.

Sample ID	EMS Location ID	Species Tested	Sample Collection Dates
FR_UFR1*	E216777	*C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas*† and *O. mykiss*	October 17, 25 and November 1, 8 and 15, 2016
GH_ER2 *	0200389	*C. dubia*, *P. subcapitata* and *O. mykiss*	October 17, 25 and November 1, 8 and 15, 2016
FR_FRCP1	E300071	*C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas*† and *O. mykiss*	October 17, 25 and November 1, 8 and 15, 2016
GH_FR1	0200378	*C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas*† and *O. mykiss*	October 17, 25 and November 1, 8 and 15, 2016
GH_ERC	E300090	*C. dubia*, *P. subcapitata* and *O. mykiss*	October 17, 25 and November 1, 8 and 15, 2016
EV_MC2	E300091	*C. dubia*, *P. subcapitata* and *O. mykiss*	October 17, 25 and November 1, 8 and 15, 2016
EV_HC1	E102682	*C. dubia*, *P. subcapitata* and *O. mykiss*	October 17, 25 and November 1, 8 and 15, 2016
CM_MC2	E258937	*C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas*† and *O. mykiss*	October 17, 25 and November 1, 8 and 15, 2016
LC_LCDSSLCC	E297110	*C. dubia*, *P. subcapitata* and *O. mykiss*	October 17, 25 and November 1, 8 and 15, 2016

* Site water controls

† *P. promelas* tests were conducted on untreated and copper-amended samples



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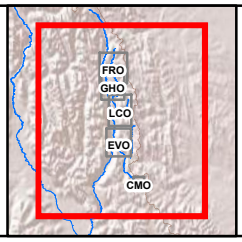

Chronic Toxicity Monitoring Locations

- Roads
- Rivers
- Monitoring Locations

N

0 4,000 8,000 16,000 Meters

DATE:	MINE OPERATION:
11/10/2015	Elk Valley
SCALE:	COORDINATE SYSTEM:
1:550,000	NAD 1983 UTM Zone 11N

Document Path: \\teckcominco.loc\CGO\Groups\TCGIS\Data\Operations\SPO\Dan_Vasiga\BaseLandscape_letter.mxd

2.0 METHODS

Methods for the toxicity tests using *C. dubia*, *P. subcapitata*, *H. azteca, P. promelas* and *O. mykiss* are summarized in Tables 2 through 6. Laboratory control water was 20% Perrier water prepared with deionized water for *C. dubia*; City of Calgary dechlorinated municipal tap water for *P. promelas*; and moderately hard water prepared by addition of reagent grade salts to dechlorinated municipal tap water for *H. azteca* according to a recipe provided in Environment Canada (2013); and dechlorinated municipal tap water for *O. mykiss*.

For the *H. azteca* tests, all of the site waters were supplemented with 25 mg/L chloride and 0.02 mg/L bromide using NaCl and NaBr, respectively, according to recommendations of the *Hyalella* Advisory Group (chaired by Chris Ingersoll, USGS) (Norberg-King et al., 2014), since low concentrations of these halides are known to impair growth of this species. The laboratory control water contained approximately 75 mg/L chloride and 0.8 mg/L bromide, respectively.

Fathead minnows are known to be susceptible to adverse effects caused by fungi and microbes (Grothe and Johnson, 1996; Ksoz et al., 2997; Downey et al. 2000). Results of toxicity tests and Toxicity Identification Evaluation efforts conducted in 2015 indicated that artefactual toxicity (i.e., adverse effects that were not associated with toxicants in the sample) had occurred in fathead minnow tests using ambient water samples from the Elk Valley and amendment of the samples with a low dose of copper appeared to counteract the adverse effect. Consequently, the *P. promelas* tests were tested on both untreated samples, as well as following the addition of 10 µg/L copper, in order to reduce the potential adverse effects caused by fungi and microbes in the samples. A copper-amended control water treatment was also evaluated to test whether the copper itself caused any adverse response.

Statistical analyses were performed using CETIS (Tidepool Scientific Software, 2013), and involved comparison of results to both the laboratory and site water controls.

Table 2. Test conditions: *Ceriodaphnia dubia* survival and reproduction single concentration test.

Test species	*Ceriodaphnia dubia*
Organism source	In-house culture
Organism age	<24 hour old neonates, produced within a 12 hour window
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20-mL glass test tube
Test volume	15 mL
Test solution depth	10 cm
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	10 per treatment
Number of organisms	1 per replicate
Control/dilution water	20% Perrier water and 80% deionized water + 5 µg/L Se and 2 µg/L vitamin B12
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	Daily with *Pseudokirchneriella subcapitata* and YCT (3:1 ratio)
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival and reproduction checked daily
Test protocol	Environment Canada (2007a), EPS 1/RM/21
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods; no ephippia present
Reference toxicant	Sodium chloride (NaCl)

Table 3. Test conditions: *Pseudokirchneriella subcapitata* growth inhibition single concentration test.

Test species	*Pseudokirchneriella subcapitata*, strain UTCC# 37
Organism source	In-house axenic culture, obtained from Canadian Phycological Culture Center, and originally isolated from Nivelta River, Norway.
Organism age	3-to 7-day old culture in logarithmic growth phase
Test type	Static
Test duration	72 hours
Test vessel	Microplate
Test volume	220 µL
Test concentrations	95.2% (v/v), plus laboratory control
Test replicates	4 per treatment; 8 for laboratory control
Number of organisms	10,000 cells/mL
Control/dilution water	Deionized water supplemented with nutrients
Test solution renewal	None
Test temperature	24 ± 2°C
Feeding	None
Light intensity	3600 to 4400 lux
Photoperiod	24 hours light
Aeration	None
Test measurements	Test area temperature measured daily; temperature and pH measured at test initiation; pH of two control wells measured at test termination
Test protocol	Environment Canada (2007b), EPS 1/RM/25
Statistical software	CETIS Version 1.8.7
Test endpoints	Algal cell growth inhibition
Test acceptability criteria for controls	>16-fold increase in number of algal cells; CV ≤ 20%; no trend when analyzed using Mann-Kendall test
Reference toxicant	Zinc (added as $ZnCl_2$)

Table 4. Test conditions: *Hyalella azteca* survival and growth single concentration test.

Test species	*Hyalella azteca*
Organism source	Aquatic Research Organisms, NH
Organism age	7- to 8-days old
Test type	Static-renewal
Test duration	28 days
Test vessel	375-mL glass container
Test volume	300 mL
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	5 per treatment
Number of organisms	10 per replicate
Control/dilution water	Reconstituted water containing ~75 mg/L Cl and 0.8 mg/L Br (Environment Canada 2013). Samples supplemented with 25 mg/L Cl and 0.02 mg/L Br.
Test solution renewal	Twice daily (~80% renewal)
Test temperature	23 ± 1°C
Feeding	1 mL of YCT daily to each container. Tetramin daily, with amounts increasing weekly: Week 1: 0.25 mg, Week 2: 0.5 mg, Week 3: 1 mg, Week 4: 1.5 mg in each test container.
Light intensity	500 to 1000 lux at water surface
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured upon arrival; total ammonia measured at test initiation and termination
Test protocol	Modified from US EPA (2000), as described in Norberg-King et al. (2014)
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival and dry weight
Test acceptability criteria for controls	Mean control survival of ≥80% survival
Reference toxicant	Sodium chloride (NaCl)

Table 5. Test conditions: *Pimephales promelas* survival and growth single concentration test.

Test species	*Pimephales promelas*
Organism source	Aquatox, Hot Springs, AR
Organism age	<24 hours
Test type	Static-renewal
Test duration	From egg stage until 28 days post hatch
Test vessel	1-L plastic container
Test volume	1 L
Test concentrations	100% (undiluted) sample, plus laboratory control
Test replicates	4 per treatment
Number of organisms	10 per replicate
Control/dilution water	Dechlorinated City of Calgary municipal tapwater
Test solution renewal	Daily (80% renewal)
Test temperature	25 ± 1°C
Feeding	Twice a day, after hatch, with newly hatched brine shrimp (*Artemia* nauplii)
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None unless dissolved oxygen fell to less than 60% saturation
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity measured upon arrival; survival checked daily
Test protocol	US EPA (1996) and ASTM (2013)
Statistical software	CETIS Version 1.8.7
Test endpoints	Hatch, survival, length, biomass, normal development (which assesses incidence of deformities)
Test acceptability criteria for controls	>66% hatch, ≥70% post-hatch survival
Reference toxicant	Sodium chloride (NaCl)

Table 6. Test conditions: *Oncorhynchus mykiss* embryo-alevin test.

Test organism	*Oncorhynchus mykiss*
Test organism source	Vancouver Island Trout Hatchery, Duncan, BC
Gamete quality	Small amount of water added to milt on a dry glass slide; verification of vigorous sperm motility using a compound microscope (100 X magnification)
Test organism age	<30 minutes post fertilization, <24 hour old gametes
Test type	Static renewal
Test duration	30 days
Test vessel	2-L plastic containers
Test volume	2 L
Test solution depth	17 cm
Test concentrations	100% (v/v), plus laboratory control
Test replicates	4 test replicates per treatment
No. of organisms	30 eggs per replicate
Control water	City of Burnaby dechlorinated municipal tap water (hardness 12 mg/L $CaCO_3$)
Test solution renewal	Daily (80% renewal)
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24 hours dark; low intensity light used during solution renewals
Aeration	6.5 ± 1 mL/min/L
Test protocol	Environment Canada (1998)
Statistical software	CETIS
Test endpoint	Survival, viability (which assesses incidence of deformities), length, wet weight
Test acceptability criteria for controls	≥65% normal hatched fish
Reference toxicant	Sodium dodecyl sulphate (SDS)

3.0 RESULTS

Results of the toxicity tests using *C. dubia* are provided in Table 7. The Fording River site water (FR_UFR1), Elk River site water (GH_ER2) and laboratory water control performed similarly for this species, indicating that there was no adverse effect associated with the upstream Fording River and Elk River stations. No adverse effect was observed on survival of *C. dubia*; survival was 100% in all of the samples. Compared to the laboratory and site water controls, a statistically significant reduction in *C. dubia* reproduction was observed in three samples (FR_FRCP1, EV_MC2 and CM_MC2). Percent reduction compared to the laboratory control was 37, 34 and 32% for FR_FRCP1, EV_MC2 and CM_MC2, respectively. Compared to the Fording River site water control, percent reduction was 32% for FR_FRCP1, 28% for EV_MC2 and 26% for CM_MC2. Compared to the Elk River site water control, percent reduction was 34%, 30% and 28% for FR_FRCP1, EV_MC2 and CM_MC2, respectively.

Results of the toxicity tests using *P. subcapitata* are provided in Table 8. In these tests, the Fording River and Elk River site water controls produced 3.9 to 4.0-fold greater growth than the laboratory water control. This finding is not unusual, since the higher ionic strength associated with the site water controls would be expected to stimulate cell growth of this species relative to the very low ionic strength associated with the laboratory control water. Similarly, the other samples also exhibited a stimulation of cell growth relative to the laboratory water control; none of the samples exhibited a statistically significant reduction in cell growth relative to the laboratory water control. Compared to the site water controls, a statistically significant reduction in cell yield was observed for FR_FRCP1; percent reduction was 9% compared to the Fording River site water control and 7% compared to the Elk River site water control.

Results of the toxicity tests using *H. azteca* are provided in Table 9. Survival and dry weight in the Fording River site water and laboratory water control were similar for this species, indicating that there were no adverse effects associated with the sample from the upstream Fording River station. No adverse effect was observed on survival of *H. azteca*; survival ranged from 86 to 98% in the samples. Compared to the laboratory control, there was no adverse effect on dry weight in any of the samples. Compared to the Fording River site water control, a statistically significant reduction in dry weight was observed for one sample (FR_FRCP1); percent reduction compared to the Fording River site water control was 17%.

Results of the untreated and copper amended toxicity tests using *P. promelas* are provided in Tables 10 and 11, respectively. Survival and biomass in the untreated Fording River site control were statistically significantly lower than the untreated laboratory control; percent reduction was 72% for survival and 60% for biomass. Hatch, length and normal development were similar in

the untreated Fording River site control and untreated laboratory control for this species, indicating that there was no adverse or stimulatory effects associated with the upstream Fording River station for these endpoints.

A statistically significant reduction in *P. promelas* survival was observed in all untreated samples compared to the untreated laboratory control; percent reduction was 81%, 61% and 15% for FR_FRCP1, GH_FR1 and CM_MC2, respectively. Compared to the untreated laboratory control, a statistically significant reduction in biomass was observed in two untreated samples (FR_FRCP1 and GH_FR1); percent reduction was 66% for FR_FRCP1 and 38% for GH_FR1. There were no adverse effects on hatch, length, or normal development (i.e., incidence of deformities) in the untreated samples compared to the untreated laboratory control. There were no adverse effects on hatch, survival, biomass, length or normal development (i.e., incidence of deformities) in the untreated samples when compared to the untreated Fording River site control.

The effects that were observed on fathead minnows in the untreated tests were restricted to mortalities, and occurred predominantly between days 6 and 12 of the tests. Fathead minnows are known to be susceptible to adverse effects caused by fungi and microbes (Grothe and Johnson, 1996; Ksoz et al., 1997; Downey et al. 2000). These effects have been termed "sporadic mortality phenomenon", and are associated with mortalities that generally occur beginning on day 4 of the 7-day test with this species (Downey et al. 2000); this age is equivalent to day 6 of the 32-day test, which starts with an earlier life-stage. Effects associated with this phenomenon are generally associated with a high degree of between-replicate variability, as was observed in these 32-day tests. Thus, the pattern of effects observed with the samples tested here is consistent with effects caused by sporadic mortality phenomenon.

The samples, Fording River site control and laboratory control were also tested with the addition of 10 µg/L Cu, to reduce fungal and microbial growth in the samples throughout the test. Survival and biomass in the copper-amended Fording River site control were statistically significantly lower than the copper-amended laboratory control; percent reduction was 42% for survival and 43% for biomass. The adverse effect observed on survival and biomass in this sample was primarily related to mortalities that occurred in the final 24 h of the test; survival on day 31 of exposure was 85 ± 10% (which was not statistically different from the control), but was 53.3 ± 9.4% the following day in this sample. Dissolved oxygen measured in the sample on the final day of the test was 5.7 mg/L, which was within the acceptable range for this species, but it is possible that stress associated with depressed dissolved oxygen contributed to the adverse effect. Otherwise, the cause of the mortalities was not immediately apparent, but did not appear to be related to effects of fungal growth based on the appearance of the fish.

Hatch, length and normal development (i.e. incidence of deformities) were similar in the copper amended Fording River site control and copper amended laboratory control. There were no adverse effects on hatch, survival, biomass, length or normal development (i.e., incidence of deformities) in the copper amended samples when compared to the copper amended Fording River site control and copper amended laboratory control.

Results of the toxicity tests using *O. mykiss* are provided in Table 12. The Fording River site water, Elk River site water and laboratory water control performed similarly for this species, indicating that there was no adverse effect associated with the upstream Fording River and Elk River stations. Compared to the laboratory control water, a statistically significant reduction in survival and viability of *O. mykiss* was observed in all samples except GH_ERC; percent reduction ranged from 13 to 56% for survival and from 13 to 54% for viability. There were no adverse effects on length or wet weight in the samples compared to the laboratory control water.

Compared to the Fording River site water control, a statistically significant reduction in survival and viability of *O. mykiss* was observed in four samples (FR_FRCP1, GH_FR1, EV_HC1 and LC_LCDSSLCC). Percent reduction in survival ranged from 24 to 51% and from 23 to 49% for viability. A small but statistically significant reduction (4%) in length was observed in one sample (GH_ERC) compared to the Fording River site water control. There was no adverse effect on wet weight compared to the Fording River site water control.

Compared to the Elk River site water control, a statistically significant reduction in survival of *O. mykiss* was observed for four samples (FR_FRCP1, GH_FR1, EV_HC1 and LC_LCDSSLCC); percent reduction ranged from 27 to 53%. A statistically significant reduction in viability was observed in five samples (FR_FRCP1, GH_FR1, EV_HC1, CM_MC2 and LC_LCDSSLCC) compared to the Elk River site water control; percent reduction ranged from 14 to 53%. There was no adverse effect on length or wet weight compared to the Elk River site water control.

There were no observations of unusual behaviour of *O. mykiss* in any of the test solutions, and the survival and viability endpoints were similar, indicating a low rate of deformities in all samples. A hatch rate was not calculated in these tests; however, the survival endpoint provides an appropriate measure of successful hatch, since the test is terminated shortly following hatch.

Table 7. Results: *Ceriodaphnia dubia* survival and reproduction test.

Sample ID	Survival (%)	Reproduction (Mean ± SD)
Laboratory Control	100	22.5 ± 2.7
FR_UFR1 (Site Control)	100	20.7 ± 2.5
GH_ER2 (Site Control)	100	21.3 ± 3.9
FR_FRCP1	100	14.1 ± 4.5 $^{*\,\alpha\,\beta}$
GH_FR1	100	18.6 ± 2.8
GH_ERC	100	18.9 ± 4.0
EV_MC2	100	14.9 ± 5.4 $^{*\,\alpha\,\beta}$
EV_HC1	100	19.8 ± 2.9
CM_MC2	100	15.3 ± 4.5 $^{*\,\alpha\,\beta}$
LC_LCDSSLCC	100	21.2 ± 4.0

SD = Standard Deviation
* Result was significantly lower than the laboratory control
$^{\alpha}$ Result was significantly lower than the site control FR_UFR1
$^{\beta}$ Result was significantly lower than the site control GH_ER2

Table 8. Results: *Pseudokirchneriella subcapitata* growth inhibition test.

Sample ID	Cell Yield (x 10^4 cells/mL) (Mean ± SD)	Stimulation relative to laboratory control (%)
Laboratory Control	30.9 ± 1.5	-
FR_UFR1 (Site Control)	154.3 ± 9.5	399.6
GH_ER2 (Site Control)	152.0 ± 8.1	392.3
FR_FRCP1	141.0 ± 2.9 $^{\alpha\,\beta}$	356.7
GH_FR1	158.5 ± 1.9	413.4
GH_ERC	156.8 ± 10.4	407.7
EV_MC2	166.3 ± 2.2	438.5
EV_HC1	157.8 ± 2.2	410.9
CM_MC2	156.0 ± 10.1	405.3
LC_LCDSSLCC	156.0 ± 4.5	405.3

SD = Standard Deviation
$^{\alpha}$ Result was significantly lower than the site control FR_UFR1
$^{\beta}$ Result was significantly lower than the site control GH_ER2

Table 9. Results: *Hyalella azteca* survival and growth test.

Sample ID	(Mean ± SD)	
	Survival (%)	Dry weight (mg)
Laboratory Control	98.0 ± 4.5	0.63 ± 0.03
FR_UFR1 (Site Control)	94.0 ± 5.5	0.71 ± 0.07
FR_FRCP1	94.0 ± 8.9	0.60 ± 0.08 $^{\alpha}$
GH_FR1	86.0 ± 20.7	0.58 ± 0.23
CM_MC2	98.0 ± 4.5	0.71 ± 0.05

SD = Standard Deviation
$^{\alpha}$ Result was significantly lower than the site control FR_UFR1

Table 10. Results: *Pimephales promelas* survival and growth test (untreated samples).

Sample ID	(Mean ± SD)				
	Hatch (%)	Survival (%)	Biomass (mg)	Length (mm)	Normal development (%)
Laboratory Control	100 ± 0.0	90.0 ± 3.8	0.71 ± 0.02	8.1 ± 0.2	100 ± 0.0
FR_UFR1 (Site Control)	100 ± 0.0	25.0 ± 10.0 *	0.28 ± 0.02 *	9.2 ± 1.2	91.7 ± 16.7
FR_FRCP1	100 ± 0.0	16.7 ± 17.6 *	0.24 ± 0.17 *	10.6 ± 3.0	100 ± 0.0
GH_FR1	98.3 ± 3.3	35.0 ± 16.7 *	0.44 ± 0.13*	9.3 ± 0.8	100 ± 0.0
CM_MC2	100± 0.0	76.7 ± 11.6 *	0.65 ± 0.03	8.4 ± 0.4	95.4 ± 9.1

SD = Standard Deviation
* Result was significantly lower than the laboratory control

Table 11. Results: *Pimephales promelas* survival and growth test (copper amended samples).

Sample ID	(Mean ± SD)				
	Hatch (%)	Survival (%)	Biomass (mg)	Length (mm)	Normal development (%)
Laboratory Control [+Cu]	100 ± 0.0	91.7 ± 3.3	0.73 ± 0.02	7.7 ± 0.2	98.1 ± 3.8
FR_UFR1 (Site Control) [+Cu]	100 ± 0.0	53.3 ± 9.4 *	0.42 ± 0.07 *	7.5 ± 0.2	100 ± 0.0
FR_FRCP1 [+Cu]	96.7 ± 3.8	80.0 ± 9.4	0.69 ± 0.06	7.9 ± 0.4	100 ± 0.0
GH_FR1 [+Cu]	98.3 ± 3.3	81.7 ± 8.4	0.67 ± 0.06	7.8 ± 0.2	100 ± 0.0
CM_MC2 [+Cu]	100 ± 0.0	96.7 ± 3.8	0.67 ± 0.03	7.9 ± 0.1	100 ± 0.0

SD = Standard Deviation
* Result was significantly lower than the copper amended laboratory control

Table 12. Results: *Oncorhynchus mykiss* embryo-alevin test.

Sample ID	(Mean ± SD)			
	Survival (%)	Viability (%)	Length (mm)	Wet weight (mg)
Laboratory Control	93.3 ± 6.1	90.0 ± 6.1	19.8 ± 0.2	82.8 ± 0.7
FR_UFR1 (Site Control)	85.0 ± 4.3	81.7 ± 1.9	20.0 ± 0.1	85.0 ± 2.1
GH_ER2 (Site Control)	89.2 ± 5.0	87.5 ± 6.3	20.0 ± 0.3	85.2 ± 2.6
FR_FRCP1	50.0 ± 6.8 $^{*\alpha\beta}$	49.1 ± 5.2$^{*\alpha\beta}$	19.5 ± 0.3	82.8 ± 2.5
GH_FR1	41.4 ± 18.3 $^{*\alpha\beta}$	41.4 ± 18.3$^{*\alpha\beta}$	19.4 ± 0.9	86.8 ± 0.3
GH_ERC	91.7 ± 5.8	91.7 ± 5.8	19.2 ± 0.6 $^{\alpha}$	85.2 ± 3.5
EV_MC2	81.6 ± 8.5 *	79.0 ± 6.5*	20.1 ± 0.2	91.2 ± 3.2
EV_HC1	56.3 ± 15.1 $^{*\alpha\beta}$	53.0 ± 12.4$^{*\alpha\beta}$	19.3 ± 0.4	86.3 ± 2.3
CM_MC2	81.4 ± 14.9 *	75.4 ± 13.2$^{*\beta}$	20.2 ± 0.2	90.9 ± 2.1
LC_LCDSSLCC	64.5 ± 7.4$^{*\alpha\beta}$	62.8 ± 8.6$^{*\alpha\beta}$	20.6 ± 0.2	96.2 ± 8.8

SD = Standard Deviation
* Result was significantly lower than the laboratory control
$^{\alpha}$ Result was significantly lower than the site control FR_UFR1
$^{\beta}$ Result was significantly lower than the site control GH_ER2

4.0 QA/QC

The health histories of the test organisms used in the exposures were acceptable and met the requirements of the test protocols. The tests met all control acceptability criteria and water quality parameters remained within the ranges specified in the protocols throughout the tests. Uncertainty associated with these tests is best described by the standard deviations around the means.

There were no deviations from test methodology, other than the planned modification to the *H. azteca* method and addition of copper in the *P. promelas* tests, as described in Section 2.0, with the exception that in the *O. mykiss* test, the eggs were fertilized with milt that was pooled from two males, rather than four as specified in the method, since the remaining samples of milt provided by the hatchery exhibited poor motility. However, the control met the acceptability criterion, indicating that the eggs were successfully fertilized and, therefore, this minor deviation would not be expected to have affected the test results.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 13. The result for survival in the *P. promelas* reference toxicant test was marginally outside the historical two standard deviation range; however, this would be expected to occur by chance alone in 5% of cases. Moreover, the result for biomass in this reference toxicant test fell within the historical two standard deviation range, indicating that the fish were of appropriate sensitivity. Consequently, the results from this reference toxicant test were considered to be acceptable. Results for the remaining reference toxicant tests fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in these tests was considered to be appropriate.

Table 13. Reference toxicant test results.

Test species	Endpoint	Historical mean (2 SD Range)	CV (%)	Test date
C. dubia	Survival (LC50): 2.0 g/L NaCl	2.0 (1.8 – 2.2)	5	October 13, 2016
	Reproduction (IC50): 1.4 g/L NaCl	1.6 (1.2 – 2.0)	13	
P. subcapitata	Growth (IC50): 36.9 µg/L Zn	32.6 (24.0 – 44.3)	16	October 14, 2016
H. azteca	Survival (LC50): 6.0 g/L NaCl	5.6 (4.9 – 6.4)	7	October 18, 2016
P. promelas	Survival (LC50): 0.6 g/L NaCl	0.7 (0.7 – 0.8)	4	October 24, 2016
	Biomass (IC25): 0.5 g/L NaCl	0.5 (0.4 – 0.7)	10	
O. mykiss	Viability (EC50): 3.8 mg/L SDS	4.0 (2.0 – 7.8)	40	October 18, 2016

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration, EC = Effect Concentration

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APPENDIX A – *Ceriodaphnia dubia* Toxicity Test Data

Ceriodaphnia dubia Summary Sheet

Client: Teck coal
Work Order No.: 161119

Start Date/Time: Oct 20/16 @1500
Set up by: EMM/JTS

Sample Information:

Sample ID: Teck various pass/fail samples (+)
Sample Date: oct 17/16
Date Received: oct 18/16
Sample Volume: all samples 6x2L except
LC_LCOSSLCC - 9x2L

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 101216A
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 20
Mortality (%) in previous 7 d: 5
Individual female # used ≥8 young on test day 4,5,6,7,9,10,13,14,15,16,18,19,20

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd150
Stock Solution ID: 16NaCl
Date Initiated: Oct 13/16

7-d LC50 (95% CL): 2.0 (1.9-2.3) g/L NaCL
7-d IC50 (95% CL): 1.4 (1.2-1.7) g/L NaCL

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCL CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.6 (1.2-2.0) g/L NaCL CV (%): 13

(+) Test Results:

	Survival (%)	Reproduction (Mean ± SD)
Negative Control (2)	100	22.5 ± 2.7
FR_UFR1_@_03102016_N (1)	100	20.7 ± 2.5
GH_EF2_WS_2016-10-17_N	100	21.3 ± 3.9
FR_FRCP1_@_03102016_N	100	14.1 ± 4.5 ab*
GH_FR1_WS_2016-10-17_N	100	18.6 ± 2.8
GH_FRC_WS_2016-10-17_N	100	18.9 ± 4.0
EV_MC2_WS_2016-10-17_N	100	14.9 ± 5.4 ab*
EV_HC1_WS_2016-10-17_N	100	19.8 ± 2.9
CM_MC2_WS_2016-10-17_N	100	15.3 ± 4.5 ab*
LC_LCOSSLCC_WS_2016-10-17	100	21.2 ± 4.0

a = reproduction that was significantly lower than the lab control.
b = reproduction that was significantly lower than the site control (FR_UFR1)
(1) site control = FR_UFR1
(2) negative control = lab control

* result that was significantly lower than the site control (GH_EF2)

Reviewed by: JGH
Date reviewed: Dec. 20/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck coal
Sample ID: various passfail samples
Work Order #: 16119

Start Date & Time: OCT 20/16 @ 1500
Stop Date & Time: OCT 26/16 2130
Test Species: *Ceriodaphnia dubia*

Concentration: lab control	Days											final		
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.2	7.8	8.1	7.5	8.0	8.0	8.2	7.5	8.2	7.4	8.0	7.3		
pH	7.9	7.7	8.0	7.9	8.0	8.0	8.2	7.8	7.9	7.8	8.0	7.7		
Cond. (µS/cm)	219	219		224		220		222		221		220		
Initials	JS	EMM		MLT		JW		JS		EMM		EMM		

Concentration: 100% (v/v) FR_UFR1	Days											final		
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.2	7.8	8.0	7.5	8.0	8.0	8.0	7.5	8.0	7.6	8.2	7.3		
pH	8.0	7.9	8.0	7.9	7.9	8.0	8.0	7.8	7.9	7.8	7.9	7.8		
Cond. (µS/cm)	337	338		332		8.2 339		343		339		333		
Initials	JS	EMM		MLT		JW		JS		EMM		EMM		

Concentration: 100% (v/v) GH_FR2	Days											final		
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.2	7.7	8.0	7.5	8.3	7.9	8.2	7.5	8.0	7.6	8.1	7.4		
pH	7.9	7.9	7.9	8.0	7.9	8.0	8.0	8.0	7.8	8.0	7.9	7.8		
Cond. (µS/cm)	308	308		306		8.2 308		315		309		314		
Initials	JS	EMM		MLT		JW		JS		EMM		EMM		

Concentration: 100% (v/v) FR_FRCP1	Days											final		
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.2	7.7	8.0	7.5	8.3	7.9	8.2	7.5	8.0	7.6	8.2	7.5		
pH	8.0	8.0	8.0	8.0	7.9	7.9	7.9	8.0	7.9	8.0	7.9	7.9		
Cond. (µS/cm)	831	826		836		8.2 835		840		835		840		
Initials	JS	EMM		MLT		JW		JS		EMM		EMM		

Thermometer: 4 **DO meter:** 21 **pH meter:** 21 **Conductivity meter:** 21

	Control	see HA sheet for 100% sample
Hardness*	100	hardness + alkalinity
Alkalinity*	98	

* mg/L as CaCO3

Analysts: JS, JW, EMM, MLT
Reviewed by: JW
Date reviewed: Dec. 20/16

Sample Description: all samples except FR_FRCP1 are clear, colourless, odourless, no particulate
FR_FRCP1 is clear, colourless, odourless w/ some brown particulates

Comments: **Broodboard Used:** 101216A

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck coal
Sample ID: various possible samples
Work Order #: 16119

Start Date & Time: OCT 20/16 @ 1500
Stop Date & Time: OCT 26/16 @ 2130
Test Species: *Ceriodaphnia dubia*

100%(v/v) Concentration GH-FR1	Days											final 6		7
	0	1		2		3		4		5				
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	8.0	7.5	8.3	7.9	8.2	7.6	8.2	7.5	8.2	7.3		
pH	8.0	8.1	8.0	8.0	7.9	~~8.0~~	8.0	8.0	7.9	8.0	7.9	8.0		
Cond. (µS/cm)	741	744		746		8.3 751		749		748		742		
Initials	JS	EMM		MLT		JW		JS		EMM		EMM		

100%(v/v) Concentration GH-FR2	Days											final 6		7
	0	1		2		3		4		5				
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	7.9	7.5	8.3	7.9	8.2	7.6	8.2	7.4	8.2	7.3		
pH	8.0	8.0	8.0	8.0	8.0	~~8.0~~	8.0	8.0	7.8	8.0	7.9	7.9		
Cond. (µS/cm)	337	337		335		8.2 332		340		339		342		
Initials	JS	EMM		MLT		JW		JS		EMM		EMM		

100%(v/v) Concentration EV-MC2	Days											final 6		7
	0	1		2		3		4		5				
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	7.9	7.5	8.1	7.9	8.2	7.6	8.2	7.5	8.0	7.3		
pH	7.8	7.9	7.8	8.0	7.9	~~8.0~~	8.0	8.0	7.8	8.0	7.9	7.8		
Cond. (µS/cm)	362	369		361		8.1 360		366		369		365		
Initials	JS	EMM		MLT		JW		JS		EMM		EMM		

100%(v/v) Concentration EV-HC1	Days											final 6		7
	0	1		2		3		4		5				
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.7	8.0	7.5	8.2	7.9	8.1	7.6	8.2	7.5	8.1	7.4		
pH	8.1	8.1	8.1	8.1	8.0	~~8.0~~	8.0	8.1	7.9	8.1	7.9	8.0		
Cond. (µS/cm)	682	691		684		8.4 683		708		690		701		
Initials	JS	EMM		MLT		JW		JS		EMM		EMM		

Thermometer: 4 **DO meter:** 2/1 **pH meter:** 2/1 **Conductivity meter:** 2/1

	Control	See H/A Sheet for 100% sample		
Hardness*	100	hardness + alkalinity		
Alkalinity*	98			

* mg/L as CaCO3

Analysts: ~~See page 1~~ JS, EMM, MLT, JW
Reviewed by: JSole
Date reviewed: Dec. 20/16

Sample Description: See page 1

Comments: **Broodboard Used:** 101216A

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck coal
Sample ID: various possible samples
Work Order #: 16119

Start Date & Time: Oct 20/16 @ 1500
Stop Date & Time: Oct 26/16 @ 2130
Test Species: *Ceriodaphnia dubia*

100% (v/v) Concentration CM-MC2	Days														
	0	1		2		3		4		5		final 6		7	
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final	
Temperature (°C)	24.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0			
DO (mg/L)	8.0	7.6	8.0	7.5	8.1	7.9	8.1	7.6	8.2	7.5	8.2	7.4			
pH	8.1	8.0	8.1	8.1	8.0	8.0	8.0	8.1	7.9	7.8	7.9	8.0			
Cond. (µS/cm)	639	648		648		639		645		640		642			
Initials	JS	EMM		MLT		JW		JS		EMM		EMM			

100% (v/v) Concentration LC-LCDSSLCC	Days														
	0	1		2		3		4		5		final 6		7	
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final	
Temperature (°C)	24.0	25.0	25.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0			
DO (mg/L)	8.1	7.8	7.9	7.5	8.1	7.9	8.2	7.6	8.2	7.5	8.1	7.4			
pH	8.1	8.1	8.1	8.1	8.0	8.3	8.3	8.1	7.9	8.0	7.9	7.9			
Cond. (µS/cm)	708	716		710		726		724		722		723			
Initials	JS	EMM		MLT		JW		JS		EMM		EMM			

Concentration	Days														
	0	1		2		3		4		5		6		7	
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final	
Temperature (°C)															
DO (mg/L)															
pH															
Cond. (µS/cm)															
Initials															

Concentration	Days														
	0	1		2		3		4		5		6		7	
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final	
Temperature (°C)															
DO (mg/L)															
pH															
Cond. (µS/cm)															
Initials															

Thermometer: 4 DO meter: 2/1 pH meter: 2/1 Conductivity meter: 2/1

	Control	See H/A sheet for 100% sample hardness + alkalinity
Hardness*	100	
Alkalinity*	98	

* mg/L as CaCO3

Analysts: See page 1
JS, EMM, MLT, JW
Reviewed by: JW
Date reviewed: Dec. 20/16

Sample Description: see page 1

Comments: **Broodboard Used:** 10216A

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck Coal
Sample ID: various samples pass/fail
Work Order: 161119

Start Date & Time: OCT 20/16 @ 1500
Stop Date & Time: OCT 26/16 @ 2130
Set up by: EMM/JS

100% (v/v)

Days	Concentration: control										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	~~JW~~ MLT
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	3	3	4	5	6	4	5	2	4	4	JS
5	8	8	9	8	8	7	7	6	8	7	EMM
6	11	11	10	12	11	12	11	8	13	10	EMM
7											
8											
Total	22	22	23	25	25	23	23	16	25	21	EMM

Days	Concentration: FR_UFR1										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	~~JW~~ MLT
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	4	4	3	3	4	4	3	4	5	3	JS
5	7	6	6	8	8	7	✓	6	8	8	EMM
6	10	11	11	10	12	10	12	10	11	9	EMM
7											
8											
Total	21	21	20	21	24	21	15	20	24	20	EMM

Days	Concentration: GH_ER2										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	~~MLT~~ MLT
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	4	4	4	4	2	4	4	3	4	3	JS
5	8	8	9	9	6	10	9	6	8	8	EMM
6	13	10	11	/	11	12	11	9	9	10	EMM
7											
8											
Total	25	22	24	13	19	26	24	18	21	21	EMM

MLT

Days	Concentration: FR_FRCP1										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	—	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	~~JW~~ MLT
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	4	2	3	3	2	4	3	4	2	3	JS
5	8	8	9	9	6	✓	8	9	7	8	EMM
6	9	8	6	/	/	8	/	/	/	8	EMM
7											
8											
Total	21	18	18	12	8	12	11	13	9	19	EMM

Days	Concentration: GH_FR1										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	—	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	~~JW~~ MLT
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	2	3	4	4	3	2	3	3	4	2	JS
5	8	9	8	7	8	8	6	9	9	7	EMM
6	10	8	/	8	9	6	10	9	8	9	EMM
7											
8											
Total	20	20	12	19	20	16	19	21	21	18	EMM

Days	Concentration: GH_ER6										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	~~JW~~ EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	2	3	2	2	2	5	4	4	4	3	JS
5	6	6	7	7	5	6	8	✓	7	7	EMM
6	11	11	13	12	11	/	12	9	10	10	EMM
7											
8											
Total	19	20	22	21	18	11	24	13	21	20	EMM

EMM MLT

Days	Concentration: EV_MC2										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	~~JW~~ MLT
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	3	4	4	2	3	5	4	4	3	3	JS
5	6	6	8	7	6	✓	7	6	6	7	EMM
6	11	10	/	/	/	12	/	11	/	11	EMM
7											
8											
Total	20	20	12	9	9	17	11	21	9	21	EMM

Days	Concentration: EV_HC1										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	~~JW~~ MLT
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	3	3	3	4	4	3	4	4	3	3	JS
5	✓	7	10	✓	9	7	9	8	8	8	EMM
6	11	11	10	12	10	10	8	9	9	8	EMM
7											
8						20	21	21	20		
Total	14	21	23	16	23	~~16~~	~~23~~	~~21~~	19	EMM	

EMM EMM

Days	Concentration: CM_MC2										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	MLT
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	3	4	4	3	3	2	3	4	4	3	JS
5	9	9	8	6	9	6	8	8	7	5	EMM
6	10	/	9	/	/	10	/	/	8	8	EMM
7											
8											
Total	22	~~20~~ 013	21	9	12	18	11	12	19	16	EMM

Notes: X = mortality.

Sample Description: See water quality page

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JW

Date reviewed: Dec. 20/16

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck coal
Sample ID: various samples pass/fail
Work Order: 16119

100%(v/v)

Start Date & Time: Oct 20/16 @ 1500h
Stop Date & Time: Oct 26/16 @ 2130h
Set up by: EMM/JS

Concentration: LC_LCDSSLCC

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	~~JW~~ MLT
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	4	4	2	4	4	4	3	3	2	6	JS
5	10	9	8	10	11	9	8	9	✓	8	EMM
6	12	8	10	11	10	9	6	8	11	9	EMM
7											
8											
Total	26	21	20	25	25	22	17	20	13	23	EMM

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											~~JS~~
2											JS
3											
4											
5											
6											
7											
8											
Total											

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											~~JS~~
2											JS
3											
4											
5											
6											
7											
8											
Total											

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality.

Sample Description: See water quality page

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JGL

Date reviewed: Dec. 20/16

Version 2.1 Issued July 29, 2009

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Batch ID:	20-8803-2243	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	20 Oct-16 15:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	
Ending Date:	26 Oct-16 21:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 7h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	09-7285-1140	20 Oct-16	20 Oct-16	15h (25 °C)	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	76h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	87h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	75h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	87h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	87h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	74h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	76h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	87h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	87h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	control	Teck Coal	Lab Control		
(1) FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

6d Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	10	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	10	1	1	1	1	1	0	0	0.0%	0.0%
GH_ER2	10	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	10	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	10	1	1	1	1	1	0	0	0.0%	0.0%
GH_ERC	10	1	1	1	1	1	0	0	0.0%	0.0%
EV_MC2	10	1	1	1	1	1	0	0	0.0%	0.0%
EV_HC1	10	1	1	1	1	1	0	0	0.0%	0.0%
CM_MC2	10	1	1	1	1	1	0	0	0.0%	0.0%
LC_LCDSSLCC	10	1	1	1	1	1	0	0	0.0%	0.0%

Reproduction Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	10	22.5	20.58	24.42	16	25	0.8466	2.677	11.9%	0.0%
FR_UFR1	10	20.7	18.91	22.49	15	24	0.7895	2.497	12.06%	8.0%
GH_ER2	10	21.3	18.52	24.08	13	26	1.23	3.889	18.26%	5.33%
FR_FRCP1	10	14.1	10.86	17.34	8	21	1.433	4.533	32.15%	37.33%
GH_FR1	10	18.6	16.63	20.57	12	21	0.8718	2.757	14.82%	17.33%
GH_ERC	10	18.9	16.03	21.77	11	24	1.269	4.012	21.23%	16.0%
EV_MC2	10	14.9	11.06	18.74	9	21	1.696	5.363	36.0%	33.78%
EV_HC1	10	19.8	17.75	21.85	14	23	0.9043	2.86	14.44%	12.0%
CM_MC2	10	15.3	12.06	18.54	9	22	1.43	4.523	29.56%	32.0%
LC_LCDSSLCC	10	21.2	18.34	24.06	13	26	1.263	3.994	18.84%	5.78%

(1) lab control = negative control
FR_UFR1 = site control

Ceriodaphnia 7-d Survival and Reproduction Test **Nautilus Environmental**

6d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
FR_UFR1	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	1	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	1	1	1	1
GH_ERC	1	1	1	1	1	1	1	1	1	1
EV_MC2	1	1	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1
LC_LCDSSLCC	1	1	1	1	1	1	1	1	1	1

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	22	22	23	25	25	23	23	16	25	21
FR_UFR1	21	21	20	21	24	21	15	20	24	20
GH_ER2	25	22	24	13	19	26	24	18	21	21
FR_FRCP1	21	18	18	12	8	12	11	13	9	19
GH_FR1	20	20	12	19	20	16	19	21	21	18
GH_ERC	19	20	22	21	18	11	24	13	21	20
EV_MC2	20	20	12	9	9	17	11	21	9	21
EV_HC1	14	21	23	16	23	20	21	21	20	19
CM_MC2	22	13	21	9	12	18	11	12	19	16
LC_LCDSSLCC	26	21	20	25	25	22	17	20	13	23

6d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_UFR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ERC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
LC_LCDSSLCC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	12-9058-6161	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 12:44	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	20-8803-2243	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	20 Oct-16 15:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	
Ending Date:	26 Oct-16 21:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 7h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	09-7285-1140	20 Oct-16	20 Oct-16	15h (25 °C)	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	76h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	87h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	75h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	87h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	87h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	74h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	76h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	87h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	87h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	control	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_ER2	1	1.0000	Exact	Non-Significant Effect
Lab Control		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_ERC	1	1.0000	Exact	Non-Significant Effect
Lab Control		EV_MC2	1	1.0000	Exact	Non-Significant Effect
Lab Control		EV_HC1	1	1.0000	Exact	Non-Significant Effect
Lab Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect
Lab Control		LC_LCDSSLCC	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Negative Contr	10	0	10	1	0	0.0%
FR_UFR1		10	0	10	1	0	0.0%
GH_ER2		10	0	10	1	0	0.0%
FR_FRCP1		10	0	10	1	0	0.0%
GH_FR1		10	0	10	1	0	0.0%
GH_ERC		10	0	10	1	0	0.0%
EV_MC2		10	0	10	1	0	0.0%
EV_HC1		10	0	10	1	0	0.0%
CM_MC2		10	0	10	1	0	0.0%
LC_LCDSSLCC		10	0	10	1	0	0.0%

Analysis ID: 12-9058-6161 **Endpoint:** 6d Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 16 Nov-16 12:44 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

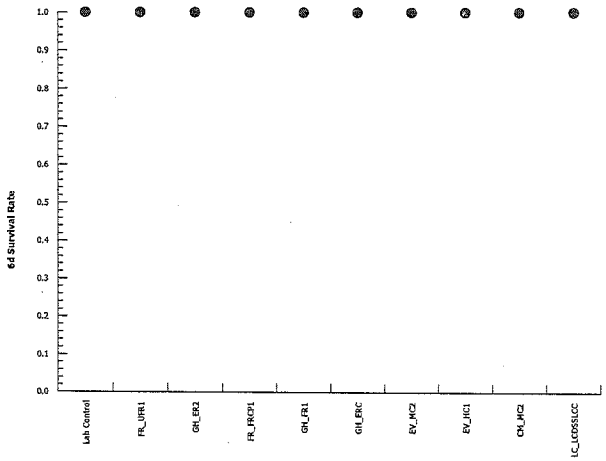
6d Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
FR_UFR1	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	1	1	1	1	1	1	1	1
FR_FRCP1	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	1	1	1	1
GH_ERC	1	1	1	1	1	1	1	1	1	1
EV_MC2	1	1	1	1	1	1	1	1	1	1
EV_HC1	1	1	1	1	1	1	1	1	1	1
CM_MC2	1	1	1	1	1	1	1	1	1	1
LC_LCDSSLCC	1	1	1	1	1	1	1	1	1	1

6d Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_UFR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
FR_FRCP1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ERC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_HC1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
CM_MC2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
LC_LCDSSLCC	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	01-8854-7522	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 12:44	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	20-8803-2243	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	20 Oct-16 15:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	
Ending Date:	26 Oct-16 21:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 7h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	09-7285-1140	20 Oct-16	20 Oct-16	15h (25 °C)	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	76h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	87h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	75h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	87h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	87h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	74h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	76h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	87h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	87h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	control	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	18.7%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	1.053	2.456	4.199	18	0.4966	CDF	Non-Significant Effect
		GH_ER2	0.702	2.456	4.199	18	0.6619	CDF	Non-Significant Effect
		FR_FRCP1	4.914	2.456	4.199	18	<0.0001	CDF	Significant Effect
		GH_FR1	2.281	2.456	4.199	18	0.0737	CDF	Non-Significant Effect
		GH_ERC	2.106	2.456	4.199	18	0.1059	CDF	Non-Significant Effect
		EV_MC2	4.446	2.456	4.199	18	0.0001	CDF	Significant Effect
		EV_HC1	1.579	2.456	4.199	18	0.2620	CDF	Non-Significant Effect
		CM_MC2	4.212	2.456	4.199	18	0.0003	CDF	Significant Effect
		LC_LCDSSLCC	0.7604	2.456	4.199	18	0.6355	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	798.61	88.73444	9	6.073	<0.0001	Significant Effect
Error	1315.1	14.61222	90			
Total	2113.71		99			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	10.59	21.67	0.3047	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9714	0.9654	0.0281	Normal Distribution

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	01-8854-7522	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 12:44	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

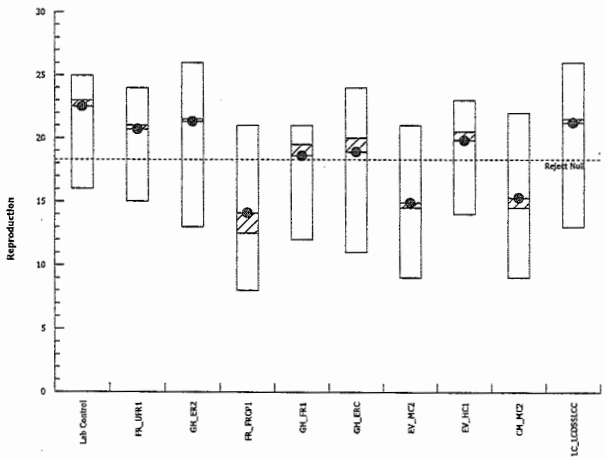
Reproduction Summary

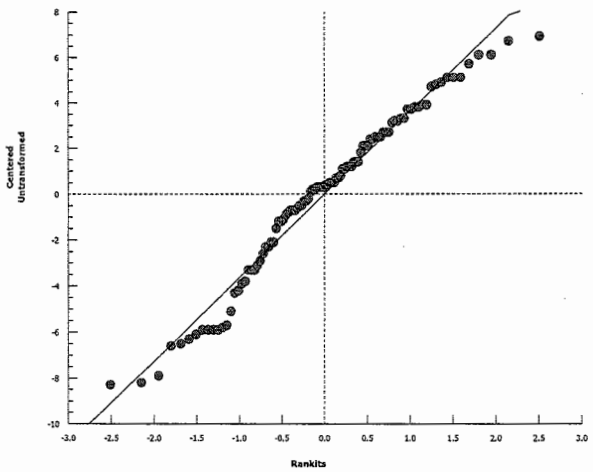
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	22.5	20.58	24.42	23	16	25	0.8466	11.9%	0.0%
FR_UFR1	10	20.7	18.91	22.49	21	15	24	0.7895	12.06%	8.0%
GH_ER2	10	21.3	18.52	24.08	21.5	13	26	1.23	18.26%	5.33%
FR_FRCP1	10	14.1	10.86	17.34	12.5	8	21	1.433	32.15%	37.33%
GH_FR1	10	18.6	16.63	20.57	19.5	12	21	0.8718	14.82%	17.33%
GH_ERC	10	18.9	16.03	21.77	20	11	24	1.269	21.23%	16.0%
EV_MC2	10	14.9	11.06	18.74	14.5	9	21	1.696	36.0%	33.78%
EV_HC1	10	19.8	17.75	21.85	20.5	14	23	0.9043	14.44%	12.0%
CM_MC2	10	15.3	12.06	18.54	14.5	9	22	1.43	29.56%	32.0%
LC_LCDSSLCC	10	21.2	18.34	24.06	21.5	13	26	1.263	18.84%	5.78%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	22	22	23	25	25	23	23	16	25	21
FR_UFR1	21	21	20	21	24	21	15	20	24	20
GH_ER2	25	22	24	13	19	26	24	18	21	21
FR_FRCP1	21	18	18	12	8	12	11	13	9	19
GH_FR1	20	20	12	19	20	16	19	21	21	18
GH_ERC	19	20	22	21	18	11	24	13	21	20
EV_MC2	20	20	12	9	9	17	11	21	9	21
EV_HC1	14	21	23	16	23	20	21	21	20	19
CM_MC2	22	13	21	9	12	18	11	12	19	16
LC_LCDSSLCC	26	21	20	25	25	22	17	20	13	23

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	17-1534-6129	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 12:47	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	20-8803-2243	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	20 Oct-16 15:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	
Ending Date:	26 Oct-16 21:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 7h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	76h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	87h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	75h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	87h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	87h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	74h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	76h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	87h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	87h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	20.6%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	-0.3414	2.424	4.259	18	0.9495	CDF	Non-Significant Effect
		FR_FRCP1	3.756	2.424	4.259	18	0.0012	CDF	Significant Effect
		GH_FR1	1.195	2.424	4.259	18	0.4090	CDF	Non-Significant Effect
		GH_ERC	1.024	2.424	4.259	18	0.4896	CDF	Non-Significant Effect
		EV_MC2	3.301	2.424	4.259	18	0.0049	CDF	Significant Effect
		EV_HC1	0.5122	2.424	4.259	18	0.7236	CDF	Non-Significant Effect
		CM_MC2	3.073	2.424	4.259	18	0.0095	CDF	Significant Effect
		LC_LCDSSLCC	-0.2845	2.424	4.259	18	0.9418	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	640.6889	80.08611	8	5.187	<0.0001	Significant Effect
Error	1250.6	15.43951	81			
Total	1891.289		89			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	8.714	20.09	0.3670	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9721	0.962	0.0498	Normal Distribution

Analysis ID: 17-1534-6129 **Endpoint:** Reproduction **CETIS Version:** CETISv1.8.7
Analyzed: 16 Nov-16 12:47 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

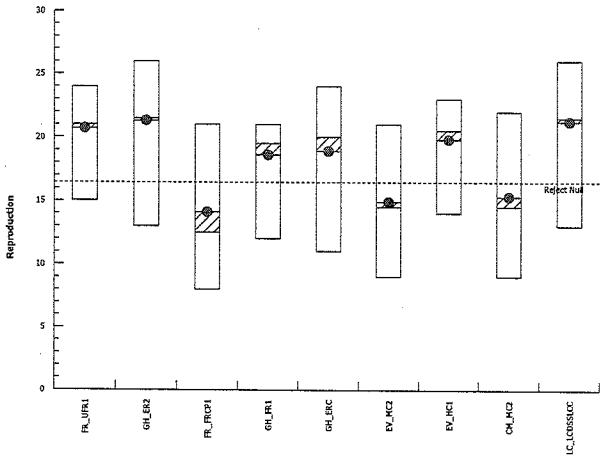
Reproduction Summary

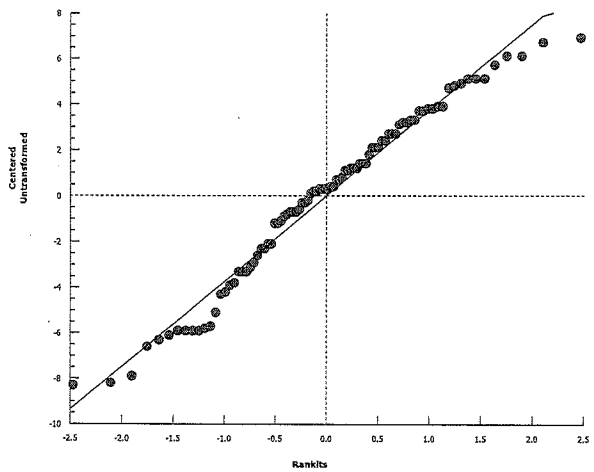
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	10	20.7	18.91	22.49	21	15	24	0.7895	12.06%	0.0%
GH_ER2	10	21.3	18.52	24.08	21.5	13	26	1.23	18.26%	-2.9%
FR_FRCP1	10	14.1	10.86	17.34	12.5	8	21	1.433	32.15%	31.88%
GH_FR1	10	18.6	16.63	20.57	19.5	12	21	0.8718	14.82%	10.14%
GH_ERC	10	18.9	16.03	21.77	20	11	24	1.269	21.23%	8.7%
EV_MC2	10	14.9	11.06	18.74	14.5	9	21	1.696	36.0%	28.02%
EV_HC1	10	19.8	17.75	21.85	20.5	14	23	0.9043	14.44%	4.35%
CM_MC2	10	15.3	12.06	18.54	14.5	9	22	1.43	29.56%	26.09%
LC_LCDSSLCC	10	21.2	18.34	24.06	21.5	13	26	1.263	18.84%	-2.42%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
FR_UFR1	21	21	20	21	24	21	15	20	24	20
GH_ER2	25	22	24	13	19	26	24	18	21	21
FR_FRCP1	21	18	18	12	8	12	11	13	9	19
GH_FR1	20	20	12	19	20	16	19	21	21	18
GH_ERC	19	20	22	21	18	11	24	13	21	20
EV_MC2	20	20	12	9	9	17	11	21	9	21
EV_HC1	14	21	23	16	23	20	21	21	20	19
CM_MC2	22	13	21	9	12	18	11	12	19	16
LC_LCDSSLCC	26	21	20	25	25	22	17	20	13	23

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:	14-2155-8594	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Jan-17 13:56	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	20-8803-2243	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	20 Oct-16 15:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	
Ending Date:	26 Oct-16 21:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 7h	**Source:**	In-House Culture	**Age:**	<24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	76h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	87h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	75h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	87h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	87h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	74h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	76h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	87h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	87h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	20.0%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
① GH_ER2		FR_UFR1	0.3414	2.424	4.259	18	0.7887	CDF	Non-Significant Effect
		FR_FRCP1	4.097	2.424	4.259	18	0.0004	CDF	Significant Effect
		GH_FR1	1.536	2.424	4.259	18	0.2632	CDF	Non-Significant Effect
		GH_ERC	1.366	2.424	4.259	18	0.3326	CDF	Non-Significant Effect
		EV_MC2	3.642	2.424	4.259	18	0.0017	CDF	Significant Effect
		EV_HC1	0.8536	2.424	4.259	18	0.5711	CDF	Non-Significant Effect
		CM_MC2	3.414	2.424	4.259	18	0.0035	CDF	Significant Effect
		LC_LCDSSLCC	0.05691	2.424	4.259	18	0.8751	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	640.6889	80.08611	8	5.187	<0.0001	Significant Effect
Error	1250.6	15.43951	81			
Total	1891.289		89			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	8.714	20.09	0.3670	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9721	0.962	0.0498	Normal Distribution

① GH_ER2 = site control

Analysis ID: 14-2155-8594 **Endpoint:** Reproduction **CETIS Version:** CETISv1.8.7
Analyzed: 16 Jan-17 13:56 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

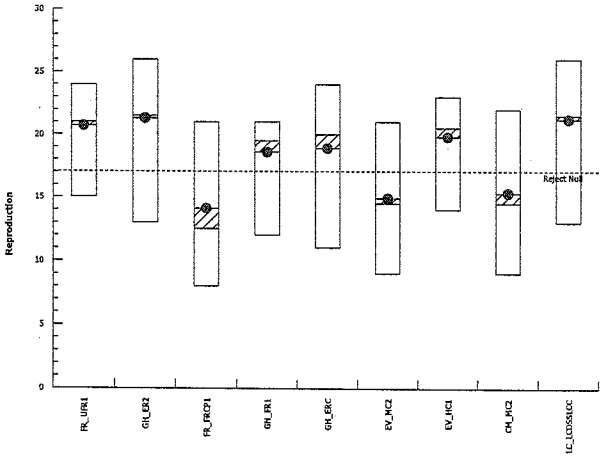
Reproduction Summary

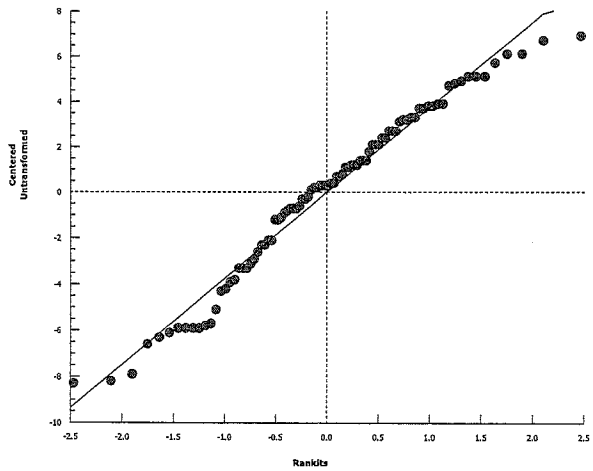
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	10	20.7	18.91	22.49	21	15	24	0.7895	12.06%	0.0%
GH_ER2	10	21.3	18.52	24.08	21.5	13	26	1.23	18.26%	-2.9%
FR_FRCP1	10	14.1	10.86	17.34	12.5	8	21	1.433	32.15%	31.88%
GH_FR1	10	18.6	16.63	20.57	19.5	12	21	0.8718	14.82%	10.14%
GH_ERC	10	18.9	16.03	21.77	20	11	24	1.269	21.23%	8.7%
EV_MC2	10	14.9	11.06	18.74	14.5	9	21	1.696	36.0%	28.02%
EV_HC1	10	19.8	17.75	21.85	20.5	14	23	0.9043	14.44%	4.35%
CM_MC2	10	15.3	12.06	18.54	14.5	9	22	1.43	29.56%	26.09%
LC_LCDSSLCC	10	21.2	18.34	24.06	21.5	13	26	1.263	18.84%	-2.42%

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
FR_UFR1	21	21	20	21	24	21	15	20	24	20
GH_ER2	25	22	24	13	19	26	24	18	21	21
FR_FRCP1	21	18	18	12	8	12	11	13	9	19
GH_FR1	20	20	12	19	20	16	19	21	21	18
GH_ERC	19	20	22	21	18	11	24	13	21	20
EV_MC2	20	20	12	9	9	17	11	21	9	21
EV_HC1	14	21	23	16	23	20	21	21	20	19
CM_MC2	22	13	21	9	12	18	11	12	19	16
LC_LCDSSLCC	26	21	20	25	25	22	17	20	13	23

Graphics





Client: Tek Cool

W.O.#: 161119

Hardness and Alkalinity Datasheet

	Alkalinity							Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
CMO-CM-MC2	Oct 19/16	Oct 19/16	50	8.4	8.6	164		100	3.8	380	JS
GHO-GH-FR1			50	9.5	9.7	186		100	5.1	510	
GHO-GH-ERC			50	7.8	8.0	152		50	9.1	182	
GHO-GH-ER2			50	7.5	7.5	146		50	8.3	166	
~~FRO-FRCP~~ JS		JS	~~50~~				JS	~~100~~			
FRO-FR-FRCP1			50	10.3	10.5	202		100	5.8	580	
FRO-FR-UFR1			50	7.3	7.5	142		50	9.2	184	
EVO-EV-HC1			50	10.4	10.6	204		100	4.8	480	
EVO-EV-MC2			50	6.8	7.0	132		100	5.0	500	
LCO-LC-LCPSSLCC			50	9.3	9.5	182		100	8.7	870	
20L Pemer	↓	↓	50	5.0	5.1	98		50	5.0	100	↓

Notes: (1) sample diluted to 100mL w/ D.I. water

Reviewed by: JGu Date Reviewed: Dec - 20/16

APPENDIX B – *Pseudokirchneriella subcapitata* Toxicity Test Data

Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 161120

Start Date: Oct 19/16
Set up by: MLT

Sample Information:

Sample ID: various, see results table for IDs
Sample Date: Oct 17/16
Date Received: Oct 18/16
Sample Volume: various

Test Organism Information:

Culture Date: Oct 14/16
Age of culture (Day 0): 5d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC150
Stock Solution ID: 167n01
Date Initiated: Oct 14/16

72-h IC50 (95% CL): 36.9 (31.6 - 41.0) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 32.6 (24.0 - 44.3) ug/L Zn CV (%): 16

Test Results:

	Cell Yield (Mean± SD)
Negative Control	30.9 ± 1.5 ab
FR_UFR1_Q_03102016_N ①	154.3 ± 9.5 *
GH_ER2_WS_2016-10-17_N ②	152.0 ± 8.1 *
FR_FRCP1_Q_03102016_N	141.0 ± 2.9 *ab
GH_FR1_WS_2016-10-17_N	158.5 ± 1.9 *
GH_ERC_WS_2016-10-17_N	156.8 ± 10.4 *
EV_MC2_WS_2016-10-17_N	166.3 ± 2.2 *cd
EV_HC1_WS_2016-10-17_N	157.8 ± 2.2 *
CM_MC2_WS_20161017_N	156.0 ± ~~6.6~~ MLT * 10.1 *
LC_LCDSSLCC_WS_2016-10-17_N	156.0 ± ~~2.9~~ MLT * 4.5 *

① Site control
② Site control

* indicates cell yield that were significantly greater than the lab control

a. indicates cell yield that were significantly less than the site control FR_UFR1

b. indicates cell yield that were significantly less than the site control GH_ER2

c. indicates cell yield that were significantly greater than the site control GH_ER2

d. indicates cell yield that were significantly greater than the site control FR_UFR1

Reviewed by: JGH
Date reviewed: Nov. 18/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client : Teck Coal **Setup by:** MLT

Sample ID: various **Test Date/Time:** Oct 19/16 @ 1445h

Work Order No.: 161120 **Test Species:** *Pseudokirchneriella subcapitata*

Culture Date: Oct 14/16 **Age of Culture:** 5d **Culture Health:** Good

Culture Count: 1 380 2 395 **Average:** 387.5 **Culture Cell Density (c1):** 387.5 x 10^4 cells/mL

v1 = 220,000 cells/ml x 100 ml / (c1) 387.5 x 10^4 cells/ml = 5.68 mL

Time Zero Counts: 1 23 2 ~~24~~ 23 (MG) **Average:** ~~23.5~~ 23 (MG)

No. of Cells/mL: ~~23.5~~ (MG) x 10^4 **Initial Density:** # cells/mL ÷ 220 µL x 10 µL = 10455 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.0	23.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
(site) FR_MFR1	8.1	23.0	↓	↓	↓	↓	✓	✓	✓	✓
(site) GH_ERC	8.0	23.0					✓	✓	✓	✓
FR_FRCP1	8.1	23.0					✓	✓	✓	✓
GH_FR1	8.0	23.0					✓	✓	✓	✓
GH_ERC	7.9	23.0					✓	✓	✓	✓
EV_MC2	7.9	23.0					✓	✓	✓	✓
EV_HC1	8.0	23.0					✓	✓	✓	✓
CM_MC2	8.0	23.0					✓	✓	✓	✓
LC_LCDSSLCC	8.0	23.0					✓	✓	✓	✓
Initials	MLT	MLT	MLT	MLT	MLT	MLT	MLT	MLT	MLT	MLT

Initial control pH: Well 1: 7.0 Well 2: 7.0

Final control pH: Well 1: 6.8 Well 2: 6.8

Light intensity (lux): 4400 **Date measured:** Oct 19/16

Instruments: Thermometer 4 pH meter 2 Light meter 1

Sample Description: clear, colourless, odourless, no particulates (all except FR_FRCP1)

Comments: FR_FRCP1: clear, colourless, odourless, some brown particulates

Reviewed: JGh **Date reviewed:** Nov. 15/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal
Start Date/Time: Oct 19/16 @ 1415h
Work Order #: 161120
Termination Date: Oct 22/16 @ 1415h
Sample ID: various
Test set up by: ML
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	32					ML
	B	30					
	C	33					
	D	31					
	E	31					
	F	33					
	G	32					
	H	30					
site control FR_UFR1 (95.2% v/v)	A	158					
	B	162					
	C	165					
	D	160					
	E A ML	155					
	F B	144					
	G C	152					
	H D	140					
site control GH_ERC (95.2% v/v)	A	144					
	B	159					
	C	149					
	D	143					
	E A ML	150					
	F B	152					
	G C	164					
	H D	163					
FR_FRCP1 95.2% (~~100%~~ ML v/v)	A	145					
	B	142					
	C	143					
	D	138					
GH_FR1 (~~100%~~ ML v/v) 95.2%	A	158					
	B	162					
	C	160					
	D	158					
GH_ERC (~~100%~~ ML v/v) 95.2%	A	167					
	B	~~150~~ ML 152					
	C	146					
	D	166					

Comments:

Reviewed by: JCL
Date Reviewed: Nov. 15/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal
Start Date/Time: Oct 19/16 @ 1415h
Work Order #: 1611120
Termination Date: Oct 22/16 @ 1415h
Sample ID: various
Test set up by: MLT

%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control MLT.	A						~~MT~~ MLT
	B						
	C						
	D						
	E						
	F						
	G						
	H						
EV_MCZ (~~100~~ MLT % v/v) 95.2%	A	168					MLT
	B	166					
	C	170					
	D	165					
EV_HCl (~~100~~ MLT % v/v) 95.2%	A	161					
	B	156					
	C	160					
	D	158					
CM_MCZ (~~100~~ MLT % v/v) 95.2%	A	162					
	B	164					
	C	142					
	D	160					
LC_LCDSSLCC (~~100~~ MLT % v/v) 95.2%	A	157					
	B	162					
	C	158					
	D	151					
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						
	A						
	B						
	C						
	D						

Comments:

Reviewed by: JCL Date Reviewed: Nov-15/16

Pseudokirchneriella subcapitata Algal Counts

Client: Teck Coal
WO#: 161120
Sample ID: Teck Coal samples pass/fail

Start Date/Time: 19-Oct-16 @1415h
Termination Date/Time: 22-Oct-16 @1415h
Initial Cell Density: 10455 cell/mL

									230000
									0.22
									0.01
Concentration % (v/v)	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		10454.55
Control	A	32				32	31.0	mean	30.8
Lab Control	B	30				30	29.0	SD	1.457738
	C	33				33	32.0	CV	4.72838
	D	31				31	30.0		
	E	34				34	33.0		
	F	33				33	32.0		
	G	32				32	31.0		
	H	30				30	29.0		
Control	A	158				158	157.0	mean	154.2
Site Water	B	162				162	161.0	SD	9.513149
(FR_UFR1)	C	165				165	164.0	CV	6.169175
95.2% (v/v)	D	166				166	165.0		
	E	155				155	154.0		
	F	144				144	143.0		
	G	152				152	151.0		
	H	140				140	139.0		
Control	A	144				144	143.0	mean	152.0
Site Water	B	159				159	158.0	SD	8.141604
(GH_ER2)	C	149				149	148.0	CV	5.357921
95.2% (v/v)	D	143				143	142.0		
	E	150				150	149.0		
	F	152				152	151.0		
	G	164				164	163.0		
	H	163				163	162.0		
FR_FRCP1	A	145				145	144.0		
95.2% (v/v)	B	142				142	141.0		
	C	143				143	142.0		
	D	138				138	137.0		
GH_FR1	A	158				158	157.0		
95.2% (v/v)	B	162				162	161.0		
	C	160				160	159.0		
	D	158				158	157.0		
GH_ERC	A	167				167	166.0		
95.2% (v/v)	B	152				152	151.0		
	C	146				146	145.0		
	D	166				166	165.0		

Reviewed by: JGH

Date reviewed: Nov. 16/16

Pseudokirchneriella subcapitata Algal Counts

Client:	Teck Coal	Start Date/Time:	19-Oct-16 @ 1415h		
WO#:	161120	Termination Date/Time	22-Oct-16 @ 1415h		
Sample ID:	Teck Coal samples pass/fail				
		Initial Cell Density:	10455 cell/mL		230000
					0.22
					0.01
					10454.55

Concentration %(v/v)	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		
Control	A	32				32	31.0	mean	30.8
Lab Control	B	30				30	29.0	SD	1.457738
	C	33				33	32.0	CV	4.72838
	D	31				31	30.0		
	A	34				34	33.0		
	B	33				33	32.0		
	C	32				32	31.0		
	D	30				30	29.0		
EV_MC2	A	168				168	167.0		
95.2% (v/v)	B	166				166	165.0		
	C	170				170	169.0		
	D	165				165	164.0		
EV_HC1	A	161				161	160.0		
95.2% (v/v)	B	156				156	155.0		
	C	160				160	159.0		
	D	158				158	157.0		
CM_MC2	A	162				162	161.0		
95.2% (v/v)	B	164				164	163.0		
	C	142				142	141.0		
	D	160				160	159.0		
LC_LCDSSLC	A	157				157	156.0		
95.2% (v/v)	B	162				162	161.0		
	C	158				158	157.0		
	D	151				151	150.0		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		
	A					#DIV/0!	#DIV/0!		
	B					#DIV/0!	#DIV/0!		
	C					#DIV/0!	#DIV/0!		
	D					#DIV/0!	#DIV/0!		

Reviewed by: JBh

Date reviewed: Nov. 16/16

CETIS Summary Report

Test Code: 161120 | 07-1361-4164

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Batch ID:	03-8753-0417	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	19 Oct-16 14:15	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	22 Oct-16 14:15	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	5d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	01-8018-5390	19 Oct-16	19 Oct-16	14h	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	52h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	62h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	51h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	62h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	62h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	50h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	52h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	62h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	62h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
① Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

① Lab control = Deionized water w/ nutrients
FR_UFR1 = site control
GH_ER2 = site control

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	8	30.88	29.66	32.09	29	33	0.5154	1.458	4.72%	0.0%
FR_UFR1	8	154.3	146.3	162.2	139	165	3.363	9.513	6.17%	-399.6%
GH_ER2	8	152	145.2	158.8	142	163	2.878	8.142	5.36%	-392.3%
FR_FRCP1	4	141	136.3	145.7	137	144	1.472	2.944	2.09%	-356.7%
GH_FR1	4	158.5	155.5	161.5	157	161	0.9574	1.915	1.21%	-413.4%
GH_ERC	4	156.8	140.2	173.3	145	166	5.202	10.4	6.64%	-407.7%
EV_MC2	4	166.3	162.7	169.8	164	169	1.109	2.217	1.33%	-438.5%
EV_HC1	4	157.8	154.2	161.3	155	160	1.109	2.217	1.41%	-410.9%
CM_MC2	4	156	139.9	172.1	141	163	5.066	10.13	6.5%	-405.3%
LC_LCDSSLCC	4	156	148.8	163.2	150	161	2.273	4.546	2.91%	-405.3%

Cell Yield Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	31	29	32	30	33	32	31	29
FR_UFR1	157	161	164	165	154	143	151	139
GH_ER2	143	158	148	142	149	151	163	162
FR_FRCP1	144	141	142	137				
GH_FR1	157	161	159	157				
GH_ERC	166	151	145	165				
EV_MC2	167	165	169	164				
EV_HC1	160	155	159	157				
CM_MC2	161	163	141	159				
LC_LCDSSLCC	156	161	157	150				

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	17-4889-7352	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 14:59	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes
Batch ID:	03-8753-0417	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	19 Oct-16 14:15	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	22 Oct-16 14:15	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	5d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	01-8018-5390	19 Oct-16	19 Oct-16	14h	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	52h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	62h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	51h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	62h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	62h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	50h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	52h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	62h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	62h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.02%	

Dunn-Šidák Adj t Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		Lab Control	36.94	2.648	8.842	14	<0.0001	CDF	Significant Effect
		GH_ER2	0.6737	2.648	8.842	14	0.9268	CDF	Non-Significant Effect
		FR_FRCP1	3.24	2.648	10.83	10	0.0105	CDF	Significant Effect
		GH_FR1	-1.039	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		GH_ERC	-0.6112	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		EV_MC2	-2.934	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		EV_HC1	-0.8557	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		CM_MC2	-0.4279	2.648	10.83	10	0.9999	CDF	Non-Significant Effect
		LC_LCDSSLCC	-0.4279	2.648	10.83	10	0.9999	CDF	Non-Significant Effect

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 17-4889-7352 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 16 Nov-16 14:59 **Analysis:** Parametric-Multiple Comparison **Official Results:** Yes

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.1087	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	105721.7	11746.85	9	263.3	<0.0001	Significant Effect
Error	1873.625	44.61012	42			
Total	107595.3		51			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	33.03	21.67	0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9557	0.9388	0.0511	Normal Distribution

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	30.88	29.66	32.09	31	29	33	0.5154	4.72%	0.0%
FR_UFR1	8	154.3	146.3	162.2	155.5	139	165	3.363	6.17%	-399.6%
GH_ER2	8	152	145.2	158.8	150	142	163	2.878	5.36%	-392.3%
FR_FRCP1	4	141	136.3	145.7	141.5	137	144	1.472	2.09%	-356.7%
GH_FR1	4	158.5	155.5	161.5	158	157	161	0.9574	1.21%	-413.4%
GH_ERC	4	156.8	140.2	173.3	158	145	166	5.202	6.64%	-407.7%
EV_MC2	4	166.3	162.7	169.8	166	164	169	1.109	1.33%	-438.5%
EV_HC1	4	157.8	154.2	161.3	158	155	160	1.109	1.41%	-410.9%
CM_MC2	4	156	139.9	172.1	160	141	163	5.066	6.5%	-405.3%
LC_LCDSSLCC	4	156	148.8	163.2	156.5	150	161	2.273	2.91%	-405.3%

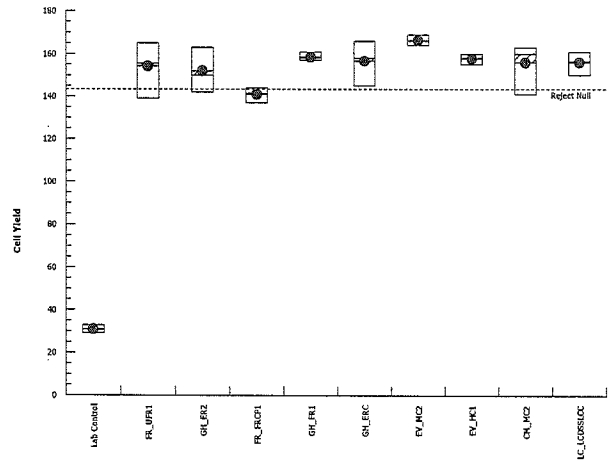
Cell Yield Detail

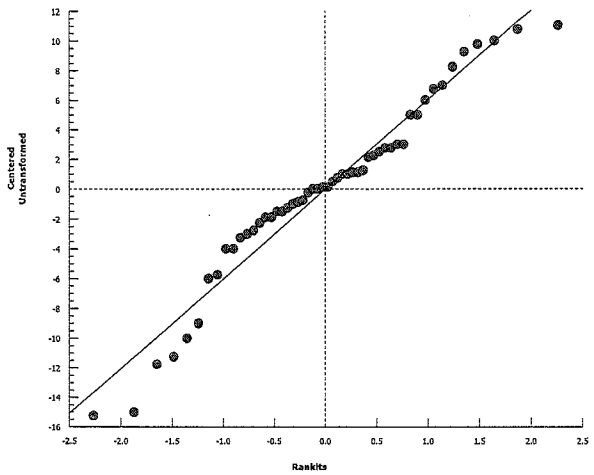
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	31	29	32	30	33	32	31	29
FR_UFR1	157	161	164	165	154	143	151	139
GH_ER2	143	158	148	142	149	151	163	162
FR_FRCP1	144	141	142	137				
GH_FR1	157	161	159	157				
GH_ERC	166	151	145	165				
EV_MC2	167	165	169	164				
EV_HC1	160	155	159	157				
CM_MC2	161	163	141	159				
LC_LCDSSLCC	156	161	157	150				

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	17-4889-7352	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 14:59	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes

Graphics





EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	04-5897-6804	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 15:00	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes
Batch ID:	03-8753-0417	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	19 Oct-16 14:15	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	22 Oct-16 14:15	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	5d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	01-8018-5390	19 Oct-16	19 Oct-16	14h	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	52h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	62h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	51h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	62h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	62h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	50h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	52h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	62h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	62h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.12%	

Dunn-Šidák Adj t Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
GH_ER2		Lab Control	36.27	2.648	8.842	14	<0.0001	CDF	Significant Effect
		FR_UFR1	-0.6737	2.648	8.842	14	1.0000	CDF	Non-Significant Effect
		FR_FRCP1	2.689	2.648	10.83	10	0.0451	CDF	Significant Effect
		GH_FR1	-1.589	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		GH_ERC	-1.161	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		EV_MC2	-3.484	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		EV_HC1	-1.406	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		CM_MC2	-0.978	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		LC_LCDSSLCC	-0.978	2.648	10.83	10	1.0000	CDF	Non-Significant Effect

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 04-5897-6804 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 16 Nov-16 15:00 **Analysis:** Parametric-Multiple Comparison **Official Results:** Yes

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.1087	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	105721.7	11746.85	9	263.3	<0.0001	Significant Effect
Error	1873.625	44.61012	42			
Total	107595.3		51			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	33.03	21.67	0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9557	0.9388	0.0511	Normal Distribution

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	30.88	29.66	32.09	31	29	33	0.5154	4.72%	0.0%
FR_UFR1	8	154.3	146.3	162.2	155.5	139	165	3.363	6.17%	-399.6%
GH_ER2	8	152	145.2	158.8	150	142	163	2.878	5.36%	-392.3%
FR_FRCP1	4	141	136.3	145.7	141.5	137	144	1.472	2.09%	-356.7%
GH_FR1	4	158.5	155.5	161.5	158	157	161	0.9574	1.21%	-413.4%
GH_ERC	4	156.8	140.2	173.3	158	145	166	5.202	6.64%	-407.7%
EV_MC2	4	166.3	162.7	169.8	166	164	169	1.109	1.33%	-438.5%
EV_HC1	4	157.8	154.2	161.3	158	155	160	1.109	1.41%	-410.9%
CM_MC2	4	156	139.9	172.1	160	141	163	5.066	6.5%	-405.3%
LC_LCDSSLCC	4	156	148.8	163.2	156.5	150	161	2.273	2.91%	-405.3%

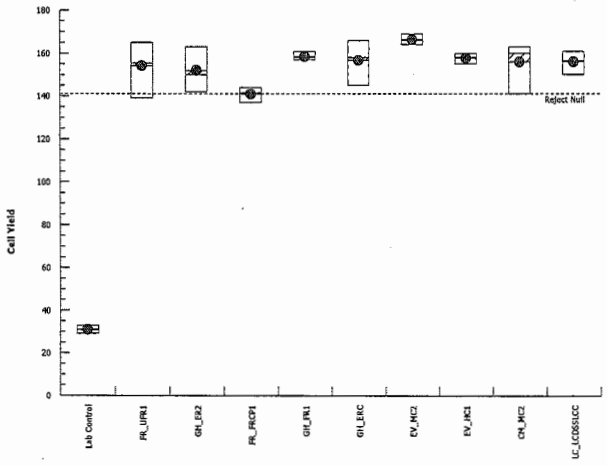
Cell Yield Detail

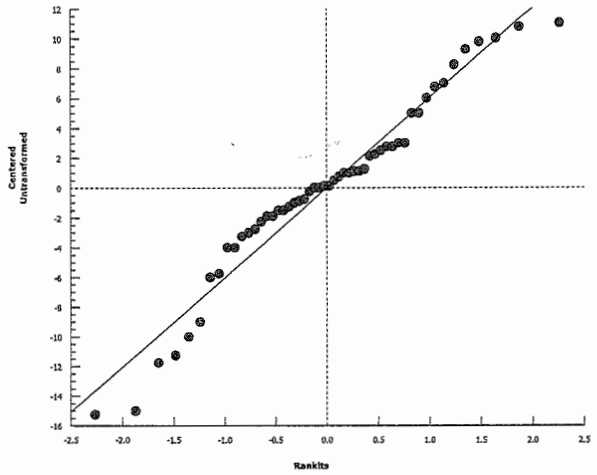
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	31	29	32	30	33	32	31	29
FR_UFR1	157	161	164	165	154	143	151	139
GH_ER2	143	158	148	142	149	151	163	162
FR_FRCP1	144	141	142	137				
GH_FR1	157	161	159	157				
GH_ERC	166	151	145	165				
EV_MC2	167	165	169	164				
EV_HC1	160	155	159	157				
CM_MC2	161	163	141	159				
LC_LCDSSLCC	156	161	157	150				

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	04-5897-6804	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 15:00	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes

Graphics





EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	19-2660-5795	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 14:57	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes
Batch ID:	03-8753-0417	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	19 Oct-16 14:15	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	22 Oct-16 14:15	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	5d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	01-8018-5390	19 Oct-16	19 Oct-16	14h	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	52h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	62h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	51h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	62h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	62h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	50h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	52h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	62h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	62h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	35.1%	

Dunn-Šidák Adj t Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	36.94	2.648	8.842	14	<0.0001	CDF	Significant Effect
		GH_ER2	36.27	2.648	8.842	14	<0.0001	CDF	Significant Effect
		FR_FRCP1	26.92	2.648	10.83	10	<0.0001	CDF	Significant Effect
		GH_FR1	31.2	2.648	10.83	10	<0.0001	CDF	Significant Effect
		GH_ERC	30.78	2.648	10.83	10	<0.0001	CDF	Significant Effect
		EV_MC2	33.1	2.648	10.83	10	<0.0001	CDF	Significant Effect
		EV_HC1	31.02	2.648	10.83	10	<0.0001	CDF	Significant Effect
		CM_MC2	30.59	2.648	10.83	10	<0.0001	CDF	Significant Effect
		LC_LCDSSLCC	30.59	2.648	10.83	10	<0.0001	CDF	Significant Effect

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID: 19-2660-5795 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 16 Nov-16 14:57 **Analysis:** Parametric-Multiple Comparison **Official Results:** Yes

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.7305	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	105721.7	11746.85	9	263.3	<0.0001	Significant Effect
Error	1873.625	44.61012	42			
Total	107595.3		51			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	33.03	21.67	0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9557	0.9388	0.0511	Normal Distribution

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	30.88	29.66	32.09	31	29	33	0.5154	4.72%	0.0%
FR_UFR1	8	154.3	146.3	162.2	155.5	139	165	3.363	6.17%	-399.6%
GH_ER2	8	152	145.2	158.8	150	142	163	2.878	5.36%	-392.3%
FR_FRCP1	4	141	136.3	145.7	141.5	137	144	1.472	2.09%	-356.7%
GH_FR1	4	158.5	155.5	161.5	158	157	161	0.9574	1.21%	-413.4%
GH_ERC	4	156.8	140.2	173.3	158	145	166	5.202	6.64%	-407.7%
EV_MC2	4	166.3	162.7	169.8	166	164	169	1.109	1.33%	-438.5%
EV_HC1	4	157.8	154.2	161.3	158	155	160	1.109	1.41%	-410.9%
CM_MC2	4	156	139.9	172.1	160	141	163	5.066	6.5%	-405.3%
LC_LCDSSLCC	4	156	148.8	163.2	156.5	150	161	2.273	2.91%	-405.3%

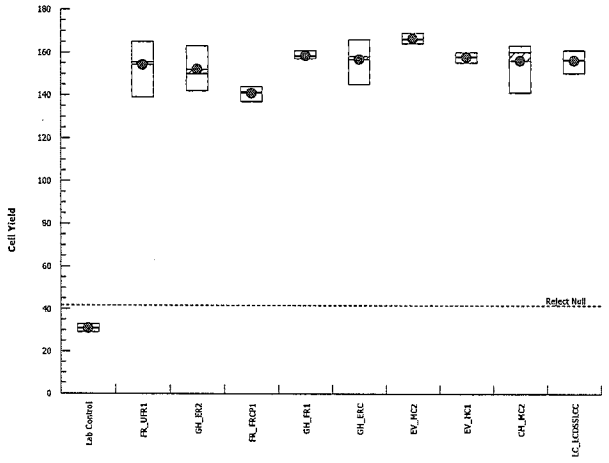
Cell Yield Detail

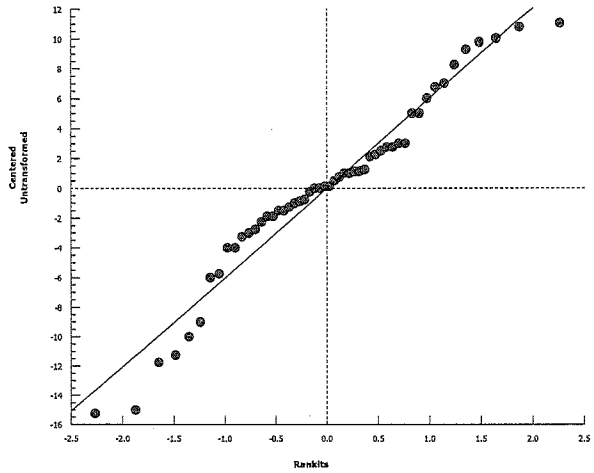
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	31	29	32	30	33	32	31	29
FR_UFR1	157	161	164	165	154	143	151	139
GH_ER2	143	158	148	142	149	151	163	162
FR_FRCP1	144	141	142	137				
GH_FR1	157	161	159	157				
GH_ERC	166	151	145	165				
EV_MC2	167	165	169	164				
EV_HC1	160	155	159	157				
CM_MC2	161	163	141	159				
LC_LCDSSLCC	156	161	157	150				

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	19-2660-5795	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 14:57	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes

Graphics





EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	17-4233-2111	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 14:59	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes
Batch ID:	03-8753-0417	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	19 Oct-16 14:15	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	22 Oct-16 14:15	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	5d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	01-8018-5390	19 Oct-16	19 Oct-16	14h	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	52h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	62h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	51h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	62h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	62h (6 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	50h (5.8 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	52h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	62h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	62h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	7.02%	

Dunn-Šidák Adj t Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		Lab Control	-36.94	2.648	8.842	14	1.0000	CDF	Non-Significant Effect
		GH_ER2	-0.6737	2.648	8.842	14	1.0000	CDF	Non-Significant Effect
		FR_FRCP1	-3.24	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		GH_FR1	1.039	2.648	10.83	10	0.7741	CDF	Non-Significant Effect
		GH_ERC	0.6112	2.648	10.83	10	0.9427	CDF	Non-Significant Effect
		EV_MC2	2.934	2.648	10.83	10	0.0241	CDF	Significant Effect
		EV_HC1	0.8557	2.648	10.83	10	0.8635	CDF	Non-Significant Effect
		CM_MC2	0.4279	2.648	10.83	10	0.9747	CDF	Non-Significant Effect
		LC_LCDSSLCC	0.4279	2.648	10.83	10	0.9747	CDF	Non-Significant Effect

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	17-4233-2111	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 14:59	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.1087	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	105721.7	11746.85	9	263.3	<0.0001	Significant Effect
Error	1873.625	44.61012	42			
Total	107595.3		51			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	33.03	21.67	0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9557	0.9388	0.0511	Normal Distribution

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	30.88	29.66	32.09	31	29	33	0.5154	4.72%	0.0%
FR_UFR1	8	154.3	146.3	162.2	155.5	139	165	3.363	6.17%	-399.6%
GH_ER2	8	152	145.2	158.8	150	142	163	2.878	5.36%	-392.3%
FR_FRCP1	4	141	136.3	145.7	141.5	137	144	1.472	2.09%	-356.7%
GH_FR1	4	158.5	155.5	161.5	158	157	161	0.9574	1.21%	-413.4%
GH_ERC	4	156.8	140.2	173.3	158	145	166	5.202	6.64%	-407.7%
EV_MC2	4	166.3	162.7	169.8	166	164	169	1.109	1.33%	-438.5%
EV_HC1	4	157.8	154.2	161.3	158	155	160	1.109	1.41%	-410.9%
CM_MC2	4	156	139.9	172.1	160	141	163	5.066	6.5%	-405.3%
LC_LCDSSLCC	4	156	148.8	163.2	156.5	150	161	2.273	2.91%	-405.3%

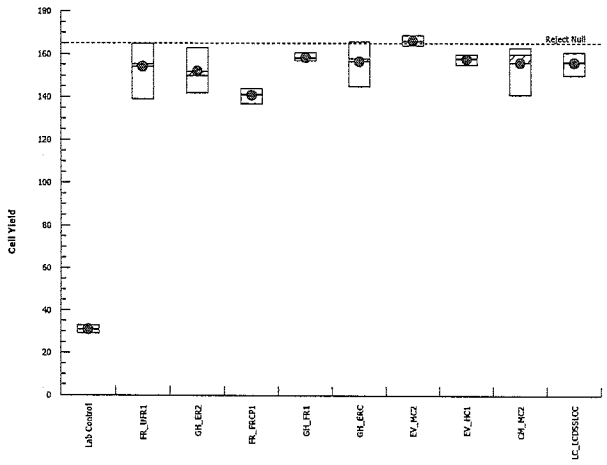
Cell Yield Detail

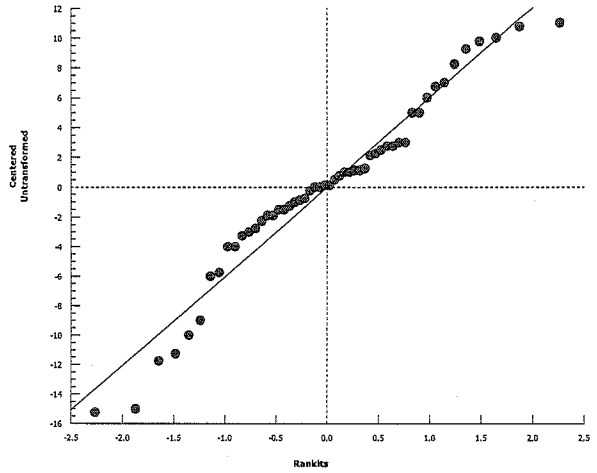
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	31	29	32	30	33	32	31	29
FR_UFR1	157	161	164	165	154	143	151	139
GH_ER2	143	158	148	142	149	151	163	162
FR_FRCP1	144	141	142	137				
GH_FR1	157	161	159	157				
GH_ERC	166	151	145	165				
EV_MC2	167	165	169	164				
EV_HC1	160	155	159	157				
CM_MC2	161	163	141	159				
LC_LCDSSLCC	156	161	157	150				

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	17-4233-2111	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 14:59	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes

Graphics





EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	03-5113-5994	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 14:56	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes
Batch ID:	03-8753-0417	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	19 Oct-16 14:15	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	22 Oct-16 14:15	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	5d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	01-8018-5390	19 Oct-16	19 Oct-16	14h	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	52h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	62h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	51h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	62h (5 °C)		
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EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	52h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	62h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	62h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	7.12%	

Dunn-Šidák Adj t Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
GH_ER2		Lab Control	-36.27	2.648	8.842	14	1.0000	CDF	Non-Significant Effect
		FR_UFR1	0.6737	2.648	8.842	14	0.9268	CDF	Non-Significant Effect
		FR_FRCP1	-2.689	2.648	10.83	10	1.0000	CDF	Non-Significant Effect
		GH_FR1	1.589	2.648	10.83	10	0.4257	CDF	Non-Significant Effect
		GH_ERC	1.161	2.648	10.83	10	0.7025	CDF	Non-Significant Effect
		EV_MC2	3.484	2.648	10.83	10	0.0052	CDF	Significant Effect
		EV_HC1	1.406	2.648	10.83	10	0.5440	CDF	Non-Significant Effect
		CM_MC2	0.978	2.648	10.83	10	0.8066	CDF	Non-Significant Effect
		LC_LCDSSLCC	0.978	2.648	10.83	10	0.8066	CDF	Non-Significant Effect

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID: 03-5113-5994 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 16 Nov-16 14:56 **Analysis:** Parametric-Multiple Comparison **Official Results:** Yes

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.1087	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	105721.7	11746.85	9	263.3	<0.0001	Significant Effect
Error	1873.625	44.61012	42			
Total	107595.3		51			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	33.03	21.67	0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9557	0.9388	0.0511	Normal Distribution

Cell Yield Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	8	30.88	29.66	32.09	31	29	33	0.5154	4.72%	0.0%
FR_UFR1	8	154.3	146.3	162.2	155.5	139	165	3.363	6.17%	-399.6%
GH_ER2	8	152	145.2	158.8	150	142	163	2.878	5.36%	-392.3%
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GH_FR1	4	158.5	155.5	161.5	158	157	161	0.9574	1.21%	-413.4%
GH_ERC	4	156.8	140.2	173.3	158	145	166	5.202	6.64%	-407.7%
EV_MC2	4	166.3	162.7	169.8	166	164	169	1.109	1.33%	-438.5%
EV_HC1	4	157.8	154.2	161.3	158	155	160	1.109	1.41%	-410.9%
CM_MC2	4	156	139.9	172.1	160	141	163	5.066	6.5%	-405.3%
LC_LCDSSLCC	4	156	148.8	163.2	156.5	150	161	2.273	2.91%	-405.3%

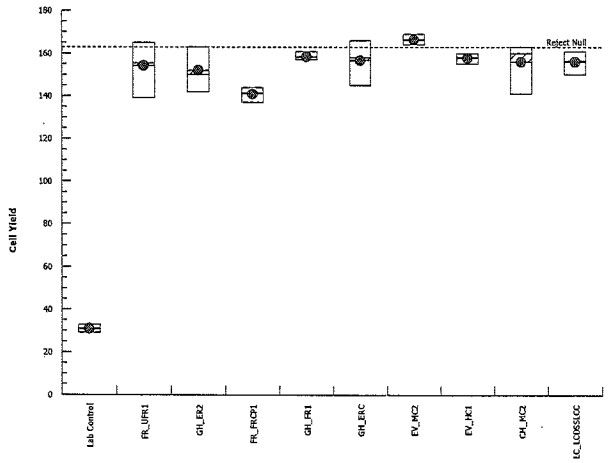
Cell Yield Detail

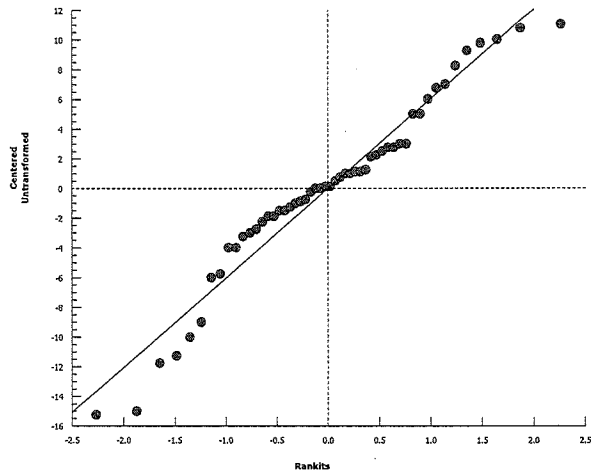
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Lab Control	31	29	32	30	33	32	31	29
FR_UFR1	157	161	164	165	154	143	151	139
GH_ER2	143	158	148	142	149	151	163	162
FR_FRCP1	144	141	142	137				
GH_FR1	157	161	159	157				
GH_ERC	166	151	145	165				
EV_MC2	167	165	169	164				
EV_HC1	160	155	159	157				
CM_MC2	161	163	141	159				
LC_LCDSSLCC	156	161	157	150				

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	03-5113-5994	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 Nov-16 14:56	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes

Graphics





Client: Teck

W.O.#: 161115 / 161172

Hardness and Alkalinity Datasheet

	Alkalinity							Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
~~Dechlor~~	~~Oct18/16~~	~~Oct18/16~~	~~100~~	~~0.6~~	~~0.7~~	5		100	0.9	9	~~MN~~
LC_LLOSSLCC_WS_2016-10-17_N	Oct17/16	Oct18/16	50	9.3	9.5	182		10①	8.7	870	JS
LC_LCS_WS_2016-10-17_N	↓	Oct18/16	50	9.1	9.4	176		50	15.0	300	↓
LC_FROSR_WS_2016-10-17_N		Oct18/16	50	9.3	9.4	184		50	~~15.0~~ 16.7	334	
LC_OC1_WS_2016-10-17_N		Oct18/16	50	~~7.26~~	7.7	150		50	9.1	182	
LC_OCDS_WS_2016-10-18_N	Oct18/16	Oct19/16	50	5.9	6.1	114		50	7.0	140	
GHLEF2_WS_2016-10-17_N	Oct17/16	Oct18/16	50	7.4	7.5	146		50	8.5	170	
WL_RFWB_OUT_SP21_	Oct17/16	Oct18/16	50	14.7	14.9	290		~~50~~ 10①	10.4	1040	↓
20161017_N											
201 pemr	Oct 19/16	Oct 19/16	50	5.0	5.1	98		50	5.0	100	tmm

Notes: ① Sample diluted w/ DI water up to 100mL

Reviewed by: _____ Date Reviewed: _____

APPENDIX C – *Hyalella azteca* Toxicity Test Data

Hyalella azteca Test Summary Sheet

Client: Teck
Work Order No.: 161117

Start Date: 18-Oct-16
Set up by: KJL

Sample Information:

Sample ID: Various - See Below
Sample Date: Oct 17 & 25, Nov 1 & 8, 2016
Date Received: Oct 18 & 26, Nov 2 & 9, 2016
Sample Volume: 1x 20L per refresh

Test Organism Information:

Species: *Hyalella azteca*
Supplier: Aquatic Research Organisms, NH
Date received: 18-Oct-16
Age or size (Day 0): 8-days

NaCl Reference Toxicant Results:

Reference Toxicant ID: HA121
Stock Solution ID: n/a
Date Initiated: 18-Oct-16

96-h LC50 (95% CL): 6.0 (4.8 - 7.5) g/L NaCl

96-h LC50 Reference Toxicant Mean and Range: 5.6 (4.9 - 6.4) CV (%): 7

Test Results:

Sample ID	Survival ± SD (%)	Average Dry Wt. ± SD (mg)
Control	98.0 ± 4.5	0.63 ± 0.03
FR_UFR1	94.0 ± 5.5	0.71 ± 0.07
GH_FR1	86.0 ± 20.7	0.58 ± 0.23
FR_FRCP1	94.0 ± 8.9	0.60 ± 0.08 *
CM_MC2	98.0 ± 4.5	0.71 ± 0.05

* Samples that are significantly different from reference site FR_UFR1.

Reviewed by: JGh Date reviewed: Nov. 30/16

Chronic *H. azteca* Sediment Toxicity Test Data Sheet

Freshwater Sediment Water Quality

Client: Teck
WO #: 161117
Sample ID: See below

Start Date: Oct 18/16
Termination Date: Nov 15/16
Test Organism: *H. azteca*

Temperature (°C)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	22.0	22.0	22.0	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
FR_UFR1	23.0	22.0	22.0	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
GH_FR1	24.0	22.0	22.0	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
FR_FRCP1	24.0	22.0	22.0	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
CM_MC2	24.0	22.0	22.0	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Technician Initials	KJL	KJL	KJL	KJL	A	A	KJL	KJL	KJL	KJL	KJL	A	A	JW	JW

Conductivity (µS)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	435	443	453	451	453	450	458	446	451	442	448	443	432	447	434
FR_UFR1	389	418	430	432	429	430	433	431	430	426	423	425	422	435	426
GH_FR1	853	810	823	831	826	827	815	829	825	833	858	869	873	887	881
FR_FRCP1	8932	902	916	925	908	927	920	923	913	933	944	949	960	969	957
CM_MC2	738	714	739	743	721	738	737	729	737	729	797	823	859	870	876
Technician Initials	KJL	KJL	KJL	KJL	A	A	KJL	KJL	KJL	KJL	KJL	A	A	JW	JW

Dissolved oxygen (mg/L)

Sample ID	Day														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	8.3	8.0	7.3	6.4	7.0A	6.9	7.2	6.7	6.8	7.0	6.9	7.0	7.1	7.3	7.1 7.3
FR_UFR1	8.6	7.9	7.0	6.5	7.2	6.8	7.2	6.8	6.9	7.0	6.7	7.0	7.2	7.2	7.4
GH_FR1	8.1	8.0	7.1	6.4	7.2	6.9	7.1	6.8	6.6	6.9	6.7	6.9	7.1	7.3	7.5
FR_FRCP1	8.1	8.0	7.0	6.7	7.1	6.9	7.2	6.7	6.7	6.9	6.8	7.0	7.2	7.2	7.5
CM_MC2	8.7	8.1	7.2	6.6	7.2	6.8	7.2	6.7	6.8	6.8	6.8	7.0	7.1	7.5	7.5
Technician Initials	KJL	KJL	KJL	KJL	A	A	KJL	KJL	KJL	KJL	KJL	A	A	JW	JW

pH

Sample ID	Day														
	0	1	2	3	4 A	5	6	7	8	9	10	11	12	13	14
Control	7.8	7.3	7.2	7.2	7.8	7.4	7.2	7.2	7.1	7.3	7.2	7.4	7.4	7.3	7.1
FR_UFR1	8.1	7.6	7.4	7.3	7.9	7.5	7.5	7.3	7.5	7.1	7.7	7.8	7.9	7.8	7.6
GH_FR1	8.0	7.8	7.8	7.7	7.7	7.8	7.8	7.5	7.7	8.0	8.0	8.0	8.0	8.0	7.8
FR_FRCP1	8.2	7.9	7.8	7.7	7.8	7.8	7.8	7.6	7.6	7.9	8.0	8.0	8.1	8.0	7.8
CM_MC2	8.1	7.8	7.8	7.1	7.9	7.8	7.8	7.6	7.6	7.9	8.0	8.1	8.1	8.1	7.9
Technician Initials	KJL	KJL	KJL	KJL	A	A	KJL	KJL	KJL	KJL	KJL	A	A	JW	JW

Comments:

Reviewed by: JGL

Date Reviewed: Nov. 29/16

Chronic *H. azteca* Sediment Toxicity Test Data Sheet

Freshwater Sediment Water Quality

Client: Teck
WO #: 161117
Sample ID: See below

Start Date: Oct 18/16
Termination Date: Nov 15/16
Test Organism: *H. azteca*

Temperature (°C)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
FR_UFR1	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
GH_FR1	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
FR_FRCP1	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
CM_MC2	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Technician Initials	JW	JW	JW			JW	JW	JW	JW	JW			JW	

Conductivity (µS)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	431	433	431	437	440	444	444	436	436	444	435	435	439	441
FR_UFR1	423	427	416	409	413	416	408	416	410	416	412	415	416	423
GH_FR1	878	870	876	872	861	864	856	871	861	883	886	883	875	865
FR_FRCP1	945	934	932	927	922	920	920	932	931	949	960	966	957	951
CM_MC2	864	871	794	754	744	748	737	745	746	753	748	761	760	758
Technician Initials	JW	JW	JW			JW	JW	JW	JW	JW			JW	

Dissolved oxygen (mg/L)

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	7.5	7.1	7.1	6.8	6.1	7.0	7.0	7.0	6.5	6.3	6.6	6.6	5.2	5.1
FR_UFR1	7.5	7.1	7.1	6.7	6.1	7.1	7.2	7.0	6.7	6.5	6.6	6.6	5.4	5.8
GH_FR1	7.8	7.0	7.5	6.8	6.5	7.3	7.4	7.1	6.8	6.8	6.6	6.9	5.8	6.2
FR_FRCP1	7.7	7.2	7.4	6.9	6.5	7.0	7.4	7.1	6.8	6.9	6.8	6.9	5.8	6.1
CM_MC2	7.7	7.0	7.6	6.9	6.5	7.6	7.5	7.4	7.1	7.2	6.8	6.9	5.9	6.2
Technician Initials	JW	JW	JW			JW	JW	JW	JW	JW			JW	

pH

Sample ID	Day													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Control	7.3	7.2	7.2	7.2	7.2	7.3	7.5	7.9	7.0	7.0	7.3	7.3	6.9	6.8
FR_UFR1	7.8	7.6	7.7	7.8	7.7	7.9	8.1	7.9	7.4	7.4	7.6	7.7	7.4	7.4
GH_FR1	7.9	7.7	8.0	8.1	7.9	8.0	8.2	8.0	7.6	7.7	7.7	7.8	7.7	7.7
FR_FRCP1	7.8	7.7	8.0	8.0	7.8	7.9	8.1	8.0	7.6	7.7	7.8	7.9	7.7	7.6
CM_MC2	8.0	7.7	7.9	8.0	7.9	8.1	8.2	8.1	7.7	7.7	7.8	8.0	7.7	7.7
Technician Initials	JW	JW	JW			JW	JW	JW	JW	JW			JW	

Comments:

Reviewed by: JW

Date Reviewed: Nov. 29/16

H. azteca Toxicity Test Data Sheet

Survival and Weight

Client: Teck

Work Order No: 161117

Sample ID: See below

Start Date: Oct 18/16

Termination Date: Nov 15/16

Test Organism: *Hyalella azteca*

Sample ID	HA-04 Pan No. green	Rep	No. alive	No. dead	No. missing	Initials	Pan weight (mg)	Pan + organism (mg)	No. weighed	Initials
Control	1	A	10	0	0	KL	1011.84	1018.34	10	KJL
	2	B	10	0	0		995.84	1002.49	10	
	3	C	9	0	1		1005.54	1011.37	9	
	4	D	10	0	0		1000.20	1006.12	10	
	5	E	11	0	0		1026.37	1033.11	11	
FR_UFR1	6	A	9	0	1	JW	1000.31	1007.03	9	
	7	B	10	0	0		1002.11	1009.01	10	
	8	C	9	0	1		1013.58	1020.13	9	
	9	D	9	0	1		1005.34 25	1012.39	9	
	10	E	11	0	0		1014.48	1021.20	11	
GH_FR1	11	A	9	0	1	KL	1013.61	1019.99	9	
	12	B	10	0	0		1013. 1014.23	1021.46	10	
	13	C	9	0	1		1015.80	1021.53	9	
	14	D	10	0	0		1015.70	1022.23	10	
	15	E	5 ①	4	1		1024.39	1025.20	5	
FR_FRCP1	16	A	10	0	0	JW	1010.10	1014.87	10	
	17	B	11	0	0		1022.69	1029.38	11	
	18	C	9	0	1		1021.61	1027.98	9	
	19	D	8	0	2		1016.11	1020.93	8	
	20	E	10	0	0		1018.99	1024.83	10	

Comments: ① checked by JW, organisms are small

Reweighed pans 6 - 1006.93 17 - 1029.30 25 - 1017.42

Reviewed by: JGh

Date Reviewed: Nov. 29/16

H. azteca Toxicity Test Data Sheet

Survival and Weight

Client: Teck

Work Order No: 161117

Sample ID: See below

Start Date: Oct 18/16

Termination Date: Nov 15/16

Test Organism: *Hyalella azteca*

Sample ID	HA-Q4 Pan No. (see below)	Rep	No. alive	No. dead	No. missing	Initials	Pan + organism weight (mg)	Pan ~~+ organism~~ (mg) KJV	No. weighed	Initials
CM_MC2	21	A	10	0	0	JW	1021.51	1015.13	10	KJV
	22	B	10	0	0	↓	995.52	987.93	10	↓
	23	C	9	0	1		1019.09	1012.34	9	
	24	D	10	0	0		1016.55	1009.47	10	
	25	E	10	0	0	↓	1017.52	1010.73	10	↓
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								
		A								
		B								
		C								
		D								
		E								

Comments:

Reviewed by: JOL

Date Reviewed: Nov. 29/16

CETIS Summary Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Batch ID:	00-1269-1788	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	18 Oct-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	15 Nov-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7181-2408	18 Oct-16	18 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	13h (3.5 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	24h (5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	12h (3.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	24h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
20-5146-2285	Survival Rate	Control Resp	0.98	0.8 - NL	Yes	Passes Acceptability Criteria

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	5	0.98	0.9245	1	0.9	1	0.02	0.04472	4.56%	0.0%
FR_UFR1	5	0.94	0.872	1	0.9	1	0.02449	0.05477	5.83%	4.08%
GH_FR1	5	0.86	0.6025	1	0.5	1	0.09274	0.2074	24.11%	12.24%
FR_FRCP1	5	0.94	0.8289	1	0.8	1	0.04	0.08944	9.52%	4.08%
CM_MC2	5	0.98	0.9245	1	0.9	1	0.02	0.04472	4.56%	0.0%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	1	1	0.9	1	1
FR_UFR1	0.9	1	0.9	0.9	1
GH_FR1	0.9	1	0.9	1	0.5
FR_FRCP1	1	1	0.9	0.8	1
CM_MC2	1	1	0.9	1	1

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	10/10	10/10	9/10	10/10	11/11
FR_UFR1	9/10	10/10	9/10	9/10	11/11
GH_FR1	9/10	10/10	9/10	10/10	5/10
FR_FRCP1	10/10	11/11	9/10	8/10	10/10
CM_MC2	10/10	10/10	9/10	10/10	10/10

CETIS Summary Report

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Batch ID:	00-1269-1788	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	18 Oct-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	15 Nov-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7181-2408	18 Oct-16	18 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	13h (3.5 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	24h (5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	12h (3.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	24h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	5	0.6335	0.5961	0.6709	0.592	0.665	0.01346	0.03009	4.75%	0.0%
FR_UFR1	5	0.7137	0.6287	0.7988	0.6109	0.7933	0.03062	0.06847	9.59%	-12.67%
GH_FR1	5	0.5767	0.2853	0.8681	0.162	0.723	0.1049	0.2347	40.69%	8.97%
FR_FRCP1	5	0.5959	0.4939	0.6979	0.477	0.7078	0.03674	0.08214	13.78%	5.94%
CM_MC2	5	0.7068	0.6444	0.7692	0.638	0.759	0.02247	0.05025	7.11%	-11.57%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	0.65	0.665	0.6478	0.592	0.6127
FR_UFR1	0.7467	0.69	0.7278	0.7933	0.6109
GH_FR1	0.7089	0.723	0.6367	0.653	0.162
FR_FRCP1	0.477	0.6082	0.7078	0.6025	0.584
CM_MC2	0.638	0.759	0.75	0.708	0.679

Hyalella 28-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID:	20-5146-2285	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Nov-16 12:09	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	00-1269-1788	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	18 Oct-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	15 Nov-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7181-2408	18 Oct-16	18 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	13h (3.5 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	24h (5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	12h (3.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	24h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.3087	0.9262	Exact	Non-Significant Effect
Control		GH_FR1	0.02786	0.1115	Exact	Non-Significant Effect
Control		FR_FRCP1	0.3087	0.9262	Exact	Non-Significant Effect
Control		CM_MC2	0.7475	0.7475	Exact	Non-Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.98	0.8 - NL	Yes	Passes Acceptability Criteria

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	50	1	51	0.9804	0.01961	0.0%
FR_UFR1		48	3	51	0.9412	0.05882	4.0%
GH_FR1		43	7	50	0.86	0.14	12.28%
FR_FRCP1		48	3	51	0.9412	0.05882	4.0%
CM_MC2		49	1	50	0.98	0.02	0.04%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	1	1	0.9	1	1
FR_UFR1	0.9	1	0.9	0.9	1
GH_FR1	0.9	1	0.9	1	0.5
FR_FRCP1	1	1	0.9	0.8	1
CM_MC2	1	1	0.9	1	1

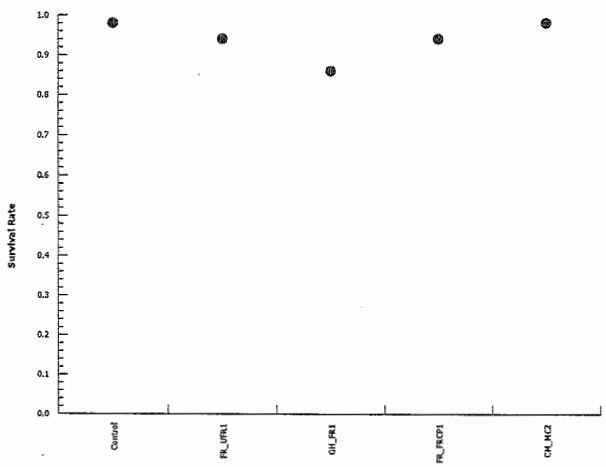
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	10/10	10/10	9/10	10/10	11/11
FR_UFR1	9/10	10/10	9/10	9/10	11/11
GH_FR1	9/10	10/10	9/10	10/10	5/10
FR_FRCP1	10/10	11/11	9/10	8/10	10/10
CM_MC2	10/10	10/10	9/10	10/10	10/10

Hyalella 28-d Survival and Growth Sediment Test **Nautilus Environmental**

Analysis ID:	20-5146-2285	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Nov-16 12:09	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Hyalella 28-d Survival and Growth Sediment Test

Nautilus Environmental

Analysis ID:	02-2465-6436	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Nov-16 12:19	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	00-1269-1788	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	18 Oct-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	15 Nov-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	13h (3.5 °C)	Teck Coal	
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	24h (5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	12h (3.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	24h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_FR1	0.1511	0.4532	Exact	Non-Significant Effect
FR_UFR1		FR_FRCP1	0.661	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Reference Sed	48	3	51	0.9412	0.05882	0.0%
GH_FR1		43	7	50	0.86	0.14	8.63%
FR_FRCP1		48	3	51	0.9412	0.05882	0.0%
CM_MC2		49	1	50	0.98	0.02	-4.13%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1	0.9	1	0.9	0.9	1
GH_FR1	0.9	1	0.9	1	0.5
FR_FRCP1	1	1	0.9	0.8	1
CM_MC2	1	1	0.9	1	1

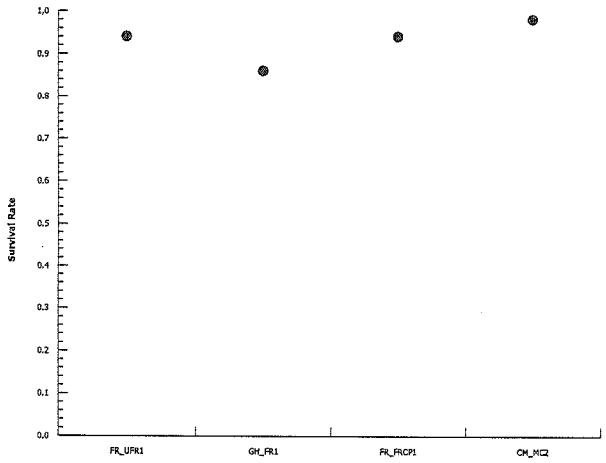
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1	9/10	10/10	9/10	9/10	11/11
GH_FR1	9/10	10/10	9/10	10/10	5/10
FR_FRCP1	10/10	11/11	9/10	8/10	10/10
CM_MC2	10/10	10/10	9/10	10/10	10/10

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	02-2465-6436	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Nov-16 12:19	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JCL 29/16

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	13-7729-9814	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	30 Nov-16 10:07	**Analysis:**	Nonparametric-Multiple Comparison	**Official Results:**	Yes
Batch ID:	00-1269-1788	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	18 Oct-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	15 Nov-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7181-2408	18 Oct-16	18 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	13h (3.5 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	24h (5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	12h (3.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	24h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	28.6%	

Wilcoxon/Bonferroni Adj Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	36	NA	0	8	1.0000	Exact	Non-Significant Effect
		GH_FR1	31	NA	0	8	1.0000	Exact	Non-Significant Effect
		FR_FRCP1	22	NA	0	8	0.6190	Exact	Non-Significant Effect
		CM_MC2	37	NA	0	8	1.0000	Exact	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.07875706	0.01968927	4	1.408	0.2676	Non-Significant Effect
Error	0.2797475	0.01398737	20			
Total	0.3585045		24			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	17.82	13.28	0.0013	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.7894	0.8877	0.0002	Non-normal Distribution

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	5	0.6335	0.5961	0.6709	0.6478	0.592	0.665	0.01346	4.75%	0.0%
FR_UFR1	5	0.7137	0.6287	0.7988	0.7278	0.6109	0.7933	0.03062	9.59%	-12.67%
GH_FR1	5	0.5767	0.2853	0.8681	0.653	0.162	0.723	0.1049	40.69%	8.97%
FR_FRCP1	5	0.5959	0.4939	0.6979	0.6025	0.477	0.7078	0.03674	13.78%	5.94%
CM_MC2	5	0.7068	0.6444	0.7692	0.708	0.638	0.759	0.02247	7.11%	-11.57%

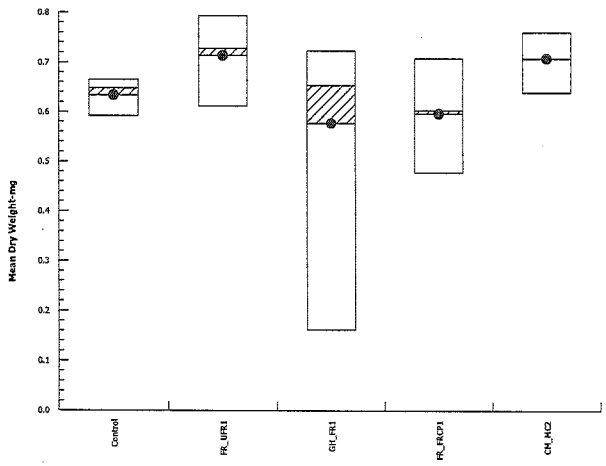
Mean Dry Weight-mg Detail

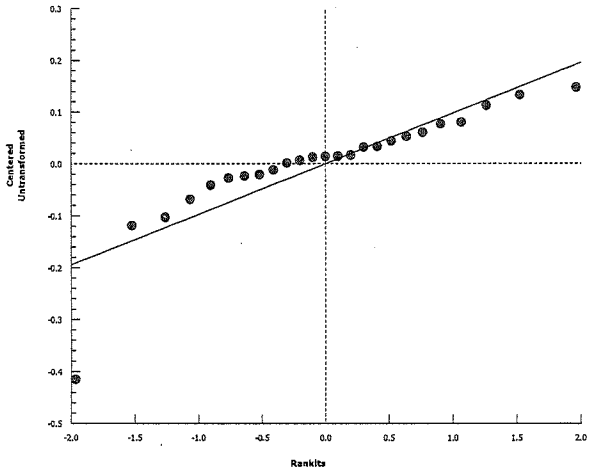
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
Control	0.65	0.665	0.6478	0.592	0.6127
FR_UFR1	0.7467	0.69	0.7278	0.7933	0.6109
GH_FR1	0.7089	0.723	0.6367	0.653	0.162
FR_FRCP1	0.477	0.6082	0.7078	0.6025	0.584
CM_MC2	0.638	0.759	0.75	0.708	0.679

Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	13-7729-9814	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	30 Nov-16 10:07	**Analysis:**	Nonparametric-Multiple Comparison	**Official Results:**	Yes

Graphics





Hyalella 28-d Survival and Growth Sediment Test — **Nautilus Environmental**

Analysis ID:	16-5632-9495	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Nov-16 12:19	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	00-1269-1788	**Test Type:**	Survival-Growth	**Analyst:**	Karen Lee
Start Date:	18 Oct-16	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	15 Nov-16	**Species:**	Hyalella azteca	**Brine:**	
Duration:	28d 0h	**Source:**	Aquatic Research Organisms, NH	**Age:**	8-d

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	13h (3.5 °C)	Teck Coal	
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	24h (5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	12h (3.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	24h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	25.9%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_FR1	21	17	0	8	0.1941	Asymp	Non-Significant Effect
		FR_FRCP1	17	17	0	8	0.0368	Asymp	Significant Effect
		CM_MC2	27	17	0	8	0.7105	Asymp	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.07788262	0.02596087	3	1.504	0.2515	Non-Significant Effect
Error	0.2761254	0.01725784	16			
Total	0.354008		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	10.88	11.34	0.0124	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8052	0.866	0.0010	Non-normal Distribution

Mean Dry Weight-mg Summary

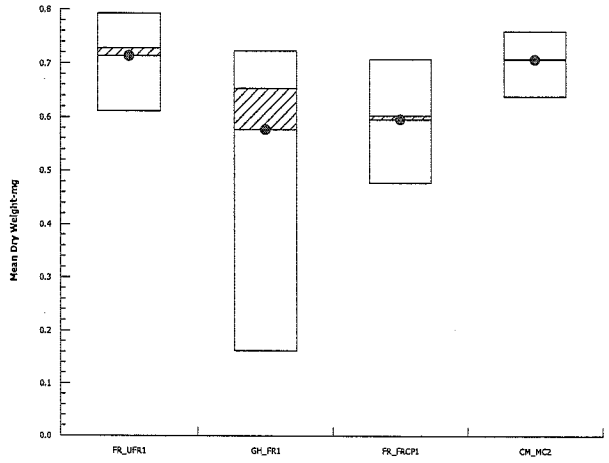
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	5	0.7137	0.6287	0.7988	0.7278	0.6109	0.7933	0.03062	9.59%	0.0%
GH_FR1	5	0.5767	0.2853	0.8681	0.653	0.162	0.723	0.1049	40.69%	19.2%
FR_FRCP1	5	0.5959	0.4939	0.6979	0.6025	0.477	0.7078	0.03674	13.78%	16.51%
CM_MC2	5	0.7068	0.6444	0.7692	0.708	0.638	0.759	0.02247	7.11%	0.97%

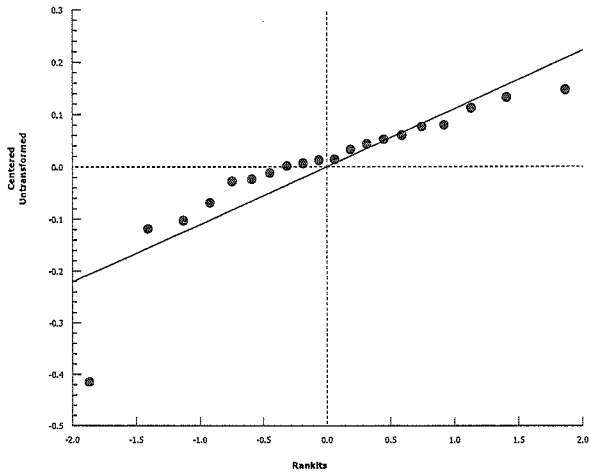
Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
FR_UFR1	0.7467	0.69	0.7278	0.7933	0.6109
GH_FR1	0.7089	0.723	0.6367	0.653	0.162
FR_FRCP1	0.477	0.6082	0.7078	0.6025	0.584
CM_MC2	0.638	0.759	0.75	0.708	0.679

Analysis ID:	16-5632-9495	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	22 Nov-16 12:19	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Client: Teck

W.O.#: 16117

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
FR-UFR1	Oct 17/16	Oct 20/16	50	7.3	7.5	142	50	9.2	184	JS
GH-FR1	↓	↓	50	9.5	9.7	186	100①	5.1	510	↓
FR-FRCP1	↓	↓	50	10.3	10.5	202	100①	5.8	580	↓
CM-MC2	↓	↓	50	8.4	8.6	164	100	3.8	380	↓
FR-UFR1	Oct 25/16	Oct 25/16	50	6.8	7.1	130	50	9.0	180	↓
GH-FR1	↓	↓	50	9.2	9.5	178	100	5.3	530	↓
FR-FRCP1	↓	↓	50	9.4	9.7	182	100	5.1	510	↓
CM-MC2	↓	↓	50	9.5	9.7	186	50	21.7	434	↓
FR-UFR1	Nov 3/16	Nov 3/16	50	7.2	7.3	142	50	8.6	172	↓
GH-FR1	↓	↓	50	9.9	10.2	192	100①	4.3	430	↓
FR-FRCP1	↓	↓	50	9.8	10.0	192	100①	5.1	510	↓
CM-MC2	↓	↓	50	9.0	9.1	178	50	16.4	328	↓
FR-UFR1	Nov 8/16	Nov 9/16	50	6.8	7.1	130	50	8.2	164	↓
GH-FR1	↓	↓	50	10.0	10.3	194	100①	4.7	470	↓
FR-FRCP1	↓	↓	50	10.3	10.6	200	100①	3.5	350	↓
CM-MC2	↓	↓	50	8.6	8.7	170	50	16.8	~~840~~ 336	↓

Notes:

Reviewed by: JH Date Reviewed: Nov-29/16

APPENDIX D – *Pimephales promelas* Toxicity Test Data

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

1617-0245 = FR_FRCP1
1617-0246 = FR_UFR1
1617-0247 = GH_FR1
1617-0248 = CM_MC2

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Control hatching success must be >66% (≥10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

replicate	CTL- TAP Day 1 Alive Embryos	CTL- TAP Day 1 Dead Embryos	CTL-MHRW Day 1 Alive Embryos	CTL-MHRW Day 1 Dead Embryos	1617-0245 Day 1 Alive Embryos	1617-0245 Day 1 Dead Embryos	1617-0246 Day 1 Alive Embryos	1617-0246 Day 1 Dead Embryos	1617-0247 Day 1 Alive Embryos	1617-0247 Day 1 Dead Embryos	1617-0248 Day 1 Alive Embryos	1617-0248 Day 1 Dead Embryos
a	12	3	15	0	14	1	12	3	14	1	13	2
b	15	2	17	3	14	1	15	0	14	1	12	3
c	14	1	15	0	14	1	15	0	15	0	13	2
d	13	2	13	2	13	2	14	1	11	4	14	1
e	25	5	20	0	29	1	28	2	26	4	27	3
f	27	3	27	3	28	2	28	2	26	4	28	3

e 27 3
f 30 0

Comments/Observations:

CTL tape → hatched, counted as alive embryo for now.

Number of Alive Embryos and Hatched Organisms

replicate	CTL- TAP Day 2 Alive Embryos	CTL- TAP Day 2 Dead Embryos	CTL- TAP Day 2 Cull to 15	CTL-MHRW Day 2 Alive Embryos	CTL-MHRW Day 2 Dead Embryos	CTL-MHRW Day 2 Cull to 15	1617-0245 Day 2 Alive Embryos	1617-0245 Day 2 Dead Embryos	1617-0245 Day 2 Cull to 15	1617-0246 Day 2 Alive Embryos	1617-0246 Day 2 Dead Embryos	1617-0246 Day 2 Cull to 15
a	12	0	15	15	0	15	14	0	15	11	1	15
b	13	0	15	12	0	15	14	0	15	15	0	15
c	14	0	15	14	1	15	13	0	15	15	0	15
d	13	0	15	13	0	15	13	0	15	14	0	15
e	25	0		27	0		29	0		28	0	
f	26	1		29	1		28	0		27	1	

1 dead embryo

replicate	1617-0247 Day 2 Alive Embryos	1617-0247 Day 2 Dead Embryos	1617-0247 Day 2 Cull to 15	1617-0248 Day 2 Alive Embryos	1617-0248 Day 2 Dead Embryos	1617-0248 Day 2 Cull to 15
a	14	0	15	13	0	15
b	13	1	15	12	0	15
c	15	0	15	13	0	15
d	11	0	15	14	0	15
e	26	0		26	1	
f	26	0		28	0	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS   Client: NAU104   Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Number of Alive Embryos and Hatched Organisms

	CTL-TAP Day 3		CTL-MHRW Day 3		1617-0245 Day 3		1617-0246 Day 3		1617-0247 Day 3		1617-0248 Day 3	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	14	1	12	3	14 15	0	14	1	13	2	14	1
b	14	1	15	0	14 15	0	14	1	15	0	12	3
c	14	1	13	2	15 14	0	14	1	13 14	2	12	3
d	15	0	13	2	9 15	0 6	15	0	12	3	15	0

Comments/Observations:

Alive Emb.	Alive hatched
a 5	10
b 2	13
c 1	14
10 15	0

	CTL-TAP Day 4		CTL-MHRW Day 4		1617-0245 Day 4		1617-0246 Day 4		1617-0247 Day 4		1617-0248 Day 4	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	14(1)	1	1	14(1)	0	15	2	12	1	14	2	13
b	14	1	1	14	0	14 15	0	15	0	15	0	14
c	15	0	0	15	0	15	0	15	0	15	1	14
d			0	15	0	15	0	15	1	14	15	0

Comments/Observations: 0246b 1 dead hatched   0248-b → 1 dead hatched

replicate	CTL-TAP Day 5 Alive Hatched	CTL-MHRW Day 5 Alive Hatched	1617-0245 Day 5 Alive Hatched	1617-0246 Day 5 Alive Hatched	1617-0247 Day 5 Alive Hatched	1617-0248 Day 5 Alive Hatched
a	15	15(1)	15	14	15(1)	15
b	14 15	15	15	15	15	14
c	14(1)	15	15	15	15	15(1)
d	15	15	15	14*	14**	15(1)

Comments/Observations: 0246D* dead hatched. **247D - dead partially hatched

CTL-TAP C - 1 dead hatched

replicate	CTL-TAP Day 6 Alive Hatched	CTL-MHRW Day 6 Alive Hatched	1617-0245 Day 6 Alive Hatched	1617-0246 Day 6 Alive Hatched	1617-0247 Day 6 Alive Hatched	1617-0248 Day 6 Alive Hatched
a	15	15	15	14	14	15
b	15	15	12	15	15	14
c	14(1)	15	14	15	15	14
d	15	15	14(1)	13 13	14	15(1)

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Number of Alive Embryos and Hatched Organisms

replicate	CTL- TAP Day 7 Alive Hatched	CTL-MHRW Day 7 Alive Hatched	1617-0245 Day 7 Alive Hatched	1617-0246 Day 7 Alive Hatched	1617-0247 Day 7 Alive Hatched	1617-0248 Day 7 Alive Hatched
a	14	15	~~13~~ 12	12 (1)	11 (1) *	13 *
b	15	15	11	12	12 *	12 *
c	14 (1)	15	10	9 (1)	11 *	12 *
d	15	15	6	9	9 *	15

Comments/Observations: 0248 A - 2 dead high microb. growth; same in 0248 B, C
0247 all death = microb. growth

0246
0245

replicate	CTL- TAP Day 8 Alive Hatched	CTL-MHRW Day 8 Alive Hatched	1617-0245 Day 8 Alive Hatched	1617-0246 Day 8 Alive Hatched	1617-0247 Day 8 Alive Hatched	1617-0248 Day 8 Alive Hatched
a	14	15	6	6 (1)	8 (2)	13 (2)
b	15	15	8	8	10	12
c	14 (1)	15	2	5 (2)	3 FD	11 (1)
d	15	15	3	4	7 + 8	15 (1)

12 (2) FD

Comments/Observations:
bact

replicate	CTL- TAP Day 9 Alive Hatched	CTL-MHRW Day 9 Alive Hatched	1617-0245 Day 9 Alive Hatched	1617-0246 Day 9 Alive Hatched	1617-0247 Day 9 Alive Hatched	1617-0248 Day 9 Alive Hatched
a	14	15	4	5	7	12 (1)
b	15	15 (1)	8	4 sac	9 (1)	12
c	13	15	1	3	2	12 (1)
d	15	~~15~~ 14	2	2	8 (1)	15 (1)

15 co

Comments/Observations:
* feeding both CTL's = 1mL, 0245 A=0.5mL B=0.25mL 0246 - all 0.5mL 0247 A=0.5mL B=1mL C=0.25mL
0248 = all 1mL

replicate	CTL- TAP Day 10 Alive Hatched	CTL-MHRW Day 10 Alive Hatched	1617-0245 Day 10 Alive Hatched	1617-0246 Day 10 Alive Hatched	1617-0247 Day 10 Alive Hatched	1617-0248 Day 10 Alive Hatched
a	14	15	4	5	7	12 (1)
b	15	14	8	5	9 (1)	12 (1)
c	13	15 (1)	1	3 (1)	2	12 (2)
d	15	15	1	2	6	14

Comments/Observations:

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Number of Alive Embryos and Hatched Organisms

replicate	CTL-TAP Day 11 Alive Hatched	CTL-MHRW Day 11 Alive Hatched	1617-0245 Day 11 Alive Hatched	1617-0246 Day 11 Alive Hatched	1617-0247 Day 11 Alive Hatched	1617-0248 Day 11 Alive Hatched
a	14	15	12(1) 4	5	7	12(1)
b	15	14	11(1) 8	5	8	11(1)
c	13	15	12(1) 11	3	2	12(1)
d	15	15	14 1 JN	2	6	14

Comments/Observations:

replicate	CTL-TAP Day 12 Alive Hatched	CTL-MHRW Day 12 Alive Hatched	1617-0245 Day 12 Alive Hatched	1617-0246 Day 12 Alive Hatched	1617-0247 Day 12 Alive Hatched	1617-0248 Day 12 Alive Hatched
a	13	14 15 JN	3(1)	5	7	12(1)
b	15(1)	14	8	5	8	11(1)
c	13	15	1	3	2	4
d	15	15	1	2	6	14

Comments/Observations: new feeding regime: CTLS - All 1.5mL; 0245 ACD=0.25mL B=1mL; 0246 - All 0.25mL CD AB=0.5mL; 0247 - ABD=1mL C=0.25mL; 0248 All 1.5mL

replicate	CTL-TAP Day 13 Alive Hatched	CTL-MHRW Day 13 Alive Hatched	1617-0245 Day 13 Alive Hatched	1617-0246 Day 13 Alive Hatched	1617-0247 Day 13 Alive Hatched	1617-0248 Day 13 Alive Hatched
a	13	15	3	5	7	11
b	14	14	8	5	8	11
c	13	15	0	3	2	11
d	15	15	1	2	5	14

Comments/Observations:

replicate	CTL-TAP Day 14 Alive Hatched	CTL-MHRW Day 14 Alive Hatched	1617-0245 Day 14 Alive Hatched	1617-0246 Day 14 Alive Hatched	1617-0247 Day 14 Alive Hatched	1617-0248 Day 14 Alive Hatched
a	13	15	3	~~4~~ 5 CA	6	11
b	14	14	8	5	8	11
c	13	15	0	3	2	11
d	15	15	1	2(1)	5	14

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 15	Day 15	Day 15	Day 15	Day 15	Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	3	5	6	11
b	14	14	6	5	8	11
c	13	15	0	3(1)	2	11
d	15	15	1	2(1)	5	14

Comments/Observations:

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 16	Day 16	Day 16	Day 16	Day 16	Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	3	5	6	10
b	14	14	6	5	8	11
c	13	15	0	3	2	11
d	15	15	1	2	5	14

Comments/Observations:

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 17	Day 17	Day 17	Day 17	Day 17	Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	3	5	6	10
b	14	14	6	5	8	11
c	13	15	0	3(1)	2	11(1)
d	15	15	1	2	5	14

Comments/Observations:

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 18	Day 18	Day 18	Day 18	Day 18	Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	3	5	6	10
b	14	14	6	5	8	11
c	13	15	0	3(1)	2	11(1)
d	15	15	1	2	5	14

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Number of Alive Embryos and Hatched Organisms

replicate	CTL-TAP Day 19 Alive Hatched	CTL-MHRW Day 19 Alive Hatched	1617-0245 Day 19 Alive Hatched	1617-0246 Day 19 Alive Hatched	1617-0247 Day 19 Alive Hatched	1617-0248 Day 19 Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	~~7~~ 8 (3rd)	11
c	13	15	0	3	2	11
d	15	14	1	2	5	14

Comments/Observations:

replicate	CTL-TAP Day 20 Alive Hatched	CTL-MHRW Day 20 Alive Hatched	1617-0245 Day 20 Alive Hatched	1617-0246 Day 20 Alive Hatched	1617-0247 Day 20 Alive Hatched	1617-0248 Day 20 Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	11
c	13	15	0	3 (1)	2	11
d	15	14	1	2	5	14

Comments/Observations:

replicate	CTL-TAP Day 21 Alive Hatched	CTL-MHRW Day 21 Alive Hatched	1617-0245 Day 21 Alive Hatched	1617-0246 Day 21 Alive Hatched	1617-0247 Day 21 Alive Hatched	1617-0248 Day 21 Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	11
c	13	15	0	3	2	11
d	15	14	1	2	5	14

Comments/Observations:

replicate	CTL-TAP Day 22 Alive Hatched	CTL-MHRW Day 22 Alive Hatched	1617-0245 Day 22 Alive Hatched	1617-0246 Day 22 Alive Hatched	1617-0247 Day 22 Alive Hatched	1617-0248 Day 22 Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	11
c	13	15	0	3	2	11
d	15	14	1	2	5	14

Comments/Observations:
feeding change in pM ctls = all 2mL

0245 AD = 0.25mL
B = 1mL

0246 AB = 0.5mL
CD = 0.25mL

0247 AB = 1mL
C = 0.25mL
D = 0.5mL

0248 ABC = 1.5mL
D = 2mL

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Number of Alive Embryos and Hatched Organisms

replicate	CTL- TAP Day 23 Alive Hatched	CTL-MHRW Day 23 Alive Hatched	1617-0245 Day 23 Alive Hatched	1617-0246 Day 23 Alive Hatched	1617-0247 Day 23 Alive Hatched	1617-0248 Day 23 Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5(1)	8	11
c	13	15	0	3	2	11
d	15	14	1	2	5	14

Comments/Observations:

replicate	CTL- TAP Day 24 Alive Hatched	CTL-MHRW Day 24 Alive Hatched	1617-0245 Day 24 Alive Hatched	1617-0246 Day 24 Alive Hatched	1617-0247 Day 24 Alive Hatched	1617-0248 Day 24 Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	10 (1)
c	13	15	0	3	2	11
d	15	14	1	2	5	14

Comments/Observations:

replicate	CTL- TAP Day 25 Alive Hatched	CTL-MHRW Day 25 Alive Hatched	1617-0245 Day 25 Alive Hatched	1617-0246 Day 25 Alive Hatched	1617-0247 Day 25 Alive Hatched	1617-0248 Day 25 Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	10 (1)
c	13	15	0	3	2	11 (1)
d	15	14	1	2	5	14

Comments/Observations:

replicate	CTL- TAP Day 26 Alive Hatched	CTL-MHRW Day 26 Alive Hatched	1617-0245 Day 26 Alive Hatched	1617-0246 Day 26 Alive Hatched	1617-0247 Day 26 Alive Hatched	1617-0248 Day 26 Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	10 (1)
c	13	15	0	3	2	11 (2)
d	15	14	1	2	5	14

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 27	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	11
c	13	15	0	3(1)	2	11(2)
d	15	13	1	2	5	14

Comments/Observations:

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 28	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	11
c	13	15	0	3(1)	2	11(2)
d	15	13	1	2	5	14

Comments/Observations:

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 29	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	11
c	13	15	0	3(1)	2	11(2)
d	15	13	1	2	5	14

the 2 stressed have hatch four 5

Comments/Observations:

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 30	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	11
c	13	15	0	3	2	11
d	15	13	1	2	5	14

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 31	Day 31	Day 31	Day 31	Day 31	Day 31
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	11
c	13	15	0	3	2	11(2)
d	15	13	1	2	5	14

Comments/Observations:

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
	Day 32	Day 32	Day 32	Day 32	Day 32	Day 32
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	14	3	5	6	10
b	14	15	6	5	8	11
c	13	15	0	3	2	11(2)
d	~~15~~ 14 JW	13	1	2	5	14

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

New Solutions

Conc. (%)	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
Day						

pH (units)

Day						
0	8.2	7.9	8.1	8.0	7.9	7.9
1	8.0	7.9	8.2	8.1	8.1	8.2
2	8.1	7.7	8.2	8.2	8.1	8.2
3	8.2	7.9	8.3	8.2	8.2	8.2
4	8.2	7.9	8.2	8.2	8.1	8.2
5	8.1	7.7	8.3	8.2	8.2	8.2
6	7.7	7.7	8.0	8.0	8.1	8.3
7	8.1	8.0	8.2	8.2	8.1	8.2
8	8.0	7.8	8.1	8.1	8.0	8.1

Conductance (µS/cm)

Day						
0	419	304	796	317	709	610
1	408	308	818	340	740	637
2	417	311	828	339	745	647
3	411	325	845	345	716	668
4	398	309	795	328	703	614
5	396	334	854	331	735	627
6	388	348	795	343	680	651
7	372	330	866	339	730	760
8	375	341	857	335	747	755

Dissolved Oxygen (mg/L) (40-100% saturation)

Day						
0	7.2	7.2	7.3	7.3	7.2	7.2
1	7.2	7.3	7.3	7.3	7.3	7.3
2	7.3	7.3	7.3	7.3	7.3	7.3
3	7.2	7.1	7.3	7.3	7.2	7.3
4	7.3	7.3	7.3	7.3	7.3	7.3
5	7.3	7.3	7.3	7.3	7.3	7.3
6	7.2	7.2	7.2	7.3	7.2	7.2
7	7.2	7.2	7.3	7.3	7.3	7.3
8	7.3	7.3	7.3	7.3	7.3	7.3

Temperature (°C)

Day						
0	24.0	24.5	24.1	24.1	24.7	24.8
1	24.9	24.5	24.0	24.0	24.0	24.0
2	23.7	23.7	23.5	23.5	23.5	23.5
3	23.6	23.9	23.8	23.8	23.5	23.7
4	24.2	23.7	23.7	24.0	24.1	24.1
5	23.6	23.6	24.0	24.0	24.0	24.0
6	24.6	24.6	24.5	24.6	24.6	24.6
7	25.0	24.0	24.4	24.4	24.4	24.2
8	24.4	23.6	24.4	23.9	24.0	23.9

Old Solutions

CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248

pH (units)

0						
1	8.1	7.8	8.1	8.1	8.1	8.1
2	8.1	7.8	8.0	8.1	8.1	8.0
3	8.1	7.8	8.2	8.1	8.1	8.2
4	8.1	7.9	8.0	8.1	8.0	8.0
5	7.9	7.6	7.9	7.9	7.9	8.1
6	8.0	7.7	7.9	8.1	8.0	8.1
7	7.8	7.5	7.9	8.0	7.9	8.1
8	7.9	7.4	7.9	8.0	8.1	8.0

Conductance (µS/cm)

0						
1	430	323	805	345	735	630
2	409	330	806	346	735	622
3	412	324	808	350	715	622
4	400	330	787	361	716	626
5	406	322	816	400	721	631
6	394	337	810	377	714	633
7	390	346	764	350	702	650
8	389	357	833	367	727	719

Dissolved Oxygen (mg/L) (40-100% saturation)

0						
1	7.2	7.0	7.0	7.1	7.1	7.1
2	7.1	7.1	6.9	7.0	7.0	7.0
3	7.0	7.0	7.3	7.2	7.2	7.2
4	7.2	7.2	7.1	7.1	7.1	7.1
5	6.4	6.5	6.6	6.4	6.5	6.7
6	6.3	6.3	6.3	6.4	6.3	6.3
7	5.8	5.9	6.2	6.1	5.9	5.9
8	6.4	6.2	6.7	6.8	6.9	6.7

Temperature (°C)

0						
1	24	→				
2	25	→				
3	26	→				
4	26	→				
5	25	→				
6	24	→				
7	23	→				
8	23	→				

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Written by JP on 2015/02/22
Revised by

Nautilus Environmental (Calgary)

File: FM 32 Day Chemistry
F318

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS Client: NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

New Solutions

Conc. (%)	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248	
Day							

pH (units)

Day							
9	8.0	8.0	8.1	8.2	8.1	8.1	
10	8.0	7.9	8.0	8.1	8.1	8.1	
11	8.0	7.9	8.2	8.2	8.1	8.3	
12	8.0	7.8	8.0	8.1	8.0	8.2	
13	8.1	8.0	8.1	8.1	8.1	8.3	
14	7.8	8.0	8.2	8.2	8.2	8.3	
15	8.1	8.0	8.0	8.1	8.0	8.2	
16	8.1	7.9	8.1	8.1	8.1	8.2	
17	8.0	7.9	8.0	8.1	8.0	8.2	

* 7.9 JN

↓ 8.3

Conductance (µS/cm)

Day							
9	411	383	823	328	741	772	
10	380	310	806	330	756	762	
11	373	377	854	332	751	764	
12	372	390	861	331	752	766	
13	365	306	831	331	737	745	
14	367	303	804	316	757	685	
15	352	300	832	309	740	628	
16	364	309	817	319	752	633	
17	351	303	807	308	731	625	

356 356

Dissolved Oxygen (mg/L) (40-100% saturation)

Day							
9	7.3	7.2	7.3	7.3	7.5	7.3	
10	7.2	7.3	7.2	7.2	7.3	7.3	
11	7.3	7.3	7.3	7.3	7.2	7.3	
12	7.3	7.3	7.1	7.1	7.1	7.2	
13	7.2	7.2	7.2	7.1	7.1	7.1	
14	6.9	7.1	7.2	7.2	7.1	7.2	
15	7.2	7.2	7.2	7.2	7.2	7.2	
16	7.2	7.2	7.3	7.1	7.2	7.2	
17	7.3	7.2	7.2	7.2	7.2	7.2	

↓ 7.2

Temperature (°C)

Day							
9	24.4	24.3	24.3	24.3	24.1	24.2	
10	25.1	24.4	25.0	24.5	24.4	24.2	
11	24.2	23.5	24.4	24.3	24.6	24.3	
12	24.2	24.1	25.9	25.5	26.2	25.4	
13	24.9	25.2	25.2	25.5	26.2	26.3	
14	25.1	25.1	25.4	25.4	26.2	25.4	
15	24.9	25.3	25.4	25.4	25.3	25.2	
16	24.1	25.0	25.4	25.5	25.4	25.4	
17	25.2	25.1	25.4	25.4	25.4	25.1	

Old Solutions

CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248	

pH (units)

9	7.7	7.6	7.9	8.0	8.0	8.1
10	7.9	7.6	7.8	8.1	7.9	8.0
11	7.9	7.7	7.9	8.2	8.0	7.9
12	7.8	7.7	8.0	8.0	8.1	7.8
13	7.7	7.6	7.8	8.1	7.8	8.0
14	7.8	7.8	8.0	8.1	7.9	8.0
15	7.6	7.3	8.0	8.0	8.0	8.0
16	7.6	7.6	7.9	8.0	7.9	8.0
17	7.6	7.6	7.9	8.0	7.9	7.9

Conductance (µS/cm)

9	366	376	853	338	738	764
10	397	342	892	359	744	761
11	391	313	839	373	738	716
12	378	358	851	347	747	834
13	379	376	841	362	723	731
14	367	339	807	333	783	715
15	364	317	814	322	760	654
16	367	319	791	321	759	657
17	369	320	795	333	749	630

316 NL

Dissolved Oxygen (mg/L) (40-100% saturation)

9	6.4	6.4	6.9	6.8	7.1	7.0
10	6.4	6.5	7.0	6.9	6.8	6.9
11	6.9	6.8	6.8	6.9	6.9	6.8
12	6.4	6.4	6.5	6.6	6.6	6.8
13	5.7	5.7	6.2	6.4	6.7	6.7
14	6.0	6.2	6.7	6.5	6.8	6.9
15	6.1	6.2	6.2	6.2	6.4	6.5
16	6.1	6.0	6.3	6.3	6.6	6.3
17	6.3	6.2	6.5	6.3	6.1	6.0

Temperature (°C)

9	25					
10	25					
11	25					
12	25					
13	25					
14	25					
15	25					
16	25					
17	25					

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

New Solutions

pH (units)

Day	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
18	8.0	7.9	8.2	8.2	8.2	8.3
19	8.0	7.9	8.0	8.2	8.0	8.2
20	8.0	7.9	8.1	8.1	8.1	8.2
21	8.1	7.9	8.0	8.1	8.0	8.1
22	8.1	7.9	8.1	8.2	8.1	8.2
23	8.1	7.9	8.1	8.2	8.1	8.2
24	8.0	7.9	7.9	8.0	7.9	8.1
25	8.1	8.0	8.1	8.1	8.1	8.2
26	7.9	7.8	8.0	8.1	8.0	8.1

Conductance (µS/cm)

Day	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
18	351	304	791	309	745	624
19	349	298	800	316	748	618
20	385	318	841	330	789	656
21	444	380	894	339	796	683
22	369	322	809	337	802	676
23	354	305	859	336	789	675
24	360	313	866	323	805	677
25	345	320	907	332	852	696
26	351	328	889	335	799	680

Dissolved Oxygen (mg/L) (40-100% saturation)

Day	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
18	7.3	7.3	7.2	7.2	7.2	7.2
19	7.2	7.2	7.2	7.1	7.1	7.1
20	7.0	7.1	7.1	7.1	7.2	7.2
21	7.3	7.1	7.1	7.1	7.1	7.1
22	7.2	7.2	7.2	7.2	7.2	7.2
23	7.2	7.2	7.3	7.2	7.2	7.1
24	7.2	7.2	7.2	7.2	7.2	7.1
25	7.2	7.2	7.2	7.2	7.2	7.2
26	7.2	7.2	7.2	7.2	7.2	7.2

Temperature (°C)

Day	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
18	24.3	24.4	25.4	25.2	25.2	25.3
19	25.0	25.1	25.4	26.1	25.9	26.1
20	25.7	25.5	25.6	25.8	24.8	25.1
21	24.1	25.6	25.6	26.0	25.6	25.6
22	25.1	25.4	26.0	25.2	24.9	25.4
23	25.0	24.9	24.1	25.3	25.4	25.5
24	24.5	25.2	25.1	24.7	25.4	25.6
25	25					
26	24.7	24.5	25.1	24.5	25.0	25.4

Old Solutions

pH (units)

Day	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
18	7.7	7.5	7.8	8.1	7.9	8.1
19	7.8	7.5	8.0	8.1	7.9	8.1
20	7.8	7.6	7.9	8.0	7.9	8.0
21	7.9	7.6	7.9	7.9	7.9	8.1
22	7.8	7.4	7.9	8.1	7.9	8.0
23	7.8	7.3	7.8	8.0	7.9	8.0
24	7.8	7.5	7.8	8.1	7.9	8.0
25	7.8	7.6	7.9	8.0	7.9	8.0
26	7.8	7.6	7.8	8.1	7.9	8.0

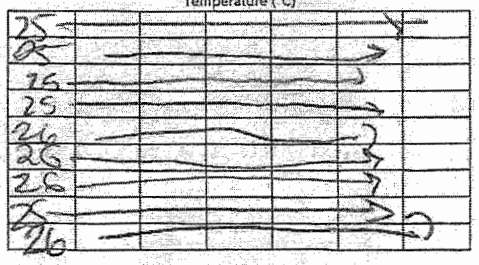
Conductance (µS/cm)

Day	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
18	360	319	796	338	737	644
19	357	320	780	339	747	641
20	378	336	823	344	780	665
21	430	334	817	342	770	671
22	445	325	854	351	769	681
23	416	322	853	341	781	697
24	391	331	879	344	771	692
25	379	328	874	335	787	697
26	346	331	852	380	769	674

Dissolved Oxygen (mg/L) (40-100% saturation)

Day	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
18	6.7	6.1	6.7	6.9	7.0	6.8
19	6.8	6.7	6.6	6.6	6.5	6.8
20	6.2	6.2	6.3	6.3	6.5	6.4
21	6.1	6.1	6.1	6.4	6.3	6.2
22	6.0	6.1	6.0	6.0	6.0	6.0
23	5.9	5.9	5.9	5.9	6.2	6.2
24	5.9	6.1	6.0	6.5	6.6	6.5
25	6.6	6.2	6.4	6.4	6.5	6.5
26	6.5	6.3	6.4	6.5	6.6	6.6

Temperature (°C)



DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Day 25 temps. new

CTL-TAP	CTL-MHRW	0245	0246	0247	0248
25.4	24.8	25.2	25.4	25.4	25.4

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS Client: NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

New Solutions

pH (units)

Conc. (%)	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
Day						
27	8.1	8.0	8.1	8.1	8.0	8.2
28	8.0	7.8	8.1	8.1	8.0	8.2
29	8.0	7.9	7.9	7.9	7.9	8.0
30	8.1	8.0	8.1	8.1	8.1	8.2
31	7.9	7.8	8.0	8.1	8.0	8.1
32						

Conductance (µS/cm)

27	321	315	888	325	760	663
28	490	378	800	771	794	565
29	376	314	895	321	779	559
30	382	327	876	341	762	547
31	368	315	877	329	786	563
32						

Dissolved Oxygen (mg/L) (40-100% saturation)

27	7.2	7.1	7.1	7.1	7.1	7.1
28	7.2	7.2	7.1	7.2	7.2	7.1
29	7.3	7.2	7.2	7.2	7.2	7.3
30	7.2	7.2	7.1	7.1	7.1	7.1
31	7.3	7.3	7.3	7.1	7.1	7.1
32						

Temperature (°C)

27	24.9	25.6	25.7	25.9	25.8	25.6
28	25.0	24.6	25.6	25.3	25.3	25.5
29	24.4	25.9	25.1	25.1	25.1	24.2
30	24.6	24.9	25.6	25.6	25.2	25.7
31	24.4	24.4	24.4	25.5	25.9	25.6
32						

Old Solutions

pH (units)

	CTL- TAP	CTL-MHRW	1617-0245	1617-0246	1617-0247	1617-0248
27	7.8	7.5	7.8	8.1	7.9	8.0
28	7.8	7.6	7.8	8.1	7.9	8.2
29	7.8	7.5	7.7	8.0	7.8	7.9
30	7.8	7.5	7.9	7.9	7.9	8.0
31	7.7	7.5	7.7	8.0	7.8	7.9
32	7.7	7.5	7.7	8.0	7.9	8.0

Conductance (µS/cm)

27	324	333	844	367	766	691
28	323	331	846	366	764	692
29	416	331	848	368	776	624
30	410	336	866	336	792	667
31	399	329	848	363	768	609
32	373	327	849	374	751	594

Dissolved Oxygen (mg/L) (40-100% saturation)

27	6.3	6.3	6.4	6.5	6.7	6.6
28	6.8	6.5	6.5	6.7	6.8	6.6
29	6.8	6.8	6.8	6.9	6.9	6.9
30	6.0	6.0	6.5	6.0	6.4	6.5
31	5.9	6.0	6.2	6.4	6.5	6.5
32	6.6	6.6	6.8	6.9	6.8	6.8

Temperature (°C)

27	25					
28	25					
29	26					
30	25					
31	26					
32	25					

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.

CTL-TAP

Fish	Rep A Length (mm)	Rep A Normal/ Abnormal	Rep B Length (mm)	Rep B Normal/ Abnormal	Rep C Length (mm)	Rep C Normal/ Abnormal	Rep D Length (mm)	Rep D Normal/ Abnormal
1	8	N	6	N	8	N	8	N
2	8	↓	6	↓	7	↓	8	↓
3	8	↓	8	↓	8	↓	8	↓
4	9	↓	8	↓	10	↓	6	↓
5	8	↓	8	↓	7	↓	7	↓
6	8	↓	9	↓	8	↓	8	↓
7	8	↓	10	↓	10	↓	8	↓
8	8	↓	10	↓	9	↓	8	↓
9	9	↓	8	↓	7	↓	7	↓
10	9	↓	8	↓	6	↓	10	↓
11	11	↓	10	↓	9	↓	8	↓
12	7	↓	8	↓	7	↓	10	↓
13	8	↓	7	↓	7	↓	8	↓
14	—		8	↓	—		7	↓
15	—		—		—		—	

Comments

CTL-MHRW

Fish	Rep A Length (mm)	Rep A Normal/ Abnormal	Rep B Length (mm)	Rep B Normal/ Abnormal	Rep C Length (mm)	Rep C Normal/ Abnormal	Rep D Length (mm)	Rep D Normal/ Abnormal
1	7	N	7	N	7	N	10	N
2	9	↓	8	↓	9	↓	9	↓
3	8	↓	7	↓	9	↓	7	↓
4	9	↓	8	↓	7	↓	7	↓
5	10	↓	9	↓	7	↓	7	↓
6	7	↓	9	↓	8	↓	11	↓
7	8	↓	8	↓	8	↓	10	↓
8	8	↓	9	↓	8	↓	8	↓
9	7	↓	8	↓	9	↓	8	↓
10	8	↓	8	↓	8	↓	6	↓
11	9	↓	8	↓	8	↓	8	↓
12	11	↓	9	↓	8	↓	8	↓
13	7	↓	8	↓	7	↓	7	↓
14	8	AS	7	↓	8	↓	—	
15	—		7	↓	8	↓	—	

Comments

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. 1617-0245

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	9	N	1	9	N	1			1	14	N
2	9	↓	2	7	↓	2			2	—	
3	10	↓	3	8	↓	3			3	—	
4	—		4	9	↓	4			4	—	
5	—		5	8	↓	5			5	—	
6	—		6	9	↓	6			6	—	
7	—		7	—		7			7	—	
8	—		8	—		8			8	—	
9	—		9	—		9			9	—	
10	—		10	—		10			10	—	
11	—		11	—		11			11	—	
12	—		12	—		12			12	—	
13	—		13	—		13			13	—	
14	—		14	—		14			14	—	
15	—		15	—		15			15	—	

Comments

Conc. 1617-0246

Replicate # D			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	7	N	1	8	N	1	6	AS	1	11	N
2	8	↓	2	9	↓	2	11	N	2	11	↓
3	10	↓	3	8	↓	3	10	↓	3	—	
4	10	↓	4	8	↓	4	—		4	—	
5	8	↓	5	9	↓	5	—		5	—	
6	—		6	—		6	—		6	—	
7	—		7	—		7	—		7	—	
8	—		8	—		8	—		8	—	
9	—		9	—		9	—		9	—	
10	—		10	—		10	—		10	—	
11	—		11	—		11	—		11	—	
12	—		12	—		12	—		12	—	
13	—		13	—		13	—		13	—	
14	—		14	—		14	—		14	—	
15	—		15	—		15	—		15	—	

Comments

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. **1617-0247**

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	10	N	1	9	N	1	10	N	1	10	N
2	9	↓	2	8	↓	2	10	↓	2	11	↓
3	9		3	7		3	—		3	10	
4	10		4	7		4	—		4	8	
5	9		5	9		5	—		5	10	
6	9		6	7		6	—		6	—	
7	—		7	9		7	—		7	—	
8	—		8	10		8	—		8	—	
9	—		9	—		9	—		9	—	
10	—		10	—		10	—		10	—	
11	—		11	—		11	—		11	—	
12	—		12	—		12	—		12	—	
13	—		13	—		13	—		13	—	
14	—		14	—		14	—		14	—	
15	—		15	—		15	—		15	—	

Comments

1617-0248

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	8	N	1	8	N	1	9	N	1	7	N
2	11	↓	2	8	↓	2	10	↓	2	8	↓
3	7		3	10		3	8		3	9	
4	8		4	9		4	8		4	9	
5	9		5	9		5	6	BS	5	8	
6	9		6	8		6	8	N	6	6	
7	10		7	8		7	7		7	8	
8	10		8	8		8	7		8	8	
9	10		9	8		9	11		9	8	
10	8	↓	10	8		10	9	↓	10	9	
11	—		11	7	↓	11	6	BS	11	8	↓
12	—		12	—		12	—		12	8	
13	—		13	—		13	—		13	8	
14	—		14	—		14	—		14	10	
15	—		15	—		15	—		15	—	

Comments

NAUTILUS ENVIRONMENTAL

Organism Weights Bench Sheet

Client NAU104 Sample A Organism FM
SP1617-011 (Untreated)

Initial Weight (mg) (dried pan)

Date: 20161115 Initials: JN Balance*: 1

Conc.	CTL TAP	CTL MHRW	1617-0245	1617-0246	1617-0247	1617-0248		
Replicate								
a	1001.85	984.32	977.85	1044.82	996.71	1021.14		
b	973.78	1002.89	974.91	1019.13	999.98	1025.88		
c	983.33	1001.87	974.00	1035.34	1016.67	1053.36		
d	990.97	968.58	987.71	1044.79	1008.04	991.13		
e								

Final Weight (mg) (dried pan+organisms)

Date: Initials: Balance*:

Conc.	CTL TAP	CTL MHRW	1617-0245	1617-0246	1617-0247	1617-0248		
Replicate								
a	1012.67	996.85	987.12	1049.33	1004.12	1031.32		
b	984.81	1012.98	979.57	1033.06	1007.37	1038.05		
c	993.70	1011.25		1039.30	1020.37	1062.85		
d	1001.26	978.59	993.42	1049.32	1015.90	1001.10		
e								

Test Validity Met: Yes/No/NA

Results are Logical: Yes/No**
**no negative numbers, consistent values across replicates

Check 0245D = good ✓
Check 0246D = good ✓

*Same balance must be used for initial and final weights
*For FM/HA/CT must use scale with 0.01 mg accuracy

Balance Calibration Check:

	Initial		Final
first pan weighed:	CTL TAP A	first pan+org weighed:	CTL TAP
weight of first pan:	1001.85	weight of first pan + org:	1012.67
re-weigh of first pan after all weights measured :	1001.84	re-weigh of first pan + org after all weights measured:	1012.67
% difference <5%:	Yes/No	**% difference <5%:**	Yes/No

Calculation: % difference = [initial weight-reweight/((initial weight+reweight)/2)]x100

If "no" is circled for any parameter, notify Lab Supervisor/QA Group to determine appropriate action

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	09-2889-3904	20 Oct-16	20 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap	Control Tap		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Hatched Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control Tap	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	4	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	1.67%
CM_MC2	4	1	1	1	1	1	0	0	0.0%	0.0%

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control Tap	4	8.095	7.747	8.443	7.923	8.385	0.1093	0.2186	2.7%	0.0%
FR_UFR1	4	9.25	7.352	11.15	8.4	11	0.5965	1.193	12.9%	-14.27%
FR_FRCP1	3	10.56	3.042	18.07	8.333	14	1.746	3.025	28.65%	-30.4%
GH_FR1	4	9.346	8.101	10.59	8.25	10	0.3911	0.7821	8.37%	-15.46%
CM_MC2	4	8.377	7.704	9.049	8.091	9	0.2113	0.4226	5.05%	-3.48%

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control Tap	4	0.7085	0.6708	0.7462	0.686	0.7353	0.01185	0.0237	3.35%	0.0%
FR_UFR1	4	0.2822	0.2469	0.3174	0.262	0.302	0.01108	0.02215	7.85%	60.17%
FR_FRCP1	4	0.243	-0.02293	0.5089	0	0.3807	0.08356	0.1671	68.77%	65.7%
GH_FR1	4	0.4393	0.2337	0.645	0.2467	0.524	0.06463	0.1293	29.42%	37.99%
CM_MC2	4	0.6468	0.5983	0.6954	0.6113	0.6787	0.01525	0.03051	4.72%	8.7%

Proportion Normal Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control Tap	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	4	0.9167	0.6515	1	0.6667	1	0.08333	0.1667	18.18%	8.33%
FR_FRCP1	3	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	4	1	1	1	1	1	0	0	0.0%	0.0%
CM_MC2	4	0.9545	0.8099	1	0.8182	1	0.04545	0.09091	9.52%	4.55%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control Tap	4	0.9	0.8388	0.9612	0.8667	0.9333	0.01925	0.03849	4.28%	0.0%
FR_UFR1	4	0.25	0.09088	0.4091	0.1333	0.3333	0.05	0.1	40.0%	72.22%
FR_FRCP1	4	0.1667	0	0.4473	0	0.4	0.08819	0.1764	105.8%	81.48%
GH_FR1	4	0.35	0.0848	0.6152	0.1333	0.5333	0.08333	0.1667	47.62%	61.11%
CM_MC2	4	0.7667	0.5829	0.9504	0.6667	0.9333	0.05774	0.1155	15.06%	14.81%

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	0.9333
CM_MC2	1	1	1	1

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	8.385	8.143	7.923	7.929
FR_UFR1	8.6	8.4	9	11
FR_FRCP1	9.333	8.333		14
GH_FR1	9.333	8.25	10	9.8
CM_MC2	9	8.273	8.091	8.143

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	0.7213	0.7353	0.6913	0.686
FR_UFR1	0.3007	0.262	0.264	0.302
FR_FRCP1	0.2847	0.3067	0	0.3807
GH_FR1	0.494	0.4927	0.2467	0.524
CM_MC2	0.6787	0.6113	0.6327	0.6647

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	1	1	1	1
FR_UFR1	1	1	0.6667	1
FR_FRCP1	1	1		1
GH_FR1	1	1	1	1
CM_MC2	1	1	0.8182	1

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	0.8667	0.9333	0.8667	0.9333
FR_UFR1	0.3333	0.3333	0.2	0.1333
FR_FRCP1	0.2	0.4	0	0.06667
GH_FR1	0.4	0.5333	0.1333	0.3333
CM_MC2	0.6667	0.7333	0.7333	0.9333

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	15/15	15/15	15/15	15/15
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	15/15
GH_FR1	15/15	15/15	15/15	14/15
CM_MC2	15/15	15/15	15/15	15/15

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	13/13	14/14	13/13	14/14
FR_UFR1	5/5	5/5	2/3	2/2
FR_FRCP1	3/3	6/6		1/1
GH_FR1	6/6	8/8	2/2	5/5
CM_MC2	10/10	11/11	9/11	14/14

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	13/15	14/15	13/15	14/15
FR_UFR1	5/15	5/15	3/15	2/15
FR_FRCP1	3/15	6/15	0/15	1/15
GH_FR1	6/15	8/15	2/15	5/15
CM_MC2	10/15	11/15	11/15	14/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-6762-3880	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jan-17 15:07	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	09-2889-3904	20 Oct-16	20 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap	Control Tap		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Control Tap		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Control Tap		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
Control Tap		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control Tap	Negative Contr	60	0	60	1	0	0.0%
FR_UFR1		60	0	60	1	0	0.0%
FR_FRCP1		60	0	60	1	0	0.0%
GH_FR1		59	1	60	0.9833	0.01667	1.67%
CM_MC2		60	0	60	1	0	0.0%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	0.9333
CM_MC2	1	1	1	1

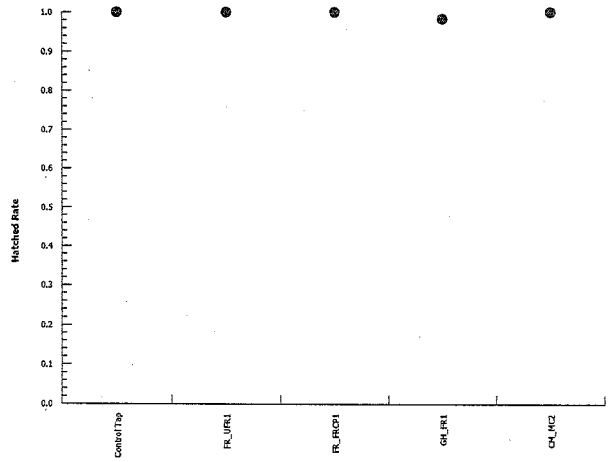
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	15/15	15/15	15/15	15/15
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	15/15
GH_FR1	15/15	15/15	15/15	14/15
CM_MC2	15/15	15/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	20-6762-3880	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jan-17 15:07	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	20-2538-1553	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Dilution Water	60	0	60	1	0	0.0%
FR_FRCP1		60	0	60	1	0	0.0%
GH_FR1		59	1	60	0.9833	0.01667	1.67%
CM_MC2		60	0	60	1	0	0.0%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	0.9333
CM_MC2	1	1	1	1

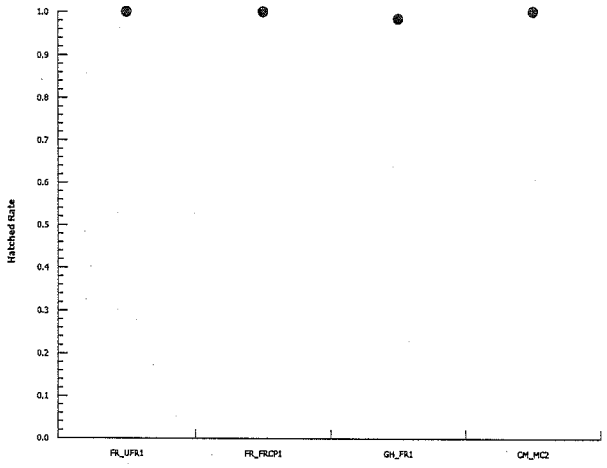
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	15/15	15/15	15/15
GH_FR1	15/15	15/15	15/15	14/15
CM_MC2	15/15	15/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	20-2538-1553	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	10-5302-3105	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jan-17 15:07	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	09-2889-3904	20 Oct-16	20 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap	Control Tap		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	0	<0.0001	Exact	Significant Effect
Control Tap		FR_FRCP1	0	<0.0001	Exact	Significant Effect
Control Tap		GH_FR1	0	<0.0001	Exact	Significant Effect
Control Tap		CM_MC2	0.04232	0.0423	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control Tap	Negative Contr	54	6	60	0.9	0.1	0.0%
FR_UFR1		15	45	60	0.25	0.75	72.22%
FR_FRCP1		10	50	60	0.1667	0.8333	81.48%
GH_FR1		21	39	60	0.35	0.65	61.11%
CM_MC2		46	14	60	0.7667	0.2333	14.81%

Survival Rate Detail

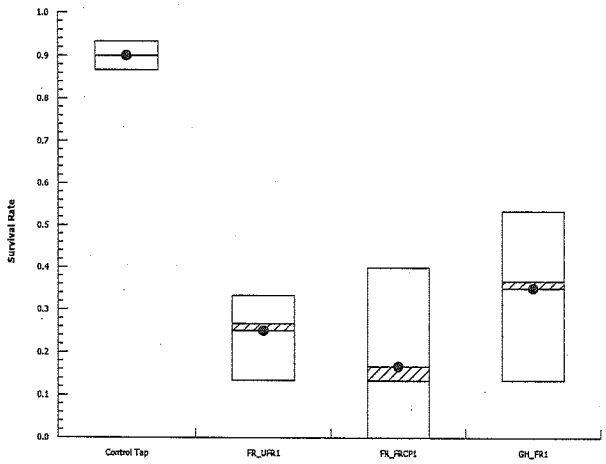
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	0.8667	0.9333	0.8667	0.9333
FR_UFR1	0.3333	0.3333	0.2	0.1333
FR_FRCP1	0.2	0.4	0	0.06667
GH_FR1	0.4	0.5333	0.1333	0.3333
CM_MC2	0.6667	0.7333	0.7333	0.9333

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	13/15	14/15	13/15	14/15
FR_UFR1	5/15	5/15	3/15	2/15
FR_FRCP1	3/15	6/15	0/15	1/15
GH_FR1	6/15	8/15	2/15	5/15
CM_MC2	10/15	11/15	11/15	14/15

Analysis ID:	10-5302-3105	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jan-17 15:07	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	04-3931-0343	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.1844	0.5533	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Dilution Water	15	45	60	0.25	0.75	0.0%
FR_FRCP1		10	50	60	0.1667	0.8333	33.33%
GH_FR1		21	39	60	0.35	0.65	-40.0%
CM_MC2		46	14	60	0.7667	0.2333	-206.7%

Survival Rate Detail

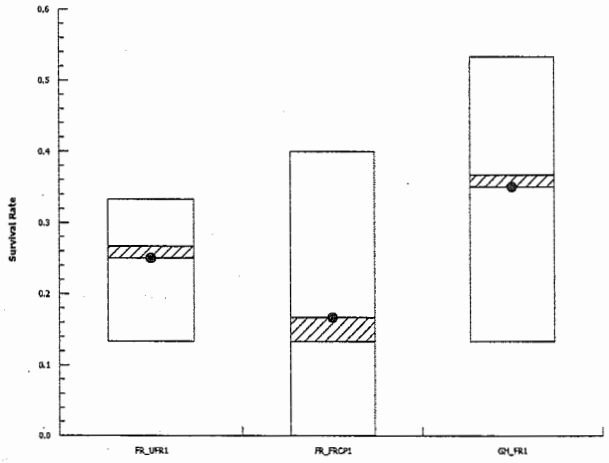
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.3333	0.3333	0.2	0.1333
FR_FRCP1	0.2	0.4	0	0.06667
GH_FR1	0.4	0.5333	0.1333	0.3333
CM_MC2	0.6667	0.7333	0.7333	0.9333

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	5/15	5/15	3/15	2/15
FR_FRCP1	3/15	6/15	0/15	1/15
GH_FR1	6/15	8/15	2/15	5/15
CM_MC2	10/15	11/15	11/15	14/15

Analysis ID:	04-3931-0343	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	05-2714-0601	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	17 Jan-17 17:36	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	09-2889-3904	20 Oct-16	20 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap	Control Tap		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed	NA	C > T	NA	NA	

Nemenyi-Damico-Wolfe Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	54	36.15	0		0.0024	Asymp	Significant Effect
		FR_FRCP1	51	36.15	0		0.0043	Asymp	Significant Effect
		GH_FR1	39	36.15	0		0.0332	Asymp	Significant Effect
		CM_MC2	16	36.15	0		0.3926	Asymp	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Treatment Effect	Fligner-Wolfe	200		0.0002	Significant Overall Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.7028826	0.1757206	4	18.85	<0.0001	Significant Effect
Error	0.1398614	0.009324096	15			
Total	0.842744		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	16.88	13.28	0.0020	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8238	0.866	0.0020	Non-normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control Tap	4	0.7085	0.6708	0.7462	0.7063	0.686	0.7353	0.01185	3.35%	0.0%
FR_UFR1	4	0.2822	0.2469	0.3174	0.2823	0.262	0.302	0.01108	7.85%	60.17%
FR_FRCP1	4	0.243	-0.02293	0.5089	0.2957	0	0.3807	0.08356	68.77%	65.7%
GH_FR1	4	0.4393	0.2337	0.645	0.4933	0.2467	0.524	0.06463	29.42%	37.99%
CM_MC2	4	0.6468	0.5983	0.6954	0.6487	0.6113	0.6787	0.01525	4.72%	8.7%

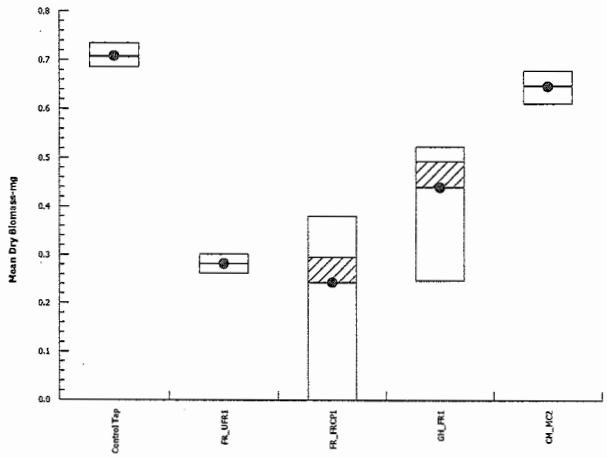
Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

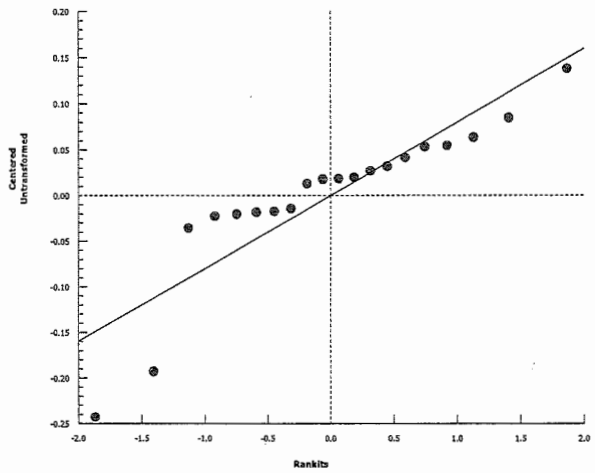
Analysis ID:	05-2714-0601	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	17 Jan-17 17:36	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	0.7213	0.7353	0.6913	0.686
FR_UFR1	0.3007	0.262	0.264	0.302
FR_FRCP1	0.2847	0.3067	0	0.3807
GH_FR1	0.494	0.4927	0.2467	0.524
CM_MC2	0.6787	0.6113	0.6327	0.6647

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	18-9440-5441	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	17 Jan-17 17:41	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	61.5%	

Steel Many-One Rank Sum Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	20	10	0	6	0.9096	Asymp	Non-Significant Effect
		GH_FR1	22	10	0	6	0.9776	Asymp	Non-Significant Effect
		CM_MC2	26	10	0	6	0.9996	Asymp	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.4038995	0.1346332	3	11.69	0.0007	Significant Effect
Error	0.138176	0.01151466	12			
Total	0.5420755		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	11.62	11.34	0.0088	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8371	0.8408	0.0089	Non-normal Distribution

Mean Dry Biomass-mg Summary

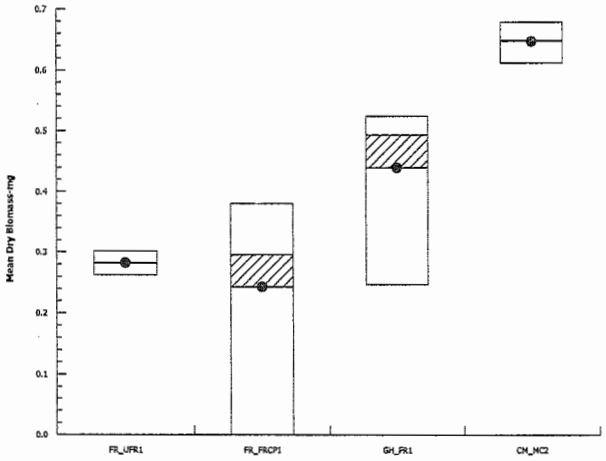
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	0.2822	0.2469	0.3174	0.2823	0.262	0.302	0.01108	7.85%	0.0%
FR_FRCP1	4	0.243	-0.02293	0.5089	0.2957	0	0.3807	0.08356	68.77%	13.88%
GH_FR1	4	0.4393	0.2337	0.645	0.4933	0.2467	0.524	0.06463	29.42%	-55.7%
CM_MC2	4	0.6468	0.5983	0.6954	0.6487	0.6113	0.6787	0.01525	4.72%	-129.2%

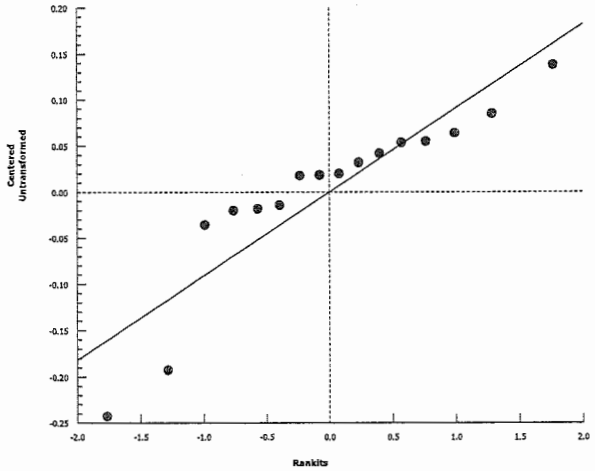
Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.3007	0.262	0.264	0.302
FR_FRCP1	0.2847	0.3067	0	0.3807
GH_FR1	0.494	0.4927	0.2467	0.524
CM_MC2	0.6787	0.6113	0.6327	0.6647

Analysis ID:	18-9440-5441	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	17 Jan-17 17:41	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Test Code: 161118a | 07-4840-6577

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	14-6699-0065	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	17 Jan-17 17:39	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	09-2889-3904	20 Oct-16	20 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap	Control Tap		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	27.8%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	-1.221	2.378	2.251	6	0.9867	CDF	Non-Significant Effect
		FR_FRCP1	-2.407	2.378	2.431	5	0.9995	CDF	Non-Significant Effect
		GH_FR1	-1.322	2.378	2.251	6	0.9898	CDF	Non-Significant Effect
		CM_MC2	-0.2978	2.378	2.251	6	0.8864	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	12.77367	3.193418	4	1.783	0.1884	Non-Significant Effect
Error	25.0806	1.791472	14			
Total	37.85427		18			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	16.08	13.28	0.0029	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8937	0.8605	0.0375	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control Tap	4	8.095	7.747	8.443	8.036	7.923	8.385	0.1093	2.7%	0.0%
FR_UFR1	4	9.25	7.352	11.15	8.8	8.4	11	0.5965	12.9%	-14.27%
FR_FRCP1	3	10.56	3.042	18.07	9.333	8.333	14	1.746	28.65%	-30.4%
GH_FR1	4	9.346	8.101	10.59	9.567	8.25	10	0.3911	8.37%	-15.46%
CM_MC2	4	8.377	7.704	9.049	8.208	8.091	9	0.2113	5.05%	-3.48%

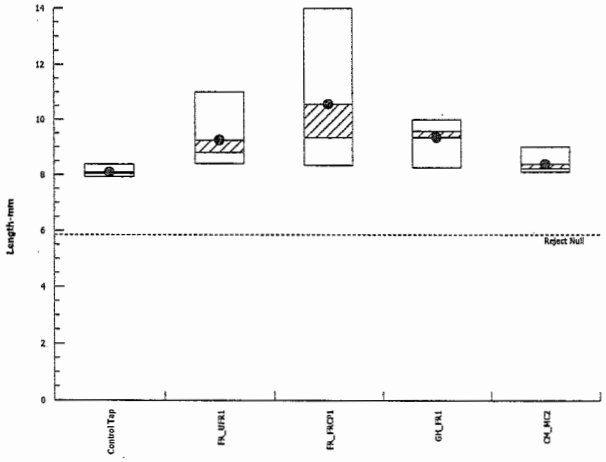
Length-mm Detail

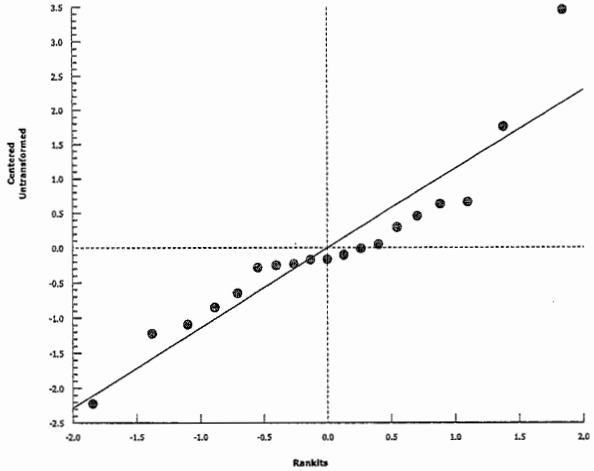
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	8.385	8.143	7.923	7.929
FR_UFR1	8.6	8.4	9	11
FR_FRCP1	9.333	8.333	14	
GH_FR1	9.333	8.25	10	9.8
CM_MC2	9	8.273	8.091	8.143

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	14-6699-0065	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	17 Jan-17 17:39	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-4661-9357	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:13	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	26.7%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	-1.135	2.318	2.665	5	0.9724	CDF	Non-Significant Effect
		GH_FR1	-0.09001	2.318	2.468	6	0.7874	CDF	Non-Significant Effect
		CM_MC2	0.8203	2.318	2.468	6	0.4133	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	8.157945	2.719315	3	1.2	0.3552	Non-Significant Effect
Error	24.93718	2.267016	11			
Total	33.09512		14			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	8.785	11.34	0.0323	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9217	0.8328	0.2046	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	9.25	7.352	11.15	8.8	8.4	11	0.5965	12.9%	0.0%
FR_FRCP1	3	10.56	3.042	18.07	9.333	8.333	14	1.746	28.65%	-14.11%
GH_FR1	4	9.346	8.101	10.59	9.567	8.25	10	0.3911	8.37%	-1.04%
CM_MC2	4	8.377	7.704	9.049	8.208	8.091	9	0.2113	5.05%	9.44%

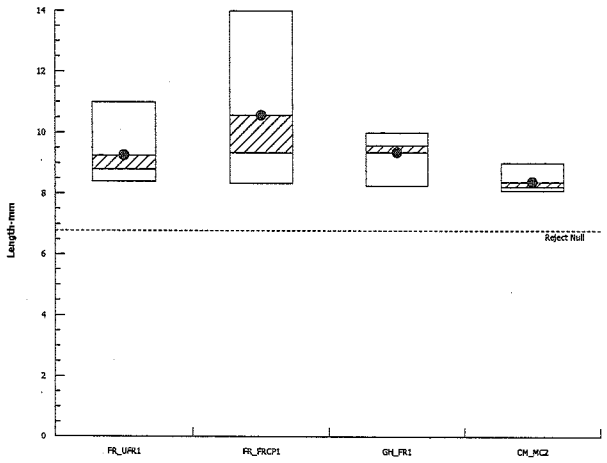
Length-mm Detail

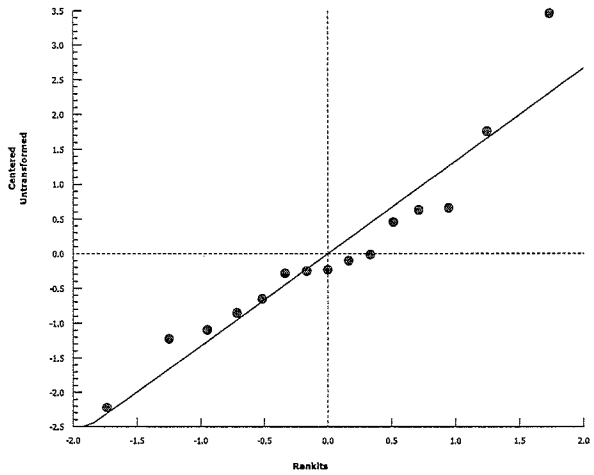
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	8.6	8.4	9	11
FR_FRCP1	9.333	8.333	14	
GH_FR1	9.333	8.25	10	9.8
CM_MC2	9	8.273	8.091	8.143

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-4661-9357	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:13	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-7205-3135	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jan-17 16:42	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control Tap	09-2889-3904	20 Oct-16	20 Oct-16	NA	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control Tap	control	Control Tap	Control Tap		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control Tap		FR_UFR1	0.2174	0.6522	Exact	Non-Significant Effect
Control Tap		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Control Tap		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Control Tap		CM_MC2	0.2091	0.8364	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control Tap	Negative Contr	54	0	54	1	0	0.0%
FR_UFR1		14	1	15	0.9333	0.06667	6.67%
FR_FRCP1		10	0	10	1	0	0.0%
GH_FR1		21	0	21	1	0	0.0%
CM_MC2		44	2	46	0.9565	0.04348	4.35%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	1	1	1	1
FR_UFR1	1	1	0.6667	1
FR_FRCP1	1	1	1	
GH_FR1	1	1	1	1
CM_MC2	1	1	0.8182	1

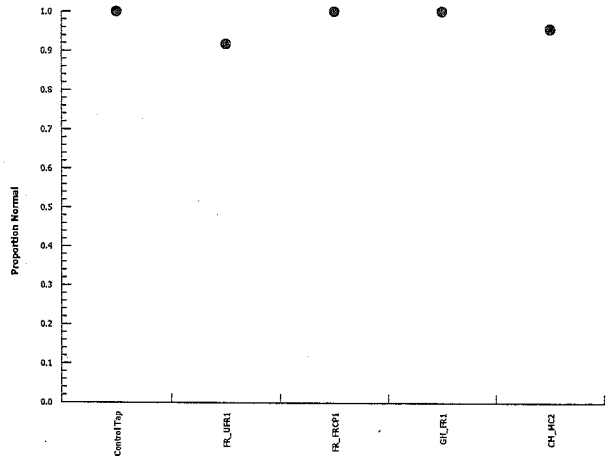
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control Tap	13/13	14/14	13/13	14/14
FR_UFR1	5/5	5/5	2/3	2/2
FR_FRCP1	3/3	6/6	1/1	
GH_FR1	6/6	8/8	2/2	5/5
CM_MC2	10/10	11/11	9/11	14/14

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	02-7205-3135	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	10 Jan-17 16:42	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JCH 1/12/17

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	09-5658-7456	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	02-9664-8962	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Dilution Water	14	1	15	0.9333	0.06667	0.0%
FR_FRCP1		10	0	10	1	0	-7.14%
GH_FR1		21	0	21	1	0	-7.14%
CM_MC2		44	2	46	0.9565	0.04348	-2.48%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	1	0.6667	1
FR_FRCP1	1	1	1	
GH_FR1	1	1	1	1
CM_MC2	1	1	0.8182	1

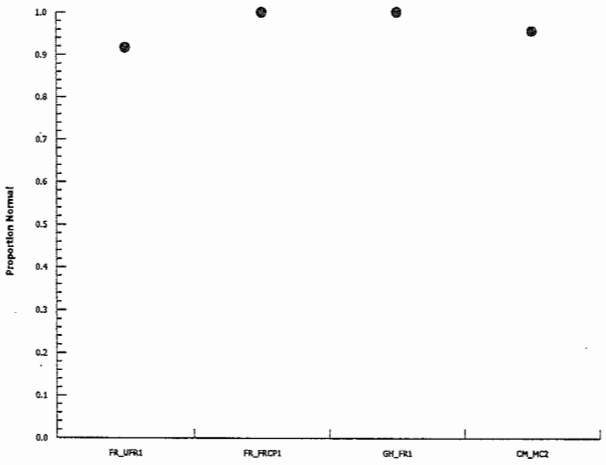
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	5/5	5/5	2/3	2/2
FR_FRCP1	3/3	6/6	1/1	
GH_FR1	6/6	8/8	2/2	5/5
CM_MC2	10/10	11/11	9/11	14/14

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	09-5658-7456	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGe 17/17

NAUTILUS ENVIRONMENTAL

1617-0245 = FR_FRCP1
1617-0246 = FR_UFR1
1617-0247 = GH_FR1
1617-0248 = CM_MC2.

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 ng/L)

Control hatching success must be >66% (≥10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

	CTL- TAP		1617-0245		1617-0246		1617-0247		1617-0248	
	Day 1		Day 1		Day 1		Day 1		Day 1	
replicate	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos
a	15	0	15	0	14	1	14	1	15	0
b	14	0	13	2	11	4	15	0	14	1
c	15	0	15	0	15	0	13	0	14	1
d	15	0	13	0	15	0	12	3	15	0
e	28	2	28	2	26	4	30	0	26	4
f	30	0	29	1	28	2	30	0	27	3

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

	CTL- TAP			1617-0245			1617-0246			1617-0247		
	Day 2			Day 2			Day 2			Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	15	0	15	14	1	15	14	0	15	14	0	15
b	14	0	15	11	2	15	11	0	15	15	0	15
c	15	0	15	15	0	15	15	0	15	13	0	15
d	15	0	15	13	0	15	15	0	15	12	0	15
e	28	0		28	0		26	0		30	0	
f	30	0		28	1		27	1		30	0	

	1617-0248		
	Day 2		
replicate	Alive Embryos	Dead Embryos	Cull to 15
a	14	1	15
b	11	3	15
c	14	0	15
d	15	0	15
e	24	2	
f	25	2	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2.

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS Client: NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 ug/L)

Number of Alive Embryos and Hatched Organisms

	CTL-TAP		1617-0245		1617-0246		1617-0247		1617-0248	
	Day 3		Day 3		Day 3		Day 3		Day 3	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	12	3	13	2	15	0	12	3	15	0
b	14	1	12	3	15	0	12	3	15	0
c	14	1	13	2	12	3	12	3	15	0
d	12	3	10	5	15	0	14	1	15	0

Comments/Observations:

	CTL-TAP		1617-0245		1617-0246		1617-0247		1617-0248	
	Day 4		Day 4		Day 4		Day 4		Day 4	
replicate	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	0	15	2	13	0	15	0	15	0	15
b	0	15	1	14	0	15	0	15	0	15
c	1	14	1	14	0	15	0	15	0	15
d	1	14	~~1~~ 2 (15)	13	0	15	2	13	0	15

Comments/Observations:

	CTL-TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 5	Day 5	Day 5	Day 5	Day 5
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	15	15	15
b	15	~~13~~ 14 ML	13	14	15
c	15(1)*	15	15	15	15
d	~~14~~ 15 ML	14	15	14	15

Comments/Observations: ~~Tap A - dead alive~~
CTL TAP D - dead egg
0245B - 1 dead embryo, ~~1 dead hatched~~ ML
0245D - 1 dead embryo
0246B - 2 dead hatched
0247D - 1 dead embryo
0247B - 1 dead hatched

	CTL-TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 6	Day 6	Day 6	Day 6	Day 6
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	15(1)	15	14
b	15 (1)	14	13(1)	12	15(1)
c	14	15 ML	14	14	15
d	15	14(1)*	15	14	15

Comments/Observations: ~~* partially hatched~~ ML ~~0245 D - one stressed - *partially hatched only~~ ML

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 ug/L)

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 7	Day 7	Day 7	Day 7	Day 7
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14	15(1)	15	14
b	15(1)	14	13	12	15
c	14	15(1)	14	14	~~14~~ 15-FP
d	15	13	15	14	~~14~~ 15-FP

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 8	Day 8	Day 8	Day 8	Day 8
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14	15(1)	14	14
b	15(1)	14	12	~~15~~ 12 NH	15(1)
c	14	15(1)	14	14	15
d	15	13(1)	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 9	Day 9	Day 9	Day 9	Day 9
replicate	Alive Hatched	Alive Hatched NH	Alive Hatched	Alive Hatched	Alive Hatched
a	14	~~14~~ 13(1)	15(1)	14	14
b	15(1)	14	12	12	14(1)
c	14	15(1)	13	~~13~~ 14 NH	15
d	15	~~15~~ 15 NH	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 10	Day 10	Day 10	Day 10	Day 10
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	13(1)	15(1)	12	14
b	15	14	12	12	14
c	14	15(1)	13	~~13~~ 14 NH	15
d	15	13	15	14	15

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS Client: NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 µg/L)

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 11	Day 11	Day 11	Day 11	Day 11
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	12	15(1)	12	14
b	14	14(1)	12	12	14
c	13	15(1)	13	or 14 13 14 NS	15
d	15	13	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 12	Day 12	Day 12	Day 12	Day 12
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	15(1)	12	14
b	14	14(1)	12	12(1)	14
c	13	15(1)	13	13 14 NS	15
d	15	13	15	NS 12 14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 13	Day 13	Day 13	Day 13	Day 13
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	15	12	14
b	14	14	12	12	14
c	13	15	13	13	15
d	15	13	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 14	Day 14	Day 14	Day 14	Day 14
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	12	14
b	14	14	12	12(1)	14
c	13	LL 14 15	13	13	15
d	15	12 NS 13	15	14	15

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 ug/L)

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 15	Day 15	Day 15	Day 15	Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	14(1)	12	12	14
c	13	15 NH	13	13	15
d	15	11 13	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 16	Day 16	Day 16	Day 16	Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	13	12	12	14
c	13	15 NH	13	13	15
d	15	11 13	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 17	Day 17	Day 17	Day 17	Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	13	12	12	14
c	13	15 NH	13	13	15
d	15	11 13	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 18	Day 18	Day 18	Day 18	Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	13	12	12	14
c	13	15(1)	13	13	15
d	15	11 13	15	14	15

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 ug/L)

Number of Alive Embryos and Hatched Organisms

replicate	CTL- TAP Day 19 Alive Hatched	1617-0245 Day 19 Alive Hatched	1617-0246 Day 19 Alive Hatched	1617-0247 Day 19 Alive Hatched	1617-0248 Day 19 Alive Hatched
a	14	11	14	11	14
b	14	13	12	12	14
c	13	15	13	13	15
d	15	13	15	14	15

Comments/Observations:

replicate	CTL- TAP Day 20 Alive Hatched	1617-0245 Day 20 Alive Hatched	1617-0246 Day 20 Alive Hatched	1617-0247 Day 20 Alive Hatched	1617-0248 Day 20 Alive Hatched
a	14	11	14	11	14
b	14	13	12	12	14
c	13	15	13	13	15
d	15	13*	15	14	15

Comments/Observations: *not microbial. MM

replicate	CTL- TAP Day 21 Alive Hatched	1617-0245 Day 21 Alive Hatched	1617-0246 Day 21 Alive Hatched	1617-0247 Day 21 Alive Hatched	1617-0248 Day 21 Alive Hatched
a	14	11	14	11	14
b	14	13	12	12	14
c	13	15	13	13	15
d	15	11*	15	14	15

Comments/Observations: *not microbial

replicate	CTL- TAP Day 22 Alive Hatched	1617-0245 Day 22 Alive Hatched	1617-0246 Day 22 Alive Hatched	1617-0247 Day 22 Alive Hatched	1617-0248 Day 22 Alive Hatched
a	14	11	14	11	14
b	14	13	12	12	14
c	13	15	13	13	15
d	15	11	15	14	15

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 µg/L)

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 23	Day 23	Day 23	Day 23	Day 23
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	12	12	12	14
c	13	14	13	13	15
d	15	11	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 24	Day 24	Day 24	Day 24	Day 24
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	12	12	12	14
c	13	14	13	12	15
d	15	11	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 25	Day 25	Day 25	Day 25	Day 25
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	12	12	12	14
c	13	14	13	12	15
d	15	11	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 26	Day 26	Day 26	Day 26	Day 26
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	12	12	12	14
c	13	14	13	12	15
d	15	11	15	14	15

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS Client: NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 µg/L)

Number of Alive Embryos and Hatched Organisms

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	12	12	12 NM	14
c	13	14	13	13 12	15
d	15	11	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14 13	11	14
b	14	10	12	12	14
c	13	14	13	10	15
d	14	11	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	12	12	12	14
c	13	14	13	12	15
d	14	11	15	14	15

Comments/Observations:

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248
	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	11	14	11	14
b	14	12	12	12	14
c	13	14	12	12	15
d	14	11	15	14	15

Comments/Observations:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS Client: NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 µg/L)

Number of Alive Embryos and Hatched Organisms

replicate	CTL- TAP Day 31 Alive Hatched	1617-0245 Day 31 Alive Hatched	1617-0246 Day 31 Alive Hatched	1617-0247 Day 31 Alive Hatched	1617-0248 Day 31 Alive Hatched
a	14	11	12*	11	14
b	14	12	12	12	14
c	13(1)*	14	12	12	15
d	14	11	10	14	15

Comments/Observations: TAP CTL c - bent body (1) 2N42 dead were very faint

replicate	CTL- TAP Day 32 Alive Hatched	1617-0245 Day 32 Alive Hatched	1617-0246 Day 32 Alive Hatched	1617-0247 Day 32 Alive Hatched	1617-0248 Day 32 Alive Hatched
a	14	11	9 NH	11	14
b	13 14	12	6 6 8	12	14
c	15	14	6 8	12	15
d	14	11	8 9	14	15

Comments/Observations: death in 0246 was not microbial

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS Client: NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 µg/L)

New Solutions

Conc. (%)	CTL-TAP	1617-0245	1617-0246	1617-0247	1617-0248		
Day							

pH (units)

Day							
0	8.2	8.0	8.1	8.0	8.0		
1	8.0	8.2	8.2	8.2	8.3		
2	8.2	8.2	8.2	8.2	8.2		
3	8.2	8.2	8.2	8.2	8.2		
4	8.2	8.2	8.2	8.2	8.2		
5	8.2	8.2	8.2	8.2	8.2		
6	8.0	8.0	8.0	8.0	8.0		
7	8.1	8.1	8.2	8.2	8.2		
8	8.1	8.1	8.1	8.1	8.2		

Conductance (µS/cm)

Day							
0	434	765	326	700	615		
1	440	826	337	732	636		
2	427	885	347	726	634		
3	408	833	345	733	6310		
4	401	823	342	723	633		
5	399	870	342	729	624		
6	385	900	358	749	655		
7	398	870	335	745	769		
8	378	865	335	753	769		

Dissolved Oxygen (mg/L) (40-100% saturation)

Day							
0	7.3	7.2	7.3	7.3	7.3		
1	7.3	7.3	7.3	7.3	7.3		
2	7.3	7.3	7.3	7.3	7.3		
3	7.3	7.3	7.3	7.3	7.3		
4	7.3	7.3	7.3	7.3	7.3		
5	7.3	7.2	7.3	7.3	7.3		
6	7.3	7.3	7.3	7.3	7.3		
7	7.1	7.3	7.2	7.3	7.3		
8	7.2	7.3	7.3	7.3	7.3		

Temperature (°C)

Day							
0	24.6	24.6	24.7	24.0	24.0		
1	24.0	24.0	24.0	24.0	24.0		
2	24.1	23.5	23.5	23.5	23.5		
3	24.3	23.9	23.8	23.7	23.7		
4	24.0	23.9	24.0	24.0	24.1		
5	24.1	24.0	24.0	24.0	24.0		
6	24.3	24.3	24.3	24.3	24.6		
7	25.0	24.4	24.4	24.3	24.3		
8	25.1	24.1	24.1	24.0	23.9		

Old Solutions

CTL-TAP	1617-0245	1617-0246	1617-0247	1617-0248		

pH (units)

Day							
0							
1	8.1	8.0	8.0	8.1	8.1		
2	8.2	8.1	8.1	8.0	8.1		
3	8.2	8.0	8.2	8.0	8.1		
4	8.1	7.9	8.1	7.9	8.1		
5	8.0	7.9	8.0	7.9	8.1		
6	8.0	7.9	8.1	8.0	8.2		
7	7.7	7.9	8.0	7.9	8.1		
8	7.9	8.0	8.1	8.0	8.1		

Conductance (µS/cm)

Day							
0		x10					
1	485	750	350	723	606		
2	474	826	354	732	610		
3	440	790	345	725	624		
4	410	781	365	700	647		
5	404	805	353	705	625		
6	408	807	384	698	657		
7	420	771	364	699	664		
8	385	839	353	707	730		

Dissolved Oxygen (mg/L) (40-100% saturation)

Day							
0							
1	7.3	7.0	7.0	7.0	7.0		
2	6.9	7.0	7.2	7.1	7.2		
3	7.1	7.1	7.2	7.2	7.2		
4	7.1	7.0	7.0	7.0	7.0		
5	6.5	6.6	6.5	6.4	6.5		
6	6.7	7.0	6.6	6.5	6.4		
7	6.3	6.3	6.3	6.3	6.3		
8	6.4	6.4	6.5	6.4	6.5		

Temperature (°C)

Day							
0							
1	24	→	→	→	→		
2	25	→	→	→	→		
3	26	→	→	→	→		
4	26	→	→	→	→		
5	25	→	→	→	→		
6	26	→	→	→	→		
7	25	→	→	→	→		
8	25	→	→	→	→		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS Client: NAU104 Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 µg/L)

New Solutions

Conc. (%)	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248		
Day							

pH (units)

Day							
9	8.1	8.1	8.1	8.1	8.2		
10	8.0	8.0	8.1	8.1	8.2		
11	8.1	8.2	8.2	8.2	8.3		
12	8.1	8.1	8.1	8.1	8.2		
13	8.1	8.1	8.2	8.2	8.3		
14	8.2	8.2	8.2	8.2	8.3		
15	8.1	8.0	8.1	8.1	8.2		
16	8.1	8.1	8.2	8.1	8.2		
17	8.0	8.0	8.1	8.1	8.2		

Conductance (µS/cm)

Day							
9	380	858	329	752	771		
10	377	869	334	752	769		
11	383	870	331	749	771		
12	377	865	332	752	769		
13	360	847	322	734	753		
14	356	814	316	707	627		
15	353	815	320	751	628		
16	360	814	316	755	629		
17	348	813	315	758	627		

390 uc

Dissolved Oxygen (mg/L) (40-100% saturation)

Day							
9	7.3	7.3	7.2	7.3	7.3		
10	7.2	7.3	7.3	7.3	7.3		
11	7.3	7.3	7.3	7.3	7.3		
12	7.3	7.1	7.1	7.1	7.1		
13	7.2	7.2	7.1	7.1	7.1		
14	7.2	7.2	7.1	7.1	7.2		
15	7.2	7.2	7.2	7.2	7.2		
16	7.3	7.1	7.1	7.2	7.2		
17	7.2	7.2	7.1	7.2	7.1		

Temperature (°C)

Day							
9	24.8	24.1	24.0	24.1	24.2		
10	24.6	24.3	24.4	24.4	24.4		
11	24.2	24.2	24.1	24.2	24.3		
12	24.1	26.2	26.0	26.2	26.1		
13	24.9	25.4	25.9	26.1	26.2		
14	25.1	25.4	26.0	26.1	25.4		
15	24.8	25.4	25.4	25.4	25.1		
16	24.0	25.9	25.9	25.4	25.4		
17	24.9	25.4	26.1	25.4	25.9		

24.1 pH

Old Solutions

	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248		

pH (units)

9	7.9	8.0	8.2	7.9	8.1		
10	7.8	7.8	8.1	7.9	8.1		
11	8.1	7.9	8.2	8.0	8.1		
12	7.8	7.8	8.1	7.8	8.0		
13	7.9	7.9	8.1	7.9	8.1		
14	7.8	7.9	8.1	7.9	8.0		
15	7.8	7.9	7.9	7.9	8.0		
16	7.8	7.8	7.9	7.9	8.0		
17	7.8	7.8	7.9	7.8	8.0		

Conductance (µS/cm)

9	382	847	353	741	753		
10	374	843	362	730	761		
11	388	819	368	713	758		
12	396	835	357	729	762		
13	393	814	339	710	751		
14	374	830	336	728	744		
15	375	815	330	725	693		
16	399	799	338	722	664		
17	380	795	345	734	641		

Dissolved Oxygen (mg/L) (40-100% saturation)

9	7.0	7.0	6.8	7.0	6.9		
10	6.5	6.5	6.8	6.8	6.8		
11	6.8	6.8	6.8	6.8	6.8		
12	6.5	6.5	6.6	6.5	6.5		
13	6.6	6.6	6.6	6.7	6.7		
14	7.0	6.4	6.7	6.5	6.4		
15	6.4	6.4	6.5	6.5	6.3		
16	6.2	6.2	6.1	6.0	6.1		
17	6.3	6.1	6.0	6.0	5.9		

6.4 LC

Temperature (°C)

9	25						
10	25						
11	25						
12	25						
13	25						
14	25						
15	25						
16	25						
17	25						

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS | Client: NAU104 | Sample: 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 ug/L)

New Solutions

Conc. (%)	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248		
Day							

pH (units)

Day							
18	8.1	8.3	8.2	8.2	8.3		
19	8.0	8.1	8.1	8.1	8.3		
20	8.0	8.2	8.1	8.1	8.2		
21	8.0	8.1	8.1	8.0	8.1		
22	8.1	8.2	8.2	8.1	8.2		
23	8.1	8.2	8.2	8.1	8.2		
24	8.0	8.0	8.1	8.0	8.1		
25	8.1	8.1	8.1	8.1	8.2		
26	7.9	8.1	8.1	8.1	8.1		

Conductance (µS/cm)

Day							
18	349	764	351	749	628		
19	357	874	335	753	625		
20	375	859	331	794	661		
21	367	900	338	796	678		
22	405	905	328	803	672		
23	389	904	338	802	678		
24	357	899	335	809	681		
25	340	902	339	802	680		
26	335	904	337	800	679		

Dissolved Oxygen (mg/L) (40-100% saturation)

Day							
18	7.3	7.2	7.2	7.2	7.2		
19	7.2	7.2	7.1	7.1	7.1		
20	7.1	7.1	7.1	7.1	7.1		
21	7.1	7.1	7.1	7.1	7.1		
22	7.2	7.2	7.2	7.2	7.2		
23	7.2	7.2	7.2	7.1	7.1		
24	7.2	7.1	7.1	7.2	7.1		
25	7.2	7.3	7.2	7.2	7.2		
26	7.2	7.3	7.2	7.2	7.3		

Temperature (°C)

Day							
18	24.4	25.2	25.1	25.2	25.6		
19	25.1	25.4	26.2	26.4	26.0		
20	25.5	25.7	25.9	25.8	25.7		
21	25.5	26.7	26.0	25.6	25.6		
22	26.4	25.0	25.4	25.4	25.4		
23	25.4	25.4	25.4	25.7	25.7		
24	24.6	25.1	25.7	25.4	25.6		
25	25.4	24.4	25.3	25.4	25.4		
26	24.7	25.5	25.8	25.9	26.0		

Old Solutions

CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248		

pH (units)

Day							
18	7.8	7.8	8.0	7.9	8.1		
19	7.7	7.8	8.0	7.8	8.1		
20	7.7	7.8	7.9	7.8	8.0		
21	7.9	7.9	8.0	7.9	8.0		
22	7.6	7.8	7.7	7.7	7.9		
23	7.8	7.8	8.0	7.8	8.1		
24	7.6	7.7	7.8	7.7	8.0		
25	7.7	7.9	7.9	7.8	8.0		
26	7.7	7.7	7.9	7.8	8.0		

Conductance (µS/cm)

Day							
18	359	795	344	737	647		
19	371	773	365	787	647		
20	397	823	354	793	664		
21	390	830	357	769	671		
22	434	853	346	796	660		
23	384	851	348	760	624		
24	362	858	367	775	683		
25	364	871	363	794	694		
26	351	861	369	766	685		

Dissolved Oxygen (mg/L) (40-100% saturation)

Day							
18	6.7	6.7	6.7	6.7	6.7		
19	6.2	6.3	6.3	6.3	6.4		
20	6.0	6.3	6.3	6.3	6.3		
21	6.2	6.1	6.1	6.1	6.1		
22	6.2	5.9	6.2	6.0	5.8		
23	6.3	6.2	6.3	6.2	5.9		
24	6.1	6.0	5.9	5.6	5.6		
25	6.4	6.0	6.2	6.0	5.9		
26	6.5	6.0	6.0	6.1	6.0		

Temperature (°C)

Day							
18	25						
19	25						
20	25						
21	26						
22	26						
23	25						
24	26						
25	25						
26	26						

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Day 26 DO New

CTL	0245	0246	0247	0248
7.2	7.1	7.1	7.1	7.1

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method: FMD 32 Day ELS Client: NAU104 Sample: 1617-0245, 1617-0245, 1617-0247, 1617-0248 Copper (10 µg/L)

New Solutions

pH (units)

Conc. (%)	CTL- TAP	1617-0245	1617-0246	1617-0247	1617-0248		
Day							
27	8.0	8.1	8.1	8.1	8.2		
28	8.1	8.1	8.0	8.1	8.0		
29	8.0	7.9	7.9	8.0	8.0		
30	8.1	8.1	8.2	8.2	8.1		
31	8.0	8.0	8.0	8.0	8.1		
32							

* 8.1 PW

Conductance (µS/cm)

Day							
27	329	903	553	799	674		
28	394	895	537	800	594		
29	401	900	338	800	597		
30	532	894	337	799	597		
31	376	894	337	800	595		
32							

Dissolved Oxygen (mg/L) (40-100% saturation)

Day							
27	7.2	7.1	7.1	7.2	7.1		
28	7.2	7.1	7.1	7.1	7.1		
29	7.3	7.2	7.2	7.2	7.2		
30	7.2	7.1	7.1	7.1	7.1		
31	7.3	7.1	7.1	7.1	7.1		
32							

Temperature (°C)

Day							
27	24.5	26.2	25.9	25.4	25.6		
28	25.0	26.0	26.1	25.9	26.0		
29	24.4	25.4	25.4	25.3	25.2		
30	24.7	25.8	25.9	25.8	25.7		
31	24.2	25.8	25.8	26.0	25.8		
32							

Old Solutions

pH (units)

CTL- TAP	1617-0245	1617-0245	1617-0247	1617-0248		
27	7.7	7.8	8.0	7.8	8.0		
28	7.9	7.9	8.1	7.9	8.1		
29	7.8	7.7	7.8	7.7	7.8		
30	7.8	7.8	7.8	7.9	7.8		
31	7.6	7.6	7.7	7.7	7.8		
32	7.8	7.8	7.8	7.8	8.0		

Conductance (µS/cm)

27	341	849	364	731	684		
28	346	870	383	770	692		
29	363	853	361	776	694		
30	380	857	348	798	626		
31	378	866	359	785	617		
32	386	836	361	779	602		

Dissolved Oxygen (mg/L) (40-100% saturation)

27	6.1	6.1	6.2	6.2	6.1		
28	6.4	6.3	6.2	6.2	6.1		
29	6.4	6.4	6.2	6.3	6.3		
30	6.0	6.0	6.0	6.0	6.0		
31	6.1	5.9	5.6	5.5	5.5		
32	6.4	6.4	5.7	5.7	6.1		

Temperature (°C)

27	25	→			→		
28	25	→			→		
29	26	→			→		
30	25.8	→			→		
31	26	→			→		
32	25	→			→		

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 µg/L)

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. CTL-TAP

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	8	N	1	9	N	1	8	N	1	7	N
2	7		2	6		2	10		2	9	
3	7		3	9		3	7		3	7	
4	10		4	7		4	8		4	8	
5	9		5	7		5	9		5	7	
6	8		6	7		6	9		6	7	
7	8		7	8		7	7		7	7	
8	6		8	8		8	7		8	8	
9	6		9	7		9	7		9	7	
10	6		10	8		10	8		10	8	
11	6		11	8		11	8		11	8	
12	6		12	9		12	8		12	8	
13	6		13	9		13	8		13	9	
14	7		14	9		14	—		14	9	
15	—		15	—		15	—		15	—	

Comments

1617-0245

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal	Fish	Length (mm)	Normal/ Abnormal
1	8	N	1	8	N	1	7	N	1	8	N
2	8		2	9		2	9		2	6	
3	7		3	9		3	8		3	8	
4	7		4	8		4	8		4	8	
5	8		5	8		5	8		5	8	
6	9		6	8		6	7		6	8	
7	9		7	8		7	8		7	8	
8	10		8	7		8	6		8	8	
9	9		9	8		9	7		9	8	
10	8		10	8		10	8		10	8	
11	7		11	8		11	8		11	8	
12	—		12	6		12	7		12	—	
13	—		13	—		13	7		13	—	
14	—		14	—		14	7		14	—	
15	—		15	—		15	—		15	—	

Comments

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 µg/L)

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. 1617-0246

Fish	A Length (mm)	A Normal/ Abnormal	B Length (mm)	B Normal/ Abnormal	C Length (mm)	C Normal/ Abnormal	D Length (mm)	D Normal/ Abnormal
1	6	N	5	N	8	N	7	N
2	7	↓	6	↓	8	↓	6	↓
3	7		10		7		7	
4	9		7		7		9	
5	6		8		6		7	
6	8		8		7		8	
7	9		—		7		8	
8	7		—		7		9	
9	8		—		—		9	
10	—		—		—		—	
11	—		—		—		—	
12	—		—		—		—	
13	—		—		—		—	
14	—		—		—		—	
15	—		—		—		—	

Comments

1617-0247

Fish	A Length (mm)	A Normal/ Abnormal	C Length (mm)	C Normal/ Abnormal	B Length (mm)	B Normal/ Abnormal	D Length (mm)	D Normal/ Abnormal
1	8	N	7	N	9	N	9	N
2	7	↓	8	↓	7	↓	9	↓
3	7		8		6		8	
4	7		7		7		8	
5	10		8		8		7	
6	8		8		8		10	
7	8		7		11		8	
8	9		7		9		6	
9	10		9		7		8	
10	9		9		9		7	
11	8	↓	8	↓	7	↓	8	↓
12	—		—		8		8	
13	—		—		—		6	
14	—		—		—		6	↓
15	—		—		—		—	

Comments

NAUTILUS ENVIRONMENTAL

Fathead Minnow Bench Sheet

Method FMD 32 Day ELS Client NAU104 Sample 1617-0245, 1617-0246, 1617-0247, 1617-0248 Copper (10 ug/L)

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. 1617-0248

Replicate # A		
Fish	Length (mm)	Normal/ Abnormal
1	8	N
2	8	↓
3	9	↓
4	7	↓
5	7	↓
6	7	↓
7	8	↓
8	7	↓
9	9	↓
10	9	↓
11	8	↓
12	8	↓
13	6	↓
14	9	↓
15	—	—

Replicate # B		
Fish	Length (mm)	Normal/ Abnormal
1	7	N
2	7	↓
3	6	↓
4	9	↓
5	7	↓
6	9	↓
7	10	↓
8	8	↓
9	9	↓
10	8	↓
11	7	↓
12	8	↓
13	7	↓
14	9	↓
15	—	—

Replicate # C		
Fish	Length (mm)	Normal/ Abnormal
1	7	N
2	7	↓
3	7	↓
4	8	↓
5	7	↓
6	8	↓
7	10	↓
8	9	↓
9	8	↓
10	8	↓
11	8	↓
12	9	↓
13	6	↓
14	6	↓
15	7	↓

Replicate # D		
Fish	Length (mm)	Normal/ Abnormal
1	8	N
2	9	↓
3	8	↓
4	8	↓
5	8	↓
6	9	↓
7	7	↓
8	8	↓
9	7	↓
10	8	↓
11	8	↓
12	9	↓
13	5	↓
14	8	↓
15	7	↓

Comments

NAUTILUS ENVIRONMENTAL

Organism Weights Bench Sheet

Client NE Sample SP1617-011 (Cu treated) Organism FM

Initial Weight (mg) (dried pan)

Date: 20161115 Initials: JN Balance*: 1

Conc.	CTL TAP	1617-0245	1617-0246	1617-0247	1617-0248			
Replicate								
a	995.56	1005.85	1050.24	1067.97	1017.39			
b	1042.28	994.67	991.12	1021.77	979.86			
c	980.57	1041.16	1026.00	1020.33	1018.69			
d	981.54	1058.48	1056.90	1027.58	1000.01			
e								

Final Weight (mg) (dried pan+organisms)

Date: Initials: Balance*:

Conc.	CTL TAP	1617-0245	1617-0246	1617-0247	1617-0248			
Replicate								
a	1006.98	1017.17	1056.56	1078.70	1026.79			
b	1053.11	1003.80	995.94	1031.83	990.13			
c	991.43	1051.83	1032.39	1031.07	1029.21			
d	992.57	1068.53	1064.41	1036.50	1010.00			
e								

Test Validity Met: Yes/No/NA

Results are Logical: Yes/No**

**no negative numbers, consistent values across replicates

*Same balance must be used for initial and final weights

*For FM/HA/CT must use scale with 0.01 mg accuracy

Balance Calibration Check:

	Initial		Final
first pan weighed:	CTL TAP D	first pan+org weighed:	1617-0247A
weight of first pan:	981.54	weight of first pan + org:	1078.70
re-weigh of first pan after all weights measured:	981.59	re-weigh of first pan + org after all weights measured:	1078.67
% difference <5%:	**Yes/No**	**% difference <5%:**	**Yes/No**

Calculation: % difference = [initial weight-reweight/((initial weight+reweight)/2)]x100

If "no" is circled for any parameter, notify Lab Supervisor/QA Group to determine appropriate action

NAUTILUS ENVIRONMENTAL

Warning Chart
Fathead minnow

Test Method: 7 days Fathead minnow Survival and Growth Test (7 treatments plus a control)
HydroQual Test Method: WTR-ME-046
Reference: Biological Test Method: Test of Larval Growth and Survival Using Fathead minnows. Environment Canada, EPS 1/RM/22, Second Edition, February 2011.

Test Organism:

test species:	*Pimephales promelas*
culture source:	Aquatox (Arkansas, USA)
temp of breeding aquaria:	23 - 26 °C
food type:	newly-hatched brine shrimp nauplii
frequency of feeding:	daily
breeding colony mortality:	<1% (last 7 days)
age of test organisms:	<24 hours
condition prior to test initiation:	normal
batch number:	20161020FM

Test Design:

test type:	static renewal
toxicant:	sodium chloride
test vessel:	polypropylene cups, 11 x 9 cm
volume of test vessel (ml):	500
test volume (ml):	250
depth of test solution:	>3 cm
replicates per treatment:	4 replicates
organisms per replicate:	10
feeding:	twice daily
temperature (°C):	24-26
photoperiod:	16 hours light: 8 hours dark
light level (surface):	100-500 lux (full spectrum)

Control/Dilution Water:

source:	dechlorinated City of Calgary tap water no chemicals were added to the dilution water
pH (units):	7.0
conductance (µS/cm):	375
dissolved oxygen (mg/L):	7.2
NH_4^+ (mg/L):	<0.1
hardness (mg $CaCO_3$/L):	175
alkalinity (mg $CaCO_3$/L):	132
total residual chlorine (mg/L):	<0.01

Comments: The result of the reference toxicant test initiated on 2016/10/24 was outside the control limit for the survival endpoint. An investigation occurred and all testing and culturing procedures were followed appropriately. As the IC25 result for this reference toxicant fell within the acceptable range for organism performance, the sensitivity of the organisms used in this test was appropriate.

The test data and results are authorized and verified correct.

Senior Verifier

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

NAUTILUS ENVIRONMENTAL

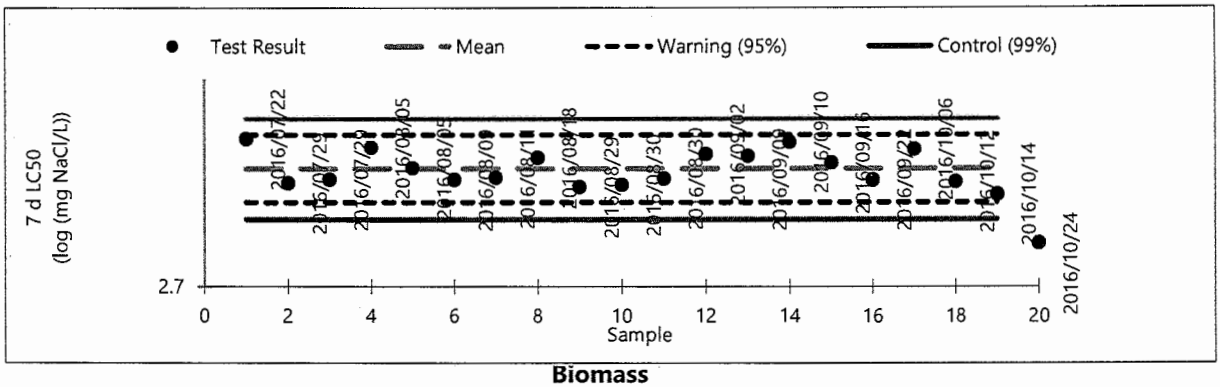
Warning Chart
Fathead minnow

Mortality
Current Test

toxicant	Sodium Chloride (NaCl)				
started on	2016/10/24	ended on	2016/10/31		
Result (7 d LC50):	2.76	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.77	upper	2.90	

Historical Values

mean	2.87	sd	0.02	cv(%):	3.7
	lower	upper			
warning limits (±2 sd)	2.82	2.92	(95% confidence limits)		
control limits (±3 sd)	2.80	2.94	(99% confidence limits)		

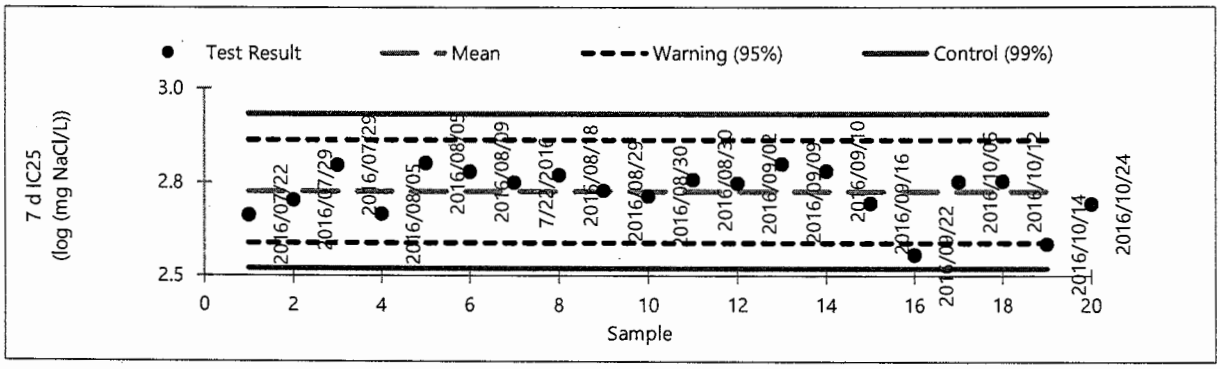


Biomass

started on	2016/10/24	ended on	2016/10/31		
Result (7 d IC25):	2.69	log (mg NaCl/L); geometric mean			
Confidence Limits (95%)	lower	2.49	upper	2.78	

Historical Values

mean	2.73	sd	0.07	cv(%):	10.4
	lower	upper			
warning limits (±2 sd)	2.59	2.86	(95% confidence limits)		
control limits (±3 sd)	2.52	2.93	(99% confidence limits)		



notes: sd, standard deviation; cv, coefficient of variance; N/A, could not be calculated

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

CETIS Summary Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	11-4085-7619	20 Oct-16	20 Oct-16	NA		
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	control	Lab Control	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Hatched Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_UFR1	4	1	1	1	1	1	0	0	0.0%	0.0%
FR_FRCP1	4	0.9667	0.9054	1	0.9333	1	0.01925	0.03849	3.98%	3.33%
GH_FR1	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	1.67%
CM_MC2	4	1	1	1	1	1	0	0	0.0%	0.0%

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	4	7.713	7.381	8.045	7.429	7.923	0.1042	0.2084	2.7%	0.0%
FR_UFR1	4	7.524	7.192	7.856	7.375	7.833	0.1043	0.2086	2.77%	2.45%
FR_FRCP1	4	7.897	7.323	8.472	7.583	8.364	0.1806	0.3612	4.57%	-2.39%
GH_FR1	4	7.847	7.468	8.226	7.583	8.091	0.119	0.2381	3.03%	-1.74%
CM_MC2	4	7.863	7.635	8.091	7.667	8	0.07168	0.1434	1.82%	-1.95%

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	4	0.7348	0.7059	0.7638	0.722	0.7613	0.009094	0.01819	2.48%	0.0%
FR_UFR1	4	0.4173	0.3002	0.5345	0.3213	0.5007	0.0368	0.0736	17.64%	43.21%
FR_FRCP1	4	0.6853	0.5883	0.7823	0.6087	0.7513	0.03047	0.06095	8.89%	6.74%
GH_FR1	4	0.6733	0.5838	0.7629	0.5947	0.7153	0.02815	0.05629	8.36%	8.37%
CM_MC2	4	0.6697	0.6186	0.7207	0.6267	0.7013	0.01605	0.03209	4.79%	8.87%

Proportion Normal Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	4	0.9808	0.9196	1	0.9231	1	0.01923	0.03846	3.92%	0.0%
FR_UFR1	4	1	1	1	1	1	0	0	0.0%	-1.96%
FR_FRCP1	4	1	1	1	1	1	0	0	0.0%	-1.96%
GH_FR1	4	1	1	1	1	1	0	0	0.0%	-1.96%
CM_MC2	4	1	1	1	1	1	0	0	0.0%	-1.96%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	4	0.9167	0.8636	0.9697	0.8667	0.9333	0.01667	0.03333	3.64%	0.0%
FR_UFR1	4	0.5333	0.3833	0.6834	0.4	0.6	0.04714	0.09428	17.68%	41.82%
FR_FRCP1	4	0.8	0.65	0.95	0.7333	0.9333	0.04714	0.09428	11.79%	12.73%
GH_FR1	4	0.8167	0.6832	0.9501	0.7333	0.9333	0.04194	0.08389	10.27%	10.91%
CM_MC2	4	0.9667	0.9054	1	0.9333	1	0.01925	0.03849	3.98%	-5.46%

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	0.9333	1	0.9333
GH_FR1	1	1	1	0.9333
CM_MC2	1	1	1	1

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	7.429	7.786	7.923	7.714
FR_UFR1	7.444	7.833	7.375	7.444
FR_FRCP1	8.364	7.583	7.643	8
GH_FR1	8.091	7.583	8	7.714
CM_MC2	7.857	7.929	7.667	8

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	0.7613	0.722	0.724	0.732
FR_UFR1	0.4213	0.3213	0.426	0.5007
FR_FRCP1	0.7513	0.6087	0.7113	0.67
GH_FR1	0.7153	0.6707	0.7127	0.5947
CM_MC2	0.6267	0.6847	0.7013	0.666

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	1	1	0.9231	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	0.9333	0.9333	0.8667	0.9333
FR_UFR1	0.6	0.4	0.5333	0.6
FR_FRCP1	0.7333	0.8	0.9333	0.7333
GH_FR1	0.7333	0.8	0.8	0.9333
CM_MC2	0.9333	0.9333	1	1

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	15/15	15/15	15/15	15/15
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	14/15
GH_FR1	15/15	15/15	15/15	14/15
CM_MC2	15/15	15/15	15/15	15/15

Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	14/14	14/14	12/13	14/14
FR_UFR1	9/9	6/6	8/8	9/9
FR_FRCP1	11/11	12/12	14/14	11/11
GH_FR1	11/11	12/12	12/12	14/14
CM_MC2	14/14	14/14	15/15	15/15

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	14/15	14/15	13/15	14/15
FR_UFR1	9/15	6/15	8/15	9/15
FR_FRCP1	11/15	12/15	14/15	11/15
GH_FR1	11/15	12/15	12/15	14/15
CM_MC2	14/15	14/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	14-0201-9194	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 10:15	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	11-4085-7619	20 Oct-16	20 Oct-16	NA		
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	control	Lab Control	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		FR_FRCP1	0.2479	0.9916	Exact	Non-Significant Effect
Lab Control		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
Lab Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Negative Contr	60	0	60	1	0	0.0%
FR_UFR1		60	0	60	1	0	0.0%
FR_FRCP1		58	2	60	0.9667	0.03333	3.33%
GH_FR1		59	1	60	0.9833	0.01667	1.67%
CM_MC2		60	0	60	1	0	0.0%

Hatched Rate Detail

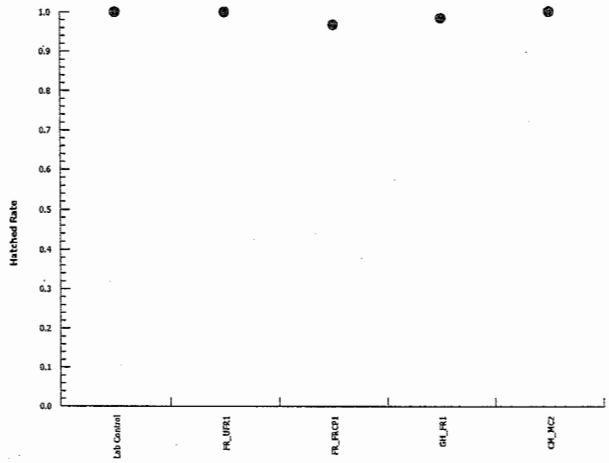
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	1	1	1	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	0.9333	1	0.9333
GH_FR1	1	1	1	0.9333
CM_MC2	1	1	1	1

Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	15/15	15/15	15/15	15/15
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	14/15
GH_FR1	15/15	15/15	15/15	14/15
CM_MC2	15/15	15/15	15/15	15/15

Analysis ID:	14-0201-9194	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 10:15	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	16-4578-2001	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:08	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	0.2479	0.7437	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	0.5	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Dilution Water	60	0	60	1	0	0.0%
FR_FRCP1		58	2	60	0.9667	0.03333	3.33%
GH_FR1		59	1	60	0.9833	0.01667	1.67%
CM_MC2		60	0	60	1	0	0.0%

Hatched Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	1	1	1
FR_FRCP1	1	0.9333	1	0.9333
GH_FR1	1	1	1	0.9333
CM_MC2	1	1	1	1

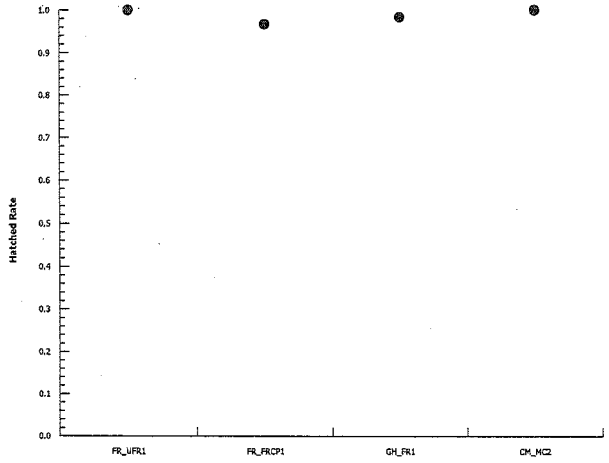
Hatched Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	15/15	15/15	15/15	15/15
FR_FRCP1	15/15	14/15	15/15	14/15
GH_FR1	15/15	15/15	15/15	14/15
CM_MC2	15/15	15/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	16-4578-2001	**Endpoint:**	Hatched Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:08	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	00-3718-4803	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 10:15	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	11-4085-7619	20 Oct-16	20 Oct-16	NA		
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	control	Lab Control	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	1.714E-06	<0.0001	Exact	Significant Effect
Lab Control		FR_FRCP1	0.05718	0.1715	Exact	Non-Significant Effect
Lab Control		GH_FR1	0.08906	0.1781	Exact	Non-Significant Effect
Lab Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Negative Contr	55	5	60	0.9167	0.08333	0.0%
FR_UFR1		32	28	60	0.5333	0.4667	41.82%
FR_FRCP1		48	12	60	0.8	0.2	12.73%
GH_FR1		49	11	60	0.8167	0.1833	10.91%
CM_MC2		58	2	60	0.9667	0.03333	-5.46%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	0.9333	0.9333	0.8667	0.9333
FR_UFR1	0.6	0.4	0.5333	0.6
FR_FRCP1	0.7333	0.8	0.9333	0.7333
GH_FR1	0.7333	0.8	0.8	0.9333
CM_MC2	0.9333	0.9333	1	1

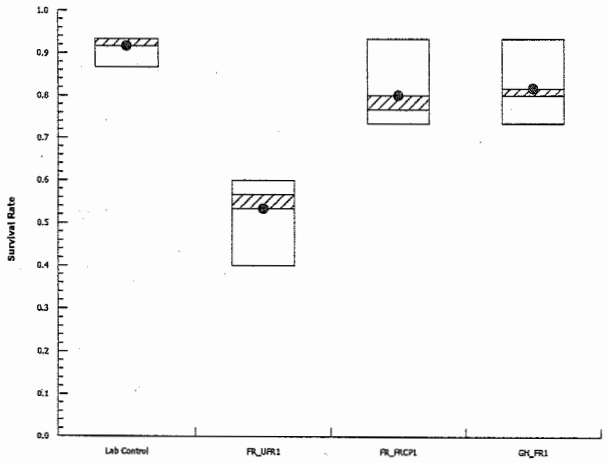
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	14/15	14/15	13/15	14/15
FR_UFR1	9/15	6/15	8/15	9/15
FR_FRCP1	11/15	12/15	14/15	11/15
GH_FR1	11/15	12/15	12/15	14/15
CM_MC2	14/15	14/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	00-3718-4803	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 10:15	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-4425-1603	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:08	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Dilution Water	32	28	60	0.5333	0.4667	0.0%
FR_FRCP1		48	12	60	0.8	0.2	-50.0%
GH_FR1		49	11	60	0.8167	0.1833	-53.12%
CM_MC2		58	2	60	0.9667	0.03333	-81.25%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.6	0.4	0.5333	0.6
FR_FRCP1	0.7333	0.8	0.9333	0.7333
GH_FR1	0.7333	0.8	0.8	0.9333
CM_MC2	0.9333	0.9333	1	1

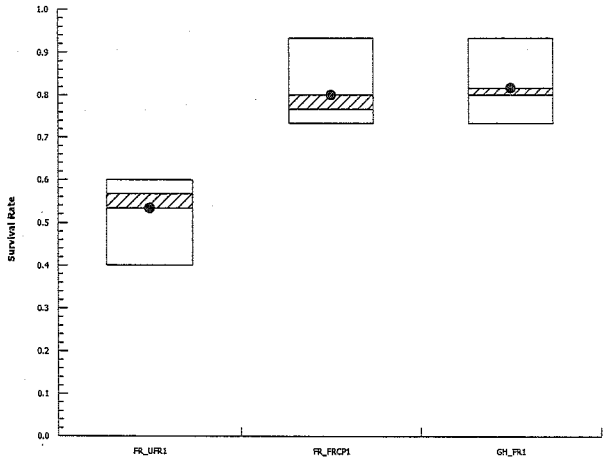
Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	9/15	6/15	8/15	9/15
FR_FRCP1	11/15	12/15	14/15	11/15
GH_FR1	11/15	12/15	12/15	14/15
CM_MC2	14/15	14/15	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	08-4425-1603	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:08	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Test Code: 161118b | 17-7592-9585

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	10-7481-7155	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 12:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	11-4085-7619	20 Oct-16	20 Oct-16	NA		
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	control	Lab Control	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	11.9%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	8.59	2.356	0.087	6	<0.0001	CDF	Significant Effect
		FR_FRCP1	1.339	2.356	0.087	6	0.2541	CDF	Non-Significant Effect
		GH_FR1	1.664	2.356	0.087	6	0.1600	CDF	Non-Significant Effect
		CM_MC2	1.763	2.356	0.087	6	0.1373	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2501727	0.06254318	4	22.89	<0.0001	Significant Effect
Error	0.0409847	0.002732313	15			
Total	0.2911574		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	5.154	13.28	0.2718	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9542	0.866	0.4345	Normal Distribution

Mean Dry Biomass-mg Summary

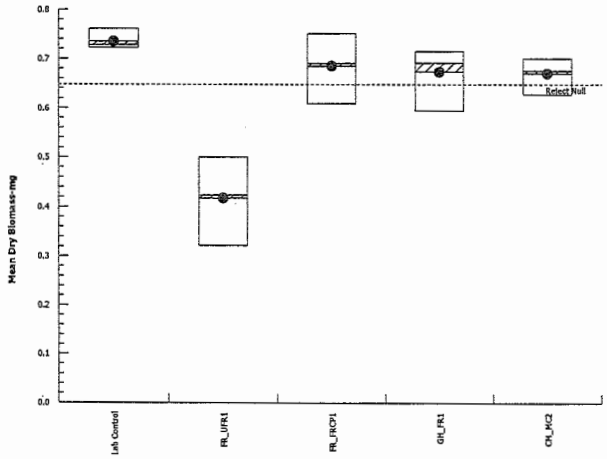
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	4	0.7348	0.7059	0.7638	0.728	0.722	0.7613	0.009094	2.48%	0.0%
FR_UFR1	4	0.4173	0.3002	0.5345	0.4237	0.3213	0.5007	0.0368	17.64%	43.21%
FR_FRCP1	4	0.6853	0.5883	0.7823	0.6907	0.6087	0.7513	0.03047	8.89%	6.74%
GH_FR1	4	0.6733	0.5838	0.7629	0.6917	0.5947	0.7153	0.02815	8.36%	8.37%
CM_MC2	4	0.6697	0.6186	0.7207	0.6753	0.6267	0.7013	0.01605	4.79%	8.87%

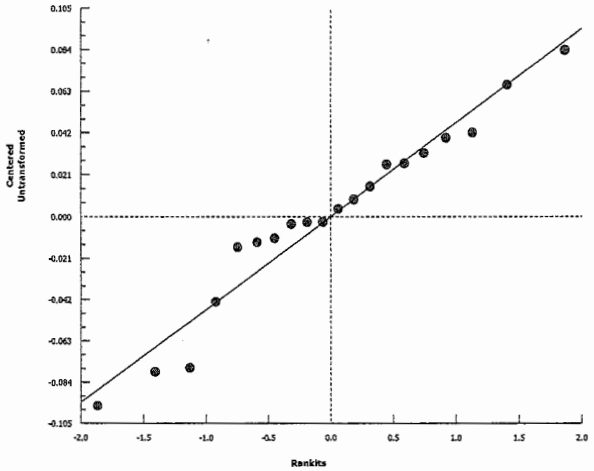
Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	0.7613	0.722	0.724	0.732
FR_UFR1	0.4213	0.3213	0.426	0.5007
FR_FRCP1	0.7513	0.6087	0.7113	0.67
GH_FR1	0.7153	0.6707	0.7127	0.5947
CM_MC2	0.6267	0.6847	0.7013	0.666

Analysis ID:	10-7481-7155	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 12:27	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Test Code: 161118b | 17-7592-9585

Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	15-1370-5226	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 12:28	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	22.4%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	-6.565	2.287	0.093	6	1.0000	CDF	Non-Significant Effect
		GH_FR1	-6.271	2.287	0.093	6	1.0000	CDF	Non-Significant Effect
		CM_MC2	-6.181	2.287	0.093	6	1.0000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.201432	0.06714399	3	20.15	<0.0001	Significant Effect
Error	0.03999234	0.003332695	12			
Total	0.2414243		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	1.66	11.34	0.6458	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9514	0.8408	0.5126	Normal Distribution

Mean Dry Biomass-mg Summary

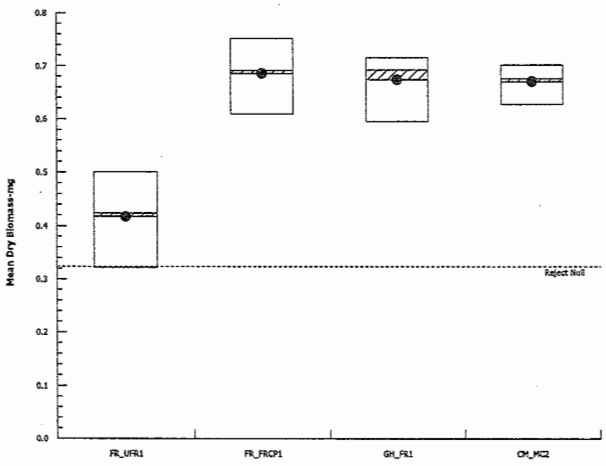
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	0.4173	0.3002	0.5345	0.4237	0.3213	0.5007	0.0368	17.64%	0.0%
FR_FRCP1	4	0.6853	0.5883	0.7823	0.6907	0.6087	0.7513	0.03047	8.89%	-64.22%
GH_FR1	4	0.6733	0.5838	0.7629	0.6917	0.5947	0.7153	0.02815	8.36%	-61.34%
CM_MC2	4	0.6697	0.6186	0.7207	0.6753	0.6267	0.7013	0.01605	4.79%	-60.46%

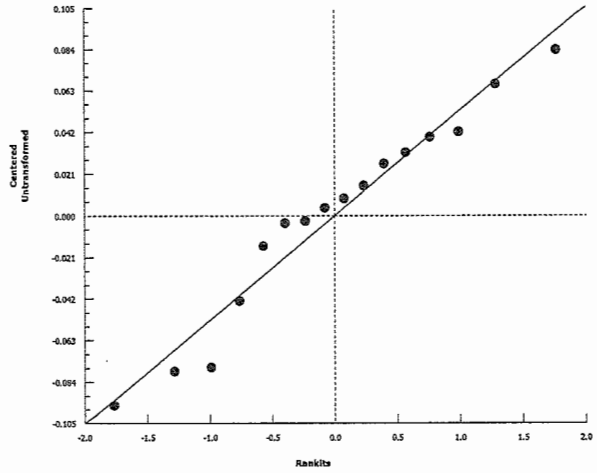
Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.4213	0.3213	0.426	0.5007
FR_FRCP1	0.7513	0.6087	0.7113	0.67
GH_FR1	0.7153	0.6707	0.7127	0.5947
CM_MC2	0.6267	0.6847	0.7013	0.666

Analysis ID:	15-1370-5226	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 12:28	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	10-4851-5997	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 10:19	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	11-4085-7619	20 Oct-16	20 Oct-16	NA		
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	control	Lab Control	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	5.24%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	1.099	2.356	0.404	6	0.3428	CDF	Non-Significant Effect
		FR_FRCP1	-1.075	2.356	0.404	6	0.9794	CDF	Non-Significant Effect
		GH_FR1	-0.782	2.356	0.404	6	0.9579	CDF	Non-Significant Effect
		CM_MC2	-0.875	2.356	0.404	6	0.9662	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.3779231	0.09448078	4	1.603	0.2249	Non-Significant Effect
Error	0.883883	0.05892553	15			
Total	1.261806		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	2.397	13.28	0.6631	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9681	0.866	0.7139	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	4	7.713	7.381	8.045	7.75	7.429	7.923	0.1042	2.7%	0.0%
FR_UFR1	4	7.524	7.192	7.856	7.444	7.375	7.833	0.1043	2.77%	2.45%
FR_FRCP1	4	7.897	7.323	8.472	7.821	7.583	8.364	0.1806	4.57%	-2.39%
GH_FR1	4	7.847	7.468	8.226	7.857	7.583	8.091	0.119	3.03%	-1.74%
CM_MC2	4	7.863	7.635	8.091	7.893	7.667	8	0.07168	1.82%	-1.95%

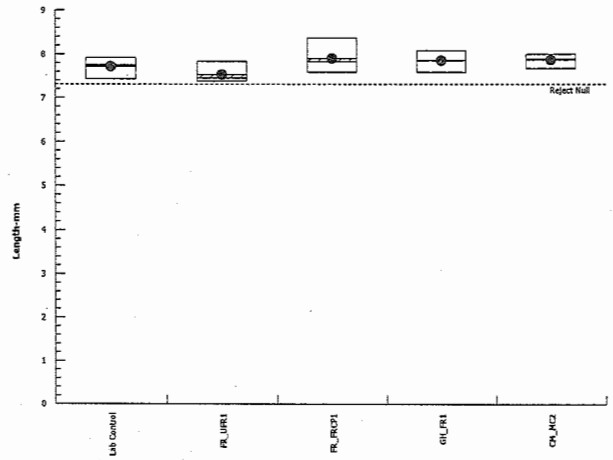
Length-mm Detail

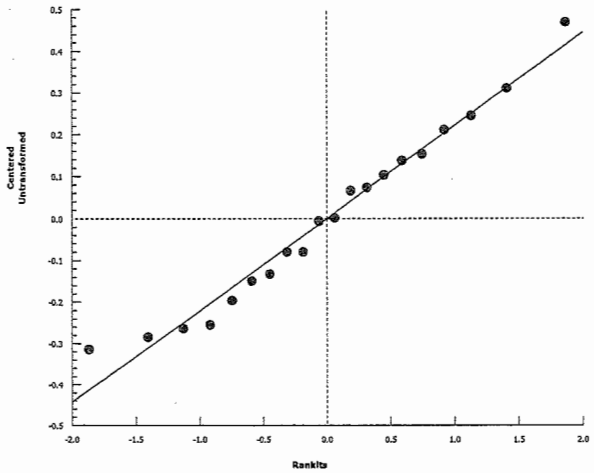
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	7.429	7.786	7.923	7.714
FR_UFR1	7.444	7.833	7.375	7.444
FR_FRCP1	8.364	7.583	7.643	8
GH_FR1	8.091	7.583	8	7.714
CM_MC2	7.857	7.929	7.667	8

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	10-4851-5997	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 10:19	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	03-3555-5408	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:08	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	5.39%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	-2.106	2.287	0.405	6	0.9972	CDF	Non-Significant Effect
		GH_FR1	-1.822	2.287	0.405	6	0.9943	CDF	Non-Significant Effect
		CM_MC2	-1.912	2.287	0.405	6	0.9955	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.3622049	0.120735	3	1.923	0.1798	Non-Significant Effect
Error	0.7535619	0.06279682	12			
Total	1.115767		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	2.253	11.34	0.5216	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9622	0.8408	0.7015	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	7.524	7.192	7.856	7.444	7.375	7.833	0.1043	2.77%	0.0%
FR_FRCP1	4	7.897	7.323	8.472	7.821	7.583	8.364	0.1806	4.57%	-4.96%
GH_FR1	4	7.847	7.468	8.226	7.857	7.583	8.091	0.119	3.03%	-4.29%
CM_MC2	4	7.863	7.635	8.091	7.893	7.667	8	0.07168	1.82%	-4.5%

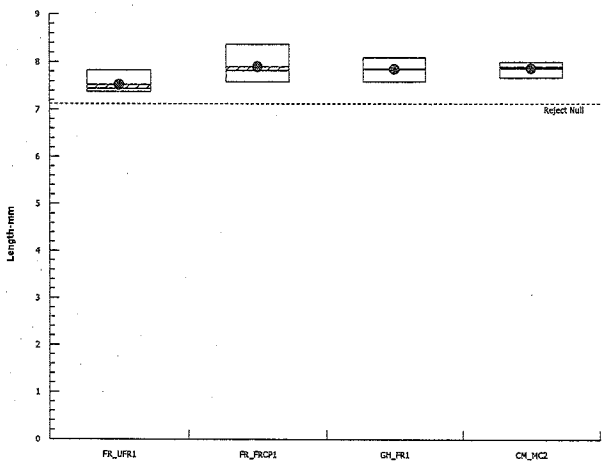
Length-mm Detail

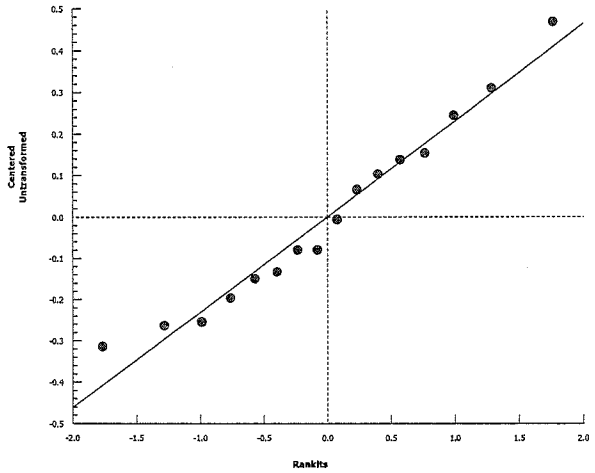
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	7.444	7.833	7.375	7.444
FR_FRCP1	8.364	7.583	7.643	8
GH_FR1	8.091	7.583	8	7.714
CM_MC2	7.857	7.929	7.667	8

Fathead Minnow 32-d Survival and Growth Test | **Nautilus Environmental**

Analysis ID:	03-3555-5408	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:08	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	16-5790-2810	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 10:21	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	11-4085-7619	20 Oct-16	20 Oct-16	NA		
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	control	Lab Control	Lab Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		FR_UFR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Negative Contr	54	1	55	0.9818	0.01818	0.0%
FR_UFR1		32	0	32	1	0	-1.85%
FR_FRCP1		48	0	48	1	0	-1.85%
GH_FR1		49	0	49	1	0	-1.85%
CM_MC2		58	0	58	1	0	-1.85%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	1	1	0.9231	1
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

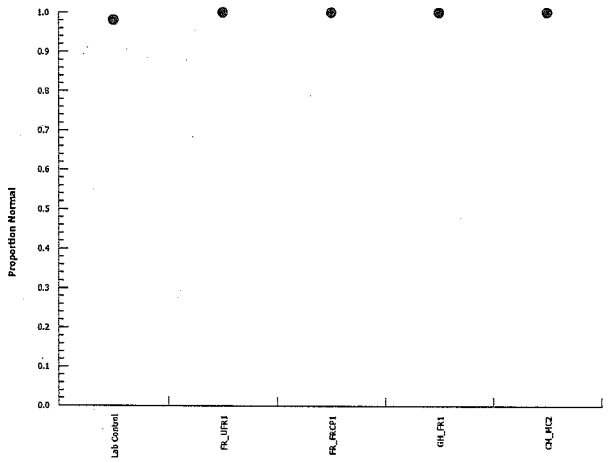
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Lab Control	14/14	14/14	12/13	14/14
FR_UFR1	9/9	6/6	8/8	9/9
FR_FRCP1	11/11	12/12	14/14	11/11
GH_FR1	11/11	12/12	12/12	14/14
CM_MC2	14/14	14/14	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	16-5790-2810	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 10:21	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



Fathead Minnow 32-d Survival and Growth Test — **Nautilus Environmental**

Analysis ID:	06-2653-3369	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:08	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	13-6269-2294	**Test Type:**	Survival-Development-Growth	**Analyst:**	Krysta Pearcy
Start Date:	20 Oct-16	**Protocol:**	ASTM E1241-05 (2013)	**Diluent:**	
Ending Date:	21 Nov-16	**Species:**	Pimephales promelas	**Brine:**	
Duration:	32d 0h	**Source:**	Aquatox, AR	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	61h (3.5 °C)	Teck Coal	
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	60h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	72h (5 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	72h (4 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		FR_FRCP1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		GH_FR1	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Dilution Water	32	0	32	1	0	0.0%
FR_FRCP1		48	0	48	1	0	0.0%
GH_FR1		49	0	49	1	0	0.0%
CM_MC2		58	0	58	1	0	0.0%

Proportion Normal Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	1	1	1	1
FR_FRCP1	1	1	1	1
GH_FR1	1	1	1	1
CM_MC2	1	1	1	1

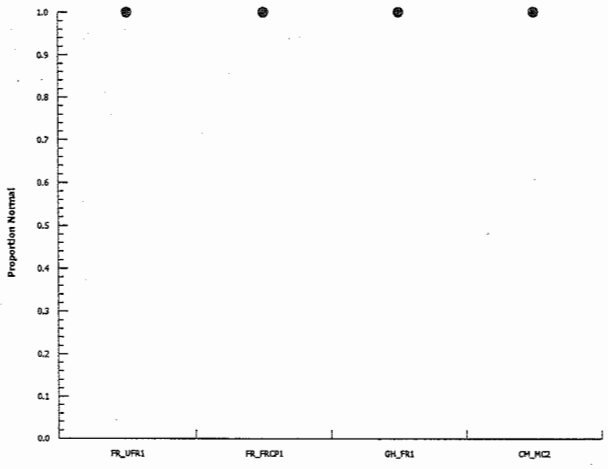
Proportion Normal Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	9/9	6/6	8/8	9/9
FR_FRCP1	11/11	12/12	14/14	11/11
GH_FR1	11/11	12/12	12/12	14/14
CM_MC2	14/14	14/14	15/15	15/15

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID:	06-2653-3369	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 Jan-17 11:08	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



APPENDIX E – *Oncorhynchus mykiss* (rainbow trout) Toxicity Test Data

Embryo-Alevin Test Summary Sheet

Client: Teck
Work Order No.: 161121
Test Date: October 18 - November 17, 2016
Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: Various - see table below
Sample Date: October 17, October 25, November 1, November 8 & November 15, 2016
Date Received: October 18, October 26, November 2, November 9 & November 16, 2016
Sample Volume: (2 - 9) x 20 L per refresh

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L CaCO3): 7 - 10
Alkalinity (mg/L CaCO3): 2 - 5

Test Organism Information:

Batch No: 101816
Source: Vancouver Island Trout Hatchery, Duncan, BC
Loading Density: 1.22 g / L
Number male broodstock used: 82
Number female broodstock used: 45

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE87
Stock Solution ID: 16SO2 (1000 mg/L SDS)
Date Initiated: October 18, 2016
7-d EC50 (95% CL): 3.8 (3.6 - 3.9) mg/L SDS

Reference Toxicant Mean and Range: 4.0 (2.0 - 7.8) mg/L SDS
Reference Toxicant CV (%): 40

Test Results:

Sample ID	Survival (%) (Mean ± SD)	Viability (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet weight (mg) (Mean ± SD)
Control	93.3 ± 6.1	90.0 ± 6.1	19.8 ± 0.2	82.8 ± 0.7
FR_UFR1	85.0 ± 4.3	81.7 ± 1.9	20.0 ± 0.1	85.0 ± 2.1
GH_ER2	89.2 ± 5.0	87.5 ± 6.3	20.0 ± 0.3	85.2 ± 2.6
FR_FRCP1	50.0 ± 6.8 *†§	49.1 ± 5.2 *†§	19.5 ± 0.3	82.8 ± 2.5
GH_FR1	41.4 ± 18.3 *†§	41.4 ± 18.3 *†§	19.4 ± 0.9	86.8 ± 0.3
GH_ERC	91.7 ± 5.8	91.7 ± 5.8	19.2 ± 0.6 †	85.2 ± 3.5
EV_HC1	56.3 ± 15.1 *†§	53.0 ± 12.4 *†§	19.3 ± 0.4	86.3 ± 2.3
EV_MC2	81.6 ± 8.5 *	79.0 ± 6.5 *	20.1 ± 0.2	91.2 ± 3.2
CM_MC2	81.4 ± 14.9 *	75.4 ± 13.2 *§	20.2 ± 0.2	90.9 ± 2.1
LC_LCDSSLCC	64.5 ± 7.4 *†§	62.8 ± 8.6 *†§	20.6 ± 0.2	96.2 ± 8.8

* Indicates results that were significantly lower relative to laboratory control
† Indicates results that were significantly lower relative to site control FR_UFR1
§ Indicates results that were significantly lower relative to site control GH_ER2

Reviewed by: JCH
Date reviewed: Dec. 19/16

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (various)
Work Order #: 161121

Start Date & Time: Oct 18 /16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

%(v/v) Concentration control	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.5	14.0
DO (mg/L)	10.0	10.0	10.0	10.1	9.8	10.0	9.9	9.9	9.8	9.8	9.8	10.0	10.1
pH	7.0	7.0	7.0	7.0	7.1	6.8	7.1	7.8	7.2	6.8	7.1	7.0	7.0
Cond. (µS/cm)	32	29		32		29		30		30		28	
Initials	KL	KL		KL		KL		A		A		KL	

100 ① Concentration FR_UFR1	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	13.8	14.0	15.0	14.0	13.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	10.2	10.3	10.2	10.0	9.9	10.3	10.0	9.9	9.9	9.9	9.8	10.0	10.1
pH	8.1	8.2	8.2	8.1	8.3	8.2	8.3	8.1	8.2	8.0	8.1	8.3	8.3
Cond. (µS/cm)	332	335		336		336		337		336		340	
Initials	KL	KL		KL		KL		A		A		KL	

100 ② Concentration QH_ER2	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.5	13.0	14.0	14.5	14.0	14.0	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	10.3	10.3	10.1	10.0	9.9	10.1	10.0	9.9	9.8	9.9	9.8	10.1	10.1
pH	8.1	8.1	8.2	8.1	8.3	8.2	8.3	8.1	8.2	8.1	8.2	8.2	8.3
Cond. (µS/cm)	305	303		303		306		306		305		317	
Initials	KL	KL		KL		KL		A		A		KL	

100 ③ Concentration FR_FRCP1	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	13.0	14.0	15.0	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	10.3	10.3	10.1	10.0	9.9	10.0	10.0	10.0	9.8	9.9	9.8	10.1	10.1
pH	8.2	8.2	8.3	8.3	8.3	8.3	8.4	8.1	8.3	8.1	8.2	8.4	8.4
Cond. (µS/cm)	835	834		837		838		839		838		845	
Initials	KL	KL		KL		KL		A		A		KL	

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	Control	FR_UFR1 100%	QH_ER2 100%	FR_FRCP1 100%
Hardness*	9	184	166	580
Alkalinity*	5	142	146	202

* mg/L as CaCO3

Analysts: AWD, KL
Reviewed by: JOLe
Date reviewed: Dec. 16/16

Sample Description: ①: clear, colourless, odourless, no particulates ②③: clear, colourless, odourless, some brown particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (various)
Work Order #: 161121

Start Date & Time: OCT 18 /16 @ 1735h
Stop Date & Time: NOV 17 /16 @ 1300h
Test Species: *Oncorhynchus mykiss*

100% (MW) Concentration ④ GH_FR1	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	13.0	14.0	14.5	14.0	14.5 ~~13.0~~	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	10.3	10.2	10.1	10.0	9.9	10.0	10.0	9.9	10.0	9.9	9.9	10.1	10.1
pH	8.1	8.1	8.3	8.2	8.4	8.2	8.4	8.1	8.3	8.2	8.3	8.3	8.5
Cond. (µS/cm)	744	748		746		~~749~~ 750		745		749		755	
Initials	KL	KL		KL		KL		AM		AM		KL	

100 Concentration ⑤ GH_ERC	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	13.0	14.0	14.5	14.0	14.0	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	10.3	10.3	10.1	10.0	9.9	10.0	10.0	9.9	10.0	9.9	9.9	10.1	10.1
pH	8.0	8.0	8.3	8.1	8.4	8.3	8.4	8.2	8.4	8.1	8.3	8.3	8.3
Cond. (µS/cm)	335	333		334		334		329		315		337	
Initials	KL	KL		KL		KL		AM		AM		KL	

100 Concentration ⑥ EV_HC1	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	13.0	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	10.3	10.3	10.1	10.1	9.9	10.0	10.0	10.0	9.8	9.9	9.8	10.1	10.1
pH	8.2	8.2	8.3	~~8.4~~ 8.3	8.4	8.2	8.4	8.1	8.4	8.2	8.3	8.4	8.5
Cond. (µS/cm)	684	684		685		615		618		614		677	
Initials	KL	KL		KL		KL		AM		AM		KL	

100 Concentration ⑦ EV_MC2	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	13.0	14.0	14.5	14.0	14.5	14.0	14.5	14.5	14.5	14.0	14.0	14.0
DO (mg/L)	10.3	10.3	10.2	10.0	9.9	10.0	10.0	9.8	9.8	9.9	9.9	10.1	10.0
pH	7.9	7.9	8.2	8.0	8.3	8.1	8.3	8.2	8.3	8.1	8.2	8.2	8.3
Cond. (µS/cm)	361	363		363		364		364		366		369	
Initials	KL	KL		KL		KL		AM		AM		KL	

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	GH_FR1 (100%) ~~Control~~	GH_ERC 100%	EV_HC1 100%	EV_MC2 100%
Hardness*	510	182	480	500
Alkalinity*	186	152	204	132

Analysts: AWO, KL

Reviewed by: JCL

Date reviewed: Dec. 16/16

* mg/L as CaCO3

Sample Description: ④⑤⑥⑦: clear, colourless, odourless, no particulates, ⑥ ~~light yellow~~ colourless, clear, odourless, no particulates KL

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: (various)
Work Order #: 161121

Start Date & Time: OCT 18 /16 @ 1735h
Stop Date & Time: NOV 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

% (v/v) 100 ② Concentration CM_MC2	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	13.0	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	10.3	10.3	10.1	10.1	9.9	10.0	10.0	9.9	9.8	9.8	9.9	10.0	10.0
pH	8.2	8.1	8.3	8.1	8.3	8.2	8.3	8.2	8.3	8.1	8.3	8.3	8.4
Cond. (µS/cm)	641	641		640		644		641		645		649	
Initials	KL	KL		KL		KL		A		A		KL	

100 ⑨ Concentration LC_LCOSSLCC	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	13.0	14.0	14.5	14.0	14.0	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	10.3	10.3	10.1	10.0	9.9	10.1	10.0	10.0	9.8	9.9	9.8	10.1	10.0
pH	8.2	8.1	8.3	8.2	8.4	8.2	8.4	8.2	8.3	8.1	8.2	8.3	8.4
Cond. (µS/cm)	713	716		715		719		716		716		723	
Initials	KL	KL		KL		KL		A		A		KL	

Concentration	Days												
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)													
DO (mg/L)													
pH													
Cond. (µS/cm)													
Initials													

Concentration	Days												
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)													
DO (mg/L)													
pH													
Cond. (µS/cm)													
Initials													

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	~~Control~~ KL	100% CM_MC2 KL	100% LC_LCOSSLCC	
Hardness*		380	KL ~~164~~ 870	
Alkalinity*		~~164~~ ~~870~~ KL	182	

* mg/L as $CaCO_3$

Analysts: AWD, KL

Reviewed by: JBe
Date reviewed: Dec-16/16

Sample Description: ⑧ & ⑨ clear, colourless, odourless, no particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various (see below)
Work Order #: 161121

Start Date & Time: Oct 18/16 @ 1735 h
Stop Date & Time: Nov 17/16 @ 1300 h
Test Species: *Oncorhynchus mykiss*

%(v/v) Concentration control	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	14.0	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.5	14.0
DO (mg/L)	9.9	10.0	10.1	10.1	10.0	10.1	10.0	10.2	10.1	9.9	10.1	9.8	10.0	10.0
pH	7.1	7.1	6.9	6.9	7.0	6.9	6.9	6.8	6.8	7.0	6.8	7.1	6.9	6.9
Cond. (µS/cm)	28		28		28		28		28		28		28	
Initials	kl		kl		kl		kl		A		A		kl	

100 Concentration ① FR_UFR1	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	14.0	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	9.7	10.1	9.8	10.1	10.3	10.1	10.~~3~~1	10.2	10.1	9.8	10.0	9.8	10.0	10.0
pH	8.1	8.2	8.1	8.1	8.1	8.2	8.2	8.1	8.2	8.3	8.2	8.2	8.2	8.4
Cond. (µS/cm)	338		337		329		336		335		336		337	
Initials	kl		kl		kl		kl		A		A		kl	

100 Concentration ② GH_ER2	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	14.0	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	9.7	10.1	9.8	10.1	10.3	10.1	10.~~3~~1	10.2	10.1	9.9	10.0	9.9	10.0	10.0
pH	8.1	8.3	8.1	8.1	8.2	8.2	8.2	8.2	8.2	8.3	8.3	8.3	8.2	8.4
Cond. (µS/cm)	310		307		312		311		309		311		310	
Initials	kl		kl		kl		kl		A		A		kl	

100 ③ Concentration FR_FRCP1	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	14.0	14.0	14.5	14.0	14.5	14.0	14.6	14.0	14.0	14.0
DO (mg/L)	9.8	10.1	10.0	10.1	10.3	10.2	10.~~3~~2	10.1	10.2	9.9	10.1	9.8	10.0	10.0
pH	8.2	~~8.~~8.3	8.2	8.2	8.3	8.1	8.3	8.3	8.1	8.2	8.3	8.2	8.2	8.5
Cond. (µS/cm)	843		836		898		904		903		904		898	
Initials	kl		kl		kl		kl		A		A		kl	

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** PH-1 **Conductivity meter:** C-2

	Control	FR ~~FRCP1~~ UFR1 (100%)	GH_ER2 (100%)	FR_FRCP1 (100%)
Hardness*	10	180	196	510
Alkalinity*	4	130	134	182

* mg/L as CaCO3

Analysts: AWD, kl
Reviewed by: JGL
Date reviewed: Dec. 16/16

Sample Description: ~~①②③~~: ①, ② ③: clear, colourless, odourless, ~~no~~ some particulates.

Comments:

Version 1.2 Issued October 6, 2015

Nautilus Environmental Company Inc.

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: Various (see below)
Work Order #: 161121

Start Date & Time: Dec 18/16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

0%(v/v) 100 Concentration ④ GH_FR1	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	13.5	14.0	14.5	14.0	14.6	14.0	14.6	14.0	14.0	14.0
DO (mg/L)	9.9	10.1	10.0	10.1	10.3	10.2	10.2 10.1	10.1	10.0	9.9	10.1	9.9	10.0	10.0
pH	8.2	8.4	8.2	8.3	8.3	8.1 8.2	8.2 8.1	8.3	8.2	8.3	8.2	8.3	8.3	8.5
Cond. (µS/cm)	752		746		~~880~~ 732		808		805		806		807	
Initials	KL		KL		KL		KL		A		A		KL	

100 Concentration ⑤ GH_ERC	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	14.0	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	9.9	10.1	10.0	10.1	10.3	10.0	10.2 10.1	10.0	10.1	9.9	10.1	9.9	10.0	10.0
pH	8.1	8.3	8.1	8.2	8.2	8.2	8.2	8.2	8.2	8.3	8.2	8.3	8.2	8.4
Cond. (µS/cm)	338		335		343		342		340		341		341	
Initials	KL		KL		KL		KL		A		A		KL	

100 Concentration ⑥ EV_HC1	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	13.5	14.0	14.5	14.0	14.6	14.0	14.6	14.0	14.0	14.0
DO (mg/L)	9.8	10.0	10.0	10.1	10.3	10.1	10.2 10.1	10.0	10.1	9.8	10.2	9.9	10.0	10.0
pH	8.2	8.4	8.2	8.2	8.3	8.2 8.3	8.3	8.3	8.2	8.2	8.3	8.2	8.3	8.5
Cond. (µS/cm)	689		687		705		705		703		705		704	
Initials	KL		KL		KL		KL		A		A		KL	

100 Concentration ⑦ EV_MC2	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	13.5	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	9.8	10.0	9.9	10.1	10.3	10.2	10.2	10.0	10.1	9.9	10.1	9.9	10.0	10.0
pH	8.0	8.3	8.0	8.1	8.1	8.2	8.0	8.2	8.1	8.3	8.0	8.2	8.2	8.4
Cond. (µS/cm)	364		362		481		479		478		479		479	
Initials	KL		KL		KL		KL		A		A		KL	

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	~~Control~~ KL GH_FR1 (100%)	GH_ERC (100%)	~~EV~~ KL EV_HC1 (100%)	EV_MC2 (100%)
Hardness*	530	184	380	316
Alkalinity*	178	140	190	136

* mg/L as CaCO3

Analysts: AWD, KL
Reviewed by: JGH
Date reviewed: Dec. 16/16

Sample Description: ④, ⑤, ⑥: Clear, colourless, odourless, some particulates, ⑦ clear, light yellow, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various (see below)
Work Order #: L61121
Start Date & Time: Oct 18 '16 @ 1735h
Stop Date & Time: Nov 7/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

⑧ Concentration 100 %(v/v) CM_MC2	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	13.5	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	9.8	10.0	9.9	10.1	10.3	10.2	10.3	10.0	10.1	9.9	10.1	9.9	10.0	10.0
pH	8.2	8.3	8.2	8.2	8.2	8.2	8.3	8.3	8.2	8.3	8.2	8.2	8.3	8.3
Cond. (µS/cm)	646		843		795		791		793		791		794	
Initials	KL		KL		KL		KL		A		A		KL	

⑨ Concentration 100 LC_LCDSSLCC	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.5	14.0	13.5	14.0	14.5	14.0	14.5	14.0	14.5	14.0	14.0	14.0
DO (mg/L)	9.8	10.0	9.9	10.1	10.3	10.2	10.3	10.0	10.1	9.9	10.0	9.8	10.0	10.0
pH	8.2	8.4	8.2	8.2	8.3	8.2	8.2	8.3	8.2	8.3	8.1	8.3	8.3	8.4
Cond. (µS/cm)	719		717		796		KL ~~798~~ 786		A ~~795~~ 786		788 A		787	
Initials	KL		KL		KL		KL		A		A		KL	

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	Control	CM_MC2 (100%)	LC_LCDSSLCC (100%)	
Hardness*	10	434	460	
Alkalinity*	4	186	176	

* mg/L as CaCO3

Analysts: AWD, KL
Reviewed by: JBL
Date reviewed: Dec. 16/16

Sample Description: ⑧: clear, light yellow, odourless, some particulates. ⑨: clear, colourless, odourless, some particulates.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various
Work Order #: 161121

Start Date & Time: Oct 18 /16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

%(v/v) Concentration control	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	~~13.5~~ 14.5	14.0	14.5	14.0	14.5	14.0	14.5	13.5	14.5	14.0	15.0	14.5	15.0	14.5
DO (mg/L)	10.1	10.2	9.8	9.9	10.1	10.2	8.~~10~~ 10.1	10.1	10.0	10.2	10.0	9.9	9.8	9.7
pH	6.9	6.9	6.9	6.9	6.9	6.9	7.1	7.0	6.9	7.0	7.0	6.9	6.9	6.8
Cond. (µS/cm)	~~37~~ 28		28		28		27		28		29		28	
Initials														

100 ① Concentration FR_UFR1	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0	14.0	14.0	14.0	13.5	14.0	14.~~5~~0	13.5	14.5	14.0	15.0	14.5	15.0	14.5
DO (mg/L)	10.4	10.2	9.8	10.0	10.3	10.2	10.1	10.1	10.2	10.1	9.8	9.9	9.7	9.7
pH	8.1	8.1	8.1	8.2	8.1	8.2	8.2	8.2	8.1	8.2	8.2	8.3	7.9	8.1
Cond. (µS/cm)	334		336		322		322		324		325		324	
Initials														

100 ② Concentration WH_ER2	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0	14.0	14.0	14.0	13.5	14.0	14.~~5~~0	13.5	14.5	14.0	15.0	14.5	15.0	14.5
DO (mg/L)	10.4	10.3	9.8	10.0	10.3	10.2	10.1	10.1	10.1	10.1	9.8	9.9	9.7	9.7
pH	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.3	8.2	8.3	7.9	8.1
Cond. (µS/cm)	310		310		308		309		307		310		308	
Initials														

100 ③ Concentration FR_FRCP1	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0	14.0	14.0	14.0	13.5	14.0	14.~~5~~0	13.5	14.5	14.0	15.0	14.5	15.0	14.5
DO (mg/L)	10.4	10.3	9.8	10.0	10.3	10.1	10.1	10.1	10.2	10.2	9.8	9.9	9.7	9.7
pH	8.2	8.3	8.1	8.3	8.~~21~~	8.3	8.2	8.3	8.2	8.3	8.2	8.4	8.1	8.2
Cond. (µS/cm)	897		894		858		867		864		867		~~857~~ 867	
Initials														

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2/3

	Control	FRUFR1 (100%)	WHER2 (100%)	FRFRCP1 (100%)
Hardness*	9	172	160	510
Alkalinity*	4	142	144	192

* mg/L as CaCO3

Analysts: AWD, KL

Reviewed by: JCL

Date reviewed: Dec. 16/16

Sample Description: ①②③ ~~clear~~ clear, colourless, odourless, some particulates.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various
Work Order #: 161121

Start Date & Time: Oct 18/16 @ 1735h
Stop Date & Time: Nov 7/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

% (v/v) 100 Concentration ④ GH_FR1	Days 14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0	14.0	14.0	14.0	13.5	14.0	14.5	13.5	14.5	14.0	15.0	14.5	15.0	14.5
DO (mg/L)	10.4	10.3	9.8	10.0	10.3	10.1	10.1	10.1	10.2	10.2	9.8	9.9	9.7	9.7
pH	8.1	8.3	8.2	8.3	8.2	8.3	8.2	8.3	8.2	8.2	8.3	8.5	8.1	8.2
Cond. (µS/cm)	808		803		795		803		795		797		793	
Initials	KL		KL		KL		KL		A		KL		KL	

100 Concentration ⑤ GH_ERC	Days 14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0	14.0	14.0	14.0	13.5	14.0	14.0	13.5	14.5	14.0	15.0	14.5	15.0	15.0
DO (mg/L)	10.4	10.3	9.7	10.0	10.3	10.1	10.1	10.1	10.1	10.2	9.8	9.9	9.7	9.7
pH	8.0	8.2	8.1	8.3	8.2	8.2	8.1	8.3	8.2	8.3	8.2	8.4	7.9	8.2
Cond. (µS/cm)	340		340		335		337		334		336		335	
Initials	KL		KL		KL		KL		A		KL		KL	

100 Concentration ⑥ EV_HC1	Days 14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0	14.0	14.0	14.0	13.0	14.0	14.0	13.5	14.5	14.0	15.0	14.5	15.0	15.0
DO (mg/L)	10.3	10.3	9.8	10.0	10.3	10.1	10.1	10.1	10.1	10.2	9.8	9.8	9.7	9.7
pH	8.2	8.3	8.2	8.4	8.1	8.3	8.2	8.4	8.2	8.3	8.3	8.5	8.1	8.2
Cond. (µS/cm)	703		700		642		648		642		642		643	
Initials	KL		KL		KL		KL		A		KL		KL	

100 Concentration ⑦ EV_MC2	Days 14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0	14.0	14.0	14.0	13.0	14.0	14.0	13.5	14.5	14.0	15.0	14.5	15.0	15.0
DO (mg/L)	10.4	10.3	9.8	10.0	10.3	10.1	10.1	10.1	10.1	10.1	9.8	9.8	9.7	9.7
pH	8.0	8.2	8.1	8.2	8.0	8.2	8.0	8.2	8.0	8.3	8.1	8.3	7.9	8.1
Cond. (µS/cm)	475		476		394		397		398		394		395	
Initials	KL		KL		KL		KL		A		KL		KL	

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** PH-1 **Conductivity meter:** C-2 13

	~~Control~~ GH_FR1 (100%)	GH_ERC (100%)	EV_HC1 (100%)	EV_MC2 (100%)
Hardness*	430	254	352	194
Alkalinity*	192	148	192	126

* mg/L as CaCO3

Analysts: AWD, KL
Reviewed by: JOL
Date reviewed: Dec. 16/16

Sample Description: ④, ⑤, ⑥: clear, odourless, some particulates, ⑦: clear, light yellow, odourless, some particulates.

Comments:

Version 1.2 Issued October 6, 2015

Nautilus Environmental Company Inc.

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: Various
Work Order #: 16124

Start Date & Time: Oct 18 16 @ 1735h
Stop Date & Time: Nov 7 16 @ Noon
Test Species: *Oncorhynchus mykiss*

% (v/v) 100 Concentration (8) CM_MC2	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0	14.0	14.0	14.0	13.5	14.0	14.0	13.5	14.5	14.0	15.0	14.5	15.0	15.0
DO (mg/L)	10.4	10.3	9.8	10.0	10.3	10.1	10.1	10.1	10.2	10.2	9.8	9.8	9.7	9.7
pH	8.2	8.3	8.2	8.3	8.1	8.3	8.2	8.3	8.0	8.2	8.3	8.3	8.0	8.2
Cond. (µS/cm)	790		790		656		661		655		656		655	
Initials	KL		KL		KL		KL		A		KL		KL	

(9) 100 Concentration LC_LCDSSLCC	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0	14.0	14.0	14.0	13.5	14.0	14.0	13.5	14.5	14.0	15.0	14.5	15.0	15.0
DO (mg/L)	10.4	10.3	9.8	10.0	10.3	10.1	10.1	10.1	10.1	10.1	9.8	9.8	9.7	9.7
pH	8.2	8.3	8.2	8.3	8.2	8.3	8.2	8.3	8.2	8.3	8.3	8.3	8.0	8.2
Cond. (µS/cm)	786		783		750		762		751		753		750	
Initials	KL		KL		KL		KL		A		KL		KL	

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2 13

	Control	(8) CM_MC2 (100%)	(9) LCDSSLCC	
Hardness*	9	~~38~~ 328	400	
Alkalinity*	4	~~192~~ 178	~~448~~ 186	

* mg/L as CaCO3

Analysts: AWD, KL

Reviewed by: JGH

Date reviewed: Dec. 16/16

Sample Description: (8) & (9): clear, colourless, odourless, some particulates.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various
Work Order #: 161124

Start Date & Time: Oct 18 1160 1735h
Stop Date & Time: Nov 7/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

% (v/v) Concentration control	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	13.5	14.0	13.5	14.5	14.0	14.5	14.0	14.5	14.0	14.5	13.5
DO (mg/L)	9.9	9.8	10.1	10.2	10.3	10.0	9.9	10.0	10.1	10.2	10.0	10.0	10.0	9.8
pH	6.8	6.8	7.0	6.9	7.1	7.0	7.0	6.9	6.8	7.1	7.2	7.2	7.2	7.0
Cond. (µS/cm)	28		28		27		28		27		27		27	
Initials	KL		KL		KL		YML		A		KL		KL	

① 100 Concentration FR_UFR1	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	13.5	14.0	13.5	14.5	14.0	14.5	14.0	14.0	14.0	14.5	13.5
DO (mg/L)	9.6	9.8	10.0	10.2	10.3	10.0	9.8	10.0	10.1	9.8	10.0	10.0	10.0	10.0
pH	8.0	8.1	8.2	8.1	8.2	8.0	8.1	8.1	8.2	8.2	8.1	8.1	8.2	8.2
Cond. (µS/cm)	323		324		324		325		326		327		328	
Initials	KL		KL		KL		YML		A		KL		KL	

② 100 Concentration GH_ER2	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	13.5	13.5	13.5	14.5	14.0	14.5	14.0	14.0	14.0	14.5	13.5
DO (mg/L)	9.6	9.8	10.0	10.2	10.3	10.0	9.8	10.0	10.1	9.9	10.0	9.9	10.0	10.0
pH	8.0	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.2	8.2	8.2	8.2	8.2
Cond. (µS/cm)	307		308		311		312		311		312		313	
Initials	KL		KL		KL		YML		A		KL		KL	

③ 100 Concentration FR_FRCP1	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	13.5	13.5	13.5	14.5	14.0	14.5	14.0	14.0	14.0	14.5	13.5
DO (mg/L)	9.8	9.8	10.0	10.2	10.3	10.0	9.9	10.1	10.0	10.2	10.0	9.8	10.0	10.0
pH	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.2	8.1	8.1	8.3	8.3	8.2	8.2
Cond. (µS/cm)	857		856		907		905		910		905		908	
Initials	KL		KL		KL		YML		A		KL		KL	

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	Control	FR_UFR1 (100%)	GH_ER2 (100%)	FR_FRCP1 (100%)
Hardness*	7	164	158	530
Alkalinity*	5	130	140	200

* mg/L as CaCO3

Analysts: AWD, YML, KL

Reviewed by: JDR

Date reviewed: Dec 16/16

Sample Description: ①, ②, ③: clear, colourless, odourless, some particulates.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various
Work Order #: 161121

Start Date & Time: Oct 18 /16 @ 1735h
Stop Date & Time: Nov 17 /16 @ 1300h
Test Species: *Oncorhynchus mykiss*

% (v/v) ④ Concentration GH_FR1	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	13.5	13.5	14.5	14.0	14.5	14.5	14.0	14.0	14.5	13.5
DO (mg/L)	9.9	9.8	10.0	10.1	10.3	10.0	10.0	10.2	10.1	10.0	10.0	9.8	10.0	10.0
pH	8.1	8.3	8.2	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.2	8.3	8.2	8.3
Cond. (µS/cm)	794		794		807		816		807		807		813	
Initials	KL		KL		KL		YML		A		KL		KL	

100 ⑤ Concentration GH_ERC	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	13.5	13.5	14.5	14.0	14.5	14.5	14.0	14.0	14.5	14.0
DO (mg/L)	9.8	9.8	10.0	10.1	10.3	10.0	10.0	10.1	10.0	10.0	9.9	9.9	10.0	10.0
pH	8.0	8.2	8.0	8.3	8.0	8.2	8.0	8.2	8.1	8.2	8.2	8.3	8.2	8.3
Cond. (µS/cm)	335		335		341		341		341		342		344	
Initials	KL		KL		KL		YML		A		KL		KL	

100 ⑥ Concentration EV_HC1	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	13.5	14.0	14.5	14.0	14.5	14.5	14.0	14.0	14.5	14.0
DO (mg/L)	9.9	9.8	10.0	10.1	10.3	10.0	9.9	10.1	10.0	10.1	9.9	9.8	10.0	10.0
pH	8.1	8.3	8.2	8.3	8.2	8.3	8.1	8.3	8.1	8.2	8.3	8.3	8.2	8.3
Cond. (µS/cm)	642		642		681		691		682		682		689	
Initials	KL		KL		KL		YML		A		KL		KL	

100 ⑦ Concentration EV_MC2	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	13.5	14.0	14.0	14.0	14.5	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	9.9	9.8	10.0	10.0	10.3	10.0	9.9	10.1	10.0	10.0	9.8	9.8	10.0	10.0
pH	7.9	8.1	8.0	8.2	8.1	8.1	8.1	8.2	8.2	8.3	8.2	8.3	8.1	8.3
Cond. (µS/cm)	396		398		408		412		406		411		421	
Initials	KL		KL		KL		YML		A		KL		KL	

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	~~Control~~ KL	GH_FR1 (100%) KL	GH_ERC (100%)	EV_HC1 (100%)	EV_MC2 (100%)
Hardness*	470		234	364	204
Alkalinity*	194 ~~130~~ KL		148	200	130

* mg/L as CaCO3

Analysts: AWD, YML, KL
Reviewed by: JKe
Date reviewed: Dec. 16/16

Sample Description: ④, ⑤, ⑥: clear, colourless, odourless, some particulates. ⑦: clear, light yellow, odourless, some particulates.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various
Work Order #: 1614

Start Date & Time: Oct 18/16 @ 1335h
Stop Date & Time: Nov 7/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

⑧ 6%(v/v) 100 Concentration CM_MC2	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	13.5	14.0	14.0	14.0	14.5	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	9.9	9.8	10.0	10.0	10.3	10.0	9.9	10.1	10.0	10.0	9.8	9.8	10.0	10.0
pH	8.1	8.2	8.2	8.3	8.2	8.2	8.1	8.2	8.1	8.2	8.2	8.3	8.1	8.3
Cond. (µS/cm)	654		654		672		680		671		673		678	
Initials	KL		KL		KL		YYL		A		KL		KL	

⑨ 100 Concentration LC_LCOSSLCC	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	15.0	14.5	14.0	14.0	14.0	14.0	14.0	14.5	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	9.9	9.8	10.0	10.0	10.3	10.0	9.9	10.1	10.0	10.0	9.8	9.8	10.0	10.0
pH	8.1	8.2	8.1	8.3	8.2	8.2	8.2	8.3	8.1	8.3	8.2	8.3	8.2	8.3
Cond. (µS/cm)	749		749		791		807		798		797		804	
Initials	KL		KL		KL		YYL		A		KL		KL	

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	~~Control~~	CM_MC2 (100%)	LC_LCOSSLCC (100%)	
Hardness*	7	336	410	
Alkalinity*	5	170	184	

* mg/L as CaCO3

Analysts: AWD, YYL, KL
Reviewed by: JOE
Date reviewed: Dec. 16/16

Sample Description: ⑧: clear, light yellow, odourless, some particulates, ⑨: clear, colourless, odourless some particulates.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various
Work Order #: 16124

Start Date & Time: Oct 18/16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

%(v/v) Concentration Control	Days													
	28		29		30									
	new	old	new	old	~~new~~ final new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0	14.0	14.0	14.0	13.5									
DO (mg/L)	10.0	9.9	10.0	9.9	10.2									
pH	~~6.8~~	6.7	7.0	6.9	6.8									
Cond. (µS/cm)	27		25		30									
Initials	KL		KL		KL									

① 100 Concentration FR_UFR1	Days													
	28		29		Final 30									
	new	old	new	old	~~new~~ new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	13.0	14.0	13.5									
DO (mg/L)	10.0	10.0	10.3	10.0	10.1									
pH	8.1	8.1	8.0	8.1	8.1									
Cond. (µS/cm)	328		324		329									
Initials	KL		KL		KL									

② 100 Concentration GH_ER2	Days													
	28		29		Final 30									
	new	old	new	old	~~new~~ new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	~~13.5~~ 14.0	14.0	13.5									
DO (mg/L)	10.1	10.0	10.2	10.0	10.1									
pH	8.1	8.1	7.9	8.1	8.1									
Cond. (µS/cm)	314		306		312									
Initials	KL		KL		KL									

③ 100 Concentration FR_FRCP1	Days													
	28		29		Final 30									
	new	old	new	old	~~new~~ new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	13.5	14.0	13.5									
DO (mg/L)	10.1	10.0	10.2	10.0	10.2									
pH	8.2	8.2	8.0	8.3	8.2									
Cond. (µS/cm)	907		906		883									
Initials	KL		KL		KL									

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	Control	FR_UFR1 (100%)	GH_ER2 (100%)	FR_FRCP1 (100%)
Hardness*	7	152	140	570
Alkalinity*	2	146	156	210

* mg/L as CaCO3

Analysts: KL

Reviewed by: JGL
Date reviewed: Dec 16/16

Sample Description: ①, ②, ⑤: clear, colourless, odourless, few particulates.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: various
Work Order #: 16124

Start Date & Time: Oct 18 16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

% (v/v) 100 ④ Concentration GH_FR1	Days													
	28		29		30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	13.0	14.0	13.5									
DO (mg/L)	10.1	10.0	10.2	10.0	10.1									
pH	8.2	8.2	8.0	8.4	8.3									
Cond. (µS/cm)	816		804		806									
Initials	KL		KL		KL									

100 ⑤ Concentration GH_ERC	Days													
	28		29		30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	14.0	14.0	13.5									
DO (mg/L)	10.1	10.0	10.2	10.0	10.1									
pH	8.0	8.2	7.9	8.2	8.2									
Cond. (µS/cm)	349		395		341									
Initials	KL		KL		KL									

100 ⑥ Concentration EV_HC1	Days													
	28		29		30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	15.0	14.0	13.5									
DO (mg/L)	10.1	10.0	10.~~20~~	10.0	10.1									
pH	8.2	8.2	8.0	8.4	8.3									
Cond. (µS/cm)	689		656		668									
Initials	KL		KL		KL									

100 ⑦ Concentration EV_MC2	Days													
	28		29		30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	13.0	14.0	13.5									
DO (mg/L)	10.1	10.0	10.2	10.0	10.1									
pH	8.0	8.1	7.8	8.2	8.1									
Cond. (µS/cm)	420		348		376									
Initials	KL		KL		KL									

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	~~Control~~ KL	GH_ERC (100%)	EV_HC1 (100%)	EV_MC2 (100%)
	GH_FR1 (100%)			
Hardness*	450	KL ~~140~~ 150	350	200 ~~250~~ KL
Alkalinity*	210	156	204	126

* mg/L as CaCO3

Analysts: KL

Reviewed by: JBe

Date reviewed: Dec. 16/16

Sample Description: ④ ⑤: clear, colourless, odourless, some particulates, ⑥ ⑦: clear, light yellow, some particulates, odourless.

Comments:

Embryo-Alevin Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: Vanay
Work Order #: 161121

Start Date & Time: Oct 18 /16 @ 1735
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

⑧ 100 Concentration ON_MC2	Days													
	28		29		30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	13.0	14.0	13.5									
DO (mg/L)	10.1	10.0	10.2	10.0	10.1									
pH	8.1	8.2	7.8	8.3	8.2									
Cond. (µS/cm)	678		586		623									
Initials	IK		IK		IK									

⑨ 100 Concentration LL_LCOSSLCC	Days													
	28		29		30									
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.0	13.5	14.0	13.5									
DO (mg/L)	10.1	10.0	10.2	10.0	10.1									
pH	8.2	8.2	8.0	8.3	8.3									
Cond. (µS/cm)	804		781		789									
Initials	IK		IK		IK									

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: Temp-3 **DO meter:** DO-2 **pH meter:** pH-1 **Conductivity meter:** C-2

	~~Control~~ IK	ON_MC2 (100%)	LL_LCOSSLCC (100%)	
Hardness*	7	300	390	
Alkalinity*	2	172	196	

* mg/L as CaCO3

Analysts: IK

Reviewed by: JGh
Date reviewed: Dec. 16/16

Sample Description: ⑧ IK: clear, colourless, odourless, ~~odourless~~ IK, no particulates. ⑧: clear, light yellow, odourless, some IK ~~fiber~~ particulates.

Comments:

Embryo-Alevin Toxicity Test
Daily Mortality

Client: TECK
Sample ID: (various)
Work Order #: 161121

Start Date & Time: Oct 18 '16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration %(v/v)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
control	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2													0
	3													0
	4													0
FR_UFR1	1													0
100	2				0			1						1
	3				1		1	0		1				3
	4				0		0			0				0
GH_ER2	1						1			0				1
100	2					2	0			0			1	1
	3					1				1			0	2
	4					0				0			0	0
FR_FRCP1	1					1	1	1		2				4
100	2						0	1		1				2
	3							0		0	3		1	4
	4								2	0	2		0	4
GH_FR1	1						0		0	0	0	0	0	0
100	2			1					0	1	0	1	0	3
	3			1					0	1	1	0	0	3
	4			0	1	2			2	1	1	0	1	8
GH_ERC	1				0	0		1	0	0	0	0	0	1
100	2							0		0	0			0
	3							0		0	2			2
	4									0	0			1
EV_HC1	1			1		1	1	0		1	0			5
100	2			0		0	0			2			0	2
	3					1	0			1			3	5
	4					0				1			1	3
EV_MC2	1		2			1	0			0			0	3
100	2		0		1	1	0			0			0	2
	3		0	1	1	0				0			0	4
	4		1	0	0	0	1			0		0	0	2
Tech Initials														

Comments:

Reviewed by: JCu **Date reviewed:** Dec. 16/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (various)
Work Order #: 161121

Start Date & Time: Oct 18/16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration % (v/v)	Rep	Day of Test - No. of Mortalities 1	2	3	4	5	6	7	8	9	10	11	12	Total Dead Eggs/Embryos/ Alevins
CM_MC2	1	0	0	0	0	0	0	0	1	0	0	0	0	1
100	2	↓	↓	1	0	0	2	↓	2	2	↓	↓	↓	7
	3	↓	↓	0	0	0	0	↓	2[cc] 0	1	↓	↓	↓	1
	4	↓	↓	0	0	0	0	↓	0	0	↓	↓	↓	0
LC_LCDSSLCC	1	↓	↓	0	0	0	0	↓	0	0	↓	↓	↓	0
100	2	↓	↓	0	1	0	0	↓	1	0	↓	↓	↓	2
	3	↓	↓	1	0	1	1	↓	0	0	↓	↓	↓	3
	4	↓	↓	1	1	0	0	↓	1	1	↓	↓	↓	4
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
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	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		KL	KL	KL	A	A	KL	KL	KL	KL	KL	A	~	~

Comments:

Reviewed by: JGh **Date reviewed:** Dec. 16/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: TRCR
Sample ID: (various)
Work Order #: 16112

Start Date & Time: Oct 18 16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration %(v/v)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		①13	14	15	16	17	18	19	②20	21	③22	④23	24	
Control	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0											0
	3	0	0											0
	4	0	0								↓			0
FR UFR1	1	1	1					↓			1			3
100	2	0	0					1	↓	↓	1			2
	3	1	0					0	1	1	0	↓		3
	4	0	0					1	0	0	1	1		3
GH_ER2	1		0					0		1	0	0		1
100	2		0	↓						0	0	0		0
	3		0	1						0	1	0		2
	4		0	0	↓				↓	0	1	2	↓	3
FR FRCP1	1	↓	1	0	2	↓		↓	2	3	0	2		10
100	2	↓	0	0	2	1	—	2	0	1	0	0	2	8
	3	1	1	2	1	0	3	1	0	1	1	1	0	12
	4	1	3	1	1	↓	0	0	3	1	1	0	0	11
GH_FR1	1	1	0	0	0	↓	1	1	3	0	~~0~~ 0	1	1	8
100	2	4	2	2	1	2	0	1	1	2	1	1	0	17
	3	0	1	0	0	2	↓	0	1	7	1	1	~~2~~ 3	16
	4	~~1~~ 2	0	0	1	0	↓	1	0	1	0	1	1	7
GH_ERC	1	0	↓	↓	0	↓	↓	0	0	1	↓	1	2	4
100	2	↓	↓	↓	0	↓	↓	↓	2	0	↓	0	0	2
	3	↓	↓	↓	0	↓	↓	↓	0	0	↓	0	0	0
	4	↓	↓	↓	0	↓	↓	↓	0	0	↓	0	0	0
EV_HC1	1	↓	↓	3	0	↓	↓	1	1	1	↓	1	↓	7
100	2	↓	↓	0	2	↓	↓	1	1	2	↓	0	↓	6
	3	↓	↓	1	1	1	↓	2	0	2	↓	↓	↓	7
	4	↓	3	3	4	0	—	1	3	1	↓	↓	↓	15
EV_MC2	1	0	0	0	1	1	1	0	0	0	↓	↓	↓	2
100	2	0	0	0	0	↓	0	↓	0	0	↓	↓	↓	0
	3	0	0	0	0	↓	0	↓	0	0	↓	1	↓	1
	4	4	2	0	0	↓	5	↓	0	1	↓	0	↓	7
Tech Initials														

Comments: ① eyed eggs present ② start to hatch ④ >50% hatched in control
③ ~50% ~~hatch~~ hatched in samples

Reviewed by: JCh **Date reviewed:** Dec. 16/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (various)
Work Order #: 16111

Start Date & Time: Oct 18/16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration % (v/v)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		① 13	14	15	16	17	18	19	② 20	21	③ 22	23	24	
CM_MC2	1	0	0	0	0	0	0	0	1	0	0	0	0	1
100	2	↓	0	0	0	↓	↓	0	0	↓	2	1	0	3
	3	↓	0	0	1	↓	↓	0	0	↓	0	0	0	1
	4	↓	1	1	0	↓	↓	1	0	↓	0	0	0	3
LC_LCDSSLCC	1	↓	0	0	0	↓	↓	0	1	2	0	1	0	4
100	2	↓	0	0	↓	↓	↓	1	1	0	1	0	1	4
	3	↓	1	0	↓	↓	↓	3	1	0	0	1	0	6
	4	↓	0	0	↓	↓	↓	0	2	1	0	0	0	3
	1													
	2													
	3													
	4													
	1													
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Tech Initials		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Comments: ① at eyed stage ② start to hatch ③ ~50% hatched in samples

Reviewed by: [illegible] **Date reviewed:** Dec. 16/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (various)
Work Order #: 161121

Start Date & Time: ~~Nov~~ Oct 18/16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h
Test Species: *Oncorhynchus mykiss*

Concentration % (v/v)	Rep	Day of Test - No. of Mortalities 25	26	27	28	29	30		Total Dead Embryos/ Alevins	Total Undeveloped/ Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
Control	1	1	0	1	0	1	0		3	2	25	30
	2	0	2	1	1	0			4	0	26	30
	3	1	0	0	0				1	0	29	30
	4	0	0	0					0	2	28	30
FR_UFR1 100	1	0	2						5	1	24	30
	2		0						3	2	25	30
	3		0						6	0	24	30
	4		0	1					4	1	25	30
GH_ER2 100	1		2	0					4	1	25	30
	2		0						1	0	29	30
	3		0						4	0	26	30
	4		1						4	1	25	30
FR_FRCP1 100	1		0	1		1			16	0	15	31
	2	1	1	0		0			12	1	17	30
	3	0	0						16	0	13	29
	4	0	1						16	0	14	30
GH_FR1 100	1	0	1		1				10	0	20	30
	2	0	0		0				20	0	10	30
	3	2	1						22	0	7	29
	4	0	2						17	0	12	29
GH_ERC 100	1		0						5	0	25	30
	2								2	0	28	30
	3								2	0	28	30
	4								1	0	29	30
EV_HC1 100	1								12	1	16	29
	2								8	2	20	30
	3						1		13	1	16	30
	4			1			0		19	0	11	30
EV_MC2 100	1	0	2	0					7	1	22	30
	2	0	0	0					2	2	24	28
	3	0	0	0					5	0	25	30
	4	~~1~~ 0	0	0	0				9	0	25	34
Tech Initials		[initials]	[initials]	[initials]	[initials]	[initials]	[initials]		[initials]	[initials]	[initials]	[initials]

Comments:

Reviewed by: JGu **Date reviewed:** Dec. 16/16

Embryo-Alevin Toxicity Test
Daily Mortality

Client: Teck
Sample ID: (various)
Work Order #: 161121

Start Date & Time: Oct 18/16 @ 1735h
Stop Date & Time: Nov 17/16 @ 1300h.
Test Species: *Oncorhynchus mykiss*

Concentration % (v/v)	Rep	Day of Test - No. of Mortalities 25	26	27	28	29	30		Total Dead Embryos/ Alevins	Total Undeveloped/ Unhatched (abnormal)	Total No. Alevins normal	Total Exposed Eggs
WLMC2	1	0	0	0	0	0	0		2	2	25	29
100	2	0	0	1	1	0			12	1	17	30
	3	1	1	0	0	1			5	2	22	29
	4	0	0	0	0	0			3	2	24	29
LC_LCDSSLCC	1	1	1	0	1	2			9	1	19	29
100	2	2	2	0	0	0			10	0	20	30
	3	2	2	0	0	0			13	1	14	28
	4	1	1	0	0	0	↓		9	0	20	29
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		K	K	K	K	K	K		K	K	K	K

Comments:

Reviewed by: JGU **Date reviewed:** Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **Control**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Control A	1	19.0	✓		
	2	21.0	✓		
	3	20.0	✓		
	4	20.0	✓		
	5	20.5	✓		
	6	21.0	✓		
	7	19.5	✓		
	8	20.0	✓		abnormally
	9	~~18.5 19.5~~ m		✓	small tail fin
	10	18.5 ~~20.0~~ m	✓		
	11	20.0	✓		
	12	22.0	✓		
	13	20.5	✓		
	14	21.0	✓		
	15	18.5	✓		
	16	19.5	✓		
	17	20.0	✓		
	18	20.0	✓		
	19	21.5	✓		
	20	20.0	✓		
	21	15.0		✓	yolksac edema
	22	20.0	✓		
	23	20.5	✓		
	24	18.5	✓		
	25	20.5	✓		
	26	19.5	✓		
	27	20.0	✓		
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.21 g

Number of survivors: 27

Number of deformed/have difficulty swimming: 2/0

Initials: JK

Reviewed by: JCK

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **Control**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Control B	1	18.0	✓		
	2	21.0	✓		
	3	19.5	✓		
	4	19.5	✓		
	5	20 ~~19.5~~	✓		
	6	19.0	✓		
	7	20.0	✓		
	8	19.0	✓		
	9	18.0	✓		
	10	21.0	✓		
	11	21.0	✓		
	12	20.5	✓		
	13	19.0	✓		
	14	20.0	✓		
	15	18.5	✓		
	16	20.0	✓		
	17	20.5	✓		
	18	21.0	✓		
	19	19.5	✓		
	20	19.5	✓		
	21	20.0	✓		
	22	19.0	✓		
	23	20.0	✓		
	24	19.0	✓		
	25	19.5	✓		
	26	20.0	✓		
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.15 g

Number of survivors: 26

Number of deformed/have difficulty swimming: 0/0

Initials: KL

Reviewed by: JM

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **Control**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
control C	1	20.0	✓		
	2	21.0	✓		
	3	20.0	✓		
	4	20.5	✓		
	5	20.5	✓		
	6	21.0	✓		
	7	20.0	✓		
	8	20.0	✓		
	9	19.5	✓		
	10	19.0	✓		
	11	20.5	✓		
	12	21.0	✓		
	13	19.0	✓		
	14	20.0	✓		
	15	21.0	✓		
	16	20.5	✓		
	17	20.5	✓		
	18	17.5	✓		
	19	21.5	✓		
	20	18.0	✓		
	21	20.0	✓		
	22	20.0	✓		
	23	20.5	✓		
	24	20.5	✓		
	25	20.0	✓		
	26	20.0	✓		
	27	19.5	✓		
	28	20.5	✓		
	29	22.0	✓		
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): ~~29~~ 14½ 2.42 g

Number of survivors: 29

Number of deformed/have difficulty swimming: 0 | 0

Initials: KL

Reviewed by: JGL

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet

Deformities

Client: Teck

Sample ID: Control

Work Order No.: 161121

Start Date: October 18, 2016

Termination Date: November 17, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Control D	1	19.0	✓		
	2	20.0	✓		
	3	19.5	✓		
	4	21.0	✓		
	5	19.0	✓		
	6	21.0	✓		
	7	20.0	✓		
	8	21.0	✓		
	9	21.0	✓		
	10	20.5	✓		
	11	19.5	✓		
	12	21.0	✓		
	13	18.0	✓		
	14	19.0	✓		
	15	18.5	✓		
	16	19.5	✓		
	17	18.5	✓		
	18	21.0	✓		
	19	19.5	✓		
	20	20.0	✓		
	21	19.0	✓		
	22	20.0	✓		
	23	19.5	✓		
	24	17.0		✓	yolksac edema
	25	17.5		✓	yolksac edema, deformed jaw
	26	20.5	✓		
	27	20.0	✓		
	28	20.5	✓		
	29	19.5	✓		
	30	19.0	✓		
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.50 g

Number of survivors: 30

Number of deformed/have difficulty swimming: ~~0~~ 2

Initials: K

Reviewed by: JOh

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: October 18, 2016

Sample ID: FR_UFR1

Termination Date: November 17, 2016

Work Order No.: 161121

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	20.5	✓		
	2	19.0	✓		
	3	21.5	✓		
	4	21.0	✓		
	5	21.0	✓		
	6	21.5	✓		
	7	20.0	✓		
	8	19.5	✓		
	9	19.5	✓		
	10	20.5	✓		
	11	19.5	✓		
	12	20.0	✓		
	13	19.5	✓		
	14	19.5	✓		
	15	20.0	✓		
	16	21.0	✓		
	17	21.0	✓		
	18	20.5	✓		
	19	19.0	✓		
	20	21.0	✓		
	21	18.5	✓		
	22	21.0	✓		
	23	20.0	✓		
	24	18.5	✓		
	25	20.0		✓	bent spine
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.18 g

Number of survivors: 25

Number of deformed/have difficulty swimming: 1/1

Initials: KL

Reviewed by: JCM

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **FR_UFR1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	21.0	✓		
	2	20.0	✓		
	3	20.0	✓		
	4	20.0	✓		
	5	20.0	✓		
	6	22.5	✓		
	7	20.5	✓		
	8	19.0	✓		
	9	20.0	✓		
	10	20.0	✓		
	11	21.0	✓		
	12	21.5		✓	lordosis
	13	21.0	✓		
	14	20.5	✓		
	15	20.5	✓		
	16	19.5	✓		
	17	20.0	✓		
	18	19.5	✓		
	19	20.0	✓		
	20	19.0	✓		
	21	20.0	✓		
	22	21.0	✓		
	23	20.5	✓		
	24	19.5	✓		
	25	20.0	✓		
	26	19.0	✓		
	27	19.5		✓	bent spine
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 233 g

Number of survivors: 27

Number of deformed/have difficulty swimming: 2 | 2

Initials: R

Reviewed by: JM

Date Reviewed: Dec - 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **FR_UFR1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	19.5	✓		
	2	20.0	✓		
	3	20.5	✓		
	4	20.5	✓		
	5	19.0	✓		
	6	21.0	✓		
	7	20.5	✓		
	8	20.5	✓		
	9	19.0	✓		
	10	19.5	✓		
	11	19.5	✓		
	12	21.0	✓		
	13	19.5	✓		
	14	20.0	✓		
	15	21.5	✓		
	16	20.5	✓		
	17	20.5	✓		
	18	20.5	✓		
	19	19.0	✓		
	20	17.0	✓		
	21	19.5	✓		
	22	20.0	✓		
	23	20.0	✓		
	24	20.0	✓		
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 24 2.00g

Number of survivors: 24

Number of deformed/have difficulty swimming: 0/0

Initials: KL

Reviewed by: JGh

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **FR_UFR1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 D	1	20.0	✓		
	2	22.0	✓		
	3	20.0	✓		
	4	21.0	✓		
	5	19.0	✓		
	6	20.5	✓		
	7	18.5	✓		
	8	19.0	✓		
	9	20.0	✓		
	10	20.5	✓		
	11	21.0	✓		
	12	21.0	✓		
	13	20.5	✓		
	14	17.5	✓		
	15	19.0	✓		
	16	20.0	✓		
	17	20.0	✓		
	18	18.5	✓		
	19	22.0	✓		
	20	20.5	✓		
	21	20.5	✓		
	22	21.0	✓		
	23	19.5	✓		
	24	20.0	✓		
	25	19.5	✓		
	26	15.5		✓	lordosis
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.16g

Number of survivors: 26

Number of deformed/have difficulty swimming: 1/1

Initials: KL

Reviewed by: JBL

Date Reviewed: Dec - 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **GH_ER2**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	21.0	✓		
	2	19.0	✓		
	3	19.5		✓	yolksac edema
	4	21.5	✓		
	5	22.0	✓		
	6	20.0	✓		
	7	21.0	✓		
	8	20.5	✓		
	9	20.0	✓		
	10	21.0	✓		
	11	19.5	✓		
	12	20.0	✓		
	13	21.5	✓		
	14	21.0	✓		
	15	22.0	✓		
	16	19.0	✓		
	17	19.0	✓		
	18	20.5	✓		
	19	20.0	✓		
	20	19.5	✓		
	21	19.5	✓		
	22	20.0	✓		
	23	20.0	✓		
	24	21.0	✓		
	25	20.5	✓		
	26	20.5	✓		
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.31 g

Number of survivors: 26

Number of deformed/have difficulty swimming: 1/0

Initials: KL

Reviewed by: JGH

Date Reviewed: Dec-16/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: October 18, 2016

Sample ID: GH_ER2

Termination Date: November 17, 2016

Work Order No.: 161121

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	21.0	✓		
	2	20.0	✓		
	3	19.0	✓		
	4	20.5	✓		
	5	19.0	✓		
	6	20.0	✓		
	7	21.0	✓		
	8	21.0	✓		
	9	18.5	✓		
	10	19.0	✓		
	11	19.0	✓		
	12	19.5	✓		
	13	20.0	✓		
	14	19.0	✓		
	15	21.5	✓		
	16	20.0	✓		
	17	19.0	✓		
	18	19.0	✓		
	19	18.0	✓		
	20	21.0	✓		
	21	20.0	✓		
	22	19.0	✓		
	23	20.0	✓		
	24	20.0	✓		
	25	21.0	✓		
	26	19.5	✓		
	27	19.5	✓		
	28	20.0	✓		
	29	18.5	✓		
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.40 g

Number of survivors: 29

Number of deformed/have difficulty swimming: 0/0

Initials: KL

Reviewed by: JGL

Date Reviewed: Dec-16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **GH_ER2**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	18.5	✓		
	2	20.5	✓		
	3	19.0	✓		
	4	21.0	✓		
	5	21.0	✓		
	6	20.0	✓		
	7	19.0	✓		
	8	19.5	✓		
	9	19.0	✓		
	10	20.5	✓		
	11	18.0	✓		
	12	20.0	✓		
	13	20.0	✓		
	14	19.5	✓		
	15	20.5	✓		
	16	20.5	✓		
	17	20.0	✓		
	18	21.0	✓		
	19	20.0	✓		
	20	20.0	✓		
	21	18.5	✓		
	22	20.0	✓		
	23	19.5	✓		
	24	21.0	✓		
	25	20.0	✓		
	26	19.5	✓		
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.19 g

Number of survivors: 26

Number of deformed/have difficulty swimming: 0/0

Initials: K

Reviewed by: JGK

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **GH_ER2**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 D	1	20.0	✓		
	2	20.0	✓		
	3	21.0	✓		
	4	20.0	✓		
	5	19.0	✓		
	6	20.5	✓		
	7	21.0	✓		
	8	20.5	✓		
	9	20.0	✓		
	10	20.0	✓		
	11	19.0	✓		
	12	18.0		✓	yolksac edema
	13	20.0	✓		
	14	21.0	✓		
	15	20.0	✓		
	16	20.0	✓		
	17	20.5	✓		
	18	20.0	✓		
	19	20.0	✓		
	20	21.0	✓		
	21	19.0	✓		
	22	19.0	✓		
	23	18.5	✓		
	24	19.0	✓		
	25	20.5	✓		
	26	20.0	✓		
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.21 g

Number of survivors: ~~25~~ 26

Number of deformed/have difficulty swimming: 1/0

Initials: KL

Reviewed by: JBL

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **FR_FRCP1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	18.5	✓		
	2	18.5	✓		
	3	19.0	✓		
	4	18.5	✓		
	5	19.5	✓		
	6	20.0	✓		
	7	18.5	✓		
	8	18.0	✓		
	9	20.0	✓		
	10	19.5	✓		
	11	20.0	✓		
	12	17.0	✓		
	13	20.0	✓		
	14	20.0	✓		
	15	21.0	✓		
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.25 g

Number of survivors: 15

Number of deformed/have difficulty swimming: 0/180

Initials: KL

Reviewed by: JGL

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **FR_FRCP1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	20.0	✓		
	2	18.5	✓		
	3	20.0	✓		
	4	18.0	✓		
	5	17.0	✓		
	6	19.0	✓		
	7	20.0	✓		
	8	19.0	✓		
	9	18.0	✓		
	10	20.0		✓	yolksac edema
	11	20.0	✓		
	12	19.0	✓		
	13	19.5	✓		
	14	18.5	✓		
	15	19.5	✓		
	16	20.0	✓		
	17	20.5	✓		
	18	19.0	✓		
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): ~~1.30~~ 1.46g

Number of survivors: 18

Number of deformed/have difficulty swimming: 1/0

Initials: KL

Reviewed by: JCh

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **FR_FRCP1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	21.0	✓		
	2	19.5	✓		
	3	20.0	✓		
	4	22.5	✓		
	5	20.5	✓		
	6	18.5	✓		
	7	17.0	✓		
	8	20.5	✓		
	9	21.0	✓		
	10	18.0	✓		
	11	22.0	✓		
	12	18.5	✓		
	13	18.0	✓		
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
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	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.12 g

Number of survivors: 13

Number of deformed/have difficulty swimming: 0/0

Initials: K

Reviewed by: JGu

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: October 18, 2016

Sample ID: FR_FRCP1

Termination Date: November 17, 2016

Work Order No.: 161121

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 D	1	21.0	✓		
	2	18.0	✓		
	3	19.5	✓		
	4	18.5	✓		
	5	21.0	✓		
	6	19.0	✓		
	7	18.5	✓		
	8	20.5	✓		
	9	20.0	✓		
	10	20.0	✓		
	11	20.5	✓		
	12	20.0	✓		
	13	20.5	✓		
	14	21.0	✓		
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
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	31				
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	33				
	34				
	35				

Total Weight (pooled): 1.18g

Number of survivors: 14

Number of deformed/have difficulty swimming: 0/0

Initials: KL

Reviewed by: JGh

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **GH_FR1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	20.5	✓		
	2	19.0	✓		
	3	20.0	✓		
	4	~~20~~ 21.0	✓		
	5	19.5	✓		
	6	20.0	✓		
	7	17.0	✓		
	8	21.0	✓		
	9	19.0	✓		
	10	21.0	✓		
	11	20.0	✓		
	12	21.0	✓		
	13	20.0	✓		
	14	20.0	✓		
	15	20.0	✓		
	16	20.0	✓		
	17	19.5	✓		
	18	20.5	✓		
	19	21.0	✓		
	20	20.0	✓		
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.73 g

Number of survivors: 20

Number of deformed/have difficulty swimming: 0/0

Initials: KL

Reviewed by: JOL

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **GH_FR1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	19.5	✓		
	2	20.5	✓		
	3	17.0	✓		
	4	19.0	✓		
	5	20.0	✓		
	6	20.0	✓		
	7	21.0	✓		
	8	20.5	✓		
	9	20.0	✓		
	10	20.5	✓		
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
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	32				
	33				
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	35				

Total Weight (pooled): 0.87 g

Number of survivors: 10

Number of deformed/have difficulty swimming: 0/0

Initials: JL

Reviewed by: JBu

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: October 18, 2016

Sample ID: GH_FR1

Termination Date: November 17, 2016

Work Order No.: 161121

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	19.0	✓		
	2	19.0	✓		
	3	18.0	✓		
	4	17.5	✓		
	5	16.0	✓		
	6	19.0	✓		
	7	18.0	✓		
	8		dead		
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 0.61 g

Number of survivors: 7

Number of deformed/have difficulty swimming: 0/0

Initials: KL

Reviewed by: JCh

Date Reviewed: Dec - 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **GH_FR1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 D	1	20.0	✓		
	2	20.0	✓		
	3	21.0	✓		
	4	21.0	✓		
	5	17.5	✓		
	6	19.0	✓		
	7	19.0	✓		
	8	20.5	✓		
	9	19.0	✓		
	10	19.0	✓		
	11	20.0	✓		
	12	20.0	✓		
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.04 g

Number of survivors: 12

Number of deformed/have difficulty swimming: 0/0

Initials: K

Reviewed by: JOK

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **GH_ERC**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	17.5	✓		
	2	18.5	✓		
	3	18.0	✓		
	4	20.0	✓		
	5	18.5	✓		
	6	18.5	✓		
	7	17.0	✓		
	8	19.5	✓		
	9	18.0	✓		
	10	20.0	✓		
	11	19.0	✓		
	12	20.0	✓		
	13	16.0	✓		
	14	18.5	✓		
	15	20.0	✓		
	16	17.0	✓		
	17	18.0	✓		
	18	19.0	✓		
	19	18.5	✓		
	20	18.5	✓		
	21	19.0	✓		
	22	19.0	✓		
	23	20.0	✓		
	24	17.0	✓		
	25	18.5	✓		
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.04g

Number of survivors: 25

Number of deformed/have difficulty swimming: 0/0

Initials: M

Reviewed by: JOH

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: October 18, 2016

Sample ID: GH_ERC

Termination Date: November 17, 2016

Work Order No.: 161121

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	18.0	✓		
	2	17.0	✓		
	3	19.5	✓		
	4	19.5	✓		
	5	19.5	✓		
	6	20.0	✓		
	7	19.0	✓		
	8	19.0	✓		
	9	19.0	✓		
	10	20.0	✓		
	11	21.0	✓		
	12	18.5	✓		
	13	16.5	✓		
	14	19.0	✓		
	15	19.5	✓		
	16	17.5	✓		
	17	18.5	✓		
	18	19.0	✓		
	19	19.0	✓		
	20	18.0	✓		
	21	17.5	✓		
	22	20.0	✓		
	23	20.0	✓		
	24	18.0	✓		
	25	19.0	✓		
	26	18.0	✓		
	27	20.0	✓		
	28	18.5	✓		
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.333

Number of survivors: 28

Number of deformed/have difficulty swimming: 0/0

Initials: [illegible]

Reviewed by: JGH

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Sample ID: **GH_ERC**

Work Order No.: **161121**

Start Date: **October 18, 2016**

Termination Date: **November 17, 2016**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	21.0	✓		
	2	19.5	✓		
	3	20.0	✓		
	4	21.0	✓		
	5	20.0	✓		
	6	19.5	✓		
	7	20.0	✓		
	8	20.0	✓		
	9	19.0	✓		
	10	21.0	✓		
	11	19.5	✓		
	12	20.0	✓		
	13	20.0	✓		
	14	20.0	✓		
	15	19.0	✓		
	16	19.0	✓		
	17	19.0	✓		
	18	19.0	✓		
	19	20.0	✓		
	20	19.0	✓		
	21	19.0	✓		
	22	21.0	✓		
	23	21.0	✓		
	24	20.0	✓		
	25	20.5	✓		
	26	20.0	✓		
	27	19.5	✓		
	28	21.0	✓		
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 251 g

Number of survivors: 28

Number of deformed/have difficulty swimming: 0/0

Initials: KL

Reviewed by: JCH

Date Reviewed: Dec - 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **GH_ERC**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 D	1	19.0	✓		
	2	20.0	✓		
	3	19.0	✓		
	4	19.0	✓		
	5	19.0	✓		
	6	20.0	✓		
	7	20.0	✓		
	8	19.0	✓		
	9	20.0	✓		
	10	19.0	✓		
	11	20.5	✓		
	12	18.5	✓		
	13	19.0	✓		
	14	19.5	✓		
	15	19.0	✓		
	16	19.0	✓		
	17	18.5	✓		
	18	20.0	✓		
	19	19.0	✓		
	20	20.0	✓		
	21	19.0	✓		
	22	19.0	✓		
	23	19.5	✓		
	24	19.5	✓		
	25	19.0	✓		
	26	20.0	✓		
	27	20.0	✓		
	28	20.0	✓		
	29	20.5	✓		
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.50 g

Number of survivors: 29

Number of deformed/have difficulty swimming: 0/0

Initials: KL

Reviewed by: JGH

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: October 18, 2016

Sample ID: EV_HC1

Termination Date: November 17, 2016

Work Order No.: 161121

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	20.0	✓		
	2	19.0	✓		
	3	21.0	✓		
	4	19.0	✓		
	5	21.5	✓		
	6	20.5	✓		
	7	21.0	✓		
	8	20.5	✓		
	9	19.0	✓		
	10	18.5	✓		
	11	18.5	✓		
	12	21.0	✓		
	13	20.0	✓		
	14	19.5	✓		
	15	19.5	✓		
	16	17.0	✓	✓	pale body, malformed tail, slight yolksac edema
	17	17.5	✓		
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.463

Number of survivors: 17

Number of deformed/have difficulty swimming: 1/1

Initials: JL

Reviewed by: JGa

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **EV_HC1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	19.5	✓		
	2	20.0	✓		
	3	19.0	✓		
	4	20.0	✓		
	5	20.5	✓		
	6	18.0	✓		
	7	19.0	✓		
	8	19.5	✓		
	9	19.0	✓		
	10	19.5	✓		
	11	20.0	✓		
	12	19.0	✓		
	13	17.0	✓		
	14	15.0		✓	shortened tail, yolksac edema
	15	19.0		✓	lordosis
	16	19.5	✓		
	17	19.0	✓		
	18	18.5	✓		
	19	19.0	✓		
	20	19.0	✓		
	21	19.5	✓		
	22	18.5	✓		
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.91 g

Number of survivors: 22

Number of deformed/have difficulty swimming: 2/2

Initials: M

Reviewed by: JOH

Date Reviewed: Dec 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **EV_HC1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	16.5		✓	kept fail
	2	19.5	✓		
	3	21.0	✓		
	4	20.0	✓		
	5	20.0	✓		
	6	19.0	✓		
	7	20.0	✓		
	8	19.0	✓		
	9	18.5	✓		
	10	16.0	✓		
	11	20.0	✓		
	12	18.5	✓		
	13	20.0	✓		
	14	19.5	✓		
	15	19.5	✓		
	16	17.5	✓		
	17	19.0	✓		
	18				
	19				
	20				
	21				
	22				
	23				
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	25				
	26				
	27				
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	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.42g

Number of survivors: 17

Number of deformed/have difficulty swimming: 1/1

Initials: K

Reviewed by: JOK

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **EV_HC1**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 D	1	19.0	✓		
	2	20.0	✓		
	3	19.5	✓		
	4	21.0	✓		
	5	20.0	✓		
	6	19.0	✓		
	7	20.0	✓		
	8	21.0	✓		
	9	19.0	✓		
	10	18.0	✓		
	11	21.5	✓		
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
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	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 0.98 g

Number of survivors: 11

Number of deformed/have difficulty swimming: 0/0

Initials: KL

Reviewed by: JCh

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **EV_MC2**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	16.0		✓	deformed jaw, shortened tailfin, yolksac edema
	2	20.5	✓		
	3	19.0	✓		
	4	19.0	✓		
	5	21.0	✓		
	6	21.0	✓		
	7	20.5	✓		
	8	21.0	✓		
	9	21.0	✓		
	10	21.0	✓		
	11	19.5	✓		
	12	20.5	✓		
	13	20.5	✓		
	14	20.0	✓		
	15	20.0	✓		
	16	19.0	✓		
	17	20.5	✓		
	18	21.5	✓		
	19	20.0	✓		
	20	20.0	✓		
	21	21.0	✓		
	22	21.5	✓		
	23	21.5	✓		
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.15g

Number of survivors: 23

Number of deformed/have difficulty swimming: 1/1

Initials: [illegible]

Reviewed by: JGM

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **EV_MC2**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	18.5	✓		
	2	19.5	✓		
	3	20.0	✓		
	4	20.0	✓		
	5	20.0	✓		
	6	18.0	✓		
	7	20.0	✓		
	8	21.0	✓		
	9	20.0	✓		
	10	20.5	✓		
	11	20.0	✓		
	12	20.0	✓		
	13	20.5	✓		
	14	19.5	✓		
	15	20.0	✓		
	16	21.0	✓		
	17	20.5	✓		
	18	20.0	✓		
	19	21.0	✓		
	20	21.0	✓		
	21	20.5	✓		
	22	18.0	✓		
	23	19.5	✓		
	24	21.0	✓		
	25	16.0		✓	lordosis, deformed jaw
	26	16.5		✓	lordosis, facial ~~deformity~~ deformity
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.25 g

Number of survivors: 26

Number of deformed/have difficulty swimming: 2/2

Initials: JK

Reviewed by: JK

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **EV_MC2**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	19.0	✓		
	2	20.0	✓		
	3	21.5	✓		
	4	21.0	✓		
	5	21.5	✓		
	6	19.0	✓		
	7	19.0	✓		
	8	21.5	✓		
	9	19.5	✓		
	10	20.0	✓		
	11	21.0	✓		
	12	22.0	✓		
	13	19.0	✓		
	14	21.0	✓		
	15	19.0	✓		
	16	21.5	✓		
	17	19.5	✓		
	18	20.5	✓		
	19	20.0	✓		
	20	19.0	✓		
	21	21.0	✓		
	22	20.0	✓		
	23	20.0	✓		
	24	19.0	✓		
	25	19.5	✓		
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.30 g

Number of survivors: 25

Number of deformed/have difficulty swimming: 0/0

Initials: JK

Reviewed by: JOH

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **EV_MC2**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 D	1	20.0	✓		
	2	20.0	✓		
	3	21.0	✓		
	4	20.5	✓		
	5	20.0	✓		
	6	20.0	✓		
	7	18.0	✓		
	8	20.5	✓		
	9	19.5	✓		
	10	21.5	✓		
	11	21.5	✓		
	12	20.5	✓		
	13	20.0	✓		
	14	21.0	✓		
	15	19.0	✓		
	16	21.0	✓		
	17	21.5	✓		
	18	20.5	✓		
	19	19.0	✓		
	20	21.0	✓		
	21	20.0	✓		
	22	21.0	✓		
	23	20.5	✓		
	24	20.0	✓		
	25	19.0	✓		
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.32 g

Number of survivors: 25

Number of deformed/have difficulty swimming: 0/0

Initials: M

Reviewed by: JOH

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: Teck

Sample ID: CM_MC2

Work Order No.: 161121

Start Date: October 18, 2016

Termination Date: November 17, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	19.0	✓		
	2	19.0	✓		
	3	20.0	✓		
	4	20.5	✓		
	5	21.0	✓		
	6	22.0	✓		
	7	19.5	✓		
	8	21.5	✓		
	9	21.0	✓		
	10	21.0	✓		
	11	20.0	✓		
	12	22.0	✓		
	13	21.0	✓		
	14	20.5	✓		
	15	19.0	✓		
	16	21.5	✓		
	17	20.5	✓		
	18	21.0	✓		
	19	21.0	✓		
	20	21.0	✓		
	21	21.5	✓		
	22	21.0	✓		
	23	21.0	✓		
	24	17.0	✓		
	25	19.0	✓		
	26	16.5		✓	Lordosis,
	27	16.0		✓	Lordosis, yolk sac edema
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.40 g

Number of survivors: 27

Number of deformed/have difficulty swimming: 2 ~~0~~ 2

Initials: KL

Reviewed by: JGh

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: October 18, 2016

Sample ID: CM_MC2

Termination Date: November 17, 2016

Work Order No.: 161121

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	17.0		✓	facial ~~dep~~ deformity; bent spine
	2	20.5	✓		
	3	21.5	✓		
	4	20.5	✓		
	5	19.0	✓		
	6	21.5	✓		
	7	21.5	✓		
	8	21.0	✓		
	9	19.5	✓		
	10	21.0	✓		
	11	18.5	✓		
	12	19.0	✓		
	13	21.5	✓		
	14	22.0	✓		
	15	21.0	✓		
	16	21.0	✓		
	17	21.0	✓		
	18	20.0	✓		
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.69 g

Number of survivors: 18

Number of deformed/have difficulty swimming: 1/0

Initials: KL

Reviewed by: JGL

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **CM_MC2**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	20.5	✓		
	2	20.0	✓		
	3	21.0	✓		
	4	20.0	✓		
	5	23.0	✓		
	6	20.5	✓		
	7	20.0	✓		
	8	19.0	✓		
	9	18.5	✓		
	10	20.5	✓		
	11	20.0	✓		
	12	19.5	✓		
	13	21.0	✓		
	14	21.0	✓		
	15	18.0	✓		
	16	21.5	✓		
	17	20.0	✓		
	18	21.0	✓		
	19	20.5	✓		
	20	20.0	✓		
	21	20.0	✓		
	22	19.5	✓		
	23	17.0		✓	Yolk sac edema, shorten tail fin, pale body color
	24	17.5		✓	Yolk sac edema, shorten tail fin, pale body color
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.1 g

Number of survivors: 24

Number of deformed/have difficulty swimming: 2/2

Initials: VL

Reviewed by: JOh

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **CM_MC2**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 D	1	21.0	✓		
	2	19.5	✓		
	3	21.0	✓		
	4	16.5	✓		
	5	21.5	✓		
	6	21.0	✓		
	7	21.5	✓		
	8	19.5	✓		
	9	20.0	✓		
	10	20.5	✓		
	11	21.0	✓		
	12	21.0	✓		
	13	20.5	✓		
	14	20.5	✓		
	15	21.0	✓		
	16	20.5	✓		
	17	20.5	✓		
	18	21.0	✓		
	19	20.0	✓		
	20	21.0	✓		
	21	21.0	✓		
	22	21.0	✓		
	23	21.5	✓		
	24	20.5	✓		
	25	16.5		✓	B Shorten tail. Yolk sac edema
	26	17.0		✓	Bent tail facial ~~deformity~~ deformity
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.36g

Number of survivors: 26

Number of deformed/have difficulty swimming: 2/0

Initials: VL

Reviewed by: JGM

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **LC_LCDSSLCC**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 A	1	20.0	✓		
	2	21.5	✓		
	3	20.0	✓		
	4	19.0	✓		
	5	21.0	✓		
	6	21.0	✓		
	7	21.0	✓		
	8	19.0	✓		
	9	21.0	✓		
	10	19.5	✓		
	11	21.5	✓		
	12	20.0	✓		
	13	21.5	✓		
	14	20.0	✓		
	15	20.0	✓		
	16	21.0	✓		
	17	19.5	✓		
	18	21.5	✓		
	19	22.0	✓		
	20	17.5		✓	edema, Lordosis, caudal deformity
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.67g

Number of survivors: 20

Number of deformed/have difficulty swimming: 1/0

Initials: M

Reviewed by: JOM

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **LC_LCDSSLCC**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 B	1	21.0	✓		
	2	22.0	✓		
	3	22.0	✓		
	4	21.0	✓		
	5	21.0	✓		
	6	21.0	✓		
	7	21.0	✓		
	8	19.75	✓		
	9	19.5	✓		
	10	21.0	✓		
	11	19.5	✓		
	12	19.5	✓		
	13	19.0	✓		
	14	21.0	✓		
	15	22.0	✓		
	16	20.0	✓		
	17	21.0	✓		
	18	22.0	✓		
	19	21.0	✓		
	20	19.0	✓		
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.95 g

Number of survivors: 20

Number of deformed/have difficulty swimming: 0/0

Initials: VL

Reviewed by: JOH

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: October 18, 2016

Sample ID: LC_LCDSSLCC

Termination Date: November 17, 2016

Work Order No.: 161121

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 C	1	21.0		✓	yolk sac edema
	2	21.0	✓		
	3	21.5	✓		
	4	22.0	✓		
	5	19.0	✓		
	6	21.5	✓		
	7	22.0	✓		
	8	21.5	✓		
	9	21.0	✓		
	10	21.0	✓		
	11	21.0	✓		
	12	21.0	✓		
	13	20.5	✓		
	14	20.0	✓		
	15	19.0	✓		
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.55 g

Number of survivors: 15

Number of deformed/have difficulty swimming: 1/0

Initials: kw

Reviewed by: JGe

Date Reviewed: Dec. 16/16

Alevin Test Data Sheet
Deformities

Client: **Teck**

Start Date: **October 18, 2016**

Sample ID: **LC_LCDSSLCC**

Termination Date: **November 17, 2016**

Work Order No.: **161121**

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
100 D	1	21.0	✓		
	2	21.5	✓		
	3	21.0	✓		
	4	20.0	✓		
	5	21.5	✓		
	6	19.5	✓		
	7	21.0	✓		
	8	20.5	✓		
	9	21.0	✓		
	10	19.0	✓		
	11	20.0	✓		
	12	19.0	✓		
	13	20.0	✓		
	14	21.0	✓		
	15	21.0	✓		
	16	18.5	✓		
	17	21.0	✓		
	18	20.5	✓		
	19	19.0	✓		
	20	21.0	✓		
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): EL ~~22~~ 2.01 g

Number of survivors: 20

Number of deformed/have difficulty swimming: 0/0

Initials: EL

Reviewed by: JGR

Date Reviewed: Dec. 16/16

Client: TRUE

W.O.#: 161121

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
Dechlor	~~Oct 18/16~~ 20 KL	~~Oct 18/16~~ 20 KL	100	0.6	0.7	5	100	0.9	9	~~JS~~ KL
FR_UFR1	Oct 17/16		50	7.3	7.5	142	50	9.2	184	JS
GH_ERC2	Oct 17/16			~~7.5~~ KL 7.4	7.5	146	50	8.3	166	
FR_FRCP1	Oct 17/16			10.3	10.5	202	10①	5.8	580	
GH_FR1	Oct 17/16			9.5	9.7	186	10①	5.1	510	
GH_ERC	Oct 17/16			7.8	8.0	152	50	9.1	~~180~~ KL 182	
EV_HC1	Oct 17/16			10.4	10.6	204	10①	4.8	480	
EV_MC2	↓			6.8	7.0	132	10①	5.0	500	
CM_MC2	Oct 17/16			8.4	8.6	164	10①	3.8	380	
LC_LCOSSLCC	Oct 17/16	↓	↓	9.3	9.5	182	10①	8.7	870	↓
Dechlor	Oct 25/16	Oct 25/16	100	0.5	0.6	4	~~100~~	~~7.0~~ KL 1.0	10	KL
FR_UFR1	↓	↓		6.8	7.1	130	50	9.0	180	↓
GH_ERC2				7.0	7.3	134	50	9.8	196	
FR_FRCP1				9.4	9.7	182	10①	5.1	510	
GH_FR1				9.2	9.5	178	10①	5.3	530	
GH_ERC				~~9.2~~ KL 7.4	7.8	140	50	9.2	184	
EV_HC1				9.8	10.1	190	50 ~~100~~ KL	~~18.8~~ KL 19.0	380	
EV_MC2				7.1	7.4	136	50 ~~100~~ KL	15.8	316	
CM_MC2				9.5	9.7	186	50 ~~100~~ KL	21.7	434	
LC_LCOSSLCC	↓	↓		9.0	9.2	176	10①	4.6	460	↓

Notes: ① Sample diluted w/ DI water up to 100mL

Reviewed by: JGH Date Reviewed: Dec. 12/16

Client: Teck

W.O.#: 16114

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
Dechlor	NOV 3/16	NOV 3/16	100	0.5	0.6	4	100	0.9	9	
FR_UFR1	NOV 1/16	NOV 3/16	50	7.2	7.3	142	50	8.6	172	
CH_ER2				7.4	7.6	144	50	8.0	160	
FR_FRCP1				9.8	10.0	192	10①	5.1	510	
CH_FR1				9.9	10.2	192	10①	4.3	430	
GM_ERC				7.5	7.6	148	50	12.7	254	
EV_HC1				9.8	10.0	192	50	17.6	352	
EV_MC2				6.4	6.5	126	50	9.7	194	
CM_MC2				9.0	9.1	178	50	16.4	328	
LC_LCOSSLCC				9.4	9.5	186	10①	4.0	400	
Dechlor	NOV 8/16	NOV 8/16	100	0.7	0.7	5	100	0.7	7	
FR_UFR1	NOV 8/16		50	6.8	7.1	130	50	8.2	164	
CH_ER2				7.2	7.4	140	50	7.9	158	
GM_ERC				7.6	7.8	148	50	11.7 ~~3.5~~	234	
EV_HC1				10.2	10.4	200	50	18.2	364	
EV_MC2				6.7	6.9	130	50	10.2	204	
CM_MC2				8.6	8.7	170	50	16.8	336	
LC_LCOSSLCC				9.4	9.6	184	10①	4.1	410	
GM_FR1				10.0	10.3	194	10①	4.7	470	
FR_FRCP1				10.3	10.6	200	10①	~~3~~ 5.3	~~350~~ 530	

Notes: ① Sample diluted w/ DI water up to 100mL

Reviewed by: JCh Date Reviewed: Dec. 12/16

Client: Teck

W.O.#: 16174

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Subsample Date	Date Measured	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
Dechlor	Nov 16/16	Nov 16/16	100	0.3	0.4	2	100	0.7	7	KL
FR_UFR1	Nov 15/16		50	7.6	7.9	146	50	7.6	152	
GH_ERC2				8.0	8.2	156	50	7.0	140	
FR_FRCP1				10.7	10.9	210	10①	5.7	570	
GH_FR1				10.7	10.9	210	10①	4.5	450	
GH_ERC				8.0	8.2	156	50①②	1.5	150	
EV_HC1				10.5	10.8	204	10①	3.5	350	
EV_MC2				6.5	6.7	126	10①③	2.0	200	
CM_MC2				8.8	9.0	172	10①	3.0	300	
LL_LCDSSLCC	↓	↓	↓	10.0	10.2	196	10①	3.9	390	↓

Notes: ①Sample diluted w/ DI water up to 100mL

Reviewed by: JGe Date Reviewed: Dec. 12/16

Rainbow Trout Embryo-Alevin Toxicity Test

Client: Teck
WO#: 161121

Test Initiation Date: October 18, 2016
Test Termination Date: November 17, 2016

	Test Conc. (% v/v)	Rep	Mortality Counts Day 1 - 12	Day 13 - 24	Day 25 - 29	Total Dead	Abnormal Alevins	Normal Alevins	Total No. Alevins	Total No. Exposed	Survival			Normal Alevins		
Control	Control	1	0	0	3	3	2	25	27	30	90.0			83.3		
		2	0	0	4	4	0	26	26	30	86.7			86.7		
		3	0	0	1	1	0	29	29	30	96.7	**Mean**	**SD**	96.7	**Mean**	**SD**
		4	0	0	0	0	2	28	30	30	100.0	93.3	6.1	93.3	90.0	6.1
1	100	1	0	3	2	5	1	24	25	30	83.3			80.0		
FR_UFR1		2	1	2	0	3	2	25	27	30	90.0			83.3		
		3	3	3	0	6	0	24	24	30	80.0	**Mean**	**SD**	80.0	**Mean**	**SD**
		4	0	3	1	4	1	25	26	30	86.7	85.0	4.3	83.3	81.7	1.9
2	100	1	1	1	2	4	1	25	26	30	86.7			83.3		
GH_ER2		2	1	0	0	1	0	29	29	30	96.7			96.7		
		3	2	2	0	4	0	26	26	30	86.7	**Mean**	**SD**	86.7	**Mean**	**SD**
		4	0	3	1	4	1	25	26	30	86.7	89.2	5.0	83.3	87.5	6.3
3	100	1	4	10	2	16	0	15	15	31	48.4			48.4		
FR_FRCP1		2	2	8	2	12	1	17	18	30	60.0			56.7		
		3	4	12	0	16	0	13	13	29	44.8	**Mean**	**SD**	44.8	**Mean**	**SD**
		4	4	11	1	16	0	14	14	30	46.7	50.0	6.8	46.7	49.1	5.2
4	100	1	0	8	2	10	0	20	20	30	66.7			66.7		
GH_FR1		2	3	17	0	20	0	10	10	30	33.3			33.3		
		3	3	16	3	22	0	7	7	29	24.1	**Mean**	**SD**	24.1	**Mean**	**SD**
		4	8	7	2	17	0	12	12	29	41.4	41.4	18.3	41.4	41.4	18.3
5	100	1	1	4	0	5	0	25	25	30	83.3			83.3		
GH_ERC		2	0	2	0	2	0	28	28	30	93.3			93.3		
		3	2	0	0	2	0	28	28	30	93.3	**Mean**	**SD**	93.3	**Mean**	**SD**
		4	1	0	0	1	0	29	29	30	96.7	91.7	5.8	96.7	91.7	5.8
6	100	1	5	7	0	12	1	16	17	29	58.6			55.2		
EV_HC1		2	2	6	0	8	2	20	22	30	73.3			66.7		
		3	5	7	1	13	1	16	17	30	56.7	**Mean**	**SD**	53.3	**Mean**	**SD**
		4	3	15	1	19	0	11	11	30	36.7	56.3	15.1	36.7	53.0	12.4
7	100	1	3	2	2	7	1	22	23	30	76.7			73.3		
EV_MC2		2	2	0	0	2	2	24	26	28	92.9			85.7		
		3	4	1	0	5	0	25	25	30	83.3	**Mean**	**SD**	83.3	**Mean**	**SD**
		4	2	7	0	9	0	25	25	34	73.5	81.6	8.5	73.5	79.0	6.5
8	100	1	1	1	0	2	2	25	27	29	93.1			86.2		
CM_MC2		2	7	3	2	12	1	17	18	30	60.0			56.7		
		3	1	1	3	5	2	22	24	29	82.8	**Mean**	**SD**	75.9	**Mean**	**SD**
		4	0	3	0	3	2	24	26	29	89.7	81.4	14.9	82.8	75.4	13.2
9	100	1	0	4	5	9	1	19	20	29	69.0			65.5		
LC_LCDSSLCC		2	2	4	4	10	0	20	20	30	66.7			66.7		
		3	3	6	4	13	1	14	15	28	53.6	**Mean**	**SD**	50.0	**Mean**	**SD**
		4	4	3	2	9	0	20	20	29	69.0	64.5	7.4	69.0	62.8	8.6

JGL
Dec - 19/16

Client: Teck
WO#: 161121

	CONTROL				FR_UFR1			
Fish #	**Control A**	**Control B**	**Control C**	**Control D**	**100 A**	**100 B**	**100 C**	**100 D**
1	19.0	18.0	20.0	19.0	20.5	21.0	19.5	20.0
2	21.0	21.0	21.0	20.0	19.0	20.0	20.0	22.0
3	20.0	19.5	20.0	19.5	21.5	20.0	20.5	20.0
4	20.0	19.5	20.5	21.0	21.0	20.0	20.5	21.0
5	20.5	20.5	20.5	19.0	21.0	20.0	19.0	19.0
6	21.0	19.0	21.0	21.0	21.5	20.5	21.0	20.5
7	19.5	20.0	20.0	20.0	20.0	20.5	20.5	18.5
8	20.0	19.0	20.0	21.0	19.5	19.0	20.5	19.0
9	16.5	19.0	19.5	21.0	19.5	20.0	19.0	20.0
10	18.5	21.0	19.0	20.5	20.5	20.0	19.5	20.5
11	20.0	21.0	20.5	19.5	19.5	21.0	19.5	21.0
12	22.0	20.5	21.0	21.0	20.0	21.5	21.0	21.0
13	20.5	19.0	19.0	18.0	19.5	21.0	19.5	20.5
14	21.0	20.0	20.0	19.0	19.5	20.5	20.0	17.5
15	18.5	18.5	21.0	18.5	20.0	20.5	21.5	19.0
16	19.5	20.0	20.5	19.5	21.0	19.5	20.5	20.0
17	20.0	20.5	20.5	18.5	21.0	20.0	20.5	20.0
18	20.0	21.0	17.5	21.0	20.5	19.5	20.5	18.5
19	21.5	19.5	21.5	19.5	19.0	20.0	19.0	22.0
20	20.0	19.5	18.0	20.0	21.0	19.0	17.0	20.5
21	15.0	20.0	20.0	19.0	18.5	20.0	19.5	20.5
22	20.0	19.0	20.0	20.0	21.0	21.0	20.0	21.0
23	20.5	20.0	20.5	19.5	20.0	20.5	20.0	19.5
24	18.5	19.0	20.5	17.0	18.5	19.5	20.0	20.0
25	20.5	19.5	20.0	17.5	20.0	20.0		19.5
26	19.5	20.0	20.0	20.5		19.0		15.5
27	20.0		19.5	20.0		19.5		
28			20.5	20.5				
29			22.0	19.5				
30				19.0				
31								
# Survivors	27	26	29	30	25	27	24	26
Average Length (mm)	19.74	19.75	20.14	19.63	20.12	20.11	19.94	19.87
Pooled Weight (g)	2.21	2.15	2.42	2.50	2.18	2.33	2.00	2.16
Pooled Weight (mg)	2210.00	2150.00	2420.00	2500.00	2180.00	2330.00	2000.00	2160.00
Average Weight (g)	0.082	0.083	0.083	0.083	0.087	0.086	0.083	0.083
= abnormal								

JCH Dec. 19/16

Client: Teck
WO#: 161121

	GH_ER2				FR_FRCP1			
Fish #	**100 A**	**100 B**	**100 C**	**100 D**	**100 A**	**100 B**	**100 C**	**100 D**
1	21.0	21.0	18.5	20.0	18.5	20.0	21.0	21.0
2	19.0	20.0	20.5	20.0	18.5	18.5	19.5	18.0
3	19.5	19.0	19.0	21.0	19.0	20.0	20.0	19.5
4	21.5	20.5	21.0	20.0	18.5	18.0	22.5	18.5
5	22.0	19.0	21.0	19.0	19.5	17.0	20.5	21.0
6	20.0	20.0	20.0	20.5	20.0	19.0	18.5	19.0
7	21.0	21.0	19.0	21.0	18.5	20.0	17.0	18.5
8	20.5	21.0	19.5	20.5	18.0	19.0	20.5	20.5
9	20.0	18.5	19.0	20.0	20.0	18.0	21.0	20.0
10	21.0	19.0	20.5	20.0	19.5	20.0	18.0	20.0
11	19.5	19.0	18.0	19.0	20.0	20.0	20.0	20.5
12	20.0	19.5	20.0	18.0	17.0	19.0	18.5	20.0
13	21.5	20.0	20.0	20.0	20.0	19.5	18.0	20.5
14	21.0	19.0	19.5	21.0	20.0	18.5		21.0
15	22.0	21.5	20.5	20.0	21.0	19.5		
16	19.0	20.0	20.5	20.0		20.0		
17	19.0	19.0	20.0	20.5		20.5		
18	20.5	19.0	21.0	20.0		19.0		
19	20.0	18.0	20.0	20.0				
20	19.5	21.0	20.0	21.0				
21	19.5	20.0	18.5	19.0				
22	20.0	19.0	20.0	19.0				
23	20.0	20.0	19.5	18.5				
24	21.0	20.0	21.0	19.0				
25	20.5	21.0	20.0	20.5				
26	20.5	19.5	19.5	20.0				
27		19.5						
28		20.0						
29		18.5						
30								
31								
# Survivors	26	29	26	26	15	18	13	14
Average Length (mm)	20.35	19.74	19.85	19.90	19.20	19.19	19.62	19.86
Pooled Weight (g)	2.31	2.40	2.19	2.21	1.25	1.46	1.12	1.13
Pooled Weight (mg)	2310.00	2400.00	2190.00	2210.00	1250.00	1460.00	1120.00	1130.00
Average Weight (g)	0.089	0.083	0.084	0.085	0.083	0.081	0.086	0.081
= abnormal								

JGu Dec. 19/16

Client: Teck
WO#: 161121

	GH_FR1				GH_ERC			
Fish #	**100 A**	**100 B**	**100 C**	**100 D**	**100 A**	**100 B**	**100 C**	**100 D**
1	20.5	19.5	19.0	20.0	17.5	18.0	21.0	19.0
2	19.0	20.5	19.0	20.0	18.5	17.0	19.5	20.0
3	20.0	17.0	18.0	21.0	18.0	19.5	20.0	19.0
4	21.0	19.0	17.5	21.0	20.0	19.5	21.0	19.0
5	19.5	20.0	16.0	17.5	18.5	19.5	20.0	19.0
6	20.0	20.0	19.0	19.0	18.5	20.0	19.5	20.0
7	17.0	21.0	18.0	19.0	17.0	19.0	20.0	20.0
8	21.0	20.5		20.5	19.5	19.0	20.0	19.0
9	18.0	20.0		19.0	18.0	19.0	19.0	20.0
10	21.0	20.5		19.0	20.0	20.0	21.0	19.0
11	20.0			20.0	19.0	21.0	19.5	20.5
12	21.0			20.0	20.0	18.5	20.0	18.5
13	20.0				16.0	16.5	20.0	19.0
14	20.0				18.5	19.0	20.0	19.5
15	20.0				20.0	19.5	19.0	19.0
16	20.0				17.0	17.5	19.0	19.0
17	19.5				18.0	18.5	19.0	18.5
18	20.5				19.0	19.0	19.0	20.0
19	21.0				18.5	19.0	20.0	19.0
20	20.0				18.5	18.0	19.0	20.0
21					19.0	17.5	19.0	19.0
22					19.0	20.0	21.0	19.0
23					20.0	20.0	21.0	19.5
24					17.0	19.0	20.0	19.5
25					18.5	19.0	20.5	19.0
26						18.0	20.0	20.0
27						20.0	19.5	20.0
28						19.5	21.0	20.0
29								20.5
30								
31								
# Survivors	20	10	7	12	25	28	28	29
Average Length (mm)	19.95	19.80	18.07	19.67	18.54	18.93	19.91	19.43
Pooled Weight (g)	1.73	0.87	0.61	1.04	2.04	2.33	2.51	2.50
Pooled Weight (mg)	1730.00	870.00	610.00	1040.00	2040.00	2330.00	2510.00	2500.00
Average Weight (g)	0.087	0.087	0.087	0.087	0.082	0.083	0.090	0.086
= abnormal								

JBe
Dec. 19/16

Client: Teck
WO#: 161121

	EV_HC1				EV_MC2			
Fish #	**100 A**	**100 B**	**100 C**	**100 D**	**100 A**	**100 B**	**100 C**	**100 D**
1	20.0	19.5	16.5	19.0	16.0	18.5	19.0	20.0
2	19.0	20.0	19.5	20.0	20.5	19.5	20.0	20.0
3	21.0	19.0	21.0	19.5	19.0	20.0	21.5	21.0
4	19.0	20.0	20.0	21.0	19.0	20.0	21.0	20.5
5	21.5	20.5	20.0	20.0	21.0	20.0	21.5	20.0
6	20.5	18.0	19.0	19.0	21.0	19.0	19.0	20.0
7	21.0	19.0	20.0	20.0	20.5	20.0	19.0	18.0
8	20.5	19.5	19.0	21.0	21.0	21.0	21.5	20.5
9	19.0	19.0	18.0	19.0	21.0	20.0	19.5	19.5
10	18.5	19.5	16.0	18.0	21.0	20.5	20.0	21.5
11	18.5	20.0	20.0	21.5	19.5	20.0	21.0	21.5
12	21.0	19.0	18.5		20.5	20.0	22.0	20.5
13	20.0	17.0	20.0		20.5	20.5	19.0	20.0
14	19.5	15.0	19.5		20.0	19.5	21.0	21.0
15	19.5	19.0	19.5		20.0	20.0	19.0	19.0
16	17.0	19.5	17.5		19.0	21.0	21.5	21.0
17	17.5	19.0	19.0		20.5	20.5	19.5	21.5
18		18.5			21.5	20.0	20.5	20.5
19		19.0			20.0	21.0	20.0	19.0
20		19.0			20.0	21.0	19.0	21.0
21		19.5			21.0	20.5	21.0	20.0
22		18.5			21.5	18.0	20.0	21.0
23					21.5	19.5	20.0	20.5
24						21.0	19.0	20.0
25						16.0	19.5	19.0
26						16.5		
27								
28								
29								
30								
31								
# Survivors	17	22	17	11	23	26	25	25
Average Length (mm)	19.59	18.95	19.00	19.82	20.24	19.75	20.16	20.26
Pooled Weight (g)	1.46	1.91	1.42	0.98	2.15	2.25	2.30	2.32
Pooled Weight (mg)	1460.00	1910.00	1420.00	980.00	2150.00	2250.00	2300.00	2320.00
Average Weight (g)	0.086	0.087	0.084	0.089	0.093	0.087	0.092	0.093

= abnormal

JOL
Dec. 19/16

Client: Teck
WO#: 161121

	CM_MC2				LC_LCDSSLCC			
Fish #	**100 A**	**100 B**	**100 C**	**100 D**	**100 A**	**100 B**	**100 C**	**100 D**
1	19.0	17.0	20.5	21.0	20.0	21.0	21.0	21.0
2	19.0	20.5	20.0	19.5	21.5	22.0	21.0	21.5
3	20.0	21.5	21.0	21.0	20.0	22.0	21.5	21.0
4	20.5	20.5	20.0	16.5	19.0	21.0	22.0	20.0
5	21.0	19.0	20.0	21.5	21.0	21.0	19.0	21.5
6	22.0	21.5	20.5	21.0	21.0	21.0	21.5	19.5
7	19.5	21.5	20.0	21.5	21.0	21.0	22.0	21.0
8	21.5	21.0	19.0	19.5	19.0	19.5	21.5	20.5
9	21.0	19.5	18.5	20.0	21.0	19.5	21.0	21.0
10	21.0	21.0	20.5	20.5	19.5	21.0	21.0	19.0
11	20.0	18.5	20.0	21.0	21.5	19.5	21.0	20.0
12	22.0	19.0	19.5	21.0	20.0	19.5	21.0	19.0
13	21.0	21.5	21.0	20.5	21.5	19.0	20.5	20.0
14	20.5	22.0	21.0	20.5	20.0	21.0	20.0	21.0
15	19.0	21.0	18.0	21.0	20.0	22.0	19.0	21.0
16	21.5	21.0	21.5	20.5	21.0	20.0		18.5
17	20.5	21.0	20.0	20.5	19.5	21.0		21.0
18	21.0	20.0	21.0	21.0	21.5	22.0		20.5
19	21.0		20.5	20.0	22.0	21.0		19.0
20	21.0		20.0	21.0	17.5	19.0		21.0
21	21.5		20.0	21.0				
22	21.0		19.5	21.0				
23	21.0		17.0	21.5				
24	17.0		17.5	20.5				
25	19.0			16.5				
26	16.5			17.0				
27	16.0							
28								
29								
30								
31								
# Survivors	27	18	24	26	20	20	15	20
Average Length (mm)	20.15	20.39	19.85	20.25	20.38	20.65	20.87	20.35
Pooled Weight (g)	2.40	1.69	2.16	2.36	1.67	1.95	1.55	2.01
Pooled Weight (mg)	2400.00	1690.00	2160.00	2360.00	1670.00	1950.00	1550.00	2010.00
Average Weight (g)	0.089	0.094	0.090	0.091	0.084	0.098	0.103	0.101
= abnormal								

JGL
Dec. 19/16

CETIS Summary Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Batch ID:	03-5261-5530	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	08-8308-2331	18 Oct-16	18 Oct-16	18h (14 °C)	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

FR_UFR1 and GH_ER2 are reference sites

Proportion Normal Summary (viability)

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	0.9	0.8032	0.9968	0.8333	0.9667	0.03043	0.06086	6.76%	0.0%
FR_UFR1	4	0.8167	0.786	0.8473	0.8	0.8333	0.009623	0.01925	2.36%	9.26%
GH_ER2	4	0.875	0.7746	0.9754	0.8333	0.9667	0.03155	0.0631	7.21%	2.78%
FR_FRCP1	4	0.4914	0.4082	0.5745	0.4483	0.5667	0.02613	0.05226	10.64%	45.4%
GH_FR1	4	0.4138	0.1231	0.7045	0.2414	0.6667	0.09135	0.1827	44.15%	54.02%
GH_ERC	4	0.9167	0.8248	1	0.8333	0.9667	0.02887	0.05774	6.3%	-1.85%
EV_HC1	4	0.5296	0.3329	0.7263	0.3667	0.6667	0.0618	0.1236	23.34%	41.16%
EV_MC2	4	0.7898	0.6867	0.8929	0.7333	0.8571	0.03239	0.06478	8.2%	12.25%
CM_MC2	4	0.7537	0.5438	0.9636	0.5667	0.8621	0.06596	0.1319	17.5%	16.25%
LC_LCDSSLCC	4	0.6279	0.4903	0.7654	0.5	0.6897	0.04322	0.08645	13.77%	30.24%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	0.9333	0.8365	1	0.8667	1	0.03043	0.06086	6.52%	0.0%
FR_UFR1	4	0.85	0.7815	0.9185	0.8	0.9	0.02152	0.04303	5.06%	8.93%
GH_ER2	4	0.8917	0.8121	0.9712	0.8667	0.9667	0.025	0.05	5.61%	4.46%
FR_FRCP1	4	0.4997	0.3908	0.6086	0.4483	0.6	0.03421	0.06843	13.69%	46.46%
GH_FR1	4	0.4138	0.1231	0.7045	0.2414	0.6667	0.09135	0.1827	44.15%	55.67%
GH_ERC	4	0.9167	0.8248	1	0.8333	0.9667	0.02887	0.05774	6.3%	1.79%
EV_HC1	4	0.5632	0.3235	0.803	0.3667	0.7333	0.07534	0.1507	26.75%	39.66%
EV_MC2	4	0.816	0.68	0.952	0.7353	0.9286	0.04274	0.08548	10.48%	12.58%
CM_MC2	4	0.8138	0.5769	1	0.6	0.931	0.07444	0.1489	18.29%	12.81%
LC_LCDSSLCC	4	0.6454	0.5278	0.7631	0.5357	0.6897	0.03697	0.07394	11.46%	30.85%

Salmonid Embryo-Alevin Survival and Development Test **Nautilus Environmental**

Proportion Normal Detail (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.8333	0.8667	0.9667	0.9333
FR_UFR1	0.8	0.8333	0.8	0.8333
GH_ER2	0.8333	0.9667	0.8667	0.8333
FR_FRCP1	0.4839	0.5667	0.4483	0.4667
GH_FR1	0.6667	0.3333	0.2414	0.4138
GH_ERC	0.8333	0.9333	0.9333	0.9667
EV_HC1	0.5517	0.6667	0.5333	0.3667
EV_MC2	0.7333	0.8571	0.8333	0.7353
CM_MC2	0.8621	0.5667	0.7586	0.8276
LC_LCDSSLCC	0.6552	0.6667	0.5	0.6897

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.9	0.8667	0.9667	1
FR_UFR1	0.8333	0.9	0.8	0.8667
GH_ER2	0.8667	0.9667	0.8667	0.8667
FR_FRCP1	0.4839	0.6	0.4483	0.4667
GH_FR1	0.6667	0.3333	0.2414	0.4138
GH_ERC	0.8333	0.9333	0.9333	0.9667
EV_HC1	0.5862	0.7333	0.5667	0.3667
EV_MC2	0.7667	0.9286	0.8333	0.7353
CM_MC2	0.931	0.6	0.8276	0.8966
LC_LCDSSLCC	0.6897	0.6667	0.5357	0.6897

FR_UFR1 and GH_ER2 are reference sites.

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	25/30	26/30	29/30	28/30
FR_UFR1	24/30	25/30	24/30	25/30
GH_ER2	25/30	29/30	26/30	25/30
FR_FRCP1	15/31	17/30	13/29	14/30
GH_FR1	20/30	10/30	7/29	12/29
GH_ERC	25/30	28/30	28/30	29/30
EV_HC1	16/29	20/30	16/30	11/30
EV_MC2	22/30	24/28	25/30	25/34
CM_MC2	25/29	17/30	22/29	24/29
LC_LCDSSLCC	19/29	20/30	14/28	20/29

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	27/30	26/30	29/30	30/30
FR_UFR1	25/30	27/30	24/30	26/30
GH_ER2	26/30	29/30	26/30	26/30
FR_FRCP1	15/31	18/30	13/29	14/30
GH_FR1	20/30	10/30	7/29	12/29
GH_ERC	25/30	28/30	28/30	29/30
EV_HC1	17/29	22/30	17/30	11/30
EV_MC2	23/30	26/28	25/30	25/34
CM_MC2	27/29	18/30	24/29	26/29
LC_LCDSSLCC	20/29	20/30	15/28	20/29

CETIS Summary Report

Test Code: 161121b | 09-0398-3065

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Batch ID:	03-3988-2984	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7181-2408	18 Oct-16	18 Oct-16	18h	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

FR_UFR1 and GH_ER2 are reference sites.

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	19.81	19.46	20.17	19.63	20.14	0.1117	0.2234	1.13%	0.0%
FR_UFR1	4	20.01	19.81	20.21	19.87	20.12	0.06232	0.1246	0.62%	-0.98%
GH_ER2	4	19.96	19.53	20.39	19.74	20.35	0.1342	0.2685	1.35%	-0.73%
FR_FRCP1	4	19.47	18.94	19.99	19.19	19.86	0.1648	0.3296	1.69%	1.75%
GH_FR1	4	19.37	17.98	20.77	18.07	19.95	0.4379	0.8758	4.52%	2.23%
GH_ERC	4	19.2	18.25	20.15	18.54	19.91	0.298	0.596	3.1%	3.09%
EV_HC1	4	19.34	18.65	20.03	18.95	19.82	0.2161	0.4323	2.24%	2.4%
EV_MC2	4	20.1	19.72	20.48	19.75	20.26	0.1195	0.2389	1.19%	-1.45%
CM_MC2	4	20.16	19.8	20.52	19.85	20.39	0.1145	0.2289	1.14%	-1.74%
LC_LCDSSLCC	4	20.56	20.17	20.95	20.35	20.87	0.1227	0.2454	1.19%	-3.77%

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	82.83	81.67	84	81.85	83.45	0.3664	0.7329	0.88%	0.0%
FR_UFR1	4	84.98	81.66	88.29	83.08	87.2	1.041	2.081	2.45%	-2.59%
GH_ER2	4	85.21	81.08	89.34	82.76	88.85	1.299	2.597	3.05%	-2.87%
FR_FRCP1	4	82.83	78.85	86.8	80.71	86.15	1.249	2.499	3.02%	0.0%
GH_FR1	4	86.83	86.36	87.3	86.5	87.14	0.1479	0.2957	0.34%	-4.82%
GH_ERC	4	85.17	79.53	90.8	81.6	89.64	1.771	3.543	4.16%	-2.82%
EV_HC1	4	86.33	82.67	89.99	83.53	89.09	1.151	2.303	2.67%	-4.22%
EV_MC2	4	91.2	86.16	96.25	86.54	93.48	1.584	3.169	3.47%	-10.11%
CM_MC2	4	90.89	87.47	94.3	88.89	93.89	1.073	2.145	2.36%	-9.73%
LC_LCDSSLCC	4	96.21	82.2	110.2	83.5	103.3	4.4	8.801	9.15%	-16.15%

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test **Nautilus Environmental**

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	19.74	19.75	20.14	19.63
FR_UFR1	20.12	20.11	19.94	19.87
GH_ER2	20.35	19.74	19.85	19.9
FR_FRCP1	19.2	19.19	19.62	19.86
GH_FR1	19.95	19.8	18.07	19.67
GH_ERC	18.54	18.93	19.91	19.43
EV_HC1	19.59	18.95	19	19.82
EV_MC2	20.24	19.75	20.16	20.26
CM_MC2	20.15	20.39	19.85	20.25
LC_LCDSSLCC	20.38	20.65	20.87	20.35

FR_UFR1 and GH_ER2 are reference sites.

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	81.85	82.69	83.45	83.33
FR_UFR1	87.2	86.3	83.33	83.08
GH_ER2	88.85	82.76	84.23	85
FR_FRCP1	83.33	81.11	86.15	80.71
GH_FR1	86.5	87	87.14	86.67
GH_ERC	81.6	83.21	89.64	86.21
EV_HC1	85.88	86.82	83.53	89.09
EV_MC2	93.48	86.54	92	92.8
CM_MC2	88.89	93.89	90	90.77
LC_LCDSSLCC	83.5	97.5	103.3	100.5

Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID:	06-2466-8887	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	03-5261-5530	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	08-8308-2331	18 Oct-16	18 Oct-16	18h (14 °C)	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

FR_UFR1 and GH_ER2 are reference sites

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.02996	0.0899	Exact	Non-Significant Effect
Control		GH_ER2	0.1806	0.3612	Exact	Non-Significant Effect
Control		FR_FRCP1	0	<0.0001	Exact	Significant Effect
Control		GH_FR1	0	<0.0001	Exact	Significant Effect
Control		GH_ERC	0.4036	0.4036	Exact	Non-Significant Effect
Control		EV_HC1	0	<0.0001	Exact	Significant Effect
Control		EV_MC2	0.003669	0.0183	Exact	Significant Effect
Control		CM_MC2	0.004087	0.0163	Exact	Significant Effect
Control		LC_LCDSSLCC	0	<0.0001	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	112	8	120	0.9333	0.06667	0.0%
FR_UFR1		102	18	120	0.85	0.15	8.93%
GH_ER2		107	13	120	0.8917	0.1083	4.46%
FR_FRCP1		60	60	120	0.5	0.5	46.43%
GH_FR1		49	69	118	0.4153	0.5847	55.51%
GH_ERC		110	10	120	0.9167	0.08333	1.79%
EV_HC1		67	52	119	0.563	0.437	39.68%
EV_MC2		99	23	122	0.8115	0.1885	13.06%
CM_MC2		95	22	117	0.812	0.188	13.0%
LC_LCDSSLCC		75	41	116	0.6466	0.3534	30.73%

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	06-2466-8887	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Survival Rate Detail

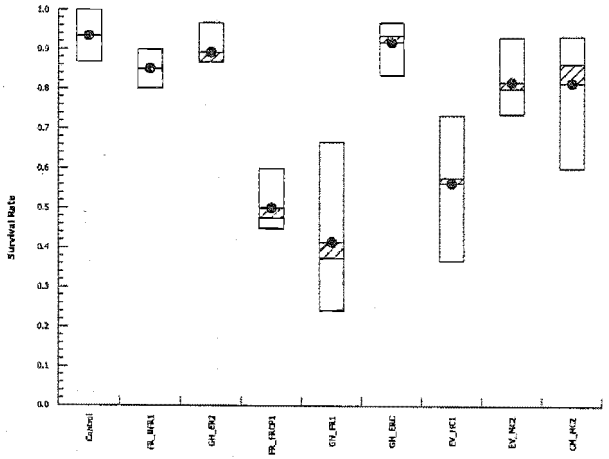
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.9	0.8667	0.9667	1
FR_UFR1	0.8333	0.9	0.8	0.8667
GH_ER2	0.8667	0.9667	0.8667	0.8667
FR_FRCP1	0.4839	0.6	0.4483	0.4667
GH_FR1	0.6667	0.3333	0.2414	0.4138
GH_ERC	0.8333	0.9333	0.9333	0.9667
EV_HC1	0.5862	0.7333	0.5667	0.3667
EV_MC2	0.7667	0.9286	0.8333	0.7353
CM_MC2	0.931	0.6	0.8276	0.8966
LC_LCDSSLCC	0.6897	0.6667	0.5357	0.6897

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	27/30	26/30	29/30	30/30
FR_UFR1	25/30	27/30	24/30	26/30
GH_ER2	26/30	29/30	26/30	26/30
FR_FRCP1	15/31	18/30	13/29	14/30
GH_FR1	20/30	10/30	7/29	12/29
GH_ERC	25/30	28/30	28/30	29/30
EV_HC1	17/29	22/30	17/30	11/30
EV_MC2	23/30	26/28	25/30	25/34
CM_MC2	27/29	18/30	24/29	26/29
LC_LCDSSLCC	20/29	20/30	15/28	20/29

FR_UFR1 and GH_ER2 are reference sites.

Graphics



Analyst:_____ QA: JCL 19/16 Dec

CETIS Analytical Report

Test Code: 161121a | 12-3712-4397

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	17-4567-7956	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:01	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	03-5261-5530	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

FR_UFR1 and GH_ER2 are reference sites.

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		FR_FRCP1	0	<0.0001	Exact	Significant Effect
FR_UFR1		GH_FR1	0	<0.0001	Exact	Significant Effect
FR_UFR1		GH_ERC	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_HC1	7.919E-07	<0.0001	Exact	Significant Effect
FR_UFR1		EV_MC2	0.2654	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.2716	0.8149	Exact	Non-Significant Effect
FR_UFR1		LC_LCDSSLCC	0.0002452	0.0012	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	102	18	120	0.85	0.15	0.0%
GH_ER2		107	13	120	0.8917	0.1083	-4.9%
FR_FRCP1		60	60	120	0.5	0.5	41.18%
GH_FR1		49	69	118	0.4153	0.5847	51.15%
GH_ERC		110	10	120	0.9167	0.08333	-7.84%
EV_HC1		67	52	119	0.563	0.437	33.76%
EV_MC2		99	23	122	0.8115	0.1885	4.53%
CM_MC2		95	22	117	0.812	0.188	4.48%
LC_LCDSSLCC		75	41	116	0.6466	0.3534	23.94%

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID: 17-4567-7956 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 19 Dec-16 13:01 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

Survival Rate Detail

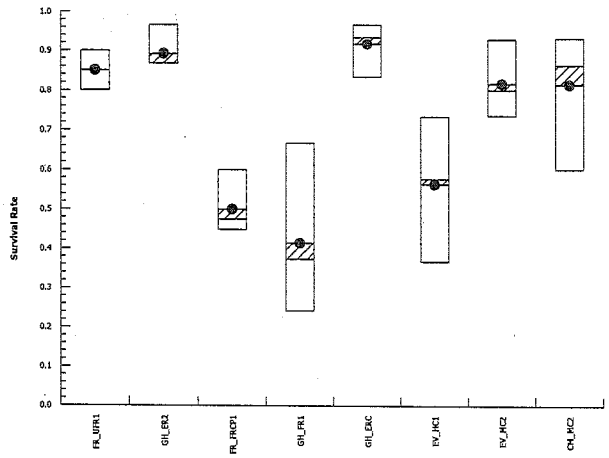
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.8333	0.9	0.8	0.8667
GH_ER2	0.8667	0.9667	0.8667	0.8667
FR_FRCP1	0.4839	0.6	0.4483	0.4667
GH_FR1	0.6667	0.3333	0.2414	0.4138
GH_ERC	0.8333	0.9333	0.9333	0.9667
EV_HC1	0.5862	0.7333	0.5667	0.3667
EV_MC2	0.7667	0.9286	0.8333	0.7353
CM_MC2	0.931	0.6	0.8276	0.8966
LC_LCDSSLCC	0.6897	0.6667	0.5357	0.6897

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	25/30	27/30	24/30	26/30
GH_ER2	26/30	29/30	26/30	26/30
FR_FRCP1	15/31	18/30	13/29	14/30
GH_FR1	20/30	10/30	7/29	12/29
GH_ERC	25/30	28/30	28/30	29/30
EV_HC1	17/29	22/30	17/30	11/30
EV_MC2	23/30	26/28	25/30	25/34
CM_MC2	27/29	18/30	24/29	26/29
LC_LCDSSLCC	20/29	20/30	15/28	20/29

FR_UFR1 and GH_ER2 are reference sites.

Graphics



CETIS Analytical Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	14-1150-1816	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 12:59	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	03-5261-5530	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

FR_UFR1 and GH_ER2 are reference sites.

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
GH_ER2		FR_UFR1	0.2209	0.4418	Exact	Non-Significant Effect
GH_ER2		FR_FRCP1	0	<0.0001	Exact	Significant Effect
GH_ER2		GH_FR1	0	<0.0001	Exact	Significant Effect
GH_ER2		GH_ERC	1	1.0000	Exact	Non-Significant Effect
GH_ER2		EV_HC1	0	<0.0001	Exact	Significant Effect
GH_ER2		EV_MC2	0.05746	0.2298	Exact	Non-Significant Effect
GH_ER2		CM_MC2	0.06071	0.1821	Exact	Non-Significant Effect
GH_ER2		LC_LCDSSLCC	5.498E-06	<0.0001	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1		102	18	120	0.85	0.15	4.67%
GH_ER2	Receiving Wate	107	13	120	0.8917	0.1083	0.0%
FR_FRCP1		60	60	120	0.5	0.5	43.93%
GH_FR1		49	69	118	0.4153	0.5847	53.43%
GH_ERC		110	10	120	0.9167	0.08333	-2.8%
EV_HC1		67	52	119	0.563	0.437	36.86%
EV_MC2		99	23	122	0.8115	0.1885	8.99%
CM_MC2		95	22	117	0.812	0.188	8.94%
LC_LCDSSLCC		75	41	116	0.6466	0.3534	27.49%

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID: 14-1150-1816 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 19 Dec-16 12:59 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

Survival Rate Detail

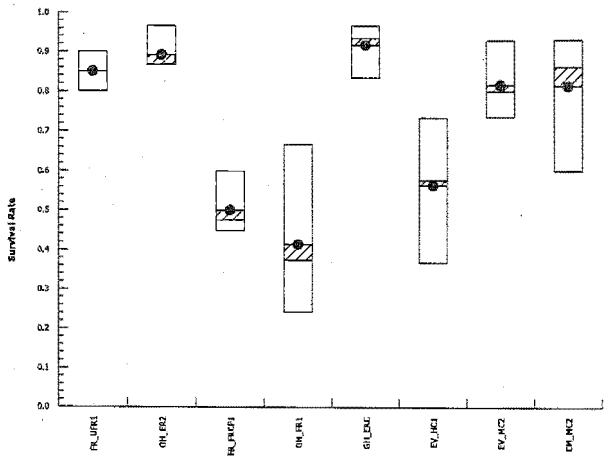
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.8333	0.9	0.8	0.8667
GH_ER2	0.8667	0.9667	0.8667	0.8667
FR_FRCP1	0.4839	0.6	0.4483	0.4667
GH_FR1	0.6667	0.3333	0.2414	0.4138
GH_ERC	0.8333	0.9333	0.9333	0.9667
EV_HC1	0.5862	0.7333	0.5667	0.3667
EV_MC2	0.7667	0.9286	0.8333	0.7353
CM_MC2	0.931	0.6	0.8276	0.8966
LC_LCDSSLCC	0.6897	0.6667	0.5357	0.6897

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	25/30	27/30	24/30	26/30
GH_ER2	26/30	29/30	26/30	26/30
FR_FRCP1	15/31	18/30	13/29	14/30
GH_FR1	20/30	10/30	7/29	12/29
GH_ERC	25/30	28/30	28/30	29/30
EV_HC1	17/29	22/30	17/30	11/30
EV_MC2	23/30	26/28	25/30	25/34
CM_MC2	27/29	18/30	24/29	26/29
LC_LCDSSLCC	20/29	20/30	15/28	20/29

FR_UFR1 and GH_ER2 are reference sites.

Graphics



CETIS Analytical Report

Test Code: 161121a | 12-3712-4397

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	06-1695-5973	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:05	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	03-5261-5530	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact Test

FR_UFR1 and GH_ER2 are reference sites.

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	102	18	120	0.85	0.15	0.0%
GH_ER2	Receiving Wate	107	13	120	0.8917	0.1083	-4.9%

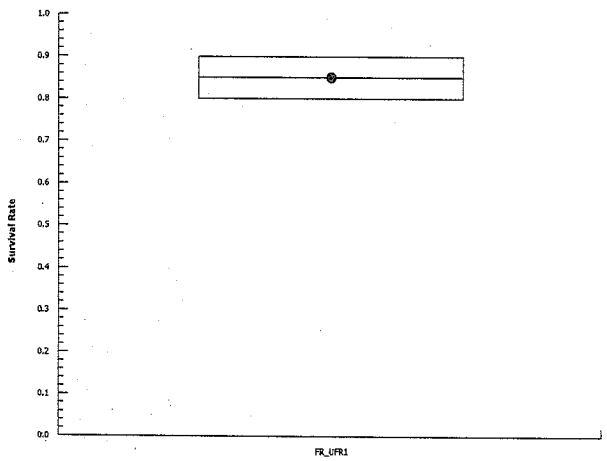
Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.8333	0.9	0.8	0.8667
GH_ER2	0.8667	0.9667	0.8667	0.8667

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	25/30	27/30	24/30	26/30
GH_ER2	26/30	29/30	26/30	26/30

Graphics



 Analyst:_____ QA: Dec 19/16

CETIS Analytical Report

Test Code: 161121a | 12-3712-4397

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	01-0737-2489	**Endpoint:**	Proportion Normal (viability)	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:13	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	03-5261-5530	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	08-8308-2331	18 Oct-16	18 Oct-16	18h (14 °C)	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

FR_UFR1 and GH_ER2 are reference sites.

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	0.04732	0.1420	Exact	Non-Significant Effect
Control		GH_ER2	0.3418	0.6835	Exact	Non-Significant Effect
Control		FR_FRCP1	0	<0.0001	Exact	Significant Effect
Control		GH_FR1	0	<0.0001	Exact	Significant Effect
Control		GH_ERC	1	1.0000	Exact	Non-Significant Effect
Control		EV_HC1	0	<0.0001	Exact	Significant Effect
Control		EV_MC2	0.01199	0.0479	Exact	Significant Effect
Control		CM_MC2	0.002097	0.0105	Exact	Significant Effect
Control		LC_LCDSSLCC	5.917E-07	<0.0001	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
Control	Negative Contr	108	12	120	0.9	0.1	0.0%
FR_UFR1		98	22	120	0.8167	0.1833	9.26%
GH_ER2		105	15	120	0.875	0.125	2.78%
FR_FRCP1		59	61	120	0.4917	0.5083	45.37%
GH_FR1		49	69	118	0.4153	0.5847	53.86%
GH_ERC		110	10	120	0.9167	0.08333	-1.85%
EV_HC1		63	56	119	0.5294	0.4706	41.18%
EV_MC2		96	26	122	0.7869	0.2131	12.57%
CM_MC2		88	29	117	0.7521	0.2479	16.43%
LC_LCDSSLCC		73	43	116	0.6293	0.3707	30.08%

Analyst:_____ QA: Dec. 9/16

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID: 01-0737-2489 **Endpoint:** Proportion Normal (viability) **CETIS Version:** CETISv1.8.7
Analyzed: 19 Dec-16 13:13 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

Proportion Normal Detail (viability)

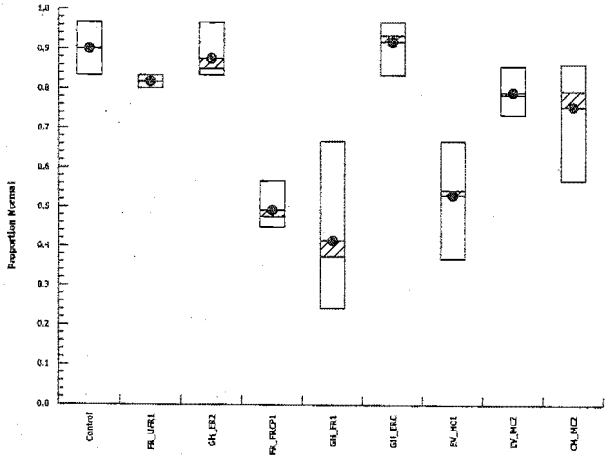
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.8333	0.8667	0.9667	0.9333
FR_UFR1	0.8	0.8333	0.8	0.8333
GH_ER2	0.8333	0.9667	0.8667	0.8333
FR_FRCP1	0.4839	0.5667	0.4483	0.4667
GH_FR1	0.6667	0.3333	0.2414	0.4138
GH_ERC	0.8333	0.9333	0.9333	0.9667
EV_HC1	0.5517	0.6667	0.5333	0.3667
EV_MC2	0.7333	0.8571	0.8333	0.7353
CM_MC2	0.8621	0.5667	0.7586	0.8276
LC_LCDSSLCC	0.6552	0.6667	0.5	0.6897

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	25/30	26/30	29/30	28/30
FR_UFR1	24/30	25/30	24/30	25/30
GH_ER2	25/30	29/30	26/30	25/30
FR_FRCP1	15/31	17/30	13/29	14/30
GH_FR1	20/30	10/30	7/29	12/29
GH_ERC	25/30	28/30	28/30	29/30
EV_HC1	16/29	20/30	16/30	11/30
EV_MC2	22/30	24/28	25/30	25/34
CM_MC2	25/29	17/30	22/29	24/29
LC_LCDSSLCC	19/29	20/30	14/28	20/29

FR_UFR1 and GH_ER2 are reference sites

Graphics



CETIS Analytical Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	05-0630-0999	**Endpoint:**	Proportion Normal (viability)	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:02	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	03-5261-5530	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

FR_UFR1 and GH_ER2 are reference sites.

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		FR_FRCP1	0	<0.0001	Exact	Significant Effect
FR_UFR1		GH_FR1	0	<0.0001	Exact	Significant Effect
FR_UFR1		GH_ERC	1	1.0000	Exact	Non-Significant Effect
FR_UFR1		EV_HC1	1.664E-06	<0.0001	Exact	Significant Effect
FR_UFR1		EV_MC2	0.3376	1.0000	Exact	Non-Significant Effect
FR_UFR1		CM_MC2	0.1467	0.5869	Exact	Non-Significant Effect
FR_UFR1		LC_LCDSSLCC	0.0009972	0.0050	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	98	22	120	0.8167	0.1833	0.0%
GH_ER2		105	15	120	0.875	0.125	-7.14%
FR_FRCP1		59	61	120	0.4917	0.5083	39.8%
GH_FR1		49	69	118	0.4153	0.5847	49.15%
GH_ERC		110	10	120	0.9167	0.08333	-12.24%
EV_HC1		63	56	119	0.5294	0.4706	35.17%
EV_MC2		96	26	122	0.7869	0.2131	3.65%
CM_MC2		88	29	117	0.7521	0.2479	7.9%
LC_LCDSSLCC		73	43	116	0.6293	0.3707	22.94%

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID: 05-0630-0999 **Endpoint:** Proportion Normal (viability) **CETIS Version:** CETISv1.8.7
Analyzed: 19 Dec-16 13:02 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

Proportion Normal Detail (viability)

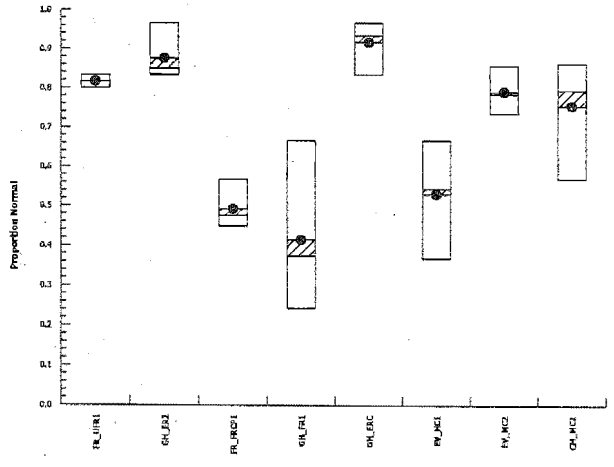
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.8	0.8333	0.8	0.8333
GH_ER2	0.8333	0.9667	0.8667	0.8333
FR_FRCP1	0.4839	0.5667	0.4483	0.4667
GH_FR1	0.6667	0.3333	0.2414	0.4138
GH_ERC	0.8333	0.9333	0.9333	0.9667
EV_HC1	0.5517	0.6667	0.5333	0.3667
EV_MC2	0.7333	0.8571	0.8333	0.7353
CM_MC2	0.8621	0.5667	0.7586	0.8276
LC_LCDSSLCC	0.6552	0.6667	0.5	0.6897

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	24/30	25/30	24/30	25/30
GH_ER2	25/30	29/30	26/30	25/30
FR_FRCP1	15/31	17/30	13/29	14/30
GH_FR1	20/30	10/30	7/29	12/29
GH_ERC	25/30	28/30	28/30	29/30
EV_HC1	16/29	20/30	16/30	11/30
EV_MC2	22/30	24/28	25/30	25/34
CM_MC2	25/29	17/30	22/29	24/29
LC_LCDSSLCC	19/29	20/30	14/28	20/29

FR_UFR1 and GH_ER2 are reference sites.

Graphics



CETIS Analytical Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	09-5679-4409	**Endpoint:**	Proportion Normal (viability)	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:00	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	03-5261-5530	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

FR_UFR1 and GH_ER2 are reference sites.

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
GH_ER2		FR_UFR1	0.1417	0.2834	Exact	Non-Significant Effect
GH_ER2		FR_FRCP1	0	<0.0001	Exact	Significant Effect
GH_ER2		GH_FR1	0	<0.0001	Exact	Significant Effect
GH_ER2		GH_ERC	1	1.0000	Exact	Non-Significant Effect
GH_ER2		EV_HC1	0	<0.0001	Exact	Significant Effect
GH_ER2		EV_MC2	0.04843	0.1453	Exact	Non-Significant Effect
GH_ER2		CM_MC2	0.01144	0.0458	Exact	Significant Effect
GH_ER2		LC_LCDSSLCC	8.971E-06	<0.0001	Exact	Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1		98	22	120	0.8167	0.1833	6.67%
GH_ER2	Receiving Wate	105	15	120	0.875	0.125	0.0%
FR_FRCP1		59	61	120	0.4917	0.5083	43.81%
GH_FR1		49	69	118	0.4153	0.5847	52.54%
GH_ERC		110	10	120	0.9167	0.08333	-4.76%
EV_HC1		63	56	119	0.5294	0.4706	39.5%
EV_MC2		96	26	122	0.7869	0.2131	10.07%
CM_MC2		88	29	117	0.7521	0.2479	14.04%
LC_LCDSSLCC		73	43	116	0.6293	0.3707	28.08%

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID: 09-5679-4409 **Endpoint:** Proportion Normal (viability) **CETIS Version:** CETISv1.8.7
Analyzed: 19 Dec-16 13:00 **Analysis:** STP 2x2 Contingency Tables **Official Results:** Yes

Proportion Normal Detail (viability)

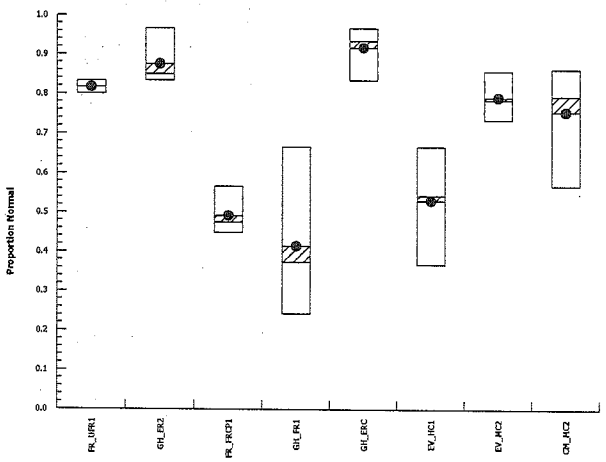
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.8	0.8333	0.8	0.8333
GH_ER2	0.8333	0.9667	0.8667	0.8333
FR_FRCP1	0.4839	0.5667	0.4483	0.4667
GH_FR1	0.6667	0.3333	0.2414	0.4138
GH_ERC	0.8333	0.9333	0.9333	0.9667
EV_HC1	0.5517	0.6667	0.5333	0.3667
EV_MC2	0.7333	0.8571	0.8333	0.7353
CM_MC2	0.8621	0.5667	0.7586	0.8276
LC_LCDSSLCC	0.6552	0.6667	0.5	0.6897

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	24/30	25/30	24/30	25/30
GH_ER2	25/30	29/30	26/30	25/30
FR_FRCP1	15/31	17/30	13/29	14/30
GH_FR1	20/30	10/30	7/29	12/29
GH_ERC	25/30	28/30	28/30	29/30
EV_HC1	16/29	20/30	16/30	11/30
EV_MC2	22/30	24/28	25/30	25/34
CM_MC2	25/29	17/30	22/29	24/29
LC_LCDSSLCC	19/29	20/30	14/28	20/29

FR_UFR1 and GH-ER2 are reference sites.

Graphics



CETIS Analytical Report

Salmonid Embryo-Alevin Survival and Development Test — **Nautilus Environmental**

Analysis ID:	14-5865-0457	**Endpoint:**	Proportion Normal (viability)	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:05	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	03-5261-5530	**Test Type:**	Survival-Development	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	1	1.0000	Exact	Non-Significant Effect

Data Summary

Sample Code		NR	R	NR + R	Prop NR	Prop R	%Effect
FR_UFR1	Upstream Contr	98	22	120	0.8167	0.1833	0.0%
GH_ER2	Receiving Wate	105	15	120	0.875	0.125	-7.14%

FR_UFR1 and GH_ER2 are reference sites

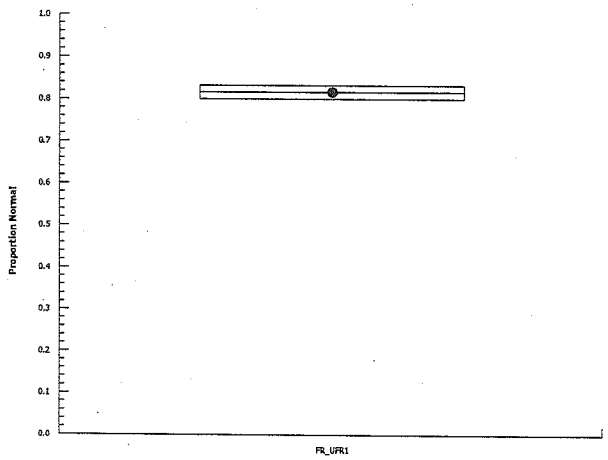
Proportion Normal Detail (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	0.8	0.8333	0.8	0.8333
GH_ER2	0.8333	0.9667	0.8667	0.8333

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	24/30	25/30	24/30	25/30
GH_ER2	25/30	29/30	26/30	25/30

Graphics



CETIS Analytical Report

Test Code: 161121b | 09-0398-3065

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	19-9459-6211	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:45	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	03-3988-2984	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7181-2408	18 Oct-16	18 Oct-16	18h	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

FR_UFR1 and GH_ER2 are reference sites.

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	3.76%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	-0.664	2.537	0.745	6	0.9817	CDF	Non-Significant Effect
		GH_ER2	-0.4937	2.537	0.745	6	0.9703	CDF	Non-Significant Effect
		FR_FRCP1	1.183	2.537	0.745	6	0.4382	CDF	Non-Significant Effect
		GH_FR1	1.507	2.537	0.745	6	0.2975	CDF	Non-Significant Effect
		GH_ERC	2.086	2.537	0.745	6	0.1202	CDF	Non-Significant Effect
		EV_HC1	1.617	2.537	0.745	6	0.2554	CDF	Non-Significant Effect
		EV_MC2	-0.979	2.537	0.745	6	0.9931	CDF	Non-Significant Effect
		CM_MC2	-1.175	2.537	0.745	6	0.9964	CDF	Non-Significant Effect
		LC_LCDSSLCC	-2.545	2.537	0.745	6	1.0000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	6.937399	0.7708222	9	4.469	0.0009	Significant Effect
Error	5.174874	0.1724958	30			
Total	12.11227		39			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	16.14	21.67	0.0640	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9407	0.9236	0.0366	Normal Distribution

Analysis ID: 19-9459-6211 **Endpoint:** Length-mm **CETIS Version:** CETISv1.8.7
Analyzed: 19 Dec-16 13:45 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

Length-mm Summary

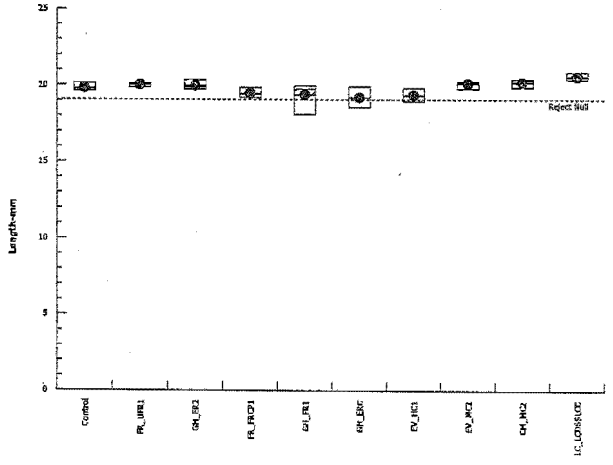
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	19.81	19.46	20.17	19.74	19.63	20.14	0.1117	1.13%	0.0%
FR_UFR1	4	20.01	19.81	20.21	20.03	19.87	20.12	0.06228	0.62%	-0.98%
GH_ER2	4	19.96	19.53	20.39	19.88	19.74	20.35	0.1342	1.35%	-0.73%
FR_FRCP1	4	19.47	18.94	19.99	19.41	19.19	19.86	0.1648	1.69%	1.75%
GH_FR1	4	19.37	17.98	20.77	19.74	18.07	19.95	0.4379	4.52%	2.23%
GH_ERC	4	19.2	18.25	20.15	19.18	18.54	19.91	0.298	3.1%	3.09%
EV_HC1	4	19.34	18.65	20.03	19.3	18.95	19.82	0.2161	2.24%	2.4%
EV_MC2	4	20.1	19.72	20.48	20.2	19.75	20.26	0.1195	1.19%	-1.45%
CM_MC2	4	20.16	19.8	20.52	20.2	19.85	20.39	0.1145	1.14%	-1.74%
LC_LCDSSLCC	4	20.56	20.17	20.95	20.51	20.35	20.87	0.1227	1.19%	-3.77%

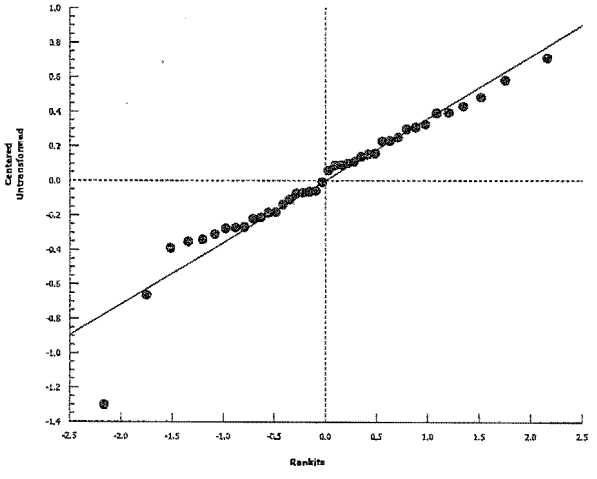
Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	19.74	19.75	20.14	19.63
FR_UFR1	20.12	20.11	19.94	19.87
GH_ER2	20.35	19.74	19.85	19.9
FR_FRCP1	19.2	19.19	19.62	19.86
GH_FR1	19.95	19.8	18.07	19.67
GH_ERC	18.54	18.93	19.91	19.43
EV_HC1	19.59	18.95	19	19.82
EV_MC2	20.24	19.75	20.16	20.26
CM_MC2	20.15	20.39	19.85	20.25
LC_LCDSSLCC	20.38	20.65	20.87	20.35

FR_UFR1 and GH_ER2 are reference sites.

Graphics





CETIS Analytical Report

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	01-9227-6045	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:49	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	03-3988-2984	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

FR_UFR1 and GHLER2 are reference sites.

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	3.83%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	0.1639	2.511	0.766	6	0.8462	CDF	Non-Significant Effect
		FR_FRCP1	1.778	2.511	0.766	6	0.1898	CDF	Non-Significant Effect
		GH_FR1	2.09	2.511	0.766	6	0.1125	CDF	Non-Significant Effect
		GH_ERC	2.647	2.511	0.766	6	0.0377	CDF	Significant Effect
		EV_HC1	2.196	2.511	0.766	6	0.0926	CDF	Non-Significant Effect
		EV_MC2	-0.3032	2.511	0.766	6	0.9440	CDF	Non-Significant Effect
		CM_MC2	-0.4917	2.511	0.766	6	0.9654	CDF	Non-Significant Effect
		LC_LCDSSLCC	-1.811	2.511	0.766	6	0.9995	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	6.936297	0.8670371	8	4.659	0.0012	Significant Effect
Error	5.025174	0.1861176	27			
Total	11.96147		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	14.64	20.09	0.0666	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9409	0.9166	0.0541	Normal Distribution

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	01-9227-6045	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:49	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Length-mm Summary

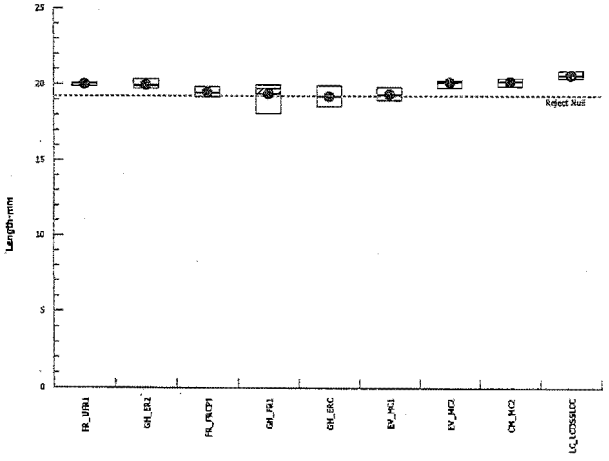
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	20.01	19.81	20.21	20.03	19.87	20.12	0.06228	0.62%	0.0%
GH_ER2	4	19.96	19.53	20.39	19.88	19.74	20.35	0.1342	1.35%	0.25%
FR_FRCP1	4	19.47	18.94	19.99	19.41	19.19	19.86	0.1648	1.69%	2.71%
GH_FR1	4	19.37	17.98	20.77	19.74	18.07	19.95	0.4379	4.52%	3.19%
GH_ERC	4	19.2	18.25	20.15	19.18	18.54	19.91	0.298	3.1%	4.04%
EV_HC1	4	19.34	18.65	20.03	19.3	18.95	19.82	0.2161	2.24%	3.35%
EV_MC2	4	20.1	19.72	20.48	20.2	19.75	20.26	0.1195	1.19%	-0.46%
CM_MC2	4	20.16	19.8	20.52	20.2	19.85	20.39	0.1145	1.14%	-0.75%
LC_LCDSSLCC	4	20.56	20.17	20.95	20.51	20.35	20.87	0.1227	1.19%	-2.76%

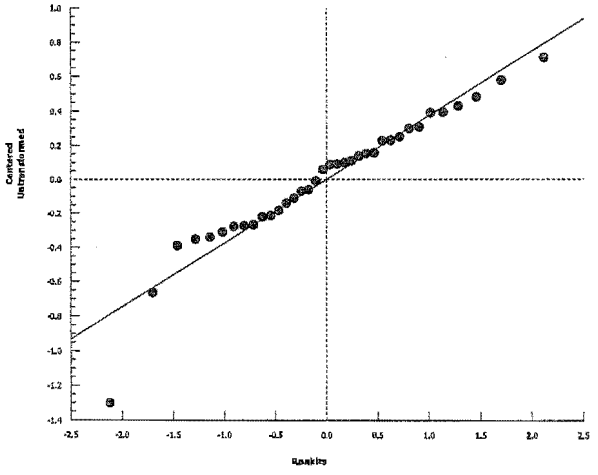
Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	20.12	20.11	19.94	19.87
GH_ER2	20.35	19.74	19.85	19.9
FR_FRCP1	19.2	19.19	19.62	19.86
GH_FR1	19.95	19.8	18.07	19.67
GH_ERC	18.54	18.93	19.91	19.43
EV_HC1	19.59	18.95	19	19.82
EV_MC2	20.24	19.75	20.16	20.26
CM_MC2	20.15	20.39	19.85	20.25
LC_LCDSSLCC	20.38	20.65	20.87	20.35

FR_UFR1 and GH_ER2 are reference sites

Graphics





CETIS Analytical Report

Report Date: 19 Dec-16 13:55 (p 1 of 2)
Test Code: 161121b | 09-0398-3065

Salmonid Embryo-Alevin-~~Fry~~ Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	07-0523-6237	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:52	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Batch ID:	03-3988-2984	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

FR_UFR1 and GH_ER2 are reference sites.

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	3.84%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
GH_ER2		FR_UFR1	-0.1639	2.511	0.766	6	0.9223	CDF	Non-Significant Effect
		FR_FRCP1	1.614	2.511	0.766	6	0.2429	CDF	Non-Significant Effect
		GH_FR1	1.926	2.511	0.766	6	0.1495	CDF	Non-Significant Effect
		GH_ERC	2.483	2.511	0.766	6	0.0530	CDF	Non-Significant Effect
		EV_HC1	2.032	2.511	0.766	6	0.1245	CDF	Non-Significant Effect
		EV_MC2	-0.4671	2.511	0.766	6	0.9631	CDF	Non-Significant Effect
		CM_MC2	-0.6556	2.511	0.766	6	0.9779	CDF	Non-Significant Effect
		LC_LCDSSLCC	-1.975	2.511	0.766	6	0.9997	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	6.936297	0.8670371	8	4.659	0.0012	Significant Effect
Error	5.025174	0.1861176	27			
Total	11.96147		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	14.64	20.09	0.0666	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9409	0.9166	0.0541	Normal Distribution

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID: 07-0523-6237 **Endpoint:** Length-mm **CETIS Version:** CETISv1.8.7
Analyzed: 19 Dec-16 13:52 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

Length-mm Summary

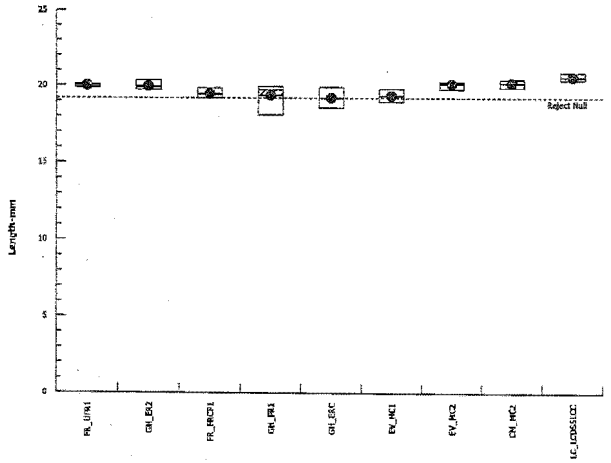
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	20.01	19.81	20.21	20.03	19.87	20.12	0.06228	0.62%	0.0%
GH_ER2	4	19.96	19.53	20.39	19.88	19.74	20.35	0.1342	1.35%	0.25%
FR_FRCP1	4	19.47	18.94	19.99	19.41	19.19	19.86	0.1648	1.69%	2.71%
GH_FR1	4	19.37	17.98	20.77	19.74	18.07	19.95	0.4379	4.52%	3.19%
GH_ERC	4	19.2	18.25	20.15	19.18	18.54	19.91	0.298	3.1%	4.04%
EV_HC1	4	19.34	18.65	20.03	19.3	18.95	19.82	0.2161	2.24%	3.35%
EV_MC2	4	20.1	19.72	20.48	20.2	19.75	20.26	0.1195	1.19%	-0.46%
CM_MC2	4	20.16	19.8	20.52	20.2	19.85	20.39	0.1145	1.14%	-0.75%
LC_LCDSSLCC	4	20.56	20.17	20.95	20.51	20.35	20.87	0.1227	1.19%	-2.76%

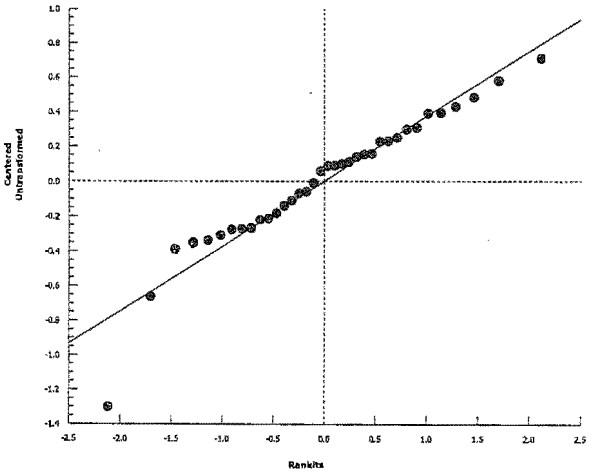
Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	20.12	20.11	19.94	19.87
GH_ER2	20.35	19.74	19.85	19.9
FR_FRCP1	19.2	19.19	19.62	19.86
GH_FR1	19.95	19.8	18.07	19.67
GH_ERC	18.54	18.93	19.91	19.43
EV_HC1	19.59	18.95	19	19.82
EV_MC2	20.24	19.75	20.16	20.26
CM_MC2	20.15	20.39	19.85	20.25
LC_LCDSSLCC	20.38	20.65	20.87	20.35

FR_UFR1 and GH_ER2 are reference sites.

Graphics





CETIS Analytical Report

Test Code: 161121b | 09-0398-3065

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	03-3398-4225	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:54	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes
Batch ID:	03-3988-2984	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	1.44%	

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	0.3379	1.943	0.288	6	0.3735	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.005000134	0.005000134	1	0.1142	0.7470	Non-Significant Effect
Error	0.2628004	0.04380006	6			
Total	0.2678005		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	4.639	47.47	0.2396	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8969	0.6451	0.2710	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	20.01	19.81	20.21	20.03	19.87	20.12	0.06228	0.62%	0.0%
GH_ER2	4	19.96	19.53	20.39	19.88	19.74	20.35	0.1342	1.35%	0.25%

Length-mm Detail

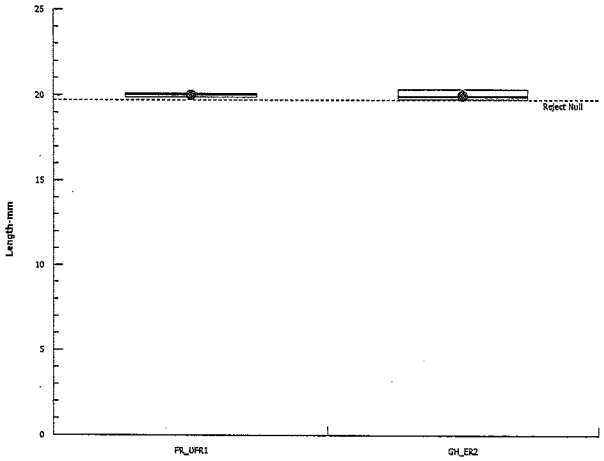
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	20.12	20.11	19.94	19.87
GH_ER2	20.35	19.74	19.85	19.9

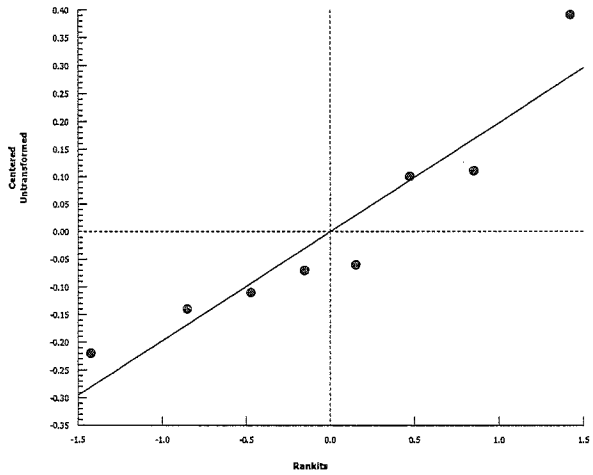
FR_UFR1 and GH_ER2 are reference sites

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test | **Nautilus Environmental**

Analysis ID:	03-3398-4225	**Endpoint:**	Length-mm	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 13:54	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Graphics





FR_UFR1 and GH-ER2 are reference sites.

CETIS Analytical Report

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	10-0202-7849	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 15:43	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes
Batch ID:	03-3988-2984	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	10-7181-2408	18 Oct-16	18 Oct-16	18h	Teck Coal	
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)		
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

FR_UFR1 and GH_ER2 are reference sites

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	5.93%	

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Control		FR_UFR1	22.5	NA	1	6	0.9143	Exact	Non-Significant Effect
		GH_ER2	24	NA	0	6	0.9714	Exact	Non-Significant Effect
		FR_FRCP1	16.5	NA	1	6	0.3714	Exact	Non-Significant Effect
		GH_FR1	26	NA	0	6	1.0000	Exact	Non-Significant Effect
		GH_ERC	20	NA	0	6	0.7571	Exact	Non-Significant Effect
		EV_HC1	26	NA	0	6	1.0000	Exact	Non-Significant Effect
		EV_MC2	26	NA	0	6	1.0000	Exact	Non-Significant Effect
		CM_MC2	26	NA	0	6	1.0000	Exact	Non-Significant Effect
		LC_LCDSSLCC	26	NA	0	6	1.0000	Exact	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	651.5662	72.39625	9	5.661	0.0001	Significant Effect
Error	383.6688	12.78896	30			
Total	1035.235		39			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	29.29	21.67	0.0006	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.889	0.9236	0.0009	Non-normal Distribution

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	10-0202-7849	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 15:43	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Mean Dry Weight-mg Summary

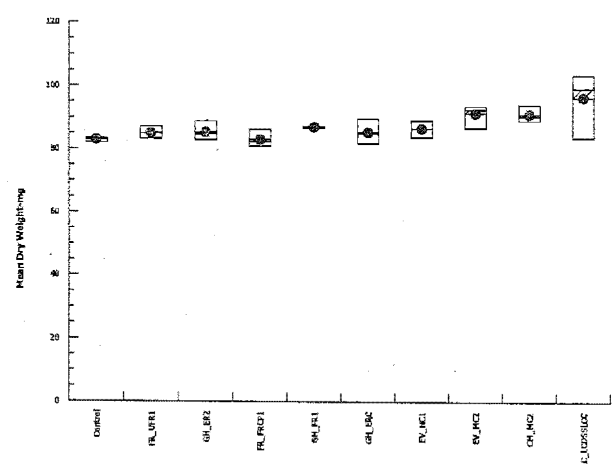
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	82.83	81.67	84	83.01	81.85	83.45	0.3664	0.88%	0.0%
FR_UFR1	4	84.98	81.66	88.29	84.81	83.08	87.2	1.041	2.45%	-2.59%
GH_ER2	4	85.21	81.08	89.34	84.62	82.76	88.85	1.299	3.05%	-2.87%
FR_FRCP1	4	82.83	78.85	86.8	82.22	80.71	86.15	1.249	3.02%	0.0%
GH_FR1	4	86.83	86.36	87.3	86.83	86.5	87.14	0.1478	0.34%	-4.82%
GH_ERC	4	85.17	79.53	90.8	84.71	81.6	89.64	1.771	4.16%	-2.82%
EV_HC1	4	86.33	82.67	89.99	86.35	83.53	89.09	1.151	2.67%	-4.22%
EV_MC2	4	91.2	86.16	96.25	92.4	86.54	93.48	1.584	3.47%	-10.11%
CM_MC2	4	90.89	87.47	94.3	90.38	88.89	93.89	1.073	2.36%	-9.73%
LC_LCDSSLCC	4	96.21	82.2	110.2	99	83.5	103.3	4.4	9.15%	-16.15%

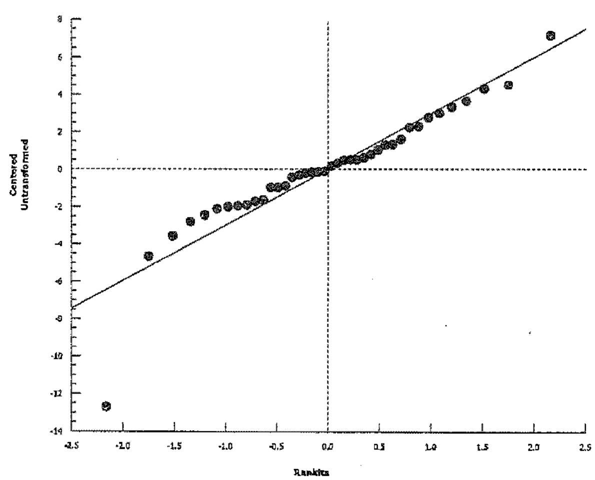
Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	81.85	82.69	83.45	83.33
FR_UFR1	87.2	86.3	83.33	83.08
GH_ER2	88.85	82.76	84.23	85
FR_FRCP1	83.33	81.11	86.15	80.71
GH_FR1	86.5	87	87.14	86.67
GH_ERC	81.6	83.21	89.64	86.21
EV_HC1	85.88	86.82	83.53	89.09
EV_MC2	93.48	86.54	92	92.8
CM_MC2	88.89	93.89	90	90.77
LC_LCDSSLCC	83.5	97.5	103.3	100.5

FR_UFR1 and GH_ER2 are reference sites.

Graphics





CETIS Analytical Report

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	17-3687-5828	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 15:45	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes
Batch ID:	03-3988-2984	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

FR_UFR1 and GH_ER2 are reference sites

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	6.08%	

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	18	NA	0	6	0.5571	Exact	Non-Significant Effect
		FR_FRCP1	13.5	NA	1	6	0.1143	Exact	Non-Significant Effect
		GH_FR1	22	NA	0	6	0.9000	Exact	Non-Significant Effect
		GH_ERC	17	NA	0	6	0.4429	Exact	Non-Significant Effect
		EV_HC1	21	NA	0	6	0.8286	Exact	Non-Significant Effect
		EV_MC2	25	NA	0	6	0.9857	Exact	Non-Significant Effect
		CM_MC2	26	NA	0	6	1.0000	Exact	Non-Significant Effect
		LC_LCDSSLCC	24	NA	0	6	0.9714	Exact	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	564.9202	70.61502	8	4.99	0.0007	Significant Effect
Error	382.0574	14.15028	27			
Total	946.9776		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	23.23	20.09	0.0031	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8999	0.9166	0.0034	Non-normal Distribution

Salmonid Embryo-Alevin-~~Fry~~ Survival Development and Growth Test **Nautilus Environmental**

Analysis ID:	17-3687-5828	**Endpoint:**	Mean ~~Dry~~ wet Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 15:45	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Mean ~~Dry~~ wet Weight-mg Summary

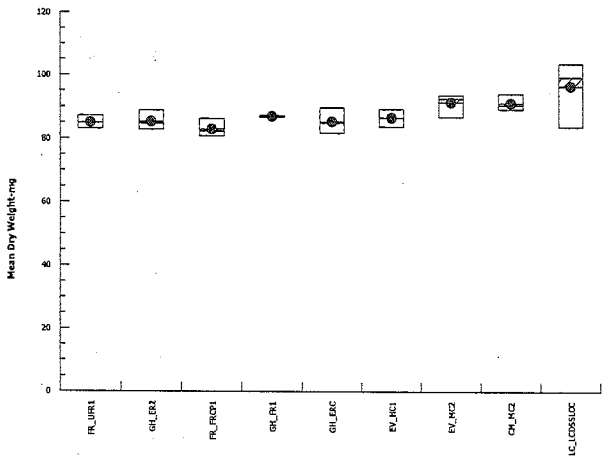
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	84.98	81.66	88.29	84.81	83.08	87.2	1.041	2.45%	0.0%
GH_ER2	4	85.21	81.08	89.34	84.62	82.76	88.85	1.299	3.05%	-0.27%
FR_FRCP1	4	82.83	78.85	86.8	82.22	80.71	86.15	1.249	3.02%	2.53%
GH_FR1	4	86.83	86.36	87.3	86.83	86.5	87.14	0.1478	0.34%	-2.18%
GH_ERC	4	85.17	79.53	90.8	84.71	81.6	89.64	1.771	4.16%	-0.22%
EV_HC1	4	86.33	82.67	89.99	86.35	83.53	89.09	1.151	2.67%	-1.59%
EV_MC2	4	91.2	86.16	96.25	92.4	86.54	93.48	1.584	3.47%	-7.33%
CM_MC2	4	90.89	87.47	94.3	90.38	88.89	93.89	1.073	2.36%	-6.96%
LC_LCDSSLCC	4	96.21	82.2	110.2	99	83.5	103.3	4.4	9.15%	-13.22%

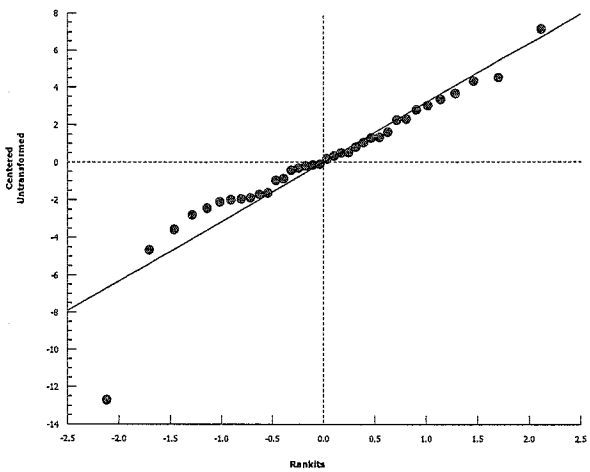
Mean ~~Dry~~ wet Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	87.2	86.3	83.33	83.08
GH_ER2	88.85	82.76	84.23	85
FR_FRCP1	83.33	81.11	86.15	80.71
GH_FR1	86.5	87	87.14	86.67
GH_ERC	81.6	83.21	89.64	86.21
EV_HC1	85.88	86.82	83.53	89.09
EV_MC2	93.48	86.54	92	92.8
CM_MC2	88.89	93.89	90	90.77
LC_LCDSSLCC	83.5	97.5	103.3	100.5

FR_UFR1 and GH_ER2 are reference sites

Graphics





CETIS Analytical Report

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	19-1698-2260	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 15:49	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes
Batch ID:	03-3988-2984	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		
FR_FRCP1	11-3445-7212	17 Oct-16 11:38	18 Oct-16 09:00	30h (3.8 °C)		
GH_FR1	08-3525-1758	17 Oct-16	18 Oct-16 09:00	42h (5 °C)		
GH_ERC	20-7388-0844	17 Oct-16	18 Oct-16 09:00	42h (6 °C)		
EV_HC1	14-4341-5487	17 Oct-16 10:45	18 Oct-16 09:00	31h (5 °C)		
EV_MC2	20-4287-7806	17 Oct-16 12:45	18 Oct-16 09:00	29h (5.8 °C)		
CM_MC2	14-4751-8514	17 Oct-16	18 Oct-16 09:00	42h (4 °C)		
LC_LCDSSLCC	12-2957-4836	17 Oct-16	18 Oct-16 09:00	42h (3.5 °C)		

FR_UFR1 and GH_ER2 are reference sites

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		
FR_FRCP1	Water Sample	Teck Coal	FR_FRCP1_Q_03102016_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-17_N		
GH_ERC	Water Sample	Teck Coal	GH_ERC_WS_2016-10-17_N		
EV_HC1	Water Sample	Teck Coal	EV_HC1_WS_2016-10-17_N		
EV_MC2	Water Sample	Teck Coal	EV_MC2_WS_2016-10-17_N		
CM_MC2	Water Sample	Teck Coal	CM_MC2_WS_20161017_N		
LC_LCDSSLCC	Water Sample	Teck Coal	LC_LCDSSLCC_WS_2016-10-17		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	6.07%	

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
GH_ER2		FR_UFR1	18	NA	0	6	0.5571	Exact	Non-Significant Effect
		FR_FRCP1	14	NA	0	6	0.1714	Exact	Non-Significant Effect
		GH_FR1	22	NA	0	6	0.9000	Exact	Non-Significant Effect
		GH_ERC	18	NA	0	6	0.5571	Exact	Non-Significant Effect
		EV_HC1	21	NA	0	6	0.8286	Exact	Non-Significant Effect
		EV_MC2	25	NA	0	6	0.9857	Exact	Non-Significant Effect
		CM_MC2	26	NA	0	6	1.0000	Exact	Non-Significant Effect
		LC_LCDSSLCC	23	NA	0	6	0.9429	Exact	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	564.9202	70.61502	8	4.99	0.0007	Significant Effect
Error	382.0574	14.15028	27			
Total	946.9776		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	23.23	20.09	0.0031	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8999	0.9166	0.0034	Non-normal Distribution

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	19-1698-2260	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 15:49	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Mean Dry Weight-mg Summary

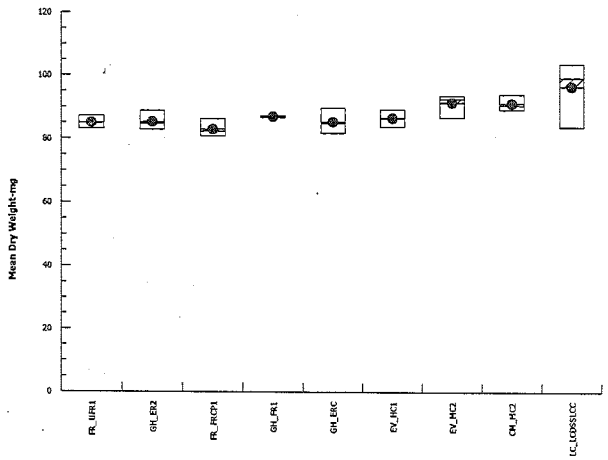
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	84.98	81.66	88.29	84.81	83.08	87.2	1.041	2.45%	0.0%
GH_ER2	4	85.21	81.08	89.34	84.62	82.76	88.85	1.299	3.05%	-0.27%
FR_FRCP1	4	82.83	78.85	86.8	82.22	80.71	86.15	1.249	3.02%	2.53%
GH_FR1	4	86.83	86.36	87.3	86.83	86.5	87.14	0.1478	0.34%	-2.18%
GH_ERC	4	85.17	79.53	90.8	84.71	81.6	89.64	1.771	4.16%	-0.22%
EV_HC1	4	86.33	82.67	89.99	86.35	83.53	89.09	1.151	2.67%	-1.59%
EV_MC2	4	91.2	86.16	96.25	92.4	86.54	93.48	1.584	3.47%	-7.33%
CM_MC2	4	90.89	87.47	94.3	90.38	88.89	93.89	1.073	2.36%	-6.96%
LC_LCDSSLCC	4	96.21	82.2	110.2	99	83.5	103.3	4.4	9.15%	-13.22%

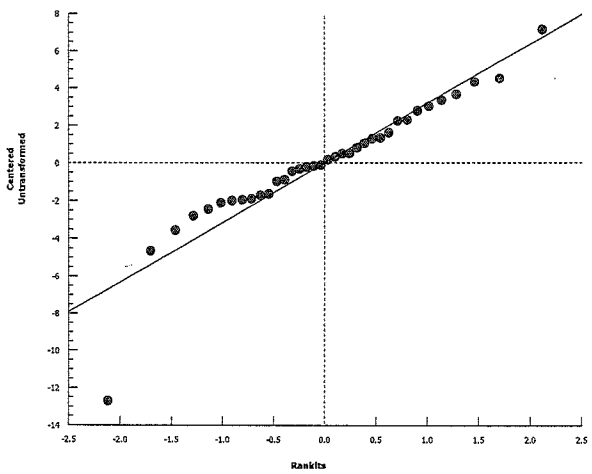
Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	87.2	86.3	83.33	83.08
GH_ER2	88.85	82.76	84.23	85
FR_FRCP1	83.33	81.11	86.15	80.71
GH_FR1	86.5	87	87.14	86.67
GH_ERC	81.6	83.21	89.64	86.21
EV_HC1	85.88	86.82	83.53	89.09
EV_MC2	93.48	86.54	92	92.8
CM_MC2	88.89	93.89	90	90.77
LC_LCDSSLCC	83.5	97.5	103.3	100.5

FR_UFR1 and GH_ER2 are reference sites

Graphics





CETIS Analytical Report

Test Code: 161121b | 09-0398-3065

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	18-9762-7776	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 15:51	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes
Batch ID:	03-3988-2984	**Test Type:**	Survival-Development-Growth	**Analyst:**	Kania Lywe
Start Date:	18 Oct-16 17:35	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	17 Nov-16 13:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	29d 19h	**Source:**	Vancouver Island Trout Hatchery	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
FR_UFR1	10-7516-2299	17 Oct-16 10:36	18 Oct-16 09:00	31h (3.5 °C)	Teck Coal	
GH_ER2	04-9422-6584	17 Oct-16	18 Oct-16 09:00	42h (5.5 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
FR_UFR1	Water Sample	Teck Coal	FR_UFR1_Q_03102016_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-17_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	3.81%	

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
FR_UFR1		GH_ER2	-0.1396	1.943	3.234	6	0.5532	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1078786	0.1078786	1	0.01948	0.8936	Non-Significant Effect
Error	33.22805	5.538009	6			
Total	33.33593		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.557	47.47	0.7248	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9269	0.6451	0.4885	Normal Distribution

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
FR_UFR1	4	84.98	81.66	88.29	84.81	83.08	87.2	1.041	2.45%	0.0%
GH_ER2	4	85.21	81.08	89.34	84.62	82.76	88.85	1.299	3.05%	-0.27%

Mean Dry Weight-mg Detail

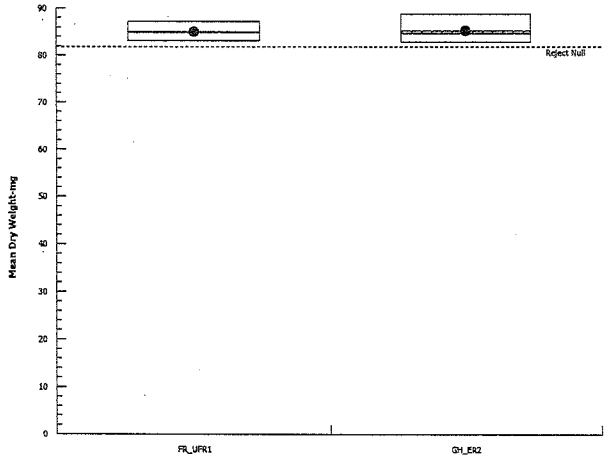
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
FR_UFR1	87.2	86.3	83.33	83.08
GH_ER2	88.85	82.76	84.23	85

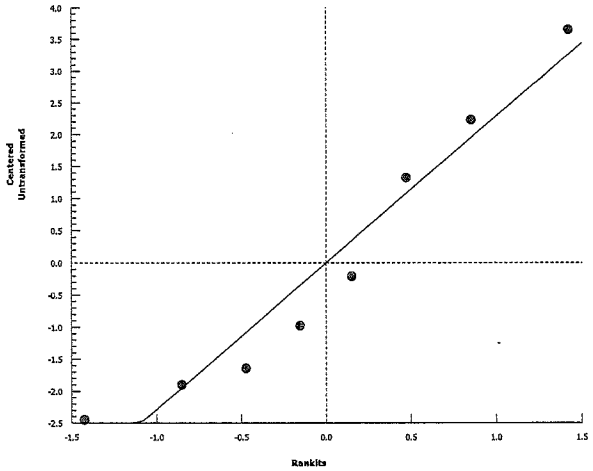
FR_UFR1 and GH_ER2 are reference sites.

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test — **Nautilus Environmental**

Analysis ID:	18-9762-7776	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	19 Dec-16 15:51	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Graphics





FR_UFR1 and GH_ER2 are reference sites.

APPENDIX F – Chain-of-Custody Forms

Teck

COC ID:	20161017-1337	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL	PRESERV.	ANALYSIS: 28 Day H. azteca Pass/Fail	7 D C. Dubia Pass/Fail	72 hr P. subcapitata Pass/Fail	30-d RBT EAPP	32-d FHM pff (Calgary)						Temp °C
② FR_FRCP1_Q_03102016_N	FR_FRCP1	WS		2016/10/17	11:38	G	5			3	1	1	X	X				5X20L		3.8
① FR_UFR1_Q_03102016_N	FR_UFR1	WS		2016/10/17	10:36	G	5			3	1	1	X	X				5X20L	-	3.5
										wo# 161117	161119	161120	161121	161118						

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	NM [signature]	2016/10/17	Nautilus NY - Nair Yamamoto	Oct 18/16 @ 9:00

NB OF BOTTLES RETURNED/DESCRIPTION	
Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	[signature]	Mobile #	250 865 5284
Sampler's Signature		Date/Time	Oct 17 2016

① sample description: clear, colourless, odourless, no particulates

② sample description: clear, colourless, odourless, some brown particulates

Teck

COC ID: 20161017-1335 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY		OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual	Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson	Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com	Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address		Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number		
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country				
Phone Number	1-250-865-5289			Phone Number	403-253-7121					

SAMPLE DETAILS | **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Week 1

1617-0245

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont	FIL	PRESERV	ANALYSIS: 30 Day Fathead Minnow										
FR_FRCP1_Q_03102016_N	FR_FRCP1	WS		2016/10/17	11:38	G	7			7										
FR_UFR1_Q_03102016_N 1617-0246	FR_UFR1	WS		2016/10/17	10:36	G	7			7										

2016/10/18
1130
Good Condition
14 + 20 Lcarbons
Bears paw
no S/I
D&C MC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	[illegible]	2016/10/17		

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	[illegible]	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	Oct 17 2016.
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	Oct 13 Q4 Tox Week 1	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commence Court				Yes PDF	Yes	Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS / ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, F/P)

	Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	#N/A 96 hr Rainbow trout (pass/fail)	#N/A 48 hr daphnia (pass/fial)	#N/A 48 hr daphnia @ 10 deg C (pass/fial)	#N/A 7 day C dubia pif	#N/A 7day embryo (pass Fail)	#N/A 72 hr P Subcapitata pif	#N/A 30 day RT early life stage pif	#N/A 28 day H azteca pif	#N/A 32-d FHM pif (calcein)	#N/A	#N/A	#N/A	
①	GH_FR1_WS_2016-10-17_N	GH_FR1	WS	N	17-Oct-16		G	5					X		X	X	X	X			5.0	5x2c
①	GH_ERC_WS_2016-10-17_N	GH_ERC	WS	N	17-Oct-16		G	4					X		X	X					6.0	4x2c
②	GH_ER2_WS_2016-10-17_N	GH_ER2	WS	N	17-Oct-16		G	7					X	X	X	X					5.5	7x2c
													161119	161126	161120	161121	161117	161118				
													WOH									

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
				Nautilus	Oct 18/16	09:00
				NY - Nan Yamamoto		

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X	Sampler's Name		Mobile #	
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

① sample description: clear, colourless, odourless, no particulates

② clear, colourless, odourless, no particulates.

Chain Of Custody Record

COC ID: Q4 tox week 1 | Page: 1 of 1

Turnaround Time: **Rush:**

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Greenhills Operation	Lab Name	HydroQual Laboratories Ltd.	Send Invoice To	
Project Number		Contact Name	Jacklyn Pool	Address	
Contact Name	Leigh Stickney	Address	#4, 6125 - 12th Street S.E		
Address	P.O. BOX 5000			City	State
		City	Calgary State AB	Postal Code	Country
City	Elkford State BC	Postal Code	T2H2K1 Country Canada	Task Code	
Postal Code	V0B1H0 Country Canada	Phone Number	403.253.7121	Shipping Company	
Phone Number	250-865-3274	Email Address		Tracking Number	
Email EDD To	Leigh.Stickney@Teck.com	Quote Number		CC Hardcopy To	
Email Report To	Leigh.Stickney@Teck.com			CC Hardcopy To	

SAMPLE DETAILS / **ANALYSIS REQUESTED** / **ADDITIONAL INFORMATION**

Week 1

1617-0217

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 d early life stage, fathead minnow Pass/Fail	28 d Hyallella	72 h P. subcapitata	7 d C. dubia	96 hr Rainbow trout pass/fail	48 hr Daphnia pass/Fail	Additional Information
GH_FR1_WS_2016-10-17_N	WS	17-Oct-16	10:20	G	7		X						Initial - PASS/FAIL

2016/10/18
1130
Good Condition
7 x 20L Carboys
Bearspaw Carrier
70S/7
12°
MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
	Jevin Wolchuk	Oct 17/16	10:45					Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
							Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name | **Mobile #**

Sampler's Signature | **Date/Time**

Teck

COC ID: **20161017** | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Elkview Operations			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Job Description	SA Chronic Toxicity Sampling			Lab Contact	Krysta Peracy			Email 1:	Michael.Moore@teck.com	X	X	X
Project Manager	Michael Moore			Email	krysta@nautilusenvironmental.ca			Email 2:	teckcoal@equisonline.com			X
Email	Michael.Moore@teck.com			Address	8664 Commerce Court			Email 3:	James.Boldt@teck.com	X	X	X
Address	RR#1 HWY# 3				Imperial Square, Lake City			Email 4:	Cameron.Griffin@teck.com	X	X	X
								Email 5:				
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number	432106			
Postal Code	V1C 4C3	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number								

SAMPLE DETAILS | ANALYSIS REQUESTED (Filtered - F, Field, L, Lab, FL, Field & Lab, N, None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-day rainbow trout early life stage P/F	72h P.subcapitata P/F	7d C.dupia P/F	96 hr rainbow trout Pass/Fail	48 hr Daphnia Pass/Fail					Temp °C	
(2) EV_HC1_WS_2016-10-17_N	EV_HC1	WS	N	10/17/2016	10:45	G	4		x	x	x							5.0	4X2L
(2) EV_MC2_WS_2016-10-17_N	EV_MC2	WS	N	10/17/2016	12:05	G	4		x	x	x							5.8	4X20
(1) EV_AQ1_WS_2016-10-17_N	EV_AQ1	WS	N	10/17/2016	13:30	G	3		161121	161120	161119	161127 #1	161128 #2					6.0	1x20 2x1L
					Total		8												

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
72h P.subcapitata P/F 7d C.dupia P/F 30d rainbow trout early life stage P/F 96 hr Rainbow Trout P/F 48 hr Daphnia P/F			Nautilus NY - Nair Yamamoto	Oct 18/16 @ 09:02

Regular (default) X	Sampler's Name	Cam Griffin	Mobile #
Priority (2-3 business days) - 50% surcharge			
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time 17 Oct 30.0
For Emergency <1 Day, ASAP or Weekend - Contact ALS			

(1) Sample Description : light yellow, clear, odourless, no particulates.

(2) sample description: clear, colourless, odourless, no particulates

Chain Of Custody Record

COC ID: 20160823-0823 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO					LABORATORY					OTHER INFO				
Facility Name	Coal Mountain Operation				Lab Name	Nautilus Environmental				Send Invoice To				
Contact Name	Carla Romero				Contact Name	Krysta Pearcy				Address				
Address	2261 Corbin Rd.				Address	8664 commerce Court								
City	Sparwood	Prov.	BC							City			State	
Postal Code	V0B 2G0	Country	Canada		City	Burnaby	State	BC		Postal Code		Country		
Phone Number	250 425 7350				Postal Code	V5A 4N7	Country	Canada		Task Code				
Email EDD To	Rick.Magliocco@teck.com				Phone Number	604-420-8773				Shipping Company				
	Don.Sacino@teck.com				Email Address	krysta@nautilusenvironmental.ca				Tracking Number				
	Carla.Romero@teck.com				PO Number					CC Hardcopy To				
										CC Hardcopy To				

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
					PRESERV.											
					ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	~~28-d Hyalella P/F~~	30 d rainbow trout early life stage P/F	32-d FHM plf (Calgary)			
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20161017_N	WS	October 17 2016		G	5			X	X	X	X	X	X			Week 1
								wo# 161119	161120	161117		161121	161118			

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions				
sample description: clear, colourless, odourless, no particulates				Nautilus	Oct 18/16	09:00	4.0	Y / N	Y / N	Y / N	
				NY - Nair Yamamoto		5x20L		Y / N	Y / N	Y / N	
3 coolers								Y / N	Y / N	Y / N	

Sampler's Name	Don Sacino	Mobile #		Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Signature		Date/Time	October 17 2016 14:00				

Chain Of Custody Record

COC ID: 20160823-0823 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com			Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
	Week 1					PRESERV.										
1617 0248						ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	28 d Hyallella P/F	30 d rainbow trout early life stage P/F			
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20161017_N	WS	October 17 2016	10:25	G	5				X	X	X	X	X			Week 1
					#NAME?											
2016/10/18																
1130																
5 x 20 L Carboys																
Good Condition					#NAME?											
Bearspaw																
NO S/I	12°C				#NAME?											
MC					#NAME?											
					#NAME?											

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time

Sample Receipt Conditions			
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name	Don Sacino	Mobile #		
Sampler's Signature		Date/Time	October 17 2016 14:00	

Teck

COC ID: 20161017-1435 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Line Creek Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	
Email	jay.jones@teck.com			Email	Krysta@NautilusEnvironmental.ca			Email 2:	tim.chala@teck.com	x	x	
Address	Box 2003			Address	8664 commerce Court			Email 3:	teckcoal@equisonline.com	x	x	x
	15km North Hwy 43							Email 4:	cait.good@teck.com	x	x	
City	Sparwood	Province	BC	City	Burnaby	Province	BC					
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	PO number	432106			
Phone Number	250-425-6111			Phone Number	604-420-8773							

SAMPLE DETAILS — **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: Non)

	Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Filt.	PRESERV.	ANALYSIS: 72h P. subcapitata P/F	7d C.dubia P/F	30 d rainbow trout early life stage P/F	7 d Cdubia dilution series	72hr Psubcapitata dilution series	7d L minor plant growth dilution series	7 d O mykis development dilution series				Temp °C
(2)	LC_LCDSSLCC_WS_2016-10-17_N	LC_LCDSSLCC	WS	N	2016/10/17		G	9			X	X	X	X	X	X	X		9 x20L		3.5
(3)	LC_LC5_WS_2016-10-17_N	LC_LC5	WS	N	2016/10/17		G	6						X	X	X	X		6x20L		4.5
(1)	~~LC_SPDC_WS_2016-10-17_N~~	~~LC_SPDC~~	~~WS~~	~~N~~	~~2016/10/17~~		~~G~~	~~6~~						~~X~~	~~X~~	~~X~~	~~X~~				
(4)	LC_FRDSDC_WS_2016-10-17_N	LC_FRDSDC	WS	N	2016/10/17		G	6						X	X	X	X		6x20L		3.5
(5)	LC_DC1_WS_2016-10-17_N	LC_DC1	WS	N	2016/10/17		G	6			161120	161119	161121	X	X	X	X		6x20L		2.5
													wo#	161122	161123	161124	161125				

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	T Phillips/ NUPQU	October 17, 2016	Nautilus BY - Nan Yamamoto	Oct 18/16 @ 09:00

NB OF BOTTLES RETURNED/DESCRIPTION	
Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Tyler Phillips	Mobile #	(250) 919-0965
Sampler's Signature		Date/Time	October 17, 2016

(1) KLP contacted Cait Good who said do not test this sample. They will collect the correct sample today and ship for arrival tomorrow, Oct 19/16. KLP discarded the sample. (LC_DC05)

Sample designation: (2) clear, colourless, odourless, no particulates
(3) clear, colourless, odourless, no particulates
(4) clear, colourless, odourless, no particulates &
(5) ~~clear, colourless, odourless, no particulates~~ particulates.

Teck

COC ID:	20161025-1258	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name /Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Filt.	PRESERV.	ANALYSIS: 28 Day H. azteca Pass/Fail	32d FHM P/F (Calgary)	30d Rbt EA P/F								Temp °C
FR_FRCP1_QR_10102016_N	FR_FRCP1	WS		2016/10/25	11:30	G	4			4	x	x							3x20L	6.0
FR_UFR1_QR_10102016_N	FR_UFR1	WS		2016/10/25	10:19	G	4			4	x	x							3x20L	5.0
										wo# 161117	161118	161121								

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	N Mato Deato.	2016/10/25	Nautilus - Burnaby	Oct 26/16 @ 08:44
			NY - Nan Yamamoto.	= refresh sample =

NB OF BOTTLES RETURNED/DESCRIPTION	
Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	[illegible]	Mobile #	250 865 5204
Sampler's Signature	[signature]	Date/Time	OCT 25 2016

Teck

COC ID:	20161025-1255	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country						
Phone Number	1-250-865-5289			Phone Number	403-253-7121							

SAMPLE DETAILS								ANALYSIS REQUESTED (Filtered - F; Field, L; Lab, FL; Field & Lab, N; None)													
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL / PRESERV / ANALYSIS: 30 Day Fathead Minnow													
FR_FRCP1_QR_10102016_N	FR_FRCP1	WS		2016/10/25	11:30	G	6	6													
FR_UFR1_QR_10102016_N	FR_UFR1	WS		2016/10/25	10:19	G	6	6													

1617.0245 Week 2

1617.0246

2016/10/26 1145
12 x 20 L Cubbys
nos 15 Beaspaw
Good Condition
12°C MC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	[signature]	2016/10/25		

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	[signature]	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	[signature]	Date/Time	Oct 25 2016
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	Oct 25 Q4 Tox Week 1	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:	
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site: leigh.stickney@teck.com	EQuIS: GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution	
Address	PO Box 5000			Address	8664 Commence Court			Yes PDF	Yes Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com
Phone Number	250 865 3274			Phone Number				PO number	359182

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Please indicate below Filtered, Perserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	#N/A 96 hr Rainbow trout (pass/fail)	#N/A 48 hr daphnia (pass/fial)	#N/A 48 hr daphnia @ 10 deg C (pass/fial)	#N/A 7d C.dubia NO3/SO4	#N/A 39 d rainbow trout early life stage NO3/SO4	#N/A 72 hr P Subcapitata	#N/A 30 day rainbow trout early life stage P/F	#N/A 28 day H azteca	#N/A 28 Day Hyallella P/F	#N/A 32 d FHM P/F (Calgary)	#N/A	#N/A Temp °C	
① GH_FR1_WS_2016-10-25_N	GH_FR1	WS	N	25-Oct-16	10:30	G	4				X	X		X		X	X		4.2	4x200l
GH_ERC_WS_2016-10-25_N	GH_ERC	WS	N	25-Oct-16	13:15	G	3							X					4.2	3x20L
② GH_ER2_WS_2016-10-25_N	GH_ER2	WS	N	25-Oct-16	12:00	G	2				X	X		X					4.2	2x200
										wo #	161182	161183		161121		161117	161118			
														Refresh		Refresh	Refresh			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

① Clear, colourless, odourless, some particulates

RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
Jevin Wolchuk	Oct. 25/16	14:00	Nautilus - Burnaby	Oct 26/16	08:44
			NY - Nan Yamamoto		
			EC - Eric Cheung		

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jevin Wolchuk	Mobile #	250.485.5316
Sampler's Signature		Date/Time	Oct. 25/16 13:15

Teck

COC ID:	Oct 25 Q4 Tox Week 1	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Hydroqual Laboratories Ltd			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Jacklyn Pool			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	#4, 6125 - 12th Street S.E.				*Yes* PDF	*Yes*	Excel
								Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Calgary	Province	AB	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	T2H 2K1	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number	403.253.7121			PO number			

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Please indicate below Filtered, Perserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	#N/A 96 hr Rainbow trout (pass/fail)	#N/A 48 hr daphnia (pass/fial)	#N/A 48 hr daphnia @ 10 deg C (pass/fial)	#N/A 7d C.dubia NO3/SO4	#N/A 39 d rainbow trout early life stage NO3/SO4	#N/A 72 hr P Subcapitata	#N/A 30 day rainbow trout early life stage P/F	#N/A 28 day H azteca	#N/A 28 Day Hyallella P/F	#N/A 30 d early life stage, fathead minnow Pass/Fail	#N/A	#N/A
GH_FR1_WS_2016-10-25_N	GH_FR1	WS	N	25-Oct-16		G	4											X		
GH_ER2_WS_2016-10-25_N	GH_ER2	WS	N	25-Oct-16	13:00	G	4											X		

Week 2
1617-0247
1617-0317
2016/10/26 1145
6 x 2 L Cubboys
2 x 50 Gal drums
no S/I 10°c
Bears paw
mc

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Jevin Wolchuk	Oct. 25/16	12:30			

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jevin Wolchuk	Mobile #	250.425.5310
Sampler's Signature	Jevin Wolchuk	Date/Time	Oct. 25/16 12:30

Teck

COC ID:	20161025N	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Elkview Operations			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Job Description	SA Chronic Toxicity Sampling			Lab Contact	Krysta Peracy			Email 1:	Michael.Moore@teck.com	X	X	X
Project Manager	Michael Moore			Email	krysta@nautilusenvironmental.ca			Email 2:	teckcoal@equisonline.com			X
Email	Michael.Moore@teck.com			Address	8664 Commerce Court			Email 3:	James.Boldt@teck.com	X	X	X
Address	RR#1 HWY# 3				Imperial Square, Lake City			Email 4:	Cameron.Griffin@teck.com	X	X	X
								Email 5:				
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number	432106			
Postal Code	V1C 4C3	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number								

SAMPLE DETAILS								ANALYSIS REQUESTED										Filtered - F: Field, L: Lab, FL: Field & Lab, N: None
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-day rainbow trout early life stage P/F CARBOYS									Temp °C
EV_HC1_WS_2016-10-25_N	EV_HC1	WS	N	10/25/2016	10:45	G	3		3									6.0 3x20L
EV_MC2_WS_2016-10-25_N	EV_MC2	WS	N	10/25/2016	11:05	G	3		3									6.0 3x20L
									WO # 161121									
					Total		6											

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
30d rainbow trout early life stage P/F			Nautilus - Burnaby	Oct 26/16 @ 08:44
			NY - Nai Yamamoto	- upon sample -

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Cam Griffin	Mobile #	
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	25 OCT - 16
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Chain Of Custody Record

COC ID: 20161025-1025 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO					LABORATORY					OTHER INFO			
Facility Name	Coal Mountain Operation				Lab Name	Nautilus Environmental				Send Invoice To			
Contact Name	Carla Romero				Contact Name	Krysta Pearcy				Address			
Address	2261 Corbin Rd.				Address	8664 commerce Court							
City	Sparwood	Prov.	BC							City		State	
Postal Code	V0B 2G0	Country	Canada		City	Burnaby	State	BC		Postal Code		Country	
Phone Number	250 425 7350				Postal Code	V5A 4N7	Country	Canada		Task Code			
Email EDD To	Rick.Magliocco@teck.com				Phone Number	604-420-8773				Shipping Company			
	Don.Sacino@teck.com				Email Address	krysta@nautilusenvironmental.ca				Tracking Number			
	Carla.Romero@teck.com				PO Number					CC Hardcopy To			
										CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS		7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	28 d Hyallella P/F	30 d rainbow trout early life stage P/F	32d FHM P/F (Calgary)		Temp °C	
CM_MC2_WS_20161025_N	WS	Oct 25 2016	11:35	G	4						X	X	X		5.3	4x20L - Refresh
											WO# 161117	161121	161118			

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
				Nautilus - Burnaby	Oct 26/16	08:44		Y / N	Y / N	Y / N
				NY - Nan Yamamoto				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

						Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Don Sacino	Mobile #							
Sampler's Signature		Date/Time	October 25 2016 14:00						

Chain Of Custody Record

COC ID: 20161025-1025 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name	Coal Mountain Operation			Lab Name	Hydroqual Laboratories			Send Invoice To	
Contact Name	Carla Romero			Contact Name	Jacklyn Pool			Address	
Address	2261 Corbin Rd.			Address	#4, 6125-12th Street S.E.				
City	Sparwood	Prov.	BC					City	State
Postal Code	V0B 2G0	Country	Canada	City	Calgary	State	AB	Postal Code	Country
Phone Number	250 425 7350			Postal Code	T2H 2K1	Country	Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com			Phone Number	403-253-7121			Shipping Company	
	Don.Sacino@teck.com			Email Address				Tracking Number	
	Carla.Romero@teck.com			PO Number				CC Hardcopy To	
								CC Hardcopy To	

1617-0248 week 2

SAMPLE DETAILS						ANALYSIS REQUESTED									ADDITIONAL INFORMATION
						PRESERV									
						ANALYSIS	30 day early life stage fathead minnow P/F								
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.										
CM_MC2_WS_20161025_N	WS	Oct 25 2016	11:55	G	6		X								Refresh
		2016/10/20													
		1145 6×20 Leashags													
		no S/I													
		12°C Good Condition													
		Bears PAW													
		MC													

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time

Sample Receipt Conditions				
	Y / N	Y / N	Y / N	
	Y / N	Y / N	Y / N	
	Y / N	Y / N	Y / N	
	Y / N	Y / N	Y / N	
Temp in °C	Samples on ice?	Sample intact?	Trip Blank?	

Sampler's Name	Don Sacino		Mobile #		
Sampler's Signature			Date/Time	October 25 2016	

Teck

COC ID: 20161025-1435 | **TURNAROUND TIME:** | **RUSH:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Line Creek Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	
Email	jay.jones@teck.com			Email	Krysta@NautilusEnvironmental.ca			Email 2:	tim.chala@teck.com	x	x	
Address	Box 2003			Address	8664 commerce Court			Email 3:	teckcoal@equisonline.com	x	x	x
	15km North Hwy 43							Email 4:	cait.good@teck.com			
City	Sparwood	Province	BC	City	Burnaby	Province	BC					
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	PO number	432106			
Phone Number	250-425-6111			Phone Number	604-420-8773							

SAMPLE DETAILS | **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL	PRESERV.	ANALYSIS: 72h P. subcapitata P/F	7d C.dubia P/F	30 d rainbow trout early life stage P/F	7 d Cdubia dilution series	72hr Psubcapitata dilution series	7d L minor plant growth dilution series	7 d O mykis development dilution series					Temp °C
LC_LCDSSLCC_WS_2016-10-25_N	LC_LCDSSLCC	WS	N	2016/10/25	12:35	G	3					X							3x20L		4.8
											WO # 161121										

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	T Phillips/ NUPQU	October 25, 2016	Nautilus - Burnaby	Oct 26/16 @08:44
			NY - Nan Yamamoto	= refresh sample

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Tyler Phillips	Mobile #	(250) 919-0965
Sampler's Signature		Date/Time	October 25, 2016

Teck

COC ID:	20161101-1258	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO			
Facility Name / Job#	Fording River Operation	Lab Name	Nautilus Environmental	Report Format / Distribution	Excel	PDF	EDD
Project Manager	Lee Wilm	Lab Contact		Email 1: Lee.Wilm@teck.com	x	x	x
Email		Email		Email 2: Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100	Address	8664 Commerce Court	Email 3: teckcoal@equisonline.com			x
City	Elkford, Province BC	City	Burnaby, Province BC	PO number			
Postal Code	V0B 1H0, Country Canada	Postal Code	V5A 4N7, Country Canada				
Phone Number	1-250-865-5289	Phone Number	604-420-8773				

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	28 Day H. azteca Pass/Fail	30 Day Rainbow trout embryo alevin Pass/Fail	32d FHM P/F conducted in Calgary.		T(°C)
FR_FRCP1_QR_17102016_N	FR_FRCP1	WS		2016/11/01	10:57	G	1	1		X	1x20L	6.2
FR_UFR1_QR_17102016_N	FR_UFR1	WS		2016/11/01	09:44	G	1	1		X	1x20L	5.8
FR_FRCP1_SA_17102016_N	FR_FRCP1	WS		2016/11/01	10:57	G	3		3		3x20L	5.0
FR_UFR1_SA_17102016_N	FR_UFR1	WS		2016/11/01	09:44	G	3		3		3x20L	6.7
							WO #	161117	161121	161118	= Refresh sample =	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	N MacDonald	2016/11/01		

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default) X	Sampler's Name	N MacDonald	Mobile #	250 865 5204
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature	[signature]	Date/Time	Nov 01 2016
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

rec'd Nov 2/16 @ 1030 BTL

Nautilus - Burnaby

Teck

COC ID:	20161101-1254	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1: Lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2: Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3: teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number			
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country					
Phone Number	1-250-865-5289			Phone Number	403-253-7121						

SAMPLE DETAILS								ANALYSIS REQUESTED											Filtered - F: Field, L: Lab, FL: Field & Lab, N: None
								FIL											
								PRESERV											
1617-0245	Week 3							ANALYSIS											
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30 Day Fathead Minnow											
FR_FRCP1_QR_17102016_N	FR_FRCP1	WS		2016/11/01	10:57	G	6	6											
FR_UFR1_QR_17102016_N	FR_UFR1	WS		2016/11/01	09:44	G	6	6											
1617-0246																			
	2016/11/02	1130																	
	Good Condition																		
	no SII	12 x 20 L carboys																	
	Bags	pw																	
	12°C	MC																	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	[signature]	2016/11/01		

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default)	X	Sampler's Name	[signature]	Mobile # 250 865 5204
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	[signature]	Date/Time Nov 1 2016
Emergency (1 Business Day) - 100% surcharge				
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Teck

Page 1 of

COC ID:	Nov 1 Q4 Tox Week 3	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commence Court			Yes	PDF	Yes	Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wojchuk@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS / ANALYSIS REQUESTED (Please indicate below Filtered, Perserved or both (F, P, F/P))

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	96 hr Rainbow trout (pass/fail) #N/A	48 hr daphnia (pass/fial) #N/A	48 hr daphnia @ 10 deg C (pass/fial) #N/A	7d C.dubia NO3/SO4 #N/A	39 d rainbow trout early life stage NO3/SO4 #N/A	72 hr P Subcapitata #N/A	30 day rainbow trout early life stage P/F #N/A	28 day H azteca #N/A	28 Day Hyallella P/F #N/A	32d FHM P/F (conducted in Calgary) #N/A	#N/A	#N/A	
① GH_FR1_WS_2016-11-01_N	GH_FR1	WS	N	1-Nov-16	10:00	G	4					X		X		X	X	4x200L		6.0
GH_ERC_WS_2016-11-01_N	GH_ERC	WS	N	1-Nov-16	12:45	G	3							X				3x20L		5.4
① GH_ER2_WS_2016-11-01_N	GH_ER2	WS	N	1-Nov-16	11:45	G	4					X		X				3x20L +1x200L		7.0
											WO#	161183		161121		161117	161118			

TEC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
① clear, colourless, no odourless, some particulates	Jevin Wojchuk	Nov 1/16	13:15			

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name		Mobile #	
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Nautilus - Burnaby
rec'd Nov 2/16 @ 1030h
8°C
- no leaks, [illegible]

Teck

COC ID:	Nov 1 Q4 Tox Week 3	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Hydroqual Laboratories Ltd			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Jacklyn Pool			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	#4, 6125 - 12th Street S.E.				Yes PDF	Yes	Excel
								Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Calgary	Province	AB	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	T2H 2K1	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number	403.253.7121			PO number			

SAMPLE DETAILS

ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
									96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7d C.dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H azteca	28 Day Hyallella P/F	30 d early life stage, fathead minnow Pass/Fail	30 d early life stage, fathead minnow SO4	
week 3 1617-0242 / 1617-0319 week 2																				
GH_FR1_WS_2016-11-01_N	GH_FR1	WS	N	1-Nov-16	10:00	G	2											X	X	
GH_ER2_WS_2016-11-01_N	GH_ER2	WS	N	1-Nov-16	11:45	G	3											X	X	
1617-0317 week 2																				
	20/6/11/02																			
	1130 Good Condition																			
	3 x 20 L Cubays																			
	2 x 55 Gal barrels																			
	Bear paw																			
	11°C NO S/I																			
	MC																			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Jevin Wolchuk	Nov 1/16	12:30			

SERVICE REQUEST (rush - subject to availability)

Regular (default) X	Sampler's Name		Mobile #		
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time		
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	20161101N	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO			
Facility Name / Job#	Elkview Operations	Lab Name	Nautilus Environmental	Report Format / Distribution	Excel	PDF	EDD
Job Description	SA Chronic Toxicity Sampling	Lab Contact	Krysta Peracy	Email 1: Michael.Moore@teck.com	X	X	X
Project Manager	Michael Moore	Email	krysta@nautilusenvironmental.ca	Email 2: teckcoal@equisonline.com			X
Email	Michael.Moore@teck.com	Address	8664 Commerce Court	Email 3: James.Boldt@teck.com	X	X	X
Address	RR#1 HWY# 3		Imperial Square, Lake City	Email 4: Cameron.Griffin@teck.com	X	X	X
				Email 5:			
City	Sparwood Province BC	City	Burnaby Province BC	PO number 418927			
Postal Code	V1C 4C3 Country Canada	Postal Code	V5A 4N7 Country Canada				
Phone Number	1-250-865-5289	Phone Number					

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-day early-stage test-rainbow trout ESP1/RM/28 P/F	39d Rbt EA NO3/SO4								
EV_HC1_WS_2016-11-01_N	EV_HC1	WS	N	11/1/2016	8:10	G	3		3								3x20L	
EV_MC2_WS_2016-11-01_N	EV_MC2	WS	N	11/1/2016	11:48	G	3		3								3x20L	
~~EV-ER4~~	~~EV-ER4~~									X							3x200L	
					Total		6											

(4°C)
5.4
6.6
7.0
WP Recd seperate COC for EV ER4

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
30 day early life stage test - rainbow trout ESP1/RM/28		WO# 161121 161183		

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default) X	Sampler's Name	Cam Griffin	Mobile #	1 Nov 2016
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature	[signature]	Date/Time	#NAME?
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Nautilus - Burnaby
Rec'd Nov 2/16 @ 1030h
BTL
= refresh sample =

Chain Of Custody Record

COC ID: 20161101-1101 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.			Address	8664 commerce Court						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com			Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com			Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
						ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	28 d Hyallella P/F	30 d rainbow trout early life stage P/F	32 d FHM P/F (conducted in Calgary)		
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20161101_N	WS	Nov 1 2016	12:00	G	4							X	X			Refresh 4x20L
											WO #	161117	161121	161118		

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
				Nautilus - Burnaby	Nov 02/16	10:30	5.0	Y / N	Y / N	Y / N
				NY - Nan Yamamoto				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

						Temp in °c	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Don Sacino / Bob Werner	Mobile #							
Sampler's Signature		Date/Time	November 1 2016 14:00						

Chain Of Custody Record

COC ID: 20161101-1101

Turnaround Time:

Page: 1 of 1

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Coal Mountain Operation	Lab Name	Hydroqual Laboratories	Send Invoice To	
Contact Name	Carla Romero	Contact Name	Jacklyn Pool	Address	
Address	2261 Corbin Rd.	Address	#4, 6125-12th Street S.E.		
City	Sparwood Prov. BC			City	State
Postal Code	V0B 2G0 Country Canada	City	Calgary State AB	Postal Code	Country
Phone Number	250 425 7350	Postal Code	T2H 2K1 Country Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com	Phone Number	403-253-7121	Shipping Company	
	Don.Sacino@teck.com	Email Address		Tracking Number	
	Carla.Romero@teck.com	PO Number		CC Hardcopy To	
				CC Hardcopy To	

1617-0848 week 3

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 day early life stage fathead minnow P/F	ADDITIONAL INFORMATION
CM_MC2_WS_20161101_N	WS	Nov 1 2016	12:00	G	6		X	ReFresh
							/	

2016/11/02 1130
Good Condition
no ST 6 x 20 L Carboys
bears paw 12°C
MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions		
							Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N

				Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Don Sacino / Bob Warner	Mobile #					
Sampler's Signature	[signature]	Date/Time	November 1 2016				

Teck

COC ID:	20161101-1435	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Line Creek Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	
Email	jay.jones@teck.com			Email	Krysta@NautilusEnvironmental.ca			Email 2:	tim.chala@teck.com	x	x	
Address	Box 2003			Address	8664 commerce Court			Email 3:	teckcoal@equisonline.com	x	x	x
	15km North Hwy 43							Email 4:	cait.good@teck.com			
City	Sparwood	Province	BC	City	Burnaby	Province	BC					
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	PO number	432106			
Phone Number	250-425-6111			Phone Number	604-420-8773							

SAMPLE DETAILS								ANALYSIS REQUESTED												Filtered - F: Field, L: Lab, FL: Field & Lab, N: None
								Filt.												
								PRESERV.												
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	72h P. subcapitata P/F	7d C.dubia P/F	30 d rainbow trout early life stage P/F	7 d Cdubia dilution series	72hr Psubcapitata dilution series	7d L minor plant growth dilution series	7 d O mykis development dilution series					TR
LC_LCDSSLCC_WS_2016-11-01_N	LC_LCDSSLCC	WS	N	2016/11/01	11:24	G	3				X							3x20L		SN
										WO# 161121										
																		refresh sample		

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	T Phillips/ NUPQU	November 1, 2016		

NB OF BOTTLES RETURNED/DESCRIPTION	
Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Tyler Phillips	Mobile #	(250) 919-0965
Sampler's Signature		Date/Time	November 1, 2016

Recd @ NOS 2/16 @ 1030 BTL
Nautilus - Burnaby

Teck

COC ID:	20161108-1303	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL.	PRESERV.	ANALYSIS: 28 Day H. azteca Pass/Fail	ANALYSIS: 30 Day Rainbow trout embryo alevin Pass/Fail	ANALYSIS: 32d FHM P/F conducted at Calgary							Temp °C
FR_FRCP1_QR_24102016_N	FR_FRCP1	WS		2016/11/08	10:40	G	1			1		x						1X20L	4.5
FR_UFR1_QR_24102016_N	FR_UFR1	WS		2016/11/08	12:19	G	1			1		x						1X20L	4.5
FR_FRCP1_SA_24102016_N	FR_FRCP1	WS		2016/11/08	10:40	G	3				3							3X20L	4.5
FR_UFR1_SA_24102016_N	FR_UFR1	WS		2016/11/08	12:19	G	3				3							3X20L	4.5

WO #: 1611117 / 1611121 / 1611118

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Dylan Begin	Nov 8.	Nautilus-Burnaby	Nov 09/16 @ 10:00
			NY - Nan Yamamoto	- Nfresh sample

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Dylan Begin	Mobile #	2508655773
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	Nov 8/16
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

Page 1 of 1

COC ID:	20161108-1301	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO

Facility Name / Job#	Fording River Operation
Project Manager	Lee Wilm
Email	
Address	PO Box 100
City	Elkford
Province	BC
Postal Code	V0B 1H0
Country	Canada
Phone Number	1-250-865-5289

LABORATORY

Lab Name	Hydroqual
Lab Contact	Elisabeth Henson
Email	elisabeth_henson@golder.com
Address	
City	
Province	
Postal Code	
Country	
Phone Number	403-253-7121

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	Lee.Wilm@teck.com	x	x	x
Email 2:	Neil.Macdonald@teck.com	x	x	x
Email 3:	teckcoal@equisonline.com			x
PO number				

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Week 4

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	30 Day Fathead Minnow
FR_FRCP1_QR_24102016_N (1617-0045)	FR_FRCP1	WS		2016/11/08	10:40	G	6	6
FR_UFR1_QR_24102016_N (1617-0046)	FR_UFR1	WS		2016/11/08	12:19	G	6	6

2016/11/09
1145
12x 20 L Carboys
no S/I 13°C
Good Condition
Becs pam
MC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Dylan Bergen	Nov 8		

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Dylan Bergen	Mobile #	250 865 5273
Sampler's Signature	[signature]	Date/Time	Nov 8/16

Teck

COC ID:	Q4 Tox Refresh Nov 8	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commence Court				*Yes* PDF	*Yes*	Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Please indicate below Filtered, Perserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	#N/A 96 hr Rainbow trout (pass/fail)	#N/A 48 hr daphnia (pass/fial)	#N/A 48 hr daphnia @ 10 deg C (pass/fial)	#N/A 7d C.dubia NO3/SO4	#N/A 39 d rainbow trout early life stage NO3/SO4	#N/A 72 hr P Subcapitata	#N/A 30 day rainbow trout early life stage P/F	#N/A 28 day H azteca	#N/A 28 Day Hyallella P/F	#N/A 32d FHM P/F conducted in Calgary	#N/A	#N/A	
① GH_FR1_WS_2016-11-08_N	GH_FR1	WS	N	8-Nov-16	08:45	G	4						X		X		X	X		6.0	4x200
GH_ERC_WS_2016-11-08_N	GH_ERC	WS	N	8-Nov-16	09:00	G	3								X					6.7	3x2
② GH_ER2_WS_2016-11-08_N	GH_ER2	WS	N	8-Nov-16	10:15	G	4						X		X					6.0 5.3	3x200 1x200
												WOH	161183		161112		161117	161118			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
① Sm clear, colourless, odourless, some particulates	Jevin Wolchuk	Nov 8/16	1030	Nautilus-Burnaby	Nov 09/16	10:00
				NY - Ken Yamamoto		
						= refresh sample =

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jevin Wolchuk	**Mobile #**	**250.425.5310**
Sampler's Signature		**Date/Time**	

Teck

COC ID:	Q4 Tox Refresh Nov 8	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Hydroqual Laboratories Ltd			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Jacklyn Pool			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	#4, 6125 - 12th Street S.E.				Yes PDF	Yes	Excel
								Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Calgary	Province	AB	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	T2H 2K1	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number	403.253.7121			PO number			

SAMPLE DETAILS

1617-0947 week 4
1617-0319 week 3

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.
GH_FR1_WS_2016-11-08_N	GH_FR1	WS	N	8-Nov-16	09:45	G	2
GH_ER2_WS_2016-11-08_N	GH_ER2	WS	N	8-Nov-16	10:15	G	3
1617-2317							
week 3	2016/11/09					✓	
	1445			Beads Pan			
	Good Condition			13°			
	10°C/I			IMC			
	3 × 5 G HDPE drums						
	2 × 20 L Coolers						

ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, F/P)

ANALYSIS	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fial)	48 hr daphnia @ 10 deg C (pass/fial)	7d C.dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H azteca	28 Day Hyallella P/F	30 d early life stage, fathead minnow Pass/Fail	30 d early life stage, fathead minnow SO4	
GH_FR1_WS_2016-11-08_N										X	X	
GH_ER2_WS_2016-11-08_N											X	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Jevin Wolchuk	Nov. 8/16	10:30			

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470
Sampler's Signature		Date/Time	

Teck

COC ID:	20161108N	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Elkview Operations			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Job Description	SA Chronic Toxicity Sampling			Lab Contact	Krysta Peracy			Email 1:	Michael.Moore@teck.com	X	X	X
Project Manager	Michael Moore			Email	krysta@nautilusenvironmental.ca			Email 2:	teckcoal@equisonline.com			X
Email	Michael.Moore@teck.com			Address	8664 Commerce Court			Email 3:	James.Boldt@teck.com	X	X	X
Address	RR#1 HWY# 3				Imperial Square, Lake City			Email 4:	Cameron.Griffin@teck.com	X	X	X
								Email 5:				
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number	418927			
Postal Code	V1C 4C3	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number								

SAMPLE DETAILS								ANALYSIS REQUESTED										Filtered - F; Field, L: Lab, FL: Field & Lab, N: None
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-day early-stage test - rainbow trout. ESP1/RM/28 P/F	Toxicity 96-h rainbow trout (Pass/Fail)	Toxicity 48-h Daphnia magna							Temp °C
EV_HC1_WS_2016-11-08_N	EV_HC1	WS	N	11/8/2016	8:05	G	3		3									5.5 3x20L
EV_MC2_WS_2016-11-08_N	EV_MC2	WS	N	11/8/2016	11:25	G	3		3									4.5 3x20L
[redacted]																		
								WOA										
					Total		6		16/21									

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Toxicity 96-Hr/48-HR = 96 Hr Rainbow Trout pass/fail & 48 Hr Daphnia pass/fail (Daphnia testing to occur at 20 degrees). 30 day early life stage test - rainbow trout ESP1/RM/28			Nautilus - Burnaby	NOV 09/16 @ 10:00
			NY - Nari Yamamoto	- refrish sample -

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Cam Griffin	Mobile #	
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	8 NOV - 2016 #NAME?
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Chain Of Custody Record

COC ID: 20161108-1108 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO					LABORATORY					OTHER INFO			
Facility Name	Coal Mountain Operation				Lab Name	Nautilus Environmental				Send Invoice To			
Contact Name	Carla Romero				Contact Name	Krysta Pearcy				Address			
Address	2261 Corbin Rd.				Address	8664 commerce Court				City		State	
City	Sparwood	Prov.	BC							Postal Code		Country	
Postal Code	V0B 2G0	Country	Canada		City	Burnaby	State	BC		Task Code			
Phone Number	250 425 7350				Postal Code	V5A 4N7	Country	Canada		Shipping Company			
Email EDD To	Rick.Magliocco@teck.com				Phone Number	604-420-8773				Tracking Number			
	Don.Sacino@teck.com				Email Address	krysta@nautilusenvironmental.ca				CC Hardcopy To			
	Carla.Romero@teck.com				PO Number					CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS		7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	28 d Hyallella P/F	30 d rainbow trout early life stage P/F	32d FHM P/F conducted in Calgary			
CM_MC2_WS_20161108_N	WS	Nov 8 2016	8:45	G	4						X	X	X			4X20L Refresh
											161117	161121	161118			
											WO#					

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
				Nautilus - Burnaby	Nov 09/16	10:00	3.5°C	Y / N	Y / N	Y / N
				NY - Nair Yamamoto				Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

					Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Don Sacino/Carla Romero/Bob Werner	Mobile #						
Sampler's Signature		Date/Time	November 8 2016 14:00					

Chain Of Custody Record

COC ID: 20161108-1108

Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO	
Facility Name	Coal Mountain Operation	Lab Name	Hydroqual Laboratories	Send Invoice To	
Contact Name	Carla Romero	Contact Name	Jacklyn Pool	Address	
Address	2261 Corbin Rd.	Address	#4, 6125-12th Street S.E.		
City	Sparwood Prov. BC			City	State
Postal Code	V0B 2G0 Country Canada	City	Calgary State AB	Postal Code	Country
Phone Number	250 425 7350	Postal Code	T2H 2K1 Country Canada	Task Code	
Email EDD To	Rick.Magliocco@teck.com	Phone Number	403-253-7121	Shipping Company	
	Don.Sacino@teck.com	Email Address		Tracking Number	
	Carla.Romero@teck.com	PO Number		CC Hardcopy To	
				CC Hardcopy To	

SAMPLE DETAILS / ANALYSIS REQUESTED / ADDITIONAL INFORMATION

1617-0248 week 4

Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERV. / ANALYSIS	30 day early life stage fathead minnow P/F	Additional Information
CM_MC2_WS_20161108_N	WS	Nov 8 2016	8:45	G	6		X	ReFresh

2016/11/09 1145 Bearspaw N05/I

6×20 L Carboys Good Condition 13°C MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
							Temp in °C	Samples on ice?	Sample intact?	Trip Blank?

Sampler's Name	Don Sacino/Carla Romero/Bob Werner	Mobile #	
Sampler's Signature	[signature]	Date/Time	November 8 2016

Teck

COC ID: 20161108-1435 | **TURNAROUND TIME:** | **RUSH:**

PROJECT/CLIENT INFO

Facility Name / Job#	Line Creek Operation		
Project Manager	Jay Jones		
Email	jay.jones@teck.com		
Address	Box 2003		
	15km North Hwy 43		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250-425-6111		

LABORATORY

Lab Name	Nautilus Environmental		
Lab Contact	Krysta Pearcy		
Email	Krysta@NautilusEnvironmental.ca		
Address	8664 commerce Court		
City	Burnaby	Province	BC
Postal Code	V5A 4N7	Country	Canada
Phone Number	604-420-8773		

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	jay.jones@teck.com	x	x	
Email 2:	tim.chala@teck.com	x	x	
Email 3:	teckcoal@equisonline.com	x	x	x
Email 4:	cait.good@teck.com			
PO number	432106			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: No

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	FIL.	PRESERV.	ANALYSIS: 72h P. subcapitata P/F	7d C.dubia P/F	30 d rainbow trout early life stage P/F	7 d Cdubia dilution series	72hr Psubcapitata dilution series	7d L minor plant grown dilution series	7 d O mykis development dilution series
LC_LCDSSLCC_WS_2016-11-08_N	LC_LCDSSLCC	WS	N	2016/11/08	14:30	G	3					X				

WO# 161121

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION

T Phillips/ NUPQU

DATE/TIME

November 8, 2016

ACCEPTED BY/AFFILIATION

Nautilus - Burnaby
MY - Nau Yamamoto
Temp °C - 4.2 - 3x 20L - fresh sample

DATE/TIME

Nov 09/16 @ 10:00

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	**Tyler Phillips**	**Mobile #**	**(250) 919-0965**
Sampler's Signature		**Date/Time**	**November 8, 2016**

Teck

COC ID:	20161115-1349	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact				Email 1:	Lee.Wilm@teck.com	x	x	x
Email				Email				Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address	8664 Commerce Court			Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number	604-420-8773							

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	PRESERVED	28 Day H. azteca Pass/Fail	32d FHM Calgary		48 hr Dapnia Sinlge Conc. Pass/Fail	96 Hr Rainbow Trout Single Conc. Pass/Fail	30 Day Rainbow trout embryo alevin Pass/Fail	48 hr Dapnia Sinlge Conc. Pass/Fail @	48 hr Dapnia Sinlge Conc. Pass/Fail @ 10 deg	48 hr Dapnia Sinlge Conc. Pass/Fail @ 15 deg		Temp °C	
									ANALYSIS											
									just emted	161118		161245	161244	16121		161245	161245			
FR_SP1_Q_03102016_N (2)	FR_SP1	WS		2016/11/15	10:05	G	2					x	1				1		4.8	2X20
GH_CC1_Q_03102016_N (1)	GH_CC1	WS		2016/11/15	11:13	G	2					x	1			1			4.5	2X20 ~~2X1L~~ N
GH_SC1_Q_03102016_N (3)	GH_SC1	WS		2016/11/15	11:25	G	1					x	1						4.5	1X20L
FR_FRCP1_QR_31102016_N	FR_FRCP1	WS		2016/11/15	11:59	G	1		1	x									3.5	1X20L
FR_UFR1_QR_31102016_N	FR_UFR1	WS		2016/11/15	09:14	G	1		1	x									3.5	1X20L
FR_FRCP1_SA_31102016_N (4)	FR_FRCP1	WS		2016/11/15	11:59	G	2							2					3.5	2X20L
FR_UFR1_SA_31102016_N (5)	FR_UFR1	WS		2016/11/15	09:14	G	2							2					3.5	2X20L

Preservation

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

(1) Clear, Colorless, No particulates, odourless
(2) Clear, Colorless, No odour, No particulates
(3) Grey, Slightly turbid, some particulates, no odour
(4) & (5) - clear, colourless, odourless, some particulates

(4) & ~~(5)~~

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
N MACDONALD	2016/11/15	Nautilus - Burnaby	Nov 16/16 - 10:00
		NY - Nair Yamamoto	

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	N MACDONALD	Mobile #	250 865 5104
Sampler's Signature		Date/Time	NOV 15 2016

Teck

COC ID: 20161115-1346 | **TURNAROUND TIME:** | **RUSH:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Fording River Operation			Lab Name	Hydroqual			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Lee Wilm			Lab Contact	Elisabeth Henson			Email 1:	lee.Wilm@teck.com	x	x	x
Email				Email	elisabeth_henson@golder.com			Email 2:	Neil.Macdonald@teck.com	x	x	x
Address	PO Box 100			Address				Email 3:	teckcoal@equisonline.com			x
City	Elkford	Province	BC	City		Province		PO number				
Postal Code	V0B 1H0	Country	Canada	Postal Code		Country						
Phone Number	1-250-865-5289			Phone Number	403-253-7121							

SAMPLE DETAILS | **ANALYSIS REQUESTED** | Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

1617-0245

	Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS: 30 Day Fathead Minnow	PRESERV	FIL
①	FR_FRCP1_QR_31102016_N	FR_FRCP1	WS		2016/11/15	11:59	G	6	6		
②	FR_UFR1_QR_31102016_N	FR_UFR1	WS		2016/11/15	09:14	G	6	6		

1617-0246

2016/11/16
1130
12x 20 L Carboys
no ice
Bears paw
10°C Good Condition
MC

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
① & ② - clear, colourless, odourless, some particulates	N MacDonald -	2016/11/15		

NB OF BOTTLES RETURNED/DESCRIPTION				
Regular (default) X	Sampler's Name	N MacDonald	Mobile #	250 865 5289
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	Nov 15 2016
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Teck

COC ID:	Q4 Tox Refresh Nov 15	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com	EQuIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	8664 Commerce Court				*Yes* PDF		*Yes* Excel
					Imperial Square Lake City			Email 1:	leigh.stickney@teck.com		
City	Elkford	Province	BC	City	Burnaby	Province	BC	Email 2:	sean.beswick@teck.com		
Postal Code	V0B 1H0	Country	Canada	Postal Code	V5A 4N7	Country	Can	Email 3:	jevin.wolchuk@teck.com		
Phone Number	250 865 3274			Phone Number				PO number	359182		

SAMPLE DETAILS / ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, F/P)

	Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fial)	48 hr daphnia @ 10 deg C (pass/fial)	7d C.dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H azteca	28 Day Hyalella P/F	32d FHM P/F Calgary		Temp °C	
									#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
①	GH_FR1_WS_2016-11-15_N	GH_FR1	WS	N	15-Nov-16	9:30	G	7					X		X			X		3.2	4x200
②	GH_ERC_WS_2016-11-15_N	GH_ERC	WS	N	15-Nov-16	14:00	G	3							X					4.8	3x20
③	GH_ER2_WS_2016-11-15_N	GH_ER2	WS	N	15-Nov-16	12:00	G	4					X		X					4.4	1x20 3x20
								WO#					161183		161121			161118			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
①,②,③ ; clear colourless, odourless, some particulates	J. Evans (Calgary)	15-NOV-16	14:00	Nautilus - Burnaby	Nov16/16	10:00
				NY - Nair Yamamoto		

= refresh sample =

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Jevin Wolchuk	Mobile #	250.425.5310
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Teck

COC ID:	Q4 Tox Refresh Nov 15	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name	Greenhills Operations			Lab Name	Hydroqual Laboratories Ltd			EDD delivery:				
Project Manager	Leigh Stickney			Lab Contact	Jacklyn Pool			Site:	leigh.stickney@teck.com	EQuIS:	GHO	
Email	leigh.stickney@teck.com			Email				Report Format / Distribution				
Address	PO Box 5000			Address	#4, 6125 - 12th Street S.E.				Yes PDF	Yes Excel		
								Email 1:	leigh.stickney@teck.com			
City	Elkford	Province	BC	City	Calgary	Province	AB	Email 2:	sean.beswick@teck.com			
Postal Code	V0B 1H0	Country	Canada	Postal Code	T2H 2K1	Country	Can	Email 3:	jevin.wolchuk@teck.com			
Phone Number	250 865 3274			Phone Number	403.253.7121			PO number				

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Please indicate below Filtered, Perserved or both (F, P, F/P)

1617-0247 | 1617-0319

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	#N/A 96 hr Rainbow trout (pass/fail)	#N/A 48 hr daphnia (pass/fial)	#N/A 48 hr daphnia @ 10 deg C (pass/fial)	#N/A 7d C.dubia NO3/SO4	#N/A 39 d rainbow trout early life stage NO3/SO4	#N/A 72 hr P Subcapitata	#N/A 30 day rainbow trout early life stage P/F	#N/A 28 day H azteca	#N/A 28 Day Hyalkella P/F	#N/A 30 d early life stage, fathead minnow Pass/Fail	#N/A 30 d early life stage, fathead minnow SO4	#N/A
GH_FR1_WS_2016-11-15_N	GH_FR1	WS	N	15-Nov-16	~~11:30~~	G	2											X	X	
GH_ER2_WS_2016-11-15_N	GH_ER2	WS	N	15-Nov-16	12:00	G	3												X	
1617-0317																				
	2016/11/16 1130																			
	Good Condition			NOS/17																
	3 x 20 L Carboys			12C																
	2 x 55 Gal barrel																			
	Bass Dam			MC																

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	J. Evans (Maxxam)	15-NOV-16	14:00			

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470
Sampler's Signature		Date/Time	

Teck

COC ID: 20161115N | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Elkview Operations			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Job Description	SA Chronic Toxicity Sampling			Lab Contact	Krysta Peracy			Email 1:	Michael.Moore@teck.com	X	X	X
Project Manager	Michael Moore			Email	krysta@nautilusenvironmental.ca			Email 2:	teckcoal@equisonline.com			X
Email	Michael.Moore@teck.com			Address	8664 Commerce Court			Email 3:	James.Boldt@teck.com	X	X	X
Address	RR#1 HWY# 3				Imperial Square, Lake City			Email 4:	Cameron.Griffin@teck.com	X	X	X
								Email 5:				
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number	418927			
Postal Code	V1C 4C3	Country	Canada	Postal Code	V5A 4N7	Country	Canada					
Phone Number	1-250-865-5289			Phone Number								

SAMPLE DETAILS | **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-day early-stage test - rainbow trout. ESP1/RM/28								Temp °C	
① EV_HC1_WS_2016-11-15_N	EV_HC1	WS	N	11/15/2016	12:20	G	3		3								3.3	3x20L
② EV_MC2_WS_2016-11-15_N	EV_MC2	WS	N	11/15/2016	15:15 12:20	G	3		3							①	3.3	3x20L
									WO# 161121									
					Total		6											

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
30 day early life stage test - rainbow trout ESP1/RM/28			Nautilus - Burnaby	Nov 16/16 @ 10:00
			NY - Nair Yamamoto	= refrig sample =

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Cameron Griffin	Mobile #	
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	15 Nov '16 #NAME?
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

① & ② clear, light yellow, some particulates, odourless

① 1 container leaked

Chain Of Custody Record

COC ID: 20161115-1115 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO					LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation				Lab Name	Nautilus Environmental			Send Invoice To			
Contact Name	Carla Romero				Contact Name	Krysta Pearcy			Address			
Address	2261 Corbin Rd.				Address	8664 commerce Court						
City	Sparwood	Prov.	BC						City		State	
Postal Code	V0B 2G0	Country	Canada		City	Burnaby	State	BC	Postal Code		Country	
Phone Number	250 425 7350				Postal Code	V5A 4N7	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com				Phone Number	604-420-8773			Shipping Company			
	Don.Sacino@teck.com				Email Address	krysta@nautilusenvironmental.ca			Tracking Number			
	Carla.Romero@teck.com				PO Number				CC Hardcopy To			
									CC Hardcopy To			

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS			7-d C. dubia (pass/fail)	72-h P. subcapitata (pass/fail)	28-d H. azteca (pass/fail)	28 d Hyallella P/F	30 d rainbow trout early life stage P/F	32d FHM P/F Calgary		
(1) CM_MC2_WS_20161115_N	WS	Nov 15 2016	12:12	G	3								X	X		Refresh
													161121	161118		
													WOH			

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
(1) clear, light yellow, odourless, some particulates				Nautilus - Burnaby	Nov 16/16	10:00	2.0	Y / N	Y / N	Y / N
				NY - Nan Yamamoto				Y / N	Y / N	Y / N
				3 X 20L				Y / N	Y / N	Y / N

						Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Don Sacino / Bob Werner	Mobile #							
Sampler's Signature		Date/Time	November 15 2016 14:00						

Chain Of Custody Record

COC ID: 20161115-1115 | Page: 1 of 1

Turnaround Time:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Coal Mountain Operation			Lab Name	Hydroqual Laboratories			Send Invoice To			
Contact Name	Carla Romero			Contact Name	Jacklyn Pool			Address			
Address	2261 Corbin Rd.			Address	#4, 6125-12th Street S.E.						
City	Sparwood	Prov.	BC					City		State	
Postal Code	V0B 2G0	Country	Canada	City	Calgary	State	AB	Postal Code		Country	
Phone Number	250 425 7350			Postal Code	T2H 2K1	Country	Canada	Task Code			
Email EDD To	Rick.Magliocco@teck.com			Phone Number	403-253-7121			Shipping Company			
	Don.Sacino@teck.com			Email Address				Tracking Number			
	Carla.Romero@teck.com			PO Number				CC Hardcopy To			
								CC Hardcopy To			

Week 5

1617-0248

SAMPLE DETAILS						ANALYSIS REQUESTED										ADDITIONAL INFORMATION
						PRESERV.										
						ANALYSIS		30 day early life stage fathead minnow P/F								
Sample ID	Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.											
CM_MC2_WS_20161115_N	WS	Nov 15 2016	12:42	G	6			X								ReFresh

2016/11/16
1130
6 x 90L Carboys
NO SE 122
Good Condition
Bears Paw
MC

Additional Comments/Special Instructions	Relinquished By/Affiliation	Date	Time	Accepted By/Affiliation	Date	Time	Sample Receipt Conditions			
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N
								Y / N	Y / N	Y / N

					Temp in °C	Samples on ice?	Sample intact?	Trip Blank?
Sampler's Name	Don Sacino / Bob Werner	Mobile #						
Sampler's Signature		Date/Time	November 15 2016					

Teck

COC ID: 20161115-1435 | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	
Email	jay.jones@teck.com			Email	Krysta@NautilusEnvironmental.ca			Email 2:	tim.chala@teck.com	x	x	
Address	Box 2003			Address	8664 commerce Court			Email 3:	teckcoal@equisonline.com	x	x	x
	15km North Hwy 43							Email 4:	cait.good@teck.com			
City	Sparwood	Province	BC	City	Burnaby	Province	BC					
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	PO number	432106			
Phone Number	250-425-6111			Phone Number	604-420-8773							

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: Non)

	Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Fil.	PRESERV.	ANALYSIS: 72h P. subcapitata P/F	7d C.dubia P/F	30 d rainbow trout early life stage P/F	7 d Cdubia dilution series	72hr Psubcapitata dilution series	7d L minor plant grown dilution series	7 d O mykis development dilution series	[redacted]	96hr RT single concentration Toxicity test	48hr DM single Concentration Toxicity test		Temp °C
(1)	LC_LCDSSLCC_WS_2016-11-15_N	LC_LCDSSLCC	WS	N	2016/11/15	12:30	G	16					X						X	X		3.5
(2)	LC_LCS_WS_2016-11-15_N	LC_LCS	WS	N	2016/11/15	10:56	G	3											X	X		4.5
																						1x20
									WO #				1611121						161244C	161245C	+	2x1L

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
(1) Clear, Colorless, No ~~particulates~~ particulates, No odour	T Phillips/ NUPQU	November 15, 2016	Nautilus - Burnaby	Nov 16/16 @ 10:0
(2) Clear, Colorless, No particulates, No odour			NY - Nair Yamamoto	(1) refuse sample

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Tyler Phillips	Mobile #	(250) 919-0965
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	November 15, 2016
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

END OF REPORT

Appendix B-5 Second Quarter 2016 Results: Toxicity testing on Line Creek Operations samples with *Ceriodaphnia dubia, Oncorhynchus mykiss, Lemna minor* and *Pseudokirchneriella subcapitata*

Nautilus Environmental

Toxicity testing on Line Creek Operations samples with *Ceriodaphnia dubia*, *Oncorhynchus mykiss*, *Lemna minor* and *Pseudokirchneriella subcapitata*

Second Quarter 2016 Results

Final Report

Report date:
October 31, 2016

Submitted to:

Teck Coal Ltd.
Sparwood, BC

8664 Commerce Court
Burnaby, BC
V5A 4N7

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SIGNATURE PAGE

Krysta Pearcy, B.Sc.
Testing Manager

James Elphick, R.P.Bio.
Senior Reviewer

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

1.0 INTRODUCTION

Nautilus Environmental conducted toxicity tests for Teck Coal Ltd. on samples collected from the Line Creek Operations as part of a toxicity testing program required under BC Ministry of Environment permit number 106970, Section 5.2. Test types included survival and reproduction of a cladoceran (*Ceriodaphnia dubia*), embryo development of rainbow trout (*Oncorhynchus mykiss*), growth of a freshwater plant (*Lemna minor*) and population growth of a unicellular green alga (*Pseudokirchneriella subcapitata*). Table 1 outlines the toxicity tests that were conducted on each sample and Figure 1 shows the locations of sample sites. Samples were transported in 20-L plastic containers in coolers containing ice packs. Samples were received at temperatures ranging from 6.0 to 10.2°C and were stored in the dark at 4 ± 2°C prior to testing.

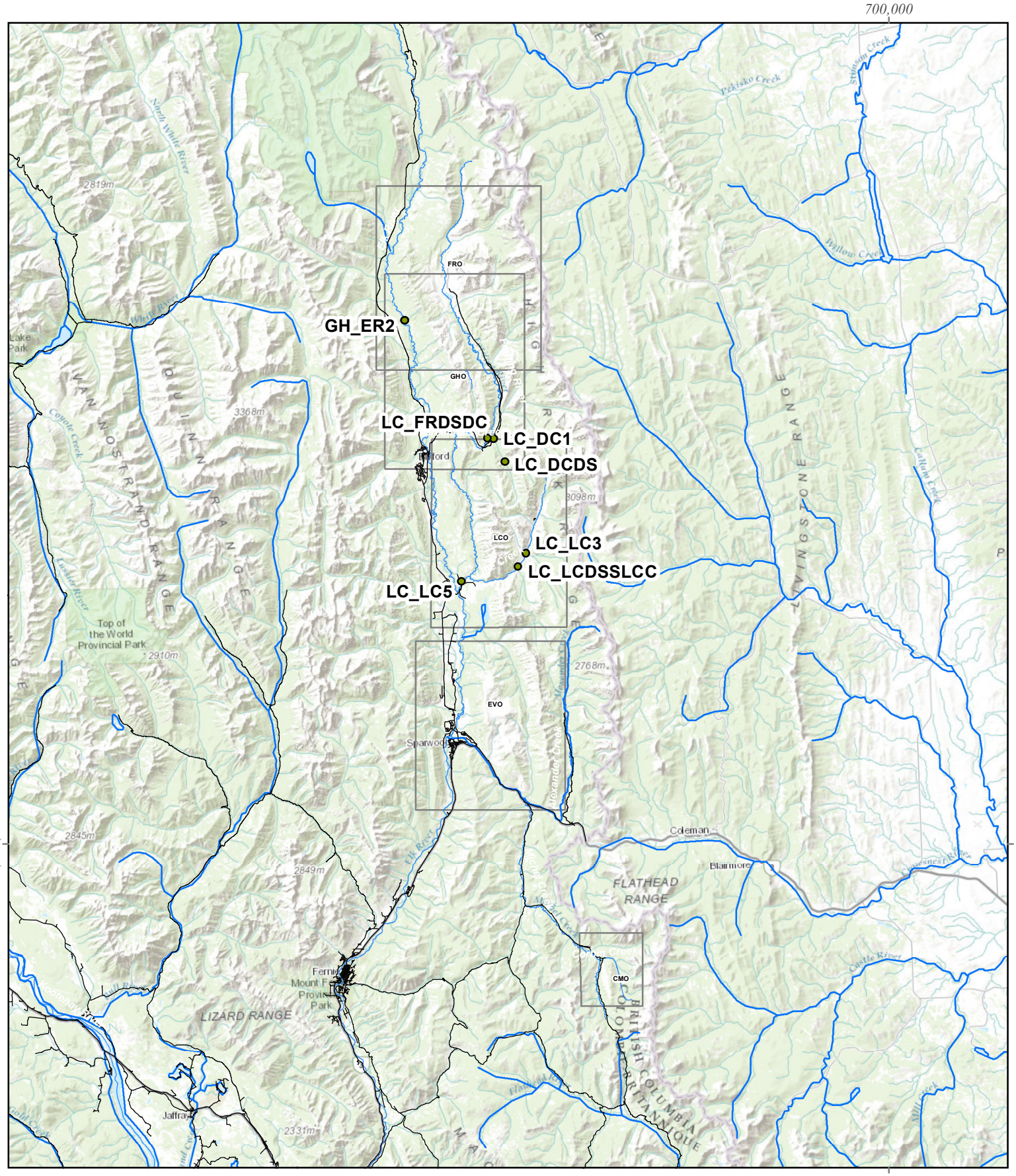
Table 1. Summary of toxicity testing program.

Sample ID	EMS #	Location Description	Species Tested	Sample Collection Date
GH_ER2*	200389	Elk River upstream of Greenhill Operations	*C. dubia*, *O. mykiss*, and *P. subcapitata*	April 27, 2016
LC_LCDSSLCC	297110	Line Creek downstream of South Line Creek	*C. dubia*, *O. mykiss*, *L. minor* and *P. subcapitata*	April 27, 2016
LC_DC1	E288270	Dry Creek near mouth	*C. dubia*, *O. mykiss*, *L. minor* and *P. subcapitata*	April 27, 2016
LC_FRDSDC	E288272	Fording River downstream of Dry Creek	*C. dubia*, *O. mykiss*, *L. minor* and *P. subcapitata*	April 27, 2016
LC_DCDS	E295210	Dry Creek downstream of sedimentation ponds	*C. dubia*, *O. mykiss*, *L. minor* and *P. subcapitata*	April 27, 2016
LC_LC5	200028	Lower Fording River (downstream of Line Creek)	*C. dubia*, *O. mykiss*, *L. minor* and *P. subcapitata*	April 27, 2016
LC_WTF_OUT	E291569	West Line Creek Active Water Treatment Facility Effluent Outfall	*C. dubia*, *O. mykiss*, *L. minor* and *P. subcapitata*	April 27, 2016

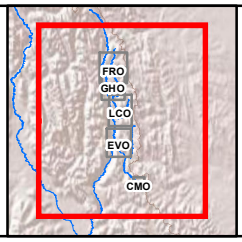
*Reference site. Conducted as a single concentration toxicity test.

The samples from Line Creek Operations were tested using serial dilutions of the sample with laboratory control water. Sample GH_ER2 was tested using only a single (100%) concentration with no dilution. GH_ER2 is an upstream reference location that is not required as part of the Line Creek Operations testing program, but the data for this sample were included here as a basis for comparison to Line Creek Operations mine-influenced samples.

This report describes the results of the toxicity tests. Copies of laboratory data sheets and printouts of statistical analyses are provided in Appendices A through D. Results of analytical chemistry that was performed on the samples tested in this program have been uploaded to the BC Ministry of Environment web reporting system (EMS). Samples for water chemistry analysis were collected by Teck personnel at the same time the samples were collected for toxicity testing. The chain-of-custody forms are provided in Appendix F.



Teck



Line Creek Chronic Toxicity Monitoring Locations

- Roads
- Rivers
- Monitoring Locations

N

0 2.5 5 10 15 Kilometers

DATE:	MINE OPERATION:
8/28/2015	Elk Valley
SCALE:	COORDINATE SYSTEM:
1:550,000	NAD 1983 UTM Zone 11N

Document Path: \\teckcominco\CGO\Groups\TCGIS\Data\Operations\SPO\Dan_Vasiga\BaseLandscape_letter_v2.mxd

2.0 METHODS

Methods for the toxicity tests are summarized in Tables 2 through 5. Testing was conducted according to procedures described by Environment Canada protocols (1998, 2007a, 2007b and 2007c). Statistical analyses for the tests were performed using CETIS (Tidepool Scientific Software, 2013).

Table 2. Summary of test conditions: *Ceriodaphnia dubia* survival and reproduction test.

Test organism	*Ceriodaphnia dubia*
Test organism source	In-house culture
Test organism age	<24 h old neonates produced within 12 h
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20 mL glass test tube
Test volume	15 mL
Test solution depth	10 cm
Test concentrations	Seven concentrations, plus laboratory control
Test replicates	10 test replicates per treatment
Number of organisms	1 per replicate
Control water	20% Perrier water and 80% deionized water (hardness 80-100 mg/L $CaCO_3$)
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	Daily with *Pseudokirchneriella subcapitata* and YCT (3:1 ratio)
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light/8 hours dark
Sample filtration	None
Aeration	None
pH adjustment	None
Test protocol	Environment Canada (2007a)
Statistical software	CETIS
Test endpoint	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods, no ephippia present
Reference toxicant	Sodium chloride

Table 3. Summary of test conditions: rainbow trout (*Oncorhynchus mykiss*) embryo viability test.

Test organism	*Oncorhynchus mykiss*
Test organism source	Ted's Trout Farm, Little Fort, BC
Gamete quality	Small amount of water added to milt on a dry glass slide; verification of vigorous sperm motility using a compound microscope (100 X magnification)
Test organism age	<30 minutes post fertilization, <24 hour old gametes
Test type	Static-renewal
Test duration	7 days
Test vessel	2-L plastic container
Test volume	2 L
Test solution depth	17 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	4 test replicates per treatment
No. of organisms	30 eggs per replicate
Control/dilution water	Dechlorinated municipal water (hardness 10 mg/L $CaCO_3$)
Test solution renewal	Daily (80% renewal)
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24 hours dark
Sample filtration	None
Aeration	6.5 ± 1 mL/min/L
pH adjustment	None
Test protocol	Environment Canada (1998); Canaria et al. (1999)
Statistical software	CETIS
Test endpoint	Embryo viability
Test acceptability criteria for controls	Embryo viability ≥70%
Reference toxicant	Sodium dodecyl sulphate

Table 4. Summary of test conditions: *Lemna minor* growth inhibition test.

Test organism	*Lemna minor*, strain CPCC# 490
Test organism source	In-house axenic culture, obtained from Canadian Phycological Culture Centre, and originally isolated from Wainfleet, Stinking Barn, Niagara Peninsula, Ontario, Canada
Test organism age	7-to 10-day old
Test type	Static
Test duration	7 days
Test vessel	250-mL glass container
Test volume	100 mL
Test solution depth	4 cm
Test concentrations	Seven concentrations, plus laboratory control
Test replicates	4 test replicates per treatment
No. of organisms	Two 3-frond plants per replicate
Control/dilution water	Modified APHA media (deionized water plus 1% of each APHA stock solution A, B and C)
Test solution renewal	None
Test temperature	25 ± 2°C
Feeding	None
Light intensity	4000 to 5600 lux
Photoperiod	24 hours light
Sample filtration	None
Aeration	None
pH adjustment	None
Test protocol	Environment Canada (2007b)
Statistical software	CETIS
Test endpoints	Number of fronds and dry weight
Test acceptability criteria for controls	≥ 8-fold increase in number of fronds
Reference toxicant	Potassium chloride

Table 5. Summary of test conditions: *Pseudokirchneriella subcapitata* growth inhibition test.

Test organism	*Pseudokirchneriella subcapitata*, strain UTCC# 37
Test organism source	In-house axenic culture, obtained from Canadian Phycological Culture Center, and originally isolated from Nivelta River, Norway.
Test organism age	3-to 7-day old culture in logarithmic growth phase
Test type	Static
Test duration	72 hours
Test vessel	Microplate
Test volume	220 µL
Test concentrations	Seven concentrations, plus laboratory control
Test replicates	4 test replicates per treatment; 8 test replicates for control
No. of organisms	10, 000 cells/mL
Control/dilution water	Deionized water with supplemented nutrients
Test solution renewal	None
Test temperature	24 ± 2°C
Feeding	None
Light intensity	3600 to 4400 lux
Photoperiod	24 hours light
Sample filtration	Through a preconditioned membrane filter of 0.45 µm using a vacuum pump
Aeration	None
pH adjustment	None
Test protocol	Environment Canada (2007c)
Statistical software	CETIS
Test endpoint	Algal cell growth inhibition
Test acceptability criteria for controls	>16-fold increase in number of algal cells; CV ≤ 20%; no trend when analyzed using Mann-Kendall test
Reference toxicant	Zinc

3.0 RESULTS

The results of the toxicity tests and associated statistical analyses are provided in Appendices A through D, with the exception of data for sample GH_ER2 for *C. dubia* and *P. subcapitata*, which are reproduced here, but the raw data are provided in a separate report (Nautilus Environmental, 2016). The statistical analysis for sample GH_ER2 involved a comparison of performance in the site water with the control using a hypothesis test, since there were no dilutions tested for this sample. The results for all of the other samples are presented here on the basis of point estimates (e.g., IC25), since the data available for a range of test concentrations in these samples enabled statistical fitting of dose-response relationships. This approach is considered preferable to hypothesis testing in cases where the data allow. Hypothesis tests were conducted for all samples in the *P. subcapitata* test to identify stimulation in cell growth relative to the control, as specified in the test method for this species.

Results of the toxicity tests using *C. dubia* are provided in Table 6. There was no adverse effect on survival in the samples; the LC50 values were >100%. An adverse effect on reproduction was observed in four of the six samples. The IC25 values for LC_LCDSSLCC, LC_DC1, LC_DCDS and LC_WTF_OUT were 22.6, 70.6, 32.9 and 29.2 , respectively.

Results of the toxicity tests using *O. mykiss* are provided in Table 7. An adverse effect on embryo viability was observed only in sample LC_WTF_OUT; the EC25 value was 65.1%.

Results of the toxicity tests using *L. minor* are provided in Table 8; the highest test concentration was 97% as a result of dilution associated with addition of nutrients, as required in the method. There were no adverse effects on frond count or dry weight in the samples; therefore the IC25 values for all samples were >97%.

Results of the toxicity tests using *P. subcapitata* are provided in Table 9; the highest test concentraton was 95.2% as a result of dilution associated with addition of nutrients. An adverse inhibition effect on cell yield was only observed in sample LC_WTF_OUT; the IC25 was 72.7%.

Reference sample GH_ER2 was only tested at full strength with *C. dubia*, *O. mykiss* and *P. subcapitata*. There were no significant adverse effects in GH_ER2 compared to the laboratory control for *C. dubia* survival, *O. mykiss* viability and *P. subcapitata* cell yield. In the *P. subcapitata* test, the site water control produced 2.9-fold greater growth than the laboratory water control. This finding is not unusual, since the higher ionic strength associated with the reference sample

would be expected to stimulate cell growth of this species relative to the very low ionic strength associated with the laboratory control water, and growth enhancement of *P. subcapitata* observed in this reference sample was similar to that observed in most of the samples. Reproduction of *C. dubia* in reference sample GH_ER2 was statistically significantly reduced by 26% compared to the laboratory control.

Table 6. Results: *Ceriodaphnia dubia* survival and reproduction test.

Concentration (% v/v)	GH_ER2		LC_LCDSSLCC		LC_DC1	
	Survival (%)	Reproduction (Mean ± SD)	Survival (%)	Reproduction (Mean ± SD)	Survival (%)	Reproduction (Mean ± SD)
Control	100	22.7 ± 2.5	100	19.8 ± 7.6	90	22.5 ± 8.0
1.56	NT	NT	100	21.1 ± 4.8	100	25.4 ± 1.5
3.12	NT	NT	100	15.6 ± 8.9	90	21.9 ± 6.8
6.25	NT	NT	100	20.5 ± 4.7	100	23.6 ± 2.8
12.5	NT	NT	80	19.2 ± 8.1	90	21.8 ± 6.8
25	NT	NT	100	14.8 ± 7.5	100	22.0 ± 3.3
50	NT	NT	90	14.1 ± 8.2	90	20.3 ± 5.1
100	90	16.8 ± 7.0*	100	15.3 ± 8.8	80	15.6 ± 8.6
Test endpoint (% v/v) [with 95% CL]						
LC50	--	--	>100	--	>100	--
IC25	--	--	--	22.6 (2.9 – N/A)	--	70.6 (40.1 – N/A)
IC50	--	--	--	>100	--	>100

NT = Not Tested, SD = Standard Deviation, CL = Confidence Limits, LC = Lethal Concentration, IC = Inhibition Concentration, N/A = Not Available

* Result was significantly lower than the laboratory control (hypothesis tests were only conducted for sample GH_ER2)

Table 6. (continued) Results: *Ceriodaphnia dubia* survival and reproduction test.

Concentration (% v/v)	LC_FRDSDC		LC_DCDS		LC_LC5		LC_WTF_OUT	
	Survival (%)	Reproduction (Mean ± SD)	Survival (%)	Reproduction (Mean ± SD)	Survival (%)	Reproduction (Mean ± SD)	Survival (%)	Reproduction (Mean ± SD)
Control	100	23.4 ± 2.4	100	21.7 ± 3.2	100	21.7 ± 3.4	100	24.2 ± 2.0
1.56	90	21.0 ± 4.2	100	22.6 ± 8.8	100	19.4 ± 5.0	100	24.7 ± 1.2
3.12	100	21.3 ± 3.3	100	18.4 ± 9.8	100	20.6 ± 4.4	100	25.3 ± 1.6
6.25	90	19.2 ± 6.2	100	19.4 ± 7.5	100	18.7 ± 4.4	100	23.9 ± 5.5
12.5	100	23.6 ± 2.5	100	22.9 ± 3.0	80	17.2 ± 9.2	80	17.8 ± 11.7
25	90	21.0 ± 4.2	90	17.4 ± 9.5	100	19.2 ± 4.2	90	22.5 ± 7.9
50	100	21.7 ± 2.1	100	15.4 ± 5.7	100	19.2 ± 4.2	100	13.0 ± 3.5
100	100	18.7 ± 3.2	90	13.5 ± 9.6	100	20.7 ± 2.8	90	0.7 ± 1.6
Test Endpoint (% v/v) [with 95% CL]								
LC50	>100	--	>100	--	>100	--	>100	--
IC25	--	>100	--	32.9 (14.8 – N/A)	--	>100	--	29.2 (9.5 – 36.0)
IC50	--	>100	--	>100	--	>100	--	51.8 (43.0 – 57.0)

SD = Standard Deviation, CL = Confidence Limits, LC = Lethal Concentration, IC = Inhibition Concentration, N/A = Not Available

Table 7. Results: rainbow trout embryo (*Oncorhynchus mykiss*) viability test.

Concentration (% v/v)	Embryo Viability (%) (Mean ± SD)						
	GH_ER2	**LC_LCDSSLCC**	**LC_DC1**	**LC_FRDSDC**	**LC_DCDS**	**LC_LC5**	**LC_WTF_OUT**
Control	90.1 ± 8.9	84.0 ± 9.0	89.2 ± 5.0	88.3 ± 8.8	90.8 ± 4.2	88.3 ± 4.3	87.5 ± 10.3
6.25	NT	90.0 ± 7.2	88.3 ± 4.3	87.5 ± 3.2	85.0 ± 4.3	90.0 ± 6.7	85.4 ± 5.6
12.5	NT	87.5 ± 5.0	91.7 ± 4.3	90.0 ± 3.8	86.7 ± 2.7	89.1 ± 5.7	81.5 ± 6.9
25	NT	88.2 ± 3.3	92.5 ± 3.2	88.3 ± 1.9	90.0 ± 5.2	85.8 ± 7.4	79.0 ± 5.7
50	NT	86.8 ± 2.7	86.7 ± 4.7	88.3 ± 3.3	85.8 ± 3.2	84.2 ± 5.0	73.5 ± 10.7
100	93.2 ± 6.2	85.0 ± 6.9	87.5 ± 7.4	85.0 ± 4.3	88.4 ± 6.9	79.2 ± 7.4	48.4 ± 13.9
Test endpoint (% v/v) [with 95% CL]							
EC25	-	>100	>100	>100	>100	>100	65.1 (38.3 – 80.5)
EC50	-	>100	>100	>100	>100	>100	100 (93.8 – 100)

NT = Not Tested, SD = Standard Deviation, CL = Confidence Limits, EC = Effective Concentration

Table 8. Results: *Lemna minor* growth inhibition test.

Concentration (% v/v)	LC_LCDSSLCC		LC_DC1		LC_FRDSDC	
	Fronds (Mean ± SD)	Dry Weight (mg) (Mean ± SD)	Fronds (Mean ± SD)	Dry Weight (mg) (Mean ± SD)	Fronds (Mean ± SD)	Dry Weight (mg) (Mean ± SD)
Control	80.2 ± 5.3	6.6 ± 0.4	69.5 ± 5.9	6.0 ± 0.5	74.2 ± 9.2	5.7 ± 0.8
1.5	58.8 ± 4.4	4.5 ± 0.5	68.0 ± 2.4	6.0 ± 0.3	64.5 ± 3.1	5.4 ± 0.4
3.0	76.8 ± 3.9	6.1 ± 0.4	63.2 ± 7.9	6.0 ± 0.8	65.2 ± 3.8	5.2 ± 0.4
6.1	74.0 ± 12.8	5.6 ± 0.9	69.2 ± 15.6	6.3 ± 1.3	72.8 ± 3.6	6.2 ± 0.3
12.1	70.0 ± 7.3	5.4 ± 0.6	61.8 ± 5.7	5.7 ± 0.5	73.8 ± 4.3	5.8 ± 0.6
24.2	78.0 ± 9.1	6.2 ± 0.7	78.5 ± 16.7	6.8 ± 1.2	65.2 ± 11.9	5.4 ± 0.7
48.5	80.8 ± 10.2	6.4 ± 0.8	75.0 ± 9.1	6.4 ± 0.5	77.5 ± 9.8	6.0 ± 0.5
97	65.5 ± 6.4	5.3 ± 0.4	66.0 ± 9.2	5.8 ± 0.4	65.8 ± 4.6	5.9 ± 0.3
Test Endpoint (% v/v)						
IC25	>97	>97	>97	>97	>97	>97
IC50	>97	>97	>97	>97	>97	>97

SD = Standard Deviation, IC = Inhibition Concentration

Table 8. (continued) Results: *Lemna minor* growth inhibition test.

Concentration (% v/v)	LC_DCDS		LC_LC5		LC_WTF_OUT	
	Fronds (Mean ± SD)	Dry Weight (mg) (Mean ± SD)	Fronds (Mean ± SD)	Dry Weight (mg) (Mean ± SD)	Fronds (Mean ± SD)	Dry Weight (mg) (Mean ± SD)
Control	73.5 ± 10.2	6.8 ± 1.2	84.5 ± 12.7	6.5 ± 1.1	62.0 ± 11.2	6.3 ± 0.7
1.5	70.8 ± 1.7	6.3 ± 0.6	78.5 ± 9.5	6.1 ± 0.9	53.8 ± 7.8	5.0 ± 1.0
3.0	87.0 ± 13.6	8.5 ± 1.2	78.8 ± 7.8	5.8 ± 0.4	57.5 ± 6.4	5.8 ± 0.8
6.1	77.0 ± 24.4	7.1 ± 2.6	73.2 ± 15.1	5.8 ± 1.2	62.5 ± 11.4	6.0 ± 0.8
12.1	73.5 ± 10.8	6.7 ± 1.2	83.0 ± 4.9	6.4 ± 0.4	63.2 ± 11.5	6.5 ± 1.0
24.2	87.8 ± 14.9	7.6 ± 1.1	94.5 ± 8.3	7.4 ± 0.7	62.5 ± 5.3	6.5 ± 0.5
48.5	83.2 ± 9.4	7.3 ± 0.9	90.5 ± 7.1	6.9 ± 0.6	46.5 ± 5.3	6.1 ± 0.9
97	84.0 ± 5.4	8.0 ± 0.6	85.2 ± 5.4	6.6 ± 0.5	52.5 ± 5.7	6.9 ± 1.0
Test Endpoint (% v/v)						
IC25	>97	>97	>97	>97	>97	>97
IC50	>97	>97	>97	>97	>97	>97

SD = Standard Deviation, IC = Inhibition Concentration

Table 9. Results: *Pseudokirchneriella subcapitata* growth inhibition test.

Concentration (% v/v)	GH_ER2		LC_LCDSSLCC		LC_DC1		LC_FRDSDC	
	Cell Yield x10⁴ (Mean ± SD)	Stimulation (%)	Cell Yield x10⁴ (Mean ± SD)	Stimulation (%)	Cell Yield x10⁴ (Mean ± SD)	Stimulation (%)	Cell Yield x10⁴ (Mean ± SD)	Stimulation (%)
Control	34.4 ± 2.7	--	31.6 ± 1.7	--	31.6 ± 2.5	--	31.5 ± 2.6	--
1.5	NT	NT	32.5 ± 2.1	2.8	31.8 ± 2.5	0.4	34.0 ± 2.2	7.9
3.0	NT	NT	40.8 ± 3.5 [α]	28.8	34.8 ± 1.7	9.9	45.8 ± 4.6 [α]	45.2
6.0	NT	NT	59.5 ± 3.9 [α]	88.1	45.2 ± 3.5 [α]	43.1	64.2 ± 4.0 [α]	104.0
11.9	NT	NT	86.2 ± 7.8 [α]	172.7	58.2 ± 4.0 [α]	84.2	76.0 ± 4.8 [α]	141.3
23.8	NT	NT	90.8 ± 2.8 [α]	187.0	73.5 ± 2.6 [α]	132.4	84.0 ± 4.2 [α]	166.7
47.6	NT	NT	91.0 ± 2.7 [α]	187.7	94.0 ± 5.4 [α]	197.2	92.5 ± 6.2 [α]	193.7
95.2	98.8 ± 5.3 [α]	187.3	91.0 ± 4.8 [α]	187.7	98.8 ± 8.6 [α]	212.3	86.8 ± 4.0 [α]	175.4
Test Endpoint (% v/v)								
IC25	--	--	>95.2	--	>95.2	--	>95.2	--
IC50	--	--	>95.2	--	>95.2	--	>95.2	--

NT = Not Tested, SD = Standard Deviation, IC = Inhibition Concentration

[α] Result was significantly greater than the laboratory control

Table 9. (continued) Results: *Pseudokirchneriella subcapitata* growth inhibition test.

Concentration (% v/v)	LC_DCDS		LC_LC5		LC_WTF_OUT	
	Cell Yield x10⁴ (Mean ± SD)	Stimulation (%)	Cell Yield x10⁴ (Mean ± SD)	Stimulation (%)	Cell Yield x10⁴ (Mean ± SD)	Stimulation (%)
Control	31.9 ± 3.0	--	31.8 ± 2.3	--	32.5 ± 2.1	--
1.5	36.0 ± 2.4	12.9	45.5 ± 3.8 α	43.3	72.5 ± 2.1 †	--
3.0	42.2 ± 2.4 α	32.6	60.0 ± 6.6 α	89.0	79.5 ± 6.2 †	--
6.0	51.8 ± 4.1 α	62.4	65.8 ± 4.1 α	107.1	92.5 ± 8.1 †	--
11.9	59.8 ± 4.0 α	87.4	84.0 ± 6.2 α	164.6	106.5 ± 5.8 †	--
23.8	91.2 ± 3.3 α	186.3	93.8 ± 5.3 α	195.3	87.0 ± 3.6 †	--
47.6	110.5 ± 9.6 α	246.7	95.5 ± 3.4 α	200.8	73.0 ± 2.6 †	--
95.2	118.5 ± 8.1 α	271.8	85.2 ± 5.6 α	168.5	19.5 ± 1.7	--
Test endpoint (% v/v) [with 95% CL]						
IC25	>95.2	--	>95.2	--	72.7 (64.9 – 82.6)	--
IC50	>95.2	--	>95.2	--	>95.2	--

SD = Standard Deviation, CL = Confidence Limits, IC = Inhibition Concentration

α Result was significantly greater than the laboratory control

† The data did not fit the hormesis regression model; therefore the cell yield was adjusted to that of the control value and analyzed using linear interpolation.

4.0 QA/QC

The health history of the test organisms used in the exposures was acceptable and met the requirements of the Environment Canada protocols. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocols throughout the tests. There were no deviations from the test methodologies. Uncertainty associated with these tests is best described by the standard deviation around the mean and/or the confidence intervals around the point estimates.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 10. Results for these tests fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in these tests was considered appropriate.

Table 10. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
C. dubia	Survival (LC50): 2.1 g/L NaCl	2.0 (1.8 – 2.2)	5	April 13, 2016
	Reproduction (IC50): 1.6 g/L NaCl	1.5 (1.2 – 1.9)	12	
O.mykiss	Embryo viability (EC50): 5.5 mg/L SDS	4.1 (2.1 – 8.0)	40	April 28, 2016
L. minor	Number of fronds (IC50): 4.2 g/L KCl	4.0 (3.2 – 5.0)	12	April 28, 2016
P. subcapitata	Growth (IC50) 34.0 µg/L Zn	30.5 (17.4 – 53.5)	32	April 26, 2016

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration, EC= Effective Concentration

5.0 REFERENCES

Canaria, E.C., J.R. Elphick and H.C. Bailey. 1999. A simplified procedure for conducting small-scale short-term embryo toxicity tests with salmonids. Environ Toxicol 14:301-307.

Environment Canada. 1998. Biological test method: toxicity tests using early life stages of salmonid fish (rainbow trout). Environmental Protection Series EPS 1/RM/28. Second Edition, July 1998. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 102 pp.

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Nautilus Environmental. 2016. Toxicity testing on Elk Valley samples with *Ceriodaphnia dubia, Pseudokirchneriella subcapitata, Hyalella azteca, Pimephales promelas* and *Oncorhynchus mykiss*: Second Quarter 2016 results.

Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.8.7.16 Tidepool Scientific Software, McKinleyville, CA. 222 pp.

6.0 END OF REPORT

APPENDIX A – *Ceriodaphnia dubia* Toxicity Test Data

Ceriodaphnia dubia Summary Sheet

Client: Teck coal
Work Order No.: 16479

Start Date/Time: April 28/16 @ 1600h
Set up by: EMM

Sample Information:

Sample ID: LC_LCDSICC_WS_20160427
Sample Date: April 27/16 25N
Date Received: April 28/16
Sample Volume: 8x20L

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: ~~042016~~ emm 041416B
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 29
Mortality (%) in previous 7 d: 5
Individual female # used ≥8 young on test day: 22,23,24,25,26,27,28,29,30,35,39,40

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd143
Stock Solution ID: 16Na01**
Date Initiated: April 13/16

7-d LC50 (95% CL): 2.1 (2.0-2.2) g/L NaCl
7-d IC50 (95% CL): 1.6 (1.4-1.8) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCl CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-1.9) g/L NaCl CV (%): 12

Test Results:

	Survival	Reproduction
LC50 % (v/v) (95% CL)	>100	
IC25 % (v/v) (95% CL)		22.6 (29 - N/A)
IC50 % (v/v) (95% CL)		>100

Reviewed by: JGR
Date reviewed: May 19/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck Coal
Sample ID: LC-CROSSLCC WS ~~2016-04-25~~ MG 2016-04-25N
Work Order #: 16479
Start Date & Time: April 28/16 @ 1605 h
Stop Date & Time: May 4/16 @ 1630 h
Test Species: *Ceriodaphnia dubia*

Concentration: control	Days														
	0	1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final	
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0		
DO (mg/L)	8.0	7.5 JS	8.2	7.6	7.9	7.4	8.2	7.5	8.2	7.4	8.2	7.5	8.1		
pH	7.8	7.7 JS	8.0	7.7	8.0	7.7	7.9	7.9	8.0	7.6	7.9	7.6	8.1		
Cond. (µS/cm)	222	222		212		223		223		216		221	216		
Initials	EMM	EMM		KL		YML		JS		JS		EMM	MG		

MG

Concentration: 1.56% (v/v)	Days														
	0	1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final	
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0		
DO (mg/L)	7.9	7.4 JS	8.1	7.6	8.1	7.5	8.1	7.5	8.2	7.4	8.1	7.5	8.2		
pH	7.8	7.7 JS	8.0	7.8	7.9	7.8	8.0	7.9	7.9	7.6	7.8	7.6	7.9		
Cond. (µS/cm)	224	224		221		222		JS 224	222	227		224	221		
Initials	EMM	EMM		KL		YML		JS		JS		EMM	MG		

MG

Concentration: 12.5% (v/v)	Days														
	0	1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final	
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0		
DO (mg/L)	7.9	7.4	8.1	7.5	8.1	7.6	8.0	7.5	8.2	7.3	8.1	7.4	8.2		
pH	7.9	7.9	8.0	7.9	8.0	7.9	8.1	7.7	7.9	7.6	7.8	7.6	8.0		
Cond. (µS/cm)	264	263		259		264		260		262		26	258		
Initials	EMM	EMM		KL		YML		JS		JS		EMM	MG		

MG

Concentration: 100% (v/v)	Days														
	0	1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final	
Temperature (°C)	24.5	25.0	24.6	25.0	25.5	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0		
DO (mg/L)	7.8	7.5	8.1	7.5	8.1	7.5	8.2	7.5	8.2	7.3	8.2	7.3	8.2		
pH	8.2	8.0	8.1	8.1	8.0	8.1	8.0	7.7	8.0	7.7	8.0	7.7	7.9		
Cond. (µS/cm)	553	555		543		555		546		543		549	525		
Initials	EMM	EMM		KL		YML		JS		JS		EMM	MG		

MG

Thermometer: 4 DO meter: 2 pH meter: 4 Conductivity meter: 2

	Control	100% (v/v)		
Hardness*	100	282		
Alkalinity*	98	160		

* mg/L as CaCO3

Analysts: EMM, AWD, JS, MG, YML, KL
Reviewed by: JGH
Date reviewed: May 19/16

Sample Description: clear, some particulate ~~or precipitate~~, odourless, colourless

Comments: **Broodboard Used:** 041416B

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck Coal
Sample ID: CC ICRSSLCC WS 2016-04-25 N
Work Order: 16-779

(v/v) %

Start Date & Time: April 28/16 @ 1600h
Stop Date & Time: May 4/16 @ 1630h
Set up by: EMMA

Days	Concentration: Control										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	2	4	3	3	✓	4	4	3	4	4	MM
5	6	8	8	9	✓	8	10	9	7	✓	MG
6	10	11	12	12	✓	12	11	12	11	11	MG
7											
8											
Total	18	23	23	24	0	24	25	24	22	15	MG

Days	Concentration: 1.56%										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	4	2	3	4	3	3	4	3	3	3	MM
5	8	9	9	10	6	9	8	✓	✓	8	MG
6	12	12	11	13	10	12	12	11	9	10	MG
7											
8			23								
Total	24	23	23 MG	27	19	24	24	14	12	21	MG

Days	Concentration: 3.12%										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	3	✓	3	3	✓	4	4	4	3	4	MM
5	6	✓	5	7	✓	✓	7	✓	8	9	MG
6	12	✓	10	10	✓	9	11	11	11	12	MG
7											
8											
Total	21	0	18	20	0	13	22	15	22	25	MG

Days	Concentration: 6.25%										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	4	4	4	3	3	1	3	✓	4	4	MM
5	7	9	8	9	10	6	6	5	✓	8	MG
6	12	12	11	12	12	9	10	10	8	11	MG
7											
8											
Total	23	25	23	24	25	16	19	15	12	23	MG

Days	Concentration: 12.5%										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	4	3	3	3	4	4	6	3	3	3	MM
5	6	10	6	8	9	9	X	X	9	6	MG
6	12	13	12	11	12	13	|	|	10	10	MG
7											
8											
Total	22	26	21	22	25	26	6X	3X	22	19	MG

Days	Concentration: 25%										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	3	4	✓	4	3	2	3	✓	3	3	MM
5	6	6	6	7	7	4	7	✓	✓	✓	MG
6	10	9	12	10	10	9	10	✓	✓	10	MG
7											
8											
Total	19	19	18	21	20	15	20	0	3	13	MG

Days	Concentration: 50%										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	4	4	5	4	3	✓	3	X	4	3	MM
5	6	6	4	4	3	✓	8	|	✓	✓	MG
6	10	13	10	9	10	✓	10	|	8	10	MG
7											
8											
Total	20	23	19	17	16	0	21	09	12	13	MG

Days	Concentration: 100%										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	✓	3	2	3	✓	4	4	3	3	3	MM
5	✓	9	6	9	✓	✓	9	✓	8	10	MG
6	✓	11	9	8	✓	9	10	11	10	9	MG
7											
8											
Total	0	23	17	20	0	13	23	14	21	22	MG

Days	Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality.

Sample Description: some particulate clear, no ~~precipitate or particulate~~, odourless, colourless

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JSR

Date reviewed: May 19/16

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	01-8271-3680	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:25	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	02-3451-4972	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 16:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 16:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 1h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1972985	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	9.973	7.919	N/A	10.03	NA	12.63
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

6d Survival Rate Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	10	1	1	1	0	0	0.0%	0.0%	10	10
1.56		10	1	1	1	0	0	0.0%	0.0%	10	10
3.12		10	1	1	1	0	0	0.0%	0.0%	10	10
6.25		10	1	1	1	0	0	0.0%	0.0%	10	10
12.5		10	0.8	0	1	0.1333	0.4216	52.7%	20.0%	8	10
25		10	1	1	1	0	0	0.0%	0.0%	10	10
50		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10
100		10	1	1	1	0	0	0.0%	0.0%	10	10

6d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1	1	1	1	1	1	1	1	1	1
1.56		1	1	1	1	1	1	1	1	1	1
3.12		1	1	1	1	1	1	1	1	1	1
6.25		1	1	1	1	1	1	1	1	1	1
12.5		1	1	1	1	1	1	0	0	1	1
25		1	1	1	1	1	1	1	1	1	1
50		1	1	1	1	1	1	1	0	1	1
100		1	1	1	1	1	1	1	1	1	1

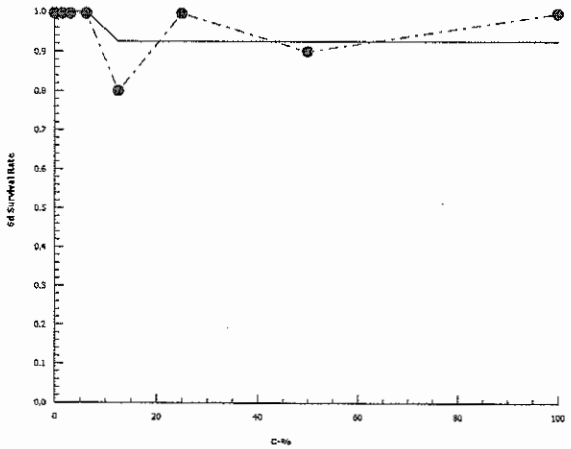
Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID: 01-8271-3680 **Endpoint:** 6d Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 11 May-16 12:25 **Analysis:** Linear Interpolation (ICPIN) **Official Results:** Yes

6d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.56		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.12		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	0/1	0/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	19-4952-9143	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 May-16 14:23	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	02-3451-4972	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 16:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	04 May-16 16:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 1h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	873355	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	2.259	0.329	16.3	44.28	6.134	304
IC10	12.57	0.7662	35.4	7.956	2.825	130.5
IC15	15.32	1.347	60.13	6.528	1.663	74.23
IC20	18.62	2.069	N/A	5.37	NA	48.34
IC25	22.6	2.861	N/A	4.425	NA	34.95
IC40	>100	N/A	N/A	<1	NA	NA
IC50	>100	N/A	N/A	<1	NA	NA

Reproduction Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	10	19.8	0	25	2.412	7.627	38.52%	0.0%
1.56		10	21.1	12	27	1.509	4.771	22.61%	-6.57%
3.12		10	15.6	0	25	2.825	8.934	57.27%	21.21%
6.25		10	20.5	12	25	1.478	4.673	22.79%	-3.54%
12.5		10	19.2	3	26	2.56	8.094	42.16%	3.03%
25		10	14.8	0	21	2.356	7.451	50.34%	25.25%
50		10	14.1	0	23	2.584	8.171	57.95%	28.79%
100		10	15.3	0	23	2.781	8.795	57.48%	22.73%

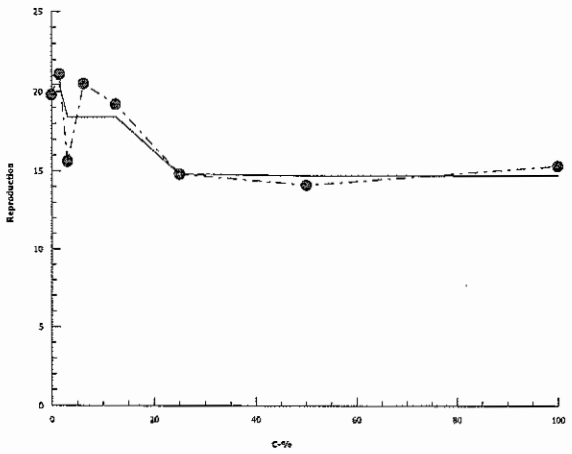
Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	18	23	23	24	0	24	25	24	22	15
1.56		24	23	23	27	19	24	24	14	12	21
3.12		21	0	18	20	0	13	22	15	22	25
6.25		23	25	23	24	25	16	19	15	12	23
12.5		22	26	21	22	25	26	6	3	22	19
25		19	19	18	21	20	15	20	0	3	13
50		20	23	19	17	16	0	21	0	12	13
100		0	23	17	20	0	13	23	14	21	22

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	19-4952-9143	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 May-16 14:23	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck Coal
Work Order No.: 16479

Start Date/Time: Apr 28/16 @ 1300h
Set up by: EMM

Sample Information:

Sample ID: LC_DCL_WS_2016-04-26_N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 5x20L

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 042016B
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 18
Mortality (%) in previous 7 d: 10
Individual female # used ≥8 young on test day: 23, 26, 28, 29, 30, 32, 33, 34, 36, 37, 40

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd 143
Stock Solution ID: 16NaCl
Date Initiated: Apr 13/16

7-d LC50 (95% CL): 2.1 (2.0-2.2) g/L NaCL
7-d IC50 (95% CL): 1.6 (1.4-1.8) g/L NaCL

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCL CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-1.9) g/L NaCL CV (%): 12

Test Results:

	Survival	Reproduction
LC50 % (v/v) (95% CL)	>100	
IC25 % (v/v) (95% CL)		70.6 (40.1-NA)
IC50 % (v/v) (95% CL)		>100

Reviewed by: JGL
Date reviewed: May 18/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck Coal
Sample ID: LC_DC1_WS_2016-04-26_N
Work Order #: 16479

Start Date & Time: April 28/16 @ 1300h
Stop Date & Time: May 5/16 @ 0905h
Test Species: *Ceriodaphnia dubia*

Concentration: control	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	24.0
DO (mg/L)	8.0	7.3	8.2	7.3	7.9	7.4	8.2	7.2	8.2	8.0	8.2	7.5	8.1	7.3
pH	7.8	7.9	8.0	7.7	8.0	7.7	7.9	7.3	8.0	7.6	7.9	7.6	8.1	7.6
Cond. (µS/cm)	222	222		212		223		223		216		221		222
Initials	EMM	EMM		KL		ML		JS		JS		EMM		MG

Concentration: 1.56% (v/v)	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	24.0
DO (mg/L)	8.0	7.4	8.1	7.3	8.0	7.3	8.1	7.3	8.2	7.4	8.2	7.5	8.1	7.3
pH	8.0	7.9	8.0	7.8	7.9	7.8	8.0	7.5	8.0	7.7	7.9	7.5	8.0	7.6
Cond. (µS/cm)	222	222		215		214		216		218		222		220
Initials	EMM	EMM		KL		ML		JS		JS		EMM		MG

Concentration: 12.5% (v/v)	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	24.0	25.0	24.0	25.0	24.5	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	24.0
DO (mg/L)	8.0	7.4	8.1	7.4	8.1	7.2	8.1	7.4	8.2	7.4	8.2	7.4	8.1	7.2
pH	8.0	7.9	8.0	7.8	7.9	7.8	8.1	7.5	8.1	7.7	7.9	7.5	8.0	7.6
Cond. (µS/cm)	223	229		217		219		218		221		222		221
Initials	EMM	EMM		KL		ML		JS		JS		EMM		MG

Concentration: 100% (v/v)	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	24.5	25.0	24.0	25.0	25.5	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	24.0
DO (mg/L)	7.9	7.4	8.1	7.3	8.1	7.3	8.2	7.4	8.2	7.3	8.2	7.4	8.1	7.2
pH	8.1	7.9	8.1	7.9	8.0	7.8	8.0	7.6	8.0	7.7	7.9	7.5	8.0	7.7
Cond. (µS/cm)	229	231		225		228		225		226		228		227
Initials	EMM	EMM		KL		ML		JS		JS		EMM		MG

Thermometer: 4 **DO meter:** 2 **pH meter:** 4 **Conductivity meter:** 2

	Control	100% (v/v)		
Hardness*	100	129		
Alkalinity*	98	116		

* mg/L as CaCO3

Analysts: EMM, AM, JS, MG, ML, KL
Reviewed by: JM
Date reviewed: May 18/16

Sample Description: clear, ~~no precipitate~~ (emm) / ~~no~~ some particulate, odourless, colourless

Comments: **Broodboard Used:** 042016B

Version 1.3 Issued May 22, 2015

Nautilus Environmental Company Inc.

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck Coal
Sample ID: LC-DC1-WS_2016-04-26_N
Work Order: 16479

Start Date & Time: April 28/16 @ 1300h
Stop Date & Time: May 5/16 @ 0905h
Set up by: EMM

% (v/v)

Days	Concentration: CONTROL										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KC
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	YWL
4	4	X	4	3	4	3	3	4	4	4	EMM
5	10	|	9	9	10	8	8	9	10	9	EMM
6	✓	|	13	✓	✓	✓	✓	✓	✓	✓	MLT
7	12	|	✓	12	13	13	12	11	13	11	MLT
8											
Total	26	0X	26	24	27	24	23	24	27	24	MLT

Days	Concentration: 1.56										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	—	—	—	—	—	✓	✓	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	YWL
4	4	4	4	3	4	4	4	3	5	4	EMM
5	8	9	9	8	10	8	6	✓	8	9	EMM
6	✓	✓	✓	✓	✓	10	✓	9	✓	✓	MLT
7	14	13	12	14	13	✓	14	14	14	13	MLT
8											
Total	26	26	25	25	27	22	24	26	27	26	MLT

Days	Concentration: 3.12										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	✓	YWL
4	4	4	3	4	4	3	3	5	4	|	EMM
5	8	9	8	✓	9	8	8	✓	10	|	EMM
6	✓	✓	10	6	11	✓	✓	9	✓	|	MLT
7	10	14	~~14~~ ✓	11	10	11	12	13	14	|	MLT
8											
Total	22	27	21	21	24	22	23	27	28	4X	MLT

Days	Concentration: 6.25										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	YWL
4	4	4	5	4	3	4	4	5	2	4	EMM
5	6	8	8	9	8	9	10	✓	9	✓	EMM
6	✓	✓	10	✓	11	✓	✓	10	9	9	MLT
7	10	13	12	11	✓	12	11	14	✓	11	MLT
8											
Total	20	25	23	24	21	25	25	29	20	24	MLT

Days	Concentration: 12.5										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	YWL
4	4	4	4	4	4	3	3	4	3	4	EMM
5	✓	✓	✓	10	9	X	9	9	✓	8	EMM
6	8	8	9	✓	10	|	✓	✓	9	✓	MLT
7	10	12	14	12	12	|	12	11	11	10	MLT
8											
Total	22	24	27	26	23	3X	24	24	23	22	MLT

Days	Concentration: 25										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	—	—	—	—	—	—	—	✓	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	YWL
4	4	3	4	4	✓	3	4	4	3	5	EMM
5	6	✓	7	✓	5	✓	✓	10	8	✓	EMM
6	✓	7	9	7	4	8	8	✓	✓	5	MLT
7	13	13	✓	12	5	13	12	11	10	14	MLT
8											
Total	23	23	20	23	14	24	24	25	20	24	MLT

Days	Concentration: 50										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	—	—	—	—	—	—	—	—	—	—	KC
3	—	—	—	—	—	—	—	—	—	—	YWL
4	5	4	3	3	✓	4	4	✓	3	3	EMM
5	10	8	✓	9	4	10	8	5	✓	✓	EMM
6	✓	11	6	✓	9	✓	✓	10	6	9X	MLT
7	12	✓	14	10	✓	11	10	✓	12	|	MLT
8								MLT			
Total	27	23	23	22	13	25	22	13 15	21	12X	MLT

Days	Concentration: 100										
	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	—	—	—	—	—	—	—	—	—	KC
3	—	✓	✓	✓	X	✓	✓	✓	✓	✓	YWL
4	X	4	3	3	|	✓	3	4	4	3	EMM
5	|	✓	9	✓	|	5	✓	✓	✓	10	EMM
6	|	3	✓	4	|	10	5	5	6	✓	MLT
7	|	10	11	11	|	✓	11	11	10	11	MLT
8	↓										
Total	0X	17	23	18	0X	15	19	20	20	24	MLT

Days	Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality.

Sample Description: clear, ~~no precipitate or particulate~~ some particulate, odourless, colourless

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JGR

Date reviewed: May 18/16

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	13-2808-1729	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 May-16 14:48	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	16-2804-2804	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 13:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 09:05	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 20h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	00-8128-9240	**Code:**	4D86018	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:30	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	28h (7.5 °C)	**Station:**	LC_DC1_WS_2016-04-26_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	536760	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	48.31	2.248	N/A	2.07	NA	44.49
EC10	68.36	8.893	N/A	1.463	NA	11.24
EC15	94.95	34.32	N/A	1.053	NA	2.914
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

7d Survival Rate Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	10	0.9	0	1	0.1	0.3162	35.14%	0.0%	9	10
1.56		10	1	1	1	0	0	0.0%	-11.11%	10	10
3.12		10	0.9	0	1	0.1	0.3162	35.14%	0.0%	9	10
6.25		10	1	1	1	0	0	0.0%	-11.11%	10	10
12.5		10	0.9	0	1	0.1	0.3162	35.14%	0.0%	9	10
25		10	1	1	1	0	0	0.0%	-11.11%	10	10
50		10	0.9	0	1	0.1	0.3162	35.14%	0.0%	9	10
100		10	0.8	0	1	0.1333	0.4216	52.7%	11.11%	8	10

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1	0	1	1	1	1	1	1	1	1
1.56		1	1	1	1	1	1	1	1	1	1
3.12		1	1	1	1	1	1	1	1	1	0
6.25		1	1	1	1	1	1	1	1	1	1
12.5		1	1	1	1	1	0	1	1	1	1
25		1	1	1	1	1	1	1	1	1	1
50		1	1	1	1	1	1	1	1	1	0
100		0	1	1	1	0	1	1	1	1	1

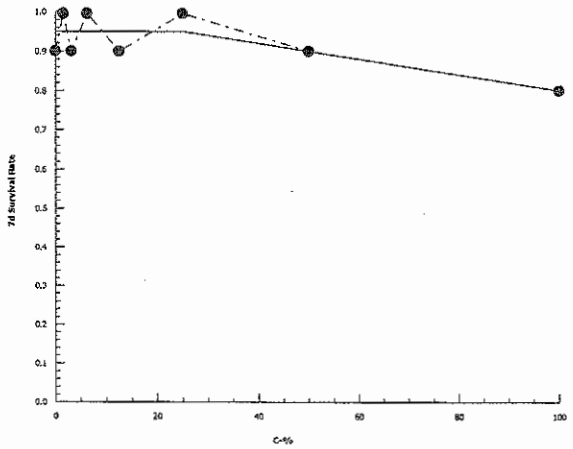
Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	13-2808-1729	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 May-16 14:48	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.56		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.12		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
100		0/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1

Graphics



Analyst:_____ QA: Mar 18/16

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	04-5027-5753	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 May-16 15:03	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	16-2804-2804	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 13:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 09:05	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 20h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	00-8128-9240	**Code:**	4D86018	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:30	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	28h (7.5 °C)	**Station:**	LC_DC1_WS_2016-04-26_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1630851	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	3.116	1.976	50.08	32.09	1.997	50.6
IC10	29.07	2.529	63.32	3.441	1.579	39.54
IC15	48.78	6.421	N/A	2.05	NA	15.57
IC20	59.19	26.37	N/A	1.689	NA	3.792
IC25	70.64	40.14	N/A	1.416	NA	2.491
IC40	>100	N/A	N/A	<1	NA	NA
IC50	>100	N/A	N/A	<1	NA	NA

Reproduction Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	10	22.5	0	27	2.54	8.031	35.69%	0.0%
1.56		10	25.4	22	27	0.4761	1.506	5.93%	-12.89%
3.12		10	21.9	4	28	2.152	6.806	31.08%	2.67%
6.25		10	23.6	20	29	0.8718	2.757	11.68%	-4.89%
12.5		10	21.8	3	27	2.149	6.795	31.17%	3.11%
25		10	22	14	25	1.033	3.266	14.85%	2.22%
50		10	20.3	12	27	1.627	5.143	25.34%	9.78%
100		10	15.6	0	24	2.729	8.631	55.32%	30.67%

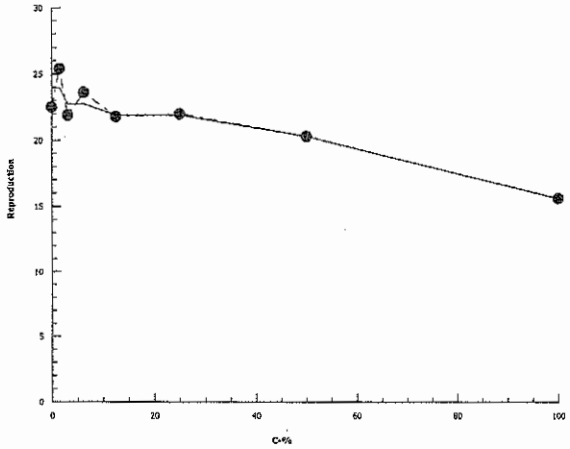
Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	26	0	26	24	27	24	23	24	27	24
1.56		26	26	25	25	27	22	24	26	27	26
3.12		22	27	21	21	24	22	23	27	28	4
6.25		20	25	23	24	21	25	25	29	20	24
12.5		22	24	27	26	23	3	24	24	23	22
25		23	23	20	23	14	24	24	25	20	24
50		27	23	23	22	13	25	22	15	21	12
100		0	17	23	18	0	15	19	20	20	24

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	04-5027-5753	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	16 May-16 15:03	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck Coal
Work Order No.: 16479

Start Date/Time: April 28/16 @ 1330h
Set up by: EMM

Sample Information:

Sample ID: LC_FD DSDC W3 2016-04-26 N
Sample Date: April 27/16
Date Received: April 28/16
Sample Volume: 5 x 20L

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 042016A
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 18
Mortality (%) in previous 7 d: 0
Individual female # used ≥8 young on test day: 2, 3, 4, 5, 6, 9, 11, 12, 13, 16 → 20

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd143
Stock Solution ID: 16NaCl**
Date Initiated: April 13/16

7-d LC50 (95% CL): 2.1 (2.0-2.2) g/L NaCL
7-d IC50 (95% CL): 1.6 (1.4-1.8) g/L NaCL

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCL CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-1.9) g/L NaCL CV (%): 12

Test Results:

	Survival	Reproduction
LC50 % (v/v) (95% CL)	>100	
IC25 % (v/v) (95% CL)		>100
IC50 % (v/v) (95% CL)		>100

Reviewed by: JGH
Date reviewed: May 19/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: TECK
Sample ID: LC-FRDSDC-WS20160426
Work Order #: 16479

Start Date & Time: April 28/16 @ 1330
Stop Date & Time: May 5/16 @ 1115h
Test Species: *Ceriodaphnia dubia*

Concentration: control	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.5	8.2	7.3	7.9	7.4	8.2	7.1	8.2	7.1	8.2	7.1	8.1	7.3
pH	7.8	7.8	8.0	7.7	8.0	7.7	7.9	7.5	8.0	7.6	7.9	7.6	8.1	7.6
Cond. (µS/cm)	227	227		212		223		223		216		221		223
Initials	EMM	EMM		KL		YML		JS		JS		EMM		MLT

Concentration: 1.56% (v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	7.9	7.4	8.1	7.3	8.1	7.4	8.0	7.1	8.2	7.1	8.2	7.0	8.2	7.3
pH	7.9	7.8	8.0	7.8	8.0	7.9	8.0	7.6	8.0	7.6	7.9	7.6	7.9	7.6
Cond. (µS/cm)	224	224		220		223		220		226		224		222
Initials	EMM	EMM		KL		YML		JS		JS		EMM		MLT

Concentration: 12.5% (v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.5	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	7.8	7.4	8.1	7.3	8.1	7.5	8.0	7.2	8.2	7.1	8.2	7.0	8.2	7.3
pH	8.0	7.7	8.0	7.8	8.0	7.9	8.1	7.7	8.0	7.7	7.9	7.7	7.9	7.7
Cond. (µS/cm)	263	266		256		258		258		263		269		262
Initials	EMM	EMM		KL		YML		JS		JS		EMM		MLT

Concentration: 100% (v/v)	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	7.6	7.4	8.0	7.3	8.2	7.5	8.0	7.2	8.2	7.2	8.2	7.1	8.2	7.3
pH	8.1	8.0	8.1	8.0	8.0	8.0	8.0	7.9	8.0	7.9	8.0	7.9	8.0	7.8
Cond. (µS/cm)	547	547		539		543		542		551		549		519
Initials	EMM	EMM		KL		YML		JS		JS		EMM		MLT

Thermometer: 4 DO meter: 2 pH meter: 4 Conductivity meter: 2

	Control	100% (v/v)		
Hardness*	100	287		
Alkalinity*	98	158		

* mg/L as CaCO3

Analysts: EMM, AWD, JS, MLT, MH, KL
Reviewed by: JBL
Date reviewed: May 19/16

Sample Description: clear, ~~no particulate~~ some particulate, ~~no precipitate~~, odorless, colorless

Comments: Broodboard Used: 042016A

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck
Sample ID: ~~LC-FRD3SCC~~ LC-FRD5DC WS 2016-04-26N
Work Order: 16479
% (v/v)

Start Date & Time: April 28/16 @ 1330
Stop Date & Time: May 5/16 @ 1115h
Set up by: EMM

Concentration: CONTROL

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
3	/	/	/	/	/	/	/	/	/	/	A
4	✓	4	4	4	3	4	5	4	4	3	EMM
5	6	7	8	8	8	✓	8	8	7	7	JS
6	9	✓	✓	✓	✓	10	✓	✓	✓	✓	JS
7	13	10	12	11	11	12	12	11	10	11	MG
8											
Total	28	21	24	23	22	26	25	23	21	21	MG

Concentration: 1.56

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	–	–	–	–	–	–	–	–	–	–	KL
3	/	/	/	/	/	/	/	/	/	/	A
4	3	3	4	3	4	3	4	✓	4	5	EMM
5	7X	8?	7	9	8	8	6	5	7	7	JS
6	|	✓	✓	✓	✓	✓	✓	9	✓	✓	JS
7	|	10	11	9	12	9	12	10	12	12	MG
8											
Total	10X	20	22	21	24	20	22	24	23	24	MG

Concentration: 3.12

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	–	–	–	–	–	–	–	–	–	–	KL
3	/	/	/	/	/	/	/	/	/	/	A
4	①	5	4	3	4	3	✓	4	4	✓	JS
5	6	8	8	7	8	8	5	8	8	5	JS
6	✓	✓	11	✓	✓	✓	✓	✓	✓	10	JS
7	12	11	✓	10	12	12	11	10	12	✓	MG
8											
Total	22	24	23	20	24	23	16	22	24	15	MG

① 4 eggs

Concentration: 6.25

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	–	–	–	–	–	–	–	–	–	–	KL
3	/	/	/	/	/	/	/	/	/	/	A
4	3	5	3	3	3	2	3X	5	✓	4	JS
5	8	✓	7	8	8	7	|	✓	6	7	JS
6	✓	9	✓	✓	✓	✓	|	9	9	✓	JS
7	10	9	12	11	10	10	|	10	✓	11	MG
8											
Total	21	23	22	22	21	19	3X	24	15	22	MG

Concentration: 12.5

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	–	–	–	–	–	–	–	–	–	–	KL
3	/	/	/	/	/	/	/	/	/	/	A
4	4	4	✓	5	4	3	3	4	4	4	EMM
5	8	7	6	7	8	8	7	6	8	7	JS
6	13	✓	13	✓	✓	✓	13	✓	✓	✓	JS
7	✓	10	11	10	10	11	✓	13	12	13	MG
8											
Total	25	21	30	22	22	22	23	23	24	24	MG

Concentration: 25

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	–	–	–	–	–	–	–	–	–	–	KL
3	/	/	/	/	/	/	/	/	/	/	A
4	✓	4	4	5	3	4	4	5	4	4	JS
5	4	7	7	✓	8	7	7	6	9	8	JS
6	9	✓	✓	10	✓	✓	✓	✓	✓	✓	JS
7	11	X	10	11	11	10	9	8	12	12	MG
8											
Total	24	11X	21	26	22	21	20	18	23	24	MG

Concentration: 50

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	–	–	–	–	–	–	–	–	–	–	KL
3	/	/	/	/	/	/	/	/	/	/	A
4	4	4	3	3	4	2	3	4	4	3	JS
5	8	7	7	7	8	7	8	8	8	8	JS
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
7	12	11	11	10	13	9	10	11	8	12	MG
8											
Total	24	22	21	20	25	18	21	23	20	23	MG

Concentration: 100

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	–	–	–	–	–	–	–	–	–	–	KL
3	/	/	/	/	/	/	/	/	/	/	A
4	4	✓	✓	4	3	3	3	2	3	4	EMM
5	7	4	6	7	8	7	6	7	8	7	JS
6	✓	9	9	✓	✓	✓	✓	✓	✓	✓	JS
7	10	✓	✓	10	6	9	10	8	11	12	MG
8											
Total	21	13	15	21	17	19	19	17	22	23	MG

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality. Same particulate

Sample Description: clear, ~~no particulate, no precipitate~~, odourless, colourless

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JGL

Date reviewed: May 19/16

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:	15-8089-6457	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:54	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	17-2769-4644	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 13:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 11:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 22h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	07-5438-7274	**Code:**	2CF7094A	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:04	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	28h (8 °C)	**Station:**	LC FRDSDC WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1328034	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	N/A	N/A	<1	NA	NA
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

7d Survival Rate Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	10	1	1	1	0	0	0.0%	0.0%	10	10
1.56		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10
3.12		10	1	1	1	0	0	0.0%	0.0%	10	10
6.25		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10
12.5		10	1	1	1	0	0	0.0%	0.0%	10	10
25		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10
50		10	1	1	1	0	0	0.0%	0.0%	10	10
100		10	1	1	1	0	0	0.0%	0.0%	10	10

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1	1	1	1	1	1	1	1	1	1
1.56		0	1	1	1	1	1	1	1	1	1
3.12		1	1	1	1	1	1	1	1	1	1
6.25		1	1	1	1	1	1	0	1	1	1
12.5		1	1	1	1	1	1	1	1	1	1
25		1	0	1	1	1	1	1	1	1	1
50		1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	1

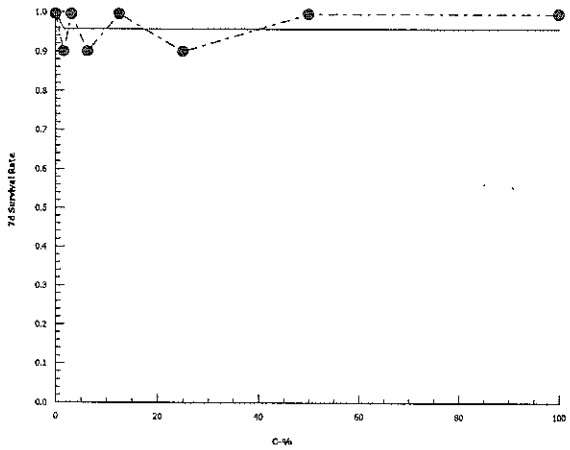
Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	15-8089-6457	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:54	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.56		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.12		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



Analyst:_____ QA: JGL May 19/16

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	06-6421-9313	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:54	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	17-2769-4644	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 13:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 11:15	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 22h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	07-5438-7274	**Code:**	2CF7094A	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:04	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	28h (8 °C)	**Station:**	LC FRDSDC WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	204869	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	0.6883	0.4173	57.94	145.3	1.726	239.7
IC10	53.32	1.009	86.34	1.875	1.158	99.14
IC15	72.88	2.729	N/A	1.372	NA	36.64
IC20	99.47	61.08	N/A	1.005	NA	1.637
IC25	>100	N/A	N/A	<1	NA	NA
IC40	>100	N/A	N/A	<1	NA	NA
IC50	>100	N/A	N/A	<1	NA	NA

Reproduction Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	10	23.4	21	28	0.7483	2.366	10.11%	0.0%
1.56		10	21	10	24	1.317	4.163	19.83%	10.26%
3.12		10	21.3	15	24	1.044	3.302	15.5%	8.97%
6.25		10	19.2	3	24	1.965	6.215	32.37%	17.95%
12.5		10	23.6	21	30	0.8055	2.547	10.79%	-0.85%
25		10	21	11	26	1.325	4.19	19.95%	10.26%
50		10	21.7	18	25	0.6675	2.111	9.73%	7.27%
100		10	18.7	13	23	1.012	3.199	17.11%	20.09%

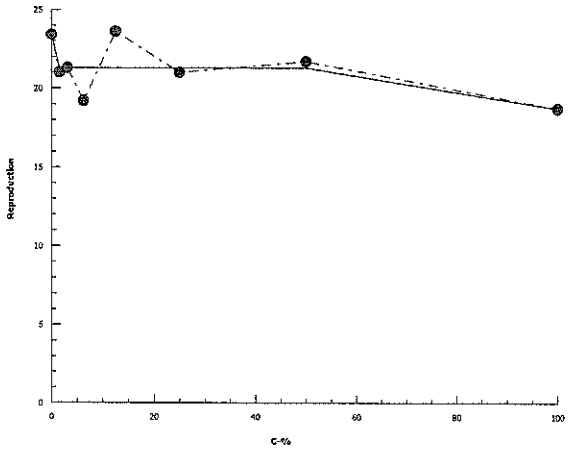
Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	28	21	24	23	22	26	25	23	21	21
1.56		10	20	22	21	24	20	22	24	23	24
3.12		22	24	23	20	24	23	16	22	24	15
6.25		21	23	22	22	21	19	3	24	15	22
12.5		25	21	30	22	22	22	23	23	24	24
25		24	11	21	26	22	21	20	18	23	24
50		24	22	21	20	25	18	21	23	20	23
100		21	13	15	21	17	19	19	17	22	23

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	06-6421-9313	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:54	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck coal
Work Order No.: 16479

Start Date/Time: April 28/16 @ 1600h
Set up by: EMM

Sample Information:

Sample ID: LC_DCDSWS20160426A
Sample Date: April 27/16
Date Received: April 28/16
Sample Volume: 5 x20L

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: ~~042016~~ 041416B
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 29
Mortality (%) in previous 7 d: 5
Individual female # used ≥8 young on test day: 22,23,24,25,26,27,28,29,30,35,39,40

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd143
Stock Solution ID: 16NaCl*
Date Initiated: April 13/16

7-d LC50 (95% CL): 2.1 (2.0-2.2) g/L NaCl
7-d IC50 (95% CL): 1.6 (1.4-1.8) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCl CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-1.9) g/L NaCl CV (%): 12

Test Results:

	Survival	Reproduction
LC50 % (v/v) (95% CL)	>100	
IC25 % (v/v) (95% CL)		32.9 (14.8 – N/A)
IC50 % (v/v) (95% CL)		>100

Reviewed by: JGL
Date reviewed: May 19/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: LC-DCDS WS2016-04-26
Work Order #: 16479
Start Date & Time: April 28/16 @ 1600h
Stop Date & Time: May 5/16 @ 1050h
Test Species: *Ceriodaphnia dubia*

Concentration: control

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.5	8.2	7.3	7.9	7.4	8.2	7.5	8.2	7.5	8.1	7.7	8.1	7.3
pH	7.8	7.8	8.0	7.5	8.0	7.7	7.9	7.9	8.0	7.7	8.0	7.6	8.1	7.6
Cond. (µS/cm)	222	222		212		223		223		219		221		222
Initials	EMM	EMM		KC		YuL		JS		EMM		EMM		MLT

Concentration: 1.56% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	7.9	7.4	7.9	7.8	8.0	7.5	8.1	7.5	8.2	7.4	8.1	7.7	8.1	7.3
pH	7.8	7.7	7.8	7.8	8.0	7.8	8.0	7.9	8.0	7.7	8.0	7.6	8.0	7.6
Cond. (µS/cm) (1)	238	220		214		214		215		218		216		216
Initials	EMM	EMM		KC		YuL		JS		EMM		EMM		MLT

(1) 223 ev

Concentration: 12.5% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	7.9	7.5	7.9	7.8	8.1	7.4	8.0	7.5	8.2	7.4	8.0	7.7	8.1	7.3
pH	7.8	7.8	7.8	7.8	8.0	7.8	8.0	7.9	8.0	7.7	8.0	7.6	8.0	7.6
Cond. (µS/cm)	223	218		212		211		214		213		213		214
Initials	EMM	EMM		KC		YuL		JS		EMM		EMM		MLT

Concentration: 100% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	7.8	7.8	7.9	7.3	8.1	7.5	8.0	7.5	8.2	7.2	7.9	7.6	8.0	7.2
pH	7.8	7.5	7.8	7.8	8.0	8.0	8.0	7.8	8.0	7.6	7.9	7.6	7.8	7.5
Cond. (µS/cm)	204	193		189		191		190		192		191		204
Initials	EMM	EMM		KC		YuL		JS		EMM		EMM		MLT

Thermometer: 4 **DO meter:** 2 **pH meter:** 4 **Conductivity meter:** 2

	Control	100% (v/v)		
Hardness*	100	104		
Alkalinity*	98	86		

* mg/L as CaCO3

Analysts: EMM, AWD, JS, MLT, DS, KC, YuL
Reviewed by: JH
Date reviewed: May 19/16

Sample Description: clear, odourless, some particulate, colourless ~~no precipitate~~

Comments: **Broodboard Used:** 041416B

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck
Sample ID: C-DCDSWS2016-04-26 D
Work Order: 16479

Start Date & Time: April 28/16 @ 1600h (JS)
Stop Date & Time: May 5/16 @ 1050h
Set up by: AMM

(v/v) %

Concentration: Control

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	–	–	–	–	–	–	–	+	–	–	KK
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	4	5	✓	3	3	✓	4	4	3	4	JS
5	6	✓	8	9	7	9	8	8	6	5	MG
6	✓	12	10	11	12	12	✓	✓	✓	✓	MG
7	10	12	✓	✓	✓	✓	12	10	10	10	MG
8											
Total	20	29	18	23	22	21	24	22	19	19	MG

Concentration: 1.56%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	–	–	–	–	–	–	–	–	–	–	KK
3	✓	✓	✓	✓	✓	✓	✓	✓	3	✓	A
4	✓	5	5	3	4	4	✓	✓	✓	2	JS
5	7	✓	✓	8	✓	9	9	✓	10	7	MG
6	10	6	10	✓	11	✓	12	✓	13	✓	MG
7	14	12	14	12	14	12	✓	✓	✓	10	MG
8											
Total	31	23	29	23	29	25	21	0	26	19	MG

Concentration: 3.12%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	–	–	–	–	–	–	–	–	–	–	KK
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	✓	5	5	✓	4	5	✓	4	✓	4	JS
5	8	✓	✓	✓	9	✓	6	9	3	8	MG
6	✓	4	12	✓	10	8	8	✓	6	✓	MG
7	9	✓	13	✓	✓	10	11	11	✓	11	MG
8											
Total	21	6	30	0	23	23	25	24	9	23	MG

Concentration: 6.25%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	–	–	–	–	–	–	–	–	–	–	KK
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	✓	4	✓	5	3	✓	3	3	4	4	JS
5	5	8	8	9	9	✓	9	8	8	9	MG
6	9	✓	10	✓	✓	✓	✓	✓	✓	✓	MG
7	✓	12	✓	11	10	✓	10	12	11	10	MG
8											
Total	14	24	18	25	22	0	22	23	23	23	MG

Concentration: 12.5%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	–	–	–	–	–	–	–	–	–	–	KK
3	✓	✓	✓	✓	✓	✓	3	✓	✓	✓	A
4	2	5	4	✓	3	2	✓	4	4	3	JS
5	8	✓	9	10	7	7	9	8	9	8	MG
6	✓	12	12	12	✓	11	10	✓	✓	✓	MG
7	10	13	✓	✓	11	✓	✓	10	10	13	MG
8											
Total	20	30	25	22	21	20	22	22	23	24	MG

Concentration: 25%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	–	–	–	–	–	–	–	–	–	–	KK
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	✓	4	4	5	3	3	2	3	✓	5	JS
5	✓	6	✓	✓	8	7	8	8	9	X	MG
6	✓	✓	9	11	✓	✓	✓	✓	✓	1	MG
7	✓	10	12	11	10	9	11	11	10	1	MG
8											
Total	0	20	25	27	21	19	19	21	22	0X	MG

Concentration: 50%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	–	–	–	–	–	–	–	–	–	–	KK
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	5	5	2	3	✓	✓	✓	✓	✓	✓	JS
5	5	6	4	7	✓	6	8	5	6	6	MG
6	✓	✓	✓	✓	✓	10	11	11	12	10	MG
7	10	9	7	8	✓	✓	✓	✓	✓	✓	MG
8											
Total	19	19	13	18	0	16	19	16	18	16	MG

Concentration: 100%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	–	–	–	–	–	–	–	–	–	–	KK
3	✓	✓	+	✓	✓	✓	✓	✓	✓	✓	A
4	✓	4	|	3	3	✓	5	✓	3	5	JS
5	✓	6	|	6	5	6	6	✓	5	✓	MG
6	✓	✓	|	✓	✓	11	✓	✓	✓	8	MG
7	✓	10	|	11	9	✓	8	✓	10	12	MG
8											
Total	0	20	0X	20	17	17	18	0	18	25	MG

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality.

Sample Description: clear, odourless, some particulate, ~~no precipitate present~~, colourless

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JGR

Date reviewed: May 19/16

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	03-1747-8434	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:45	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	18-9629-3832	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 16:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 10:50	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 19h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-8345-2068	**Code:**	5275CDA4	**Client:**	Teck Coal
Sample Date:	27 Apr-16 07:58	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (6 °C)	**Station:**	LC DCDS WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	476804	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	50	16.26	N/A	2	NA	6.15
EC10	100	21.07	N/A	1	NA	4.746
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

7d Survival Rate Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	10	1	1	1	0	0	0.0%	0.0%	10	10
1.56		10	1	1	1	0	0	0.0%	0.0%	10	10
3.12		10	1	1	1	0	0	0.0%	0.0%	10	10
6.25		10	1	1	1	0	0	0.0%	0.0%	10	10
12.5		10	1	1	1	0	0	0.0%	0.0%	10	10
25		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10
50		10	1	1	1	0	0	0.0%	0.0%	10	10
100		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1	1	1	1	1	1	1	1	1	1
1.56		1	1	1	1	1	1	1	1	1	1
3.12		1	1	1	1	1	1	1	1	1	1
6.25		1	1	1	1	1	1	1	1	1	1
12.5		1	1	1	1	1	1	1	1	1	1
25		1	1	1	1	1	1	1	1	1	0
50		1	1	1	1	1	1	1	1	1	1
100		1	1	0	1	1	1	1	1	1	1

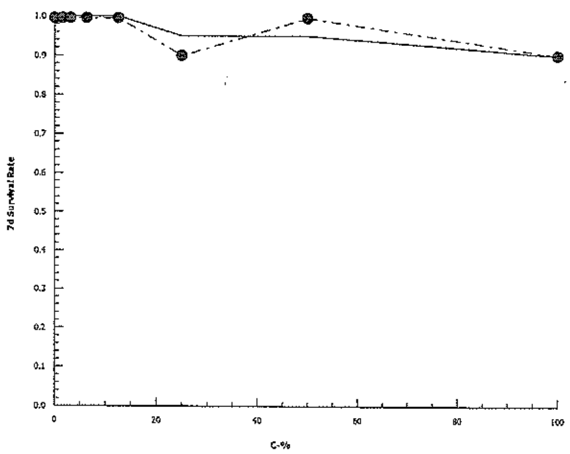
Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	03-1747-8434	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:45	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.56		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.12		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	17-9041-4250	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:45	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	18-9629-3832	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 16:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 10:50	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 19h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-8345-2068	**Code:**	5275CDA4	**Client:**	Teck Coal
Sample Date:	27 Apr-16 07:58	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (6 °C)	**Station:**	LC DCDS WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	164674	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	2.37	0.3974	27.57	42.19	3.627	251.6
IC10	13.46	0.9527	32.15	7.427	3.11	105
IC15	17.69	2.265	40.83	5.654	2.449	44.14
IC20	23.14	2.984	58.94	4.321	1.697	33.51
IC25	32.9	14.81	N/A	3.04	NA	6.754
IC40	>100	N/A	N/A	<1	NA	NA
IC50	>100	N/A	N/A	<1	NA	NA

Reproduction Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	10	21.7	18	29	1.012	3.199	14.74%	0.0%
1.56		10	22.6	0	31	2.782	8.796	38.92%	-4.15%
3.12		10	18.4	0	30	3.092	9.778	53.14%	15.21%
6.25		10	19.4	0	25	2.386	7.545	38.89%	10.6%
12.5		10	22.9	20	30	0.9363	2.961	12.93%	-5.53%
25		10	17.4	0	27	3.008	9.513	54.67%	19.82%
50		10	15.4	0	19	1.815	5.739	37.26%	29.03%
100		10	13.5	0	25	3.034	9.595	71.07%	37.79%

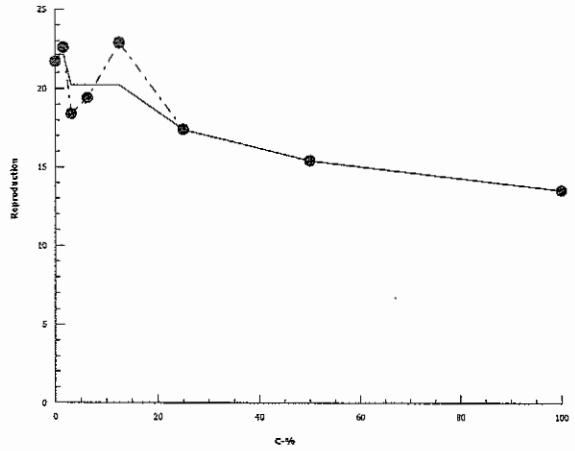
Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	20	29	18	23	22	21	24	22	19	19
1.56		31	23	29	23	29	25	21	0	26	19
3.12		21	6	30	0	23	23	25	24	9	23
6.25		14	24	18	25	22	0	22	23	23	23
12.5		20	30	25	22	21	20	22	22	23	24
25		0	20	25	27	21	19	19	21	22	0
50		19	19	13	18	0	16	19	16	18	16
100		0	20	0	20	17	17	18	0	18	25

Ceriodaphnia 7-d Survival and Reproduction Test | **Nautilus Environmental**

Analysis ID:	17-9041-4250	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:45	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck coal
Work Order No.: 16479

Start Date/Time: Apr 28/16 @ 1330h
Set up by: EMM

Sample Information:

Sample ID: LC-LCSWS 2016-0425
Sample Date: Apr 27/16 -N
Date Received: Apr 28/16
Sample Volume: 5x20L

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 042016A
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 18
Mortality (%) in previous 7 d: Ø
Individual female # used ≥8 young on test day: 2,3,4,5,6,9,11,12,13,16→20

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd143
Stock Solution ID: 16Na01
Date Initiated: Apr 13/16

7-d LC50 (95% CL): 2.1 (2.0-2.2) g/L NaCl
7-d IC50 (95% CL): 1.6 (1.4-1.8) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCl CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-1.9) g/L NaCl CV (%): 12

Test Results:

	Survival	Reproduction
LC50 % (v/v) (95% CL)	>100	
IC25 % (v/v) (95% CL)		>100
IC50 % (v/v) (95% CL)		>100

Reviewed by: JOL
Date reviewed: May 19/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck Coal
Sample ID: LC_LC5_WS-2016-04-25_N
Work Order #: 16479

Start Date & Time: April 28/16 @ 1330h
Stop Date & Time: ~~May 5/16~~ ① May 5/16 @ 1400h
Test Species: *Ceriodaphnia dubia*

① May 5/16 emm

Concentration: Control

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.5	8.2	7.2	7.9	7.4	8.2	7.0	8.2	7.4	8.1	7.5	8.1	7.6
pH	7.8	7.8	8.0	7.7	8.0	7.7	7.9	7.7	8.0	7.8	8.0	7.7	8.1	7.7
Cond. (µS/cm)	222	221		212		223		223		219		221		220
Initials	EMM	EMM		KL		MML		JS		EMM		EMM		EMM

emm

Concentration: 1.56% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	7.5	8.0	7.2	8.0	7.4	8.2	7.1	8.2	7.4	8.1	7.5	8.2	7.6
pH	7.9	7.8	8.0	7.8	8.0	7.8	8.0	7.7	8.0	7.8	8.0	7.7	8.0	7.7
Cond. (µS/cm)	226	225		221		220		223		220		221		225
Initials	EMM	EMM		KL		MML		JS		EMM		EMM		EMM

Concentration: 12.5% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.5	25.0	24.0	25.0	25.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	7.8	7.5	8.0	7.2	8.0	7.3	8.1	7.1	8.2	7.4	8.1	7.5	8.2	7.6
pH	8.0	7.8	8.0	7.9	8.0	7.9	8.0	7.7	8.0	7.8	8.0	7.7	8.0	7.7
Cond. (µS/cm)	262	261		262		256		259		260		258		259
Initials	EMM	EMM		KL		MML		JS		EMM		EMM		EMM

Concentration: 100% (v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.0	25.0	24.0	25.0	26.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	7.7	7.5	7.9	7.3	8.0	7.4	8.2	7.3	8.2	7.4	8.1	7.5	8.3	7.4
pH	8.1	8.0	8.1	8.0	8.1	8.0	8.1	7.8	8.1	7.8	8.1	7.7	8.1	7.7
Cond. (µS/cm)	529	533		529		532		532		533		532		501
Initials	EMM	EMM		KL		MML		JS		EMM		EMM		EMM

Thermometer: 4 **DO meter:** 2 **pH meter:** 4 **Conductivity meter:** 2

	Control	100% (v/v)		
Hardness*	100	268		
Alkalinity*	98	156		

* mg/L as CaCO3

Analysts: EMM, AWD, JS, ~~HG~~, KL, MML
Reviewed by: JSh
Date reviewed: May 19/16

Sample Description: clear, no (some) particulate ~~or precipitate~~ (emm), odourless, colourless

Comments: **Broodboard Used:** 042016A

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck Coal
Sample ID: CC-LCS-WS-2016-04-25-N
Work Order: 164714

% (v/v)

Start Date & Time: April 28/16 @ 1330h
Stop Date & Time: May 4/16 @ 1400h
Set up by: emm 5 emm

Concentration: CONTROL

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	kc
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	3	4	4	4	4	4	3	3	✓	5	JS
5	8	✓	✓	8	9	9	7	7	5	✓	emm
6	✓	8	8	✓	✓	✓	✓	10	✓	9	JS
7	11	10	9	12	12	10	10	✓	9	12	emm
8											
Total	22	22	21	24	25	23	20	20	14	26	emm

Concentration: 1,56

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	kc
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	4	✓	5	✓	2	4	4	✓	✓	3	JS
5	8	4	9	4	7	8	7	3	4	✓	emm
6	✓	9	✓	8	✓	✓	✓	9	9	6	JS
7	11	✓	11	✓	10	12	12	10	✓	11	emm
8											
Total	23	13	25	12	19	24	23	22	13	20	emm

Concentration: 3,12

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	kc
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	3	✓	4	3	5	✓	5	4	✓	✓	JS
5	8	4	6	✓	9	4	✓	6	3	4	emm
6	✓	3	✓	8	✓	6	8	8	9	9	JS
7	11	10	10	9	10	✓	12	12	10	9	emm
8											
Total	22	17	20	20	24	10	25	24	22	22	emm

Concentration: 6,25

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	kc
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	4	3	5	3	✓	4	3	2	✓	✓	JS
5	9	✓	✓	✓	4	✓	✓	✓	4	3	emm
6	✓	7	7	6	9	✓	6	7	9	3	JS
7	11	13	12	10	✓	10	12	11	✓	10	emm
8											
Total	24	23	24	19	13	14	21	20	13	16	emm

Concentration: 12,5

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	kc
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	A
4	3	✓	4	5	ex	4	3	4	4		JS
5	7	3	8	✓	|	✓	✓	✓	7		emm
6	✓	5	✓	8	|	6	7	9	✓		JS
7	10	11	10	10	|	12	12	11	9		emm
8											
Total	20	19	22	23	0X	22	22	24	20	0X	emm

Concentration: 25

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	kc
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	4	3	4	4	4	4	4	✓	✓	3	JS
5	✓	9	✓	✓	✓	✓	✓	4	3	✓	emm
6	6	9	7	7	6	8	8	8	8	5	JS
7	12	10	12	10	10	9	9	✓	✓	12	emm
8											
Total	22	22	23	21	20	21	20	12	11	20	emm

Concentration: 50

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	kc
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	4	4	2	5	3	✓	3	4	4	4	JS
5	✓	8	✓	✓	✓	3	✓	✓	9	9	emm
6	✓	✓	6	✓	8	9	6	5	✓	✓	JS
7	10	13	11	10	10	✓	12	11	9	10	emm
8											
Total	19	25	19	15	21	12	21	20	22	23	emm

Concentration: 100

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	—	—	—	—	—	—	—	—	—	—	kc
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
4	3	5	4	4	3	4	3	4	✓	2	JS
5	7	7	6	✓	✓	✓	✓	✓	5	6	emm
6	✓	✓	✓	7	8	6	7	5/6	9	✓	JS
7	11	12	10	10	12	11	11	13	✓	11	emm
8											
Total	21	24	20	21	23	21	21	23	14	19	emm

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality.

Sample Description: Clear, no particulate ~~or precipitate~~ (same particulate), odourless / colourless

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JGh

Date reviewed: May 19/16

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:	14-9968-9844	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:18	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	13-4242-4617	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 13:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 14:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 1h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	18-5443-1080	**Code:**	6E885F68	**Client:**	Teck Coal
Sample Date:	27 Apr-16 06:50	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	31h (6.6 °C)	**Station:**	LC_LC5_WS_2016-04-25_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	638875	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	100	8.893	N/A	1	NA	11.24
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

7d Survival Rate Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	10	1	1	1	0	0	0.0%	0.0%	10	10
1.56		10	1	1	1	0	0	0.0%	0.0%	10	10
3.12		10	1	1	1	0	0	0.0%	0.0%	10	10
6.25		10	1	1	1	0	0	0.0%	0.0%	10	10
12.5		10	0.8	0	1	0.1333	0.4216	52.7%	20.0%	8	10
25		10	1	1	1	0	0	0.0%	0.0%	10	10
50		10	1	1	1	0	0	0.0%	0.0%	10	10
100		10	1	1	1	0	0	0.0%	0.0%	10	10

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1	1	1	1	1	1	1	1	1	1
1.56		1	1	1	1	1	1	1	1	1	1
3.12		1	1	1	1	1	1	1	1	1	1
6.25		1	1	1	1	1	1	1	1	1	1
12.5		1	1	1	1	0	1	1	1	1	0
25		1	1	1	1	1	1	1	1	1	1
50		1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	1

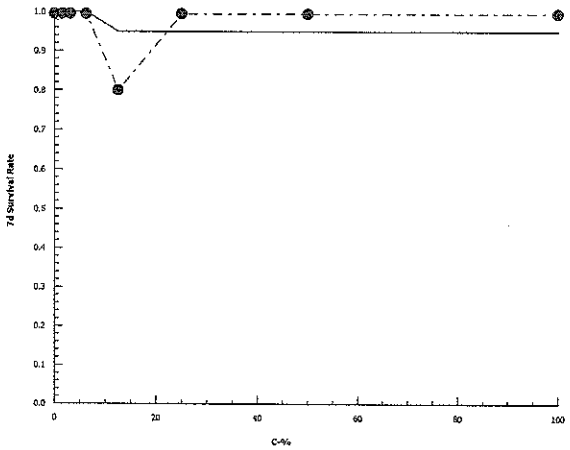
Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	14-9968-9844	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:18	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.56		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.12		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	0/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



Analyst:_____ QA: JOH

Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	16-6335-0518	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:19	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	13-4242-4617	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 13:30	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 14:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	7d 1h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	18-5443-1080	**Code:**	6E885F68	**Client:**	Teck Coal
Sample Date:	27 Apr-16 06:50	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	31h (6.6 °C)	**Station:**	LC_LC5_WS_2016-04-25_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1639451	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	0.822	0.3023	N/A	121.7	NA	330.8
IC10	4.373	0.696	N/A	22.87	NA	143.7
IC15	>100	N/A	N/A	<1	NA	NA
IC20	>100	N/A	N/A	<1	NA	NA
IC25	>100	N/A	N/A	<1	NA	NA
IC40	>100	N/A	N/A	<1	NA	NA
IC50	>100	N/A	N/A	<1	NA	NA

Reproduction Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	10	21.7	14	26	1.065	3.368	15.52%	0.0%
1.56		10	19.4	12	25	1.572	4.971	25.62%	10.6%
3.12		10	20.6	10	25	1.392	4.402	21.37%	5.07%
6.25		10	18.7	13	24	1.399	4.423	23.65%	13.82%
12.5		10	17.2	0	24	2.905	9.187	53.41%	20.74%
25		10	19.2	11	23	1.323	4.185	21.79%	11.52%
50		10	19.2	12	25	1.332	4.211	21.93%	11.52%
100		10	20.7	14	24	0.8825	2.791	13.48%	4.61%

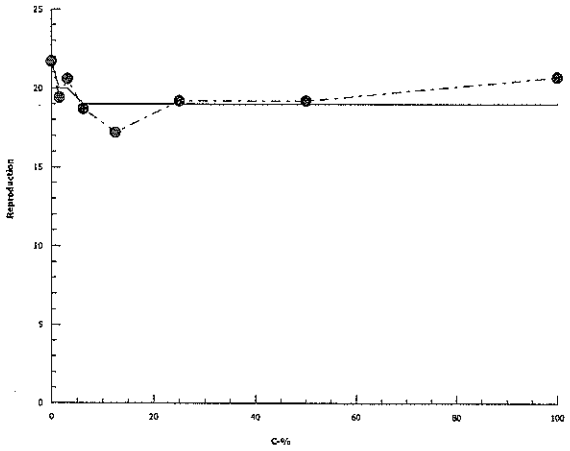
Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	22	22	21	24	25	23	20	20	14	26
1.56		23	13	25	12	19	24	23	22	13	20
3.12		22	17	20	20	24	10	25	24	22	22
6.25		24	23	24	19	13	14	21	20	13	16
12.5		20	19	22	23	0	22	22	24	20	0
25		22	22	23	21	20	21	20	12	11	20
50		14	25	19	15	21	12	21	20	22	23
100		21	24	20	21	23	21	21	23	14	19

Ceriodaphnia 7-d Survival and Reproduction Test | **Nautilus Environmental**

Analysis ID:	16-6335-0518	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 12:19	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Analyst:_____ QA: May 19/16

Ceriodaphnia dubia Summary Sheet

Client: Teck Coal
Work Order No.: 16479

Start Date/Time: Apr 28/16 @ 1300h
Set up by: EMM

Sample Information:

Sample ID: ~~LC_WF_OUT_WS_20160427~~ LC_WF_OUT_WS_20160427N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 5x20L

Test Validity Criteria:

1) Mean survival of first generation controls is ≥80 %
2) At least 60% of controls have produced three broods within 8 days
3) An average of ≥15 live young produced per surviving female in the control solutions during the first three broods.
4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 042016B
Age of young (Day 0): <24-h (within 12-h)
Avg No. young in first 3 broods of previous 7 d: 18
Mortality (%) in previous 7 d: 10
Individual female # used ≥8 young on test day: 23, 26, 28, 29, 30, 32, 33, 34, 36, 37, 40

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd143
Stock Solution ID: 16NaCl
Date Initiated: Apr 13/16

7-d LC50 (95% CL): 2.1 (2.0-2.2) g/L NaCl
7-d IC50 (95% CL): 1.6 (1.4-1.8) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.2) g/L NaCl CV (%): 5
7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-1.9) g/L NaCl CV (%): 12

Test Results:

	Survival	Reproduction
LC50 % (v/v) (95% CL)	>100	
IC25 % (v/v) (95% CL)		29.2 (9.5-36.0)
IC50 % (v/v) (95% CL)		51.8 (43.0-57.0)

Reviewed by: JGL
Date reviewed: May 19/16

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: teck coal
Sample ID: LC_WTF_WS_20160427_N
Work Order #: 16479

Start Date & Time: April 28/16 @ 1300h
Stop Date & Time: May 5/16 @ 1000h
Test Species: *Ceriodaphnia dubia*

Concentration	Days 0	1		2		3		4		5		6		7
control	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	24.0
DO (mg/L)	8.0	7.6	8.2	7.1	7.9	7.4	8.2	7.0	8.2	7.6	8.2	7.5	8.1	7.3
pH	7.8	7.7	8.0	7.7	8.0	7.7	7.9	7.8	8.0	7.8	7.9	7.7	8.1	7.6
Cond. (µS/cm)	222	222		212		223		223		216		221		223
Initials	EMM	EMM		KL		YML		JS		JS		EMM		MLT

Concentration	Days 0	1		2		3		4		5		6		7
1.56% (v/v)	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	24.0
DO (mg/L)	8.0	7.6	8.1	7.1	7.9	7.1	8.1	7.1	8.2	7.6	8.2	7.4	8.2	7.3
pH	7.9	7.9	8.0	7.8	7.9	7.8	8.0	7.7	7.9	7.8	7.8	7.7	7.9	7.6
Cond. (µS/cm)	258	259		250		256		252		258		257		257
Initials	EMM	EMM		KL		YML		JS		JS		EMM		MLT

Concentration	Days 0	1		2		3		4		5		6		7
12.5% (v/v)	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	24.5	25.0	24.0	25.0	24.0	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	24.0
DO (mg/L)	8.0	7.6	8.1	7.1	8.0	7.2	8.1	7.1	8.2	7.3	8.2	7.1	8.2	7.2
pH	7.9	7.9	7.9	7.9	7.9	7.7	7.9	7.8	7.9	7.7	7.8	7.8	7.9	7.6
Cond. (µS/cm)	497	495		483		479		487		486		490		477
Initials	EMM	EMM		KL		YML		JS		JS		EMM		MLT

Concentration	Days 0	1		2		3		4		5		6		7
100% (v/v)	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	25.5	25.0	24.0	25.0	24.5	25.0	24.0	24.0	24.0	25.0	24.0	25.0	24.0	24.0
DO (mg/L)	7.8	7.6	8.0	7.2	8.0	6.9	7.8	7.1	8.2	6.4	8.2	6.1	8.2	6.2
pH	7.8	7.9	7.9	7.7	7.96	7.6	7.6	7.7	7.7	7.6	7.6	7.6	7.9	7.6
Cond. (µS/cm)	1966	1988		1979		1976		1975		~~1983~~ 1973		1989		1845
Initials	EMM	EMM		KL		YML		JS		JS		EMM		MLT

Thermometer: 4 DO meter: 2 pH meter: 4 Conductivity meter: 2

	Control	100% (v/v)		
Hardness*	100	1040		
Alkalinity*	98	352		

* mg/L as CaCO3

Analysts: EMM, AWD, JS, MLT, YML, KL
Reviewed by: JOL
Date reviewed: May 19/16

Sample Description: clear, ~~no precipitate or particulate~~ some brown debris, ~~odourless~~ colourless, hydrocarbon smell

Comments: Broodboard Used: 042016B

Version 1.3 issued May 22, 2015

Nautilus Environmental Company Inc.

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck
Sample ID: LC_WTF_OUTLOS_20160427-N
Work Order: 16479 (U/N)

Start Date & Time: April 28/16 @ 1300h
Stop Date & Time: May 5/16 @ 1000h
Set up by: EMM

Concentration: Control

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KC
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	YML
4	4	4	3	3	3	4	4	3	3	4	EMM
5	10	9	9	9	8	8	11	9	9	9	EMM
6	✓	✓	✓	✓	✓	✓	13	✓	✓	✓	MLT
7	11	12	11	10	10	11	✓	12	13	13	MLT
8											
Total	25	25	23	22	21	23	28	24	25	26	MLT

Concentration: 1.56%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KC
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	YML
4	4	4	3	3	5	4	4	4	4	3	EMM
5	9	10	✓	8	10	9	9	8	10	9	EMM
6	10	✓	10	✓	✓	11	✓	✓	✓	✓	MLT
7	✓	10	11	14	10	14	14	12	12	13	MLT
8											
Total	23	24	24	25	25	24	27	24	26	25	MLT

Concentration: 3.12%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KC
3	✓	✓	4	✓	✓	✓	✓	✓	✓	✓	YML
4	4	4	✓	3	3	4	4	4	4	4	EMM
5	9	9	8	✓	10	9	✓	8	10	9	EMM
6	✓	✓	10	8	✓	✓	9	✓	✓	✓	MLT
7	13	14	✓	12	14	12	13	13	12	13	MLT
8											
Total	26	27	22	23	27	25	26	25	26	26	MLT

Concentration: 6.25%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KC
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	YML
4	4	4	3	3	✓	4	3	5	4	4	EMM
5	9	8	11	10	4	✓	9	✓	9	8	EMM
6	✓	✓	✓	✓	5	10	✓	8	✓	✓	MLT
7	14	14	14	12	✓	13	14	11	12	10	MLT
8											
Total	27	26	28	25	9	27	26	24	25	22	MLT

Concentration: 12.5%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	KC
3	✓	✓	✓	✓	✓	✓	↓	✓	✓	✓	YML
4	4	✓	4	4	3	3	↓	3	4	3	EMM
5	10	✓	9	9	X	8	↓	11	10	9	EMM
6	10	✓	✓	✓	|	✓	↓	14	✓	✓	MLT
7	8	✓	12	11	|	14	↓	✓	11	12	MLT
8					|		↓				
Total	24	0	25	24	3X	25	0X	28	25	24	MLT

Concentration: 25%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KC
3	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	YML
4	3	✓	4	4	3	3	|	5	4	4	EMM
5	10	9	9	8	9	9	|	8	9	10	EMM
6	✓	✓	✓	✓	✓	14	|	✓	✓	✓	MLT
7	10	14	12	14	13	✓	|	11	12	10	MLT
8						26	|				
Total	24	26	25	26	25	23 MLT	0X	24	25	24	MLT

Concentration: 50%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KC
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	YML
4	✓	3	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	8	✓	6	5	6	2	✓	3	✓	2	JS
6	✓	2	12	✓	✓	7	8	10	12	11	MLT
7	9	10	✓	12	8	✓	✓	✓	✓	✓	MLT
8											
Total	13	15	18	17	14	7	8	13	12	13	MLT

Concentration: 100%

Days	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KC
3	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	YML
4	✓	✓	↓	✓	✓	✓	✓	✓	✓	✓	EMM
5	2	✓	↓	✓	✓	✓	✓	✓	✓	✓	JS
6	3	✓	↓	✓	✓	✓	✓	✓	2	✓	MLT
7	✓	✓	↓	✓	✓	✓	✓	✓	✓	✓	MLT
8			↓								
Total	5	0	0X	0	0	0	0	0	2	0	MLT

Concentration:

Days	A	B	C	D	E	F	G	H	I	J	Init
1											JS
2											
3											
4											
5											
6											
7											
8											
Total											

Notes: X = mortality. some debris, hydrocarbon smell and odourless

Sample Description: clear / ~~no precipitate or particulate~~, odourless

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JON

Date reviewed: May 19/16

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID:	10-1715-8360	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 13:06	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	12-2989-4008	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 13:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 10:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 21h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	05-4497-8051	**Code:**	207BB483	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:00	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	28h (10.2 °C)	**Station:**	LC_WTF_OUT_WS_20160427_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	472996	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	8.893	7.469	N/A	11.24	NA	13.39
EC10	100	8.893	N/A	1	NA	11.24
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

7d Survival Rate Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	10	1	1	1	0	0	0.0%	0.0%	10	10
1.56		10	1	1	1	0	0	0.0%	0.0%	10	10
3.12		10	1	1	1	0	0	0.0%	0.0%	10	10
6.25		10	1	1	1	0	0	0.0%	0.0%	10	10
12.5		10	0.8	0	1	0.1333	0.4216	52.7%	20.0%	8	10
25		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10
50		10	1	1	1	0	0	0.0%	0.0%	10	10
100		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1	1	1	1	1	1	1	1	1	1
1.56		1	1	1	1	1	1	1	1	1	1
3.12		1	1	1	1	1	1	1	1	1	1
6.25		1	1	1	1	1	1	1	1	1	1
12.5		1	1	1	1	0	1	0	1	1	1
25		1	1	1	1	1	1	0	1	1	1
50		1	1	1	1	1	1	1	1	1	1
100		1	1	0	1	1	1	1	1	1	1

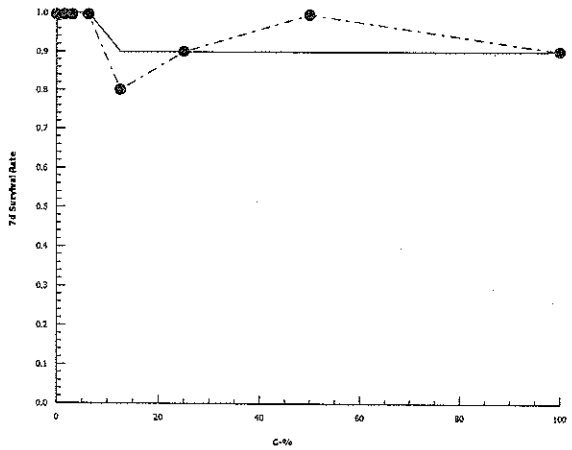
Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID: 10-1715-8360 **Endpoint:** 7d Survival Rate **CETIS Version:** CETISv1.8.7
Analyzed: 11 May-16 13:06 **Analysis:** Linear Interpolation (ICPIN) **Official Results:** Yes

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1.56		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.12		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	0/1	1/1	0/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Nautilus Environmental**

Analysis ID:	00-6427-1346	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 13:06	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	12-2989-4008	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Emma Marus
Start Date:	28 Apr-16 13:00	**Protocol:**	EC/EPS 1/RM/21	**Diluent:**	20% Perrier Water
Ending Date:	05 May-16 10:00	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 21h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	05-4497-8051	**Code:**	207BB483	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:00	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	28h (10.2 °C)	**Station:**	LC_WTF_OUT_WS_20160427_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1621668	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	6.751	3.806	14.12	14.81	7.081	26.28
IC10	8.515	4.726	27.02	11.74	3.701	21.16
IC15	10.68	5.75	29.26	9.363	3.417	17.39
IC20	25.91	7.867	32.3	3.86	3.096	12.71
IC25	29.23	9.501	36	3.421	2.778	10.53
IC40	41.88	26.73	50.5	2.388	1.98	3.741
IC50	51.83	43	57.01	1.93	1.754	2.326

Reproduction Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	10	24.2	21	28	0.6464	2.044	8.45%	0.0%
1.56		10	24.7	23	27	0.3667	1.16	4.69%	-2.07%
3.12		10	25.3	22	27	0.5175	1.636	6.47%	-4.55%
6.25		10	23.9	9	28	1.741	5.507	23.04%	1.24%
12.5		10	17.8	0	28	3.693	11.68	65.61%	26.45%
25		10	22.5	0	26	2.513	7.948	35.32%	7.03%
50		10	13	7	18	1.095	3.464	26.65%	46.28%
100		10	0.7	0	5	0.5175	1.636	233.8%	97.11%

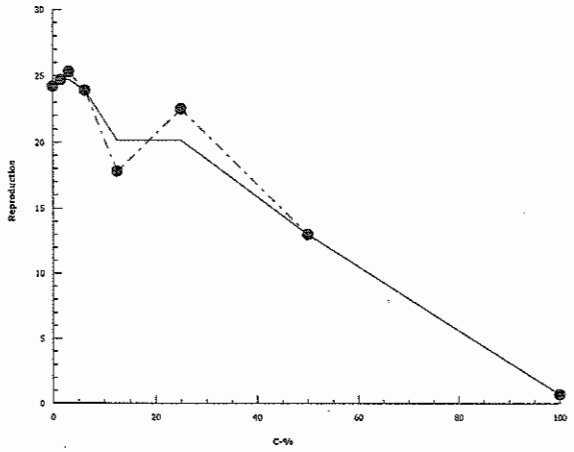
Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Negative Control	25	25	23	22	21	23	28	24	25	26
1.56		23	24	24	25	25	24	27	24	26	25
3.12		26	27	22	23	27	25	26	25	26	26
6.25		27	26	28	25	9	27	26	24	25	22
12.5		24	0	25	24	3	25	0	28	25	24
25		24	26	25	26	25	26	0	24	25	24
50		13	15	18	17	14	7	8	13	12	13
100		5	0	0	0	0	0	0	0	2	0

Ceriodaphnia 7-d Survival and Reproduction Test **Nautilus Environmental**

Analysis ID:	00-6427-1346	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 13:06	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Client: Teck

W.O.#: ~~16474~~ emr 16479

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
LC_LCDSSLCC	Apr 28/16	50	8.1	8.2	160		50	14.1	282	KL
LC_DC1	↓	↓	5.9	6.0	116		↓	6.2	124	↓
LC_FRDSDC			8.0 ~~7.9~~ KL	8.1	158			14.1	282	
LC_DCDS			4.4	4.5	86			5.2	104	
LC_LCS		↓	7.9	8.0	156		↓	13.4	268	
LC_WTF	↓	50	17.8	18.0	352		10①	10.4	1040	↓
201. pemer	apr 28/16	50	5.0	5.1	98		50	5.0	100	EMM

Notes: ① Sample diluted w/ DI up to 100mL

Reviewed by: JGu

Date Reviewed: May 18/16

APPENDIX B – Rainbow Trout Embryo *(Oncorhynchus mykiss)* Toxicity Test Data

Rainbow Trout Embryo Summary Sheet

Client: Teck

Start Date/Time: Apr 28/16 @ 1640h.

Work Order No.: 16475

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: GH_ER2_WS_2016-04_27_N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 6x20L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 10
Alkalinity (mg/L $CaCO_3$): 5

Test Organism Information:

Batch No.: 042816
Source: Ted's Trout Farm (Campbell Lake)
Loading Density: 1.35 g/L

Number of male broodstock used: 4
Number of female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE84
Stock Solution ID: 15503
Date Initiated: Apr 28/16
7-d EC50 (95% CL): 5.5 (5.0 – 5.8) mg/L SDS

Reference Toxicant Mean and Range: 4.1 (2.1 – 8.0) mg/L SDS
Reference Toxicant CV (%): 40

Test Results:

Embryo viability (mean ± SD) %	Sample ID		
	Control	GH_ER2_WS_2016_04_27_N	
EC25 % (v/v) (95% CL)	90.1 ± 8.9	93.2 ± 6.2	
~~EC50 %~~ (v/v) (95% CL)			

Reviewed by: JGh

Date reviewed: May 26/16

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

7d

Client: Teck
Sample ID: GH-ER2-WS-2016-04-27-N
Work Order #: 16475

Start Date & Time: Apr 28/16 @ 1640h
Stop Date & Time: May 5/16 @ 1145h
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	14.5
DO (mg/L)	10.0	9.9	9.5	10.1	9.9	10.1	9.9	10.1	10.0	9.9	9.5	10.0	9.9	9.8
pH	7.0	7.0	7.2	7.0	7.1	7.0	7.1	7.0	7.1	6.7	6.7	6.9	7.0	7.0
Cond. (µS/cm)	29	29		27		28		29		27		26		28
Initials	VML	KL		AD		AD		KL		KL		KL		KL

100 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	15.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	14.5
DO (mg/L)	9.9	9.8	9.6	10.0	9.8	10.0	9.7	10.1	10.0	9.5	9.5	9.9	9.9	9.9
pH	8.1	8.1	8.3	8.1	8.2	8.1	8.2	8.1	8.2	7.6	7.7	8.2	8.3	8.2
Cond. (µS/cm)	309	292		292		293		293		300		292		292
Initials	KL	KL		AD		AD		KL		KL		KL		KL

Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: temp-3 DO meter: DO-1/3 pH meter: pH-1/3 Conductivity meter: C-1/3

	Control	100% (v/v)		
Hardness*	10	136		
Alkalinity*	5	138		

* mg/L as CaCO3

Analysts: MML, AWD, KL

Reviewed by: JGA

Date reviewed: May 25/16

Sample Description: Clear, colourless, some debris, no odour

Comments:

Embryo Toxicity Test
Daily Mortality

7d

Client: Teck
Sample ID: GH_ER2_WS_2016_04_27_N
Work Order #: 16475

Start Date & Time: Apr 28/16 @ 1640h.
Stop Date & Time: ~~Ap~~ KL May 5/16 @ 1145h.
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	0	~~4~~0 KL	~~2~~0 KL	KL ~~6~~0	0	31	31
	2	↓	↓	↓	↓	↓	1	1	2	1	24	27
	3	↓	↓	↓	↓	↓	5	1	6	1	26	33
	4	↓	↓	↓	↓	↓	2	0	2	0	26	28
100	1	↓	↓	↓	2	↓	0	1	3	1	26	30
	2	↓	↓	↓	1	↓	1	0	2	1	25	28
	3	↓	↓	↓	0	↓	0	0	0	1	29	30
	4	↓	↓	↓	0	↓	0	0	0	0	30	30
	1											
	2											
	3											
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	1											
	2											
	3											
	4											
Tech Initials		KL	A	A	KL	KL	KL	KL	KL	KL	KL	KL

Comments:

Reviewed by: [signature] **Date reviewed:** May 25/16

CETIS Summary Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Batch ID:	08-1274-1635	**Test Type:**	Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	05 May-16 11:45	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	6d 19h	**Source:**	Campbel Lake	**Age:**	

Sample ID:	01-0356-4872	**Code:**	62C4648	**Client:**	Teck Coal
Sample Date:	27 Apr-16	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	41h (8 °C)	**Station:**	GH_ER2_WS_2016_04_27_N		

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
01-9202-1345	Proportion Normal	100	>100	NA	NA	1	Fisher Exact Test

Proportion Normal Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	0.9013	0.7605	1	0.7879	1	0.04426	0.08851	9.82%	0.0%
100		4	0.9315	0.8325	1	0.8667	1	0.03113	0.06225	6.68%	-3.35%

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	1	0.8889	0.7879	0.9286
100		0.8667	0.8929	0.9667	1

Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	31/31	24/27	26/33	26/28
100		26/30	25/28	29/30	30/30

CETIS Analytical Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	01-9202-1345	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:22	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes
Batch ID:	08-1274-1635	**Test Type:**	Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	05 May-16 11:45	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	6d 19h	**Source:**	Campbel Lake	**Age:**	
Sample ID:	01-0356-4872	**Code:**	62C4648	**Client:**	Teck Coal
Sample Date:	27 Apr-16	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	41h (8 °C)	**Station:**	GH_ER2_WS_2016_04_27_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes proportion normal

Fisher Exact Test

Control	vs	C-%	Test Stat	P-Value	P-Type	Decision(α:5%)
Negative Control		100	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Negative Contr	107	12	119	0.8992	0.1008	0.0%
100		110	8	118	0.9322	0.0678	-3.68%

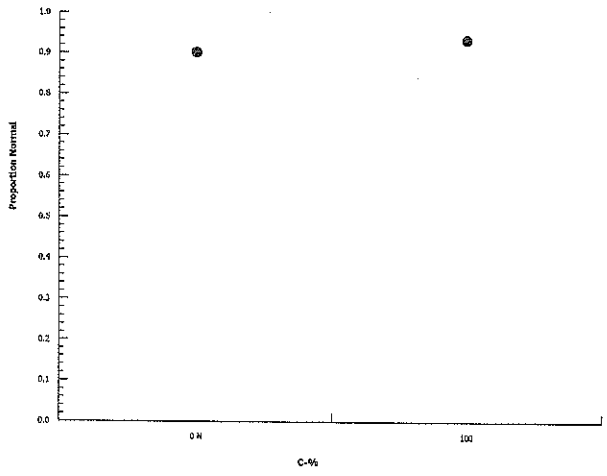
Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	1	0.8889	0.7879	0.9286
100		0.8667	0.8929	0.9667	1

Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	31/31	24/27	26/33	26/28
100		26/30	25/28	29/30	30/30

Graphics



Analyst:_____ QA: JOL May 26/16

Rainbow Trout Embryo Summary Sheet

Client: Teck

Start Date/Time: Apr 28/16 @ 1640h.

Work Order No.: 16474

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: LC, LCDSSLCC WS 2016-04-25 N

Sample Date: Apr 27/16

Date Received: Apr 28/16

Sample Volume: 8 x 20L

Dilution Water:

Type: Dechlorinated Tap Water

Hardness (mg/L $CaCO_3$): 10

Alkalinity (mg/L $CaCO_3$): 5

Test Organism Information:

Batch No.: 042816

Source: Ted's Trout ~~Lodge~~ Farm (Campbell Lake)

Loading Density: 1.135 g/L

Number of male broodstock used: 4

Number of female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: ~~RTE 84~~ RTE84

Stock Solution ID: 15503

Date Initiated: Apr 28/16

7-d EC50 (95% CL): 5.5 (5.0 – 5.8) mg/L SDS

Reference Toxicant Mean and Range: 4.1 (2.1 – 8.0) mg/L SDS

Reference Toxicant CV (%): 40

Test Results:

	Sample ID		
	LC_LCDSSLCC WS	2016-04-25 N	
EC25 % (v/v) (95% CL)	>100		
EC50 % (v/v) (95% CL)	>100		

Reviewed by: JCL

Date reviewed: May 25/16

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: LC-LCDSSLCC WS 2016-04-25 N
Work Order #: 16474

Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 5/16 @ 1000h
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)

	Days 0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	~~14.5~~	15.0	14.5
DO (mg/L)	10.0	9.9	9.8	10.1	9.9	10.1	9.7	~~9.7~~	10.1	9.9	9.5	10.0	10.0	9.9
pH	7.0	7.0	7.2	7.0	7.1	7.0	7.1	7.0	7.1	6.7	6.6	6.9	6.9	7.0
Cond. (µS/cm)	29	28		27		28		29		27		26		28
Initials	MM	KL		AM		AS		KL		KL		KL		KL

① 10.1

6.25 Concentration

	Days 0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	~~14.5~~ 15.0	15.0	14.5
DO (mg/L)	9.6	9.7	9.8	10.1	9.8	10.0	9.8	10.2	10.3	9.7	9.5	10.0	10.1	9.9
pH	7.2	7.4	7.1	7.2	7.3	7.3	7.4	7.3	7.3	7.1	6.8	7.2	7.1	7.2
Cond. (µS/cm)	57	61		62		63		66		58		58		60
Initials	KL	KL		AM		AS		KL		KL		KL		KL

25 Concentration

	Days 0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	14.5
DO (mg/L)	9.7	9.8	9.8	10.0	9.9	10.1	9.7	10.1	10.1	9.7	9.6	10.1	10.1	9.9
pH	7.4	7.7	7.6	7.5	7.7	7.5	7.7	7.7	7.8	7.2	~~6.7~~ 7.1	7.6	7.5	7.5
Cond. (µS/cm)	166	164		170		173		170		169		170		168
Initials	KL	KL		AM		AS		KL		KL		KL		KL

100 Concentration

	Days 0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	15.0	15.0	14.5
DO (mg/L)	9.7	10.2	9.8	10.0	9.8	10.1	9.7	10.1	10.1	9.5	9.5	9.8	10.0	9.9
pH	8.01	8.1	8.3	~~7.8~~ 8.1	8.2	8.1	8.2	8.2	8.3	7.6	7.7	7.9	8.2	8.1
Cond. (µS/cm)	562	544		540		539		544		559		542		543
Initials	KL	KL		AM		AS		KL		KL		KL		KL

Thermometer: Temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control	100% (v/v)		
Hardness*	10	282		
Alkalinity*	5	160		

* mg/L as CaCO3

Analysts: KL, AJO, KL

Reviewed by: JGL

Date reviewed: May 25/16

Sample Description: Clear, colourless, some debris, no odour

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Teck
Sample ID: LC#LCDSSLCC WS 2016-04-25N
Work Order #: 16474
Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 5/16 @ 10:00h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	0	2	KL 23	5	2	22	29
	2	↓	↓	↓	0	↓	0	1	1	2	27	30
	3				0		1	0	1	KL ~~28~~ 1	28	30
	4				1		2	2	5	2	23	30
6.25	1				0		1	1	2	KL ~~0~~ 3	KL ~~26~~ 25	KL ~~28~~ 30
	2				↓		3	0	3	KL ~~0~~ 1	KL ~~25~~ 26	KL ~~28~~ 30
	3						0	0	0	0	30	30
	4					↓	1	0	1	2	27	30
12.5	1				↓	1	2	0	3	0	27	30
	2				1	0	2	0	3	2	25	30
	3				0	1	1	0	2	0	28	30
	4				0	0	1	1	2	3	25	30
25	1				1	1	1	0	2	1	27	30
	2				↓	0	2	0	2	1	26	29
	3					0	3	0	3	0	27	30
	4					1	2	1	4	1	25	30
50	1					1	1	1	3	1	26	30
	2					2	1	1	4	0	27	31
	3					2	0	2	4	1	25	30
	4					0	2	1	3	0	27	30
100	1				↓	0	3	1	4	1	25	30
	2				1	2	1	2	6	1	23	30
	3				1	0	1	2	4	0	26	30
	4	↓	↓	↓	0	1	1	0	2	0	28	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		KL	AS	A	KL	KL	KL	KL	KL	KL	KL	KL

Comments: _____

Reviewed by: JBe **Date reviewed:** May 25/16

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	20-7375-0701	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:35	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	09-7514-1410	**Test Type:**	Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	05 May-16 10:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	6d 17h	**Source:**	Campbel Lake	**Age:**	
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	768156	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	N/A	N/A	<1	NA	NA
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

Proportion Normal Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.8397	0.7586	0.9333	0.04501	0.09002	10.72%	0.0%	100	119
6.25		4	0.9	0.8333	1	0.036	0.07201	8.0%	-7.19%	108	120
12.5		4	0.875	0.8333	0.9333	0.025	0.05	5.71%	-4.21%	105	120
25		4	0.8825	0.8333	0.9	0.0164	0.0328	3.72%	-5.1%	105	119
50		4	0.8677	0.8333	0.9	0.01365	0.0273	3.15%	-3.35%	105	121
100		4	0.85	0.7667	0.9333	0.03469	0.06939	8.16%	-1.23%	102	120

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	0.7586	0.9	0.9333	0.7667
6.25		0.8333	0.8667	1	0.9
12.5		0.9	0.8333	0.9333	0.8333
25		0.9	0.8966	0.9	0.8333
50		0.8667	0.871	0.8333	0.9
100		0.8333	0.7667	0.8667	0.9333

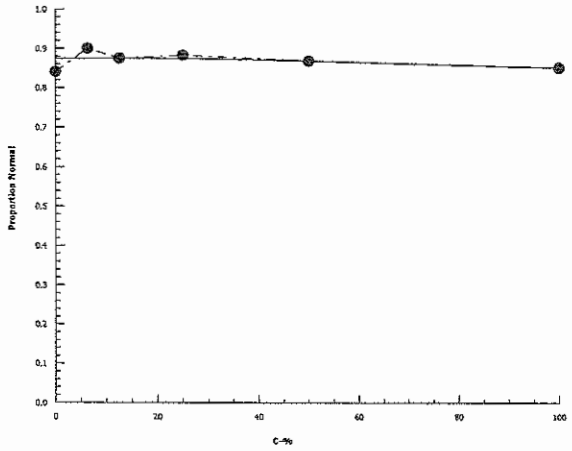
Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	22/29	27/30	28/30	23/30
6.25		25/30	26/30	30/30	27/30
12.5		27/30	25/30	28/30	25/30
25		27/30	26/29	27/30	25/30
50		26/30	27/31	25/30	27/30
100		25/30	23/30	26/30	28/30

Salmonid Embryo Survival and Development Test **Nautilus Environmental**

Analysis ID:	20-7375-0701	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:35	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Rainbow Trout Embryo Summary Sheet

Client: Teck

Start Date/Time: Apr 28/16 @ 1640h.

Work Order No.: 16474

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: LC_DC1_WS_2016-04-26_N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 5X 20L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 10
Alkalinity (mg/L $CaCO_3$): 5

Test Organism Information:

Batch No.: 042816
Source: Ted's Trout Farm (Campbell Lake)
Loading Density: 1.135 g/L

Number of male broodstock used: 4
Number of female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE84
Stock Solution ID: 15503
Date Initiated: Apr 28/16
7-d EC50 (95% CL): 5.5 (5.0-5.8) mg/L SDS

Reference Toxicant Mean and Range: 4.1 (2.1 - 8.0) mg/L SDS
Reference Toxicant CV (%): 40

Test Results:

	Sample ID		
	LC_DC1_WS_2016-04-26_N		
EC25 % (v/v) (95% CL)	> 100		
EC50 % (v/v) (95% CL)	>100		

Reviewed by: JGL

Date reviewed: May 25/16

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: LC-DC1-WS-2016-04-26-N
Work Order #: 16474

Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 5th/16 @ 1015h
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	10.0	9.9	9.9	10.1	9.8	10.1	9.7	10.1	10.1	9.9	9.6	10.0	9.9	9.9
pH	7.0	7.0	7.2	7.0	7.1	7.0	7.0	7.0	7.1	6.7	6.6	6.9	7.0	7.0
Cond. (µS/cm)	29	29		27		28		29		27		26		28
Initials	YML	KL		AW		AD		KL		KL		KL		KL

6.25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	9.7	9.9	9.9	10.0	9.9	10.1	9.8	9.9	10.1	9.7	9.6	10.1	9.9	9.9
pH	7.1	7.4	7.2	7.3	7.2	7.3	7.4	7.1	7.2	7.4	7.5	7.1	7.1	7.4
Cond. (µS/cm)	43	41		40		41		40		37		38		40
Initials	KL	KL		AW		AD		KL		KL		KL		KL

25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	9.7	9.9	9.9	10.0	9.8	10.1	9.8	10.1	10.1	9.7	9.6	10.1	9.9	9.9
pH	7.4	7.3	7.4	7.5	7.6	7.5	7.7	7.5	7.5	7.4	7.3	7.4	7.5	7.4
Cond. (µS/cm)	76	82		83		82		79		83		81		81
Initials	KL	KL		AW		AD		KL		KL		KL		KL

100 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	15.0	15.0	15.0
DO (mg/L)	9.7	10.3	9.9	10.0	9.7	10.0	9.7	10.1	10.0	9.7	9.6	10.1	9.9	9.9
pH	8.0	8.1 KL	8.2	8.1	8.2	8.1	8.1	8.1	8.1	7.6	7.7	7.9	8.0	8.0
Cond. (µS/cm)	237	223		225		229		223		228		222		223
Initials	KL	KL		AW		AD		KL		KL		KL		KL

Thermometer: Temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control	100% (v/v)		
Hardness*	10	124		
Alkalinity*	5	116		

* mg/L as CaCO3

Analysts: YML, KL, AWD

Reviewed by: JOL

Date reviewed: May 25/16

Sample Description: Clear, colourless, some debris, no odour

Comments:

Embryo Toxicity Test
Daily Mortality

Client: TECK
Sample ID: LC-DC1-WS-2016-04-26_N
Work Order #: 16474
Start Date & Time: Apr 28/16 @1640h
Stop Date & Time: May 5/16 @1015h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	0	2	2	4	~~0~~ 0	26	30
	2	1	↓	↓	↓	↓	~~0~~ 1	3	5	~~0~~ 0	25	30
	3	0	↓	↓	↓	↓	1	0	~~2~~ 1	1	28	30
	4	↓	↓	↓	↓	↓	1	1	2	0	28	30
6.25	1	↓	↓	↓	↓	↓	1	3	4	1	25	30
	2	↓	↓	↓	↓	1	1	1	3	0	27	30
	3	↓	↓	↓	↓	0	0	1	1	1	28	30
	4	↓	↓	↓	1	↓	1	2	4	0	26	30
12.5	1	↓	↓	↓	0	↓	0	1	1	0	29	30
	2	↓	↓	↓	↓	↓	1	2	3	0	27	30
	3	↓	↓	↓	↓	↓	1	1	2	0	28	30
	4	↓	↓	↓	↓	1	0	2	3	1	26	30
25	1	↓	↓	↓	↓	0	2	0	2	~~2~~ 0	28	30
	2	↓	↓	↓	↓	0	0	1	1	0	29	30
	3	↓	↓	↓	↓	0	2	1	3	0	27	30
	4	↓	↓	↓	↓	2	0	0	2	1	27	30
50	1	↓	↓	↓	1	1	2	2	6	0	24	30
	2	↓	↓	↓	0	0	1	0	1	2	27	30
	3	↓	↓	↓	0	0	0	1	1	2	27	30
	4	↓	↓	↓	1	0	1	2	4	0	26	30
100	1	↓	↓	↓	0	0	4	0	4	2	24	30
	2	↓	↓	↓	~~1~~ 0	1	0	0	1	2	27	30
	3	↓	↓	↓	0	2	1	0	3	2	25	30
	4	↓	↓	↓	0	1	0	0	1	0	29	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		KL	AS	A	KL	KL	KL	KL	KL	KL	KL	KL

Comments:

Reviewed by: JGL **Date reviewed:** May 25/16

CETIS Analytical Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	05-9825-0157	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:39	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	02-2486-7524	**Test Type:**	Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	05 May-16 10:15	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	6d 18h	**Source:**	Campbel Lake	**Age:**	
Sample ID:	00-8128-9240	**Code:**	4D86018	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:30	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (7.5 °C)	**Station:**	LC_DC1_WS_2016-04-26_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	490097	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	N/A	N/A	<1	NA	NA
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

Proportion Normal Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.8917	0.8333	0.9333	0.025	0.05	5.61%	0.0%	107	120
6.25		4	0.8833	0.8333	0.9333	0.02152	0.04303	4.87%	0.93%	106	120
12.5		4	0.9167	0.8667	0.9667	0.02152	0.04303	4.7%	-2.8%	110	120
25		4	0.925	0.9	0.9667	0.01596	0.03191	3.45%	-3.74%	111	120
50		4	0.8667	0.8	0.9	0.02357	0.04714	5.44%	2.8%	104	120
100		4	0.875	0.8	0.9667	0.03696	0.07391	8.45%	1.87%	105	120

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	0.8667	0.8333	0.9333	0.9333
6.25		0.8333	0.9	0.9333	0.8667
12.5		0.9667	0.9	0.9333	0.8667
25		0.9333	0.9667	0.9	0.9
50		0.8	0.9	0.9	0.8667
100		0.8	0.9	0.8333	0.9667

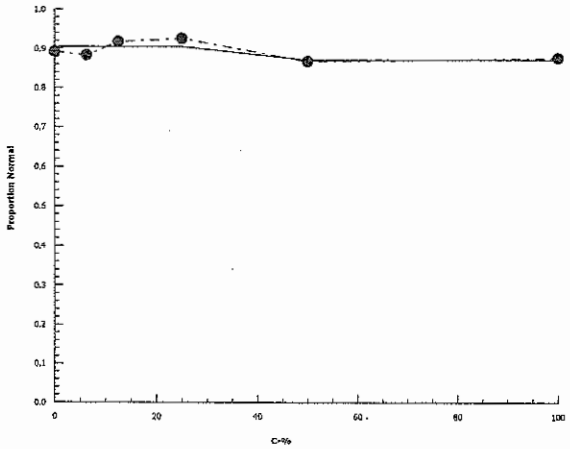
Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	26/30	25/30	28/30	28/30
6.25		25/30	27/30	28/30	26/30
12.5		29/30	27/30	28/30	26/30
25		28/30	29/30	27/30	27/30
50		24/30	27/30	27/30	26/30
100		24/30	27/30	25/30	29/30

Salmonid Embryo Survival and Development Test **Nautilus Environmental**

Analysis ID:	05-9825-0157	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:39	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Rainbow Trout Embryo Summary Sheet

Client: Teck

Start Date/Time: Apr 28/16 @ 1640h

Work Order No.: 16474

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: ~~X~~ LC FRDSDC WS 2016-04-26 N

Sample Date: Apr 27/16

Date Received: Apr 28/16

Sample Volume: 5 X 20L

Dilution Water:

Type: Dechlorinated Tap Water

Hardness (mg/L $CaCO_3$): 10

Alkalinity (mg/L $CaCO_3$): 5

Test Organism Information:

Batch No.: 042816

Source: Ted's Trout Farm (Campbell Lake)

Loading Density: 1.135 g/L

Number of male broodstock used: 4

Number of female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE84

Stock Solution ID: IS503

Date Initiated: Apr 28/16

7-d EC50 (95% CL): 5.5 (5.0 – 5.8) mg/L SDS

Reference Toxicant Mean and Range: 4.1 (2.1 – 8.0) mg/L SDS

Reference Toxicant CV (%): 40

Test Results:

	Sample ID		
	LC FRDSDC WS 2016-04-26 N		
EC25 % (v/v) (95% CL)	>100		
EC50 % (v/v) (95% CL)	>100		

Reviewed by: JGh

Date reviewed: May 25/16

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: LCFRDSDC WS 2016-04-26 N
Work Order #: 16474
Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 5/16 @ 1030h
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	10.0	9.9	9.9	10.1	9.8	10.1	9.7	10.1	10.0	9.9	9.6	10.0	9.8	9.9
pH	7.0	7.0	7.2 final	7.0	7.1	7.0	7.0	7.0	7.1	6.7	6.6	6.9	7.0	7.0
Cond. (µS/cm)	29	29		27		28		29		27		26		28
Initials	MM	KL		AW		AD		KL		KL		KL		KL

6.25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	9.7	9.8	9.9	10.1	9.8	10.1	9.7	10.0	10.1	9.7	9.5	10.1	9.8	9.9
pH	7.1	7.2	7.3	7.2	7.3	7.3	7.2	7.2	7.3	7.4	7.1	7.2	7.3	7.2
Cond. (µS/cm)	68	66		60		59		64		63		61		63
Initials	KL	KL		AW		AD		KL		KL		KL		KL

25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	14.5
DO (mg/L)	9.7	9.9	9.9	10.0	9.9	10.0	9.8	10.1	10.1	9.7	9.5	10.1	9.9	9.9
pH	7.5	7.2	7.6	7.5	7.6	7.6	7.5	7.8	7.7	7.4	7.3	7.5	7.6	7.5
Cond. (µS/cm)	167	177		174		173		171		182		171		174
Initials	KL	KL		AW		AD		KL		KL		KL		KL

100 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	15.0	15.0	14.5
DO (mg/L)	9.7	10.0	9.9	10.1	9.8	10.0	9.8	10.1	10.0	9.7	9.5	10.1	9.9	9.9
pH	8.1	8.0	8.3	8.1	8.2	8.1	8.1	8.2	8.3	7.8	7.8	8.0	8.2	8.1
Cond. (µS/cm)	554	539		541		545		536		553		536		539
Initials	KL	KL		AW		AD		KL		KL		KL		KL

Thermometer: temp-3 **DO meter:** DO-1|3 **pH meter:** pH-1|3 **Conductivity meter:** C-1|3

	Control	100% (v/v)		
Hardness*	10	282		
Alkalinity*	5	158		

* mg/L as CaCO3

Analysts: YYL, AWD, KL
Reviewed by: JOL
Date reviewed: May 25/16

Sample Description: clear, colourless, some debris, no odour

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Teck
Sample ID: LC FERDSDC WS 2016-04-26 N
Work Order #: 16474
Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 5/16 @ 1030h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	0	1	2	3	4	23	30
	2	↓	↓	↓	↓	0	1	2	3	1	26	30
	3					0	0	2	2	0	28	30
	4					0	0	0	0	1	29	30
6.25	1					0	1	1	2	1	27	30
	2					0	1	3	4	1	25	30
	3					1	1	0	2	2	26	30
	4					0	2	0	2	1	27	30
12.5	1					0	2	0	2	0	28	30
	2					1	1	0	2	2	26	30
	3					0	2	0	2	0	28	30
	4					1	0	3	4	0	26	30
25	1					1	0	2	3	1	26	30
	2					0	1	0	1	3	26	30
	3					1	0	1	2	1	27	30
	4					1	1	1	3	0	27	30
50	1					0	1	1	2	1	27	30
	2					0	2	1	3	2	25	30
	3					0	2	1	3	0	27	30
	4					0	2	0	2	1	27	30
100	1				↓	0	2	1	3	1	26	30
	2				1	2	1	0	4	1	25	30
	3				0	0	2	3	5	1	24	30
	4	↓	↓	↓	0	1	2	0	3	0	27	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		KL	AO	AO	KL	KL	KL	KL	KL	KL	KL	KL

Comments:

Reviewed by: JGL
Date reviewed: May 25/16

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	08-4884-2210	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:47	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	02-8151-7168	**Test Type:**	Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	05 May-16 10:30	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	6d 18h	**Source:**	Campbel Lake	**Age:**	
Sample ID:	07-5438-7274	**Code:**	2CF7094A	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:04	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (8 °C)	**Station:**	LC FRDSDC WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1220707	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	N/A	N/A	<1	NA	NA
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

Proportion Normal Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.8833	0.7667	0.9667	0.0441	0.08819	9.98%	0.0%	106	120
6.25		4	0.875	0.8333	0.9	0.01596	0.03191	3.65%	0.94%	105	120
12.5		4	0.9	0.8667	0.9333	0.01925	0.03849	4.28%	-1.89%	108	120
25		4	0.8833	0.8667	0.9	0.009623	0.01925	2.18%	0.0%	106	120
50		4	0.8833	0.8333	0.9	0.01667	0.03333	3.77%	0.0%	106	120
100		4	0.85	0.8	0.9	0.02152	0.04303	5.06%	3.77%	102	120

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	0.7667	0.8667	0.9333	0.9667
6.25		0.9	0.8333	0.8667	0.9
12.5		0.9333	0.8667	0.9333	0.8667
25		0.8667	0.8667	0.9	0.9
50		0.9	0.8333	0.9	0.9
100		0.8667	0.8333	0.8	0.9

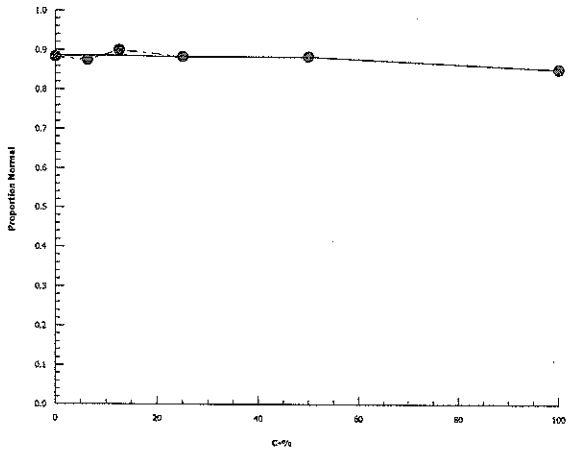
Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	23/30	26/30	28/30	29/30
6.25		27/30	25/30	26/30	27/30
12.5		28/30	26/30	28/30	26/30
25		26/30	26/30	27/30	27/30
50		27/30	25/30	27/30	27/30
100		26/30	25/30	24/30	27/30

Salmonid Embryo Survival and Development Test | **Nautilus Environmental**

Analysis ID:	08-4884-2210	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:47	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Rainbow Trout Embryo Summary Sheet

Client: Teck

Start Date/Time: Apr 28/16 @ 1640h.

Work Order No.: 16474

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: LC DCDS WS 2016-04-26 N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 5x20L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 10
Alkalinity (mg/L $CaCO_3$): 5

Test Organism Information:

Batch No.: 042816
Source: Ted's Trout Farm (Campbell Lake)
Loading Density: 1.135 g/L

Number of male broodstock used: 4
Number of female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE84
Stock Solution ID: 15503
Date Initiated: Apr 28/16
7-d EC50 (95% CL): 5.5 (5.0 – 5.8) mg/L SDS

Reference Toxicant Mean and Range: 4.1 (2.1 – 8.0) mg/L SDS
Reference Toxicant CV (%): 40

Test Results:

	Sample ID		
	LC DCDS WS 2016-04-26 N		
EC25 % (v/v) (95% CL)	>100		
EC50 % (v/v) (95% CL)	>100		

Reviewed by: JGL

Date reviewed: May 26/16

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: LC#PCDS WS 2016-04-26 N
Work Order #: 16474
Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 5th/16 1045h
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	10.0	9.9	9.9	10.1	9.9	10.1	9.7	10.1	10.0	9.9	9.5	10.0	9.8	9.9
pH	7.0	7.0	7.2	7.0	7.0	7.0	7.1	7.0	7.2	6.7	6.6	6.9	7.0	7.0
Cond. (µS/cm)	29	29		27		28		29		27		26		27
Initials	MM	KL		AV		AS		KL		KL		KL		KL

6.25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	9.7	10.0	9.9	10.1	9.9	10.1	9.8	9.9	10.0	9.7	9.5	10.1	9.8	9.9
pH	7.2	7.1	7.1	7.2	7.2	7.2	7.3	7.2	7.2	7.0	7.3	7.2	7.3	7.2
Cond. (µS/cm)	41	39		38		37		38		36		34		37
Initials	KL	KL		AS		AS		KL		KL		KL		KL

25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	14.5
DO (mg/L)	9.7	10.0	9.9	10.0	9.7	10.0	9.9	10.1	10.0	9.7	9.1	10.1	9.9	9.9
pH	7.4	7.3	7.4	7.5	7.6	7.6	7.7	7.4	7.4	7.3	7.3	7.5	7.5	7.4
Cond. (µS/cm)	68	71		68		70		68		72		70		71
Initials	KL	KL		AS		AS		KL		KL		KL		KL

100 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	9.7	10.2	9.9	10.0	9.8	10.1	9.8	10.1	10.1	9.7	9.3	9.9	9.9	10.0
pH	8.0	7.9	7.9	8.1	8.1	8.0	8.1	8.0	8.0	7.6	7.5	7.8	7.9	7.8
Cond. (µS/cm)	189	187		186		187		189		191		187		190
Initials	KL	KL		AS		AS		KL		KL		KL		KL

Thermometer: temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control	100% (v/v)		
Hardness*	10	104		
Alkalinity*	5	86		

* mg/L as CaCO3

Analysts: MML, AWD, KL
Reviewed by: JOL
Date reviewed: May 25/16

Sample Description: clear, colourless, some debris, no odour

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Teck
Sample ID: LC# DCDS WS 2016-04-26 N
Work Order #: 16474
Start Date & Time: April 28/16 @1640h
Stop Date & Time: May 5/16 @1045h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	0	0	1	1	0	29	30
	2	↓	↓	↓	0	1	0	1	2	1	27	30
	3	↓	↓	↓	0	0	2	0	2	1	27	30
	4	↓	↓	↓	1	0	1	0	2	2	26	30
6.25	1	↓	↓	↓	0	0	1	2	3	2	25	30
	2	↓	↓	↓	↓	0	1	1	2	1	27	30
	3	↓	↓	↓	↓	1	3	2	6	0	24	30
	4	↓	↓	↓	↓	1	0	2	3	1	26	30
12.5	1	↓	↓	↓	↓	1	1	2	4	0	26	30
	2	↓	↓	↓	1	0	0	2	3	1	26	30
	3	↓	↓	↓	0	0	1	0	1	2	27	30
	4	↓	↓	↓	↓	2	0	3	5	0	25	30
25	1	↓	↓	↓	↓	0	0	0	0	1	29	30
	2	↓	↓	↓	↓	~~10~~ 0	2	1	3	0	26	~~29~~ 30
	3	↓	↓	↓	↓	1	3	1	5	0	26	31
	4	↓	↓	↓	↓	0	0	1	1	2	27	30
50	1	↓	↓	↓	↓	0	~~2~~ 3	1	4	1	25	30
	2	↓	↓	↓	↓	2	0	1	3	2	~~25~~	30
	3	↓	↓	↓	↓	0	1	0	1	2	27	30
	4	↓	↓	↓	↓	0	1	0	2	2	26	30
100	1	0	↓	↓	↓	2	2	2	6	0	24	30
	2	↓	↓	↓	↓	0	1	2	3	0	28	31
	3	↓	↓	↓	↓	0	0	1	1	0	28	29
	4	↓	↓	↓	↓	2	0	1	3	1	26	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		KL	AM	A	KL	KL	KL	KL	KL	KL	KL	KL

Comments:

Reviewed by: JCL **Date reviewed:** May 25/16

CETIS Analytical Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	14-5561-1206	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	25 May-16 16:22	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	01-1756-9548	**Test Type:**	Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	05 May-16 10:45	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	6d 18h	**Source:**	Campbel Lake	**Age:**	
Sample ID:	13-8345-2068	**Code:**	5275CDA4	**Client:**	Teck Coal
Sample Date:	27 Apr-16 07:58	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	33h (6 °C)	**Station:**	LC DCDS WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	297288	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	N/A	N/A	<1	NA	NA
EC10	>100	N/A	N/A	<1	NA	NA
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

Proportion Normal Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.9083	0.8667	0.9667	0.02097	0.04194	4.62%	0.0%	109	120
6.25		4	0.85	0.8	0.9	0.02152	0.04303	5.06%	6.42%	102	120
12.5		4	0.8667	0.8333	0.9	0.01361	0.02722	3.14%	4.59%	104	120
25		4	0.9005	0.8387	0.9667	0.02616	0.05232	5.81%	0.86%	108	120
50		4	0.8583	0.8333	0.9	0.01596	0.03191	3.72%	5.51%	103	120
100		4	0.8839	0.8	0.9655	0.03461	0.06921	7.83%	2.7%	106	120

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	0.9667	0.9	0.9	0.8667
6.25		0.8333	0.9	0.8	0.8667
12.5		0.8667	0.8667	0.9	0.8333
25		0.9667	0.8966	0.8387	0.9
50		0.8333	0.8333	0.9	0.8667
100		0.8	0.9032	0.9655	0.8667

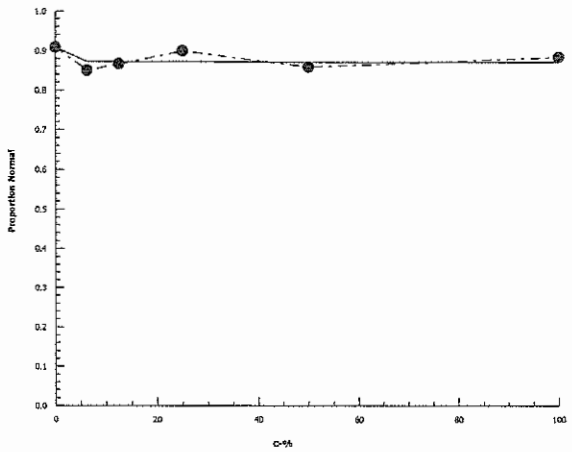
Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	29/30	27/30	27/30	26/30
6.25		25/30	27/30	24/30	26/30
12.5		26/30	26/30	27/30	25/30
25		29/30	26/29	26/31	27/30
50		25/30	25/30	27/30	26/30
100		24/30	28/31	28/29	26/30

Salmonid Embryo Survival and Development Test **Nautilus Environmental**

Analysis ID:	14-5561-1206	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	25 May-16 16:22	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Rainbow Trout Embryo Summary Sheet

Client: Teck

Start Date/Time: Apr 28/16 @ 1640h

Work Order No.: 16474

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: LC_LCS_WS-2016-04-25_N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 5X20L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 10
Alkalinity (mg/L $CaCO_3$): 5

Test Organism Information:

Batch No.: 042816
Source: Ted's Trout Farm (Campbell Lake)
Loading Density: 1.135 g/L

Number of male broodstock used: 4
Number of female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE 84
Stock Solution ID: 15503
Date Initiated: Apr 28/16
7-d EC50 (95% CL): 5.5 (5.0 - 5.8) mg/L SDS

Reference Toxicant Mean and Range: 4.1 (2.1 - 8.0) mg/L SDS
Reference Toxicant CV (%): 40

Test Results:

	Sample ID		
	LC_LCS_WS_2016-04-25_N		
EC25 % (v/v) (95% CL)	>100		
EC50 % (v/v) (95% CL)	>100		

Reviewed by: JOL

Date reviewed: May 25/16

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: LC_LCS_WS_2016-04-25_N
Work Order #: 16474
Start Date & Time: April 28/16 @ 1640h
Stop Date & Time: May 5/16 @ 1100h
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	10.0	9.9	9.9	10.1	9.9	10.1	9.9	10.1	10.1	9.8	9.6	10.0	10.1	9.8
pH	7.0	7.0	7.2	7.0	7.1	7.0	6.9	7.0	7.1	6.7	6.6	6.9	7.0	7.0
Cond. (µS/cm)	29	29		27		28		29		27		26		30
Initials	YML	KL		AW		AS		KL		KL		KL		KL

6.25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	9.7	10.0	9.9	10.1	9.8	10.1	9.8	10.0	10.1	9.7	9.6	10.1	10.0	9.9
pH	7.4	7.2	7.2	7.2	7.3	7.3	7.4	7.2	7.2	6.8	7.3	7.5	7.4	7.3
Cond. (µS/cm)	69	60		59		60		64		60		59		61
Initials	KL	KL		AS		AS		KL		KL		KL		KL

25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	9.7	10.0	9.9	10.1	9.8	10.0	9.9	10.0	10.1	9.7	9.7	10.1	9.9	9.9
pH	7.7	7.6	7.8	7.6	7.7	7.7	7.7	7.5	7.6	7.1	7.4	7.9	7.7	7.6
Cond. (µS/cm)	164	176		164		162		188		186		175		180
Initials	KL	KL		AS		AS		KL		KL		KL		KL

100 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	15.0	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	15.0	15.0	15.0
DO (mg/L)	9.8	10.0	9.9	10.0	9.8	10.0	9.8	10.1	10.1	9.6	9.6	10.1	9.9	9.9
pH	8.2	8.2	8.5	8.2	8.3	8.3	8.2	8.2	8.2	7.7	7.7	8.2	8.1	8.2
Cond. (µS/cm)	538	526		524		525		526		541		524		527
Initials	KL	KL		AS		AS		KL		KL		KL		KL

Thermometer: Temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control	100% (v/v)		
Hardness*	10	268		
Alkalinity*	5	156		

* mg/L as CaCO3

Analysts: YML, AWO, KL
Reviewed by: JBL
Date reviewed: May 25/16

Sample Description: Clear, colourless, some debris, no odour

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Teck
Sample ID: LC_LCS_WS_2016-04-25_W
Work Order #: 16474
Start Date & Time: April 28/16 @1640h
Stop Date & Time: May 5/16 @1100h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	1	2	1	4	0	26	30
	2	↓	↓	↓	0	0	0	1	1	1	28	30
	3	↓	↓	↓	1	0	1	3	5	0	25	30
	4	↓	↓	↓	0	1	1	1	3	0	27	30
6.25	1	↓	↓	↓	1	1	1	0	3	1	26	30
	2	↓	↓	↓	0	0	3	0	3	1	26	30
	3	↓	↓	↓	↓	0	0	0	0	0	30	30
	4	↓	↓	↓	↓	0	3	1	4	0	26	30
12.5	1	↓	↓	↓	↓	1	0	0	1	2	26	29
	2	↓	↓	↓	↓	0	1	0	1	0	29	30
	3	↓	↓	↓	↓	0	2	1	3	2	25	30
	4	↓	↓	↓	↓	0	3	0	3	1	26	30
25	1	↓	↓	↓	↓	0	4	2	6	1	23	30
	2	↓	↓	↓	↓	1	0	0	1	1	28	30
	3	↓	↓	↓	↓	1	2	0	3	0	27	30
	4	↓	↓	↓	↓	0	2	1	3	2	25	30
50	1	↓	↓	↓	↓	2	1	1	4	2	24	30
	2	↓	↓	↓	↓	1	0	0	1	2	27	30
	3	↓	↓	↓	↓	0	N	0	2	2	26	30
	4	↓	↓	↓	↓	2	2	1	5	1	24	30
100	1	↓	↓	↓	↓	2	1	0	3	1	26	30
	2	↓	↓	↓	↓	0	1	3	4	1	25	30
	3	↓	↓	↓	↓	1	4	2	7	0	23	30
	4	↓	↓	↓	2	~~3~~ 3	2	2	9	0	21	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		KL	AS	A	KL	KL	KL	KL	KL	KL	KL	KL

Comments:

Reviewed by: JOL **Date reviewed:** May 25/16

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	08-6409-1543	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:29	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	12-6912-3480	**Test Type:**	Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	05 May-16 11:00	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	6d 18h	**Source:**	Campbel Lake	**Age:**	
Sample ID:	18-5443-1080	**Code:**	6E885F68	**Client:**	Teck Coal
Sample Date:	27 Apr-16 06:50	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	34h (6.6 °C)	**Station:**	LC_LC5_WS_2016-04-25_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1621035	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	39.97	N/A	101.6	2.502	0.9838	NA
EC10	86.1	6.998	N/A	1.161	NA	14.29
EC15	>100	N/A	N/A	<1	NA	NA
EC20	>100	N/A	N/A	<1	NA	NA
EC25	>100	N/A	N/A	<1	NA	NA
EC40	>100	N/A	N/A	<1	NA	NA
EC50	>100	N/A	N/A	<1	NA	NA

Proportion Normal Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.8833	0.8333	0.9333	0.02152	0.04303	4.87%	0.0%	106	120
6.25		4	0.9	0.8667	1	0.03333	0.06667	7.41%	-1.89%	108	120
12.5		4	0.8908	0.8333	0.9667	0.02839	0.05679	6.38%	-0.85%	106	119
25		4	0.8583	0.7667	0.9333	0.03696	0.07391	8.61%	2.83%	103	120
50		4	0.8417	0.8	0.9	0.025	0.05	5.94%	4.72%	101	120
100		4	0.7917	0.7	0.8667	0.03696	0.07391	9.34%	10.38%	95	120

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	0.8667	0.9333	0.8333	0.9
6.25		0.8667	0.8667	1	0.8667
12.5		0.8966	0.9667	0.8333	0.8667
25		0.7667	0.9333	0.9	0.8333
50		0.8	0.9	0.8667	0.8
100		0.8667	0.8333	0.7667	0.7

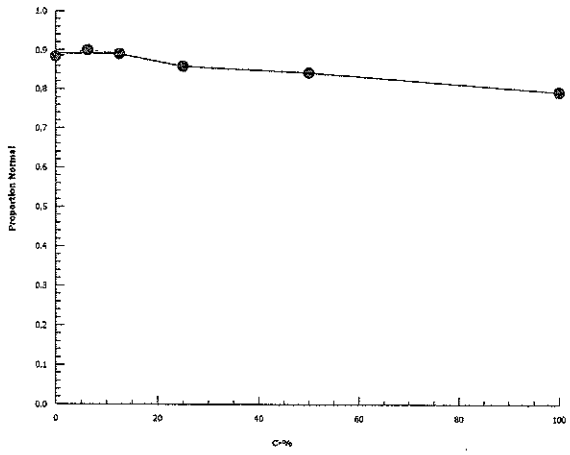
Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	26/30	28/30	25/30	27/30
6.25		26/30	26/30	30/30	26/30
12.5		26/29	29/30	25/30	26/30
25		23/30	28/30	27/30	25/30
50		24/30	27/30	26/30	24/30
100		26/30	25/30	23/30	21/30

Salmonid Embryo Survival and Development Test **Nautilus Environmental**

Analysis ID:	08-6409-1543	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:29	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Rainbow Trout Embryo Summary Sheet

Client: Teck

Start Date/Time: Apr 28 16 @ 1640h

Work Order No.: 16474

Test Species: *Oncorhynchus mykiss*

Sample Information:

Sample ID: LC_WTF-OUT_WS_20160427_N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 5X20L

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L $CaCO_3$): 10
Alkalinity (mg/L $CaCO_3$): 5

Test Organism Information:

Batch No.: 042816
Source: Ted's Trout Farm (Campbell Lake)
Loading Density: 1.135 g/L

Number of male broodstock used: 4
Number of female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE84
Stock Solution ID: 15503
Date Initiated: Apr 28/16
7-d EC50 (95% CL): 5.5 (5.0 - 5.8) mg/L SDS

Reference Toxicant Mean and Range: ~~24.1~~ 24.1 (2.1 - 8.0) mg/L SDS
Reference Toxicant CV (%): 40

Test Results:

	Sample ID		
	LC_WTF_OUT_WS_20160427_N		
EC25 % (v/v) (95% CL)	65.1 (38.3 - 80.5)		
EC50 % (v/v) (95% CL)	100 (93.8 - 100)		

Reviewed by: JGL

Date reviewed: May 25/16

7-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Teck
Sample ID: LC-WTF-OUT-WS-20160427-N
Work Order #: 16474
Start Date & Time: April 28, 2016 @1640h
Stop Date & Time: May 5, 2016 @1115h
Test Species: *Oncorhynchus mykiss*

Control Concentration (% v/v)

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	10.0	9.9	9.8	10.1	9.9	10.1	9.9	10.1	10.0	9.9	9.2	10.0	9.7	9.7
pH	7.0	7.0	7.2	7.0	7.1	7.0	7.1	7.0	7.1	6.7	6.6	6.9	7.0	7.0
Cond. (µS/cm)	29	29		27		28		29		27		26		30
Initials	YML	KL		A		A		KL		KL		KL		KL

6.25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	9.5	10.0	9.8	10.2	9.9	10.1	9.7	10.1	10.0	9.6	9.3	10.0	9.7	9.8
pH	7.2	7.15	7.2	7.3	7.3	7.2	7.3	7.4	7.2	7.3	7.3	7.4	7.2	7.5
Cond. (µS/cm)	204	180		187		185		184		178		193		189
Initials	KL	KL		A		A		KL		KL		KL		

25 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	14.5	15.0	15.0	15.0
DO (mg/L)	9.5	10.0	9.7	10.1	9.8	10.1	9.8	10.1	10.1	9.6	9.3	10.0	9.7	9.8
pH	7.4	7.40	7.6	7.5	7.6	7.5	7.6	7.8	7.4	7.4	7.6	7.6	7.8	7.9
Cond. (µS/cm)	567	638	672	594		602		606		676		605		615
Initials	KL	KL		A		A		KL		KL		KL		KL

100 Concentration

	Days													
	0	1		2		3		4		5		6		7
	init.	new	old	new	old	new	old	new	old	new	old	new	old	final
Temperature (°C)	14.5 @ 13.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	14.5	15.0	15.0	15.0
DO (mg/L)	9.5	10.0	9.7	10.0	9.8	10.1	9.9	10.0	10.1	9.5	9.4	9.8	9.8	9.8
pH	7.5	7.6	7.9	8.0	8.1	7.9	8.0	8.02	7.9	7.9	8.0	7.6	8.3	8.5
Cond. (µS/cm)	2nd 1996	2010		2000		1997		2000		2050		1992		1951
Initials	KL	KL		A		A		KL		KL		KL		KL

Thermometer: temp-3 **DO meter:** DO-1/3 **pH meter:** pH-1/3 **Conductivity meter:** C-1/3

	Control	100% (v/v)		
Hardness*	10	1040		
Alkalinity*	5	352		

* mg/L as CaCO3

Analysts: YML, AWD, KL
Reviewed by: JC
Date reviewed: May 25/16

Sample Description: clear, colourless, some brown debris, hydrocarbon smell

Comments:

Embryo Toxicity Test
Daily Mortality

Client: Teck
Sample ID: LC_WTF_OUT_WS_20160427_N
Work Order #: 16474
Start Date & Time: April 28, 2016 @ 1640h.
Stop Date & Time: May 5/16 @ 1115h
Test Species: *Oncorhynchus mykiss*

Concentration (% v/v)	Rep	Day of Test - No. of Mortalities							Total Dead Eggs	Total Undeveloped	Total No. Embryo	Total Exposed
		1	2	3	4	5	6	7				
Control	1	0	0	0	0	1	~~2~~ 0	1	2	2	26	30
	2	0			0	1	~~1~~ 1	0	2	0	28	30
	3	0			0	0	~~3~~ 0	1	1	0	29	30
	4	1			1	1	2	2	7	1	22	30
6.25	1	0			1	3	0	0	4	1	23	28
	2				1	0	4	1	6	0	~~24~~ 24	30
	3				1	0	~~4~~ 2	1	4	0	26	30
	4				0	0	0	2	2	0	25	~~30~~ 27
12.5	1				0	0	1	0	1	2	27	30
	2				1	2	1	1	5	1	24	30
	3				0	1	3	1	5	3	22	30
	4				1	0	4	0	5	0	24	29
25	1				1	2	1	1	5	2	23	30
	2				1	3	2	0	6	0	23	29
	3				0	3	~~4~~ 5	0	8	0	22	30
	4				1	1	0	1	3	1	26	30
50	1				4	1	3	1	9	0	21	30
	2				0	0	0	2	2	3	25	~~30~~ 30
	3				~~3~~ 3	2	4	1	10	2	18	30
	4				0	1	2	1	4	2	25	31
100	1				0	8	0	2	10	6	14	30
	2				0	1	3	2	6	8	16	30
	3				2	7	0	9	18	5	10	33
	4				2	1	0	1	4	7	19	30
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		KL	A	—	KL	KL	KL	KL	KL	KL	KL	KL

Comments:

Reviewed by: JGK
Date reviewed: May 25/16

CETIS Analytical Report

Salmonid Embryo Survival and Development Test — **Nautilus Environmental**

Analysis ID:	00-7509-8675	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:51	**Analysis:**	Linear Regression (MLE)	**Official Results:**	Yes
Batch ID:	15-7260-3829	**Test Type:**	Development	**Analyst:**	Kania Lywe
Start Date:	28 Apr-16 16:40	**Protocol:**	EC/EPS 1/RM/28	**Diluent:**	Dechlorinated Tap Water
Ending Date:	05 May-16 11:15	**Species:**	Oncorhynchus mykiss	**Brine:**	
Duration:	6d 19h	**Source:**	Campbel Lake	**Age:**	
Sample ID:	05-4497-8051	**Code:**	207BB483	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:00	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	32h (10.2 °C)	**Station:**	LC_WTF_OUT_WS_20160427_N		

Linear Regression Options

Model Function	Threshold Option	Threshold	Optimized	Pooled	Het Corr	Weighted
Log-Gompertz [log(-log(1-P)=A+B*log(X)]	Control Threshold	0.125	Yes	No	No	Yes

Regression Summary

Iters	LL	AICc	BIC	Mu	Sigma	Adj R2	F Stat	Critical	P-Value	Decision(α:5%)
14	-367.3	741.8	744.1	2.161		0.6709	0.1148	3.16	0.9503	Non-Significant Lack of Fit

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	21.55	3.214	37.2	4.641	2.688	31.11
EC10	34.2	9.193	50.52	2.924	1.98	10.88
EC15	45.16	17.2	61.12	2.215	1.636	5.814
EC20	55.34	26.99	70.79	1.807	1.413	3.705
EC25	65.14	38.32	80.51	1.535	1.242	2.61
EC40	94.14	74.87	121.6	1.062	0.8223	1.336
EC50	~~114.5~~ >100	93.79	~~172.6~~ >100	0.8733	0.5794	1.066

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
Threshold	0.143	0.02302	0.09787	0.1881	6.212	<0.0001	Significant Parameter
Slope	3.589	1.035	1.561	5.617	3.468	0.0023	Significant Parameter
Intercept	-7.756	1.979	-11.63	-3.878	-3.92	0.0008	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	66.56597	66.56597	1	48.89	<0.0001	Significant
Lack of Fit	0.536611	0.178871	3	0.1148	0.9503	Non-Significant
Pure Error	28.05504	1.558613	18			
Residual	28.59165	1.361507	21			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Goodness-of-Fit	Pearson Chi-Sq GOF	28.59	32.67	0.1242	Non-Significant Heterogenity
	Likelihood Ratio GOF	29.77	32.67	0.0967	Non-Significant Heterogenity
Variances	Bartlett Equality of Variance	2.482	11.07	0.7792	Equal Variances
	Mod Levene Equality of Variance	0.5836	2.773	0.7123	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9634	0.9169	0.5102	Normal Distribution
	Anderson-Darling A2 Normality	0.2842	2.492	0.6604	Normal Distribution

Salmonid Embryo Survival and Development Test **Nautilus Environmental**

Analysis ID: 00-7509-8675 **Endpoint:** Proportion Normal **CETIS Version:** CETISv1.8.7
Analyzed: 12 May-16 16:51 **Analysis:** Linear Regression (MLE) **Official Results:** Yes

Proportion Normal Summary

			Calculated Variate(A/B)								
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	4	0.875	0.7333	0.9667	0.05159	0.1032	11.79%	0.0%	105	120
6.25		4	0.8535	0.8	0.9259	0.02785	0.05571	6.53%	2.46%	98	115
12.5		4	0.8152	0.7333	0.9	0.03449	0.06899	8.46%	6.83%	97	119
25		4	0.7899	0.7333	0.8667	0.02835	0.05669	7.18%	9.72%	94	119
50		4	0.7349	0.6	0.8333	0.0534	0.1068	14.53%	16.01%	89	121
100		4	0.4841	0.303	0.6333	0.06939	0.1388	28.67%	44.68%	59	123

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	0.8667	0.9333	0.9667	0.7333
6.25		0.8214	0.8	0.8667	0.9259
12.5		0.9	0.8	0.7333	0.8276
25		0.7667	0.7931	0.7333	0.8667
50		0.7	0.8333	0.6	0.8065
100		0.4667	0.5333	0.303	0.6333

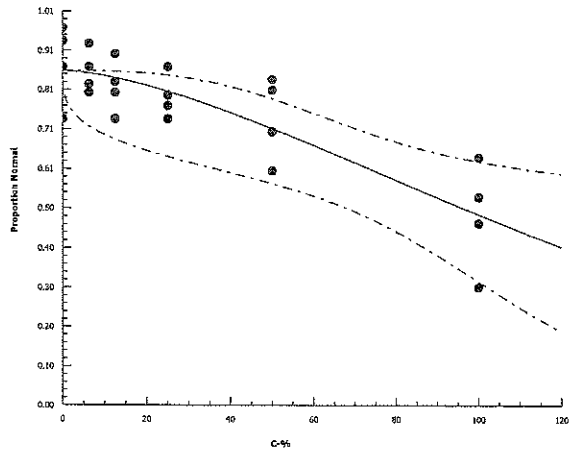
Proportion Normal Binomials

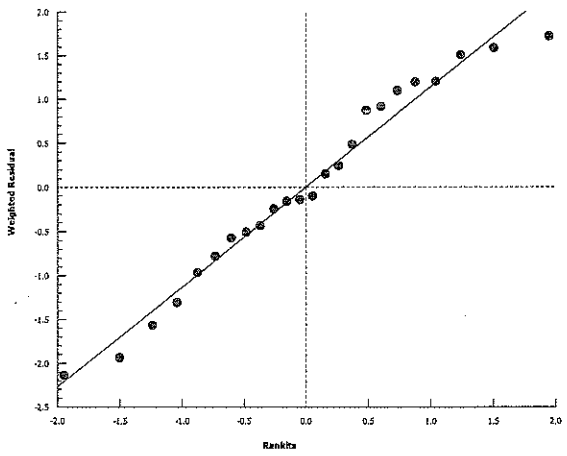
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	26/30	28/30	29/30	22/30
6.25		23/28	24/30	26/30	25/27
12.5		27/30	24/30	22/30	24/29
25		23/30	23/29	22/30	26/30
50		21/30	25/30	18/30	25/31
100		14/30	16/30	10/33	19/30

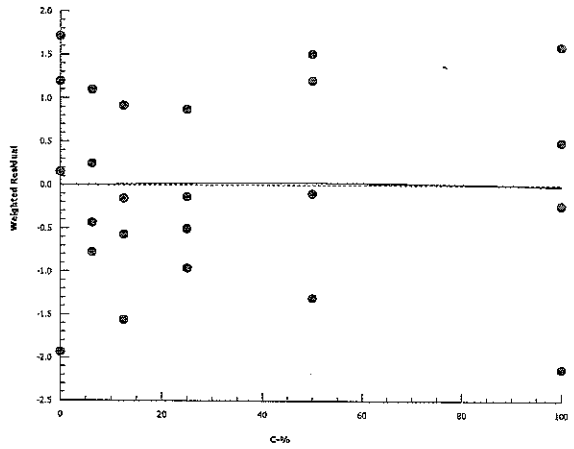
Salmonid Embryo Survival and Development Test | **Nautilus Environmental**

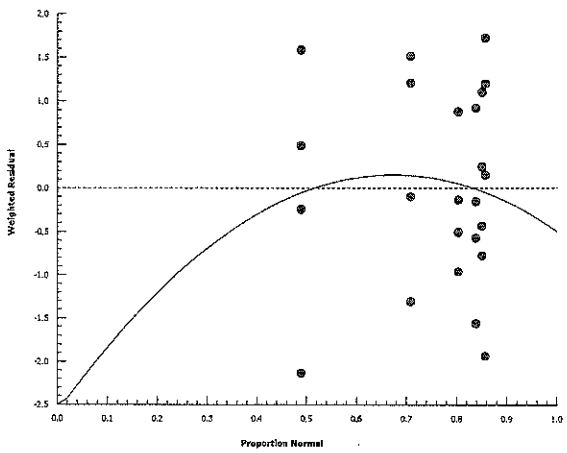
Analysis ID:	00-7509-8675	**Endpoint:**	Proportion Normal	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 16:51	**Analysis:**	Linear Regression (MLE)	**Official Results:**	Yes

Graphics Log-Gompertz [log(-log(1-P)=A+B*log(X)]









Client: Teck

W.O.#: 16475

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
GH_ER2_WS_2016_	Apr 28 16	50	7.1	7.3	138		50	6.8	136	JS
04_27_N										
Dechlor	Apr 28/16	100	0.6	0.7	5		100	1.0	10	KL

Notes:

Reviewed by: JGh

Date Reviewed: May 24/16

Client: Teck

W.O.#: 16474

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
LC_LCDSSLCC ~~WS 2016~~ KL	Apr 28/16	50	8.1	8.2	160		50	14.1	282	KL
LC_DC1	↓	↓	5.9	6.0	116		↓	6.2	124	↓
LC_FRDSDC			8.0 ~~7.9~~ KL	8.1	158			14.1	282	
LC_DCDS			4.4	4.5	86			5.2	104	
LC_CCS		↓	7.9	8.0	156		↓	13.4	268	
LC_WTF	↓	50	17.8	18.0	352		10[1]	10.4	1040	↓
Dechlor	Apr 28/16	~~50~~ KL 100	0.6	0.7	KL ~~70~~ 5		100 ~~50~~ KL	1.0	100 KL	KL

Notes: [1] Sample diluted w/ DI up to 100mL

Reviewed by: JCh

Date Reviewed: May 24/16

APPENDIX C – ***Lemna minor*** **Toxicity Test Data**

Lemna minor Summary Sheet

Client: TECK
Work Order No.: 16482

Start Date: April 28 , 2016
Set up by: JW

Sample Information:

Sample ID: LC - LCDSSLCC - WS - 2016 - 04 - 29 - N
Sample Date: April 27 /16
Date Received: April 28 /16
Sample Volume: 8 x 20L

Test Organism Information:

Culture Date: 04-2016
Age of culture (Day 0): 8 days
>8X growth in APHA?: Y (45 fronds)

KCl Reference Toxicant Results:

Reference Toxicant ID: Lm 132
Date Initiated: April 28/16

7-d No. of Fronds IC50 (95% CL): 4.2 (2.7 - 5.5) g/L KCl

7-d No. Fronds IC50 Reference Toxicant Mean (2 SD Range): 4.0 (3.2 - 5.0) g/L KCl CV (%): 12

Test Results:		Number of Fronds	Dry Weight
	IC25 %(v/v) (95% CL)	> 97	> 97
	IC50 %(v/v) (95% CL)	> 97	> 97

Reviewed by: JGL

Date reviewed: May 24/16

Plant Growth Inhibition Toxicity Test
Water Quality Measurements

Client : Teck **Setup by:** JW

Sample ID: LC - LCDSS LCC - WS - 2016-04-25_N **Test Date:** April 28 , 2016

Work Order No.: 16482 **Test Species:** *Lemna minor*

Culture Source: CPCC # 490

Test Culture Age: 8 days **> 8X Growth? (Y/N):** Y (45 fronds)

Light Intensity Range: 4300 - 4900 lux **Date Measured:** April 28 , 2016

Day	0	1	2	3	4	5	6	7
Shelf Temp (°C)	24.0	24.5	25.0	25.0	24.5	25.0	25.0	25.0
Initials	JW	JW	A>	A>	JW	MLT	JW	JW

Sample Characteristics:	Initial Water Quality		Adjusted Water Quality
Temperature (°C)	25.5	Aeration?: 20 min	25.5
DO (mg/L)	9.7	Nutrients added?[1]: Y	8.3
pH	8.1		8.0
Conductivity (µS)	557		1327

[1] 10 mL of each APHA stock (A,B and C) added to 970 mL sample.

Concentration % (V/V)	Temperature (°C)		pH		Conductivity (µS)
	Day 0	Day 7	Day 0	Day 7	0 h
Control	23.0	25.0	8.2	8.2	863
1.5	23.0	25.0	7.9	8.2	880
3.0	23.5	25.0	8.0	8.4	885
6.1	23.5	25.0	8.0	8.5	900
12.1	24.0	25.0	8.0	8.7	930
24.2	25.0	25.0	8.0	9.3	988
48.5	25.0	25.0	8.0	9.2	1104
97	25.5	25.0	8.0	8.9	1327
Initials	JW	JW	JW	KC	JW

Thermometer: # 6 **Cond. Meter:** C-2 **pH meter:** pH - 1 **Light meter:** Lit - L

Sample Description: clear, colorless, colourless, debris present

Comments: ~~Light meter - Lit - 1~~ JW

Reviewed: JGu **Date Reviewed:** May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC_LCDSSLCC_WS_2016-04-25_N
Work Order #: 16482

Start Date: April 28 /16
Termination Date: May 5 /16
Test set up by: JW

Concentration %/o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
control	A	6	84										JW
	B	6	92										
	C	6	89										
	D	6	~~60~~	80 JW									
1.5	A	6	60										
	B	6	69										
	C	6	68										
	D	6	62										
3.0	A	6	79										
	B	6	85										
	C	6	80										
	D	6	87										
6.1	A	6	84										
	B	6	62										
	C	6	92										
	D	6	82										
12.1	A	6	79										
	B	6	70										
	C	6	85										
	D	6	70										
24.2	A	6	88										
	B	6	81										
	C	6	94										
	D	6	73										↓

Comments:

Reviewed by: JW

Date Reviewed: May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC-LCDSSLCC-INS-2016-04-25-N
Work Order #: 16482

Start Date: April 28 /16
Termination Date: May 5 /16
Test set up by: JW

Concentration %/o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
48.5	A	6	95										JW
	B	6	76										
	C	6	80										
	D	6	96										
97	A	6	62										
	B	6	74			X							
	C	6	74										
	D	6	76			X							✓
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												

Comments:

Reviewed by: JGL

Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC_LCDSSLCC_WS_2016-04-25_N
WO #: 16482

Start Date: April 28 /16
Termination Date: May 5 /16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		LCC Blue			
Control	A	1	1013.80	1019.89	JW / JW
	B	2	1041.61	1048.66	
	C	3	1002.15	1009.02	
	D	4	1003.83	1010.17	
1.5	A	5	1026.72	1030.95	
	B	6	1007.12	1011.75	
	C	7	1011.80	1017.01	
	D	8	1013.19	1017.14	
3.0	A	9	1016.28	1022.23	
	B	10	1010.93	1016.76	
	C	11	1009.56	1016.16	
	D	12	1012.26	1018.19	
6.1	A	13	994.52	1000.24	
	B	14	997.29	1001.60	
	C	15	1008.08	1014.59	
	D	16	1027.92	1033.97	
12.1	A	17	1024.76	1030.63	
	B	18	990.61	995.46	
	C	19	983.37	989.37	
	D	20	995.10	1000.15	
24.2	A	21	1035.46	1041.72	
	B	22	1030.09	1036.13	
	C	23	1025.30	1032.40	
	D	24	1016.52	1021.86	
48.5	A	25	1019.52	1026.53	
	B	26	999.62	1005.ϕ57 JW	
	C	27	1007.86	1013.38	
	D	28	1006.15	1013.27	✓

Comments: 10% Re-weigh : #5. 1030.96 #22. 1035.90
#14. 1001.57 #31. 1022.81

Reviewed by: JW

Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC-LCDSSLCC-WS-2016-04-25-N
WO #: 16482

Start Date: April 28 / 16
Termination Date: May 5 / 16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		LCC Blue			
	A	29	1011.21	1016.10	JW / JW
	B	30	1006.67	1011.91	↓
97	C	31	1017.62	1022.93	↓
	D	32	1015.65	1021.47	↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Comments:

Reviewed by: JBL

Date Reviewed: May 24/16

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	03-2124-8247	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 9:25	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	20-1540-1191	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	28 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	05 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	16h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	615481	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	0.6654	0.2169	89.54	150.3	1.117	461
IC10	52.3	N/A	101.2	1.912	0.9886	NA
IC15	75.66	39.12	N/A	1.322	NA	2.556
IC20	>97	N/A	N/A	<1.031	NA	NA
IC25	>97	N/A	N/A	<1.031	NA	NA
IC40	>97	N/A	N/A	<1.031	NA	NA
IC50	>97	N/A	N/A	<1.031	NA	NA

Frond Count Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	80.25	74	86	2.658	5.315	6.62%	0.0%
1.5		4	58.75	54	63	2.213	4.425	7.53%	26.79%
3		4	76.75	73	81	1.931	3.862	5.03%	4.36%
6.1		4	74	56	86	6.377	12.75	17.24%	7.79%
12.1		4	70	64	79	3.674	7.348	10.5%	12.77%
24.2		4	78	67	88	4.528	9.055	11.61%	2.8%
48.5		4	80.75	70	90	5.121	10.24	12.68%	-0.62%
97		4	65.5	56	70	3.202	6.403	9.78%	18.38%

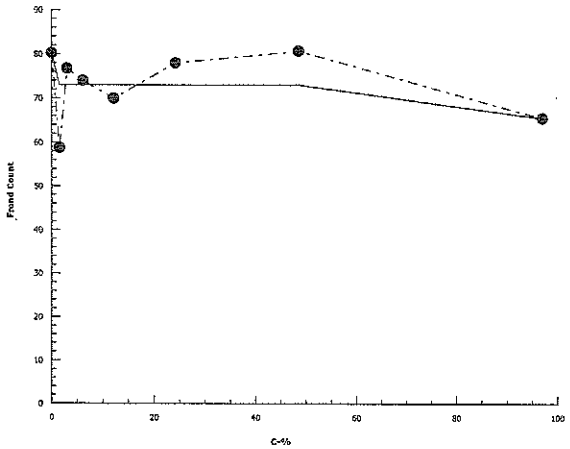
Frond Count Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	78	86	83	74
1.5		54	63	62	56
3		73	79	74	81
6.1		78	56	86	76
12.1		73	64	79	64
24.2		82	75	88	67
48.5		89	70	74	90
97		56	68	68	70

Lemna Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	03-2124-8247	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 9:25	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Analyst: JW QA: JGL May 24/16

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	07-2435-4878	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 9:38	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	20-1540-1191	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	28 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	05 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	16h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1503641	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	0.4103	0.1945	1.252	243.8	79.85	514.2
IC10	0.9888	0.4093	109	101.1	0.917	244.3
IC15	58.9	N/A	N/A	1.698	NA	NA
IC20	>97	N/A	N/A	<1.031	NA	NA
IC25	>97	N/A	N/A	<1.031	NA	NA
IC40	>97	N/A	N/A	<1.031	NA	NA
IC50	>97	N/A	N/A	<1.031	NA	NA

Total Dry Weight-mg Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	6.588	6.09	7.05	0.2241	0.4481	6.8%	0.0%
1.5		4	4.505	3.95	5.21	0.2733	0.5466	12.13%	31.61%
3		4	6.077	5.83	6.6	0.1761	0.3523	5.8%	7.74%
6.1		4	5.647	4.31	6.51	0.4743	0.9487	16.8%	14.27%
12.1		4	5.443	4.85	6	0.2885	0.5769	10.6%	17.38%
24.2		4	6.185	5.34	7.1	0.3626	0.7252	11.73%	6.11%
48.5		4	6.4	5.52	7.12	0.3945	0.789	12.33%	2.85%
97		4	5.315	4.89	5.82	0.1918	0.3835	7.22%	19.32%

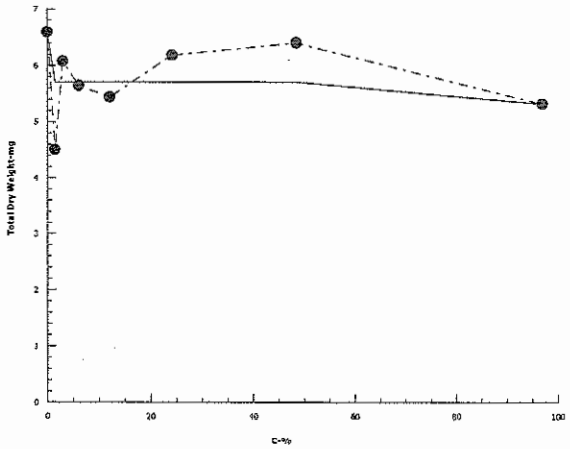
Total Dry Weight-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	6.09	7.05	6.87	6.34
1.5		4.23	4.63	5.21	3.95
3		5.95	5.83	6.6	5.93
6.1		5.72	4.31	6.51	6.05
12.1		5.87	4.85	6	5.05
24.2		6.26	6.04	7.1	5.34
48.5		7.01	5.95	5.52	7.12
97		4.89	5.24	5.31	5.82

Lemna Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	07-2435-4878	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 9:38	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Analyst: JW QA: JGL May 24/16

Lemna minor Summary Sheet

Client: Teck
Work Order No.: 16482

Start Date: April 29, 2016
Set up by: JW

Sample Information:

Sample ID: LC-DCL_WS_2016_04-26_N
Sample Date: April 27 /16
Date Received: April 28 /16
Sample Volume: 5 x 20L

Test Organism Information:

Culture Date: 042116
Age of culture (Day 0): 8 days
>8X growth in APHA?: Y (45 fronds)

KCl Reference Toxicant Results:

Reference Toxicant ID: Lm 132
Date Initiated: April 28/16

7-d No. of Fronds IC50 (95% CL): 4.2 (2.7 - 5.5) g/L KCl

7-d No. Fronds IC50 Reference Toxicant Mean (2 SD Range): 4.0 (3.2 - 5.0) g/L KCl CV (%): 12

		Number of Fronds	Dry Weight
Test Results:	IC25 %(v/v) (95% CL)	> 97	> 97
	IC50 %(v/v) (95% CL)	> 97	> 97

Reviewed by: JGL
Date reviewed: May 24/16

Plant Growth Inhibition Toxicity Test
Water Quality Measurements

Client : Teck | **Setup by:** JW

Sample ID: LC - DC1 - WS - 2016 - 04 - 28 - N | **Test Date:** April 29 / 16

Work Order No.: 16482 | **Test Species:** *Lemna minor*

Culture Source: CPCC # 490

Test Culture Age: 8 days | **> 8X Growth? (Y/N):** Y (45 fronds)

Light Intensity Range: 4630 - 5440 lux | **Date Measured:** April 28 / 16

Day	0	1	2	3	4	5	6	7
Shelf Temp (°C)	24.5	25.0	25.0	24.5	25.0	25.0	25.0	25.0
Initials	JW	A>	A>	JW	MLT	JW	JW	JW

Sample Characteristics:	Initial Water Quality		Adjusted Water Quality
Temperature (°C)	23.0	Aeration?: 20 min	23.0
DO (mg/L)	9.6	Nutrients added?[1]: Y →	8.4
pH	8.0		8.0
Conductivity (µS)	224		1039

[1] 10 mL of each APHA stock (A,B and C) added to 970 mL sample.

Concentration % (V/V)	Temperature (°C)		pH		Conductivity (µS)
	Day 0	Day 7	Day 0	Day 7	0 h
Control	23.0	26.0	8.2	8.7	912
1.5	23.0	26.0	8.1	8.7	JW ~~921~~ 920
3.0	23.0	26.0	8.1	8.6	~~924~~ 921
6.1	23.0	26.0	8.1	8.7	~~932~~ 924
12.1	23.0	26.0	8.1	8.8	932
24.2	23.0	26.0	8.1	8.8	949
48.5	23.0	26.0	8.1	8.8	981
97	23.0	26.0	8.0	9.2	1039
Initials	JW	JW	JW	JW	JW

Thermometer: #6 **Cond. Meter:** C-3 **pH meter:** PH3 **Light meter:** Lit-1

Sample Description: Clear, colorless, odourless, some debris present.

Comments:

Reviewed: JW **Date Reviewed:** May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC-OCL-WS-2016-04-26-N
Work Order #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Test set up by: JW

Concentration %/o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
control	A	6	70										JW
	B	6	82										
	C	6	71										
	D	6	79										
1.5	A	6	74										
	B	6	77										
	C	6	74										
	D	6	71										
3.0	A	6	64										
	B	6	65										
	C	6	81										
	D	6	67										
6.1	A	6	91										
	B	6	68										
	C	6	57										
	D	6	85										
12.1	A	6	76										
	B	6	67										
	C	6	63										
	D	6	65										
24.2	A	6	87										
	B	6	74										
	C	6	107										
	D	6	70										

Comments:

Reviewed by: JGH

Date Reviewed: May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC_DCL_WS_2016-04-26_N
Work Order #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Test set up by: JW

Concentration %/o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
48.5	A	6	77										JW
	B	6	84										↓
	C	6	71										
	D	6	92										
97	A	6	83										
	B	6	76										
	C	6	66										
	D	6	63										↓
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												

Comments:

Reviewed by: JW

Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC-DC1-WS-2016-04-26-N
WO #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Balance ID: Bal - 1

Concentration	Rep	Pan No	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		DC1 Red			
Control	A	1	978.89	984.48	JW / JW
	B	2	978.54	985.25	
	C	3	964.13	969.78	
	D	4	999.75	1005.93	
1.5	A	5	1017.49	1023.33	
	B	6	1003.12	1009.41	
	C	7	1026.44	1032.05	
	D	8	1006.59	1012.81	
3.0	A	9	1023.02	1028.73	
	B	10	1012.59	1018.25	
	C	11	1020.98	1028.16	
	D	12	996.36	1001.80	
6.1	A	13	1033.26	1040.73	
	B	14	1026.26	1031.77	
	C	15	1011.86	1016.76	
	D	16	1014.40	1021.65	
12.1	A	17	996.11	1002.50	
	B	18	1000.00	1005.78	
	C	19	1024.58 ~~47~~ JW	1029.65	
	D	20	1019.34	1024.78	
24.2	A	21	1024.43	1030.77	
	B	22	1021.18	1027.66	
	C	23	997.09	1005.69	
	D	24	985.01	990.81	
48.5	A	25	1003.71	1009.85	
	B	26	1011.07	1017.96	
	C	27	1033.65	1039.49	
	D	28	980.21	987.12	↓

Comments: 10% Re-weigh : # 6. 1009.31 # 24 : 990.70
16. 1021.54 # 31. 1001.49

Reviewed by: JW Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC-DCL-WS-2016-04-26-N
WO #: 16482

Start Date: April 29 / 16
Termination Date: May 6 / 16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		DCL Red			
	A	29	1005.62	1011.69	JW / JW
97	B	30	994.28	1000.53	↓
	C	31	996.10	1001.54	↓
	D	32	1005.40	1010.82	↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Comments:

Reviewed by: JGL

Date Reviewed: May 24/16

CETIS Analytical Report

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	21-0227-1789	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:19	**Analysis:**	Nonlinear Regression	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	.8d
Sample ID:	00-8128-9240	**Code:**	4D86018	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:30	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	40h (7.5 °C)	**Station:**	LC_DC1_WS_2016-04-26_N		

Non-Linear Regression Options

Model Function	X Transform	Y Transform	Weighting Function	PTBS Function
2P Exponential EV [Y=A*exp(log(0.5)*X/D)]	None	None	Normal [W=1]	Off [Y*=Y]

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
5	-90.5	185.4	187.9		Yes	1.447	2.508	0.2383	Non-Significant Lack of Fit

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	10490000	N/A	N/A	0.0000009	NA	NA JW
IC10	21550000	N/A	N/A	0.0000004	NA	NA
IC15	33240000	N/A	N/A	0.0000003	NA	NA
IC20	45640000	N/A	N/A	0.0000002	NA	NA
IC25	58840000	N/A	N/A	0.0000001	NA	NA
IC40	10450000	N/A	N/A	0.0000000	NA	NA
IC50	14180000	N/A	N/A	0.0000000	NA	NA

> 97 % (v/v)

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
A	68.47	2.357	63.85	73.09	29.05	<0.0001	Significant Parameter
D	1.42E+09	2.52E+15	-4.9E+15	4.94E+15	5.62E-07	1.0000	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	0	0	1	0	1.0000	Non-Significant
Lack of Fit	894.5108	149.0851	6	1.447	0.2383	Non-Significant
Pure Error	2472.25	103.0104	24			
Residual	3366.761	112.2254	30			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance	11.02	14.07	0.1379	Equal Variances
	Mod Levene Equality of Variance	2.385	2.423	0.0530	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9454	0.9338	0.1068	Normal Distribution
	Anderson-Darling A2 Normality	0.5102	2.492	0.2008	Normal Distribution

Frond Count Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	69.5	64	76	2.958	5.916	8.51%	0.0%
1.5		4	68	65	71	1.225	2.449	3.6%	2.16%
3		4	63.25	58	75	3.966	7.932	12.54%	8.99%
6.1		4	69.25	51	85	7.793	15.59	22.51%	0.36%
12.1		4	61.75	57	70	2.869	5.737	9.29%	11.15%
24.2		4	78.5	64	101	8.332	16.66	21.23%	-12.95%
48.5		4	75	65	86	4.528	9.055	12.07%	-7.91%
97		4	66	57	77	4.601	9.201	13.94%	5.04%

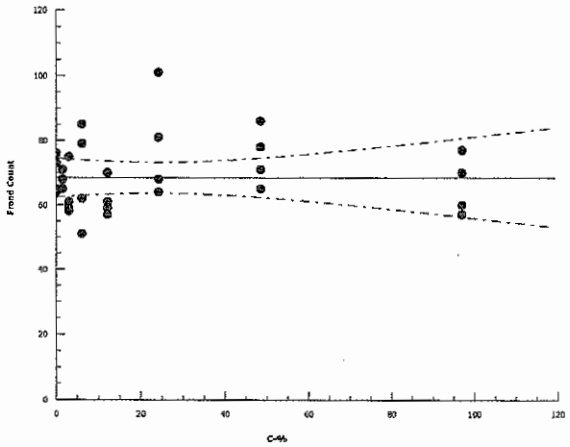
Lemna Growth Inhibition Test — **Nautilus Environmental**

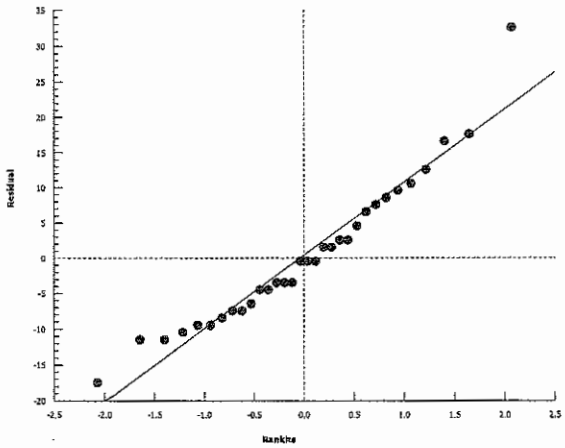
Analysis ID: 21-0227-1789 **Endpoint:** Frond Count **CETIS Version:** CETISv1.8.7
Analyzed: 12 May-16 10:19 **Analysis:** Nonlinear Regression **Official Results:** Yes

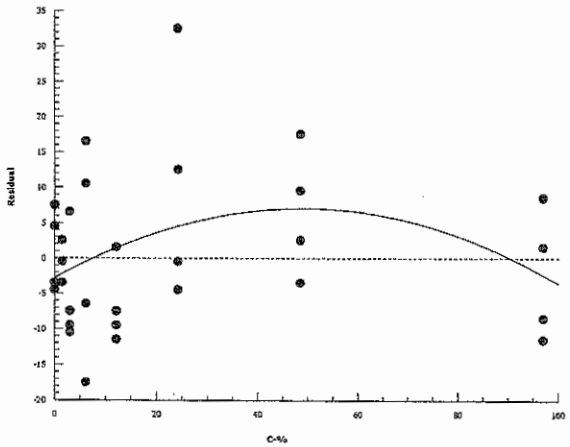
Frond Count Detail

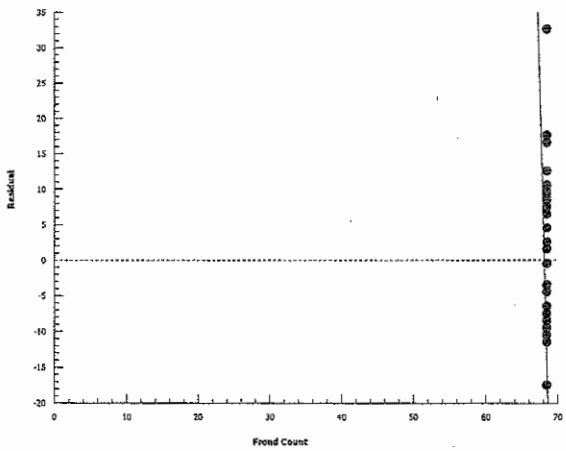
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	64	76	65	73
1.5		68	71	68	65
3		58	59	75	61
6.1		85	62	51	79
12.1		70	61	57	59
24.2		81	68	101	64
48.5		71	78	65	86
97		77	70	60	57

Graphics 2P Exponential EV [Y=A*exp(log(0.5)*X/D)]









CETIS Analytical Report

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	17-0050-9618	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:19	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	00-8128-9240	**Code:**	4D86018	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:30	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	40h (7.5 °C)	**Station:**	LC_DC1_WS_2016-04-26_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	25.6%	97	>97	NA	1.031

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	-0.209	2.482	17.81	6	0.9196	CDF	Non-Significant Effect
		3	-0.8709	2.482	17.81	6	0.9856	CDF	Non-Significant Effect
		6.1	-0.03483	2.482	17.81	6	0.8835	CDF	Non-Significant Effect
		12.1	-1.08	2.482	17.81	6	0.9923	CDF	Non-Significant Effect
		24.2	1.254	2.482	17.81	6	0.3663	CDF	Non-Significant Effect
		48.5	0.7664	2.482	17.81	6	0.5899	CDF	Non-Significant Effect
		97	-0.4877	2.482	17.81	6	0.9587	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	888.4688	126.9241	7	1.232	0.3243	Non-Significant Effect
Error	2472.25	103.0104	24			
Total	3360.719		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	11.02	18.48	0.1379	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9816	0.9081	0.8436	Normal Distribution

Frond Count Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	4	69.5	60.09	78.91	69	64	76	2.958	8.51%	0.0%
1.5		4	68	64.1	71.9	68	65	71	1.225	3.6%	2.16%
3		4	63.25	50.63	75.87	60	58	75	3.966	12.54%	8.99%
6.1		4	69.25	44.45	94.05	70.5	51	85	7.793	22.51%	0.36%
12.1		4	61.75	52.62	70.88	60	57	70	2.869	9.29%	11.15%
24.2		4	78.5	51.98	105	74.5	64	101	8.332	21.23%	-12.95%
48.5		4	75	60.59	89.41	74.5	65	86	4.528	12.07%	-7.91%
97		4	66	51.36	80.64	65	57	77	4.601	13.94%	5.04%

Frond Count Detail

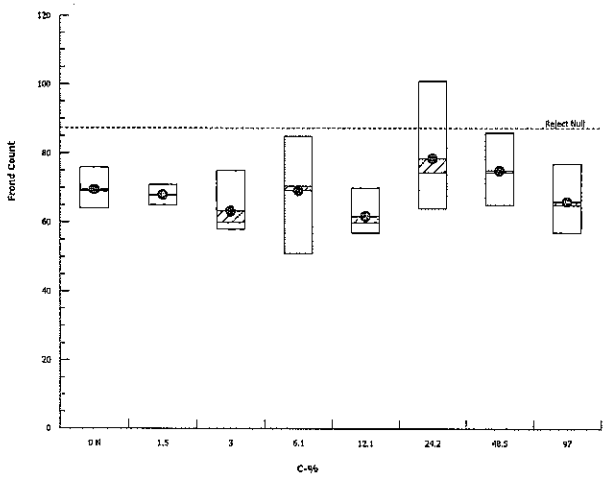
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	64	76	65	73
1.5		68	71	68	65
3		58	59	75	61
6.1		85	62	51	79
12.1		70	61	57	59
24.2		81	68	101	64
48.5		71	78	65	86
97		77	70	60	57

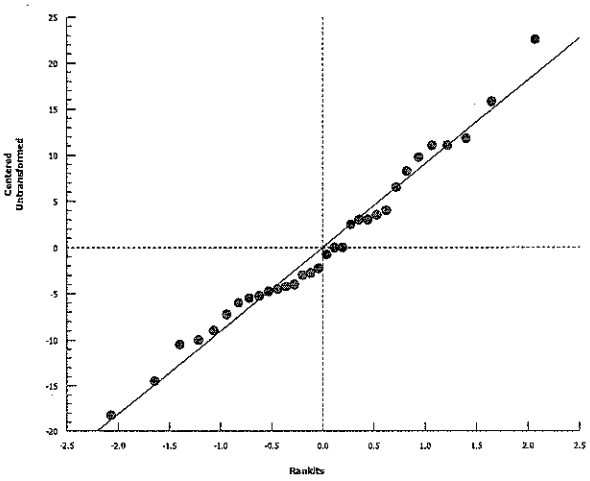
Analyst: JW QA: JGL May 24/1

Lemna Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	17-0050-9618	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:19	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	04-5945-3571	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:25	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	00-8128-9240	**Code:**	4D86018	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:30	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	40h (7.5 °C)	**Station:**	LC_DC1_WS_2016-04-26_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2114675	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	84.8	N/A	N/A	1.179	NA	NA
IC10	>97	N/A	N/A	<1.031	NA	NA
IC15	>97	N/A	N/A	<1.031	NA	NA
IC20	>97	N/A	N/A	<1.031	NA	NA
IC25	>97	N/A	N/A	<1.031	NA	NA
IC40	>97	N/A	N/A	<1.031	NA	NA
IC50	>97	N/A	N/A	<1.031	NA	NA

Total Dry Weight-mg Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	6.033	5.59	6.71	0.2619	0.5237	8.68%	0.0%
1.5		4	5.99	5.61	6.29	0.1606	0.3213	5.36%	0.7%
3		4	5.997	5.44	7.18	0.3985	0.797	13.29%	0.58%
6.1		4	6.283	4.9	7.47	0.636	1.272	20.25%	-4.14%
12.1		4	5.698	5.18	6.39	0.2615	0.523	9.18%	5.55%
24.2		4	6.805	5.8	8.6	0.616	1.232	18.11%	-12.81%
48.5		4	6.445	5.84	6.91	0.2698	0.5396	8.37%	-6.84%
97		4	5.795	5.42	6.25	0.214	0.4279	7.38%	3.94%

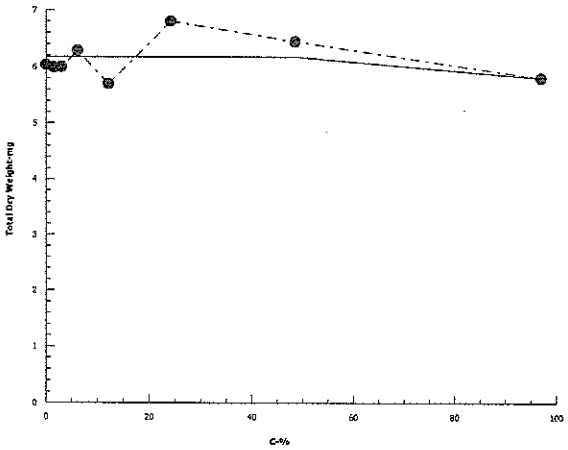
Total Dry Weight-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	5.59	6.71	5.65	6.18
1.5		5.84	6.29	5.61	6.22
3		5.71	5.66	7.18	5.44
6.1		7.47	5.51	4.9	7.25
12.1		6.39	5.78	5.18	5.44
24.2		6.34	6.48	8.6	5.8
48.5		6.14	6.89	5.84	6.91
97		6.07	6.25	5.44	5.42

Lemna Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	04-5945-3571	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:25	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	02-6092-3710	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:25	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	00-8128-9240	**Code:**	4D86018	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:30	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	40h (7.5 °C)	**Station:**	LC_DC1_WS_2016-04-26_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	22.8%	97	>97	NA	1.031

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	-0.07679	2.482	1.373	6	0.8931	CDF	Non-Significant Effect
		3	-0.06327	2.482	1.373	6	0.8901	CDF	Non-Significant Effect
		6.1	0.4519	2.482	1.373	6	0.7270	CDF	Non-Significant Effect
		12.1	-0.6055	2.482	1.373	6	0.9696	CDF	Non-Significant Effect
		24.2	1.396	2.482	1.373	6	0.3075	CDF	Non-Significant Effect
		48.5	0.7456	2.482	1.373	6	0.5995	CDF	Non-Significant Effect
		97	-0.4293	2.482	1.373	6	0.9522	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3.695988	0.5279982	7	0.8627	0.5490	Non-Significant Effect
Error	14.68952	0.6120633	24			
Total	18.38551		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	9.121	18.48	0.2441	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9549	0.9081	0.1986	Normal Distribution

Total Dry Weight-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	4	6.033	5.199	6.866	5.915	5.59	6.71	0.2619	8.68%	0.0%
1.5		4	5.99	5.479	6.501	6.03	5.61	6.29	0.1606	5.36%	0.7%
3		4	5.997	4.729	7.266	5.685	5.44	7.18	0.3985	13.29%	0.58%
6.1		4	6.283	4.258	8.307	6.38	4.9	7.47	0.636	20.25%	-4.14%
12.1		4	5.698	4.865	6.53	5.61	5.18	6.39	0.2615	9.18%	5.55%
24.2		4	6.805	4.845	8.765	6.41	5.8	8.6	0.616	18.11%	-12.81%
48.5		4	6.445	5.586	7.304	6.515	5.84	6.91	0.2698	8.37%	-6.84%
97		4	5.795	5.114	6.476	5.755	5.42	6.25	0.214	7.38%	3.94%

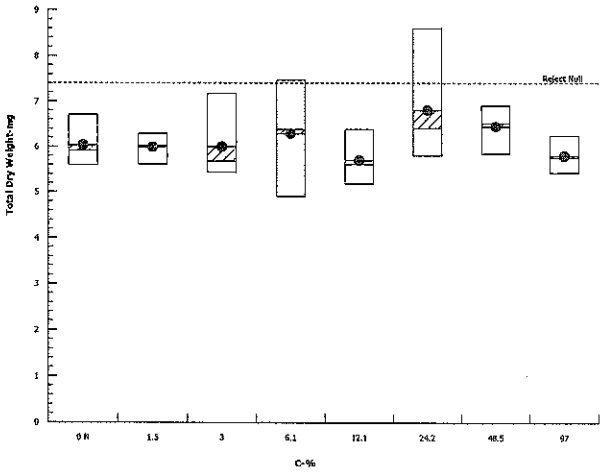
Total Dry Weight-mg Detail

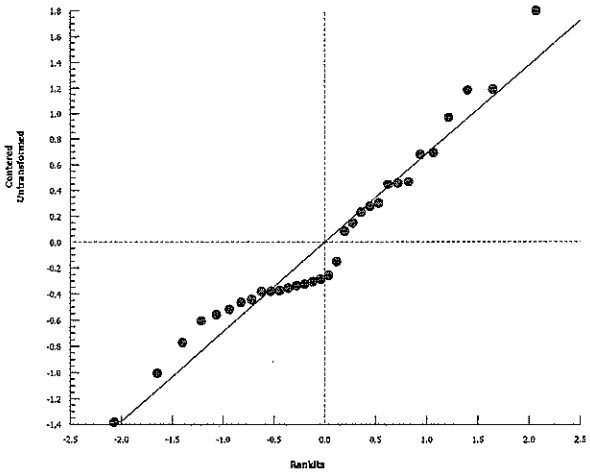
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	5.59	6.71	5.65	6.18
1.5		5.84	6.29	5.61	6.22
3		5.71	5.66	7.18	5.44
6.1		7.47	5.51	4.9	7.25
12.1		6.39	5.78	5.18	5.44
24.2		6.34	6.48	8.6	5.8
48.5		6.14	6.89	5.84	6.91
97		6.07	6.25	5.44	5.42

Lemna Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	02-6092-3710	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:25	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Analyst: JW QA: JBu May 24/16

Lemna minor Summary Sheet

Client: TECK
Work Order No.: 16482

Start Date: April 29, 2016
Set up by: JW

Sample Information:

Sample ID: LC-FROSDC-WS-2016-04-26_N
Sample Date: April 27/16
Date Received: April 28/16
Sample Volume: 5 x 20L

Test Organism Information:

Culture Date: 042016
Age of culture (Day 0): 9 days
>8X growth in APHA?: Y (45 fronds)

KCl Reference Toxicant Results:

Reference Toxicant ID: Lm 132
Date Initiated: April 28/16

7-d No. of Fronds IC50 (95% CL): 4.2 (2.7 - 5.5) g/L KCl

7-d No. Fronds IC50 Reference Toxicant Mean (2 SD Range): 4.0 (3.2 - 5.0) g/L KCl CV (%): 12

		Number of Fronds	Dry Weight
Test Results:	IC25 %(v/v) (95% CL)	> 97	> 97
	IC50 %(v/v) (95% CL)	> 97	> 97

Reviewed by: JGH

Date reviewed: May 24/16

Plant Growth Inhibition Toxicity Test
Water Quality Measurements

Client : Teck - LEO JW
Setup by: JW
Sample ID: LC - FRDSDC - WS - 2016 - 04 - 26 - N
Test Date: April 29 , 2016
Work Order No.: 16482
Test Species: *Lemna minor*
Culture Source: CPCC # 490
Test Culture Age: 9 days
> 8X Growth? (Y/N): Y (45 fronds)
Light Intensity Range: 4300 - 4900 lux
Date Measured: April 28 , 2016

Day	0	1	2	3	4	5	6	7
Shelf Temp (°C)	24.5	25.0	25.0	24.5	25.0	25.0	25.0	25.0
Initials	JW	A		JW	MG	JW	JW	JW

Sample Characteristics:	Initial Water Quality		Adjusted Water Quality
Temperature (°C)	23.0	Aeration?: 20 min	23.0
DO (mg/L)	9.4	Nutrients	8.4
pH	8.0	added?[1]: Y →	8.0
Conductivity (µS)	540		1316

[1] 10 mL of each APHA stock (A,B and C) added to 970 mL sample.

Concentration %(v/v)	Temperature (°C)		pH		Conductivity (µS)
	Day 0	Day 7	Day 0	Day 7	0 h
Control	23.0	25.5	8.3	8.3	912
1.5	23.0	25.5	8.0	8.3	919
3.0	23.0	25.5	8.0	8.5	931
6.1	23.0	25.5	8.1	8.5	943
12.1	23.0	25.5	8.1	8.6	970
24.2	23.0	25.5	8.1	8.7	1020
48.5	23.0	25.5	8.1	8.8	1120
97	23.0	25.5	8.0	8.9	1316
Initials	JW	JW	JW	JW	JW

Thermometer: #6 **Cond. Meter:** C-4 **pH meter:** pH-2 **Light meter:** LH-L

Sample Description: clear, colorless, odourless, some debris present,

Comments:

Reviewed: JBK **Date Reviewed:** May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC - FRDSDC - WS - 2016 - 04 - 27 - N
Work Order #: 16482

Start Date: April 29 / 16
Termination Date: May 6 / 16
Test set up by: JW

Concentration %o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
control	A	6	93										JW
	B	6	78										
	C	6	79										
	D	6	71										
1.5	A	6	72										
	B	6	73										
	C	6	66										
	D	6	71										
3.0	A	6	70										
	B	6	72										
	C	6	67										
	D	6	76										
6.1	A	6	78										
	B	6	84										
	C	6	76										
	D	6	77										
12.1	A	6	81										
	B	6	78										
	C	6	85										
	D	6	75										
24.2	A	6	71										
	B	6	85										
	C	6	73										
	D	6	56										↓

Comments:

Reviewed by: JGa

Date Reviewed: May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC - FRDSOC - WS - 2016 - 04 - 27 - N
Work Order #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Test set up by: JW

Concentration %/o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
48.5	A	6	86										JW
	B	6	90										↓
	C	6	69										
	D	6	89										
97	A	6	72										
	B	6	67										
	C	6	78										
	D	6	70										↓
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												

Comments:

Reviewed by: JGL

Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC_FROSDC_WS_2016-04-26_N
WO #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		DSDC green			
Control	A	1	1015.08	1021.39	JW / JW
	B	2	1021.46	1026.84	
	C	3	995.18	1001.62	
	D	4	1004.38	1009.23	
1.5	A	5	1011.75	1016.54	
	B	6	992.~~38~~ 34 JW	997.89	
	C	7	995.33	1001.06	
	D	8	987.60	993.12	
3.0	A	9	1005.49	1010.95	
	B	10	1022.45	1027.84	
	C	11	1006.50	1011.08	
	D	12	1017.54	1023.09	
6.1	A	13	1008.39	1014.14	
	B	14	1014.29	1020.73	
	C	15	1010.58	1017.05	
	D	16	1011.76	1017.82	
12.1	A	17	1021.70	1026.68	
	B	18	1020.16	1026.37	
	C	19	988.30	994.54	
	D	20	1014.56	1020.52	
24.2	A	21	1025.34	1030.67	
	B	22	1011.95	1018.23	
	C	23	1025.76	1031.38	
	D	24	1007.45	1011.99	
48.5	A	25	1007.56	1013.29	
	B	26	1010.04	1016.37	
	C	27	996.01	1001.48	
	D	28	996.35	1002.80	↓

Comments: 10 % Re-weigh : # 1. 1021.32 # 27. 1001.36
11. 1011.02 # 32. 1021.39

Reviewed by: JW

Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC_FRDSDC_WS_2016-04-26_N
WO #: 16482

Start Date: April 29 / 16
Termination Date: May 6 / 16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		DSDC green			
	A	29	1012.61	1018.80	JW / JW
	B	30	1010.04	1015.68	
97	C	31	1033.04	1038.70	
	D	32	1015.43	1021.55	↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Comments:

Reviewed by: JW

Date Reviewed: May 24/16

CETIS Analytical Report

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	21-1258-2328	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 9:46	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	07-3504-4440	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	9d
Sample ID:	07-5438-7274	**Code:**	2CF7094A	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:04	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	39h (8 °C)	**Station:**	LC FRDSDC WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	780566	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	1.16	N/A	N/A	86.19	NA	NA
IC10	80.87	N/A	N/A	1.237	NA	NA
IC15	>97	N/A	N/A	<1.031	NA	NA
IC20	>97	N/A	N/A	<1.031	NA	NA
IC25	>97	N/A	N/A	<1.031	NA	NA
IC40	>97	N/A	N/A	<1.031	NA	NA
IC50	>97	N/A	N/A	<1.031	NA	NA

Frond Count Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	74.25	65	87	4.608	9.215	12.41%	0.0%
1.5		4	64.5	60	67	1.555	3.109	4.82%	13.13%
3		4	65.25	61	70	1.887	3.775	5.79%	12.12%
6.1		4	72.75	70	78	1.797	3.594	4.94%	2.02%
12.1		4	73.75	69	79	2.136	4.272	5.79%	0.67%
24.2		4	65.25	50	79	5.949	11.9	18.24%	12.12%
48.5		4	77.5	63	84	4.907	9.815	12.66%	-4.38%
97		4	65.75	61	72	2.323	4.646	7.07%	11.45%

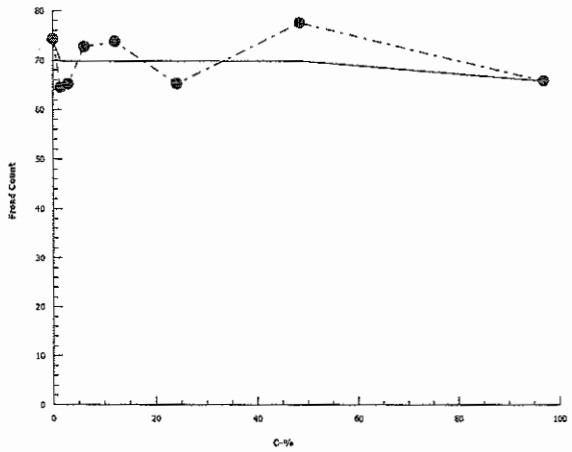
Frond Count Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	87	72	73	65
1.5		66	67	60	65
3		64	66	61	70
6.1		72	78	70	71
12.1		75	72	79	69
24.2		65	79	67	50
48.5		80	84	63	83
97		66	61	72	64

Lemna Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	21-1258-2328	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 9:46	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Analyst: JW QA: JGL May 24/16

CETIS Analytical Report

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	03-8201-6297	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 9:56	**Analysis:**	Nonlinear Regression	**Official Results:**	Yes
Batch ID:	07-3504-4440	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	9d
Sample ID:	07-5438-7274	**Code:**	2CF7094A	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:04	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	39h (8 °C)	**Station:**	LC FRDSDC WS 2016-04-26 N		

Non-Linear Regression Options

Model Function	X Transform	Y Transform	Weighting Function	PTBS Function
2P Exponential EV [Y=A*exp(log(0.5)*X/D)]	None	None	Normal [W=1]	Off [Y*=Y]

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
6	2.809	-1.204	1.314		Yes	1.86	2.508	0.1295	Non-Significant Lack of Fit

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	1658000	N/A	N/A	0.0000603	NA	NA JW
IC10	3407000	N/A	N/A	0.0000293	NA	NA
IC15	5255000	N/A	N/A	0.0000190	NA	NA
IC20	7215000	N/A	N/A	0.0000138	NA	NA
IC25	9302000	N/A	N/A	0.0000107	NA	NA
IC40	16520000	N/A	N/A	0.0000060	NA	NA
IC50	22410000	N/A	N/A	0.0000044	NA	NA

> 97 % (v/v)

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
A	5.649	0.1277	5.399	5.899	44.24	<0.0001	Significant Parameter
D	22410000	4.14E+11	-8.1E+11	8.11E+11	5.42E-05	1.0000	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	0	0	1	0	1.0000	Non-Significant
Lack of Fit	3.13529	0.522548	6	1.86	0.1295	Non-Significant
Pure Error	6.741494	0.280896	24			
Residual	9.876784	0.329226	30			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance	4.16	14.07	0.7612	Equal Variances
	Mod Levene Equality of Variance	0.8016	2.423	0.5939	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9345	0.9338	0.0523	Normal Distribution
	Anderson-Darling A2 Normality	0.6651	2.492	0.0827	Normal Distribution

Total Dry Weight-mg Summary

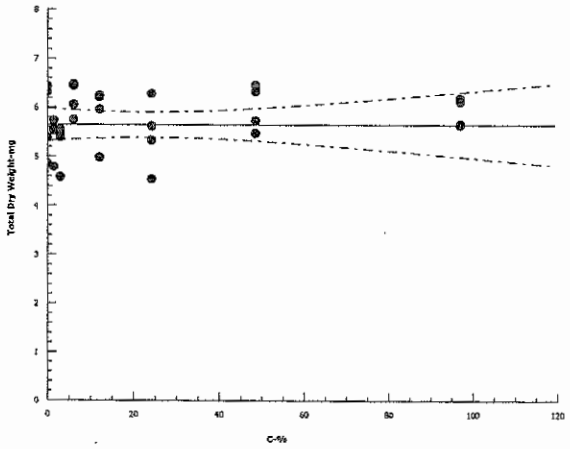
			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	5.745	4.85	6.44	0.3804	0.7608	13.24%	0.0%
1.5		4	5.397	4.79	5.73	0.2077	0.4155	7.7%	6.05%
3		4	5.245	4.58	5.55	0.2241	0.4481	8.54%	8.7%
6.1		4	6.18	5.75	6.47	0.171	0.342	5.54%	-7.57%
12.1		4	5.848	4.98	6.24	0.2959	0.5918	10.12%	-1.79%
24.2		4	5.443	4.54	6.28	0.3606	0.7211	13.25%	5.27%
48.5		4	5.995	5.47	6.45	0.2354	0.4709	7.85%	-4.35%
97		4	5.902	5.64	6.19	0.1465	0.2931	4.97%	-2.74%

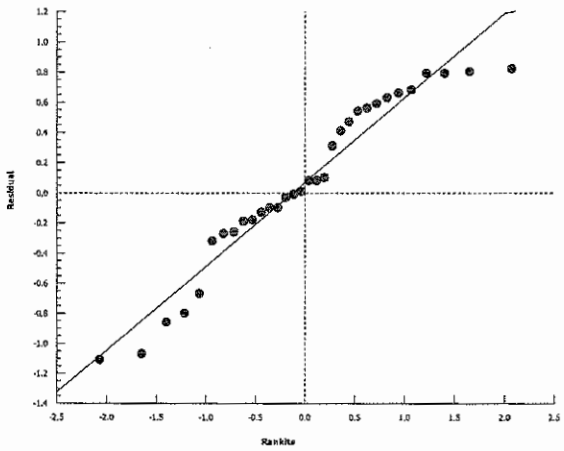
Analysis ID:	03-8201-6297	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 9:56	**Analysis:**	Nonlinear Regression	**Official Results:**	Yes

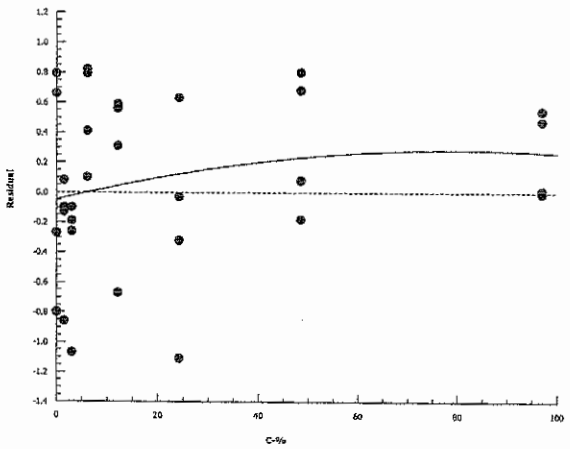
Total Dry Weight-mg Detail

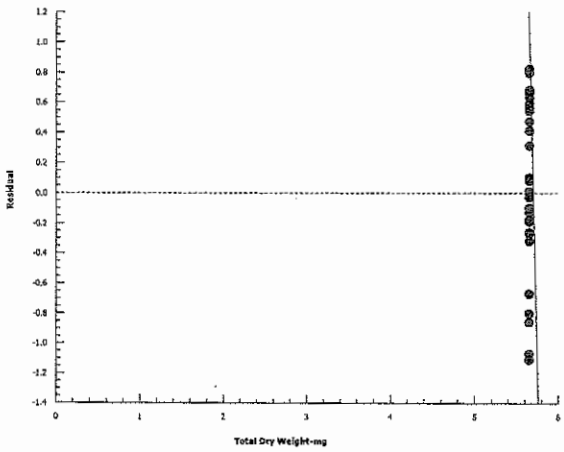
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	6.31	5.38	6.44	4.85
1.5		4.79	5.55	5.73	5.52
3		5.46	5.39	4.58	5.55
6.1		5.75	6.44	6.47	6.06
12.1		4.98	6.21	6.24	5.96
24.2		5.33	6.28	5.62	4.54
48.5		5.73	6.33	5.47	6.45
97		6.19	5.64	5.66	6.12

Graphics 2P Exponential EV [Y=A*exp(log(0.5)*X/D)]









CETIS Analytical Report

Test Code: 16482e | 08-2205-9823

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	07-4526-3672	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:00	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	07-3504-4440	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	9d
Sample ID:	07-5438-7274	**Code:**	2CF7094A	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:04	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	39h (8 °C)	**Station:**	LC FRDSDC WS 2016-04-26 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	16.2%	97	>97	NA	1.031

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	-0.9272	2.482	0.930	6	0.9878	CDF	Non-Significant Effect
		3	-1.334	2.482	0.930	6	0.9966	CDF	Non-Significant Effect
		6.1	1.161	2.482	0.930	6	0.4073	CDF	Non-Significant Effect
		12.1	0.2736	2.482	0.930	6	0.7936	CDF	Non-Significant Effect
		24.2	-0.8071	2.482	0.930	6	0.9826	CDF	Non-Significant Effect
		48.5	0.6671	2.482	0.930	6	0.6352	CDF	Non-Significant Effect
		97	0.4203	2.482	0.930	6	0.7396	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.976109	0.4251584	7	1.514	0.2101	Non-Significant Effect
Error	6.741494	0.2808956	24			
Total	9.717604		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.16	18.48	0.7612	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9424	0.9081	0.0878	Normal Distribution

Total Dry Weight-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	4	5.745	4.534	6.956	5.845	4.85	6.44	0.3804	13.24%	0.0%
1.5		4	5.397	4.736	6.059	5.535	4.79	5.73	0.2077	7.7%	6.05%
3		4	5.245	4.532	5.958	5.425	4.58	5.55	0.2241	8.54%	8.7%
6.1		4	6.18	5.636	6.724	6.25	5.75	6.47	0.171	5.54%	-7.57%
12.1		4	5.848	4.906	6.789	6.085	4.98	6.24	0.2959	10.12%	-1.79%
24.2		4	5.443	4.295	6.59	5.475	4.54	6.28	0.3606	13.25%	5.27%
48.5		4	5.995	5.246	6.744	6.03	5.47	6.45	0.2354	7.85%	-4.35%
97		4	5.902	5.436	6.369	5.89	5.64	6.19	0.1465	4.97%	-2.74%

Total Dry Weight-mg Detail

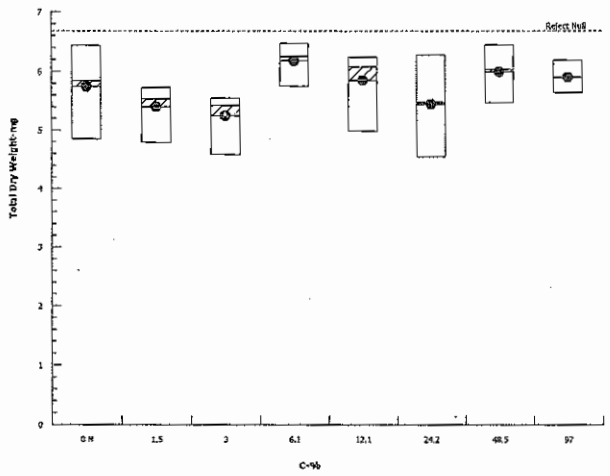
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	6.31	5.38	6.44	4.85
1.5		4.79	5.55	5.73	5.52
3		5.46	5.39	4.58	5.55
6.1		5.75	6.44	6.47	6.06
12.1		4.98	6.21	6.24	5.96
24.2		5.33	6.28	5.62	4.54
48.5		5.73	6.33	5.47	6.45
97		6.19	5.64	5.66	6.12

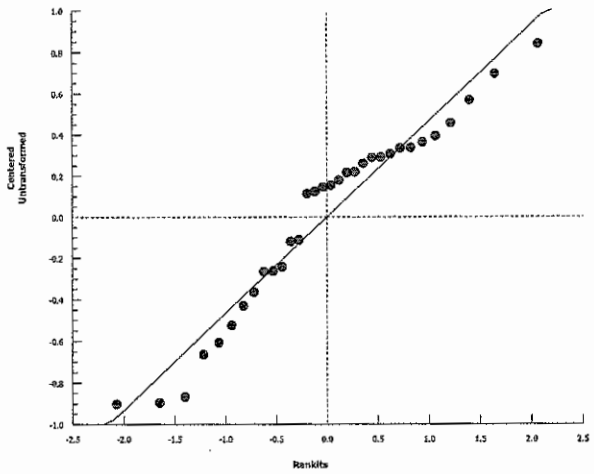
Analyst: JW QA: JGH May 24/16

Lemna Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	07-4526-3672	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:00	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Analyst: JN QA: JGe May 24/16

Lemna minor Summary Sheet

Client: Teck
Work Order No.: 16482

Start Date: April 29, 2016
Set up by: JW

Sample Information:

Sample ID: LC - OCDS - WS - 2016-04-26_N
Sample Date: April 27 /16
Date Received: April 28 /16
Sample Volume: 5 x 20L

Test Organism Information:

Culture Date: 042116
Age of culture (Day 0): 8 days
>8X growth in APHA?: Y (45 fronds)

KCl Reference Toxicant Results:

Reference Toxicant ID: Lm 132
Date Initiated: April 28/16

7-d No. of Fronds IC50 (95% CL): 4.2 (2.7 - 5.5) g/L KCl

7-d No. Fronds IC50 Reference Toxicant Mean (2 SD Range): 4.0 (3.2 - 5.0) g/L KCl CV (%): 12

		Number of Fronds	Dry Weight
Test Results:	IC25 %(v/v) (95% CL)	>97	>97
	IC50 %(v/v) (95% CL)	>97	>97

Reviewed by: JGh

Date reviewed: May 24/16

Plant Growth Inhibition Toxicity Test
Water Quality Measurements

Client : Teck | **Setup by:** JW

Sample ID: LC - DCDS - WS - 2016-04-26_N | **Test Date:** April 29 / 16

Work Order No.: 16482 | **Test Species:** *Lemna minor*

Culture Source: CPCC # 490

Test Culture Age: 8 days | **> 8X Growth? (Y/N):** Y (45 fronds)

Light Intensity Range: 4630 - 5440 lux | **Date Measured:** April 28 / 16

Day	0	1	2	3	4	5	6	7
Shelf Temp (°C)	24.5	25.0	25.0	24.5	25.0	25.0	25.0	25.0
Initials	JW	AD	AD	JW	MLT	JW	JW	JW

Sample Characteristics: Initial Water Quality

	Initial Water Quality		Adjusted Water Quality
Temperature (°C)	23.0	Aeration?: 20 min	23.0
DO (mg/L)	9.7	Nutrients added?[1]: Y →	8.1
pH	7.9		8.0
Conductivity (µS)	188		1003

[1] 10 mL of each APHA stock (A,B and C) added to 970 mL sample.

Concentration % (v/v)	Temperature (°C)		pH		Conductivity (µS)
	Day 0	Day 7	Day 0	Day 7	0 h
Control	23.0	25.5	8.2	8.5	912
1.5	23.0	25.5	8.1	8.8	913
3.0	23.0	25.5	8.1	8.9	917
6.1	23.0	25.5	8.1	8.9	921
12.1	23.0	25.5	8.1	8.9	927
24.2	23.0	25.5	8.1	8.8	941
48.5	23.0	25.5	8.1	9.0	966
97	23.0	25.5	8.0	9.1	1003
Initials	JW	JW	JW	JW	JW

Thermometer: #6 **Cond. Meter:** C-3 **pH meter:** PH-3 **Light meter:** Lit-1

Sample Description: clear, colorless, colourless, some debris present.

Comments:

Reviewed: JGu **Date Reviewed:** May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC_DCDS_WS_2016-04-26_N
Work Order #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Test set up by: JW

Concentration %/o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
control	A	6	86										JW
	B	6	87										
	C	6	80										
	D	6	65										
1.5	A	6	76										
	B	6	79										
	C	6	75										
	D	6	77										
3.0	A	6	101		X								
	B	6	108		X								
	C	6	83		X								
	D	6	80		X								
6.1	A	6	89		X								
	B	6	111		X								
	C	6	52			X						Plants have 2 fronds	
	D	6	80									^most	
12.1	A	6	73										
	B	6	93		X	X							
	C	6	83										
	D	6	69			X							
24.2	A	6	98										
	B	6	112										
	C	6	77										
	D	6	88										↓

Comments:

Reviewed by: JW

Date Reviewed: May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC_DCDS_WS_2016-04-26_N
Work Order #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Test set up by: JW

Concentration %/o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
48.5	A	6	86										JW
	B	6	103										
	C	6	82										
	D	6	86										
97	A	6	93										
	B	6	96										
	C	6	85										
	D	6	86										↓
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												

Comments:

Reviewed by: JGu

Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC_DCDS_WS_2016-04-26_N
WO #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		DCDS Purple			
Control	A	1	1010.04	1017.90	JW / JW
	B	2	988.80	995.93	
	C	3	1012.04	1019.06	
	D	4	1012.72	1017.87	
1.5	A	5	1002.33	JW ~~1016.22~~ 1009.20	
	B	6	1009.95	↓ ~~1009.20~~ 1016.22	
	C	7	1006.23	1011.65	
	D	8	1014.92	1021.50	
3.0	A	9	1005.57	1014.17	
	B	10	998.02	1008.19	
	C	11	1005.98	1013.24	
	D	12	1005.30	1013.28	
6.1	A	13	1005.17	1013.24	
	B	14	1005.53	1015.16	
	C	15	1003.50	1006.90	
	D	16	983.30	990.57	
12.1	A	17	1008.91	1014.94	
	B	18	1021.19	1029.56	
	C	19	1012.85	1019.71	
	D	20	1026.19	1031.72	
24.2	A	21	1007.22	1015.11	
	B	22	1032.42	1041.39	
	C	23	1025.09	1031.43	
	D	24	1013.02	1020.37	
48.5	A	25	1009.25	1016.30	
	B	26	1005.26	1013.89	
	C	27	999.64	1006.10	
	D	28	997.52	1004.67	↓

Comments: 10% Re-weigh : # 1. 1017.83 # 25. 1016.13
15. 1006.83 # 32. 965.36

Reviewed by: JGh Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC_DCDS_WS_2016-04-26_N
WO #: 16482

Start Date: April 29 / 16
Termination Date: May 6 / 16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		DCDS Purple			
	A	29	992.64	1000.87	JW / JW
97	B	30	979.34	987.99 JW	↓
	C	31	1000.27	1007.60	↓
	D	32	957.70	965.63	↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Comments:

Reviewed by: JGa

Date Reviewed: May 24/16

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	18-3890-5306	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:36	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	13-8345-2068	**Code:**	5275CDA4	**Client:**	Teck Coal
Sample Date:	27 Apr-16 07:58	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	40h (6 °C)	**Station:**	LC DCDS WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1757853	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>97	N/A	N/A	<1.031	NA	NA
IC10	>97	N/A	N/A	<1.031	NA	NA
IC15	>97	N/A	N/A	<1.031	NA	NA
IC20	>97	N/A	N/A	<1.031	NA	NA
IC25	>97	N/A	N/A	<1.031	NA	NA
IC40	>97	N/A	N/A	<1.031	NA	NA
IC50	>97	N/A	N/A	<1.031	NA	NA

Frond Count Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	73.5	59	81	5.074	10.15	13.81%	0.0%
1.5		4	70.75	69	73	0.8539	1.708	2.41%	3.74%
3		4	87	74	102	6.819	13.64	15.68%	-18.37%
6.1		4	77	46	105	12.21	24.43	31.72%	-4.76%
12.1		4	73.5	63	87	5.377	10.75	14.63%	0.0%
24.2		4	87.75	71	106	7.443	14.89	16.96%	-19.39%
48.5		4	83.25	76	97	4.679	9.359	11.24%	-13.27%
97		4	84	79	90	2.677	5.354	6.37%	-14.29%

Frond Count Detail

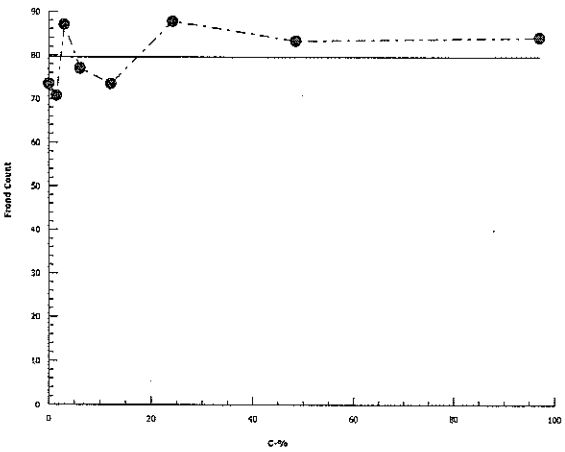
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	80	81	74	59
1.5		70	73	69	71
3		95	102	77	74
6.1		83	105	46	74
12.1		67	87	77	63
24.2		92	106	71	82
48.5		80	97	76	80
97		87	90	79	80

Analyst: JW QA: JGa May 24/16

Lemna Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	18-3890-5306	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:36	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Analyst: JW QA: JGu May 24/1

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	10-0174-0340	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:36	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	13-8345-2068	**Code:**	5275CDA4	**Client:**	Teck Coal
Sample Date:	27 Apr-16 07:58	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	40h (6 °C)	**Station:**	LC DCDS WS 2016-04-26 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	30.9%	97	>97	NA	1.031

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	-0.3003	2.482	22.73	6	0.9348	CDF	Non-Significant Effect
		3	1.474	2.482	22.73	6	0.2776	CDF	Non-Significant Effect
		6.1	0.3822	2.482	22.73	6	0.7543	CDF	Non-Significant Effect
		12.1	0	2.482	22.73	6	0.8750	CDF	Non-Significant Effect
		24.2	1.556	2.482	22.73	6	0.2479	CDF	Non-Significant Effect
		48.5	1.065	2.482	22.73	6	0.4510	CDF	Non-Significant Effect
		97	1.146	2.482	22.73	6	0.4137	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1253.469	179.067	7	1.067	0.4136	Non-Significant Effect
Error	4026.25	167.7604	24			
Total	5279.719		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	15.14	18.48	0.0342	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9827	0.9081	0.8742	Normal Distribution

Frond Count Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	4	73.5	57.35	89.65	77	59	81	5.074	13.81%	0.0%
1.5		4	70.75	68.03	73.47	70.5	69	73	0.8539	2.41%	3.74%
3		4	87	65.3	108.7	86	74	102	6.819	15.68%	-18.37%
6.1		4	77	38.13	115.9	78.5	46	105	12.21	31.72%	-4.76%
12.1		4	73.5	56.39	90.61	72	63	87	5.377	14.63%	0.0%
24.2		4	87.75	64.06	111.4	87	71	106	7.443	16.96%	-19.39%
48.5		4	83.25	68.36	98.14	80	76	97	4.679	11.24%	-13.27%
97		4	84	75.48	92.52	83.5	79	90	2.677	6.37%	-14.29%

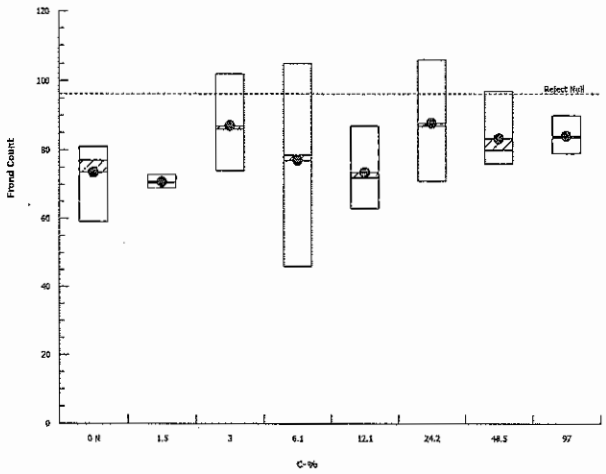
Frond Count Detail

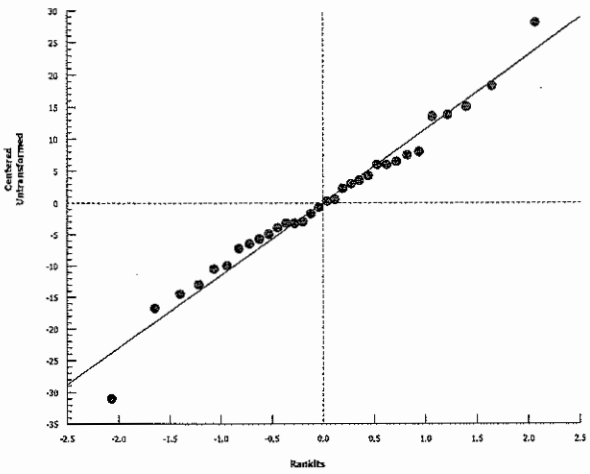
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	80	81	74	59
1.5		70	73	69	71
3		95	102	77	74
6.1		83	105	46	74
12.1		67	87	77	63
24.2		92	106	71	82
48.5		80	97	76	80
97		87	90	79	80

Lemna Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	10-0174-0340	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:36	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	02-8685-7462	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:43	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	13-8345-2068	**Code:**	5275CDA4	**Client:**	Teck Coal
Sample Date:	27 Apr-16 07:58	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	40h (6 °C)	**Station:**	LC DCDS WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1098212	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>97	N/A	N/A	<1.031	NA	NA
IC10	>97	N/A	N/A	<1.031	NA	NA
IC15	>97	N/A	N/A	<1.031	NA	NA
IC20	>97	N/A	N/A	<1.031	NA	NA
IC25	>97	N/A	N/A	<1.031	NA	NA
IC40	>97	N/A	N/A	<1.031	NA	NA
IC50	>97	N/A	N/A	<1.031	NA	NA

Total Dry Weight-mg Summary

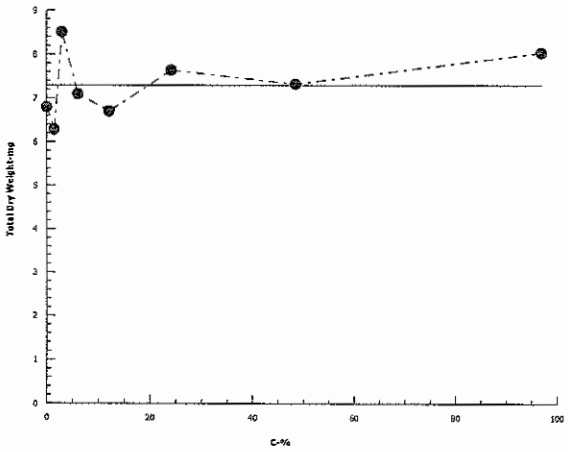
			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	6.79	5.15	7.86	0.5776	1.155	17.01%	0.0%
1.5		4	6.285	5.42	6.87	0.3133	0.6265	9.97%	7.44%
3		4	8.503	7.26	10.17	0.6196	1.239	14.57%	-25.22%
6.1		4	7.092	3.4	9.63	1.325	2.65	37.36%	-4.46%
12.1		4	6.698	5.53	8.37	0.6213	1.243	18.55%	1.36%
24.2		4	7.638	6.34	8.97	0.5481	1.096	14.35%	-12.48%
48.5		4	7.322	6.46	8.63	0.4617	0.9233	12.61%	-7.84%
97		4	8.035	7.33	8.65	0.2775	0.5551	6.91%	-18.33%

Total Dry Weight-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	7.86	7.13	7.02	5.15
1.5		6.87	6.27	5.42	6.58
3		8.6	10.17	7.26	7.98
6.1		8.07	9.63	3.4	7.27
12.1		6.03	8.37	6.86	5.53
24.2		7.89	8.97	6.34	7.35
48.5		7.05	8.63	6.46	7.15
97		8.23	8.65	7.33	7.93

Analysis ID:	02-8685-7462	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:43	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	06-0366-2053	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:42	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	13-8345-2068	**Code:**	5275CDA4	**Client:**	Teck Coal
Sample Date:	27 Apr-16 07:58	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	40h (6 °C)	**Station:**	LC DCDS WS 2016-04-26 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	34.4%	97	>97	NA	1.031

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	-0.5363	2.482	2.337	6	0.9636	CDF	Non-Significant Effect
		3	1.818	2.482	2.337	6	0.1668	CDF	Non-Significant Effect
		6.1	0.3212	2.482	2.337	6	0.7768	CDF	Non-Significant Effect
		12.1	-0.09821	2.482	2.337	6	0.8978	CDF	Non-Significant Effect
		24.2	0.9	2.482	2.337	6	0.5277	CDF	Non-Significant Effect
		48.5	0.5654	2.482	2.337	6	0.6799	CDF	Non-Significant Effect
		97	1.322	2.482	2.337	6	0.3376	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	15.187	2.169571	7	1.223	0.3287	Non-Significant Effect
Error	42.56688	1.77362	24			
Total	57.75388		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	9.525	18.48	0.2171	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9569	0.9081	0.2252	Normal Distribution

Total Dry Weight-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	4	6.79	4.952	8.628	7.075	5.15	7.86	0.5776	17.01%	0.0%
1.5		4	6.285	5.288	7.282	6.425	5.42	6.87	0.3133	9.97%	7.44%
3		4	8.503	6.531	10.47	8.29	7.26	10.17	0.6196	14.57%	-25.22%
6.1		4	7.092	2.877	11.31	7.67	3.4	9.63	1.325	37.36%	-4.46%
12.1		4	6.698	4.72	8.675	6.445	5.53	8.37	0.6213	18.55%	1.36%
24.2		4	7.638	5.893	9.382	7.62	6.34	8.97	0.5481	14.35%	-12.48%
48.5		4	7.322	5.853	8.792	7.1	6.46	8.63	0.4617	12.61%	-7.84%
97		4	8.035	7.152	8.918	8.08	7.33	8.65	0.2775	6.91%	-18.33%

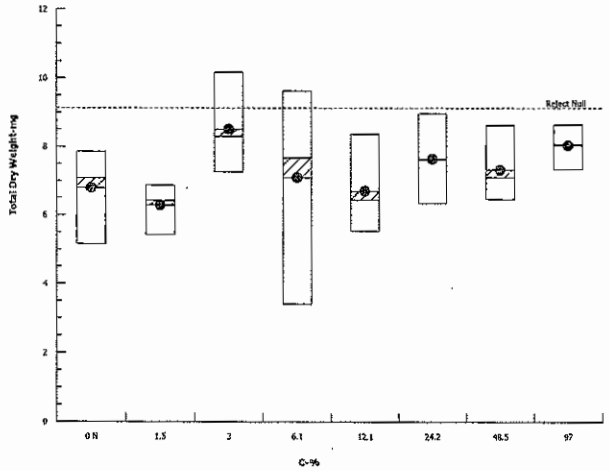
Total Dry Weight-mg Detail

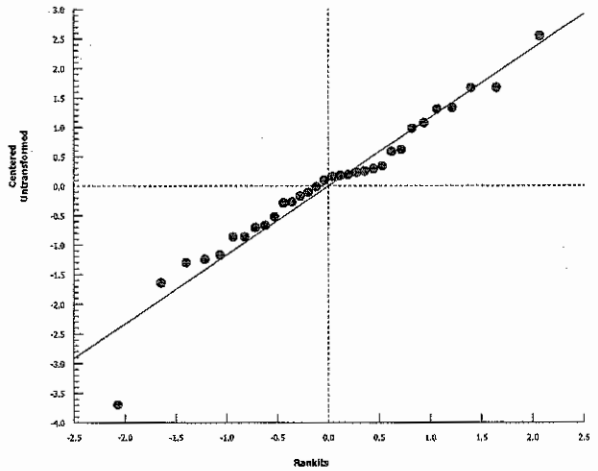
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	7.86	7.13	7.02	5.15
1.5		6.87	6.27	5.42	6.58
3		8.6	10.17	7.26	7.98
6.1		8.07	9.63	3.4	7.27
12.1		6.03	8.37	6.86	5.53
24.2		7.89	8.97	6.34	7.35
48.5		7.05	8.63	6.46	7.15
97		8.23	8.65	7.33	7.93

Lemna Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	06-0366-2053	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:42	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





 Analyst: JW QA: JGa 5/4/16

Lemna minor Summary Sheet

Client: Teck
Work Order No.: 16482

Start Date: April 28, 2016
Set up by: JN

Sample Information:

Sample ID: LC-LC5-WS-2016-04-25-N
Sample Date: April 27/16
Date Received: April 28/16
Sample Volume: 5 x 20L

Test Organism Information:

Culture Date: 042016
Age of culture (Day 0): 8 days
>8X growth in APHA?: Y (45 fronds)

KCl Reference Toxicant Results:

Reference Toxicant ID: Lm 132
Date Initiated: April 28/16

7-d No. of Fronds IC50 (95% CL): 4.2 (2.7 - 5.5) g/L KCl

7-d No. Fronds IC50 Reference Toxicant Mean (2 SD Range): 4.0 (3.2 - 5.0) g/L KCl CV (%): 12

Test Results:		Number of Fronds	Dry Weight
	IC25 %(v/v) (95% CL)	>97	>97
	IC50 %(v/v) (95% CL)	>97	>97

Reviewed by: JGL
Date reviewed: May 24/16

Plant Growth Inhibition Toxicity Test
Water Quality Measurements

Client : Teck - LCO
Setup by: JW
Sample ID: LC - LC5 _WS - 2016-04-25 _N
Test Date: April 28 , 2016
Work Order No.: 16482
Test Species: *Lemna minor*
Culture Source: CPCC # 490
Test Culture Age: 8 days
> 8X Growth? (Y/N): Y (45 fronds)
Light Intensity Range: 4300 - 4900 lux
Date Measured: April 28 , 2016

Day	0	1	2	3	4	5	6	7
Shelf Temp (°C)	24.0	24.5	25.0	25.0	24.5	25.0	25.0	25.0
Initials	JW	JW	AS	AS	JW	MLT	JW	JW

Sample Characteristics:	Initial Water Quality		Adjusted Water Quality
Temperature (°C)	25.5	Aeration?: 20 min	25.5
DO (mg/L)	9.8	Nutrients added?[1]: Y →	8.5
pH	8.2		8.0
Conductivity (µS)	540		1316

[1] 10 mL of each APHA stock (A,B and C) added to 970 mL sample.

Concentration % (v/v)	Temperature (°C)		pH		Conductivity (µS)
	Day 0	Day 7	Day 0	Day 7	0 h
Control	23.0	25.0	8.2	8.3	863
1.5	23.5	25.0	7.9	8.3	874
3.0	23.5	25.0	8.0	8.3	886
6.1	24.0	25.0	8.0	8.3	901
12.1	24.0	25.0	8.0	8.4	929
24.2	24.5	25.0	8.0	8.7	985
48.5	25.0	25.0	8.0	8.7	1097
97	25.5	25.0	8.0	9.1	1316
Initials	JW	JW	JW	KL	JW

Thermometer: #6 **Cond. Meter:** C-2 **pH meter:** pH-1 **Light meter:** Lt-1

Sample Description: clear, colorless, odourless, some debris present.

Comments: ~~light meter - Lt-1~~ JW

Reviewed: JGL **Date Reviewed:** May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC_LCS_WS_2016-04-25_N
Work Order #: 16482

Start Date: April 28 /16
Termination Date: May 5 /16
Test set up by: JW

Concentration %/o (V/V)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
control	A	6	97										JW
	B	6	75										
	C	6	104										
	D	6	86										
1.5	A	6	83										
	B	6	86										
	C	6	73										
	D	6	96										
3.0	A	6	84										
	B	6	90										
	C	6	74										
	D	6	91										
6.1	A	6	86										
	B	6	74										
	C	6	61										
	D	6	96										
12.1	A	6	83										
	B	6	95										
	C	6	89										
	D	6	89										
24.2	A	6	109										
	B	6	90										
	C	6	105										
	D	6	98										

Comments:

Reviewed by: JW

Date Reviewed: May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC-LCS-WS-2016-04-25-N
Work Order #: 16482

Start Date: April 28 /16
Termination Date: May 5 /16
Test set up by: JW

Concentration % (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
48.5	A	6	92										JW
	B	6	89										↓
	C	6	101										
	D	6	104										
97	A	6	86										
	B	6	88										
	C	6	98										
	D	6	93										✓
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												

Comments:

Reviewed by: JGe

Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC_LCS_WS_2016-04-25_N
WO #: 16482

Start Date: April 28 /16
Termination Date: May 5 /16
Balance ID: Bal - 1

Concentration	Rep	Pan No	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		LCS Block			
Control	A	1	1003.18	1010.51	JW / JW
	B	2	1004.85	1010.00	
	C	3	1013.14	1020.48	
	D	4	1001.80	1007.84	
1.5	A	5	1006.01	1011.83	
	B	6	1011.66	1017.44	
	C	7	1025.50	1030.87	
	D	8	1008.06	1015.53	
3.0	A	9	1012.16	1017.89	
	B	10	1008.64	1014.55	
	C	11	995.30	1000.70	
	D	12	1010.34	1016.62	
6.1	A	13	1021.80	1028.20	
	B	14	999.93	1005.23	
	C	15	999.19	1003.59	
	D	16	1025.51	1032.73	
12.1	A	17	991.46	997.20	
	B	18	999.89	1006.43	
	C	19	1005.76	1012.47	
	D	20	1008.42	1014.86	
24.2	A	21	993.70	1001.56	
	B	22	1006.24	1012.59	
	C	23	1004.14	1012.07	
	D	24	988.51	995.86	
48.5	A	25	989.43	995.97	
	B	26	1008.31	1014.57	
	C	27	1011.04	1018.73	
	D	28	1007.53	1018.56 JW	↓

Comments: 10% Re-weigh : #5 · 1011.77 #26 · 1014.46
#18 · 1006.33 #31 · 1027.92

Reviewed by: JGa Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC-LC5-WS-2016-04-25-N
WO #: 16482

Start Date: April 28 / 16
Termination Date: May 5 / 16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		LC5 Blank			
	A	29	1021.00	1027.02	JW / JW
	B	30	1031.58	1038.18	
97	C	31	1021.43	1028.04	
	D	32	1015.14	1022.48	↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Comments:

Reviewed by: JBL

Date Reviewed: May 24/16

CETIS Analytical Report

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	15-2796-5911	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 7:50	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	20-1540-1191	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	28 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	05 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	18-5443-1080	**Code:**	6E885F68	**Client:**	Teck Coal
Sample Date:	27 Apr-16 06:50	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	17h (6.6 °C)	**Station:**	LC_LC5_WS_2016-04-25_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	503842	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>97	N/A	N/A	<1.031	NA	NA
IC10	>97	N/A	N/A	<1.031	NA	NA
IC15	>97	N/A	N/A	<1.031	NA	NA
IC20	>97	N/A	N/A	<1.031	NA	NA
IC25	>97	N/A	N/A	<1.031	NA	NA
IC40	>97	N/A	N/A	<1.031	NA	NA
IC50	>97	N/A	N/A	<1.031	NA	NA

Frond Count Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	84.5	69	98	6.357	12.71	15.05%	0.0%
1.5		4	78.5	67	90	4.735	9.469	12.06%	7.1%
3		4	78.75	68	85	3.902	7.805	9.91%	6.81%
6.1		4	73.25	55	90	7.565	15.13	20.66%	13.31%
12.1		4	83	77	89	2.449	4.899	5.9%	1.78%
24.2		4	94.5	84	103	4.173	8.347	8.83%	-11.83%
48.5		4	90.5	83	98	3.571	7.141	7.89%	-7.1%
97		4	85.25	80	92	2.689	5.377	6.31%	-0.89%

Frond Count Detail

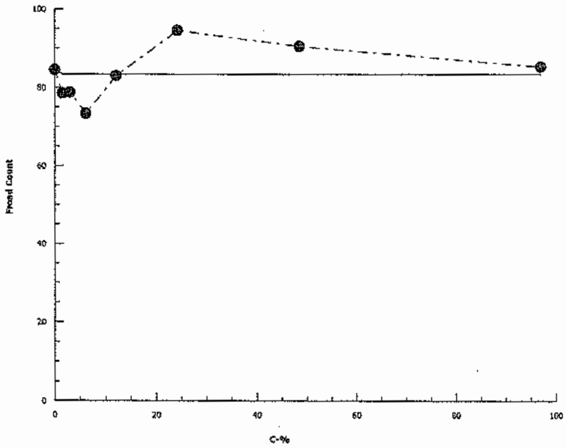
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	91	69	98	80
1.5		77	80	67	90
3		78	84	68	85
6.1		80	68	55	90
12.1		77	89	83	83
24.2		103	84	99	92
48.5		86	83	95	98
97		80	82	92	87

Analyst: JW QA: JGe May 24/16

Lemna Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	15-2796-5911	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 7:50	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	14-0861-2047	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 7:51	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	20-1540-1191	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	28 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	05 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	18-5443-1080	**Code:**	6E885F68	**Client:**	Teck Coal
Sample Date:	27 Apr-16 06:50	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	17h (6.6 °C)	**Station:**	LC_LC5_WS_2016-04-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	19.6%	97	>97	NA	1.031

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	-0.8977	2.482	16.59	6	0.9867	CDF	Non-Significant Effect
		3	-0.8603	2.482	16.59	6	0.9851	CDF	Non-Significant Effect
		6.1	-1.683	2.482	16.59	6	0.9990	CDF	Non-Significant Effect
		12.1	-0.2244	2.482	16.59	6	0.9224	CDF	Non-Significant Effect
		24.2	1.496	2.482	16.59	6	0.2694	CDF	Non-Significant Effect
		48.5	0.8977	2.482	16.59	6	0.5287	CDF	Non-Significant Effect
		97	0.1122	2.482	16.59	6	0.8448	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1307.719	186.817	7	2.091	0.0842	Non-Significant Effect
Error	2144.25	89.34375	24			
Total	3451.969		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	5.593	18.48	0.5880	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9845	0.9081	0.9137	Normal Distribution

Frond Count Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	4	84.5	64.27	104.7	85.5	69	98	6.357	15.05%	0.0%
1.5		4	78.5	63.43	93.57	78.5	67	90	4.735	12.06%	7.1%
3		4	78.75	66.33	91.17	81	68	85	3.902	9.91%	6.81%
6.1		4	73.25	49.17	97.33	74	55	90	7.565	20.66%	13.31%
12.1		4	83	75.2	90.8	83	77	89	2.449	5.9%	1.78%
24.2		4	94.5	81.22	107.8	95.5	84	103	4.173	8.83%	-11.83%
48.5		4	90.5	79.14	101.9	90.5	83	98	3.571	7.89%	-7.1%
97		4	85.25	76.69	93.81	84.5	80	92	2.689	6.31%	-0.89%

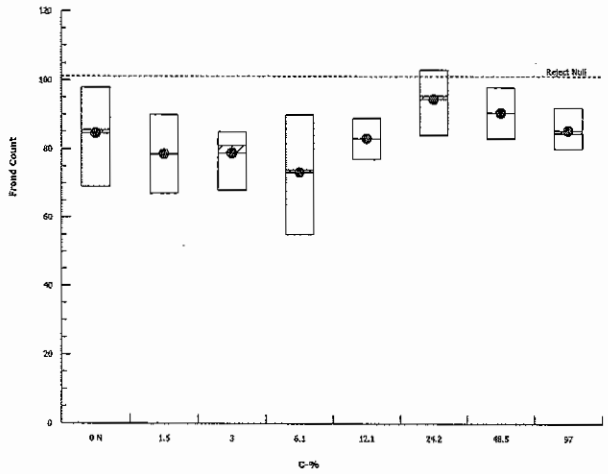
Frond Count Detail

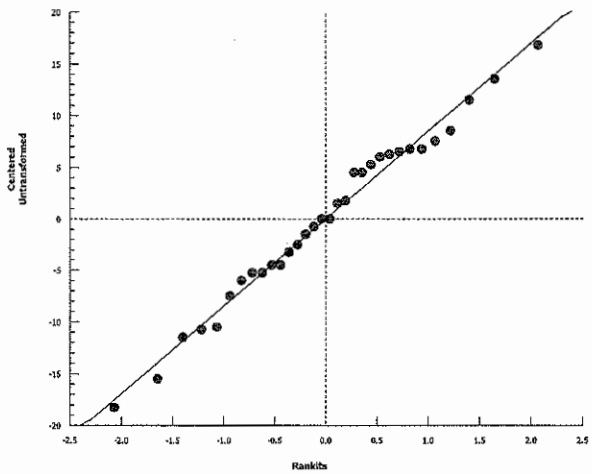
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	91	69	98	80
1.5		77	80	67	90
3		78	84	68	85
6.1		80	68	55	90
12.1		77	89	83	83
24.2		103	84	99	92
48.5		86	83	95	98
97		80	82	92	87

Lemna Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	14-0861-2047	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 7:51	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	13-7202-5483	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 7:56	**Analysis:**	Nonlinear Regression	**Official Results:**	Yes
Batch ID:	20-1540-1191	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	28 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	05 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	18-5443-1080	**Code:**	6E885F68	**Client:**	Teck Coal
Sample Date:	27 Apr-16 06:50	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	17h (6.6 °C)	**Station:**	LC_LC5_WS_2016-04-25_N		

Non-Linear Regression Options

Model Function	X Transform	Y Transform	Weighting Function	PTBS Function
2P Exponential EV [Y=A*exp(log(0.5)*X/D)]	None	None	Normal [W=1]	Off [Y*=Y]

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
6	-11.25	26.91	29.43		Yes	2.259	2.508	0.0719	Non-Significant Lack of Fit

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	9439000	N/A	N/A	0.0000105	NA	NA
IC10	19390000	N/A	N/A	0.0000051	NA	NA
IC15	29910000	N/A	N/A	0.0000033	NA	NA
IC20	41060000	N/A	N/A	0.0000024	NA	NA
IC25	52940000	N/A	N/A	0.0000018	NA	NA
IC40	94000000	N/A	N/A	0.0000010	NA	NA
IC50	12760000	N/A	N/A	0.0000007	NA	NA

JW

>97 % (V/V)

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
A	6.286	0.1981	5.897	6.674	31.73	<0.0001	Significant Parameter
D	1.28E+08	1.87E+13	-3.7E+13	3.66E+13	6.83E-06	1.0000	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	0	0	1	0	1.0000	Non-Significant
Lack of Fit	8.580897	1.430149	6	2.259	0.0719	Non-Significant
Pure Error	15.19562	0.633151	24			
Residual	23.77652	0.792551	30			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance	6.51	14.07	0.4816	Equal Variances
	Mod Levene Equality of Variance	1.35	2.423	0.2710	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9762	0.9338	0.6837	Normal Distribution
	Anderson-Darling A2 Normality	0.2948	2.492	0.6275	Normal Distribution

Total Dry Weight-mg Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	6.465	5.15	7.34	0.5341	1.068	16.52%	0.0%
1.5		4	6.11	5.37	7.47	0.4646	0.9292	15.21%	5.49%
3		4	5.83	5.4	6.28	0.1834	0.3668	6.29%	9.82%
6.1		4	5.83	4.4	7.22	0.618	1.236	21.2%	9.82%
12.1		4	6.357	5.74	6.71	0.2132	0.4265	6.71%	1.66%
24.2		4	7.372	6.35	7.93	0.3645	0.729	9.89%	-14.04%
48.5		4	6.88	6.26	7.69	0.3134	0.6268	9.11%	-6.42%
97		4	6.643	6.02	7.34	0.2703	0.5406	8.14%	-2.75%

Analyst: JW QA: JGL May 24/16

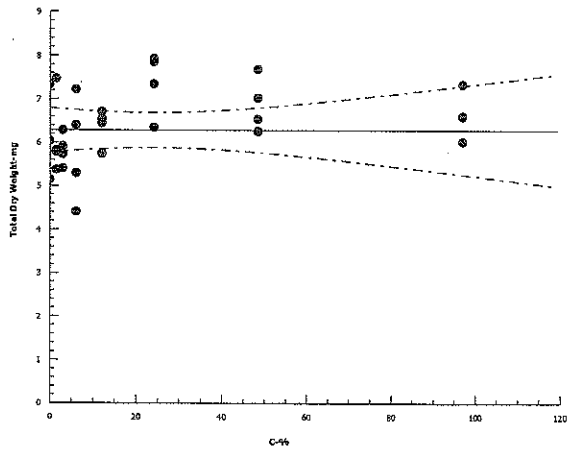
Lemna Growth Inhibition Test | **Nautilus Environmental**

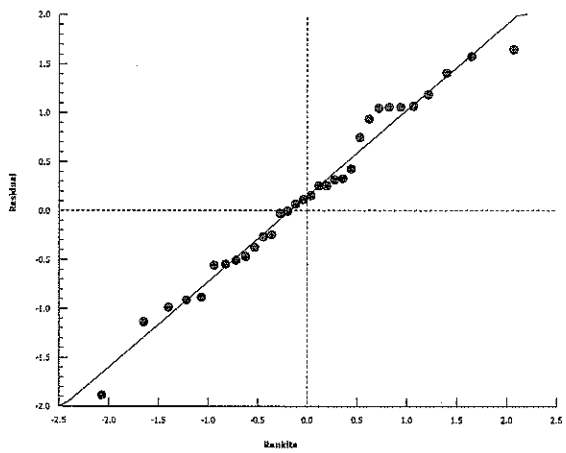
Analysis ID:	13-7202-5483	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 7:56	**Analysis:**	Nonlinear Regression	**Official Results:**	Yes

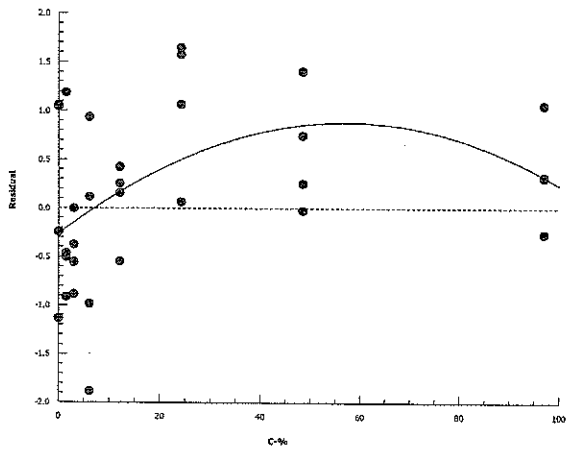
Total Dry Weight-mg Detail

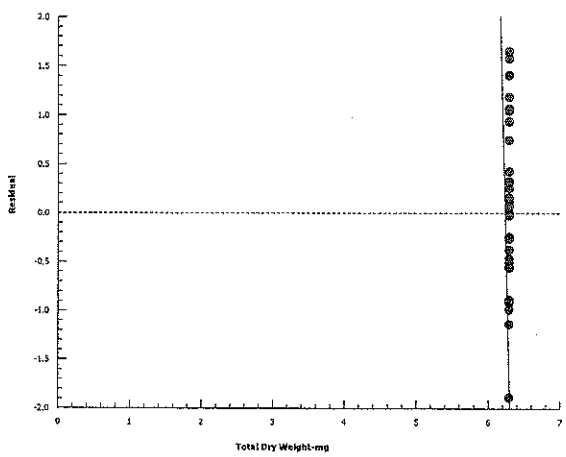
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	7.33	5.15	7.34	6.04
1.5		5.82	5.78	5.37	7.47
3		5.73	5.91	5.4	6.28
6.1		6.4	5.3	4.4	7.22
12.1		5.74	6.54	6.71	6.44
24.2		7.86	6.35	7.93	7.35
48.5		6.54	6.26	7.69	7.03
97		6.02	6.6	6.61	7.34

Graphics 2P Exponential EV [Y=A*exp(log(0.5)*X/D)]









Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	00-8348-1882	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 7:58	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	20-1540-1191	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	28 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	05 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	18-5443-1080	**Code:**	6E885F68	**Client:**	Teck Coal
Sample Date:	27 Apr-16 06:50	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	17h (6.6 °C)	**Station:**	LC_LC5_WS_2016-04-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	21.6%	97	>97	NA	1.031

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	-0.6309	2.482	1.396	6	0.9716	CDF	Non-Significant Effect
		3	-1.129	2.482	1.396	6	0.9934	CDF	Non-Significant Effect
		6.1	-1.129	2.482	1.396	6	0.9934	CDF	Non-Significant Effect
		12.1	-0.1911	2.482	1.396	6	0.9164	CDF	Non-Significant Effect
		24.2	1.613	2.482	1.396	6	0.2285	CDF	Non-Significant Effect
		48.5	0.7375	2.482	1.396	6	0.6032	CDF	Non-Significant Effect
		97	0.3155	2.482	1.396	6	0.7789	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	7.858274	1.12261	7	1.773	0.1395	Non-Significant Effect
Error	15.19562	0.6331508	24			
Total	23.05389		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	6.51	18.48	0.4816	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9848	0.9081	0.9206	Normal Distribution

Total Dry Weight-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	4	6.465	4.765	8.165	6.685	5.15	7.34	0.5341	16.52%	0.0%
1.5		4	6.11	4.631	7.589	5.8	5.37	7.47	0.4646	15.21%	5.49%
3		4	5.83	5.246	6.414	5.82	5.4	6.28	0.1834	6.29%	9.82%
6.1		4	5.83	3.863	7.797	5.85	4.4	7.22	0.618	21.2%	9.82%
12.1		4	6.357	5.679	7.036	6.49	5.74	6.71	0.2132	6.71%	1.66%
24.2		4	7.372	6.212	8.533	7.605	6.35	7.93	0.3645	9.89%	-14.04%
48.5		4	6.88	5.883	7.877	6.785	6.26	7.69	0.3134	9.11%	-6.42%
97		4	6.643	5.782	7.503	6.605	6.02	7.34	0.2703	8.14%	-2.75%

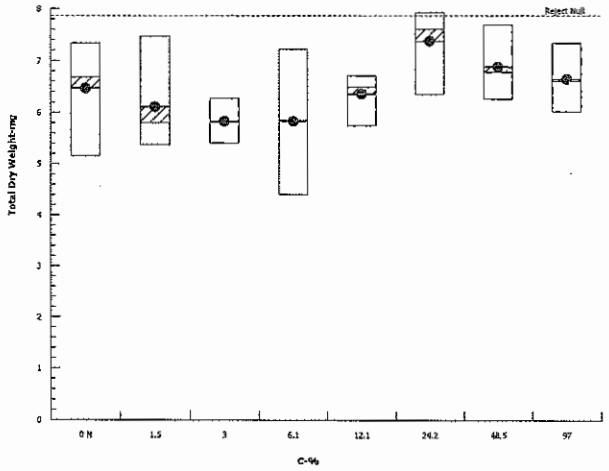
Total Dry Weight-mg Detail

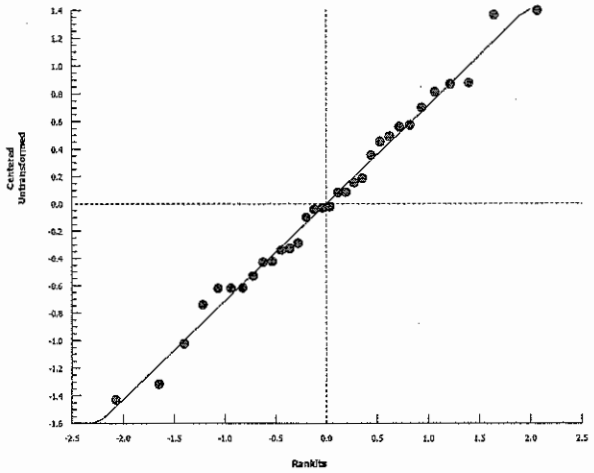
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	7.33	5.15	7.34	6.04
1.5		5.82	5.78	5.37	7.47
3		5.73	5.91	5.4	6.28
6.1		6.4	5.3	4.4	7.22
12.1		5.74	6.54	6.71	6.44
24.2		7.86	6.35	7.93	7.35
48.5		6.54	6.26	7.69	7.03
97		6.02	6.6	6.61	7.34

Lemna Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	00-8348-1882	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 7:58	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Analyst: JW QA: JGL May 24/16

Lemna minor Summary Sheet

Client: Teck
Work Order No.: 16482

Start Date: April 29 , 2016
Set up by: JW

Sample Information:

Sample ID: LC-WTF-OUT-WS-20160427-N
Sample Date: April 27 /16
Date Received: April 28 /16
Sample Volume: 5 x 20L

Test Organism Information:

Culture Date: 042116
Age of culture (Day 0): 8 days
>8X growth in APHA?: Y (45 fronds)

KCl Reference Toxicant Results:

Reference Toxicant ID: Lm 132
Date Initiated: April 28/16

7-d No. of Fronds IC50 (95% CL): 4.2 (2.7 - 5.5) g/L KCl

7-d No. Fronds IC50 Reference Toxicant Mean (2 SD Range): 4.0 (3.2 - 5.0) g/L KCl CV (%): 12

		Number of Fronds	Dry Weight
Test Results:	IC25 %(v/v) (95% CL)	>97	>97
	IC50 %(v/v) (95% CL)	>97	>97

Reviewed by: JOL

Date reviewed: May 25/16

JW

Plant Growth Inhibition Toxicity Test
Water Quality Measurements

Client : Teck **Setup by:** JW

Sample ID: LC - WTF_OUT_WS_20160427_N **Test Date:** April 29 / 16

Work Order No.: 16482 **Test Species:** *Lemna minor*

Culture Source: CPCC#490

Test Culture Age: 8 days **> 8X Growth? (Y/N):** Y (45 fronds)

Light Intensity Range: 4630 - 5440 lux **Date Measured:** April 28 / 16

Day	0	1	2	3	4	5	6	7
Shelf Temp (°C)	24.5	25.0	25.0	24.5	25.0	25.0	25.0	25.0
Initials	JW	A	A	JW	MLT	JW	JW	JW

Sample Characteristics: Initial Water Quality

	Initial Water Quality		Adjusted Water Quality
Temperature (°C)	23.0	Aeration?: 20 min	23.0
DO (mg/L)	7.8	Nutrients added?[1]: Y →	8.0
pH	7.5		7.8
Conductivity (µS)	2000		JW ~~2669~~ 2660

[1] 10 mL of each APHA stock (A,B and C) added to 970 mL sample.

Concentration % (v/v)	Temperature (°C)		pH		Conductivity (µS)
	Day 0	Day 7	Day 0	Day 7	0 h
Control	23.0	24.5	8.2	8.5	912
1.5	23.0	24.5	8.2	8.6	946
3.0	23.0	24.5	8.1	8.5	985
6.1	23.0	24.5	8.1	8.7	1052
12.1	23.0	24.5	8.1	8.8	1182
24.2	23.0	24.5	8.1	8.7	1425
48.5	23.0	24.5	8.0	8.7	1906
97	23.0	24.5	JW ~~8.7~~ 7.8	8.7	2660
Initials	JW	JW	JW	JW	JW

Thermometer: #6 **Cond. Meter:** C-3 **pH meter:** pH-3 **Light meter:** Lit - 1

Sample Description: clear, colourless, hydrocarbon odour, brown debris present.

Comments:

Reviewed: JGh **Date Reviewed:** May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC-WTF-OUT-WS-20160427-N
Work Order #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Test set up by: JW

Concentration %/o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
control	A	6	59										JW
	B	6	58										
	C	6	80										
	D	6	75										
1.5	A	6	52										
	B	6	70										
	C	6	61										
	D	6	56										
3.0	A	6	70										
	B	6	63										
	C	6	66										
	D	6	55										
6.1	A	6	56			X						JW	
	B	6	83		X	X						~~Protruding~~ Fronds are necrotic	
	C	6	71		X	X						Emerging ↓	
	D	6	64			X						JW	
12.1	A	6	69		X	X						~~Protruding~~ Fronds are necrotic	
	B	6	68		X	X						Emerging	
	C	6	56		X	X							
	D	6	84		X	X						↓	
24.2	A	6	66		X	X							
	B	6	76			X						JW	
	C	6	68		X	X						~~Protruding~~ Fronds are necrotic	
	D	6	64		X	X						Emerging ↓	↓

Comments:

Reviewed by: JGu

Date Reviewed: May 24/16

Lemna minor Toxicity Test Data Sheet - 7-d Frond Counts

Client: Teck
Sample ID: LC-WTF_OUT-WS-20160427-N
Work Order #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Test set up by: JW

Concentration %/o (v/v)	Rep	No. of fronds		Chlorosis	Necrosis	Yellow	Abnormal size	Gibbosity	Single fronds	Root destruction	Loss of buoyancy	Comments	Initials
		Day 0	Day 7										
48.5	A	6	53		X	X	X					Fronds are very small & necrotic	JW
	B	6	52		X	X	X					↓	↓
	C	6	59		X	X	X						
	D	6	46		X	X	X						
97	A	6	56		X	X	X						
	B	6	56		X								
	C	6	67		X								
	D	6	55		X								✓
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												
	A												
	B												
	C												
	D												

Comments:

Reviewed by: JGL

Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: TECK
Sample ID: LC_WTF_OUT_WS_20160427_N
WO #: 16482

Start Date: April 29 /16
Termination Date: May 6 /16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
% (v/v)		WTF Brown			
	A	1	1037.59	1042.96	JW / JW
	B	2	1027.89	1034.24	
Control	C	3	1029.42	1036.39	
	D	4	1027.08	1033.62	
	A	5	979.98	983.76	
	B	6	964.25	970.42	
1.5	C	7	957.09	962.21	
	D	8	966.41	971.53	
	A	9	973.19	979.57	
	B	10	1006.16	1011.50	
3.0	C	11	1007.54	1014.11	
	D	12	1026.80	1031.69	
	A	13	1034.90	1039.93	
	B	14	1021.87	1028.93	
6.1	C	15	1033.81	1039.72	
	D	16	994.62	1000.61	
	A	17	998.98	1005.78	
	B	18	1003.59	1010.31	
12.1	C	19	1006.05	1011.00	
	D	20	1005.35	1012.72	
	A	21	1004.25	1010.78	
	B	22	1013.61	1020.62	
24.2	C	23	1018.54	1024.38	
	D	24	1012.72	1019.20	
	A	25	1009.64	1015.76	
	B	26	1013.62	1019.04	
48.5	C	27	951.91	959.20	
	D	28	972.85	978.34	↓

Comments: ID Re-weigh = #6. 970.24 #24. 1019.05
#15. 1039.61 #32. 1021.54

Reviewed by: JW

Date Reviewed: May 24/16

7-d *Lemna minor* Weight Data Sheet

Client: Teck
Sample ID: LC_WTF_OUT_WS_20160427_N
WO #: 16482

Start Date: April 29 / 16
Termination Date: May 6 / 16
Balance ID: Bal - 1

Concentration	Rep	Pan No.	Pan weight (mg)	Pan + plant (mg)	Initials
0/0 (v/v)		WTF BROWN			
	A	29	964.00	970.03	JW / JW
97	B	30	994.16	1000.48 45 JW	↓
	C	31	999.50	1007.73	↓
	D	32	1014.84	1021.71	↓
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				
	A				
	B				
	C				
	D				

Comments:

Reviewed by: JGe

Date Reviewed: May 24/16

CETIS Analytical Report

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	06-1463-1897	**Endpoint:**	Frond Count	**CETIS Version:**	CETISv1.8.7
Analyzed:	12 May-16 10:50	**Analysis:**	Nonlinear Regression	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	05-4497-8051	**Code:**	207BB483	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:00	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	39h (10.2 °C)	**Station:**	LC_WTF_OUT_WS_20160427_N		

Non-Linear Regression Options

Model Function	X Transform	Y Transform	Weighting Function	PTBS Function
3P Cumulative Log-Normal EV [Y=A*(1- Φ(log(X/D)/C))]	None	None	Normal [W=1]	Off [Y*=Y]

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
26	-85.21	177.3	180.8	0.0703	Yes	1.919	2.621	0.1285	Non-Significant Lack of Fit

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	30.35	N/A	85.41	3.294	1.171	NA
IC10	55.54	3.175	114.5	1.801	0.8733	31.49
IC15	83.48	22.15	166.1	1.198	0.6022	4.514
IC20	115.4	8.396	296.8	0.8664	0.3369	~~11.91~~ JW
IC25	152.4	N/A	567.6	~~0.6562~~	0.1762	NA
IC40	307	N/A	N/A	0.3258	NA	NA
IC50	~~467.8~~	N/A	N/A	0.2138	NA	NA

> 97 % (v/v)

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
A	59.92	2.469	55.09	64.76	24.27	<0.0001	Significant Parameter
C	1.663	1.683	-1.635	4.961	0.9882	0.3312	Non-Significant Parameter
D	467.8	831.5	-1162	2097	0.5626	0.5780	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	362.488	362.488	1	4.345	0.0460	Significant
Lack of Fit	690.887	138.1774	5	1.919	0.1285	Non-Significant
Pure Error	1728.5	72.02084	24			
Residual	2419.387	83.42714	29			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance	4.531	14.07	0.7170	Equal Variances
	Mod Levene Equality of Variance	1.027	2.423	0.4383	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9666	0.9338	0.4119	Normal Distribution
	Anderson-Darling A2 Normality	0.3737	2.492	0.4217	Normal Distribution

Analyst: JW QA: May 24/16

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID: 06-1463-1897 **Endpoint:** Frond Count **CETIS Version:** CETISv1.8.7
Analyzed: 12 May-16 10:50 **Analysis:** Nonlinear Regression **Official Results:** Yes

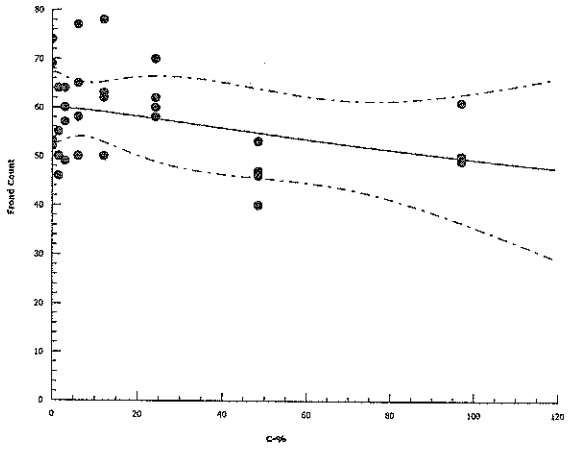
Frond Count Summary

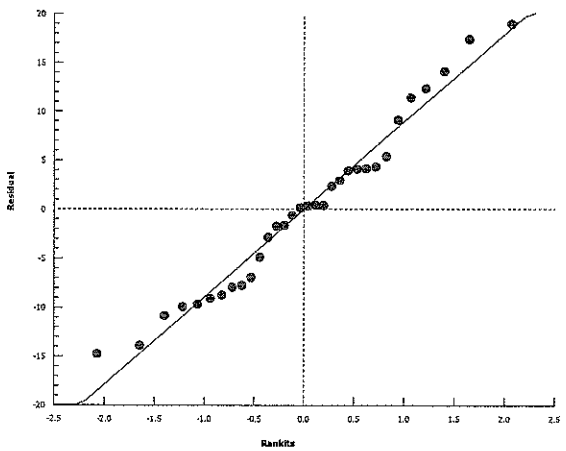
			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	62	52	74	5.583	11.17	18.01%	0.0%
1.5		4	53.75	46	64	3.881	7.762	14.44%	13.31%
3		4	57.5	49	64	3.175	6.351	11.04%	7.26%
6.1		4	62.5	50	77	5.723	11.45	18.31%	-0.81%
12.1		4	63.25	50	78	5.735	11.47	18.14%	-2.02%
24.2		4	62.5	58	70	2.63	5.26	8.42%	-0.81%
48.5		4	46.5	40	53	2.661	5.323	11.45%	25.0%
97		4	52.5	49	61	2.843	5.686	10.83%	15.32%

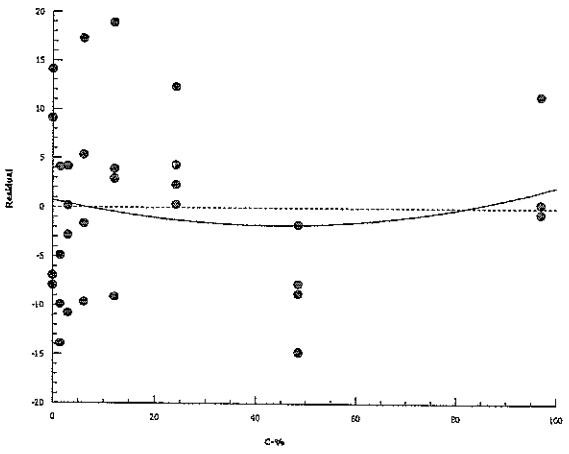
Frond Count Detail

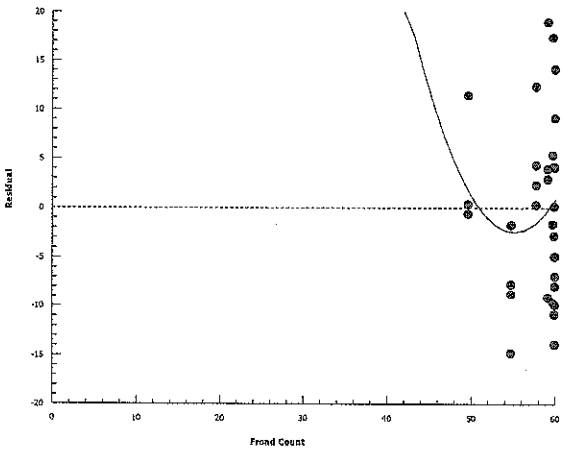
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	53	52	74	69
1.5		46	64	55	50
3		64	57	60	49
6.1		50	77	65	58
12.1		63	62	50	78
24.2		60	70	62	58
48.5		47	46	53	40
97		50	50	61	49

Graphics 3P Cumulative Log-Normal EV [Y=A*(1- Φ(log(X/D)/C))]









CETIS Analytical Report

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	04-9163-4081	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	25 May-16 9:23	**Analysis:**	Nonlinear Regression	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	05-4497-8051	**Code:**	207BB483	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:00	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	39h (10.2 °C)	**Station:**	LC_WTF_OUT_WS_20160427_N		

Non-Linear Regression Options

Model Function	X Transform	Y Transform	Weighting Function	PTBS Function
2P Exponential EV [Y=A*exp(log(0.5)*X/D)]	None	None	Normal [W=1]	Off [Y*=Y]

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
4	-13.58	31.58	34.1		Yes	2.319	2.508	0.0659	Non-Significant Lack of Fit

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	32930000	N/A	N/A	0.0000030	NA	NA
IC10	67640000	N/A	N/A	0.0000014	NA	NA
IC15	104300000	N/A	N/A	0.0000009	NA	NA
IC20	143300000	N/A	N/A	0.0000006	NA	NA
IC25	184700000	N/A	N/A	0.0000005	NA	NA
IC40	327900000	N/A	N/A	0.0000003	NA	NA
IC50	445000000	N/A	N/A	0.0000002	NA	NA

> 97 % (v/v)

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
A	5.891	0.2131	5.473	6.309	27.64	<0.0001	Significant Parameter
D	445000000	2.61E+14	-5.12E+14	5.116E+14	1.705E-06	1.0000	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	0	0	1	0	1.0000	Non-Significant
Lack of Fit	10.09603	1.682671	6	2.319	0.0659	Non-Significant
Pure Error	17.41594	0.7256642	24			
Residual	27.51197	0.9170657	30			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance	1.993	14.07	0.9602	Equal Variances
	Mod Levene Equality of Variance	0.2106	2.423	0.9796	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9819	0.9338	0.8516	Normal Distribution
	Anderson-Darling A2 Normality	0.2859	2.492	0.6550	Normal Distribution

Total Dry Weight-mg Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	4	6.307	5.37	6.97	0.3383	0.6767	10.73%	0.0%
1.5		4	5.048	3.78	6.17	0.4896	0.9793	19.4%	19.98%
3		4	5.795	4.89	6.57	0.4051	0.8102	13.98%	8.13%
6.1		4	5.997	5.03	7.06	0.4156	0.8312	13.86%	4.92%
12.1		4	6.46	4.95	7.37	0.5237	1.047	16.21%	-2.42%
24.2		4	6.465	5.84	7.01	0.2402	0.4803	7.43%	-2.5%
48.5		4	6.08	5.42	7.29	0.433	0.8659	14.24%	3.61%
97		4	6.855	6.03	8.23	0.4908	0.9816	14.32%	-8.68%

Analyst: JW QA: JGH May 25/16

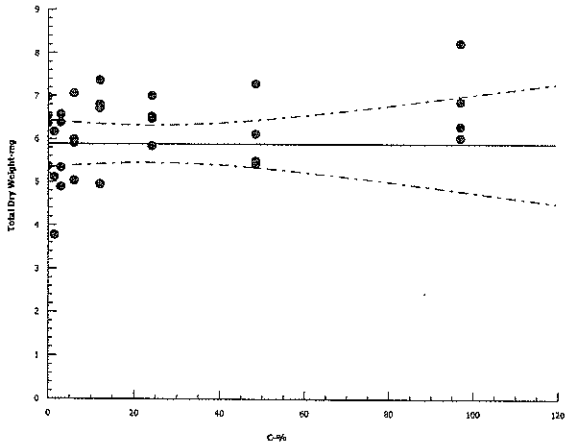
Lemna Growth Inhibition Test — **Nautilus Environmental**

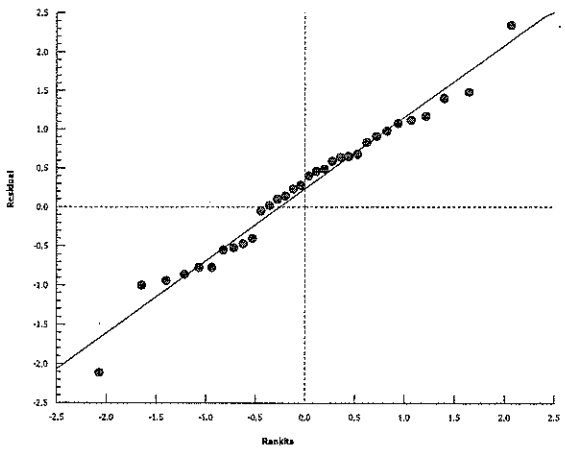
Analysis ID:	04-9163-4081	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	25 May-16 9:23	**Analysis:**	Nonlinear Regression	**Official Results:**	Yes

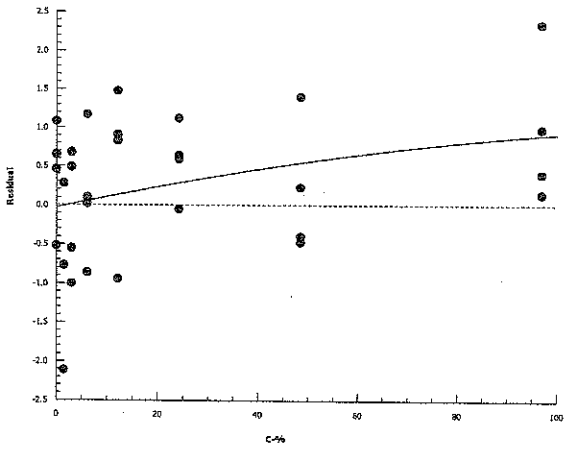
Total Dry Weight-mg Detail

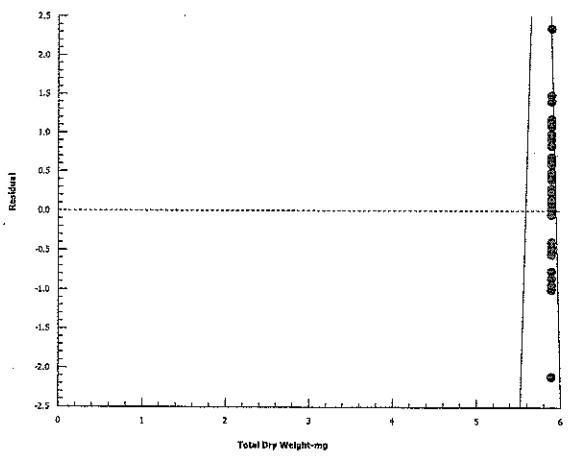
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	5.37	6.35	6.97	6.54
1.5		3.78	6.17	5.12	5.12
3		6.38	5.34	6.57	4.89
6.1		5.03	7.06	5.91	5.99
12.1		6.8	6.72	4.95	7.37
24.2		6.53	7.01	5.84	6.48
48.5		6.12	5.42	7.29	5.49
97		6.03	6.29	8.23	6.87

Graphics — 2P Exponential EV [Y=A*exp(log(0.5)*X/D)]









Analyst: JW QA: JBe May 25/16

Lemna Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	11-9499-8501	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	25 May-16 9:23	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	18-5200-6809	**Test Type:**	Lemna Growth	**Analyst:**	Jeslin Wijaya
Start Date:	29 Apr-16	**Protocol:**	EC/EPS 1/RM/37	**Diluent:**	Modified APHA
Ending Date:	06 May-16	**Species:**	Lemna minor	**Brine:**	
Duration:	7d 0h	**Source:**	CPCC#490	**Age:**	8d
Sample ID:	05-4497-8051	**Code:**	207BB483	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:00	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	39h (10.2 °C)	**Station:**	LC_WTF_OUT_WS_20160427_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	23.7%	97	>97	NA	1.031

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	-2.092	2.482	1.495	6	0.9998	CDF	Non-Significant Effect
		3	-0.8508	2.482	1.495	6	0.9847	CDF	Non-Significant Effect
		6.1	-0.5146	2.482	1.495	6	0.9615	CDF	Non-Significant Effect
		12.1	0.2532	2.482	1.495	6	0.8006	CDF	Non-Significant Effect
		24.2	0.2615	2.482	1.495	6	0.7978	CDF	Non-Significant Effect
		48.5	-0.3776	2.482	1.495	6	0.9458	CDF	Non-Significant Effect
		97	0.909	2.482	1.495	6	0.5234	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	8.328899	1.189843	7	1.64	0.1723	Non-Significant Effect
Error	17.41594	0.7256642	24			
Total	25.74484		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	1.993	18.48	0.9602	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9736	0.9081	0.6041	Normal Distribution

Total Dry Weight-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	4	6.307	5.231	7.384	6.445	5.37	6.97	0.3383	10.73%	0.0%
1.5		4	5.048	3.489	6.606	5.12	3.78	6.17	0.4896	19.4%	19.98%
3		4	5.795	4.506	7.084	5.86	4.89	6.57	0.4051	13.98%	8.13%
6.1		4	5.997	4.675	7.32	5.95	5.03	7.06	0.4156	13.86%	4.92%
12.1		4	6.46	4.793	8.127	6.76	4.95	7.37	0.5237	16.21%	-2.42%
24.2		4	6.465	5.701	7.229	6.505	5.84	7.01	0.2402	7.43%	-2.5%
48.5		4	6.08	4.702	7.458	5.805	5.42	7.29	0.433	14.24%	3.61%
97		4	6.855	5.293	8.417	6.58	6.03	8.23	0.4908	14.32%	-8.68%

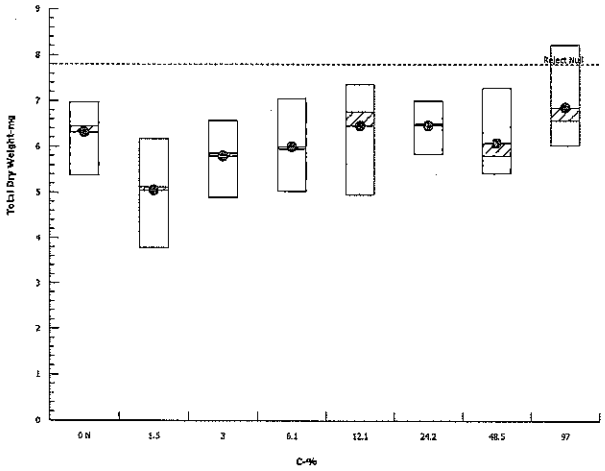
Total Dry Weight-mg Detail

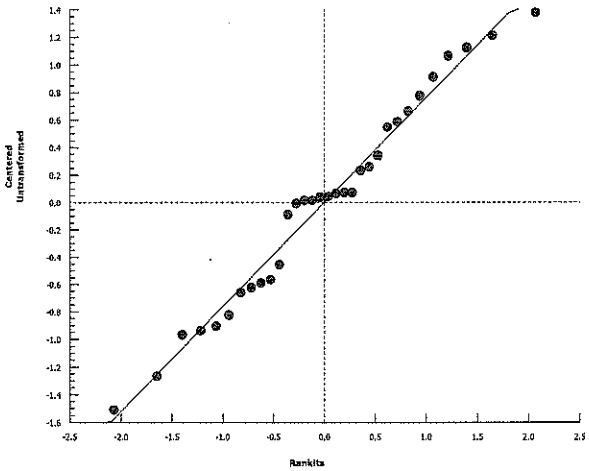
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Negative Control	5.37	6.35	6.97	6.54
1.5		3.78	6.17	5.12	5.12
3		6.38	5.34	6.57	4.89
6.1		5.03	7.06	5.91	5.99
12.1		6.8	6.72	4.95	7.37
24.2		6.53	7.01	5.84	6.48
48.5		6.12	5.42	7.29	5.49
97		6.03	6.29	8.23	6.87

Lemna Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	11-9499-8501	**Endpoint:**	Total Dry Weight-mg	**CETIS Version:**	CETISv1.8.7
Analyzed:	25 May-16 9:23	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Analyst: JW QA: JW May 25/16

APPENDIX D – *Pseudokirchneriella subcapitata* Toxicity Test Data

Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 16481

Start Date: April 29/16
Set up by: MLT

Sample Information:

Sample ID: LC LCDSSLCC WS 2016-04-25 N
Sample Date: April 27/16
Date Received: April 28/16
Sample Volume: 8 x 20L

Test Organism Information:

Culture Date: April 22/16
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC141
Stock Solution ID: 157n03
Date Initiated: April 26/16

72-h IC50 (95% CL): 34.0 (31.2 - 36.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 30.5 (17.4 - 53.5) ug/L Zn CV (%): 32

Test Results:

	Algal Growth
IC25 %(v/v) (95% CL)	>95.2
IC50 %(v/v) (95% CL)	>95.2

Reviewed by: JGR

Date reviewed: May 24/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client : Teck Coal **Setup by:** MLT

Sample ID: LC LE MLT LCDSSLCC WS 2016-04-25 N **Test Date/Time:** April 29/16 @ 1435h

Work Order No.: 16481 **Test Species:** *Pseudokirchneriella subcapitata*

Culture Date: April 22/16 **Age of Culture:** 7d **Culture Health:** Good

Culture Count: 1 555 2 535 **Average:** 545 **Culture Cell Density (c1):** 545 x10⁴ cells/mL

v1 = 220,000 cells/ml x 100 ml / (c1) 545 x 10⁴ cells/ml = 4.04 mL

Time Zero Counts: 1 20 2 22 **Average:** 21

No. of Cells/mL: 21 x10⁴ **Initial Density:** # cells/mL ÷ 220 µL x 10 µL = 9545 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.0	23.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
1.5	7.0	23.0	↓	↓	↓	↓	✓	✓	✓	✓
3.0	7.0	23.0	↓	↓	↓	↓	✓	✓	✓	✓
6.0	7.1	23.0	↓	↓	↓	↓	✓	✓	✓	✓
11.9	7.2	23.0	↓	↓	↓	↓	✓	✓	✓	✓
23.8	7.4	23.0	↓	↓	↓	↓	✓	✓	✓	✓
47.6	7.7	23.0	↓	↓	↓	↓	✓	✓	✓	✓
95.2	8.0	23.0	↓	↓	↓	↓	✓	✓	✓	✓
Initials	MLT	MLT	[illegible]	[illegible]	[illegible]	MLT	MLT	[illegible]	[illegible]	MLT

Initial control pH: Well 1: 7.0 Well 2: 7.0

Final control pH: Well 1: 6.8 Well 2: 6.8

Light intensity (lux): 3740 **Date measured:** April 29/16

Instruments: Thermometer 4 pH meter 2 Light meter 1

Sample Description: clear, colourless, some debris, odourless

Comments:

Reviewed: JCL **Date reviewed:** May 24/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal — Start Date/Time: May 29/16 @ 1435h

Work Order #: 16481 — Termination Date: May 2/16 @ 1435h

Sample ID: ~~LC-LCDSSLCC WS~~ MG — Test set up by: MG

%(v/v) LC LCDSSLCC WS 2016-04-25 N

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	35					MG
	B	32					
	C	34					
	D	31					
	E	32					
	F	33					
	G	34					
	H	30					
1.5	A	33					
	B	31					
	C	34					
	D	36					
3.0	A	43					
	B	40					
	C	46					
	D	38					
6.0	A	65					
	B	59					
	C	56					
	D	62					
11.9	A	95					
	B	93					
	C	80					
	D	81					
23.8	A	90					
	B	95					
	C	93					
	D	89					
47.6	A	90					
	B	91					
	C	96					
	D	91					
95.2	A	95					
	B	97					
	C	89					
	D	87					

Comments:

Reviewed by: JGL — Date Reviewed: May 29/16

Pseudokirchneriella subcapitata Algal Counts

Client:	Teck Coal	Start Date/Time:	29-Apr-16 @ 1435h		
WO#:	16481	Termination Date:	02-May-16 @ 1435h		
Sample ID:	LC LCDSSLCC WS 2016-04-25 N				
		Initial Cell Density:	9545 cell/mL		210000
					0.22
					0.01

Concentration % v/v	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		9545.455
Control	A	35				35	34.0	mean	31.7
	B	32				32	31.0	SD	1.685018
	C	34				34	33.0	CV	5.320473
	D	31				31	30.0		
	E	32				32	31.0		
	F	33				33	32.0		
	G	34				34	33.0		
	H	30				30	29.0		
1.5	A	33				33	32.0		
	B	31				31	30.0		
	C	34				34	33.0		
	D	36				36	35.0		
3	A	43				43	42.0		
	B	40				40	39.0		
	C	46				46	45.0		
	D	38				38	37.0		
6	A	65				65	64.0		
	B	59				59	58.0		
	C	56				56	55.0		
	D	62				62	61.0		
11.9	A	95				95	94.0		
	B	93				93	92.0		
	C	80				80	79.0		
	D	81				81	80.0		
23.8	A	90				90	89.0		
	B	95				95	94.0		
	C	93				93	92.0		
	D	89				89	88.0		
47.6	A	90				90	89.0		
	B	91				91	90.0		
	C	96				96	95.0		
	D	91				91	90.0		
95.2	A	95				95	94.0		
	B	97				97	96.0		
	C	89				89	88.0		
	D	87				87	86.0		

JBL
May 29/16

CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	07-8986-3455	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:31	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	18-6669-7151	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 14:35	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 14:35	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	54h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	489168	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.7232	Non-significant Trend in Controls

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>95.2	N/A	N/A	<1.05	NA	NA
IC10	>95.2	N/A	N/A	<1.05	NA	NA
IC15	>95.2	N/A	N/A	<1.05	NA	NA
IC20	>95.2	N/A	N/A	<1.05	NA	NA
IC25	>95.2	N/A	N/A	<1.05	NA	NA
IC40	>95.2	N/A	N/A	<1.05	NA	NA
IC50	>95.2	N/A	N/A	<1.05	NA	NA

Cell Yield Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	8	31.63	29	34	0.5957	1.685	5.33%	0.0%
1.5		4	32.5	30	35	1.041	2.082	6.41%	-2.77%
3		4	40.75	37	45	1.75	3.5	8.59%	-28.85%
6		4	59.5	55	64	1.936	3.873	6.51%	-88.14%
11.9		4	86.25	79	94	3.924	7.848	9.1%	-172.7%
23.8		4	90.75	88	94	1.377	2.754	3.03%	-187.0%
47.6		4	91	89	95	1.354	2.708	2.98%	-187.7%
95.2		4	91	86	96	2.38	4.761	5.23%	-187.7%

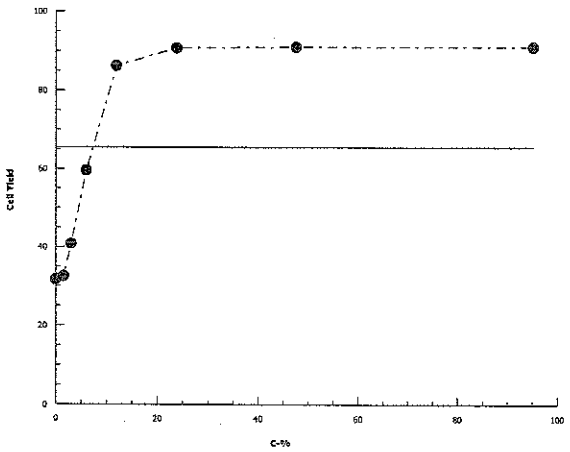
Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	34	31	33	30	31	32	33	29
1.5		32	30	33	35				
3		42	39	45	37				
6		64	58	55	61				
11.9		94	92	79	80				
23.8		89	94	92	88				
47.6		89	90	95	90				
95.2		94	96	88	86				

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	07-8986-3455	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:31	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	01-8993-1717	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:31	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	18-6669-7151	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 14:35	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 14:35	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	12-8781-3119	**Code:**	4CC277FF	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:18	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	54h (8 °C)	**Station:**	LC LCDSSLCC WS 2016-04-25 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	18.8%	1.5	3	2.121	66.67

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	0.3724	2.526	5.935	10	0.8297	CDF	Non-Significant Effect
		3*	3.884	2.526	5.935	10	0.0019	CDF	Significant Effect
		6*	11.86	2.526	5.935	10	<0.0001	CDF	Significant Effect
		11.9*	23.25	2.526	5.935	10	<0.0001	CDF	Significant Effect
		23.8*	25.17	2.526	5.935	10	<0.0001	CDF	Significant Effect
		47.6*	25.27	2.526	5.935	10	<0.0001	CDF	Significant Effect
		95.2*	25.27	2.526	5.935	10	<0.0001	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.7232	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	25075.88	3582.268	7	243.4	<0.0001	Significant Effect
Error	412.125	14.71875	28			
Total	25488		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	12.7	18.48	0.0799	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.992	0.9166	0.9949	Normal Distribution

Cell Yield Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	8	31.63	30.22	33.03	31.5	29	34	0.5957	5.33%	0.0%
1.5		4	32.5	29.19	35.81	32.5	30	35	1.041	6.41%	-2.77%
3		4	40.75	35.18	46.32	40.5	37	45	1.75	8.59%	-28.85%
6		4	59.5	53.34	65.66	59.5	55	64	1.936	6.51%	-88.14%
11.9		4	86.25	73.76	98.74	86	79	94	3.924	9.1%	-172.7%
23.8		4	90.75	86.37	95.13	90.5	88	94	1.377	3.03%	-187.0%
47.6		4	91	86.69	95.31	90	89	95	1.354	2.98%	-187.7%
95.2		4	91	83.42	98.58	91	86	96	2.38	5.23%	-187.7%

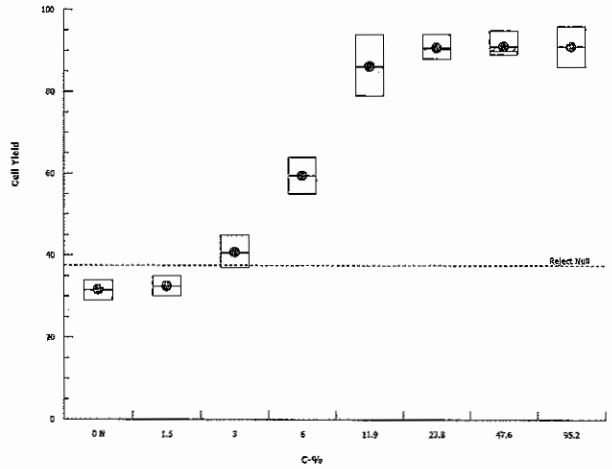
EC Alga Growth Inhibition Test | **Nautilus Environmental**

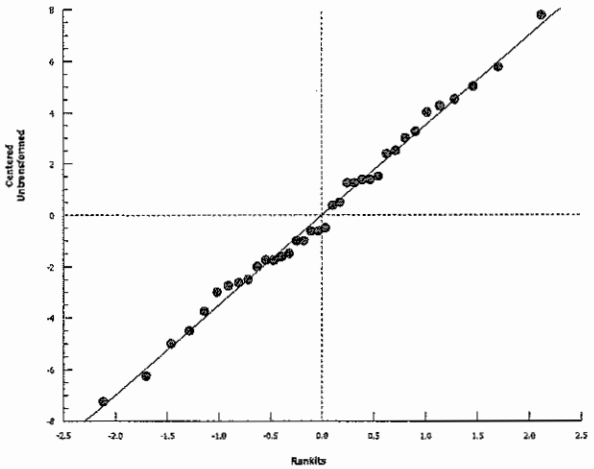
Analysis ID:	01-8993-1717	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:31	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	34	31	33	30	31	32	33	29
1.5		32	30	33	35				
3		42	39	45	37				
6		64	58	55	61				
11.9		94	92	79	80				
23.8		89	94	92	88				
47.6		89	90	95	90				
95.2		94	96	88	86				

Graphics





Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 16481

Start Date: April 29/16
Set up by: MLT

Sample Information:

Sample ID: LC-DCI_WS_2016-04-26_N
Sample Date: April 27/16
Date Received: April 28/16
Sample Volume: 5x20L

Test Organism Information:

Culture Date: April 22/16
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC141
Stock Solution ID: 157n03
Date Initiated: April 26/16

72-h IC50 (95% CL): 34.0 (31.2 - 36.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 30.5 (17.4 - 53.5) ug/L Zn CV (%): 32

Test Results:

	Algal Growth
IC25 %(v/v) (95% CL)	>95.2
IC50 %(v/v) (95% CL)	>95.2

Reviewed by: JGL

Date reviewed: May 24/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Teck Coal | Setup by: MH

Sample ID: LC-DCLWS-2016-04-26-N | Test Date/Time: April 29/16 @ 1445h

Work Order No.: 16481 | Test Species: *Pseudokirchneriella subcapitata*

Culture Date: April 22/16 | Age of Culture: 7d | Culture Health: Good

Culture Count: 1 555 2 535 | Average: 545 | Culture Cell Density (c1): 545 x 10^4 cells/mL.

v1 = 220,000 cells/ml x 100 ml / (c1) 545 x 10^4 cells/ml = 4.04mL

Time Zero Counts: 1 20 2 22 | Average: 21

No. of Cells/mL: 21 x 10^4 | Initial Density: # cells/mL ÷ 220 µL x 10 µL = 9545 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.0	23.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
1.5	7.1	23.0	↓	↓	↓	↓	✓	✓	✓	✓
3.0	7.2	23.0					✓	✓	✓	✓
6.0	7.3	23.0					✓	✓	✓	✓
11.9	7.4	23.0					✓	✓	✓	✓
23.8	7.5	23.0					✓	✓	✓	✓
47.6	7.7	23.0					✓	✓	✓	✓
95.2	8.1	23.0	↓	↓	↓	↓	✓	✓	✓	✓
Initials	MH	MH	MH	A	A	MH	MH	A	A	MH

Initial control pH: Well 1: 7.0 | Well 2: 7.0

Final control pH: Well 1: 6.8 | Well 2: 6.8

Light intensity (lux): 3880 | Date measured: April 29/16

Instruments: Thermometer 4 | pH meter 2 | Light meter 1

Sample Description: clear, colourless, some debris, odourless

Comments:

Reviewed: JCR | Date reviewed: May 29/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal Start Date/Time: April 29/16 @ 1445h
Work Order #: 10481 Termination Date: May 2/16 @ 1445h
Sample ID: LE_DC1_WS_2016-04-26_N Test set up by: MLT
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	31					MLT
	B	38					
	C	30					
	D	31					
	E	32					
	F	34					
	G	32					
	H	33					
1.5	A	30					
	B	33					
	C	32					
	D	36					
3.0	A	36					
	B	35					
	C	38					
	D	34					
6.0	A	48					
	B	42					
	C	45					
	D	50					
11.9	A	55					
	B	57					
	C	64					
	D	61					
23.8	A	77					
	B	74					
	C	71					
	D	76					
47.6	A	91					
	B	101					
	C	98					
	D	90					
95.2	A	112					
	B	97					
	C	92					
	D	98					✓

Comments:

Reviewed by: JGW Date Reviewed: May 24/16

Pseudokirchneriella subcapitata Algal Counts

Client:	Teck Coal	Start Date/Time:	29-Apr-16 @ 1445h
WO#:	16481	Termination Date:	02-May-16 @ 1445h
Sample ID:	LC_DC1_WS_2016-04-26_N		
		Initial Cell Density:	9545 cell/mL

									210000
									0.22
									0.01
Concentration % v/v	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		9545.455
Control	A	31				31	30.0	mean	31.7
	B	38				38	37.0	SD	2.503569
	C	30				30	29.0	CV	7.905061
	D	31				31	30.0		
	E	32				32	31.0		
	F	34				34	33.0		
	G	32				32	31.0		
	H	33				33	32.0		
1.5	A	30				30	29.0		
	B	33				33	32.0		
	C	32				32	31.0		
	D	36				36	35.0		
3	A	36				36	35.0		
	B	35				35	34.0		
	C	38				38	37.0		
	D	34				34	33.0		
6	A	48				48	47.0		
	B	42				42	41.0		
	C	45				45	44.0		
	D	50				50	49.0		
11.9	A	55				55	54.0		
	B	57				57	56.0		
	C	64				64	63.0		
	D	61				61	60.0		
23.8	A	77				77	76.0		
	B	74				74	73.0		
	C	71				71	70.0		
	D	76				76	75.0		
47.6	A	91				91	90.0		
	B	101				101	100.0		
	C	98				98	97.0		
	D	90				90	89.0		
95.2	A	112				112	111.0		
	B	97				97	96.0		
	C	92				92	91.0		
	D	98				98	97.0		

JGH
May 24/16

CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	12-4845-6960	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:34	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	15-1304-8365	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 14:45	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 14:45	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	00-8128-9240	**Code:**	4D86018	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:30	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	54h (7.5 °C)	**Station:**	LC_DC1_WS_2016-04-26_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1236400	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.5540	Non-significant Trend in Controls

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>95.2	N/A	N/A	<1.05	NA	NA
IC10	>95.2	N/A	N/A	<1.05	NA	NA
IC15	>95.2	N/A	N/A	<1.05	NA	NA
IC20	>95.2	N/A	N/A	<1.05	NA	NA
IC25	>95.2	N/A	N/A	<1.05	NA	NA
IC40	>95.2	N/A	N/A	<1.05	NA	NA
IC50	>95.2	N/A	N/A	<1.05	NA	NA

Cell Yield Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	8	31.63	29	37	0.8851	2.504	7.92%	0.0%
1.5		4	31.75	29	35	1.25	2.5	7.87%	-0.4%
3		4	34.75	33	37	0.8539	1.708	4.92%	-9.88%
6		4	45.25	41	49	1.75	3.5	7.74%	-43.08%
11.9		4	58.25	54	63	2.016	4.031	6.92%	-84.19%
23.8		4	73.5	70	76	1.323	2.646	3.6%	-132.4%
47.6		4	94	89	100	2.677	5.354	5.7%	-197.2%
95.2		4	98.75	91	111	4.289	8.578	8.69%	-212.3%

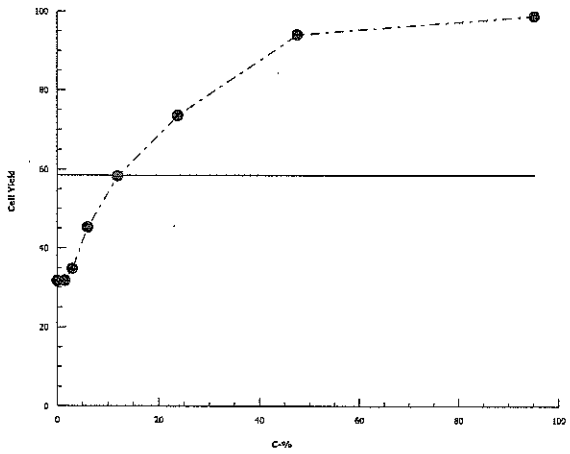
Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	30	37	29	30	31	33	31	32
1.5		29	32	31	35				
3		35	34	37	33				
6		47	41	44	49				
11.9		54	56	63	60				
23.8		76	73	70	75				
47.6		90	100	97	89				
95.2		111	96	91	97				

EC Alga Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	12-4845-6960	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:34	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	20-4183-5385	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:34	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	15-1304-8365	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 14:45	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 14:45	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	00-8128-9240	**Code:**	4D86018	**Client:**	Teck Coal
Sample Date:	27 Apr-16 08:30	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	54h (7.5 °C)	**Station:**	LC_DC1_WS_2016-04-26_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	20.4%	3	6	4.243	33.33

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	0.04906	2.526	6.436	10	0.9173	CDF	Non-Significant Effect
		3	1.227	2.526	6.436	10	0.4373	CDF	Non-Significant Effect
		6*	5.348	2.526	6.436	10	<0.0001	CDF	Significant Effect
		11.9*	10.45	2.526	6.436	10	<0.0001	CDF	Significant Effect
		23.8*	16.44	2.526	6.436	10	<0.0001	CDF	Significant Effect
		47.6*	24.48	2.526	6.436	10	<0.0001	CDF	Significant Effect
		95.2*	26.35	2.526	6.436	10	<0.0001	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.5540	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	23696.38	3385.197	7	195.6	<0.0001	Significant Effect
Error	484.625	17.30803	28			
Total	24181		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	12.18	18.48	0.0948	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9539	0.9166	0.1386	Normal Distribution

Cell Yield Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	8	31.63	29.53	33.72	31	29	37	0.8851	7.92%	0.0%
1.5		4	31.75	27.77	35.73	31.5	29	35	1.25	7.87%	-0.4%
3		4	34.75	32.03	37.47	34.5	33	37	0.8539	4.92%	-9.88%
6		4	45.25	39.68	50.82	45.5	41	49	1.75	7.74%	-43.08%
11.9		4	58.25	51.84	64.66	58	54	63	2.016	6.92%	-84.19%
23.8		4	73.5	69.29	77.71	74	70	76	1.323	3.6%	-132.4%
47.6		4	94	85.48	102.5	93.5	89	100	2.677	5.7%	-197.2%
95.2		4	98.75	85.1	112.4	96.5	91	111	4.289	8.69%	-212.3%

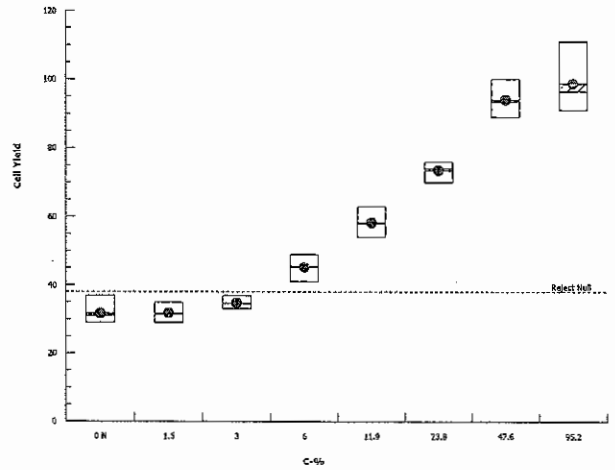
EC Alga Growth Inhibition Test — **Nautilus Environmental**

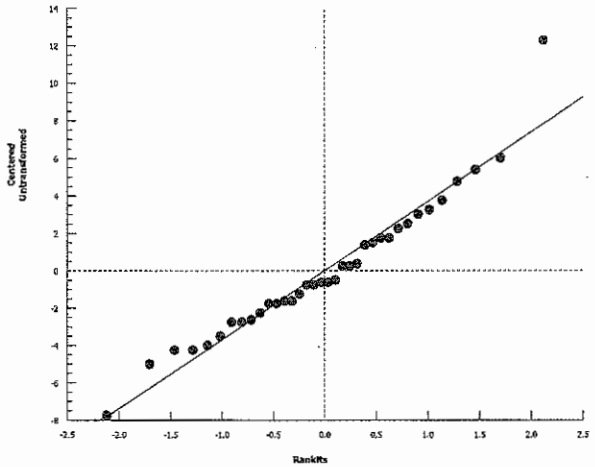
Analysis ID:	20-4183-5385	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:34	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	30	37	29	30	31	33	31	32
1.5		29	32	31	35				
3		35	34	37	33				
6		47	41	44	49				
11.9		54	56	63	60				
23.8		76	73	70	75				
47.6		90	100	97	89				
95.2		111	96	91	97				

Graphics





Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 16481

Start Date: Apr 29/16
Set up by: MLT

Sample Information:

Sample ID: LC FRDSDC WS 2016-04-26 N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 5X20L

Test Organism Information:

Culture Date: Apr 22/16
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC141
Stock Solution ID: 15Zn03
Date Initiated: Apr 26/16

72-h IC50 (95% CL): 34.0 (31.2 - 36.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 30.5 (17.4 - 53.5) ug/L Zn CV (%): 32

Test Results:

	Algal Growth
IC25 %(v/v) (95% CL)	>95.2
IC50 %(v/v) (95% CL)	>95.2

Reviewed by: JGL

Date reviewed: May 24/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Teck Coal | Setup by: MLT

Sample ID: LC MLT FRDSDC WS 2016-04-26 N | Test Date/Time: April 29/16 @ 1450h

Work Order No.: 16481 | Test Species: *Pseudokirchneriella subcapitata*

Culture Date: April 22/16 | Age of Culture: 7d | Culture Health: Good

Culture Count: 1 555 2 535 | Average: 545 | Culture Cell Density (c1): 545 x 10⁴ cells/mL

v1 = 220,000 cells/ml x 100 ml / (c1) 545 x 10⁴ cells/ml = 4.04mL

Time Zero Counts: 1 20 2 22 | Average: 21

No. of Cells/mL: 21 x 10⁴ | Initial Density: # cells/mL ÷ 220 µL x 10 µL = 9545 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.0	23.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
1.5	7.2	23.0	↓	↓	↓	↓	✓	✓	✓	✓
3.0	7.3	23.0					✓	✓	✓	✓
6.0	7.4	23.0					✓	✓	✓	✓
11.9	7.4	23.0					✓	✓	✓	✓
23.8	7.6	23.0					✓	✓	✓	✓
47.6	7.8	23.0					✓	✓	✓	✓
95.2	8.2	23.0					✓	✓	✓	✓
Initials	MLT	MLT	MLT	[illegible]	[illegible]	MLT	MLT	[illegible]	[illegible]	MLT

Initial control pH: Well 1: 7.0 | Well 2: 7.0

Final control pH: Well 1: 6.8 | Well 2: 6.8

Light intensity (lux): 3940 | Date measured: April 29/16

Instruments: Thermometer 4 | pH meter 2 | Light meter 1

Sample Description: clear, colourless, some debris, odourless

Comments:

Reviewed: JGw | Date reviewed: May 24/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal
Start Date/Time: April 29/16 @ 1450h
Work Order #: 16481
Termination Date: May 2/16 @ 1450h
Sample ID: ~~LC-FRDSDC WS 2016-04~~ LC FRDSDC WS 2016-04-26 N
Test set up by: MLT
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	31					MLT
	B	35					
	C	30					
	D	33					
	E	29					
	F	31					
	G	36					
	H	35					
1.5	A	35					
	B	34					
	C	38					
	D	33					
3.0	A	45					
	B	42					
	C	53					
	D	47					
6.0	A	70					
	B	61					
	C	63					
	D	67					
11.9	A	72					
	B	74					
	C	82					
	D	80					
23.8	A	86					
	B	90					
	C	84					
	D	80					
47.6	A	90					
	B	88					
	C	102					
	D	94					
95.2	A	92					
	B	83					
	C	90					
	D	86					

Comments:

Reviewed by: JCL
Date Reviewed: May 24/16

Pseudokirchneriella subcapitata Algal Counts

Client:	Teck Coal	Start Date/Time:	29-Apr-16 @ 1450h
WO#:	16481	Termination Date:	02-May-16 @ 1450h
Sample ID:	LC FRDSDC WS 2016-04-26 N		
		Initial Cell Density:	9545 cell/mL

									210000
									0.22
									0.01
Concentration % v/v	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		9545.455
Control	A	31				31	30.0	mean	31.5
	B	35				35	34.0	SD	2.618615
	C	30				30	29.0	CV	8.301084
	D	33				33	32.0		
	E	29				29	28.0		
	F	31				31	30.0		
	G	36				36	35.0		
	H	35				35	34.0		
1.5	A	35				35	34.0		
	B	34				34	33.0		
	C	38				38	37.0		
	D	33				33	32.0		
3	A	45				45	44.0		
	B	42				42	41.0		
	C	53				53	52.0		
	D	47				47	46.0		
6	A	70				70	69.0		
	B	61				61	60.0		
	C	63				63	62.0		
	D	67				67	66.0		
11.9	A	72				72	71.0		
	B	74				74	73.0		
	C	82				82	81.0		
	D	80				80	79.0		
23.8	A	86				86	85.0		
	B	90				90	89.0		
	C	84				84	83.0		
	D	80				80	79.0		
47.6	A	90				90	89.0		
	B	88				88	87.0		
	C	102				102	101.0		
	D	94				94	93.0		
95.2	A	92				92	91.0		
	B	83				83	82.0		
	C	90				90	89.0		
	D	86				86	85.0		

JGH
May 24/16

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	12-8232-9799	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:20	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	12-2121-6828	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 14:50	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 14:50	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	07-5438-7274	**Code:**	2CF7094A	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:04	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	54h (8 °C)	**Station:**	LC FRDSDC WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1791725	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.7232	Non-significant Trend in Controls

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>95.2	N/A	N/A	<1.05	NA	NA
IC10	>95.2	N/A	N/A	<1.05	NA	NA
IC15	>95.2	N/A	N/A	<1.05	NA	NA
IC20	>95.2	N/A	N/A	<1.05	NA	NA
IC25	>95.2	N/A	N/A	<1.05	NA	NA
IC40	>95.2	N/A	N/A	<1.05	NA	NA
IC50	>95.2	N/A	N/A	<1.05	NA	NA

Cell Yield Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	8	31.5	28	35	0.9258	2.619	8.31%	0.0%
1.5		4	34	32	37	1.08	2.16	6.35%	-7.94%
3		4	45.75	41	52	2.323	4.646	10.15%	-45.24%
6		4	64.25	60	69	2.016	4.031	6.27%	-104.0%
11.9		4	76	71	81	2.38	4.761	6.26%	-141.3%
23.8		4	84	79	89	2.082	4.163	4.96%	-166.7%
47.6		4	92.5	87	101	3.096	6.191	6.69%	-193.7%
95.2		4	86.75	82	91	2.016	4.031	4.65%	-175.4%

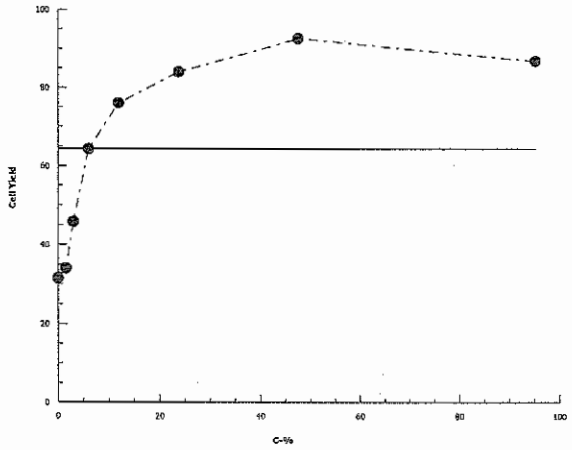
Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	30	34	29	32	28	30	35	34
1.5		34	33	37	32				
3		44	41	52	46				
6		69	60	62	66				
11.9		71	73	81	79				
23.8		85	89	83	79				
47.6		89	87	101	93				
95.2		91	82	89	85				

EC Alga Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	12-8232-9799	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:20	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	06-7659-1513	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:20	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	12-2121-6828	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 14:50	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 14:50	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	07-5438-7274	**Code:**	2CF7094A	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:04	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	54h (8 °C)	**Station:**	LC FRDSDC WS 2016-04-26 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	19.9%	1.5	3	2.121	66.67

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	1.008	2.526	6.265	10	0.5472	CDF	Non-Significant Effect
		3*	5.746	2.526	6.265	10	<0.0001	CDF	Significant Effect
		6*	13.21	2.526	6.265	10	<0.0001	CDF	Significant Effect
		11.9*	17.94	2.526	6.265	10	<0.0001	CDF	Significant Effect
		23.8*	21.17	2.526	6.265	10	<0.0001	CDF	Significant Effect
		47.6*	24.6	2.526	6.265	10	<0.0001	CDF	Significant Effect
		95.2*	22.28	2.526	6.265	10	<0.0001	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.7232	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	20484.39	2926.341	7	178.4	<0.0001	Significant Effect
Error	459.25	16.40178	28			
Total	20943.64		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.86	18.48	0.6771	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.964	0.9166	0.2840	Normal Distribution

Cell Yield Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	8	31.5	29.31	33.69	31	28	35	0.9258	8.31%	0.0%
1.5		4	34	30.56	37.44	33.5	32	37	1.08	6.35%	-7.94%
3		4	45.75	38.36	53.14	45	41	52	2.323	10.15%	-45.24%
6		4	64.25	57.84	70.66	64	60	69	2.016	6.27%	-104.0%
11.9		4	76	68.42	83.58	76	71	81	2.38	6.26%	-141.3%
23.8		4	84	77.38	90.62	84	79	89	2.082	4.96%	-166.7%
47.6		4	92.5	82.65	102.4	91	87	101	3.096	6.69%	-193.7%
95.2		4	86.75	80.34	93.16	87	82	91	2.016	4.65%	-175.4%

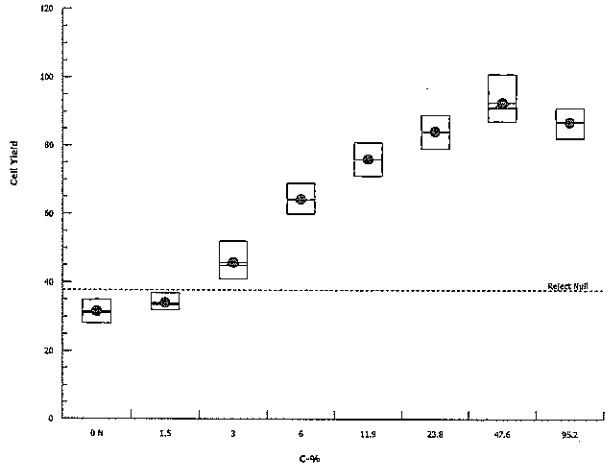
EC Alga Growth Inhibition Test | **Nautilus Environmental**

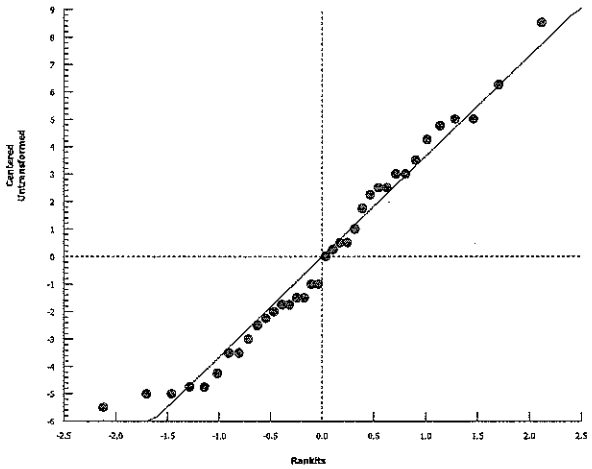
Analysis ID:	06-7659-1513	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:20	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	30	34	29	32	28	30	35	34
1.5		34	33	37	32				
3		44	41	52	46				
6		69	60	62	66				
11.9		71	73	81	79				
23.8		85	89	83	79				
47.6		89	87	101	93				
95.2		91	82	89	85				

Graphics





Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 16481

Start Date: Apr 29/16
Set up by: MLT

Sample Information:

Sample ID: LC DCDS WS 2016-04-26 N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 5x20L.

Test Organism Information:

Culture Date: Apr 22/16
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC141
Stock Solution ID: 15Zn03
Date Initiated: Apr 26/16

72-h IC50 (95% CL): 34.0 (31.2 - 36.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 30.5 (17.4 - 53.5) mg/L Zn CV (%): 32

Test Results:

	Algal Growth
IC25 %(v/v) (95% CL)	>95.2
IC50 %(v/v) (95% CL)	>95.2

Reviewed by: JGu

Date reviewed: May 29/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Teck Coal **Setup by:** MLT

Sample ID: ~~LC~~ DDS WS 2016-04-26.N **Test Date/Time:** Apr 29/16 @ 1500h

Work Order No.: 16481 **Test Species:** *Pseudokirchneriella subcapitata*

Culture Date: Apr 22/16 **Age of Culture:** 7d **Culture Health:** Good

Culture Count: 1 555 2 535 **Average:** 545 **Culture Cell Density (c1):** 545 x 10^4 cells/mL

$v1 = \frac{220{,}000 \text{ cells/ml} \times 100 \text{ ml}}{(c1)\ 545 \times 10^4 \text{ cells/ml}} = 4.04 \text{mL}$

Time Zero Counts: 1 20 2 22 **Average:** 21

No. of Cells/mL: 21 x 10^4 **Initial Density:** # cells/mL + 220 µL x 10 µL = 9545 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.0	23.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
1.5	7.2	23.0	↓	↓	↓	↓	✓	✓	✓	✓
3.0	7.3	23.0					✓	✓	✓	✓
6.0	7.3	23.0					✓	✓	✓	✓
11.9	7.4	23.0					✓	✓	✓	✓
23.8	7.5	23.0					✓	✓	✓	✓
47.6	7.7	23.0					✓	✓	✓	✓
95.2	7.9	23.0	↓	↓	↓	↓	✓	✓	✓	✓
Initials	MLT	MLT	MLT	"	"	MLT	MLT	"	"	MLT

Initial control pH: Well 1: 7.0 Well 2: 7.0

Final control pH: Well 1: 6.8 Well 2: 6.8

Light intensity (lux): 3890 **Date measured:** Apr 29/16

Instruments: Thermometer 4 pH meter 2 Light meter 1

Sample Description: clear, colourless, some debris, odourless

Comments:

Reviewed: Jon **Date reviewed:** May 29/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal Start Date/Time: Apr 29/16 @ 1500h
Work Order #: 16481 Termination Date: May 2/16 @ 1500h
Sample ID: LC/DCDS WS 2016-04-26 N Test set up by: MLT
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	39					MLT
	B	32					
	C	30					
	D	31					
	E	34					
	F	30					
	G	32					
	H	35					
1.5	A	38					
	B	35					
	C	35					
	D	40					
3.0	A	45					
	B	43					
	C	40					
	D	45					
6.0	A	54					
	B	50					
	C	58					
	D	49					
11.9	A	63					
	B	55					
	C	64					
	D	61					
23.8	A	97					
	B	90					
	C	92					
	D	90					
47.6	A	98					
	B	112					
	C	120					
	D	116					
95.2	A	116					
	B	110					
	C	128					
	D	124					

Comments:

Reviewed by: JGL Date Reviewed: May 24/16

Pseudokirchneriella subcapitata Algal Counts

Client:	Teck Coal	Start Date/Time:	29-Apr-16 @ 1500h		
WO#:	16481	Termination Date:	02-May-16 @ 1500h		
Sample ID:	LC DCDS WS 2016-04-26 N				
		Initial Cell Density:	9545 cell/mL		210000
					0.22
					0.01

Concentration % v/v	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		9545.455
Control	A	39				39	38.0	mean	31.9
	B	32				32	31.0	SD	3.044316
	C	30				30	29.0	CV	9.537194
	D	31				31	30.0		
	E	34				34	33.0		
	F	30				30	29.0		
	G	32				32	31.0		
	H	35				35	34.0		
1.5	A	38				38	37.0		
	B	35				35	34.0		
	C	35				35	34.0		
	D	40				40	39.0		
3	A	45				45	44.0		
	B	43				43	42.0		
	C	40				40	39.0		
	D	45				45	44.0		
6	A	54				54	53.0		
	B	50				50	49.0		
	C	58				58	57.0		
	D	49				49	48.0		
11.9	A	63				63	62.0		
	B	55				55	54.0		
	C	64				64	63.0		
	D	61				61	60.0		
23.8	A	97				97	96.0		
	B	90				90	89.0		
	C	92				92	91.0		
	D	90				90	89.0		
47.6	A	98				98	97.0		
	B	112				112	111.0		
	C	120				120	119.0		
	D	116				116	115.0		
95.2	A	116				116	115.0		
	B	110				110	109.0		
	C	128				128	127.0		
	D	124				124	123.0		

JGe
May 24/16

CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	03-6490-0139	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:16	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	11-0367-9767	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:00	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:00	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	13-8345-2068	**Code:**	5275CDA4	**Client:**	Teck Coal
Sample Date:	27 Apr-16 07:58	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	55h (6 °C)	**Station:**	LC DCDS WS 2016-04-26 N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1740523	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.9061	Non-significant Trend in Controls

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>95.2	N/A	N/A	<1.05	NA	NA
IC10	>95.2	N/A	N/A	<1.05	NA	NA
IC15	>95.2	N/A	N/A	<1.05	NA	NA
IC20	>95.2	N/A	N/A	<1.05	NA	NA
IC25	>95.2	N/A	N/A	<1.05	NA	NA
IC40	>95.2	N/A	N/A	<1.05	NA	NA
IC50	>95.2	N/A	N/A	<1.05	NA	NA

Cell Yield Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	8	31.88	29	38	1.076	3.044	9.55%	0.0%
1.5		4	36	34	39	1.225	2.449	6.8%	-12.94%
3		4	42.25	39	44	1.181	2.363	5.59%	-32.55%
6		4	51.75	48	57	2.056	4.113	7.95%	-62.35%
11.9		4	59.75	54	63	2.016	4.031	6.75%	-87.45%
23.8		4	91.25	89	96	1.652	3.304	3.62%	-186.3%
47.6		4	110.5	97	119	4.787	9.574	8.66%	-246.7%
95.2		4	118.5	109	127	4.031	8.062	6.8%	-271.8%

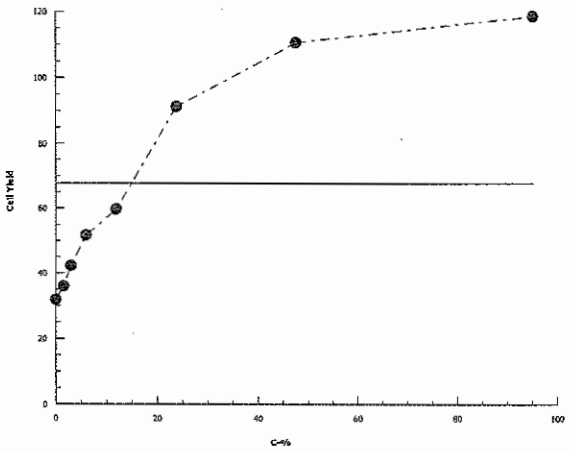
Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	38	31	29	30	33	29	31	34
1.5		37	34	34	39				
3		44	42	39	44				
6		53	49	57	48				
11.9		62	54	63	60				
23.8		96	89	91	89				
47.6		97	111	119	115				
95.2		115	109	127	123				

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	03-6490-0139	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:16	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JCH May 24/16

CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	02-9746-8591	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:16	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	11-0367-9767	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:00	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:00	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	13-8345-2068	**Code:**	5275CDA4	**Client:**	Teck Coal
Sample Date:	27 Apr-16 07:58	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	55h (6 °C)	**Station:**	LC DCDS WS 2016-04-26 N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	24.3%	1.5	3	2.121	66.67

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5	1.345	2.526	7.745	10	0.3801	CDF	Non-Significant Effect
		3*	3.384	2.526	7.745	10	0.0068	CDF	Significant Effect
		6*	6.482	2.526	7.745	10	<0.0001	CDF	Significant Effect
		11.9*	9.092	2.526	7.745	10	<0.0001	CDF	Significant Effect
		23.8*	19.37	2.526	7.745	10	<0.0001	CDF	Significant Effect
		47.6*	25.64	2.526	7.745	10	<0.0001	CDF	Significant Effect
		95.2*	28.25	2.526	7.745	10	<0.0001	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.9061	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	37454.88	5350.696	7	213.5	<0.0001	Significant Effect
Error	701.875	25.06697	28			
Total	38156.75		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	12.53	18.48	0.0844	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.958	0.9166	0.1860	Normal Distribution

Cell Yield Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	8	31.88	29.33	34.42	31	29	38	1.076	9.55%	0.0%
1.5		4	36	32.1	39.9	35.5	34	39	1.225	6.8%	-12.94%
3		4	42.25	38.49	46.01	43	39	44	1.181	5.59%	-32.55%
6		4	51.75	45.21	58.29	51	48	57	2.056	7.95%	-62.35%
11.9		4	59.75	53.34	66.16	61	54	63	2.016	6.75%	-87.45%
23.8		4	91.25	85.99	96.51	90	89	96	1.652	3.62%	-186.3%
47.6		4	110.5	95.27	125.7	113	97	119	4.787	8.66%	-246.7%
95.2		4	118.5	105.7	131.3	119	109	127	4.031	6.8%	-271.8%

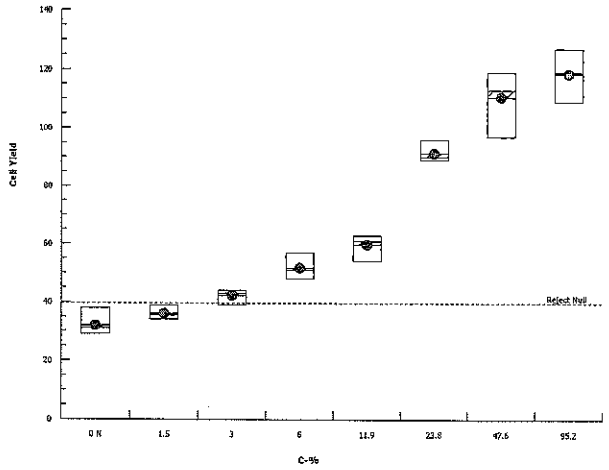
EC Alga Growth Inhibition Test — **Nautilus Environmental**

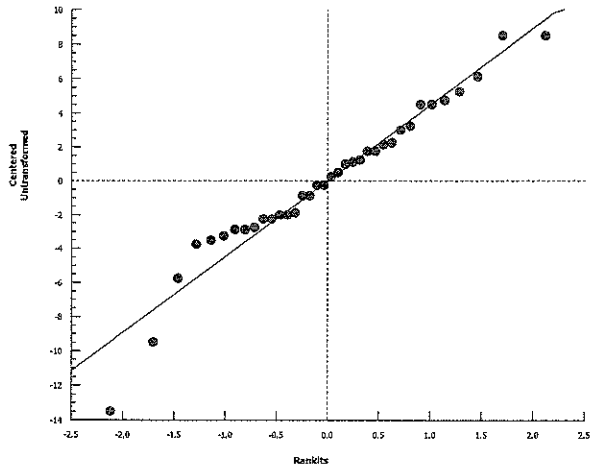
Analysis ID: 02-9746-8591 **Endpoint:** Cell Yield **CETIS Version:** CETISv1.8.7
Analyzed: 11 May-16 10:16 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	38	31	29	30	33	29	31	34
1.5		37	34	34	39				
3		44	42	39	44				
6		53	49	57	48				
11.9		62	54	63	60				
23.8		96	89	91	89				
47.6		97	111	119	115				
95.2		115	109	127	123				

Graphics





Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 16481

Start Date: Apr 29/16
Set up by: MLT

Sample Information:

Sample ID: LC-LC5_WS_2016-04-25_N
Sample Date: April 27/16
Date Received: April 28/16
Sample Volume: 5x20L

Test Organism Information:

Culture Date: April 22/16
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC141
Stock Solution ID: 15Zn03
Date Initiated: April 26/16

72-h IC50 (95% CL): 34.0 (31.2 - 36.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 30.5 (17.4 - 53.5) ug/L Zn CV (%): 32

Test Results:

	Algal Growth
IC25 %(v/v) (95% CL)	>95.2
IC50 %(v/v) (95% CL)	>95.2

Reviewed by: JGL

Date reviewed: May 24/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Teck Coal | **Setup by:** MLT

Sample ID: LC-LC5_WS_2016-04-25_N | **Test Date/Time:** April 29/16 @ 1505h

Work Order No.: 16481 | **Test Species:** *Pseudokirchneriella subcapitata*

Culture Date: April 22/16 | **Age of Culture:** 7d | **Culture Health:** Good

Culture Count: 1 555 2 535 | **Average:** 545 | **Culture Cell Density (c1):** 545 x 10⁴ cells/mL.

$$v1 = \frac{220{,}000 \text{ cells/ml} \times 100 \text{ ml}}{(c1)\ 545 \times 10^4 \text{ cells/ml}} = 4.04 \text{mL}$$

Time Zero Counts: 1 20 2 22 | **Average:** 21

No. of Cells/mL: 21 x 10⁴ | **Initial Density:** # cells/mL ÷ 220 µL x 10 µL = 9545 cells/mL

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.0	23.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
1.5	7.1	23.0	↓	↓	↓	↓	✓	✓	✓	✓
3.0	7.3	23.0					✓	✓	✓	✓
6.0	7.3	23.0					✓	✓	✓	✓
11.9	7.4	23.0					✓	✓	✓	✓
23.8	7.6	23.0					✓	✓	✓	✓
47.6	7.8	23.0					✓	✓	✓	✓
95.2	8.2	23.0	↓	↓	↓	↓	✓	✓	✓	✓
Initials	MLT	MLT	MLT	~	~	MLT	MLT	~	~	MLT

Initial control pH: Well 1: 7.0 | Well 2: 7.0

Final control pH: Well 1: 6.8 | Well 2: 6.8

Light intensity (lux): 3680 | **Date measured:** April 29/16

Instruments: Thermometer 4 | pH meter 2 | Light meter 1

Sample Description: clear, colourless, some debris, odourless

Comments:

Reviewed: JGL | **Date reviewed:** May 24/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal — Start Date/Time: April 29/16 @ 1505h
Work Order #: 16481 — Termination Date: May 2/16 @ 1505h
Sample ID: LC_LC5_WS_2016-04-25_N — Test set up by: ML
%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	36					ML
	B	32					
	C	34					
	D	30					
	E	32					
	F	31					
	G	31					
	H	36					
1.5	A	41					
	B	49					
	C	47					
	D	49					
3.0	A	65					
	B	57					
	C	68					
	D	54					
6.0	A	66					
	B	67					
	C	72					
	D	62					
11.9	A	76					
	B	88					
	C	90					
	D	86					
23.8	A	90					
	B	102					
	C	95					
	D	92					
47.6	A	95					
	B	93					
	C	97					
	D	101					
95.2	A	81					
	B	94					
	C	86					
	D	84					

Comments:

Reviewed by: JGL — Date Reviewed: May 24/16

Pseudokirchneriella subcapitata Algal Counts

Client:	Teck Coal	Start Date/Time:	29-Apr-16 @ 1505h		
WO#:	16481	Termination Date:	02-May-16 @ 1505h		
Sample ID:	LC_LC5_WS_2016-04-25_N				
		Initial Cell Density:	9545 cell/mL		210000
					0.22
					0.01
					9545.455

Concentration % v/v	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		
Control	A	36				36	35.0	mean	31.8
	B	32				32	31.0	SD	2.31455
	C	34				34	33.0	CV	7.2795
	D	30				30	29.0		
	E	32				32	31.0		
	F	31				31	30.0		
	G	31				31	30.0		
	H	36				36	35.0		
1.5	A	41				41	40.0		
	B	49				49	48.0		
	C	47				47	46.0		
	D	49				49	48.0		
3	A	65				65	64.0		
	B	57				57	56.0		
	C	68				68	67.0		
	D	54				54	53.0		
6	A	66				66	65.0		
	B	67				67	66.0		
	C	72				72	71.0		
	D	62				62	61.0		
11.9	A	76				76	75.0		
	B	88				88	87.0		
	C	90				90	89.0		
	D	86				86	85.0		
23.8	A	90				90	89.0		
	B	102				102	101.0		
	C	95				95	94.0		
	D	92				92	91.0		
47.6	A	95				95	94.0		
	B	93				93	92.0		
	C	97				97	96.0		
	D	101				101	100.0		
95.2	A	81				81	80.0		
	B	94				94	93.0		
	C	86				86	85.0		
	D	84				84	83.0		

JGH
May 24/16

CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	13-9666-5271	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:26	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	17-8192-7362	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:05	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:05	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	18-5443-1080	**Code:**	6E885F68	**Client:**	Teck Coal
Sample Date:	27 Apr-16 06:50	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	56h (6.6 °C)	**Station:**	LC_LC5_WS_2016-04-25_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	199506	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.4188	Non-significant Trend in Controls

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>95.2	N/A	N/A	<1.05	NA	NA
IC10	>95.2	N/A	N/A	<1.05	NA	NA
IC15	>95.2	N/A	N/A	<1.05	NA	NA
IC20	>95.2	N/A	N/A	<1.05	NA	NA
IC25	>95.2	N/A	N/A	<1.05	NA	NA
IC40	>95.2	N/A	N/A	<1.05	NA	NA
IC50	>95.2	N/A	N/A	<1.05	NA	NA

Cell Yield Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	8	31.75	29	35	0.8183	2.315	7.29%	0.0%
1.5		4	45.5	40	48	1.893	3.786	8.32%	-43.31%
3		4	60	53	67	3.291	6.583	10.97%	-88.98%
6		4	65.75	61	71	2.056	4.113	6.26%	-107.1%
11.9		4	84	75	89	3.109	6.218	7.4%	-164.6%
23.8		4	93.75	89	101	2.626	5.252	5.6%	-195.3%
47.6		4	95.5	92	100	1.708	3.416	3.58%	-200.8%
95.2		4	85.25	80	93	2.78	5.56	6.52%	-168.5%

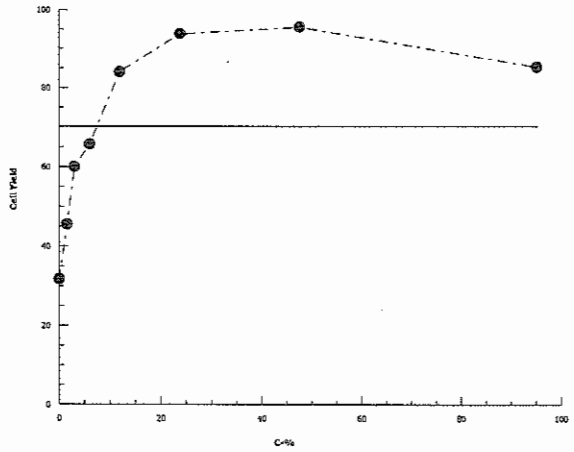
Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	35	31	33	29	31	30	30	35
1.5		40	48	46	48				
3		64	56	67	53				
6		65	66	71	61				
11.9		75	87	89	85				
23.8		89	101	94	91				
47.6		94	92	96	100				
95.2		80	93	85	83				

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	13-9666-5271	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:26	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGL 5/9/16

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	20-9709-2805	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:26	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	17-8192-7362	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:05	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:05	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	18-5443-1080	**Code:**	6E885F68	**Client:**	Teck Coal
Sample Date:	27 Apr-16 06:50	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	56h (6.6 °C)	**Station:**	LC_LC5_WS_2016-04-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C < T	NA	NA	22.3%	<1.5	1.5	NA	>66.67

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		1.5*	4.901	2.526	7.088	10	0.0001	CDF	Significant Effect
		3*	10.07	2.526	7.088	10	<0.0001	CDF	Significant Effect
		6*	12.12	2.526	7.088	10	<0.0001	CDF	Significant Effect
		11.9*	18.62	2.526	7.088	10	<0.0001	CDF	Significant Effect
		23.8*	22.1	2.526	7.088	10	<0.0001	CDF	Significant Effect
		47.6*	22.72	2.526	7.088	10	<0.0001	CDF	Significant Effect
		95.2*	19.07	2.526	7.088	10	<0.0001	CDF	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			0.4188	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	20549	2935.572	7	139.8	<0.0001	Significant Effect
Error	587.75	20.99107	28			
Total	21136.75		35			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	6.384	18.48	0.4957	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9876	0.9166	0.9512	Normal Distribution

Cell Yield Summary

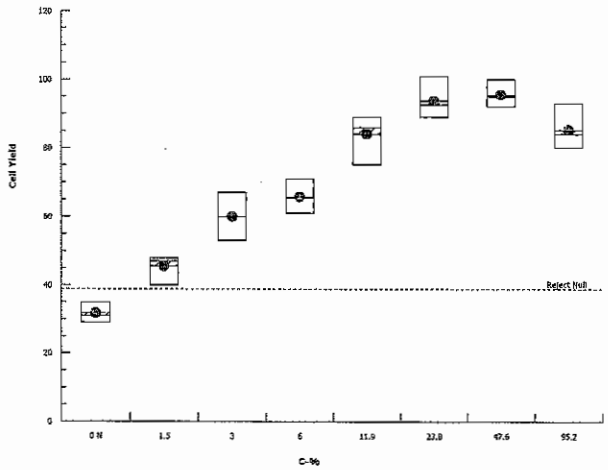
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	8	31.75	29.81	33.69	31	29	35	0.8183	7.29%	0.0%
1.5		4	45.5	39.48	51.52	47	40	48	1.893	8.32%	-43.31%
3		4	60	49.53	70.47	60	53	67	3.291	10.97%	-88.98%
6		4	65.75	59.21	72.29	65.5	61	71	2.056	6.26%	-107.1%
11.9		4	84	74.11	93.89	86	75	89	3.109	7.4%	-164.6%
23.8		4	93.75	85.39	102.1	92.5	89	101	2.626	5.6%	-195.3%
47.6		4	95.5	90.06	100.9	95	92	100	1.708	3.58%	-200.8%
95.2		4	85.25	76.4	94.1	84	80	93	2.78	6.52%	-168.5%

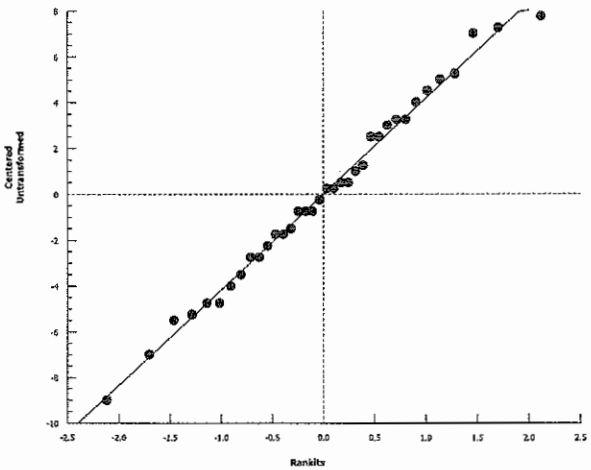
Analysis ID:	20-9709-2805	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	09 May-16 16:26	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	35	31	33	29	31	30	30	35
1.5		40	48	46	48				
3		64	56	67	53				
6		65	66	71	61				
11.9		75	87	89	85				
23.8		89	101	94	91				
47.6		94	92	96	100				
95.2		80	93	85	83				

Graphics





Pseudokirchneriella subcapitata Summary Sheet

Client: Teck Coal
Work Order No.: 16481

Start Date: Apr 29/16
Set up by: MLT

Sample Information:

Sample ID: LC-WTP_OUT_WS_20160427_N
Sample Date: Apr 27/16
Date Received: Apr 28/16
Sample Volume: 5X20L

Test Organism Information:

Culture Date: Apr 22/16
Age of culture (Day 0): 7d

Zinc Reference Toxicant Results:

Reference Toxicant ID: SC141
Stock Solution ID: 15Zn03
Date Initiated: Apr 26/16

72-h IC50 (95% CL): 34.0 (31.2 - 36.6) ug/L Zn

72-h IC50 Reference Toxicant Mean and Range: 30.5 (17.4 - 53.5) ug/L Zn CV (%): 32

Test Results:

	Algal Growth
IC25 %(v/v) (95% CL)	72.7 (64.9 - 82.6)
IC50 %(v/v) (95% CL)	>95.2

Reviewed by: JGL

Date reviewed: May 24/16

72-h Algal Growth Inhibition Toxicity Test
Water Quality Measurements

Client: Teck Coal | Setup by: MH

Sample ID: LC_WTF_OUT_WS_20160427_N | Test Date/Time: April 29/16 @ 1515h

Work Order No.: 16481 | Test Species: *Pseudokirchneriella subcapitata*

Culture Date: April 22/16 | Age of Culture: 7d | Culture Health: Good

Culture Count: 1 555 2 535 | Average: 545 | Culture Cell Density (c1): 545 X104 cells/mL

v1 = 220,000 cells/ml x 100 ml / (c1) 545 X10⁴ cells/ml = 4.04mL

Time Zero Counts: 1 20 2 22 | Average: 21

No. of Cells/mL: 21 X10⁴ | Initial Density: # cells/mL ÷ 220 µL x 10 µL = 9545 cells/mL.

Concentration %(v/v)	Water Quality		Incubator Temperature (°C)				Microplates rotated 2X per day?			
	pH	Temp (°C)								
	0 h	0 h	0 h	24 h	48 h	72 h	0 h	24 h	48 h	72 h
Control	7.0	23.0	25.0	25.0	25.0	25.0	✓	✓	✓	✓
1.5	7.2	23.0	↓	↓	↓	↓	✓	✓	✓	✓
3.0	7.4	23.0					✓	✓	✓	✓
6.0	7.5	23.0					✓	✓	✓	✓
11.9	7.8	23.0					✓	✓	✓	✓
23.8	8.0	23.0					✓	✓	✓	✓
47.6	8.2	23.0					✓	✓	✓	✓
95.2	8.3	23.0	↓	↓	↓	↓	✓	✓	✓	✓
Initials	MH	MH	MH	A	MH	MH	MH	A	A	MH

Initial control pH: Well 1: 7.0 | Well 2: 7.0

Final control pH: Well 1: 6.8 | Well 2: 6.8

Light intensity (lux): 3770 | Date measured: April 22/16

Instruments: Thermometer 4 | pH meter 2 | Light meter 1

Sample Description: clear, colourless, some brown debris, hydrocarbon smell

Comments:

Reviewed: JGL | Date reviewed: May 24/16

Pseudokirchneriella subcapitata Toxicity Test Data Sheet
72-h Algal Cell Counts

Client: Teck Coal Start Date/Time: April 29/16 @ 1515h

Work Order #: 16481 Termination Date: May 2/16 @ 1515h

Sample ID: LC_WTF_OUT_WS_20160427_N Test set up by: MLT

%(v/v)

Concentration	Rep	Count 1	Count 2	Count 3	Count 4	Comments	Initials
Control	A	34					MLT
	B	33					
	C	31					
	D	32					
	E	37					
	F	32					
	G	36					
	H	33					
1.5	A	76					
	B	71					
	C	74					
	D	73					
3.0	A	74					
	B	79					
	C	89					
	D	80					
6.0	A	94					
	B	82					
	C	100					
	D	98					
11.9	A	113					
	B	106					
	C	111					
	D	100					
23.8	A	88					
	B	85					
	C	93					
	D	86					
47.6	A	73					
	B	77					
	C	75					
	D	71					
95.2	A	23					
	B	20					
	C	19					
	D	20					

Comments:

Reviewed by: JGu Date Reviewed: May 24/16

Pseudokirchneriella subcapitata Algal Counts

Client:	Teck Coal	Start Date/Time:	29-Apr-16 @ 1515h
WO#:	16481	Termination Date:	02-May-16 @ 1515h
Sample ID:	LC_WTF_OUT_WS_20160427_N		
		Initial Cell Density:	9545 cell/mL

									210000
									0.22
									0.01
Concentration % v/v	Rep	Count 1 (x 10^4)	Count 2 (x 10^4)	Count 3 (x 10^4)	Count 4 (x 10^4)	Mean (x 10^4)	Cell Yield (x 10^4) cell/mL		9545.455
Control	A	34				34	33.0	mean	32.5
	B	33				33	32.0	SD	2.070197
	C	31				31	30.0	CV	6.36094
	D	32				32	31.0		
	E	37				37	36.0		
	F	32				32	31.0		
	G	36				36	35.0		
	H	33				33	32.0		
1.5	A	76				76	75.0		
	B	71				71	70.0		
	C	74				74	73.0		
	D	73				73	72.0		
3	A	74				74	73.0		
	B	79				79	78.0		
	C	89				89	88.0		
	D	80				80	79.0		
6	A	94				94	93.0		
	B	82				82	81.0		
	C	100				100	99.0		
	D	98				98	97.0		
11.9	A	113				113	112.0		
	B	106				106	105.0		
	C	111				111	110.0		
	D	100				100	99.0		
23.8	A	88				88	87.0		
	B	85				85	84.0		
	C	93				93	92.0		
	D	86				86	85.0		
47.6	A	73				73	72.0		
	B	77				77	76.0		
	C	75				75	74.0		
	D	71				71	70.0		
95.2	A	23				23	22.0		
	B	20				20	19.0		
	C	19				19	18.0		
	D	20				20	19.0		

JCH
May 24/16

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	11-3238-2829	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:24	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	15-6046-3108	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:15	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:15	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	05-4497-8051	**Code:**	207BB483	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:00	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	54h (10.2 °C)	**Station:**	LC_WTF_OUT_WS_20160427_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1464867	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			1.0000	Non-significant Trend in Controls

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	39.36	29.75	53.71	2.541	1.862	3.361
IC10	49.13	45.07	51.66	2.036	1.936	2.219
IC15	51.7	48.99	54.11	1.934	1.848	2.041
IC20	54.4	51.81	56.73	1.838	1.763	1.93
IC25	57.25	54.82	59.64	1.747	1.677	1.824
IC40	66.68	64.74	68.9	1.5	1.451	1.545
IC50	73.81	71.72	76.33	1.355	1.31	1.394

Cell Yield Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	8	32.5	30	36	0.7319	2.07	6.37%	0.0%
1.5		4	72.5	70	75	1.041	2.082	2.87%	-123.1%
3		4	79.5	73	88	3.122	6.245	7.86%	-144.6%
6		4	92.5	81	99	4.031	8.062	8.72%	-184.6%
11.9		4	106.5	99	112	2.901	5.802	5.45%	-227.7%
23.8		4	87	84	92	1.78	3.559	4.09%	-167.7%
47.6		4	73	70	76	1.291	2.582	3.54%	-124.6%
95.2		4	19.5	18	22	0.866	1.732	8.88%	40.0%

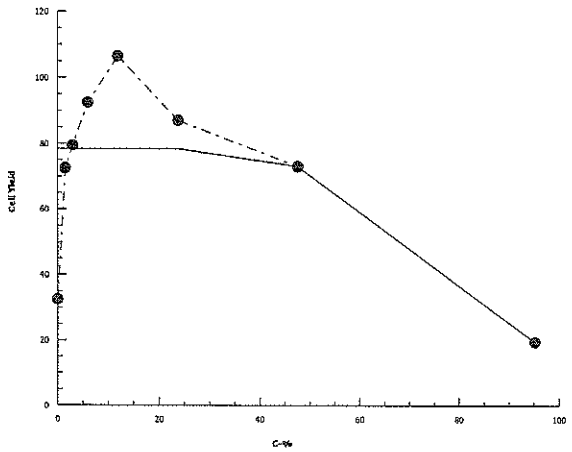
Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	33	32	30	31	36	31	35	32
1.5		75	70	73	72				
3		73	78	88	79				
6		93	81	99	97				
11.9		112	105	110	99				
23.8		87	84	92	85				
47.6		72	76	74	70				
95.2		22	19	18	19				

EC Alga Growth Inhibition Test **Nautilus Environmental**

Analysis ID:	11-3238-2829	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:24	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Analyst:_____ QA: JGH May 24/16

CETIS Analytical Report

EC Alga Growth Inhibition Test — **Nautilus Environmental**

Analysis ID:	00-6106-1758	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:28	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	03-5692-5427	**Test Type:**	Cell Growth	**Analyst:**	Mimi Tran
Start Date:	29 Apr-16 15:15	**Protocol:**	EC/EPS 1/RM/25	**Diluent:**	Deionized Water + nutrients
Ending Date:	02 May-16 15:15	**Species:**	Pseudokirchneriella subcapitata	**Brine:**	
Duration:	72h	**Source:**	In-House Culture	**Age:**	7d
Sample ID:	05-4497-8051	**Code:**	207BB483	**Client:**	Teck Coal
Sample Date:	27 Apr-16 09:00	**Material:**	Water Sample	**Project:**	
Receive Date:	28 Apr-16 10:50	**Source:**	Teck Coal (TECK COAL)		
Sample Age:	54h (10.2 °C)	**Station:**	LC_WTF_OUT_WS_20160427_N		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1056879	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			1.0000	Non-significant Trend in Controls

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	50.68	N/A	53.54	1.973	1.868	NA
IC10	55.48	48.37	59.72	1.803	1.674	2.067
IC15	60.72	53.85	66.74	1.647	1.498	1.857
IC20	66.45	59.58	74.27	1.505	1.346	1.678
IC25	72.71	64.87	82.61	1.375	1.211	1.542
IC40	95.2	84.85	N/A	1.05	NA	1.179
IC50	>95.2	N/A	N/A	<1.05	NA	NA

Cell Yield Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	8	32.5	30	36	0.7319	2.07	6.37%	0.0%
1.5		4	32	32	32	0	0	0.0%	1.54%
3		4	32	32	32	0	0	0.0%	1.54%
6		4	32	32	32	0	0	0.0%	1.54%
11.9		4	32	32	32	0	0	0.0%	1.54%
23.8		4	32	32	32	0	0	0.0%	1.54%
47.6		4	32	32	32	0	0	0.0%	1.54%
95.2		4	19.5	18	22	0.866	1.732	8.88%	40.0%

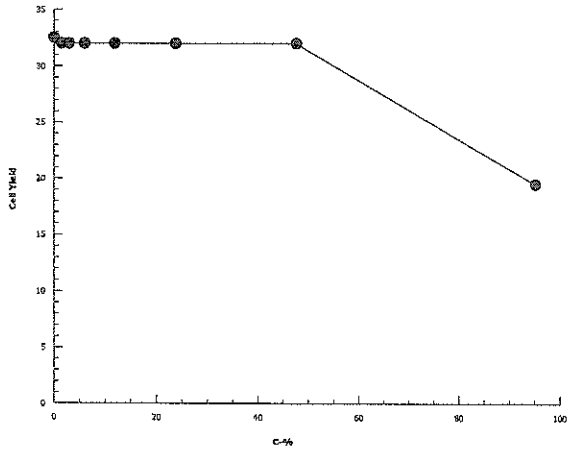
Cell Yield Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0	Negative Control	33	32	30	31	36	31	35	32
1.5		32	32	32	32				
3		32	32	32	32				
6		32	32	32	32				
11.9		32	32	32	32				
23.8		32	32	32	32				
47.6		32	32	32	32				
95.2		22	19	18	19				

EC Alga Growth Inhibition Test | **Nautilus Environmental**

Analysis ID:	00-6106-1758	**Endpoint:**	Cell Yield	**CETIS Version:**	CETISv1.8.7
Analyzed:	11 May-16 10:28	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



APPENDIX E – Analytical Chemistry

All analytical chemistry for Q2 chronic toxicity has been uploaded to EMS.

APPENDIX F – Chain-of-Custody Forms

Teck

COC ID:	20160427-0941	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operation			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Jay Jones			Lab Contact	Krysta Pearcy			Email 1:	jay.jones@teck.com	x	x	
Email	jay.jones@teck.com			Email	Krysta@NautilusEnvironmental.ca			Email 2:	tim.chaia@teck.com	x	x	
Address	Box 2003			Address	8664 commerce Court			Email 3:	teckcoal@equisonline.com			x
	15km North Hwy 43							Email 4:	cait.good@teck.com	x	x	x
City	Sparwood	Province	BC	City	Burnaby	Province	BC	PO number				
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada	PO number				
Phone Number	250-425-6111			Phone Number	604-420-8773							

SAMPLE DETAILS								ANALYSIS REQUESTED											Filtered - F; Field, L: Lab, FL: Field & Lab, N: None
								Bottle #	16479	16481	16482	16474	16483						
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	7-d *C. dubia* dilution series	72-h *P. subcapitata* dilution series	7-d *L. minor* plant growth dilution series	7-d *O. mykiss* development dilution series	30-d *O. mykiss* embryo-alevin (semi-annual) pass/fail						
LC_LC5_WS_2016-04-25_N (1) 5x20L	LC_LC5	WS	N	2016/04/27	06:50	G	5		X	X	X	X							6.6
LC_LCDSSLCC_WS_2016-04-25_N (1) 8x20L	LC_LCDSSLCC	WS	N	2016/04/27	08:18	G	8		X	X	X	X	X						8.0
LC_DC1_WS_2016-04-26_N (1) 5x20L	LC_DC1	WS	N	2016/04/27	08:30	G	5		X	X	X	X							7.5
LC_DCDS_WS_2016-04-26_N (1) 5x20L	LC_DCDS	WS	N	2016/04/27	07:58	G	5		X	X	X	X							6.0
LC_FRDSDC_WS_2016-04-26_N (1) 5x20L	LC_FRDSDC	WS	N	2016/04/27	09:04	G	5		X	X	X	X							8.0

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	T. Phillips/ Nupqu	April 27, 2016	Nautilus NY - Nan Yamamoto	Apr 28/16 @ 10:50.
	G.Abott/ Nupqu			
	J. Jones/ Teck			

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	T. Phillips/ G. Abbott/ J. Jones	Mobile #	(250) 919-0965
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	April 27, 2016
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

sample description
(1) clear, colourless, some debris, odourless

Teck

COC ID:	20160427-Chronic Toxicity	TURNAROUND TIME:	REGULAR	RUSH:	No

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	WLC AWTF			Lab Name	Nautilus Environmental			Report Format / Distribution		Excel	PDF
Project Manager	Thomas Davidson			Lab Contact	Krysta Pearcy			Email 1:	thomas.davidson@teck.com	x	x
Email	Thomas.Davidson@gmail.com			Email	Krysta@NautilusEnvironmental.com			Email 2:	teckcoal@equisonline.com		
Address	15 Km North HWY 43			Address	8664 commerce Court			Email 3:	tmckenna@epcor.com	x	x
								Email 4:	greg.ross@teck.com	x	x
City	Sparwood	Province	BC	City	Burnaby	Province	BC	Email 5:	Colin.Lynch@teck.com		
Postal Code	V0B 2G0	Country	Canada	Postal Code	V5A 4N7	Country	Canada				
Phone Number	250.603.9417			Phone Number	604-420-8773			PO 411634			

SAMPLE DETAILS								ANALYSIS REQUESTED												Filtered - F: Field, L: Lab, FL: Field & Lab, N: None
								FIL	N	N										
								PRESERV	N	N										
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	NAUT_Chronic Toxicity Test	7-d C.dubia dilution	72-h P.subcapitata dilution	7-d Luminescence dilution	7-d embryo dilution							
LC_WTF_OUT_WS_20160427_N (1)	LC_WTF_OUT	WS	N	27-Apr-16	0900	G	5		X	X	X	X	X						10.2 °C	
										WO# 164479	164481	164482	164474							

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
			Nautilus NY - Nan Yamamoto	Apr 28/16 @ 10:50

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	X	Sampler's Name	Jocelyn Traverse	Mobile #	
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	Jocelyn Traverse	Date/Time	27-April-16
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Sample description: (1) clear, colourless, some brown debris, hydrocarbon smell

~~clear, no precipitate, no particulate, odourless~~

Teck

COC ID:	Dec Monthly East	TURNAROUND TIME:	regular	RUSH:	

PROJECT/CLIENT INFO

Facility Name	Greenhills Operations
Project Manager	Leigh Stickney
Email	leigh.stickney@teck.com
Address	PO Box 5000
City	Elkford — Province: BC
Postal Code	V0B 1H0 — Country: Canada
Phone Number	250 865 3274

LABORATORY

Lab Name	Nautilus Environmental
Lab Contact	Krysta Pearcy
Email	
Address	8664 Commence Court Imperial Square Lake City
City	Burnaby — Province: BC
Postal Code	V5A 4N7 — Country: Can
Phone Number	

OTHER INFO

EDD delivery:	
Site:	leigh.stickney@teck.com — EQuIS: GHO
Report Format / Distribution	Yes PDF — Yes Excel
Email 1:	leigh.stickney@teck.com
Email 2:	jim.thorner@teck.com
Email 3:	Zahir.jina@teck.com
PO number	359182

SAMPLE DETAILS / ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, F/P)

	Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fial)	48 hr daphnia @ 10 deg C (pass/fial)	7 day C dubia pass fail	7day embryo (pass Fail)	72 hr P Subcapitata pass fail	30 day RT early life stage pass fail	28 day H azteca P/F	30-d FHM pf (conducted in Calgary)			Temp
									#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X20	GH_ER2_WS_2016_04_27_N (2)	GH_ER2	WS	N	27-Apr		G	6				X	X	X	X					8.0
X20	GH_FR1_WS_2016_04_27_N (1)	GH_FR1	WS	N	27-Apr	14:06	G	4				X		X	X	X	X			7.8
X20	GH_ERC_WS_2016_04_27_N (1)	GH_ERC	WS	N	27-Apr		G	3				X		X	X					8.0
											WO#	16478	16475	16480	16473	16476	16477			

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Jevin Wohlgemuth	April 27/16	14:30	Nautilus NY - Wan Yamamoto	Apr 28/16	10:50

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X	Sampler's Name	Jevin Wohlgemuth	Mobile #	250 425 9352
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature	[signature]	Date/Time	April 27/16 14:30
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Sample description

(2) clear, no precipitate or particulate, odourless, colourless

(1) clear, no precipitate, some particulate, odourless, colourless

APPENDIX C

Concentration-Response Analysis

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	Mean Survival	Mean Reproduction (Control Normalized)	ACIDITY TO pH 8.3 (As CaCO3)-N-mg/l	ALKALINITY, BICARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, CARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, HYDROXIDE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, TOTAL (As CaCO3), lab measured.-N-mg/l
References									
2015	Q1	Reference (FR_UFR1)	100	103	< 1.0	147	2.30	< 1.0	149
2015	Q1	Reference (FR_UFR1)	100	92.7	< 1.0	147	2.30	< 1.0	149
2015	Q1	Reference (FR_UFR1)	100	102	< 1.0	144	1.30	< 1.0	145
2015	Q2	Reference (FR_UFR1)	100	92.3	< 1.0	116	2.80	< 1.0	119
2015	Q3	Reference (FR_UFR1)	100	106	< 1.0	152	7.40	< 1.0	159
2015	Q4	Reference (FR_UFR1)	100	99.5	< 1.0	138	7.60	< 1.0	146
2015	Q2	Reference (GH_ER2)	100	93.2	< 1.0	151	6.20	< 1.0	157
2015	Q4	Reference (GH_ER2)	100	97.5	< 1.0	147	< 1.0	< 1.0	147
2016	Q1	Reference (FR_UFR1)	100	102	< 1.0	138	< 1.0	< 1.0	138
2016	Q2	Reference (FR_UFR1)	100	97.8	< 1.0	110	< 1.0	< 1.0	110
2016	Q3	Reference (FR_UFR1)	100	98.9	< 1.0	160	< 1.0	< 1.0	160
2016	Q4	Reference (FR_UFR1)	100	92.0	< 1.0	141	< 1.0	< 1.0	141
2016	Q2	Reference (GH_ER2)	90.0	74.0	< 1.0	143	< 1.0	< 1.0	143
2016	Q4	Reference (GH_ER2)	100	94.7	< 1.0	143	< 1.0	< 1.0	143
Tests that were not statistically different than reference									
2015	Q1	CM_MC2	100	87.4	1.80	205	8.40	1.00	213
2015	Q3	CM_MC2	100	104	1.00	188	10.6	1.00	198
2015	Q1	EV_HC1	100	96.7	1.00	131	4.30	1.00	135
2015	Q2	EV_HC1	100	97.3	1.30	103	6.73	1.00	110
2015	Q3	EV_HC1	100	123	1.00	182	9.80	1.00	192
2015	Q4	EV_HC1	100	106	1.00	187	8.00	1.00	195
2015	Q1	EV_MC2	100	96.0	3.40	193	1.00	1.00	193
2015	Q2	EV_MC2	100	90.1	1.60	112	3.70	1.00	116
2015	Q3	EV_MC2	100	114	3.20	194	1.00	1.00	194
2015	Q4	EV_MC2	100	98.5	3.00	193	1.00	1.00	193
2015	Q2	FR_FRCP1	100	93.7	1.00	142	5.00	1.00	147
2015	Q3	FR_FRCP1	100	119	1.00	187	11.2	1.00	198
2015	Q1	GH_ERC	90.0	96.4	2.60	155	1.00	1.00	155
2015	Q2	GH_ERC	100	90.5	1.00	157	4.80	1.00	161
2015	Q3	GH_ERC	100	100.0	1.00	142	1.00	1.00	142
2015	Q4	GH_ERC	100	107	1.00	151	1.00	1.00	151
2015	Q1	GH_FR1	100	99.1	1.70	202	1.00	1.00	202
2015	Q2	GH_FR1	100	103	1.00	159	8.00	1.00	167
2015	Q3	GH_FR1	100	114	1.00	174	8.20	1.00	182
2015	Q4	GH_FR1	100	111	1.00	183	4.80	1.00	188
2015	Q1	LC_LCDSSLCC	100	97.8	1.00	193	2.70	1.00	195
2015	Q3	LC_LCDSSLCC	100	107	1.00	171	10.0	1.00	181
2015	Q4	LC_LCDSSLCC	100	79.5	< 1.0	197	< 1.0	< 1.0	197
2016	Q1	EV_HC1	100	101	< 1.0	191	< 1.0	< 1.0	191
2016	Q3	EV_HC1	100	88.9	< 1.0	192	< 1.0	< 1.0	192
2016	Q4	EV_HC1	100	88.0	< 1.0	190	2.00	< 1.0	192
2016	Q1	EV_MC2	100	97.9	3.50	179	< 1.0	< 1.0	179
2016	Q3	EV_MC2	100	95.8	1.60	204	< 1.0	< 1.0	204
2016	Q1	GH_ERC	90.0	90.4	< 1.0	152	< 1.0	< 1.0	152
2016	Q3	GH_ERC	100	95.0	1.10	144	< 1.0	< 1.0	144
2016	Q4	GH_ERC	100	84.0	< 1.0	148	< 1.0	< 1.0	148
2016	Q1	GH_FR1	80.0	82.1	< 1.0	190	< 1.0	< 1.0	190
2016	Q3	GH_FR1	100	100	< 1.0	198	< 1.0	< 1.0	198
2016	Q4	GH_FR1	100	82.7	<1	188	<1	<1	188
2016	Q1	LC_LCDSSLCC	100	97.9	< 1.0	193	< 1.0	< 1.0	193
2016	Q3	LC_LCDSSLCC	100	83.2	1.10	187	< 1.0	< 1.0	187
2016	Q4	LC_LCDSSLCC	100	94.2	< 1.0	174	2.20	< 1.0	176
Tests with significant results (2015)									
2015	Q2	CM_MC2	100	55.0	1.00	143	4.90	1.00	148
2015	Q4	CM_MC2	100	61.5	1.00	209	6.40	1.00	215
2015	Q1	FR_FRCP1	90.0	47.1	5.10	337	1.00	1.00	337
2015	Q4	FR_FRCP1	100	50.5	1.00	211	1.00	1.00	211
2015	Q2	LC_LCDSSLCC	100	81.5	1.00	144	5.50	1.00	150
Tests with significant results (2016)									
2016	Q1	CM_MC2	100	86.7	< 1.0	199	7.00	< 1.0	206
2016	Q2	CM_MC2	100	42.7	1.10	152	< 1.0	< 1.0	152
2016	Q3	CM_MC2	100	72.9	< 1.0	193	8.80	< 1.0	201
2016	Q4	CM_MC2	100	68.0	< 1.0	165	< 1.0	< 1.0	165
2016	Q2	EV_HC1	90.0	79.3	< 1.0	173	6.00	< 1.0	179
2016	Q2	EV_MC2	100	77.1	1.40	98.0	< 1.0	< 1.0	98.0
2016	Q4	EV_MC2	100	66.2	1.10	122	< 1.0	< 1.0	122
2016	Q1	FR_FRCP1	90.0	53.3	2.20	254	< 1.0	< 1.0	254
2016	Q2	FR_FRCP1	100	80.2	< 1.0	147	< 1.0	< 1.0	147
2016	Q3	FR_FRCP1	100	67.2	< 1.0	193	4.80	< 1.0	198
2016	Q4	FR_FRCP1	100	62.7	< 1.0	190	3.40	< 1.0	193
2016	Q2	GH_ERC	100	77.1	< 1.0	146	< 1.0	< 1.0	146
2016	Q2	GH_FR1	90.0	74.4	< 1.0	160	< 1.0	< 1.0	160
2016	Q2	LC_LCDSSLCC	100	67.4	< 1.0	153	< 1.0	< 1.0	153

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	ALUMINUM-D-mg/l	ALUMINUM-T-mg/l	ANTIMONY-D-mg/l	ANTIMONY-T-mg/l	ARSENIC-D-mg/l	ARSENIC-T-mg/l	BARIUM-D-mg/l
References									
2015	Q1	Reference (FR_UFR1)	< 0.0030	0.0032	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0773
2015	Q1	Reference (FR_UFR1)	< 0.0030	0.0032	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0773
2015	Q1	Reference (FR_UFR1)	< 0.0030	0.0059	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0752
2015	Q2	Reference (FR_UFR1)	0.0092	0.0832	< 0.00010	< 0.00010	0.00012	0.00014	0.0422
2015	Q3	Reference (FR_UFR1)	< 0.0030	0.0078	< 0.00010	< 0.00010	0.00011	0.00012	0.0757
2015	Q4	Reference (FR_UFR1)	< 0.0030	0.0046	< 0.00010	< 0.00010	< 0.00010	0.00010	0.0741
2015	Q2	Reference (GH_ER2)	< 0.0030	0.0761	< 0.00010	< 0.00010	0.00011	0.00016	0.0462
2015	Q4	Reference (GH_ER2)	< 0.0030	0.0046	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0466
2016	Q1	Reference (FR_UFR1)	< 0.0030	0.0048	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.074
2016	Q2	Reference (FR_UFR1)	0.0147	0.113	< 0.00010	< 0.00010	0.00011	0.00014	0.0396
2016	Q3	Reference (FR_UFR1)	< 0.0030	0.0128	< 0.00010	< 0.00010	< 0.00010	0.00010	0.0737
2016	Q4	Reference (FR_UFR1)	0.0111	0.0509	< 0.00010	< 0.00010	< 0.00010	0.00015	0.0685
2016	Q2	Reference (GH_ER2)	0.0036	0.201	< 0.00010	< 0.00010	0.00011	0.00024	0.0417
2016	Q4	Reference (GH_ER2)	< 0.0030	0.0075	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0421
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.0097	0.032	0.00017	0.00019	0.00017	0.00022	0.072
2015	Q3	CM_MC2	0.0030	0.016	0.00018	0.00021	0.00019	0.00021	0.0689
2015	Q1	EV_HC1	0.0030	0.00903	0.00010	0.000103	0.00013	0.000143	0.0413
2015	Q2	EV_HC1	0.00317	0.0499	0.00010	0.00010	0.00013	0.00016	0.0246
2015	Q3	EV_HC1	0.0049	0.0344	0.00010	0.00011	0.00017	0.00024	0.0584
2015	Q4	EV_HC1	0.0030	0.0058	0.00010	0.00012	0.00014	0.00015	0.0596
2015	Q1	EV_MC2	0.0037	0.0185	0.00010	0.00010	0.00015	0.00018	0.108
2015	Q2	EV_MC2	0.0070	0.361	0.00010	0.00011	0.00018	0.00033	0.0623
2015	Q3	EV_MC2	0.0030	0.0085	0.00041	0.00044	0.00016	0.00023	0.102
2015	Q4	EV_MC2	0.0030	0.0056	0.00035	0.00038	0.00014	0.00019	0.111
2015	Q2	FR_FRCP1	0.0030	0.0725	0.00022	0.00022	0.00010	0.00015	0.0639
2015	Q3	FR_FRCP1	0.0030	0.0217	0.00027	0.00033	0.00010	0.00019	0.0757
2015	Q1	GH_ERC	0.0030	0.0281	0.00010	0.00012	0.00010	0.00015	0.0551
2015	Q2	GH_ERC	0.0030	0.133	0.00010	0.00010	0.00010	0.00017	0.0496
2015	Q3	GH_ERC	0.0030	0.0834	0.00010	0.00010	0.00010	0.00017	0.0462
2015	Q4	GH_ERC	0.0030	0.0070	0.00010	0.00010	0.00010	0.00010	0.0576
2015	Q1	GH_FR1	0.0030	0.0048	0.00014	0.00014	0.00010	0.00014	0.124
2015	Q2	GH_FR1	0.0030	0.0526	0.00017	0.00017	0.00010	0.00014	0.0845
2015	Q3	GH_FR1	0.0030	0.0132	0.00022	0.00025	0.00014	0.00020	0.098
2015	Q4	GH_FR1	0.0030	0.0040	0.00011	0.00015	0.00010	0.00014	0.117
2015	Q1	LC_LCDSSLCC	0.0030	0.0052	0.00022	0.00022	0.00011	0.00013	0.0956
2015	Q3	LC_LCDSSLCC	0.0030	0.013	0.00019	0.00026	0.00010	0.00011	0.0604
2015	Q4	LC_LCDSSLCC	< 0.0050	< 0.015	< 0.00050	< 0.00050	< 0.00050	< 0.00050	0.0845
2016	Q1	EV_HC1	< 0.0030	0.0096	< 0.00010	< 0.00010	0.00015	0.00016	0.0672
2016	Q3	EV_HC1	0.0139	0.0725	< 0.00010	< 0.00010	0.00016	0.00021	0.0645
2016	Q4	EV_HC1	0.0054	0.0755	< 0.00010	0.00010	0.00015	0.00019	0.0595
2016	Q1	EV_MC2	< 0.0030	0.031	0.00025	0.00025	0.00013	0.00016	0.111
2016	Q3	EV_MC2	< 0.0030	0.0054	0.00021	0.00022	0.00018	0.00018	0.10
2016	Q1	GH_ERC	< 0.0030	0.0031	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0668
2016	Q3	GH_ERC	< 0.0030	0.0206	< 0.00010	< 0.00010	< 0.00010	0.00011	0.0494
2016	Q4	GH_ERC	< 0.0030	0.0189	< 0.00010	< 0.00010	< 0.00010	0.00012	0.0554
2016	Q1	GH_FR1	< 0.0030	0.0040	0.00012	0.00014	< 0.00010	< 0.00010	0.118
2016	Q3	GH_FR1	< 0.0030	0.0079	0.00013	0.00014	< 0.00010	0.00012	0.101
2016	Q4	GH_FR1	<0.003	0.012	0.00015	0.00034	<0.0001	0.000135	0.101
2016	Q1	LC_LCDSSLCC	< 0.0030	0.0074	0.00020	0.00025	< 0.00010	0.00013	0.0864
2016	Q3	LC_LCDSSLCC	< 0.0030	0.0047	0.00021	0.00024	< 0.00010	0.00011	0.0719
2016	Q4	LC_LCDSSLCC	< 0.0030	0.0056	0.00019	0.00026	< 0.00010	0.00020	0.0554
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.0044	0.314	0.00012	0.00013	0.00017	0.00031	0.0436
2015	Q4	CM_MC2	0.0030	0.0054	0.00013	0.00013	0.00018	0.00022	0.0902
2015	Q1	FR_FRCP1	0.0030	0.0060	0.00048	0.00051	0.00020	0.00022	0.0355
2015	Q4	FR_FRCP1	0.0030	0.0035	0.00025	0.00026	0.00010	0.00010	0.0804
2015	Q2	LC_LCDSSLCC	0.0030	0.0163	0.00015	0.00017	0.00011	0.00014	0.0414
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 0.0030	0.0122	0.00018	0.00018	0.00015	0.00021	0.0771
2016	Q2	CM_MC2	0.0076	0.344	0.00014	0.00015	0.00017	0.00029	0.050
2016	Q3	CM_MC2	< 0.0030	0.0053	0.00019	0.00025	0.00019	0.00020	0.077
2016	Q4	CM_MC2	0.0088	0.149	0.00014	0.00016	0.00017	0.00026	0.054
2016	Q2	EV_HC1	0.0046	0.151	< 0.00010	0.00013	0.00013	0.00024	0.0379
2016	Q2	EV_MC2	0.0176	0.419	< 0.00010	0.00020	0.00017	0.00037	0.0579
2016	Q4	EV_MC2	0.0234	0.225	< 0.00010	0.00011	0.00019	0.00027	0.0737
2016	Q1	FR_FRCP1	< 0.0030	< 0.0030	0.00027	0.00030	< 0.00010	0.00010	0.0747
2016	Q2	FR_FRCP1	< 0.0030	0.106	0.00018	0.00025	< 0.00010	0.00016	0.0645
2016	Q3	FR_FRCP1	< 0.0030	0.0144	0.00020	0.00022	< 0.00010	0.00012	0.071
2016	Q4	FR_FRCP1	0.0046	0.0148	0.00019	0.00020	< 0.00010	0.00018	0.0718
2016	Q2	GH_ERC	0.0045	0.305	< 0.00010	0.00011	< 0.00010	0.00030	0.0506
2016	Q2	GH_FR1	< 0.0030	0.0895	0.00017	0.00023	0.00011	0.00017	0.0792
2016	Q2	LC_LCDSSLCC	< 0.0030	0.0288	0.00024	0.00033	0.00012	0.00015	0.0369

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	BARIUM-T-mg/l	BERYLLIUM-D-mg/l	BERYLLIUM-T-mg/l	BISMUTH-D-mg/l	BISMUTH-T-mg/l	BORON-D-mg/l	BORON-T-mg/l
References									
2015	Q1	Reference (FR_UFR1)	0.0771	< 0.00010	< 0.00010	< 0.00050	< 0.00050	< 0.010	< 0.010
2015	Q1	Reference (FR_UFR1)	0.0771	< 0.00010	< 0.00010	< 0.00050	< 0.00050	< 0.010	< 0.010
2015	Q1	Reference (FR_UFR1)	0.0778	< 0.00010	< 0.00010	< 0.00050	< 0.00050	< 0.010	< 0.010
2015	Q2	Reference (FR_UFR1)	0.043	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2015	Q3	Reference (FR_UFR1)	0.0755	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2015	Q4	Reference (FR_UFR1)	0.0746	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2015	Q2	Reference (GH_ER2)	0.0476	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2015	Q4	Reference (GH_ER2)	0.0485	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q1	Reference (FR_UFR1)	0.0734	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q2	Reference (FR_UFR1)	0.0419	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q3	Reference (FR_UFR1)	0.0766	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q4	Reference (FR_UFR1)	0.064	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q2	Reference (GH_ER2)	0.0438	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q4	Reference (GH_ER2)	0.0376	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.0722	0.00010	0.00010	0.00050	0.00050	0.024	0.025
2015	Q3	CM_MC2	0.0693	0.00010	0.00010	0.000050	0.000050	0.027	0.029
2015	Q1	EV_HC1	0.0422	0.00010	0.00010	0.00050	0.00050	0.010	0.010
2015	Q2	EV_HC1	0.025	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q3	EV_HC1	0.0586	0.00010	0.00010	0.000050	0.000050	0.010	0.011
2015	Q4	EV_HC1	0.0628	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q1	EV_MC2	0.111	0.00010	0.00010	0.00050	0.00050	0.014	0.016
2015	Q2	EV_MC2	0.067	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q3	EV_MC2	0.101	0.00010	0.00010	0.000050	0.000050	0.016	0.018
2015	Q4	EV_MC2	0.111	0.00010	0.00010	0.000050	0.000050	0.016	0.016
2015	Q2	FR_FRCP1	0.0648	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q3	FR_FRCP1	0.0764	0.00010	0.00010	0.000050	0.000050	0.013	0.014
2015	Q1	GH_ERC	0.0561	0.00010	0.00010	0.00050	0.00050	0.010	0.010
2015	Q2	GH_ERC	0.0507	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q3	GH_ERC	0.0487	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q4	GH_ERC	0.060	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q1	GH_FR1	0.126	0.00010	0.00010	0.00050	0.00050	0.012	0.010
2015	Q2	GH_FR1	0.087	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q3	GH_FR1	0.0996	0.00010	0.00010	0.000050	0.000050	0.010	0.011
2015	Q4	GH_FR1	0.116	0.00010	0.00010	0.000050	0.000050	0.010	0.011
2015	Q1	LC_LCDSSLCC	0.0929	0.00010	0.00010	0.00050	0.00050	0.013	0.014
2015	Q3	LC_LCDSSLCC	0.0627	0.00010	0.00010	0.000050	0.000050	0.012	0.013
2015	Q4	LC_LCDSSLCC	0.0912	< 0.00050	< 0.00050	< 0.00025	< 0.00025	< 0.050	< 0.050
2016	Q1	EV_HC1	0.0654	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q3	EV_HC1	0.0659	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q4	EV_HC1	0.0599	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q1	EV_MC2	0.109	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.013	0.013
2016	Q3	EV_MC2	0.10	< 0.000020	< 0.000020	< 0.000050	< 0.000050	0.017	0.018
2016	Q1	GH_ERC	0.066	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q3	GH_ERC	0.050	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q4	GH_ERC	0.0509	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q1	GH_FR1	0.111	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q3	GH_FR1	0.102	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q4	GH_FR1	0.0972	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01
2016	Q1	LC_LCDSSLCC	0.0887	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.012	0.013
2016	Q3	LC_LCDSSLCC	0.0662	< 0.000020	< 0.000020	< 0.000050	< 0.000050	0.013	0.012
2016	Q4	LC_LCDSSLCC	0.0526	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	0.010
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.0456	0.00010	0.00010	0.000050	0.000050	0.014	0.015
2015	Q4	CM_MC2	0.0916	0.00010	0.00010	0.000050	0.000050	0.026	0.027
2015	Q1	FR_FRCP1	0.0373	0.00020	0.00020	0.0010	0.0010	0.020	0.020
2015	Q4	FR_FRCP1	0.0781	0.00010	0.00010	0.000050	0.000050	0.011	0.016
2015	Q2	LC_LCDSSLCC	0.0421	0.00010	0.00010	0.000050	0.000050	0.010	0.010
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.0754	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.026	0.026
2016	Q2	CM_MC2	0.0518	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.016	0.017
2016	Q3	CM_MC2	0.0754	< 0.000020	< 0.000020	< 0.000050	< 0.000050	0.028	0.029
2016	Q4	CM_MC2	0.0566	< 0.000020	< 0.000020	< 0.000050	< 0.000050	0.018	0.020
2016	Q2	EV_HC1	0.0402	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q2	EV_MC2	0.0629	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q4	EV_MC2	0.0812	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q1	FR_FRCP1	0.0745	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.010	0.011
2016	Q2	FR_FRCP1	0.0676	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q3	FR_FRCP1	0.0727	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	0.011
2016	Q4	FR_FRCP1	0.0673	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q2	GH_ERC	0.0525	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q2	GH_FR1	0.0779	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010
2016	Q2	LC_LCDSSLCC	0.0384	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	0.011

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	BROMIDE-D-mg/l	CADMIUM-D-mg/l	CADMIUM-T-mg/l	CALCIUM-D-mg/l	CALCIUM-T-mg/l	CARBON, DISSOLVED ORGANIC-D-mg/l	CHLORIDE-D-mg/l
References									
2015	Q1	Reference (FR_UFR1)	< 0.050	< 0.000010	0.000011	55.6	55.6	0.84	< 1.0
2015	Q1	Reference (FR_UFR1)	< 0.050	< 0.000010	0.000011	55.6	55.6	0.84	< 1.0
2015	Q1	Reference (FR_UFR1)	< 0.050	0.000011	< 0.000010	55.9	57.0	< 0.50	< 1.0
2015	Q2	Reference (FR_UFR1)	< 0.050	0.0000074	0.000013	37.0	37.5	1.84	< 1.0
2015	Q3	Reference (FR_UFR1)	< 0.050	0.0000057	0.0000083	54.1	55.1	0.75	1.00
2015	Q4	Reference (FR_UFR1)	< 0.050	< 0.0000050	0.0000083	53.5	55.6	0.60	< 1.0
2015	Q2	Reference (GH_ER2)	< 0.050	< 0.0000050	0.0000155	46.7	48.2	0.84	1.00
2015	Q4	Reference (GH_ER2)	< 0.050	0.0000053	0.0000069	50.2	51.2	0.61	1.20
2016	Q1	Reference (FR_UFR1)	< 0.050	0.0000054	0.0000062	57.1	58.0	< 0.50	1.10
2016	Q2	Reference (FR_UFR1)	< 0.050	0.0000062	0.0000159	35.0	36.6	2.49	< 0.10
2016	Q3	Reference (FR_UFR1)	< 0.050	0.0000055	0.0000108	49.3	51.1	0.86	0.13
2016	Q4	Reference (FR_UFR1)	< 0.050	0.0000057	0.0000058	50.0	48.0	1.06	0.18
2016	Q2	Reference (GH_ER2)	< 0.050	0.0000076	0.0000247	47.1	48.0	1.40	0.61
2016	Q4	Reference (GH_ER2)	< 0.050	< 0.0000050	0.0000079	47.6	47.8	0.64	0.36
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.10	0.000022	0.000023	105	106	0.93	3.40
2015	Q3	CM_MC2	0.10	0.0000099	0.0000182	102	104	0.86	2.10
2015	Q1	EV_HC1	0.050	0.000017	0.0000163	60.0	60.4	0.823	1.47
2015	Q2	EV_HC1	0.050	0.0000131	0.0000212	47.5	47.1	1.09	1.30
2015	Q3	EV_HC1	0.050	0.0000172	0.0000249	81.7	74.5	1.08	1.40
2015	Q4	EV_HC1	0.25	0.0000128	0.0000182	92.1	92.5	0.63	1.80
2015	Q1	EV_MC2	0.050	0.000055	0.000044	94.6	90.7	1.65	11.4
2015	Q2	EV_MC2	0.050	0.0000179	0.0000644	43.4	44.3	1.90	2.90
2015	Q3	EV_MC2	0.10	0.0000492	0.0000557	94.6	86.8	1.04	9.60
2015	Q4	EV_MC2	0.25	0.0000365	0.0000469	102	102	0.60	8.70
2015	Q2	FR_FRCP1	0.050	0.0000304	0.0000496	73.4	73.0	1.56	1.20
2015	Q3	FR_FRCP1	0.10	0.0000376	0.0000474	107	109	0.93	1.50
2015	Q1	GH_ERC	0.050	0.000010	0.000010	54.7	55.2	0.64	1.00
2015	Q2	GH_ERC	0.050	0.0000070	0.0000218	51.9	53.3	0.96	1.00
2015	Q3	GH_ERC	0.050	0.0000059	0.0000163	46.8	49.4	0.75	1.00
2015	Q4	GH_ERC	0.050	0.0000050	0.0000073	55.7	57.7	0.50	1.20
2015	Q1	GH_FR1	0.10	0.000021	0.000024	112	114	1.06	2.60
2015	Q2	GH_FR1	0.050	0.0000213	0.0000346	79.0	81.2	1.36	1.40
2015	Q3	GH_FR1	0.050	0.0000185	0.0000213	88.8	89.8	0.87	1.60
2015	Q4	GH_FR1	0.25	0.0000147	0.0000235	105	106	0.50	1.70
2015	Q1	LC_LCDSSLCC	0.10	0.000086	0.000109	126	123	1.14	2.70
2015	Q3	LC_LCDSSLCC	0.10	0.000245	0.000256	87.6	92.0	0.83	2.00
2015	Q4	LC_LCDSSLCC	< 0.050	0.000243	0.000261	116	117	0.74	2.22
2016	Q1	EV_HC1	< 0.25	0.0000173	0.0000186	96.0	94.6	0.65	2.10
2016	Q3	EV_HC1	< 0.050	0.0000159	0.0000271	78.1	80.6	0.95	1.05
2016	Q4	EV_HC1	< 0.25	0.0000192	0.0000236	79.2	81.6	1.36	1.27
2016	Q1	EV_MC2	< 0.25	0.0000353	0.0000364	97.4	94.1	0.85	9.20
2016	Q3	EV_MC2	< 0.25	0.0000661	0.0000691	106	111	0.83	13.4
2016	Q1	GH_ERC	< 0.050	< 0.0000050	0.0000065	67.1	66.7	< 0.50	1.30
2016	Q3	GH_ERC	< 0.050	< 0.0000050	0.0000053	46.2	44.7	0.58	0.37
2016	Q4	GH_ERC	< 0.050	< 0.0000050	< 0.0000050	54.9	50.6	< 0.50	0.44
2016	Q1	GH_FR1	< 0.25	0.0000144	0.0000175	119	119	0.51	2.50
2016	Q3	GH_FR1	< 0.25	0.0000154	0.000016	88.6	89.1	0.80	1.49
2016	Q4	GH_FR1	<0.25	0.0000173	0.0000209	93.4	93.7	0.745	1.48
2016	Q1	LC_LCDSSLCC	< 0.25	0.0000828	0.0000763	134	134	< 0.50	17.3
2016	Q3	LC_LCDSSLCC	< 0.25	0.000174	0.000161	98.3	91.4	< 0.50	4.65
2016	Q4	LC_LCDSSLCC	< 0.25	0.000139	0.000147	93.9	83.3	0.91	6.76
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.050	0.0000357	0.0000596	60.6	60.3	1.53	1.20
2015	Q4	CM_MC2	0.25	0.0000075	0.0000093	118	115	0.56	3.20
2015	Q1	FR_FRCP1	1.00	0.000020	0.000053	331	337	1.44	2.60
2015	Q4	FR_FRCP1	0.25	0.000040	0.0000549	131	130	0.65	2.20
2015	Q2	LC_LCDSSLCC	0.050	0.000135	0.000139	67.0	68.2	1.24	1.40
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 0.25	0.0000164	0.0000181	117	117	0.58	4.90
2016	Q2	CM_MC2	< 0.050	0.0000692	0.00011	68.7	67.1	1.93	1.50
2016	Q3	CM_MC2	< 0.25	0.0000075	0.0000086	101	105	0.99	3.37
2016	Q4	CM_MC2	< 0.050	0.0000129	0.0000162	79.4	79.2	2.31	2.10
2016	Q2	EV_HC1	< 0.050	0.0000268	0.000047	69.5	71.6	1.94	0.79
2016	Q2	EV_MC2	< 0.050	0.0000376	0.0000783	37.6	36.9	2.58	1.24
2016	Q4	EV_MC2	< 0.050	0.0000252	0.0000387	45.3	47.5	2.84	2.85
2016	Q1	FR_FRCP1	< 0.50	0.0000363	0.0000482	221	221	0.80	3.50
2016	Q2	FR_FRCP1	< 0.050	0.0000305	0.0000516	70.9	73.2	2.03	0.51
2016	Q3	FR_FRCP1	< 0.25	0.0000242	0.000042	101	103	0.99	1.47
2016	Q4	FR_FRCP1	< 0.25	0.0000449	0.0000505	104	96.8	0.90	1.25
2016	Q2	GH_ERC	< 0.050	0.0000108	0.0000348	52.9	52.5	1.32	0.79
2016	Q2	GH_FR1	< 0.050	0.0000245	0.0000352	73.5	71.2	1.95	0.99
2016	Q2	LC_LCDSSLCC	< 0.050	0.000199	0.000221	71.1	72.1	1.55	2.83

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	CHROMIUM-D-mg/l	CHROMIUM-T-mg/l	COBALT-D-mg/l	COBALT-T-mg/l	CONDUCTIVITY, LAB-N-us/cm	COPPER-D-mg/l	COPPER-T-mg/l
References									
2015	Q1	Reference (FR_UFR1)	0.00017	0.00017	< 0.00010	< 0.00010	367	< 0.00050	< 0.00050
2015	Q1	Reference (FR_UFR1)	0.00017	0.00017	< 0.00010	< 0.00010	367	< 0.00050	< 0.00050
2015	Q1	Reference (FR_UFR1)	0.00013	0.00015	< 0.00010	< 0.00010	353	< 0.00050	< 0.00050
2015	Q2	Reference (FR_UFR1)	0.00014	0.00046	< 0.00010	< 0.00010	245	< 0.00050	< 0.00050
2015	Q3	Reference (FR_UFR1)	0.00013	0.00013	< 0.00010	< 0.00010	342	< 0.00050	< 0.00050
2015	Q4	Reference (FR_UFR1)	0.00011	0.00036	< 0.00010	< 0.00010	354	< 0.00050	< 0.00050
2015	Q2	Reference (GH_ER2)	0.00022	0.00037	< 0.00010	< 0.00010	303	< 0.00050	< 0.00050
2015	Q4	Reference (GH_ER2)	0.00022	0.00034	< 0.00010	< 0.00010	314	< 0.00050	< 0.00050
2016	Q1	Reference (FR_UFR1)	0.00012	< 0.00020	< 0.00010	< 0.00010	358	< 0.00050	< 0.00050
2016	Q2	Reference (FR_UFR1)	0.00011	0.00029	< 0.00010	< 0.00010	233	< 0.00050	< 0.00050
2016	Q3	Reference (FR_UFR1)	< 0.00010	0.00018	< 0.00010	< 0.00010	338	< 0.00050	< 0.00050
2016	Q4	Reference (FR_UFR1)	< 0.00010	0.00021	< 0.00010	< 0.00010	330	< 0.00050	< 0.00050
2016	Q2	Reference (GH_ER2)	0.00017	0.00062	< 0.00010	< 0.00010	289	< 0.00050	< 0.00050
2016	Q4	Reference (GH_ER2)	0.00021	0.00024	< 0.00010	< 0.00010	297	< 0.00050	< 0.00050
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.00019	0.00024	0.00074	0.00079	826	0.00050	0.00050
2015	Q3	CM_MC2	0.00019	0.00023	0.00026	0.00034	802	0.00050	0.00050
2015	Q1	EV_HC1	0.000137	0.00018	0.00010	0.00010	453	0.00050	0.00050
2015	Q2	EV_HC1	0.000133	0.000213	0.00010	0.00010	350	0.00050	0.00050
2015	Q3	EV_HC1	0.00015	0.00024	0.00010	0.00010	625	0.00050	0.00050
2015	Q4	EV_HC1	0.00013	0.00022	0.00010	0.00010	732	0.00050	0.00050
2015	Q1	EV_MC2	0.00012	0.00020	0.00010	0.00010	665	0.00124	0.00076
2015	Q2	EV_MC2	0.00020	0.00070	0.00010	0.00022	299	0.00050	0.00073
2015	Q3	EV_MC2	0.00013	0.00019	0.00010	0.00010	686	0.00050	0.00050
2015	Q4	EV_MC2	0.00012	0.00015	0.00010	0.00010	733	0.00050	0.00050
2015	Q2	FR_FRCP1	0.00010	0.00028	0.00010	0.00012	573	0.00050	0.00050
2015	Q3	FR_FRCP1	0.00010	0.00017	0.00010	0.00010	815	0.00050	0.00050
2015	Q1	GH_ERC	0.00029	0.00034	0.00010	0.00010	345	0.00050	0.00050
2015	Q2	GH_ERC	0.00017	0.00054	0.00010	0.00010	338	0.00050	0.00050
2015	Q3	GH_ERC	0.00019	0.00037	0.00010	0.00010	284	0.00050	0.00050
2015	Q4	GH_ERC	0.00022	0.00026	0.00010	0.00010	355	0.00050	0.00050
2015	Q1	GH_FR1	0.00021	0.00015	0.00010	0.00010	851	0.00050	0.00050
2015	Q2	GH_FR1	0.00010	0.00020	0.00010	0.00010	614	0.00050	0.00050
2015	Q3	GH_FR1	0.00012	0.00015	0.00010	0.00010	657	0.00050	0.00050
2015	Q4	GH_FR1	0.00012	0.00013	0.00010	0.00010	760	0.00050	0.00050
2015	Q1	LC_LCDSSLCC	0.00016	0.00021	0.00010	0.00010	940	0.00050	0.00050
2015	Q3	LC_LCDSSLCC	0.00011	0.00020	0.00010	0.00010	660	0.00050	0.00050
2015	Q4	LC_LCDSSLCC	< 0.00050	< 0.00050	< 0.00050	< 0.00050	770	< 0.0010	< 0.0025
2016	Q1	EV_HC1	0.00016	< 0.00020	< 0.00010	< 0.00010	745	< 0.00050	< 0.00050
2016	Q3	EV_HC1	0.00016	0.00025	< 0.00010	< 0.00010	652	< 0.00050	< 0.00050
2016	Q4	EV_HC1	0.00014	0.00023	< 0.00010	< 0.00010	668	< 0.00050	< 0.00050
2016	Q1	EV_MC2	0.00013	0.00018	< 0.00010	< 0.00010	700	< 0.00050	< 0.00050
2016	Q3	EV_MC2	0.00012	0.00015	< 0.00010	< 0.00010	793	< 0.00050	< 0.00050
2016	Q1	GH_ERC	0.00024	< 0.00030	< 0.00010	< 0.00010	419	< 0.00050	< 0.00050
2016	Q3	GH_ERC	0.00020	0.00027	< 0.00010	< 0.00010	317	< 0.00050	< 0.00050
2016	Q4	GH_ERC	0.00020	0.00035	< 0.00010	< 0.00010	327	< 0.00050	0.00054
2016	Q1	GH_FR1	0.00012	0.00013	< 0.00010	< 0.00010	885	< 0.00050	< 0.00050
2016	Q3	GH_FR1	< 0.00010	0.00017	< 0.00010	< 0.00010	732	< 0.00050	< 0.00050
2016	Q4	GH_FR1	0.00010	0.000185	<0.0001	<0.0001	735	<0.0005	<0.0005
2016	Q1	LC_LCDSSLCC	0.00014	< 0.00020	< 0.00010	< 0.00010	1010	< 0.00050	< 0.00050
2016	Q3	LC_LCDSSLCC	0.00012	0.00027	< 0.00010	< 0.00010	754	< 0.00050	< 0.00050
2016	Q4	LC_LCDSSLCC	0.00010	0.00019	< 0.00010	< 0.00010	700	< 0.00050	< 0.00050
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.00020	0.00058	0.00037	0.00061	484	0.00050	0.00053
2015	Q4	CM_MC2	0.00019	0.00020	0.00010	0.00010	876	0.00050	0.00050
2015	Q1	FR_FRCP1	0.00020	0.00020	0.00020	0.00020	2680	0.00050	0.0010
2015	Q4	FR_FRCP1	0.00010	0.00027	0.00010	0.00010	1030	0.00050	0.00050
2015	Q2	LC_LCDSSLCC	0.00014	0.00019	0.00010	0.00010	535	0.00050	0.00050
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.00018	< 0.00030	0.00072	0.00081	927	< 0.00050	< 0.00050
2016	Q2	CM_MC2	0.00016	0.00058	0.00077	0.00126	549	< 0.00050	0.00079
2016	Q3	CM_MC2	0.00011	0.00018	0.00026	0.00034	901	< 0.00050	< 0.00050
2016	Q4	CM_MC2	0.00017	0.00035	0.00065	0.00108	622	< 0.00050	< 0.00050
2016	Q2	EV_HC1	0.00011	0.00031	< 0.00010	< 0.00010	547	< 0.00050	< 0.00050
2016	Q2	EV_MC2	0.00014	0.00076	< 0.00010	0.00027	266	< 0.00050	0.0010
2016	Q4	EV_MC2	0.00012	0.00045	< 0.00010	0.00013	359	< 0.00050	0.00065
2016	Q1	FR_FRCP1	< 0.00010	< 0.00010	< 0.00010	< 0.00010	1720	< 0.00050	< 0.00050
2016	Q2	FR_FRCP1	0.00010	0.00027	< 0.00010	0.00011	555	< 0.00050	0.00054
2016	Q3	FR_FRCP1	< 0.00010	0.00012	< 0.00010	< 0.00010	874	< 0.00050	< 0.00050
2016	Q4	FR_FRCP1	< 0.00010	0.00015	< 0.00010	< 0.00010	810	< 0.00050	< 0.00050
2016	Q2	GH_ERC	0.00019	0.00085	< 0.00010	0.00015	342	< 0.00050	0.00065
2016	Q2	GH_FR1	< 0.00010	0.00029	< 0.00010	< 0.00010	573	< 0.00050	< 0.00050
2016	Q2	LC_LCDSSLCC	0.00014	0.00021	< 0.00010	< 0.00010	557	< 0.00050	< 0.00050

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	FLUORIDE-D-mg/l	Hardness, Total or Dissolved CaCO3-N-mg/l	IRON-D-mg/l	IRON-T-mg/l	LEAD-D-mg/l	LEAD-T-mg/l	LITHIUM-D-mg/l
References									
2015	Q1	Reference (FR_UFR1)	0.137	197	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0019
2015	Q1	Reference (FR_UFR1)	0.137	197	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0019
2015	Q1	Reference (FR_UFR1)	0.137	197	< 0.010	< 0.010	< 0.000050	< 0.000050	0.00151
2015	Q2	Reference (FR_UFR1)	0.145	129	< 0.010	0.052	< 0.000050	< 0.000050	< 0.0010
2015	Q3	Reference (FR_UFR1)	0.153	188	< 0.010	< 0.010	0.000055	< 0.000050	0.0020
2015	Q4	Reference (FR_UFR1)	0.156	190	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0015
2015	Q2	Reference (GH_ER2)	0.153	160	< 0.010	0.066	< 0.000050	< 0.000050	0.0017
2015	Q4	Reference (GH_ER2)	0.16	170	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0016
2016	Q1	Reference (FR_UFR1)	0.155	202	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0014
2016	Q2	Reference (FR_UFR1)	0.149	126	< 0.010	0.075	< 0.000050	0.000060	0.0011
2016	Q3	Reference (FR_UFR1)	0.173	177	< 0.010	0.013	< 0.000050	< 0.000050	0.0017
2016	Q4	Reference (FR_UFR1)	0.155	177	< 0.010	0.022	< 0.000050	< 0.000050	0.0015
2016	Q2	Reference (GH_ER2)	0.157	163	< 0.010	0.227	< 0.000050	0.000131	0.0020
2016	Q4	Reference (GH_ER2)	0.166	163	< 0.010	0.013	< 0.000050	< 0.000050	0.0019
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.137	445	0.010	0.031	0.000050	0.000050	0.0109
2015	Q3	CM_MC2	0.119	458	0.010	0.022	0.000050	0.000050	0.0132
2015	Q1	EV_HC1	0.146	274	0.010	0.0127	0.000050	0.000050	0.00474
2015	Q2	EV_HC1	0.129	205	0.010	0.0507	0.000050	0.000056	0.00443
2015	Q3	EV_HC1	0.21	373	0.010	0.027	0.000050	0.000050	0.0069
2015	Q4	EV_HC1	0.20	431	0.010	0.010	0.000050	0.000050	0.0069
2015	Q1	EV_MC2	0.146	381	0.010	0.024	0.000050	0.000050	0.0146
2015	Q2	EV_MC2	0.115	159	0.010	0.385	0.000050	0.000277	0.0054
2015	Q3	EV_MC2	0.175	384	0.010	0.018	0.000050	0.000050	0.022
2015	Q4	EV_MC2	0.16	415	0.010	0.014	0.000050	0.000050	0.0229
2015	Q2	FR_FRCP1	0.204	302	0.010	0.107	0.000050	0.000144	0.0187
2015	Q3	FR_FRCP1	0.201	471	0.010	0.033	0.000050	0.000050	0.030
2015	Q1	GH_ERC	0.149	191	0.010	0.036	0.000050	0.000195	0.00193
2015	Q2	GH_ERC	0.151	179	0.010	0.153	0.000050	0.000106	0.0022
2015	Q3	GH_ERC	0.158	160	0.010	0.088	0.000050	0.000070	0.0017
2015	Q4	GH_ERC	0.156	190	0.010	0.010	0.000050	0.000050	0.0020
2015	Q1	GH_FR1	0.18	475	0.010	0.010	0.000050	0.000050	0.0155
2015	Q2	GH_FR1	0.174	332	0.010	0.070	0.000050	0.000063	0.0139
2015	Q3	GH_FR1	0.184	374	0.010	0.016	0.000050	0.000050	0.0147
2015	Q4	GH_FR1	0.16	436	0.010	0.010	0.000050	0.000050	0.0169
2015	Q1	LC_LCDSSLCC	0.236	536	0.010	0.010	0.000050	0.000050	0.031
2015	Q3	LC_LCDSSLCC	0.236	355	0.010	0.010	0.000050	0.000050	0.0212
2015	Q4	LC_LCDSSLCC	0.184	499	< 0.050	< 0.050	< 0.00025	< 0.00025	0.0361
2016	Q1	EV_HC1	0.21	443	< 0.010	< 0.020	< 0.000050	< 0.000050	0.0066
2016	Q3	EV_HC1	0.232	368	< 0.010	0.063	< 0.000050	0.000076	0.0084
2016	Q4	EV_HC1	0.20	386	< 0.010	0.058	< 0.000050	< 0.000050	0.0077
2016	Q1	EV_MC2	0.15	395	< 0.010	0.038	< 0.000050	0.000053	0.0184
2016	Q3	EV_MC2	0.17	435	< 0.010	0.010	< 0.000050	< 0.000050	0.0313
2016	Q1	GH_ERC	0.158	231	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0023
2016	Q3	GH_ERC	0.175	161	< 0.010	0.024	< 0.000050	< 0.000050	0.0024
2016	Q4	GH_ERC	0.161	186	< 0.010	0.028	< 0.000050	< 0.000050	0.0026
2016	Q1	GH_FR1	0.18	507	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0145
2016	Q3	GH_FR1	0.20	379	< 0.010	0.016	< 0.000050	< 0.000050	0.0168
2016	Q4	GH_FR1	0.16	411	<0.01	0.022	<0.00005	<0.00005	0.017
2016	Q1	LC_LCDSSLCC	0.24	572	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0367
2016	Q3	LC_LCDSSLCC	0.25	403	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0338
2016	Q4	LC_LCDSSLCC	0.21	384	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0273
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.103	248	0.010	0.299	0.000050	0.000173	0.0064
2015	Q4	CM_MC2	0.11	505	0.010	0.010	0.000050	0.000050	0.0114
2015	Q1	FR_FRCP1	0.45	1880	0.020	0.020	0.00010	0.00010	0.0538
2015	Q4	FR_FRCP1	0.17	597	0.010	0.019	0.000050	0.000050	0.042
2015	Q2	LC_LCDSSLCC	0.215	269	0.010	0.018	0.000050	0.000050	0.0163
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.14	500	< 0.010	0.011	< 0.000050	< 0.000050	0.0138
2016	Q2	CM_MC2	0.104	283	< 0.010	0.387	< 0.000050	0.000212	0.0083
2016	Q3	CM_MC2	0.12	465	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0161
2016	Q4	CM_MC2	0.107	328	< 0.010	0.148	< 0.000050	0.000098	0.010
2016	Q2	EV_HC1	0.186	306	< 0.010	0.143	< 0.000050	0.000095	0.0064
2016	Q2	EV_MC2	0.111	141	0.012	0.462	< 0.000050	0.000386	0.0052
2016	Q4	EV_MC2	0.12	177	0.023	0.163	< 0.000050	0.000117	0.0064
2016	Q1	FR_FRCP1	< 0.20	1120	< 0.010	< 0.020	< 0.000050	< 0.000050	0.058
2016	Q2	FR_FRCP1	0.196	305	< 0.010	0.131	< 0.000050	0.000099	0.016
2016	Q3	FR_FRCP1	0.22	455	< 0.010	0.032	< 0.000050	< 0.000050	0.0322
2016	Q4	FR_FRCP1	0.19	453	< 0.010	0.027	< 0.000050	< 0.000050	0.0291
2016	Q2	GH_ERC	0.156	185	< 0.010	0.375	< 0.000050	0.000221	0.0021
2016	Q2	GH_FR1	0.182	312	< 0.010	0.127	< 0.000050	0.000096	0.0117
2016	Q2	LC_LCDSSLCC	0.217	293	< 0.010	0.027	< 0.000050	< 0.000050	0.0233

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	LITHIUM-T-mg/l	MAGNESIUM-D-mg/l	MAGNESIUM-T-mg/l	MAJOR ANION SUM-N-meq/l	MAJOR CATION SUM-N-meq/l	MANGANESE-D-mg/l	MANGANESE-T-mg/l
References									
2015	Q1	Reference (FR_UFR1)	0.00164	14.2	14.5	3.98	3.98	0.000054	0.000177
2015	Q1	Reference (FR_UFR1)	0.00164	14.2	14.5	3.98	3.98	0.000054	0.000177
2015	Q1	Reference (FR_UFR1)	0.00173	13.9	14.2	3.87	3.98	0.000168	0.000368
2015	Q2	Reference (FR_UFR1)	0.0012	8.97	9.19	2.69	2.62	0.00064	0.00252
2015	Q3	Reference (FR_UFR1)	0.0020	12.8	13.1	3.88	3.80	0.00062	0.00147
2015	Q4	Reference (FR_UFR1)	0.0015	13.7	14.3	3.91	3.85	0.00010	0.00031
2015	Q2	Reference (GH_ER2)	0.0016	10.4	10.8	3.55	3.23	0.00327	0.00594
2015	Q4	Reference (GH_ER2)	0.0018	10.9	11.2	3.44	3.44	0.00208	0.00267
2016	Q1	Reference (FR_UFR1)	0.0015	14.5	15.1	3.85	4.08	0.00020	0.00034
2016	Q2	Reference (FR_UFR1)	0.0013	9.25	9.76	2.47	2.54	0.00045	0.00213
2016	Q3	Reference (FR_UFR1)	0.0018	13.0	13.6	3.93	3.57	0.00027	0.00107
2016	Q4	Reference (FR_UFR1)	0.0018	12.6	12.3	3.68	3.57	0.00027	0.00073
2016	Q2	Reference (GH_ER2)	0.0021	10.9	11.0	3.24	3.29	0.00177	0.0119
2016	Q4	Reference (GH_ER2)	0.0017	10.7	9.56	3.36	3.29	0.00124	0.00208
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.0109	44.4	46.2	9.71	9.36	0.00457	0.0064
2015	Q3	CM_MC2	0.0137	49.4	51.4	9.40	9.55	0.00181	0.00319
2015	Q1	EV_HC1	0.0047	30.1	30.8	8.23	8.30	0.00103	0.0015
2015	Q2	EV_HC1	0.00423	20.8	21.0	5.85	6.19	0.00053	0.00162
2015	Q3	EV_HC1	0.0068	41.1	40.5	7.38	7.55	0.00284	0.00507
2015	Q4	EV_HC1	0.0067	48.8	49.8	8.58	8.70	0.00177	0.00199
2015	Q1	EV_MC2	0.0145	35.1	33.3	7.49	8.66	0.00239	0.00219
2015	Q2	EV_MC2	0.0052	12.3	12.6	3.32	3.28	0.00030	0.0102
2015	Q3	EV_MC2	0.0212	35.8	34.7	8.08	7.91	0.00067	0.0020
2015	Q4	EV_MC2	0.0223	39.1	38.7	8.34	8.54	0.00129	0.0018
2015	Q2	FR_FRCP1	0.018	28.8	28.7	6.14	6.12	0.00319	0.0118
2015	Q3	FR_FRCP1	0.0307	49.5	50.7	9.46	9.53	0.00312	0.00693
2015	Q1	GH_ERC	0.00197	13.2	13.3	3.77	3.87	0.000352	0.00262
2015	Q2	GH_ERC	0.0023	12.0	12.3	3.78	3.63	0.00072	0.00813
2015	Q3	GH_ERC	0.0020	10.4	11.1	3.27	3.23	0.00058	0.00777
2015	Q4	GH_ERC	0.0021	12.4	12.8	3.86	3.85	0.00063	0.00129
2015	Q1	GH_FR1	0.0154	47.5	49.3	9.90	9.61	0.00167	0.00208
2015	Q2	GH_FR1	0.0143	32.7	33.8	6.74	6.73	0.00108	0.00442
2015	Q3	GH_FR1	0.015	37.0	37.4	7.55	7.58	0.00089	0.00231
2015	Q4	GH_FR1	0.0173	42.3	43.0	8.46	8.83	0.00108	0.00157
2015	Q1	LC_LCDSSLCC	0.0312	53.6	52.9	11.0	11.0	0.000074	0.000211
2015	Q3	LC_LCDSSLCC	0.0227	33.0	34.3	7.47	7.27	0.00020	0.00054
2015	Q4	LC_LCDSSLCC	0.0361	50.8	54.3	9.85	10.3	< 0.00050	< 0.00050
2016	Q1	EV_HC1	0.0065	49.4	50.7	8.60	8.95	0.00127	0.00159
2016	Q3	EV_HC1	0.0083	42.0	44.0	7.61	7.44	0.00544	0.00807
2016	Q4	EV_HC1	0.0081	45.6	45.9	7.97	7.81	0.00209	0.00328
2016	Q1	EV_MC2	0.0184	36.7	36.8	7.84	8.14	0.0012	0.00209
2016	Q3	EV_MC2	0.0329	41.3	42.1	9.37	9.01	0.00090	0.00139
2016	Q1	GH_ERC	0.0025	15.3	15.9	4.39	4.66	0.00026	0.00034
2016	Q3	GH_ERC	0.0024	11.0	10.8	3.46	3.25	0.00045	0.00187
2016	Q4	GH_ERC	0.0022	11.9	12.1	3.67	3.76	0.00044	0.00266
2016	Q1	GH_FR1	0.0144	50.8	52.4	9.93	10.3	0.00103	0.00115
2016	Q3	GH_FR1	0.0168	38.2	39.6	8.20	7.67	0.00092	0.00195
2016	Q4	GH_FR1	0.017	43.2	43.5	8.51	8.33	0.00072	0.00173
2016	Q1	LC_LCDSSLCC	0.0379	57.8	59.6	11.5	11.7	0.00578	0.00636
2016	Q3	LC_LCDSSLCC	0.0318	38.3	37.1	8.39	8.31	0.00090	0.00182
2016	Q4	LC_LCDSSLCC	0.0257	36.4	34.6	7.90	7.89	0.00203	0.0032
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.0067	23.3	23.3	5.36	5.16	0.00351	0.0113
2015	Q4	CM_MC2	0.012	51.4	50.7	10.3	10.6	0.00064	0.00116
2015	Q1	FR_FRCP1	0.0562	257	261	39.5	37.8	0.00193	0.00265
2015	Q4	FR_FRCP1	0.0366	65.4	65.4	12.2	12.1	0.00757	0.00805
2015	Q2	LC_LCDSSLCC	0.016	24.8	25.2	5.69	5.53	0.00016	0.00051
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.0139	50.4	51.9	10.5	10.5	0.00454	0.00523
2016	Q2	CM_MC2	0.0085	27.0	26.1	5.96	5.92	0.00623	0.0194
2016	Q3	CM_MC2	0.0171	51.6	52.5	10.1	9.81	0.00052	0.00131
2016	Q4	CM_MC2	0.0103	31.5	32.7	7.19	6.86	0.00623	0.0136
2016	Q2	EV_HC1	0.0068	32.3	33.2	6.16	6.20	0.00048	0.00365
2016	Q2	EV_MC2	0.0056	11.5	11.4	2.81	2.92	0.00014	0.0127
2016	Q4	EV_MC2	0.0068	15.6	16.7	3.92	3.67	0.00101	0.00435
2016	Q1	FR_FRCP1	0.0585	137	142	23.1	22.5	0.00675	0.00749
2016	Q2	FR_FRCP1	0.0175	31.0	32.0	5.91	6.16	0.00282	0.00973
2016	Q3	FR_FRCP1	0.032	49.1	48.0	10.0	9.20	0.00446	0.00736
2016	Q4	FR_FRCP1	0.0303	46.8	45.0	9.73	9.16	0.00634	0.00829
2016	Q2	GH_ERC	0.0025	12.8	12.8	3.66	3.75	0.00133	0.0179
2016	Q2	GH_FR1	0.0116	31.3	31.0	6.21	6.33	0.00152	0.00559
2016	Q2	LC_LCDSSLCC	0.0239	28.1	28.4	5.88	6.04	0.00155	0.00325

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	MERCURY-D-mg/l	MERCURY-T-mg/l	MOLYBDENUM-D-mg/l	MOLYBDENUM-T-mg/l	NICKEL-D-mg/l	NICKEL-T-mg/l	NITRATE NITROGEN (NO3), AS N-N-mg/l
References									
2015	Q1	Reference (FR_UFR1)	< 0.000010	< 0.000010	0.000534	0.00054	< 0.00050	< 0.00050	0.133
2015	Q1	Reference (FR_UFR1)	< 0.000010	< 0.000010	0.000534	0.00054	< 0.00050	< 0.00050	0.133
2015	Q1	Reference (FR_UFR1)	< 0.000010	< 0.000010	0.000564	0.000552	< 0.00050	< 0.00050	0.133
2015	Q2	Reference (FR_UFR1)	< 0.0000050	< 0.0000050	0.000521	0.00062	< 0.00050	< 0.00050	0.0657
2015	Q3	Reference (FR_UFR1)	< 0.0000050	< 0.0000050	0.00068	0.000676	< 0.00050	< 0.00050	0.0186
2015	Q4	Reference (FR_UFR1)	< 0.0000050	< 0.0000050	0.000645	0.00059	< 0.00050	< 0.00050	0.0217
2015	Q2	Reference (GH_ER2)	< 0.0000050	< 0.0000050	0.000918	0.000936	< 0.00050	< 0.00050	0.0856
2015	Q4	Reference (GH_ER2)	< 0.0000050	< 0.0000050	0.0010	0.000998	< 0.00050	< 0.00050	0.0779
2016	Q1	Reference (FR_UFR1)	< 0.0000050	< 0.00000050	0.000577	0.000564	< 0.00050	< 0.00050	0.169
2016	Q2	Reference (FR_UFR1)	< 0.0000050	0.00000135	0.000608	0.00062	< 0.00050	< 0.00050	0.0335
2016	Q3	Reference (FR_UFR1)	< 0.0000050	< 0.00000050	0.000628	0.000634	< 0.00050	< 0.00050	0.0573
2016	Q4	Reference (FR_UFR1)	< 0.0000050	0.00000056	0.000572	0.000556	< 0.00050	< 0.00050	0.103
2016	Q2	Reference (GH_ER2)	< 0.0000050	0.00000098	0.000913	0.000934	< 0.00050	0.00050	0.115
2016	Q4	Reference (GH_ER2)	< 0.0000050	< 0.0000050	0.000965	0.00101	< 0.00050	< 0.00050	0.0711
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.000010	0.000010	0.00102	0.00106	0.00953	0.00972	2.36
2015	Q3	CM_MC2	0.0000050	0.0000050	0.00104	0.00109	0.0128	0.013	2.49
2015	Q1	EV_HC1	0.000010	0.000010	0.00063	0.000648	0.000597	0.00064	0.795
2015	Q2	EV_HC1	0.0000050	0.0000050	0.000499	0.000485	0.000753	0.000833	0.573
2015	Q3	EV_HC1	0.0000050	0.0000050	0.000915	0.000923	0.00079	0.00079	0.866
2015	Q4	EV_HC1			0.000969	0.000979	0.00066	0.00069	1.17
2015	Q1	EV_MC2	0.000010	0.000010	0.000793	0.000782	0.00070	0.00052	3.17
2015	Q2	EV_MC2	0.0000050	0.0000050	0.00059	0.000542	0.00077	0.00141	0.807
2015	Q3	EV_MC2	0.0000050	0.0000050	0.00221	0.00219	0.0047	0.00479	5.65
2015	Q4	EV_MC2			0.00204	0.00212	0.00393	0.00408	5.94
2015	Q2	FR_FRCP1	0.0000050	0.0000050	0.00128	0.00128	0.00203	0.00242	7.40
2015	Q3	FR_FRCP1	0.0000050	0.0000050	0.00153	0.00153	0.00411	0.00431	8.23
2015	Q1	GH_ERC	0.000010	0.000010	0.000915	0.000988	0.00050	0.00050	0.44
2015	Q2	GH_ERC	0.0000050	0.0000050	0.000953	0.000971	0.00050	0.00050	0.31
2015	Q3	GH_ERC	0.0000050	0.0000050	0.000951	0.00102	0.00050	0.00050	0.165
2015	Q4	GH_ERC	0.0000050	0.0000050	0.000988	0.00106	0.00050	0.00050	0.461
2015	Q1	GH_FR1	0.000010	0.000010	0.000954	0.000984	0.00219	0.00231	13.0
2015	Q2	GH_FR1	0.0000050	0.0000050	0.00108	0.00106	0.00192	0.00204	7.45
2015	Q3	GH_FR1	0.0000050	0.0000050	0.000994	0.000996	0.00164	0.00167	9.13
2015	Q4	GH_FR1	0.0000050	0.0000050	0.000899	0.000988	0.00117	0.00119	10.2
2015	Q1	LC_LCDSSLCC	0.000010	0.000010	0.00173	0.00171	0.00359	0.00359	15.1
2015	Q3	LC_LCDSSLCC	0.0000050	0.0000050	0.00135	0.00145	0.00471	0.00503	7.20
2015	Q4	LC_LCDSSLCC	< 0.0000050	< 0.0000050	0.00165	0.00164	0.0065	0.0071	12.8
2016	Q1	EV_HC1	< 0.00000050	< 0.00000050	0.000917	0.000924	0.00062	< 0.0010	1.20
2016	Q3	EV_HC1	< 0.00000050	0.00000121	0.000916	0.000913	0.00074	0.00090	0.841
2016	Q4	EV_HC1	< 0.0000005	0.00000085	0.000914	0.000932	0.00073	0.00087	1.01
2016	Q1	EV_MC2	< 0.00000050	< 0.00000050	0.00149	0.00154	0.00248	0.00264	5.05
2016	Q3	EV_MC2	< 0.00000050	0.00000085	0.00119	0.00122	0.00216	0.0024	6.52
2016	Q1	GH_ERC	< 0.0000050	< 0.0000050	0.000938	0.000921	< 0.00050	< 0.00050	0.76
2016	Q3	GH_ERC	< 0.0000050	< 0.00000050	0.000908	0.000873	< 0.00050	< 0.00050	0.195
2016	Q4	GH_ERC	< 0.0000050	< 0.0000050	0.00106	0.00103	< 0.00050	0.00086	0.282
2016	Q1	GH_FR1	< 0.0000050	< 0.0000050	0.000835	0.000856	0.00137	0.00143	12.7
2016	Q3	GH_FR1	< 0.0000050	< 0.00000050	0.000903	0.000974	0.00145	0.00151	9.61
2016	Q4	GH_FR1	<0.000005	<0.000005	0.00104	0.00108	0.00189	0.00203	8.77
2016	Q1	LC_LCDSSLCC	< 0.0000050	< 0.00000050	0.00163	0.00167	0.00341	0.00342	11.1
2016	Q3	LC_LCDSSLCC	< 0.0000050	< 0.00000050	0.00158	0.00152	0.00437	0.00462	8.57
2016	Q4	LC_LCDSSLCC	< 0.0000050	< 0.0000005	0.00139	0.00149	0.00402	0.00383	7.27
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.0000050	0.0000084	0.00076	0.000807	0.00624	0.00758	1.19
2015	Q4	CM_MC2	0.0000050	0.0000050	0.000922	0.00096	0.0059	0.00603	2.15
2015	Q1	FR_FRCP1	0.000010	0.000010	0.00284	0.00288	0.0305	0.0321	30.1
2015	Q4	FR_FRCP1	0.0000050	0.0000050	0.00149	0.00136	0.00681	0.00664	14.7
2015	Q2	LC_LCDSSLCC	0.0000050	0.0000050	0.00114	0.00115	0.00356	0.00361	5.83
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 0.0000050	< 0.0000050	0.000996	0.000997	0.00935	0.00979	2.94
2016	Q2	CM_MC2	< 0.0000050	0.00000108	0.000762	0.000741	0.0105	0.0113	1.97
2016	Q3	CM_MC2	< 0.0000050	< 0.00000050	0.00112	0.00117	0.0119	0.0127	2.67
2016	Q4	CM_MC2	< 0.0000050	0.00000124	0.000966	0.000979	0.00732	0.00831	1.82
2016	Q2	EV_HC1	0.00000062	0.00000077	0.000741	0.000774	0.00097	0.00123	0.818
2016	Q2	EV_MC2	0.00000152	0.00000177	0.000643	0.000693	0.00137	0.00221	0.776
2016	Q4	EV_MC2	0.00000163	0.00000246	0.000599	0.000651	0.00078	0.00116	1.24
2016	Q1	FR_FRCP1	< 0.0000050	< 0.00000050	0.00174	0.00176	0.0129	0.0133	27.9
2016	Q2	FR_FRCP1	< 0.0000050	0.00000121	0.00119	0.00126	0.00214	0.00296	7.35
2016	Q3	FR_FRCP1	< 0.0000050	< 0.00000050	0.00126	0.00127	0.00485	0.00516	11.9
2016	Q4	FR_FRCP1	< 0.0000050	< 0.0000005	0.00124	0.00124	0.00445	0.00468	10.0
2016	Q2	GH_ERC	< 0.0000050	0.00000157	0.000908	0.000921	< 0.00050	0.00067	0.411
2016	Q2	GH_FR1	< 0.0000050	0.00000251	0.00104	0.00104	0.00191	0.00221	6.45
2016	Q2	LC_LCDSSLCC	< 0.0000050	0.00000069	0.00136	0.0014	0.00453	0.00482	6.33

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	NITRITE NITROGEN (NO2), AS N-N-mg/l	NITROGEN, AMMONIA (AS N)-N-mg/l	ORTHO-PHOSPHATE-N-mg/l	OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	pH, LAB-N-ph units	PHOSPHORUS-N-mg/l	POTASSIUM-D-mg/l
References									
2015	Q1	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0032	344	8.36	0.0042	0.394
2015	Q1	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0032	344	8.36	0.0042	0.394
2015	Q1	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0027	371	8.34	0.0035	0.393
2015	Q2	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0042	470	8.35	0.0102	0.33
2015	Q3	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0029	325	8.37	0.0054	0.53
2015	Q4	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0017	346	8.40	0.0022	0.463
2015	Q2	Reference (GH_ER2)	< 0.0010	< 0.0050	< 0.0010	312	8.30	0.0080	0.363
2015	Q4	Reference (GH_ER2)	< 0.0010	< 0.0050	0.0015	490	8.26	< 0.0020	0.331
2016	Q1	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0032	297	8.27	0.0036	0.384
2016	Q2	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0041	318	8.32	0.0078	0.301
2016	Q3	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0031	375	8.23	0.0038	0.439
2016	Q4	Reference (FR_UFR1)	< 0.0010	< 0.0050	0.0023	343	8.32	0.0028	0.376
2016	Q2	Reference (GH_ER2)	< 0.0010	< 0.0050	0.0011	321	8.20	0.0164	0.354
2016	Q4	Reference (GH_ER2)	< 0.0010	< 0.0050	< 0.0010	378	8.29	< 0.0020	0.344
Tests that were not statistically different f									
2015	Q1	CM_MC2	0.012	0.0055	0.0010	491	8.38	0.0050	1.37
2015	Q3	CM_MC2	0.0088	0.0050	0.0010	349	8.37	0.0030	1.50
2015	Q1	EV_HC1	0.0010	0.0050	0.0035	457	7.39	0.00467	0.608
2015	Q2	EV_HC1	0.0010	0.00843	0.00313	413	7.53	0.0081	0.532
2015	Q3	EV_HC1	0.0011	0.0050	0.0040	352	8.37	0.0082	0.992
2015	Q4	EV_HC1	0.0050	0.0050	0.0058	360	8.37	0.0057	0.852
2015	Q1	EV_MC2	0.0013	0.0050	0.0010	302	8.26	0.0047	1.15
2015	Q2	EV_MC2	0.0010	0.0050	0.0010	355	8.13	0.0366	0.543
2015	Q3	EV_MC2	0.0027	0.0102	0.0027	356	8.10	0.0052	1.49
2015	Q4	EV_MC2	0.0050	0.0050	0.0035	370	8.15	0.0036	1.29
2015	Q2	FR_FRCP1	0.0056	0.0095	0.0014	345	8.43	0.0176	1.21
2015	Q3	FR_FRCP1	0.0049	0.0050	0.0010	345	8.39	0.0027	1.87
2015	Q1	GH_ERC	0.0010	0.0050	0.0010	512	8.26	0.0043	0.357
2015	Q2	GH_ERC	0.0010	0.0050	0.0010	473	8.37	0.0164	0.383
2015	Q3	GH_ERC	0.0010	0.0050	0.0010	320	8.29	0.0077	0.376
2015	Q4	GH_ERC	0.0010	0.0050	0.0018	491	8.27	0.0020	0.387
2015	Q1	GH_FR1	0.0039	0.0050	0.0010	305	8.28	0.0036	1.15
2015	Q2	GH_FR1	0.0028	0.0050	0.0010	302	8.42	0.010	1.04
2015	Q3	GH_FR1	0.0046	0.0071	0.0010	323	8.34	0.0036	1.19
2015	Q4	GH_FR1	0.0050	0.0050	0.0010	288	8.38	0.0020	1.18
2015	Q1	LC_LCDSSLCC	0.0030	0.0050	0.0010	294	8.33	0.0029	1.23
2015	Q3	LC_LCDSSLCC	0.0020	0.0050	0.0018	354	8.37	0.0029	1.03
2015	Q4	LC_LCDSSLCC	0.0030	< 0.0050	< 0.0010	364	8.25	< 0.0050	1.33
2016	Q1	EV_HC1	< 0.0050	< 0.0050	0.0041	294	8.31	0.0045	0.87
2016	Q3	EV_HC1	0.0016	0.0088	0.0064	312	8.28	0.0121	0.904
2016	Q4	EV_HC1	< 0.0050	< 0.0050	0.0061	337	8.36	0.0079	0.989
2016	Q1	EV_MC2	< 0.0050	< 0.0050	< 0.0010	308	8.05	0.0023	1.22
2016	Q3	EV_MC2	< 0.0050	0.0073	0.0040	323	8.06	0.0052	1.49
2016	Q1	GH_ERC	< 0.0010	< 0.0050	< 0.0010	312	8.16	< 0.0020	0.377
2016	Q3	GH_ERC	< 0.0010	< 0.0050	< 0.0010	370	8.20	0.0049	0.393
2016	Q4	GH_ERC	< 0.0010	< 0.0050	< 0.0010	387	8.25	< 0.0020	0.387
2016	Q1	GH_FR1	< 0.0050	< 0.0050	< 0.0010	304	8.26	< 0.0020	1.16
2016	Q3	GH_FR1	0.0056	< 0.0050	< 0.0010	374	8.26	0.0061	1.18
2016	Q4	GH_FR1	<0.005	<0.005	<0.001	360	8.28	0.00225	1.25
2016	Q1	LC_LCDSSLCC	0.0098	< 0.0050	0.0011	295	8.29	< 0.0020	1.37
2016	Q3	LC_LCDSSLCC	< 0.0050	< 0.0050	0.0021	341	8.37	0.0027	1.09
2016	Q4	LC_LCDSSLCC	< 0.0050	< 0.0050	0.0013	367	8.30	< 0.0020	1.09
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.0029	0.0050	0.0010	359	8.40	0.0173	0.904
2015	Q4	CM_MC2	0.0050	0.0050	0.0010	275	8.34	0.0020	1.45
2015	Q1	FR_FRCP1	0.020	0.0050	0.0010	354	8.27	0.0021	3.81
2015	Q4	FR_FRCP1	0.0050	0.0050	0.0010	354	8.28	0.0020	1.91
2015	Q2	LC_LCDSSLCC	0.0014	0.0050	0.0027	493	8.42	0.0056	0.82
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.0124	< 0.0050	< 0.0010	500	8.33	< 0.0020	1.48
2016	Q2	CM_MC2	0.0037	0.0074	0.0028	345	8.20	0.0215	1.04
2016	Q3	CM_MC2	< 0.0050	< 0.0050	< 0.0010	385	8.39	< 0.0020	1.76
2016	Q4	CM_MC2	0.010	0.0076	0.0016	339	8.33	0.0063	1.22
2016	Q2	EV_HC1	< 0.0010	< 0.0050	0.0054	323	8.31	0.0102	0.783
2016	Q2	EV_MC2	< 0.0010	< 0.0050	0.0133	312	8.11	0.039	0.547
2016	Q4	EV_MC2	0.0010	< 0.0050	0.0081	281	8.17	0.0142	0.633
2016	Q1	FR_FRCP1	< 0.010	< 0.0050	< 0.0010	309	8.22	< 0.0020	2.51
2016	Q2	FR_FRCP1	0.0033	0.0086	0.0029	324	8.32	0.0128	1.21
2016	Q3	FR_FRCP1	< 0.0050	< 0.0050	0.0011	365	8.38	0.0027	1.53
2016	Q4	FR_FRCP1	< 0.0050	< 0.0050	< 0.0010	344	8.38	< 0.0020	1.48
2016	Q2	GH_ERC	< 0.0010	< 0.0050	< 0.0010	337	8.26	0.0274	0.409
2016	Q2	GH_FR1	0.0025	< 0.0050	0.0020	337	8.32	0.0128	1.08
2016	Q2	LC_LCDSSLCC	< 0.0010	< 0.0050	< 0.0010	362	8.30	0.0027	0.944

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	POTASSIUM-T-mg/l	SELENIUM-D-ug/l	SELENIUM-T-ug/l	SILICON-D-mg/l	SILICON-T-mg/l	SILVER-D-mg/l	SILVER-T-mg/l
References									
2015	Q1	Reference (FR_UFR1)	0.401	0.69	0.73	1.59	1.61	< 0.000010	< 0.000010
2015	Q1	Reference (FR_UFR1)	0.401	0.69	0.73	1.59	1.61	< 0.000010	< 0.000010
2015	Q1	Reference (FR_UFR1)	0.419	0.76	0.73	1.64	1.66	< 0.000010	< 0.000010
2015	Q2	Reference (FR_UFR1)	0.365	0.477	0.492	1.74	1.88	< 0.000010	< 0.000010
2015	Q3	Reference (FR_UFR1)	0.519	0.47	0.431	2.06	2.11	< 0.000010	< 0.000010
2015	Q4	Reference (FR_UFR1)	0.419	0.685	0.622	1.49	1.57	< 0.000010	< 0.000010
2015	Q2	Reference (GH_ER2)	0.367	0.787	0.87	1.64	1.83	< 0.000010	< 0.000010
2015	Q4	Reference (GH_ER2)	0.348	0.724	0.78	1.73	1.78	< 0.000010	< 0.000010
2016	Q1	Reference (FR_UFR1)	0.369	0.799	0.781	1.77	1.82	< 0.000010	< 0.000010
2016	Q2	Reference (FR_UFR1)	0.336	0.522	0.551	1.86	2.11	< 0.000010	< 0.000010
2016	Q3	Reference (FR_UFR1)	0.466	0.557	0.63	2.07	2.06	< 0.000010	< 0.000010
2016	Q4	Reference (FR_UFR1)	0.375	0.694	0.681	1.77	1.88	< 0.000010	< 0.000010
2016	Q2	Reference (GH_ER2)	0.455	0.832	0.831	1.85	2.15	< 0.000010	< 0.000010
2016	Q4	Reference (GH_ER2)	0.363	0.868	0.826	1.67	1.71	< 0.000010	< 0.000010
Tests that were not statistically different t									
2015	Q1	CM_MC2	1.38	5.87	5.98	2.13	2.18	0.000010	0.000010
2015	Q3	CM_MC2	1.51	6.18	6.41	1.99	2.10	0.000010	0.000010
2015	Q1	EV_HC1	0.62	22.5	22.4	1.30	1.33	0.000010	0.000010
2015	Q2	EV_HC1	0.546	19.3	18.5	1.14	1.21	0.000010	0.000010
2015	Q3	EV_HC1	0.987	28.6	27.7	2.12	2.02	0.000010	0.000010
2015	Q4	EV_HC1	0.896	33.2	36.5	2.03	2.05	0.000010	0.000010
2015	Q1	EV_MC2	1.16	23.6	22.2	2.46	2.46	0.000010	0.000010
2015	Q2	EV_MC2	0.666	5.17	5.04	1.67	2.30	0.000010	0.000017
2015	Q3	EV_MC2	1.48	23.3	22.8	2.45	2.29	0.000010	0.000010
2015	Q4	EV_MC2	1.26	23.9	24.5	2.49	2.55	0.000010	0.000010
2015	Q2	FR_FRCP1	1.19	30.3	29.9	1.57	1.62	0.000010	0.000010
2015	Q3	FR_FRCP1	1.84	56.8	57.2	1.89	1.98	0.000010	0.000010
2015	Q1	GH_ERC	0.374	1.85	1.86	1.82	1.87	0.000010	0.000010
2015	Q2	GH_ERC	0.41	1.67	1.81	1.75	1.99	0.000010	0.000010
2015	Q3	GH_ERC	0.419	1.14	1.24	1.70	1.92	0.000010	0.000010
2015	Q4	GH_ERC	0.394	1.46	1.56	1.85	1.91	0.000010	0.000010
2015	Q1	GH_FR1	1.20	51.3	52.4	2.07	2.13	0.000010	0.000010
2015	Q2	GH_FR1	1.07	31.0	31.8	1.82	1.97	0.000010	0.000010
2015	Q3	GH_FR1	1.17	35.4	35.7	2.00	2.07	0.000010	0.000010
2015	Q4	GH_FR1	1.24	39.7	39.4	2.10	2.15	0.000010	0.000010
2015	Q1	LC_LCDSSLCC	1.21	72.1	70.6	2.10	2.10	0.000010	0.000010
2015	Q3	LC_LCDSSLCC	1.06	37.4	39.5	2.17	2.27	0.000010	0.000010
2015	Q4	LC_LCDSSLCC	1.38	52.3	53.5	2.17	2.29	< 0.000050	< 0.000050
2016	Q1	EV_HC1	0.861	40.4	36.7	1.99	1.99	< 0.000010	< 0.000010
2016	Q3	EV_HC1	0.984	30.5	31.9	2.10	2.30	< 0.000010	< 0.000010
2016	Q4	EV_HC1	1.01	32.0	32.4	2.02	2.34	< 0.000010	< 0.000010
2016	Q1	EV_MC2	1.12	22.3	21.3	2.34	2.36	< 0.000010	< 0.000010
2016	Q3	EV_MC2	1.56	26.3	26.3	2.79	2.83	< 0.000010	< 0.000010
2016	Q1	GH_ERC	0.389	2.28	2.33	1.82	1.85	< 0.000010	< 0.000010
2016	Q3	GH_ERC	0.415	0.983	0.997	1.68	1.71	< 0.000010	< 0.000010
2016	Q4	GH_ERC	0.41	1.38	1.41	1.77	1.82	< 0.000010	< 0.000010
2016	Q1	GH_FR1	1.05	52.0	50.0	2.15	2.19	< 0.000010	< 0.000010
2016	Q3	GH_FR1	1.20	34.2	36.6	2.12	2.20	< 0.000010	< 0.000010
2016	Q4	GH_FR1	1.34	40.9	39.5	2.09	2.14	<0.00001	<0.00001
2016	Q1	LC_LCDSSLCC	1.43	35.8	35.0	2.24	2.31	< 0.000010	< 0.000010
2016	Q3	LC_LCDSSLCC	1.39	26.5	26.8	2.22	2.14	< 0.000010	< 0.000010
2016	Q4	LC_LCDSSLCC	1.08	23.9	22.7	2.02	2.04	< 0.000010	< 0.000010
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.982	4.32	4.32	1.80	2.38	0.000010	0.000010
2015	Q4	CM_MC2	1.45	5.98	5.77	2.19	2.10	0.000010	0.000010
2015	Q1	FR_FRCP1	3.98	490	497	2.30	2.33	0.000020	0.000020
2015	Q4	FR_FRCP1	1.93	78.2	76.3	1.73	1.75	0.000010	0.000010
2015	Q2	LC_LCDSSLCC	0.821	24.8	25.1	1.82	1.88	0.000010	0.000010
Tests with significant results (2016)									
2016	Q1	CM_MC2	1.58	5.36	5.76	2.22	2.30	< 0.000010	< 0.000010
2016	Q2	CM_MC2	1.10	6.20	5.74	2.10	2.59	< 0.000010	< 0.000010
2016	Q3	CM_MC2	1.73	5.94	5.95	1.76	1.77	< 0.000010	< 0.000010
2016	Q4	CM_MC2	1.26	4.11	4.41	2.00	2.40	< 0.000010	< 0.000010
2016	Q2	EV_HC1	0.867	30.5	31.0	1.88	2.16	< 0.000010	< 0.000010
2016	Q2	EV_MC2	0.644	3.58	3.31	2.02	2.78	< 0.000010	0.000017
2016	Q4	EV_MC2	0.748	5.41	5.97	2.09	2.55	< 0.000010	< 0.000010
2016	Q1	FR_FRCP1	2.52	214	209	2.06	2.09	< 0.000010	< 0.000010
2016	Q2	FR_FRCP1	1.18	31.9	31.6	1.71	1.95	< 0.000010	< 0.000010
2016	Q3	FR_FRCP1	1.59	53.6	56.4	1.77	1.94	< 0.000010	< 0.000010
2016	Q4	FR_FRCP1	1.44	54.2	51.3	1.71	1.73	< 0.000010	< 0.000010
2016	Q2	GH_ERC	0.548	2.30	1.98	1.87	2.35	< 0.000010	< 0.000010
2016	Q2	GH_FR1	1.09	27.8	29.0	2.01	2.10	< 0.000010	< 0.000010
2016	Q2	LC_LCDSSLCC	0.989	17.5	18.5	1.99	2.07	< 0.000010	< 0.000010

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	SODIUM-D-mg/l	SODIUM-T-mg/l	STRONTIUM-D-mg/l	STRONTIUM-T-mg/l	SULFATE (AS SO4)-D-mg/l	THALLIUM-D-mg/l	THALLIUM-T-mg/l
References									
2015	Q1	Reference (FR_UFR1)	0.706	0.773	0.0884	0.0907	46.8	< 0.000010	< 0.000010
2015	Q1	Reference (FR_UFR1)	0.706	0.773	0.0884	0.0907	46.8	< 0.000010	< 0.000010
2015	Q1	Reference (FR_UFR1)	0.712	0.716	0.0885	0.0923	46.1	< 0.000010	< 0.000010
2015	Q2	Reference (FR_UFR1)	0.548	0.562	0.0608	0.0661	14.5	< 0.000010	0.000010
2015	Q3	Reference (FR_UFR1)	0.699	0.688	0.0926	0.0926	31.8	< 0.000010	< 0.000010
2015	Q4	Reference (FR_UFR1)	0.727	0.69	0.0954	0.0907	47.5	< 0.000010	< 0.000010
2015	Q2	Reference (GH_ER2)	0.727	0.726	0.20	0.21	17.7	< 0.000010	< 0.000010
2015	Q4	Reference (GH_ER2)	0.634	0.67	0.207	0.215	21.7	< 0.000010	< 0.000010
2016	Q1	Reference (FR_UFR1)	0.679	0.683	0.0892	0.0898	49.9	< 0.000010	< 0.000010
2016	Q2	Reference (FR_UFR1)	0.603	0.629	0.0628	0.0651	12.7	< 0.000010	< 0.000010
2016	Q3	Reference (FR_UFR1)	0.644	0.679	0.0954	0.0984	34.6	< 0.000010	< 0.000010
2016	Q4	Reference (FR_UFR1)	0.644	0.695	0.0927	0.0951	40.4	< 0.000010	< 0.000010
2016	Q2	Reference (GH_ER2)	0.735	0.746	0.196	0.198	17.1	< 0.000010	< 0.000010
2016	Q4	Reference (GH_ER2)	0.654	0.614	0.235	0.241	23.1	< 0.000010	< 0.000010
Tests that were not statistically different t									
2015	Q1	CM_MC2	10.0	10.0	0.29	0.299	249	0.000014	0.000010
2015	Q3	CM_MC2	8.65	8.65	0.272	0.287	249	0.000014	0.000019
2015	Q1	EV_HC1	1.14	1.17	0.0851	0.0867	130	0.000010	0.000010
2015	Q2	EV_HC1	0.81	0.817	0.0621	0.0607	78.8	0.000010	0.000010
2015	Q3	EV_HC1	1.50	1.50	0.112	0.113	165	0.000010	0.000010
2015	Q4	EV_HC1	1.58	1.71	0.126	0.131	218	0.000010	0.000010
2015	Q1	EV_MC2	23.6	5.72	0.192	0.195	147	0.000010	0.000010
2015	Q2	EV_MC2	2.09	2.05	0.103	0.0929	41.1	0.000011	0.000025
2015	Q3	EV_MC2	4.69	4.64	0.209	0.209	169	0.000013	0.000014
2015	Q4	EV_MC2	4.93	4.80	0.23	0.23	183	0.000010	0.000010
2015	Q2	FR_FRCP1	1.20	1.17	0.106	0.107	126	0.000010	0.000010
2015	Q3	FR_FRCP1	1.60	1.61	0.131	0.134	234	0.000010	0.000010
2015	Q1	GH_ERC	0.937	0.945	0.20	0.206	30.4	0.000010	0.000010
2015	Q2	GH_ERC	0.975	0.97	0.21	0.21	25.2	0.000010	0.000010
2015	Q3	GH_ERC	0.70	0.741	0.191	0.199	20.1	0.000010	0.000010
2015	Q4	GH_ERC	0.894	0.935	0.216	0.229	37.2	0.000010	0.000010
2015	Q1	GH_FR1	2.28	2.42	0.164	0.163	233	0.000010	0.000010
2015	Q2	GH_FR1	1.64	1.68	0.116	0.12	136	0.000010	0.000010
2015	Q3	GH_FR1	1.82	1.84	0.125	0.13	154	0.000010	0.000010
2015	Q4	GH_FR1	2.09	2.18	0.141	0.146	189	0.000010	0.000010
2015	Q1	LC_LCDSSLCC	5.85	5.89	0.234	0.234	283	0.000010	0.000010
2015	Q3	LC_LCDSSLCC	3.75	3.90	0.16	0.169	157	0.000010	0.000010
2015	Q4	LC_LCDSSLCC	5.82	6.18	0.212	0.222	237	< 0.000050	< 0.000050
2016	Q1	EV_HC1	1.74	1.71	0.129	0.131	222	< 0.000010	< 0.000010
2016	Q3	EV_HC1	1.54	1.63	0.119	0.123	176	< 0.000010	< 0.000010
2016	Q4	EV_HC1	1.87	1.90	0.127	0.129	193	< 0.000010	0.000010
2016	Q1	EV_MC2	5.10	4.89	0.204	0.207	174	< 0.000010	0.000010
2016	Q3	EV_MC2	6.48	6.63	0.234	0.24	214	0.000011	0.000012
2016	Q1	GH_ERC	1.01	1.04	0.24	0.237	60.7	< 0.000010	< 0.000010
2016	Q3	GH_ERC	0.724	0.703	0.208	0.199	25.9	< 0.000010	< 0.000010
2016	Q4	GH_ERC	0.796	0.848	0.248	0.236	32.1	< 0.000010	< 0.000010
2016	Q1	GH_FR1	2.22	2.07	0.155	0.155	247	< 0.000010	< 0.000010
2016	Q3	GH_FR1	1.79	1.85	0.134	0.138	168	< 0.000010	< 0.000010
2016	Q4	GH_FR1	1.91	1.98	0.143	0.145	196	<0.00001	<0.00001
2016	Q1	LC_LCDSSLCC	6.65	6.90	0.233	0.236	303	< 0.000010	< 0.000010
2016	Q3	LC_LCDSSLCC	5.34	5.12	0.195	0.185	187	< 0.000010	< 0.000010
2016	Q4	LC_LCDSSLCC	4.23	4.23	0.178	0.17	176	0.000010	< 0.000010
Tests with significant results (2015)									
2015	Q2	CM_MC2	4.43	4.47	0.16	0.168	110	0.000011	0.000018
2015	Q4	CM_MC2	10.4	10.7	0.304	0.302	277	0.000011	0.000010
2015	Q1	FR_FRCP1	1.98	2.07	0.223	0.231	1460	0.000030	0.000032
2015	Q4	FR_FRCP1	2.14	2.01	0.161	0.155	327	0.000010	0.000010
2015	Q2	LC_LCDSSLCC	2.90	2.90	0.128	0.131	107	0.000010	0.000010
Tests with significant results (2016)									
2016	Q1	CM_MC2	12.0	13.0	0.329	0.32	291	0.000010	0.000018
2016	Q2	CM_MC2	5.57	5.47	0.183	0.176	131	0.000010	0.000020
2016	Q3	CM_MC2	11.0	11.2	0.322	0.34	277	0.000017	0.000014
2016	Q4	CM_MC2	6.42	6.70	0.221	0.222	178	0.000010	0.000017
2016	Q2	EV_HC1	1.31	1.34	0.0963	0.0994	120	< 0.000010	0.000014
2016	Q2	EV_MC2	1.81	1.69	0.0876	0.0917	36.4	< 0.000010	0.000023
2016	Q4	EV_MC2	2.50	2.71	0.11	0.115	63.1	< 0.000010	0.000015
2016	Q1	FR_FRCP1	2.16	2.18	0.202	0.204	765	0.000016	0.000015
2016	Q2	FR_FRCP1	1.02	1.13	0.0972	0.103	116	< 0.000010	0.000013
2016	Q3	FR_FRCP1	1.50	1.60	0.14	0.142	249	< 0.000010	< 0.000010
2016	Q4	FR_FRCP1	1.41	1.49	0.139	0.139	245	< 0.000010	< 0.000010
2016	Q2	GH_ERC	0.952	0.936	0.208	0.203	33.2	< 0.000010	0.000014
2016	Q2	GH_FR1	1.41	1.38	0.105	0.104	121	< 0.000010	< 0.000010
2016	Q2	LC_LCDSSLCC	3.42	3.62	0.13	0.134	110	0.000010	< 0.000010

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	TIN-D-mg/l	TIN-T-mg/l	TITANIUM-D-mg/l	TITANIUM-T-mg/l	TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	TOTAL KJELDAHL NITROGEN-N-mg/l	TOTAL ORGANIC CARBON-T-mg/l
References									
2015	Q1	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.010	< 0.010	229	< 0.050	0.69
2015	Q1	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.010	< 0.010	229	< 0.050	0.69
2015	Q1	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.010	< 0.010	222	< 0.050	< 0.50
2015	Q2	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.010	< 0.010	147	0.10	2.09
2015	Q3	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.010	< 0.010	211	0.080	1.02
2015	Q4	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.010	< 0.010	215	0.095	0.60
2015	Q2	Reference (GH_ER2)	< 0.00010	< 0.00010	< 0.010	< 0.010	191	0.067	1.80
2015	Q4	Reference (GH_ER2)	< 0.00010	< 0.00010	< 0.010	< 0.010	171	< 0.050	< 0.50
2016	Q1	Reference (FR_UFR1)	< 0.00010	< 0.00010	0.011	0.011	244	< 0.050	< 0.50
2016	Q2	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.010	< 0.010	135	0.086	2.79
2016	Q3	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.010	< 0.010	222	0.077	0.92
2016	Q4	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.010	< 0.010	204	0.069	1.10
2016	Q2	Reference (GH_ER2)	< 0.00010	< 0.00010	< 0.010	< 0.010	174	0.077	2.20
2016	Q4	Reference (GH_ER2)	< 0.00010	< 0.00010	< 0.010	< 0.010	167	< 0.050	0.62
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.00010	0.00010	0.010	0.010	551	0.050	0.82
2015	Q3	CM_MC2	0.00010	0.00010	0.010	0.010	626	0.102	0.75
2015	Q1	EV_HC1	0.00010	0.00010	0.0107	0.0107	325	0.050	0.843
2015	Q2	EV_HC1	0.00010	0.00010	0.010	0.010	233	0.127	1.37
2015	Q3	EV_HC1	0.00010	0.00010	0.010	0.010	479	0.073	1.58
2015	Q4	EV_HC1	0.00010	0.00010	0.010	0.010	529	0.096	0.74
2015	Q1	EV_MC2	0.00018	0.00010	0.014	0.013	438	0.134	1.18
2015	Q2	EV_MC2	0.00010	0.00010	0.010	0.010	195	0.28	2.47
2015	Q3	EV_MC2	0.00010	0.00010	0.010	0.010	477	0.158	0.83
2015	Q4	EV_MC2	0.00010	0.00010	0.010	0.010	492	0.137	0.70
2015	Q2	FR_FRCP1	0.00010	0.00010	0.010	0.010	372	0.050	2.17
2015	Q3	FR_FRCP1	0.00010	0.00010	0.010	0.010	566	0.142	0.93
2015	Q1	GH_ERC	0.00010	0.00010	0.010	0.010	203	0.050	0.50
2015	Q2	GH_ERC	0.00010	0.00010	0.010	0.010	203	0.12	1.29
2015	Q3	GH_ERC	0.00010	0.00016	0.010	0.010	179	0.050	0.79
2015	Q4	GH_ERC	0.00010	0.00010	0.010	0.010	214	0.050	0.52
2015	Q1	GH_FR1	0.00010	0.00010	0.011	0.011	621	0.050	1.08
2015	Q2	GH_FR1	0.00010	0.00010	0.010	0.010	398	0.050	1.55
2015	Q3	GH_FR1	0.00010	0.00015	0.010	0.010	473	0.050	0.86
2015	Q4	GH_FR1	0.00010	0.00010	0.010	0.010	520	0.091	0.57
2015	Q1	LC_LCDSSLCC	0.00010	0.00010	0.014	0.013	690	0.050	0.90
2015	Q3	LC_LCDSSLCC	0.00010	0.00010	0.010	0.010	447	0.122	0.64
2015	Q4	LC_LCDSSLCC	< 0.00050	< 0.00050	< 0.010	< 0.010	565	< 0.050	0.99
2016	Q1	EV_HC1	< 0.00010	< 0.00010	0.015	0.015	504	0.081	1.04
2016	Q3	EV_HC1	< 0.00010	< 0.00010	< 0.010	< 0.010	496	0.096	1.52
2016	Q4	EV_HC1	< 0.00010	< 0.00010	< 0.010	< 0.010	480	0.103	1.66
2016	Q1	EV_MC2	< 0.00010	< 0.00010	0.015	0.016	482	0.11	0.77
2016	Q3	EV_MC2	< 0.00010	< 0.00010	< 0.010	< 0.010	570	0.137	0.96
2016	Q1	GH_ERC	< 0.00010	< 0.00010	0.012	0.012	256	< 0.050	< 0.50
2016	Q3	GH_ERC	< 0.00010	< 0.00010	< 0.010	< 0.010	195	0.055	0.65
2016	Q4	GH_ERC	< 0.00010	< 0.00010	< 0.010	< 0.010	203	< 0.050	0.80
2016	Q1	GH_FR1	< 0.00010	< 0.00010	0.017	0.017	622	< 0.050	0.71
2016	Q3	GH_FR1	< 0.00010	< 0.00010	< 0.010	< 0.010	477	0.154	1.30
2016	Q4	GH_FR1	<0.0001	<0.0001	<0.01	<0.01	517	0.127	1.12
2016	Q1	LC_LCDSSLCC	< 0.00010	< 0.00010	0.017	0.018	713	0.070	< 0.50
2016	Q3	LC_LCDSSLCC	< 0.00010	< 0.00010	< 0.010	< 0.010	508	< 0.050	0.52
2016	Q4	LC_LCDSSLCC	< 0.00010	< 0.00010	< 0.010	< 0.010	487	0.129	0.91
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.00010	0.00010	0.010	0.011	314	0.115	1.78
2015	Q4	CM_MC2	0.00010	0.00010	0.010	0.010	627	0.11	0.83
2015	Q1	FR_FRCP1	0.00020	0.00020	0.017	0.017	2580	0.050	1.46
2015	Q4	FR_FRCP1	0.00010	0.00010	0.010	0.010	765	0.050	0.81
2015	Q2	LC_LCDSSLCC	0.00010	0.00010	0.010	0.010	337	0.050	1.52
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 0.00010	< 0.00010	< 0.010	< 0.010	639	0.095	0.69
2016	Q2	CM_MC2	< 0.00010	< 0.00010	< 0.010	0.012	401	0.20	2.23
2016	Q3	CM_MC2	< 0.00010	< 0.00010	< 0.010	< 0.010	644	0.134	1.15
2016	Q4	CM_MC2	< 0.00010	< 0.00010	< 0.010	< 0.010	451	0.149	2.42
2016	Q2	EV_HC1	< 0.00010	< 0.00010	0.013	0.015	378	0.187	2.51
2016	Q2	EV_MC2	< 0.00010	< 0.00010	< 0.010	0.015	165	0.202	3.28
2016	Q4	EV_MC2	< 0.00010	< 0.00010	< 0.010	< 0.010	228	0.204	3.37
2016	Q1	FR_FRCP1	< 0.00010	< 0.00010	0.021	0.021	1520	< 0.050	0.95
2016	Q2	FR_FRCP1	< 0.00010	< 0.00010	< 0.010	< 0.010	354	0.212	2.85
2016	Q3	FR_FRCP1	< 0.00010	< 0.00010	< 0.010	< 0.010	611	0.173	1.31
2016	Q4	FR_FRCP1	< 0.00010	< 0.00010	< 0.010	< 0.010	608	0.143	1.14
2016	Q2	GH_ERC	< 0.00010	< 0.00010	< 0.010	< 0.010	191	0.191	2.15
2016	Q2	GH_FR1	< 0.00010	< 0.00010	< 0.010	< 0.010	366	0.204	2.02
2016	Q2	LC_LCDSSLCC	< 0.00010	< 0.00010	0.011	0.012	352	0.184	1.81

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	TURBIDITY, LAB-N-ntu	URANIUM-D-mg/l	URANIUM-T-mg/l	VANADIUM-D-mg/l	VANADIUM-T-mg/l	ZINC-D-mg/l
References									
2015	Q1	Reference (FR_UFR1)	< 1.0	0.13	0.000471	0.000467	< 0.0010	< 0.0010	< 0.0030
2015	Q1	Reference (FR_UFR1)	< 1.0	0.13	0.000471	0.000467	< 0.0010	< 0.0010	< 0.0030
2015	Q1	Reference (FR_UFR1)	< 1.0	0.33	0.000473	0.000472	< 0.0010	< 0.0010	< 0.0030
2015	Q2	Reference (FR_UFR1)	2.40	1.51	0.000313	0.000329	< 0.00050	< 0.00050	< 0.0030
2015	Q3	Reference (FR_UFR1)	1.10	0.20	0.000416	0.000417	< 0.00050	< 0.00050	< 0.0030
2015	Q4	Reference (FR_UFR1)	< 1.0	0.26	0.000469	0.00044	< 0.00050	< 0.00050	< 0.0030
2015	Q2	Reference (GH_ER2)	4.40	3.89	0.000785	0.000778	< 0.00050	0.00051	< 0.0030
2015	Q4	Reference (GH_ER2)	< 1.0	0.26	0.000707	0.00072	< 0.00050	< 0.00050	< 0.0030
2016	Q1	Reference (FR_UFR1)	< 1.0	0.17	0.000498	0.000489	< 0.00050	< 0.00050	< 0.0030
2016	Q2	Reference (FR_UFR1)	1.90	1.63	0.000317	0.000331	< 0.00050	0.00051	< 0.0030
2016	Q3	Reference (FR_UFR1)	1.20	0.22	0.000423	0.000441	< 0.00050	< 0.00050	< 0.0030
2016	Q4	Reference (FR_UFR1)	< 1.0	0.85	0.00044	0.00046	< 0.00050	< 0.00050	< 0.0030
2016	Q2	Reference (GH_ER2)	14.7	4.73	0.000756	0.000785	< 0.00050	0.00104	< 0.0030
2016	Q4	Reference (GH_ER2)	< 1.0	0.38	0.000761	0.000786	< 0.00050	< 0.00050	< 0.0030
Tests that were not statistically different t									
2015	Q1	CM_MC2	1.70	0.53	0.00219	0.00226	0.0010	0.0010	0.0030
2015	Q3	CM_MC2	1.20	0.61	0.00237	0.00245	0.00050	0.00050	0.0030
2015	Q1	EV_HC1	1.00	0.24	0.00173	0.00175	0.0010	0.0010	0.0030
2015	Q2	EV_HC1	2.63	1.15	0.00124	0.00121	0.00050	0.00050	0.0030
2015	Q3	EV_HC1	2.30	0.77	0.0023	0.00226	0.00050	0.00050	0.0030
2015	Q4	EV_HC1	1.00	0.29	0.00264	0.00271	0.00050	0.00050	0.0030
2015	Q1	EV_MC2	1.20	0.31	0.00126	0.00123	0.0010	0.0010	0.0041
2015	Q2	EV_MC2	23.4	4.71	0.000514	0.000478	0.00050	0.00156	0.0030
2015	Q3	EV_MC2	1.20	0.34	0.00187	0.00185	0.00050	0.00050	0.0030
2015	Q4	EV_MC2	1.00	0.36	0.00185	0.00186	0.00050	0.00050	0.0030
2015	Q2	FR_FRCP1	7.70	2.00	0.00152	0.00156	0.00050	0.00054	0.0030
2015	Q3	FR_FRCP1	2.60	0.47	0.00272	0.0028	0.00050	0.00050	0.0030
2015	Q1	GH_ERC	2.60	0.41	0.000814	0.000839	0.0010	0.0010	0.0030
2015	Q2	GH_ERC	7.00	1.58	0.00083	0.000837	0.00050	0.00070	0.0030
2015	Q3	GH_ERC	5.10	1.25	0.00065	0.00071	0.00050	0.00058	0.0030
2015	Q4	GH_ERC	1.00	0.26	0.000766	0.000808	0.00050	0.00050	0.0030
2015	Q1	GH_FR1	1.00	0.18	0.00218	0.00217	0.0010	0.0010	0.0030
2015	Q2	GH_FR1	3.60	2.22	0.00157	0.00159	0.00050	0.00050	0.0030
2015	Q3	GH_FR1	1.20	0.33	0.00175	0.00177	0.00050	0.00050	0.0030
2015	Q4	GH_FR1	1.00	0.30	0.00187	0.00191	0.00050	0.00050	0.0030
2015	Q1	LC_LCDSSLCC	1.00	0.29	0.00392	0.00395	0.0010	0.0010	0.0038
2015	Q3	LC_LCDSSLCC	1.40	0.35	0.00257	0.0028	0.00050	0.00050	0.0092
2015	Q4	LC_LCDSSLCC	< 1.0	0.29	0.00375	0.00395	< 0.0025	< 0.0025	0.0081
2016	Q1	EV_HC1	< 1.0	0.25	0.00274	0.00277	< 0.00050	< 0.00050	< 0.0030
2016	Q3	EV_HC1	2.70	2.63	0.00228	0.00233	< 0.00050	< 0.00050	< 0.0030
2016	Q4	EV_HC1	1.80	2.33	0.00256	0.0026	< 0.00050	< 0.00050	< 0.0030
2016	Q1	EV_MC2	< 1.0	0.77	0.00167	0.00173	< 0.00050	< 0.00050	< 0.0030
2016	Q3	EV_MC2	< 1.0	0.30	0.00148	0.00149	< 0.00050	< 0.00050	< 0.0030
2016	Q1	GH_ERC	< 1.0	0.24	0.000988	0.000951	< 0.00050	< 0.00050	< 0.0030
2016	Q3	GH_ERC	< 1.0	1.08	0.000702	0.000669	< 0.00050	< 0.00050	< 0.0030
2016	Q4	GH_ERC	3.40	1.19	0.000889	0.000835	< 0.00050	< 0.00050	< 0.0030
2016	Q1	GH_FR1	< 1.0	0.35	0.00219	0.00223	< 0.00050	< 0.00050	< 0.0030
2016	Q3	GH_FR1	< 1.0	0.43	0.00196	0.0020	< 0.00050	< 0.00050	< 0.0030
2016	Q4	GH_FR1	<2	0.49	0.00215	0.00215	<0.0005	<0.0005	<0.003
2016	Q1	LC_LCDSSLCC	< 1.0	0.35	0.00388	0.00391	< 0.00050	< 0.00050	< 0.0030
2016	Q3	LC_LCDSSLCC	< 1.0	0.28	0.00286	0.00236	< 0.00050	< 0.00050	0.0089
2016	Q4	LC_LCDSSLCC	< 1.0	0.39	0.00322	0.00309	< 0.00050	< 0.00050	0.0061
Tests with significant results (2015)									
2015	Q2	CM_MC2	9.60	5.84	0.00111	0.00111	0.00050	0.00088	0.0031
2015	Q4	CM_MC2	6.60	0.99	0.00222	0.00223	0.00050	0.00050	0.0030
2015	Q1	FR_FRCP1	1.00	0.12	0.0152	0.0155	0.0020	0.0020	0.0030
2015	Q4	FR_FRCP1	1.00	0.29	0.00383	0.00368	0.00050	0.00050	0.0030
2015	Q2	LC_LCDSSLCC	1.60	0.48	0.00198	0.0020	0.00050	0.00050	0.0061
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 1.0	0.57	0.00262	0.00244	< 0.00050	< 0.00050	< 0.0030
2016	Q2	CM_MC2	14.5	6.51	0.00132	0.0012	< 0.00050	0.00085	0.0076
2016	Q3	CM_MC2	1.50	0.37	0.0026	0.0027	< 0.00050	< 0.00050	< 0.0030
2016	Q4	CM_MC2	9.10	3.75	0.00171	0.00174	< 0.00050	< 0.00050	< 0.0030
2016	Q2	EV_HC1	5.90	3.14	0.00195	0.00208	< 0.00050	0.00077	< 0.0030
2016	Q2	EV_MC2	24.9	10.8	0.000515	0.000576	< 0.00050	0.00192	< 0.0030
2016	Q4	EV_MC2	6.80	5.46	0.000621	0.000659	< 0.00050	0.00109	< 0.0030
2016	Q1	FR_FRCP1	< 1.0	0.28	0.00793	0.00797	< 0.00050	< 0.00050	< 0.0030
2016	Q2	FR_FRCP1	7.10	1.45	0.00156	0.00169	< 0.00050	0.00061	< 0.0030
2016	Q3	FR_FRCP1	1.40	0.36	0.00302	0.00299	< 0.00050	< 0.00050	< 0.0030
2016	Q4	FR_FRCP1	< 1.0	0.84	0.00295	0.00298	< 0.00050	< 0.00050	< 0.0030
2016	Q2	GH_ERC	22.7	5.70	0.000846	0.000845	< 0.00050	0.00143	< 0.0030
2016	Q2	GH_FR1	7.10	2.98	0.00153	0.00148	< 0.00050	0.00060	< 0.0030
2016	Q2	LC_LCDSSLCC	< 1.0	0.94	0.00224	0.00228	< 0.00050	< 0.00050	0.0089

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-1: C. *dubia* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	ZINC-T-mg/l	PCA_Factor1 (2015 and 2016 datasets)	PCA-Factor1 (2016 dataset)
References					
2015	Q1	Reference (FR_UFR1)	< 0.0030	-1.06	-
2015	Q1	Reference (FR_UFR1)	< 0.0030	-1.06	-
2015	Q1	Reference (FR_UFR1)	< 0.0030	-1.05	-
2015	Q2	Reference (FR_UFR1)	< 0.0030	-1.68	-
2015	Q3	Reference (FR_UFR1)	< 0.0030	-1.04	-
2015	Q4	Reference (FR_UFR1)	< 0.0030	-1.17	-
2015	Q2	Reference (GH_ER2)	< 0.0030	-1.13	-
2015	Q4	Reference (GH_ER2)	< 0.0030	-1.07	-
2016	Q1	Reference (FR_UFR1)	< 0.0030	-1.08	-0.99
2016	Q2	Reference (FR_UFR1)	< 0.0030	-1.74	-1.81
2016	Q3	Reference (FR_UFR1)	< 0.0030	-1.14	-1.03
2016	Q4	Reference (FR_UFR1)	< 0.0030	-1.29	-1.23
2016	Q2	Reference (GH_ER2)	< 0.0030	-1.18	-1.32
2016	Q4	Reference (GH_ER2)	< 0.0030	-1.14	-1.06
Tests that were not statistically different t					
2015	Q1	CM_MC2	0.0032	0.94	-
2015	Q3	CM_MC2	0.0030	0.89	-
2015	Q1	EV_HC1	0.0030	-0.51	-
2015	Q2	EV_HC1	0.0030	-1.05	-
2015	Q3	EV_HC1	0.0030	-0.01	-
2015	Q4	EV_HC1	0.0030	0.23	-
2015	Q1	EV_MC2	0.0030	0.64	-
2015	Q2	EV_MC2	0.0041	-0.94	-
2015	Q3	EV_MC2	0.0031	0.96	-
2015	Q4	EV_MC2	0.0030	0.98	-
2015	Q2	FR_FRCP1	0.0030	0.01	-
2015	Q3	FR_FRCP1	0.0030	0.80	-
2015	Q1	GH_ERC	0.0041	-0.83	-
2015	Q2	GH_ERC	0.0030	-0.99	-
2015	Q3	GH_ERC	0.0030	-1.10	-
2015	Q4	GH_ERC	0.0030	-0.86	-
2015	Q1	GH_FR1	0.0030	0.70	-
2015	Q2	GH_FR1	0.0030	0.08	-
2015	Q3	GH_FR1	0.0030	0.39	-
2015	Q4	GH_FR1	0.0030	0.48	-
2015	Q1	LC_LCDSSLCC	0.0039	1.13	-
2015	Q3	LC_LCDSSLCC	0.0106	0.65	-
2015	Q4	LC_LCDSSLCC	< 0.015	2.29	-
2016	Q1	EV_HC1	< 0.0030	0.32	0.39
2016	Q3	EV_HC1	< 0.0030	-0.01	0.00
2016	Q4	EV_HC1	< 0.0030	0.11	0.17
2016	Q1	EV_MC2	< 0.0030	0.80	0.88
2016	Q3	EV_MC2	0.0031	0.96	1.04
2016	Q1	GH_ERC	< 0.0030	-0.67	-0.62
2016	Q3	GH_ERC	< 0.0030	-1.13	-1.05
2016	Q4	GH_ERC	< 0.0030	-0.97	-0.92
2016	Q1	GH_FR1	< 0.0030	0.65	0.78
2016	Q3	GH_FR1	< 0.0030	0.35	0.52
2016	Q4	GH_FR1	<0.003	0.47	0.61
2016	Q1	LC_LCDSSLCC	0.0034	1.30	1.43
2016	Q3	LC_LCDSSLCC	0.0075	0.86	1.00
2016	Q4	LC_LCDSSLCC	0.0078	0.71	0.83
Tests with significant results (2015)					
2015	Q2	CM_MC2	0.0059	-0.16	-
2015	Q4	CM_MC2	0.0030	0.80	-
2015	Q1	FR_FRCP1	0.0060	3.20	-
2015	Q4	FR_FRCP1	0.0030	1.06	-
2015	Q2	LC_LCDSSLCC	0.0066	0.03	-
Tests with significant results (2016)					
2016	Q1	CM_MC2	< 0.0030	1.06	1.09
2016	Q2	CM_MC2	0.013	0.19	-0.16
2016	Q3	CM_MC2	< 0.0030	0.97	1.10
2016	Q4	CM_MC2	< 0.0030	0.30	0.18
2016	Q2	EV_HC1	< 0.0030	-0.25	-0.32
2016	Q2	EV_MC2	0.0047	-1.00	-1.55
2016	Q4	EV_MC2	< 0.0030	-0.75	-1.05
2016	Q1	FR_FRCP1	< 0.0030	1.99	2.19
2016	Q2	FR_FRCP1	0.0033	0.00	-0.01
2016	Q3	FR_FRCP1	< 0.0030	0.72	0.93
2016	Q4	FR_FRCP1	< 0.0030	0.65	0.83
2016	Q2	GH_ERC	0.0035	-0.94	-1.18
2016	Q2	GH_FR1	< 0.0030	-0.03	-0.02
2016	Q2	LC_LCDSSLCC	0.0101	0.37	0.36

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	Mean Cell Yield (x 10^4 cells/mL) (Mean)	ACIDITY TO pH 8.3 (As CaCO3)-N-mg/l	ALKALINITY, BICARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, CARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, HYDROXIDE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, TOTAL (As CaCO3), lab measured.-N-mg/l	ALUMINUM-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	108	1.00	147	2.30	1.00	149	0.0030
2015	Q1	Reference (FR_UFR1)	111	1.00	147	2.30	1.00	149	0.0030
2015	Q1	Reference (FR_UFR1)	106	1.00	144	1.30	1.00	145	0.0030
2015	Q2	Reference (FR_UFR1)	122	1.00	116	2.80	1.00	119	0.0092
2015	Q3	Reference (FR_UFR1)	126	1.00	152	7.40	1.00	159	0.0030
2015	Q4	Reference (FR_UFR1)	122	1.00	138	7.60	1.00	146	0.0030
2015	Q2	Reference (GH_ER2)	102	1.00	151	6.20	1.00	157	0.0030
2015	Q4	Reference (GH_ER2)	132	1.00	147	1.00	1.00	147	0.0030
2016	Q1	Reference (FR_UFR1)	135	< 1.0	138	< 1.0	< 1.0	138	< 0.0030
2016	Q2	Reference (FR_UFR1)	108	< 1.0	110	< 1.0	< 1.0	110	0.0147
2016	Q3	Reference (FR_UFR1)	121	< 1.0	160	< 1.0	< 1.0	160	< 0.0030
2016	Q4	Reference (FR_UFR1)	154	< 1.0	141	< 1.0	< 1.0	141	0.0111
2016	Q2	Reference (GH_ER2)	98.8	< 1.0	143	< 1.0	< 1.0	143	0.0036
2016	Q4	Reference (GH_ER2)	152	< 1.0	143	< 1.0	< 1.0	143	< 0.0030
Tests that were not statistically different than reference									
2015	Q1	CM_MC2	101	1.80	205	8.40	1.00	213	0.0097
2015	Q2	EV_HC1	140	1.30	103	6.73	1.00	110	0.00317
2015	Q3	EV_HC1	134	1.00	182	9.80	1.00	192	0.0049
2015	Q4	EV_HC1	129	1.00	187	8.00	1.00	195	0.0030
2015	Q1	EV_MC2	141	3.40	193	1.00	1.00	193	0.0037
2015	Q4	EV_MC2	136	3.00	193	1.00	1.00	193	0.0030
2015	Q2	FR_FRCP1	140	1.00	142	5.00	1.00	147	0.0030
2015	Q3	FR_FRCP1	127	1.00	187	11.2	1.00	198	0.0030
2015	Q1	GH_ERC	108	2.60	155	1.00	1.00	155	0.0030
2015	Q2	GH_ERC	131	1.00	157	4.80	1.00	161	0.0030
2015	Q3	GH_ERC	129	1.00	142	1.00	1.00	142	0.0030
2015	Q4	GH_ERC	147	1.00	151	1.00	1.00	151	0.0030
2015	Q1	GH_FR1	96.5	1.70	202	1.00	1.00	202	0.0030
2015	Q2	GH_FR1	125	1.00	159	8.00	1.00	167	0.0030
2015	Q4	GH_FR1	153	1.00	183	4.80	1.00	188	0.0030
2015	Q1	LC_LCDSSLCC	117	1.00	193	2.70	1.00	195	0.0030
2016	Q4	CM_MC2	156	< 1.0	165	< 1.0	< 1.0	165	0.0088
2016	Q2	EV_HC1	114	< 1.0	173	6.00	< 1.0	179	0.0046
2016	Q3	EV_HC1	121	< 1.0	192	< 1.0	< 1.0	192	0.0139
2016	Q4	EV_HC1	158	< 1.0	190	2.00	< 1.0	192	0.0054
2016	Q1	EV_MC2	130	3.50	179	< 1.0	< 1.0	179	< 0.0030
2016	Q2	EV_MC2	112	1.40	98.0	< 1.0	< 1.0	98.0	0.0176
2016	Q3	EV_MC2	120	1.60	204	< 1.0	< 1.0	204	< 0.0030
2016	Q4	EV_MC2	166	1.10	122	< 1.0	< 1.0	122	0.0234
2016	Q3	FR_FRCP1	125	< 1.0	193	4.80	< 1.0	198	< 0.0030
2016	Q1	GH_ERC	130	< 1.0	152	< 1.0	< 1.0	152	< 0.0030
2016	Q2	GH_ERC	104	< 1.0	146	< 1.0	< 1.0	146	0.0045
2016	Q3	GH_ERC	121	1.10	144	< 1.0	< 1.0	144	< 0.0030
2016	Q4	GH_ERC	157	< 1.0	148	< 1.0	< 1.0	148	< 0.0030
2016	Q3	GH_FR1	118	< 1.0	198	< 1.0	< 1.0	198	< 0.0030
2016	Q4	GH_FR1	159	<1	188	<1	<1	188	<0.003
2016	Q1	LC_LCDSSLCC	130	< 1.0	193	< 1.0	< 1.0	193	< 0.0030
2016	Q3	LC_LCDSSLCC	120	1.10	187	< 1.0	< 1.0	187	< 0.0030
2016	Q4	LC_LCDSSLCC	156	< 1.0	174	2.20	< 1.0	176	< 0.0030
Tests with significant results (2015)									
2015	Q2	CM_MC2	108	1.00	143	4.90	1.00	148	0.0044
2015	Q3	CM_MC2	109	1.00	188	10.6	1.00	198	0.0030
2015	Q4	CM_MC2	115	1.00	209	6.40	1.00	215	0.0030
2015	Q1	EV_HC1	27.2	1.00	131	4.30	1.00	135	0.0030
2015	Q2	EV_MC2	102	1.60	112	3.70	1.00	116	0.0070
2015	Q3	EV_MC2	110	3.20	194	1.00	1.00	194	0.0030
2015	Q1	FR_FRCP1	64.0	5.10	337	1.00	1.00	337	0.0030
2015	Q4	FR_FRCP1	96.2	1.00	211	1.00	1.00	211	0.0030
2015	Q3	GH_FR1	107	1.00	174	8.20	1.00	182	0.0030
2015	Q2	LC_LCDSSLCC	69.2	1.00	144	5.50	1.00	150	0.0030
2015	Q3	LC_LCDSSLCC	101	1.00	171	10.0	1.00	181	0.0030
2015	Q4	LC_LCDSSLCC	112	1.00	197	1.00	1.00	197	0.0050
Tests with significant results (2016)									
2016	Q1	CM_MC2	122	< 1.0	199	7.00	< 1.0	206	< 0.0030
2016	Q2	CM_MC2	94.0	1.10	152	< 1.0	< 1.0	152	0.0076
2016	Q3	CM_MC2	108	< 1.0	193	8.80	< 1.0	201	< 0.0030
2016	Q1	EV_HC1	120	< 1.0	191	< 1.0	< 1.0	191	< 0.0030
2016	Q1	FR_FRCP1	93.5	2.20	254	< 1.0	< 1.0	254	< 0.0030
2016	Q2	FR_FRCP1	78.8	< 1.0	147	< 1.0	< 1.0	147	< 0.0030
2016	Q4	FR_FRCP1	141	< 1.0	190	3.40	< 1.0	193	0.0046
2016	Q1	GH_FR1	120	< 1.0	190	< 1.0	< 1.0	190	< 0.0030
2016	Q2	GH_FR1	100	< 1.0	160	< 1.0	< 1.0	160	< 0.0030
2016	Q2	LC_LCDSSLCC	91.0	< 1.0	153	< 1.0	< 1.0	153	< 0.0030

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	ALUMINUM-T-mg/l	ANTIMONY-D-mg/l	ANTIMONY-T-mg/l	ARSENIC-D-mg/l	ARSENIC-T-mg/l	BARIUM-D-mg/l	BARIUM-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.0032	0.00010	0.00010	0.00010	0.00010	0.0773	0.0771
2015	Q1	Reference (FR_UFR1)	0.0032	0.00010	0.00010	0.00010	0.00010	0.0773	0.0771
2015	Q1	Reference (FR_UFR1)	0.0059	0.00010	0.00010	0.00010	0.00010	0.0752	0.0778
2015	Q2	Reference (FR_UFR1)	0.0832	0.00010	0.00010	0.00012	0.00014	0.0422	0.043
2015	Q3	Reference (FR_UFR1)	0.0078	0.00010	0.00010	0.00011	0.00012	0.0757	0.0755
2015	Q4	Reference (FR_UFR1)	0.0046	0.00010	0.00010	0.00010	0.00010	0.0741	0.0746
2015	Q2	Reference (GH_ER2)	0.0761	0.00010	0.00010	0.00011	0.00016	0.0462	0.0476
2015	Q4	Reference (GH_ER2)	0.0046	0.00010	0.00010	0.00010	0.00010	0.0466	0.0485
2016	Q1	Reference (FR_UFR1)	0.0048	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.074	0.0734
2016	Q2	Reference (FR_UFR1)	0.113	< 0.00010	< 0.00010	0.00011	0.00014	0.0396	0.0419
2016	Q3	Reference (FR_UFR1)	0.0128	< 0.00010	< 0.00010	< 0.00010	0.00010	0.0737	0.0766
2016	Q4	Reference (FR_UFR1)	0.0509	< 0.00010	< 0.00010	< 0.00010	0.00015	0.0685	0.064
2016	Q2	Reference (GH_ER2)	0.201	< 0.00010	< 0.00010	0.00011	0.00024	0.0417	0.0438
2016	Q4	Reference (GH_ER2)	0.0075	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0421	0.0376
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.032	0.00017	0.00019	0.00017	0.00022	0.072	0.0722
2015	Q2	EV_HC1	0.0499	0.00010	0.00010	0.00013	0.00016	0.0246	0.025
2015	Q3	EV_HC1	0.0344	0.00010	0.00011	0.00017	0.00024	0.0584	0.0586
2015	Q4	EV_HC1	0.0058	0.00010	0.00012	0.00014	0.00015	0.0596	0.0628
2015	Q1	EV_MC2	0.0185	0.00010	0.00010	0.00015	0.00018	0.108	0.111
2015	Q4	EV_MC2	0.0056	0.00035	0.00038	0.00014	0.00019	0.111	0.111
2015	Q2	FR_FRCP1	0.0725	0.00022	0.00022	0.00010	0.00015	0.0639	0.0648
2015	Q3	FR_FRCP1	0.0217	0.00027	0.00033	0.00010	0.00019	0.0757	0.0764
2015	Q1	GH_ERC	0.0281	0.00010	0.00012	0.00010	0.00015	0.0551	0.0561
2015	Q2	GH_ERC	0.133	0.00010	0.00010	0.00010	0.00017	0.0496	0.0507
2015	Q3	GH_ERC	0.0834	0.00010	0.00010	0.00010	0.00017	0.0462	0.0487
2015	Q4	GH_ERC	0.0070	0.00010	0.00010	0.00010	0.00010	0.0576	0.060
2015	Q1	GH_FR1	0.0048	0.00014	0.00014	0.00010	0.00014	0.124	0.126
2015	Q2	GH_FR1	0.0526	0.00017	0.00017	0.00010	0.00014	0.0845	0.087
2015	Q4	GH_FR1	0.0040	0.00011	0.00015	0.00010	0.00014	0.117	0.116
2015	Q1	LC_LCDSSLCC	0.0052	0.00022	0.00022	0.00011	0.00013	0.0956	0.0929
2016	Q4	CM_MC2	0.149	0.00014	0.00016	0.00017	0.00026	0.054	0.0566
2016	Q2	EV_HC1	0.151	< 0.00010	0.00013	0.00013	0.00024	0.0379	0.0402
2016	Q3	EV_HC1	0.0725	< 0.00010	< 0.00010	0.00016	0.00021	0.0645	0.0659
2016	Q4	EV_HC1	0.0755	< 0.00010	0.00010	0.00015	0.00019	0.0595	0.0599
2016	Q1	EV_MC2	0.031	0.00025	0.00025	0.00013	0.00016	0.111	0.109
2016	Q2	EV_MC2	0.419	< 0.00010	0.00020	0.00017	0.00037	0.0579	0.0629
2016	Q3	EV_MC2	0.0054	0.00021	0.00022	0.00018	0.00018	0.10	0.10
2016	Q4	EV_MC2	0.225	< 0.00010	0.00011	0.00019	0.00027	0.0737	0.0812
2016	Q3	FR_FRCP1	0.0144	0.00020	0.00022	< 0.00010	0.00012	0.071	0.0727
2016	Q1	GH_ERC	0.0031	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0668	0.066
2016	Q2	GH_ERC	0.305	< 0.00010	0.00011	< 0.00010	0.00030	0.0506	0.0525
2016	Q3	GH_ERC	0.0206	< 0.00010	< 0.00010	< 0.00010	0.00011	0.0494	0.050
2016	Q4	GH_ERC	0.0189	< 0.00010	< 0.00010	< 0.00010	0.00012	0.0554	0.0509
2016	Q3	GH_FR1	0.0079	0.00013	0.00014	< 0.00010	0.00012	0.101	0.102
2016	Q4	GH_FR1	0.012	0.00015	0.00034	<0.0001	0.000135	0.101	0.0972
2016	Q1	LC_LCDSSLCC	0.0074	0.00020	0.00025	< 0.00010	0.00013	0.0864	0.0887
2016	Q3	LC_LCDSSLCC	0.0047	0.00021	0.00024	< 0.00010	0.00011	0.0719	0.0662
2016	Q4	LC_LCDSSLCC	0.0056	0.00019	0.00026	< 0.00010	0.00020	0.0554	0.0526
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.314	0.00012	0.00013	0.00017	0.00031	0.0436	0.0456
2015	Q3	CM_MC2	0.016	0.00018	0.00021	0.00019	0.00021	0.0689	0.0693
2015	Q4	CM_MC2	0.0054	0.00013	0.00013	0.00018	0.00022	0.0902	0.0916
2015	Q1	EV_HC1	0.00903	0.00010	0.000103	0.00013	0.000143	0.0413	0.0422
2015	Q2	EV_MC2	0.361	0.00010	0.00011	0.00018	0.00033	0.0623	0.067
2015	Q3	EV_MC2	0.0085	0.00041	0.00044	0.00016	0.00023	0.102	0.101
2015	Q1	FR_FRCP1	0.0060	0.00048	0.00051	0.00020	0.00022	0.0355	0.0373
2015	Q4	FR_FRCP1	0.0035	0.00025	0.00026	0.00010	0.00010	0.0804	0.0781
2015	Q3	GH_FR1	0.0132	0.00022	0.00025	0.00014	0.00020	0.098	0.0996
2015	Q2	LC_LCDSSLCC	0.0163	0.00015	0.00017	0.00011	0.00014	0.0414	0.0421
2015	Q3	LC_LCDSSLCC	0.013	0.00019	0.00026	0.00010	0.00011	0.0604	0.0627
2015	Q4	LC_LCDSSLCC	0.015	0.00050	0.00050	0.00050	0.00050	0.0845	0.0912
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.0122	0.00018	0.00018	0.00015	0.00021	0.0771	0.0754
2016	Q2	CM_MC2	0.344	0.00014	0.00015	0.00017	0.00029	0.050	0.0518
2016	Q3	CM_MC2	0.0053	0.00019	0.00025	0.00019	0.00020	0.077	0.0754
2016	Q1	EV_HC1	0.0096	< 0.00010	< 0.00010	0.00015	0.00016	0.0672	0.0654
2016	Q1	FR_FRCP1	< 0.0030	0.00027	0.00030	< 0.00010	0.00010	0.0747	0.0745
2016	Q2	FR_FRCP1	0.106	0.00018	0.00025	< 0.00010	0.00016	0.0645	0.0676
2016	Q4	FR_FRCP1	0.0148	0.00019	0.00020	< 0.00010	0.00018	0.0718	0.0673
2016	Q1	GH_FR1	0.0040	0.00012	0.00014	< 0.00010	< 0.00010	0.118	0.111
2016	Q2	GH_FR1	0.0895	0.00017	0.00023	0.00011	0.00017	0.0792	0.0779
2016	Q2	LC_LCDSSLCC	0.0288	0.00024	0.00033	0.00012	0.00015	0.0369	0.0384

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	BERYLLIUM-D-mg/l	BERYLLIUM-T-mg/l	BISMUTH-D-mg/l	BISMUTH-T-mg/l	BORON-D-mg/l	BORON-T-mg/l	BROMIDE-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.00010	0.00010	0.00050	0.00050	0.010	0.010	0.050
2015	Q1	Reference (FR_UFR1)	0.00010	0.00010	0.00050	0.00050	0.010	0.010	0.050
2015	Q1	Reference (FR_UFR1)	0.00010	0.00010	0.00050	0.00050	0.010	0.010	0.050
2015	Q2	Reference (FR_UFR1)	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q3	Reference (FR_UFR1)	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q4	Reference (FR_UFR1)	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q2	Reference (GH_ER2)	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q4	Reference (GH_ER2)	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2016	Q1	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q2	Reference (FR_UFR1)	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q3	Reference (FR_UFR1)	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q4	Reference (FR_UFR1)	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q2	Reference (GH_ER2)	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q4	Reference (GH_ER2)	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.00010	0.00010	0.00050	0.00050	0.024	0.025	0.10
2015	Q2	EV_HC1	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q3	EV_HC1	0.00010	0.00010	0.000050	0.000050	0.010	0.011	0.050
2015	Q4	EV_HC1	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.25
2015	Q1	EV_MC2	0.00010	0.00010	0.00050	0.00050	0.014	0.016	0.050
2015	Q4	EV_MC2	0.00010	0.00010	0.000050	0.000050	0.016	0.016	0.25
2015	Q2	FR_FRCP1	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q3	FR_FRCP1	0.00010	0.00010	0.000050	0.000050	0.013	0.014	0.10
2015	Q1	GH_ERC	0.00010	0.00010	0.00050	0.00050	0.010	0.010	0.050
2015	Q2	GH_ERC	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q3	GH_ERC	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q4	GH_ERC	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q1	GH_FR1	0.00010	0.00010	0.00050	0.00050	0.012	0.010	0.10
2015	Q2	GH_FR1	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q4	GH_FR1	0.00010	0.00010	0.000050	0.000050	0.010	0.011	0.25
2015	Q1	LC_LCDSSLCC	0.00010	0.00010	0.00050	0.00050	0.013	0.014	0.10
2016	Q4	CM_MC2	< 0.000020	< 0.000020	< 0.000050	< 0.000050	0.018	0.020	< 0.050
2016	Q2	EV_HC1	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q3	EV_HC1	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q4	EV_HC1	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.25
2016	Q1	EV_MC2	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.013	0.013	< 0.25
2016	Q2	EV_MC2	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q3	EV_MC2	< 0.000020	< 0.000020	< 0.000050	< 0.000050	0.017	0.018	< 0.25
2016	Q4	EV_MC2	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q3	FR_FRCP1	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	0.011	< 0.25
2016	Q1	GH_ERC	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q2	GH_ERC	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q3	GH_ERC	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q4	GH_ERC	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q3	GH_FR1	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.25
2016	Q4	GH_FR1	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01	<0.25
2016	Q1	LC_LCDSSLCC	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.012	0.013	< 0.25
2016	Q3	LC_LCDSSLCC	< 0.000020	< 0.000020	< 0.000050	< 0.000050	0.013	0.012	< 0.25
2016	Q4	LC_LCDSSLCC	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	0.010	< 0.25
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.00010	0.00010	0.000050	0.000050	0.014	0.015	0.050
2015	Q3	CM_MC2	0.00010	0.00010	0.000050	0.000050	0.027	0.029	0.10
2015	Q4	CM_MC2	0.00010	0.00010	0.000050	0.000050	0.026	0.027	0.25
2015	Q1	EV_HC1	0.00010	0.00010	0.00050	0.00050	0.010	0.010	0.050
2015	Q2	EV_MC2	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q3	EV_MC2	0.00010	0.00010	0.000050	0.000050	0.016	0.018	0.10
2015	Q1	FR_FRCP1	0.00020	0.00020	0.0010	0.0010	0.020	0.020	1.00
2015	Q4	FR_FRCP1	0.00010	0.00010	0.000050	0.000050	0.011	0.016	0.25
2015	Q3	GH_FR1	0.00010	0.00010	0.000050	0.000050	0.010	0.011	0.050
2015	Q2	LC_LCDSSLCC	0.00010	0.00010	0.000050	0.000050	0.010	0.010	0.050
2015	Q3	LC_LCDSSLCC	0.00010	0.00010	0.000050	0.000050	0.012	0.013	0.10
2015	Q4	LC_LCDSSLCC	0.00050	0.00050	0.00025	0.00025	0.050	0.050	0.050
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.026	0.026	< 0.25
2016	Q2	CM_MC2	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.016	0.017	< 0.050
2016	Q3	CM_MC2	< 0.000020	< 0.000020	< 0.000050	< 0.000050	0.028	0.029	< 0.25
2016	Q1	EV_HC1	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.25
2016	Q1	FR_FRCP1	< 0.00010	< 0.00010	< 0.000050	< 0.000050	0.010	0.011	< 0.50
2016	Q2	FR_FRCP1	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q4	FR_FRCP1	< 0.000020	< 0.000020	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.25
2016	Q1	GH_FR1	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.25
2016	Q2	GH_FR1	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	< 0.010	< 0.050
2016	Q2	LC_LCDSSLCC	< 0.00010	< 0.00010	< 0.000050	< 0.000050	< 0.010	0.011	< 0.050

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	CADMIUM-D-mg/l	CADMIUM-T-mg/l	CALCIUM-D-mg/l	CALCIUM-T-mg/l	CARBON, DISSOLVED ORGANIC-D-mg/l	CHLORIDE-D-mg/l	CHROMIUM-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.000010	0.000011	55.6	55.6	0.84	1.00	0.00017
2015	Q1	Reference (FR_UFR1)	0.000010	0.000011	55.6	55.6	0.84	1.00	0.00017
2015	Q1	Reference (FR_UFR1)	0.000011	0.000010	55.9	57.0	0.50	1.00	0.00013
2015	Q2	Reference (FR_UFR1)	0.0000074	0.000013	37.0	37.5	1.84	1.00	0.00014
2015	Q3	Reference (FR_UFR1)	0.0000057	0.0000083	54.1	55.1	0.75	1.00	0.00013
2015	Q4	Reference (FR_UFR1)	0.0000050	0.0000083	53.5	55.6	0.60	1.00	0.00011
2015	Q2	Reference (GH_ER2)	0.0000050	0.0000155	46.7	48.2	0.84	1.00	0.00022
2015	Q4	Reference (GH_ER2)	0.0000053	0.0000069	50.2	51.2	0.61	1.20	0.00022
2016	Q1	Reference (FR_UFR1)	0.0000054	0.0000062	57.1	58.0	< 0.50	1.10	0.00012
2016	Q2	Reference (FR_UFR1)	0.0000062	0.0000159	35.0	36.6	2.49	< 0.10	0.00011
2016	Q3	Reference (FR_UFR1)	0.0000055	0.0000108	49.3	51.1	0.86	0.13	< 0.00010
2016	Q4	Reference (FR_UFR1)	0.0000057	0.0000058	50.0	48.0	1.06	0.18	< 0.00010
2016	Q2	Reference (GH_ER2)	0.0000076	0.0000247	47.1	48.0	1.40	0.61	0.00017
2016	Q4	Reference (GH_ER2)	< 0.0000050	0.0000079	47.6	47.8	0.64	0.36	0.00021
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.000022	0.000023	105	106	0.93	3.40	0.00019
2015	Q2	EV_HC1	0.0000131	0.0000212	47.5	47.1	1.09	1.30	0.000133
2015	Q3	EV_HC1	0.0000172	0.0000249	81.7	74.5	1.08	1.40	0.00015
2015	Q4	EV_HC1	0.0000128	0.0000182	92.1	92.5	0.63	1.80	0.00013
2015	Q1	EV_MC2	0.000055	0.000044	94.6	90.7	1.65	11.4	0.00012
2015	Q4	EV_MC2	0.0000365	0.0000469	102	102	0.60	8.70	0.00012
2015	Q2	FR_FRCP1	0.0000304	0.0000496	73.4	73.0	1.56	1.20	0.00010
2015	Q3	FR_FRCP1	0.0000376	0.0000474	107	109	0.93	1.50	0.00010
2015	Q1	GH_ERC	0.000010	0.000010	54.7	55.2	0.64	1.00	0.00029
2015	Q2	GH_ERC	0.0000070	0.0000218	51.9	53.3	0.96	1.00	0.00017
2015	Q3	GH_ERC	0.0000059	0.0000163	46.8	49.4	0.75	1.00	0.00019
2015	Q4	GH_ERC	0.0000050	0.0000073	55.7	57.7	0.50	1.20	0.00022
2015	Q1	GH_FR1	0.000021	0.000024	112	114	1.06	2.60	0.00021
2015	Q2	GH_FR1	0.0000213	0.0000346	79.0	81.2	1.36	1.40	0.00010
2015	Q4	GH_FR1	0.0000147	0.0000235	105	106	0.50	1.70	0.00012
2015	Q1	LC_LCDSSLCC	0.000086	0.000109	126	123	1.14	2.70	0.00016
2016	Q4	CM_MC2	0.0000129	0.0000162	79.4	79.2	2.31	2.10	0.00017
2016	Q2	EV_HC1	0.0000268	0.000047	69.5	71.6	1.94	0.79	0.00011
2016	Q3	EV_HC1	0.0000159	0.0000271	78.1	80.6	0.95	1.05	0.00016
2016	Q4	EV_HC1	0.0000192	0.0000236	79.2	81.6	1.36	1.27	0.00014
2016	Q1	EV_MC2	0.0000353	0.0000364	97.4	94.1	0.85	9.20	0.00013
2016	Q2	EV_MC2	0.0000376	0.0000783	37.6	36.9	2.58	1.24	0.00014
2016	Q3	EV_MC2	0.0000661	0.0000691	106	111	0.83	13.4	0.00012
2016	Q4	EV_MC2	0.0000252	0.0000387	45.3	47.5	2.84	2.85	0.00012
2016	Q3	FR_FRCP1	0.0000242	0.000042	101	103	0.99	1.47	< 0.00010
2016	Q1	GH_ERC	< 0.0000050	0.0000065	67.1	66.7	< 0.50	1.30	0.00024
2016	Q2	GH_ERC	0.0000108	0.0000348	52.9	52.5	1.32	0.79	0.00019
2016	Q3	GH_ERC	< 0.0000050	0.0000053	46.2	44.7	0.58	0.37	0.00020
2016	Q4	GH_ERC	< 0.0000050	< 0.0000050	54.9	50.6	< 0.50	0.44	0.00020
2016	Q3	GH_FR1	0.0000154	0.000016	88.6	89.1	0.80	1.49	< 0.00010
2016	Q4	GH_FR1	0.0000173	0.0000209	93.4	93.7	0.745	1.48	0.00010
2016	Q1	LC_LCDSSLCC	0.0000828	0.0000763	134	134	< 0.50	17.3	0.00014
2016	Q3	LC_LCDSSLCC	0.000174	0.000161	98.3	91.4	< 0.50	4.65	0.00012
2016	Q4	LC_LCDSSLCC	0.000139	0.000147	93.9	83.3	0.91	6.76	0.00010
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.0000357	0.0000596	60.6	60.3	1.53	1.20	0.00020
2015	Q3	CM_MC2	0.0000099	0.0000182	102	104	0.86	2.10	0.00019
2015	Q4	CM_MC2	0.0000075	0.0000093	118	115	0.56	3.20	0.00019
2015	Q1	EV_HC1	0.000017	0.0000163	60.0	60.4	0.823	1.47	0.000137
2015	Q2	EV_MC2	0.0000179	0.0000644	43.4	44.3	1.90	2.90	0.00020
2015	Q3	EV_MC2	0.0000492	0.0000557	94.6	86.8	1.04	9.60	0.00013
2015	Q1	FR_FRCP1	0.000020	0.000053	331	337	1.44	2.60	0.00020
2015	Q4	FR_FRCP1	0.000040	0.0000549	131	130	0.65	2.20	0.00010
2015	Q3	GH_FR1	0.0000185	0.0000213	88.8	89.8	0.87	1.60	0.00012
2015	Q2	LC_LCDSSLCC	0.000135	0.000139	67.0	68.2	1.24	1.40	0.00014
2015	Q3	LC_LCDSSLCC	0.000245	0.000256	87.6	92.0	0.83	2.00	0.00011
2015	Q4	LC_LCDSSLCC	0.000243	0.000261	116	117	0.74	2.22	0.00050
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.0000164	0.0000181	117	117	0.58	4.90	0.00018
2016	Q2	CM_MC2	0.0000692	0.00011	68.7	67.1	1.93	1.50	0.00016
2016	Q3	CM_MC2	0.0000075	0.0000086	101	105	0.99	3.37	0.00011
2016	Q1	EV_HC1	0.0000173	0.0000186	96.0	94.6	0.65	2.10	0.00016
2016	Q1	FR_FRCP1	0.0000363	0.0000482	221	221	0.80	3.50	< 0.00010
2016	Q2	FR_FRCP1	0.0000305	0.0000516	70.9	73.2	2.03	0.51	0.00010
2016	Q4	FR_FRCP1	0.0000449	0.0000505	104	96.8	0.90	1.25	< 0.00010
2016	Q1	GH_FR1	0.0000144	0.0000175	119	119	0.51	2.50	0.00012
2016	Q2	GH_FR1	0.0000245	0.0000352	73.5	71.2	1.95	0.99	< 0.00010
2016	Q2	LC_LCDSSLCC	0.000199	0.000221	71.1	72.1	1.55	2.83	0.00014

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	CHROMIUM-T-mg/l	COBALT-D-mg/l	COBALT-T-mg/l	CONDUCTIVITY, LAB-N-us/cm	COPPER-D-mg/l	COPPER-T-mg/l	FLUORIDE-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.00017	0.00010	0.00010	367	0.00050	0.00050	0.137
2015	Q1	Reference (FR_UFR1)	0.00017	0.00010	0.00010	367	0.00050	0.00050	0.137
2015	Q1	Reference (FR_UFR1)	0.00015	0.00010	0.00010	353	0.00050	0.00050	0.137
2015	Q2	Reference (FR_UFR1)	0.00046	0.00010	0.00010	245	0.00050	0.00050	0.145
2015	Q3	Reference (FR_UFR1)	0.00013	0.00010	0.00010	342	0.00050	0.00050	0.153
2015	Q4	Reference (FR_UFR1)	0.00036	0.00010	0.00010	354	0.00050	0.00050	0.156
2015	Q2	Reference (GH_ER2)	0.00037	0.00010	0.00010	303	0.00050	0.00050	0.153
2015	Q4	Reference (GH_ER2)	0.00034	0.00010	0.00010	314	0.00050	0.00050	0.16
2016	Q1	Reference (FR_UFR1)	< 0.00020	< 0.00010	< 0.00010	358	< 0.00050	< 0.00050	0.155
2016	Q2	Reference (FR_UFR1)	0.00029	< 0.00010	< 0.00010	233	< 0.00050	< 0.00050	0.149
2016	Q3	Reference (FR_UFR1)	0.00018	< 0.00010	< 0.00010	338	< 0.00050	< 0.00050	0.173
2016	Q4	Reference (FR_UFR1)	0.00021	< 0.00010	< 0.00010	330	< 0.00050	< 0.00050	0.155
2016	Q2	Reference (GH_ER2)	0.00062	< 0.00010	< 0.00010	289	< 0.00050	< 0.00050	0.157
2016	Q4	Reference (GH_ER2)	0.00024	< 0.00010	< 0.00010	297	< 0.00050	< 0.00050	0.166
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.00024	0.00074	0.00079	826	0.00050	0.00050	0.137
2015	Q2	EV_HC1	0.000213	0.00010	0.00010	350	0.00050	0.00050	0.129
2015	Q3	EV_HC1	0.00024	0.00010	0.00010	625	0.00050	0.00050	0.21
2015	Q4	EV_HC1	0.00022	0.00010	0.00010	732	0.00050	0.00050	0.20
2015	Q1	EV_MC2	0.00020	0.00010	0.00010	665	0.00124	0.00076	0.146
2015	Q4	EV_MC2	0.00015	0.00010	0.00010	733	0.00050	0.00050	0.16
2015	Q2	FR_FRCP1	0.00028	0.00010	0.00012	573	0.00050	0.00050	0.204
2015	Q3	FR_FRCP1	0.00017	0.00010	0.00010	815	0.00050	0.00050	0.201
2015	Q1	GH_ERC	0.00034	0.00010	0.00010	345	0.00050	0.00050	0.149
2015	Q2	GH_ERC	0.00054	0.00010	0.00010	338	0.00050	0.00050	0.151
2015	Q3	GH_ERC	0.00037	0.00010	0.00010	284	0.00050	0.00050	0.158
2015	Q4	GH_ERC	0.00026	0.00010	0.00010	355	0.00050	0.00050	0.156
2015	Q1	GH_FR1	0.00015	0.00010	0.00010	851	0.00050	0.00050	0.18
2015	Q2	GH_FR1	0.00020	0.00010	0.00010	614	0.00050	0.00050	0.174
2015	Q4	GH_FR1	0.00013	0.00010	0.00010	760	0.00050	0.00050	0.16
2015	Q1	LC_LCDSSLCC	0.00021	0.00010	0.00010	940	0.00050	0.00050	0.236
2016	Q4	CM_MC2	0.00035	0.00065	0.00108	622	< 0.00050	< 0.00050	0.107
2016	Q2	EV_HC1	0.00031	< 0.00010	< 0.00010	547	< 0.00050	< 0.00050	0.186
2016	Q3	EV_HC1	0.00025	< 0.00010	< 0.00010	652	< 0.00050	< 0.00050	0.232
2016	Q4	EV_HC1	0.00023	< 0.00010	< 0.00010	668	< 0.00050	< 0.00050	0.20
2016	Q1	EV_MC2	0.00018	< 0.00010	< 0.00010	700	< 0.00050	< 0.00050	0.15
2016	Q2	EV_MC2	0.00076	< 0.00010	0.00027	266	< 0.00050	0.0010	0.111
2016	Q3	EV_MC2	0.00015	< 0.00010	< 0.00010	793	< 0.00050	< 0.00050	0.17
2016	Q4	EV_MC2	0.00045	< 0.00010	0.00013	359	< 0.00050	0.00065	0.12
2016	Q3	FR_FRCP1	0.00012	< 0.00010	< 0.00010	874	< 0.00050	< 0.00050	0.22
2016	Q1	GH_ERC	< 0.00030	< 0.00010	< 0.00010	419	< 0.00050	< 0.00050	0.158
2016	Q2	GH_ERC	0.00085	< 0.00010	0.00015	342	< 0.00050	0.00065	0.156
2016	Q3	GH_ERC	0.00027	< 0.00010	< 0.00010	317	< 0.00050	< 0.00050	0.175
2016	Q4	GH_ERC	0.00035	< 0.00010	< 0.00010	327	< 0.00050	0.00054	0.161
2016	Q3	GH_FR1	0.00017	< 0.00010	< 0.00010	732	< 0.00050	< 0.00050	0.20
2016	Q4	GH_FR1	0.000185	<0.0001	<0.0001	735	<0.0005	<0.0005	0.16
2016	Q1	LC_LCDSSLCC	< 0.00020	< 0.00010	< 0.00010	1010	< 0.00050	< 0.00050	0.24
2016	Q3	LC_LCDSSLCC	0.00027	< 0.00010	< 0.00010	754	< 0.00050	< 0.00050	0.25
2016	Q4	LC_LCDSSLCC	0.00019	< 0.00010	< 0.00010	700	< 0.00050	< 0.00050	0.21
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.00058	0.00037	0.00061	484	0.00050	0.00053	0.103
2015	Q3	CM_MC2	0.00023	0.00026	0.00034	802	0.00050	0.00050	0.119
2015	Q4	CM_MC2	0.00020	0.00010	0.00010	876	0.00050	0.00050	0.11
2015	Q1	EV_HC1	0.00018	0.00010	0.00010	453	0.00050	0.00050	0.146
2015	Q2	EV_MC2	0.00070	0.00010	0.00022	299	0.00050	0.00073	0.115
2015	Q3	EV_MC2	0.00019	0.00010	0.00010	686	0.00050	0.00050	0.175
2015	Q1	FR_FRCP1	0.00020	0.00020	0.00020	2680	0.00050	0.0010	0.45
2015	Q4	FR_FRCP1	0.00027	0.00010	0.00010	1030	0.00050	0.00050	0.17
2015	Q3	GH_FR1	0.00015	0.00010	0.00010	657	0.00050	0.00050	0.184
2015	Q2	LC_LCDSSLCC	0.00019	0.00010	0.00010	535	0.00050	0.00050	0.215
2015	Q3	LC_LCDSSLCC	0.00020	0.00010	0.00010	660	0.00050	0.00050	0.236
2015	Q4	LC_LCDSSLCC	0.00050	0.00050	0.00050	770	0.0010	0.0025	0.184
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 0.00030	0.00072	0.00081	927	< 0.00050	< 0.00050	0.14
2016	Q2	CM_MC2	0.00058	0.00077	0.00126	549	< 0.00050	0.00079	0.104
2016	Q3	CM_MC2	0.00018	0.00026	0.00034	901	< 0.00050	< 0.00050	0.12
2016	Q1	EV_HC1	< 0.00020	< 0.00010	< 0.00010	745	< 0.00050	< 0.00050	0.21
2016	Q1	FR_FRCP1	< 0.00010	< 0.00010	< 0.00010	1720	< 0.00050	< 0.00050	< 0.20
2016	Q2	FR_FRCP1	0.00027	< 0.00010	0.00011	555	< 0.00050	0.00054	0.196
2016	Q4	FR_FRCP1	0.00015	< 0.00010	< 0.00010	810	< 0.00050	< 0.00050	0.19
2016	Q1	GH_FR1	0.00013	< 0.00010	< 0.00010	885	< 0.00050	< 0.00050	0.18
2016	Q2	GH_FR1	0.00029	< 0.00010	< 0.00010	573	< 0.00050	< 0.00050	0.182
2016	Q2	LC_LCDSSLCC	0.00021	< 0.00010	< 0.00010	557	< 0.00050	< 0.00050	0.217

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	Hardness, Total or Dissolved CaCO3-N-mg/l	IRON-D-mg/l	IRON-T-mg/l	LEAD-D-mg/l	LEAD-T-mg/l	LITHIUM-D-mg/l	LITHIUM-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	197	0.010	0.010	0.000050	0.000050	0.0019	0.00164
2015	Q1	Reference (FR_UFR1)	197	0.010	0.010	0.000050	0.000050	0.0019	0.00164
2015	Q1	Reference (FR_UFR1)	197	0.010	0.010	0.000050	0.000050	0.00151	0.00173
2015	Q2	Reference (FR_UFR1)	129	0.010	0.052	0.000050	0.000050	0.0010	0.0012
2015	Q3	Reference (FR_UFR1)	188	0.010	0.010	0.000055	0.000050	0.0020	0.0020
2015	Q4	Reference (FR_UFR1)	190	0.010	0.010	0.000050	0.000050	0.0015	0.0015
2015	Q2	Reference (GH_ER2)	160	0.010	0.066	0.000050	0.000050	0.0017	0.0016
2015	Q4	Reference (GH_ER2)	170	0.010	0.010	0.000050	0.000050	0.0016	0.0018
2016	Q1	Reference (FR_UFR1)	202	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0014	0.0015
2016	Q2	Reference (FR_UFR1)	126	< 0.010	0.075	< 0.000050	0.000060	0.0011	0.0013
2016	Q3	Reference (FR_UFR1)	177	< 0.010	0.013	< 0.000050	< 0.000050	0.0017	0.0018
2016	Q4	Reference (FR_UFR1)	177	< 0.010	0.022	< 0.000050	< 0.000050	0.0015	0.0018
2016	Q2	Reference (GH_ER2)	163	< 0.010	0.227	< 0.000050	0.000131	0.0020	0.0021
2016	Q4	Reference (GH_ER2)	163	< 0.010	0.013	< 0.000050	< 0.000050	0.0019	0.0017
Tests that were not statistically different t									
2015	Q1	CM_MC2	445	0.010	0.031	0.000050	0.000050	0.0109	0.0109
2015	Q2	EV_HC1	205	0.010	0.0507	0.000050	0.000056	0.00443	0.00423
2015	Q3	EV_HC1	373	0.010	0.027	0.000050	0.000050	0.0069	0.0068
2015	Q4	EV_HC1	431	0.010	0.010	0.000050	0.000050	0.0069	0.0067
2015	Q1	EV_MC2	381	0.010	0.024	0.000050	0.000050	0.0146	0.0145
2015	Q4	EV_MC2	415	0.010	0.014	0.000050	0.000050	0.0229	0.0223
2015	Q2	FR_FRCP1	302	0.010	0.107	0.000050	0.000144	0.0187	0.018
2015	Q3	FR_FRCP1	471	0.010	0.033	0.000050	0.000050	0.030	0.0307
2015	Q1	GH_ERC	191	0.010	0.036	0.000050	0.000195	0.00193	0.00197
2015	Q2	GH_ERC	179	0.010	0.153	0.000050	0.000106	0.0022	0.0023
2015	Q3	GH_ERC	160	0.010	0.088	0.000050	0.000070	0.0017	0.0020
2015	Q4	GH_ERC	190	0.010	0.010	0.000050	0.000050	0.0020	0.0021
2015	Q1	GH_FR1	475	0.010	0.010	0.000050	0.000050	0.0155	0.0154
2015	Q2	GH_FR1	332	0.010	0.070	0.000050	0.000063	0.0139	0.0143
2015	Q4	GH_FR1	436	0.010	0.010	0.000050	0.000050	0.0169	0.0173
2015	Q1	LC_LCDSSLCC	536	0.010	0.010	0.000050	0.000050	0.031	0.0312
2016	Q4	CM_MC2	328	< 0.010	0.148	< 0.000050	0.000098	0.010	0.0103
2016	Q2	EV_HC1	306	< 0.010	0.143	< 0.000050	0.000095	0.0064	0.0068
2016	Q3	EV_HC1	368	< 0.010	0.063	< 0.000050	0.000076	0.0084	0.0083
2016	Q4	EV_HC1	386	< 0.010	0.058	< 0.000050	< 0.000050	0.0077	0.0081
2016	Q1	EV_MC2	395	< 0.010	0.038	< 0.000050	0.000053	0.0184	0.0184
2016	Q2	EV_MC2	141	0.012	0.462	< 0.000050	0.000386	0.0052	0.0056
2016	Q3	EV_MC2	435	< 0.010	0.010	< 0.000050	< 0.000050	0.0313	0.0329
2016	Q4	EV_MC2	177	0.023	0.163	< 0.000050	0.000117	0.0064	0.0068
2016	Q3	FR_FRCP1	455	< 0.010	0.032	< 0.000050	< 0.000050	0.0322	0.032
2016	Q1	GH_ERC	231	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0023	0.0025
2016	Q2	GH_ERC	185	< 0.010	0.375	< 0.000050	0.000221	0.0021	0.0025
2016	Q3	GH_ERC	161	< 0.010	0.024	< 0.000050	< 0.000050	0.0024	0.0024
2016	Q4	GH_ERC	186	< 0.010	0.028	< 0.000050	< 0.000050	0.0026	0.0022
2016	Q3	GH_FR1	379	< 0.010	0.016	< 0.000050	< 0.000050	0.0168	0.0168
2016	Q4	GH_FR1	411	<0.01	0.022	<0.00005	<0.00005	0.017	0.017
2016	Q1	LC_LCDSSLCC	572	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0367	0.0379
2016	Q3	LC_LCDSSLCC	403	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0338	0.0318
2016	Q4	LC_LCDSSLCC	384	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0273	0.0257
Tests with significant results (2015)									
2015	Q2	CM_MC2	248	0.010	0.299	0.000050	0.000173	0.0064	0.0067
2015	Q3	CM_MC2	458	0.010	0.022	0.000050	0.000050	0.0132	0.0137
2015	Q4	CM_MC2	505	0.010	0.010	0.000050	0.000050	0.0114	0.012
2015	Q1	EV_HC1	274	0.010	0.0127	0.000050	0.000050	0.00474	0.0047
2015	Q2	EV_MC2	159	0.010	0.385	0.000050	0.000277	0.0054	0.0052
2015	Q3	EV_MC2	384	0.010	0.018	0.000050	0.000050	0.022	0.0212
2015	Q1	FR_FRCP1	1880	0.020	0.020	0.00010	0.00010	0.0538	0.0562
2015	Q4	FR_FRCP1	597	0.010	0.019	0.000050	0.000050	0.042	0.0366
2015	Q3	GH_FR1	374	0.010	0.016	0.000050	0.000050	0.0147	0.015
2015	Q2	LC_LCDSSLCC	269	0.010	0.018	0.000050	0.000050	0.0163	0.016
2015	Q3	LC_LCDSSLCC	355	0.010	0.010	0.000050	0.000050	0.0212	0.0227
2015	Q4	LC_LCDSSLCC	499	0.050	0.050	0.00025	0.00025	0.0361	0.0361
Tests with significant results (2016)									
2016	Q1	CM_MC2	500	< 0.010	0.011	< 0.000050	< 0.000050	0.0138	0.0139
2016	Q2	CM_MC2	283	< 0.010	0.387	< 0.000050	0.000212	0.0083	0.0085
2016	Q3	CM_MC2	465	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0161	0.0171
2016	Q1	EV_HC1	443	< 0.010	< 0.020	< 0.000050	< 0.000050	0.0066	0.0065
2016	Q1	FR_FRCP1	1120	< 0.010	< 0.020	< 0.000050	< 0.000050	0.058	0.0585
2016	Q2	FR_FRCP1	305	< 0.010	0.131	< 0.000050	0.000099	0.016	0.0175
2016	Q4	FR_FRCP1	453	< 0.010	0.027	< 0.000050	< 0.000050	0.0291	0.0303
2016	Q1	GH_FR1	507	< 0.010	< 0.010	< 0.000050	< 0.000050	0.0145	0.0144
2016	Q2	GH_FR1	312	< 0.010	0.127	< 0.000050	0.000096	0.0117	0.0116
2016	Q2	LC_LCDSSLCC	293	< 0.010	0.027	< 0.000050	< 0.000050	0.0233	0.0239

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	MAGNESIUM-D-mg/l	MAGNESIUM-T-mg/l	MAJOR ANION SUM-N-meq/l	MAJOR CATION SUM-N-meq/l	MANGANESE-D-mg/l	MANGANESE-T-mg/l	MERCURY-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	14.2	14.5	3.98	3.98	0.000054	0.000177	0.000010
2015	Q1	Reference (FR_UFR1)	14.2	14.5	3.98	3.98	0.000054	0.000177	0.000010
2015	Q1	Reference (FR_UFR1)	13.9	14.2	3.87	3.98	0.000168	0.000368	0.000010
2015	Q2	Reference (FR_UFR1)	8.97	9.19	2.69	2.62	0.00064	0.00252	0.0000050
2015	Q3	Reference (FR_UFR1)	12.8	13.1	3.88	3.80	0.00062	0.00147	0.0000050
2015	Q4	Reference (FR_UFR1)	13.7	14.3	3.91	3.85	0.00010	0.00031	0.0000050
2015	Q2	Reference (GH_ER2)	10.4	10.8	3.55	3.23	0.00327	0.00594	0.0000050
2015	Q4	Reference (GH_ER2)	10.9	11.2	3.44	3.44	0.00208	0.00267	0.0000050
2016	Q1	Reference (FR_UFR1)	14.5	15.1	3.85	4.08	0.00020	0.00034	< 0.0000050
2016	Q2	Reference (FR_UFR1)	9.25	9.76	2.47	2.54	0.00045	0.00213	< 0.0000050
2016	Q3	Reference (FR_UFR1)	13.0	13.6	3.93	3.57	0.00027	0.00107	< 0.0000050
2016	Q4	Reference (FR_UFR1)	12.6	12.3	3.68	3.57	0.00027	0.00073	< 0.0000050
2016	Q2	Reference (GH_ER2)	10.9	11.0	3.24	3.29	0.00177	0.0119	< 0.0000050
2016	Q4	Reference (GH_ER2)	10.7	9.56	3.36	3.29	0.00124	0.00208	< 0.0000050
Tests that were not statistically different t									
2015	Q1	CM_MC2	44.4	46.2	9.71	9.36	0.00457	0.0064	0.000010
2015	Q2	EV_HC1	20.8	21.0	5.85	6.19	0.00053	0.00162	0.0000050
2015	Q3	EV_HC1	41.1	40.5	7.38	7.55	0.00284	0.00507	0.0000050
2015	Q4	EV_HC1	48.8	49.8	8.58	8.70	0.00177	0.00199	
2015	Q1	EV_MC2	35.1	33.3	7.49	8.66	0.00239	0.00219	0.000010
2015	Q4	EV_MC2	39.1	38.7	8.34	8.54	0.00129	0.0018	
2015	Q2	FR_FRCP1	28.8	28.7	6.14	6.12	0.00319	0.0118	0.0000050
2015	Q3	FR_FRCP1	49.5	50.7	9.46	9.53	0.00312	0.00693	0.0000050
2015	Q1	GH_ERC	13.2	13.3	3.77	3.87	0.000352	0.00262	0.000010
2015	Q2	GH_ERC	12.0	12.3	3.78	3.63	0.00072	0.00813	0.0000050
2015	Q3	GH_ERC	10.4	11.1	3.27	3.23	0.00058	0.00777	0.0000050
2015	Q4	GH_ERC	12.4	12.8	3.86	3.85	0.00063	0.00129	0.0000050
2015	Q1	GH_FR1	47.5	49.3	9.90	9.61	0.00167	0.00208	0.000010
2015	Q2	GH_FR1	32.7	33.8	6.74	6.73	0.00108	0.00442	0.0000050
2015	Q4	GH_FR1	42.3	43.0	8.46	8.83	0.00108	0.00157	0.0000050
2015	Q1	LC_LCDSSLCC	53.6	52.9	11.0	11.0	0.000074	0.000211	0.000010
2016	Q4	CM_MC2	31.5	32.7	7.19	6.86	0.00623	0.0136	< 0.0000050
2016	Q2	EV_HC1	32.3	33.2	6.16	6.20	0.00048	0.00365	0.00000062
2016	Q3	EV_HC1	42.0	44.0	7.61	7.44	0.00544	0.00807	< 0.00000050
2016	Q4	EV_HC1	45.6	45.9	7.97	7.81	0.00209	0.00328	< 0.0000005
2016	Q1	EV_MC2	36.7	36.8	7.84	8.14	0.0012	0.00209	< 0.00000050
2016	Q2	EV_MC2	11.5	11.4	2.81	2.92	0.00014	0.0127	0.00000152
2016	Q3	EV_MC2	41.3	42.1	9.37	9.01	0.00090	0.00139	< 0.00000050
2016	Q4	EV_MC2	15.6	16.7	3.92	3.67	0.00101	0.00435	0.00000163
2016	Q3	FR_FRCP1	49.1	48.0	10.0	9.20	0.00446	0.00736	< 0.0000050
2016	Q1	GH_ERC	15.3	15.9	4.39	4.66	0.00026	0.00034	< 0.0000050
2016	Q2	GH_ERC	12.8	12.8	3.66	3.75	0.00133	0.0179	< 0.0000050
2016	Q3	GH_ERC	11.0	10.8	3.46	3.25	0.00045	0.00187	< 0.0000050
2016	Q4	GH_ERC	11.9	12.1	3.67	3.76	0.00044	0.00266	< 0.0000050
2016	Q3	GH_FR1	38.2	39.6	8.20	7.67	0.00092	0.00195	< 0.0000050
2016	Q4	GH_FR1	43.2	43.5	8.51	8.33	0.00072	0.00173	<0.000005
2016	Q1	LC_LCDSSLCC	57.8	59.6	11.5	11.7	0.00578	0.00636	< 0.0000050
2016	Q3	LC_LCDSSLCC	38.3	37.1	8.39	8.31	0.00090	0.00182	< 0.0000050
2016	Q4	LC_LCDSSLCC	36.4	34.6	7.90	7.89	0.00203	0.0032	< 0.0000050
Tests with significant results (2015)									
2015	Q2	CM_MC2	23.3	23.3	5.36	5.16	0.00351	0.0113	0.0000050
2015	Q3	CM_MC2	49.4	51.4	9.40	9.55	0.00181	0.00319	0.0000050
2015	Q4	CM_MC2	51.4	50.7	10.3	10.6	0.00064	0.00116	0.0000050
2015	Q1	EV_HC1	30.1	30.8	8.23	8.30	0.00103	0.0015	0.000010
2015	Q2	EV_MC2	12.3	12.6	3.32	3.28	0.00030	0.0102	0.0000050
2015	Q3	EV_MC2	35.8	34.7	8.08	7.91	0.00067	0.0020	0.0000050
2015	Q1	FR_FRCP1	257	261	39.5	37.8	0.00193	0.00265	0.000010
2015	Q4	FR_FRCP1	65.4	65.4	12.2	12.1	0.00757	0.00805	0.0000050
2015	Q3	GH_FR1	37.0	37.4	7.55	7.58	0.00089	0.00231	0.0000050
2015	Q2	LC_LCDSSLCC	24.8	25.2	5.69	5.53	0.00016	0.00051	0.0000050
2015	Q3	LC_LCDSSLCC	33.0	34.3	7.47	7.27	0.00020	0.00054	0.0000050
2015	Q4	LC_LCDSSLCC	50.8	54.3	9.85	10.3	0.00050	0.00050	0.0000050
Tests with significant results (2016)									
2016	Q1	CM_MC2	50.4	51.9	10.5	10.5	0.00454	0.00523	< 0.0000050
2016	Q2	CM_MC2	27.0	26.1	5.96	5.92	0.00623	0.0194	< 0.0000050
2016	Q3	CM_MC2	51.6	52.5	10.1	9.81	0.00052	0.00131	< 0.0000050
2016	Q1	EV_HC1	49.4	50.7	8.60	8.95	0.00127	0.00159	< 0.00000050
2016	Q1	FR_FRCP1	137	142	23.1	22.5	0.00675	0.00749	< 0.0000050
2016	Q2	FR_FRCP1	31.0	32.0	5.91	6.16	0.00282	0.00973	< 0.0000050
2016	Q4	FR_FRCP1	46.8	45.0	9.73	9.16	0.00634	0.00829	< 0.0000050
2016	Q1	GH_FR1	50.8	52.4	9.93	10.3	0.00103	0.00115	< 0.0000050
2016	Q2	GH_FR1	31.3	31.0	6.21	6.33	0.00152	0.00559	< 0.0000050
2016	Q2	LC_LCDSSLCC	28.1	28.4	5.88	6.04	0.00155	0.00325	< 0.0000050

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	MERCURY-T-mg/l	MOLYBDENUM-D-mg/l	MOLYBDENUM-T-mg/l	NICKEL-D-mg/l	NICKEL-T-mg/l	NITRATE NITROGEN (NO3), AS N-N-mg/l	NITRITE NITROGEN (NO2), AS N-N-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.000010	0.000534	0.00054	0.00050	0.00050	0.133	0.0010
2015	Q1	Reference (FR_UFR1)	0.000010	0.000534	0.00054	0.00050	0.00050	0.133	0.0010
2015	Q1	Reference (FR_UFR1)	0.000010	0.000564	0.000552	0.00050	0.00050	0.133	0.0010
2015	Q2	Reference (FR_UFR1)	0.0000050	0.000521	0.00062	0.00050	0.00050	0.0657	0.0010
2015	Q3	Reference (FR_UFR1)	0.0000050	0.00068	0.000676	0.00050	0.00050	0.0186	0.0010
2015	Q4	Reference (FR_UFR1)	0.0000050	0.000645	0.00059	0.00050	0.00050	0.0217	0.0010
2015	Q2	Reference (GH_ER2)	0.0000050	0.000918	0.000936	0.00050	0.00050	0.0856	0.0010
2015	Q4	Reference (GH_ER2)	0.0000050	0.0010	0.000998	0.00050	0.00050	0.0779	0.0010
2016	Q1	Reference (FR_UFR1)	< 0.00000050	0.000577	0.000564	< 0.00050	< 0.00050	0.169	< 0.0010
2016	Q2	Reference (FR_UFR1)	0.00000135	0.000608	0.00062	< 0.00050	< 0.00050	0.0335	< 0.0010
2016	Q3	Reference (FR_UFR1)	< 0.00000050	0.000628	0.000634	< 0.00050	< 0.00050	0.0573	< 0.0010
2016	Q4	Reference (FR_UFR1)	0.00000056	0.000572	0.000556	< 0.00050	< 0.00050	0.103	< 0.0010
2016	Q2	Reference (GH_ER2)	0.00000098	0.000913	0.000934	< 0.00050	0.00050	0.115	< 0.0010
2016	Q4	Reference (GH_ER2)	< 0.0000050	0.000965	0.00101	< 0.00050	< 0.00050	0.0711	< 0.0010
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.000010	0.00102	0.00106	0.00953	0.00972	2.36	0.012
2015	Q2	EV_HC1	0.0000050	0.000499	0.000485	0.000753	0.000833	0.573	0.0010
2015	Q3	EV_HC1	0.0000050	0.000915	0.000923	0.00079	0.00079	0.866	0.0011
2015	Q4	EV_HC1		0.000969	0.000979	0.00066	0.00069	1.17	0.0050
2015	Q1	EV_MC2	0.000010	0.000793	0.000782	0.00070	0.00052	3.17	0.0013
2015	Q4	EV_MC2		0.00204	0.00212	0.00393	0.00408	5.94	0.0050
2015	Q2	FR_FRCP1	0.0000050	0.00128	0.00128	0.00203	0.00242	7.40	0.0056
2015	Q3	FR_FRCP1	0.0000050	0.00153	0.00153	0.00411	0.00431	8.23	0.0049
2015	Q1	GH_ERC	0.000010	0.000915	0.000988	0.00050	0.00050	0.44	0.0010
2015	Q2	GH_ERC	0.0000050	0.000953	0.000971	0.00050	0.00050	0.31	0.0010
2015	Q3	GH_ERC	0.0000050	0.000951	0.00102	0.00050	0.00050	0.165	0.0010
2015	Q4	GH_ERC	0.0000050	0.000988	0.00106	0.00050	0.00050	0.461	0.0010
2015	Q1	GH_FR1	0.000010	0.000954	0.000984	0.00219	0.00231	13.0	0.0039
2015	Q2	GH_FR1	0.0000050	0.00108	0.00106	0.00192	0.00204	7.45	0.0028
2015	Q4	GH_FR1	0.0000050	0.000899	0.000988	0.00117	0.00119	10.2	0.0050
2015	Q1	LC_LCDSSLCC	0.000010	0.00173	0.00171	0.00359	0.00359	15.1	0.0030
2016	Q4	CM_MC2	0.00000124	0.000966	0.000979	0.00732	0.00831	1.82	0.010
2016	Q2	EV_HC1	0.00000077	0.000741	0.000774	0.00097	0.00123	0.818	< 0.0010
2016	Q3	EV_HC1	0.00000121	0.000916	0.000913	0.00074	0.00090	0.841	0.0016
2016	Q4	EV_HC1	0.00000085	0.000914	0.000932	0.00073	0.00087	1.01	< 0.0050
2016	Q1	EV_MC2	< 0.00000050	0.00149	0.00154	0.00248	0.00264	5.05	< 0.0050
2016	Q2	EV_MC2	0.00000177	0.000643	0.000693	0.00137	0.00221	0.776	< 0.0010
2016	Q3	EV_MC2	0.00000085	0.00119	0.00122	0.00216	0.0024	6.52	< 0.0050
2016	Q4	EV_MC2	0.00000246	0.000599	0.000651	0.00078	0.00116	1.24	0.0010
2016	Q3	FR_FRCP1	< 0.00000050	0.00126	0.00127	0.00485	0.00516	11.9	< 0.0050
2016	Q1	GH_ERC	< 0.0000050	0.000938	0.000921	< 0.00050	< 0.00050	0.76	< 0.0010
2016	Q2	GH_ERC	0.00000157	0.000908	0.000921	< 0.00050	0.00067	0.411	< 0.0010
2016	Q3	GH_ERC	< 0.00000050	0.000908	0.000873	< 0.00050	< 0.00050	0.195	< 0.0010
2016	Q4	GH_ERC	< 0.0000050	0.00106	0.00103	< 0.00050	0.00086	0.282	< 0.0010
2016	Q3	GH_FR1	< 0.00000050	0.000903	0.000974	0.00145	0.00151	9.61	0.0056
2016	Q4	GH_FR1	<0.000005	0.00104	0.00108	0.00189	0.00203	8.77	<0.005
2016	Q1	LC_LCDSSLCC	< 0.00000050	0.00163	0.00167	0.00341	0.00342	11.1	0.0098
2016	Q3	LC_LCDSSLCC	< 0.00000050	0.00158	0.00152	0.00437	0.00462	8.57	< 0.0050
2016	Q4	LC_LCDSSLCC	< 0.0000005	0.00139	0.00149	0.00402	0.00383	7.27	< 0.0050
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.0000084	0.00076	0.000807	0.00624	0.00758	1.19	0.0029
2015	Q3	CM_MC2	0.0000050	0.00104	0.00109	0.0128	0.013	2.49	0.0088
2015	Q4	CM_MC2	0.0000050	0.000922	0.00096	0.0059	0.00603	2.15	0.0050
2015	Q1	EV_HC1	0.000010	0.00063	0.000648	0.000597	0.00064	0.795	0.0010
2015	Q2	EV_MC2	0.0000050	0.00059	0.000542	0.00077	0.00141	0.807	0.0010
2015	Q3	EV_MC2	0.0000050	0.00221	0.00219	0.0047	0.00479	5.65	0.0027
2015	Q1	FR_FRCP1	0.000010	0.00284	0.00288	0.0305	0.0321	30.1	0.020
2015	Q4	FR_FRCP1	0.0000050	0.00149	0.00136	0.00681	0.00664	14.7	0.0050
2015	Q3	GH_FR1	0.0000050	0.000994	0.000996	0.00164	0.00167	9.13	0.0046
2015	Q2	LC_LCDSSLCC	0.0000050	0.00114	0.00115	0.00356	0.00361	5.83	0.0014
2015	Q3	LC_LCDSSLCC	0.0000050	0.00135	0.00145	0.00471	0.00503	7.20	0.0020
2015	Q4	LC_LCDSSLCC	0.0000050	0.00165	0.00164	0.0065	0.0071	12.8	0.0030
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 0.0000050	0.000996	0.000997	0.00935	0.00979	2.94	0.0124
2016	Q2	CM_MC2	0.00000108	0.000762	0.000741	0.0105	0.0113	1.97	0.0037
2016	Q3	CM_MC2	< 0.00000050	0.00112	0.00117	0.0119	0.0127	2.67	< 0.0050
2016	Q1	EV_HC1	< 0.00000050	0.000917	0.000924	0.00062	< 0.0010	1.20	< 0.0050
2016	Q1	FR_FRCP1	< 0.00000050	0.00174	0.00176	0.0129	0.0133	27.9	< 0.010
2016	Q2	FR_FRCP1	0.00000121	0.00119	0.00126	0.00214	0.00296	7.35	0.0033
2016	Q4	FR_FRCP1	< 0.0000005	0.00124	0.00124	0.00445	0.00468	10.0	< 0.0050
2016	Q1	GH_FR1	< 0.0000050	0.000835	0.000856	0.00137	0.00143	12.7	< 0.0050
2016	Q2	GH_FR1	0.00000251	0.00104	0.00104	0.00191	0.00221	6.45	0.0025
2016	Q2	LC_LCDSSLCC	0.00000069	0.00136	0.0014	0.00453	0.00482	6.33	< 0.0010

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	NITROGEN, AMMONIA (AS N)-N-mg/l	ORTHO-PHOSPHATE-N-mg/l	OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	pH, LAB-N-ph units	PHOSPHORUS-N-mg/l	POTASSIUM-D-mg/l	POTASSIUM-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.0050	0.0032	344	8.36	0.0042	0.394	0.401
2015	Q1	Reference (FR_UFR1)	0.0050	0.0032	344	8.36	0.0042	0.394	0.401
2015	Q1	Reference (FR_UFR1)	0.0050	0.0027	371	8.34	0.0035	0.393	0.419
2015	Q2	Reference (FR_UFR1)	0.0050	0.0042	470	8.35	0.0102	0.33	0.365
2015	Q3	Reference (FR_UFR1)	0.0050	0.0029	325	8.37	0.0054	0.53	0.519
2015	Q4	Reference (FR_UFR1)	0.0050	0.0017	346	8.40	0.0022	0.463	0.419
2015	Q2	Reference (GH_ER2)	0.0050	0.0010	312	8.30	0.0080	0.363	0.367
2015	Q4	Reference (GH_ER2)	0.0050	0.0015	490	8.26	0.0020	0.331	0.348
2016	Q1	Reference (FR_UFR1)	< 0.0050	0.0032	297	8.27	0.0036	0.384	0.369
2016	Q2	Reference (FR_UFR1)	< 0.0050	0.0041	318	8.32	0.0078	0.301	0.336
2016	Q3	Reference (FR_UFR1)	< 0.0050	0.0031	375	8.23	0.0038	0.439	0.466
2016	Q4	Reference (FR_UFR1)	< 0.0050	0.0023	343	8.32	0.0028	0.376	0.375
2016	Q2	Reference (GH_ER2)	< 0.0050	0.0011	321	8.20	0.0164	0.354	0.455
2016	Q4	Reference (GH_ER2)	< 0.0050	< 0.0010	378	8.29	< 0.0020	0.344	0.363
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.0055	0.0010	491	8.38	0.0050	1.37	1.38
2015	Q2	EV_HC1	0.00843	0.00313	413	7.53	0.0081	0.532	0.546
2015	Q3	EV_HC1	0.0050	0.0040	352	8.37	0.0082	0.992	0.987
2015	Q4	EV_HC1	0.0050	0.0058	360	8.37	0.0057	0.852	0.896
2015	Q1	EV_MC2	0.0050	0.0010	302	8.26	0.0047	1.15	1.16
2015	Q4	EV_MC2	0.0050	0.0035	370	8.15	0.0036	1.29	1.26
2015	Q2	FR_FRCP1	0.0095	0.0014	345	8.43	0.0176	1.21	1.19
2015	Q3	FR_FRCP1	0.0050	0.0010	345	8.39	0.0027	1.87	1.84
2015	Q1	GH_ERC	0.0050	0.0010	512	8.26	0.0043	0.357	0.374
2015	Q2	GH_ERC	0.0050	0.0010	473	8.37	0.0164	0.383	0.41
2015	Q3	GH_ERC	0.0050	0.0010	320	8.29	0.0077	0.376	0.419
2015	Q4	GH_ERC	0.0050	0.0018	491	8.27	0.0020	0.387	0.394
2015	Q1	GH_FR1	0.0050	0.0010	305	8.28	0.0036	1.15	1.20
2015	Q2	GH_FR1	0.0050	0.0010	302	8.42	0.010	1.04	1.07
2015	Q4	GH_FR1	0.0050	0.0010	288	8.38	0.0020	1.18	1.24
2015	Q1	LC_LCDSSLCC	0.0050	0.0010	294	8.33	0.0029	1.23	1.21
2016	Q4	CM_MC2	0.0076	0.0016	339	8.33	0.0063	1.22	1.26
2016	Q2	EV_HC1	< 0.0050	0.0054	323	8.31	0.0102	0.783	0.867
2016	Q3	EV_HC1	0.0088	0.0064	312	8.28	0.0121	0.904	0.984
2016	Q4	EV_HC1	< 0.0050	0.0061	337	8.36	0.0079	0.989	1.01
2016	Q1	EV_MC2	< 0.0050	< 0.0010	308	8.05	0.0023	1.22	1.12
2016	Q2	EV_MC2	< 0.0050	0.0133	312	8.11	0.039	0.547	0.644
2016	Q3	EV_MC2	0.0073	0.0040	323	8.06	0.0052	1.49	1.56
2016	Q4	EV_MC2	< 0.0050	0.0081	281	8.17	0.0142	0.633	0.748
2016	Q3	FR_FRCP1	< 0.0050	0.0011	365	8.38	0.0027	1.53	1.59
2016	Q1	GH_ERC	< 0.0050	< 0.0010	312	8.16	< 0.0020	0.377	0.389
2016	Q2	GH_ERC	< 0.0050	< 0.0010	337	8.26	0.0274	0.409	0.548
2016	Q3	GH_ERC	< 0.0050	< 0.0010	370	8.20	0.0049	0.393	0.415
2016	Q4	GH_ERC	< 0.0050	< 0.0010	387	8.25	< 0.0020	0.387	0.41
2016	Q3	GH_FR1	< 0.0050	< 0.0010	374	8.26	0.0061	1.18	1.20
2016	Q4	GH_FR1	<0.005	<0.001	360	8.28	0.00225	1.25	1.34
2016	Q1	LC_LCDSSLCC	< 0.0050	0.0011	295	8.29	< 0.0020	1.37	1.43
2016	Q3	LC_LCDSSLCC	< 0.0050	0.0021	341	8.37	0.0027	1.09	1.39
2016	Q4	LC_LCDSSLCC	< 0.0050	0.0013	367	8.30	< 0.0020	1.09	1.08
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.0050	0.0010	359	8.40	0.0173	0.904	0.982
2015	Q3	CM_MC2	0.0050	0.0010	349	8.37	0.0030	1.50	1.51
2015	Q4	CM_MC2	0.0050	0.0010	275	8.34	0.0020	1.45	1.45
2015	Q1	EV_HC1	0.0050	0.0035	457	7.39	0.00467	0.608	0.62
2015	Q2	EV_MC2	0.0050	0.0010	355	8.13	0.0366	0.543	0.666
2015	Q3	EV_MC2	0.0102	0.0027	356	8.10	0.0052	1.49	1.48
2015	Q1	FR_FRCP1	0.0050	0.0010	354	8.27	0.0021	3.81	3.98
2015	Q4	FR_FRCP1	0.0050	0.0010	354	8.28	0.0020	1.91	1.93
2015	Q3	GH_FR1	0.0071	0.0010	323	8.34	0.0036	1.19	1.17
2015	Q2	LC_LCDSSLCC	0.0050	0.0027	493	8.42	0.0056	0.82	0.821
2015	Q3	LC_LCDSSLCC	0.0050	0.0018	354	8.37	0.0029	1.03	1.06
2015	Q4	LC_LCDSSLCC	0.0050	0.0010	364	8.25	0.0050	1.33	1.38
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 0.0050	< 0.0010	500	8.33	< 0.0020	1.48	1.58
2016	Q2	CM_MC2	0.0074	0.0028	345	8.20	0.0215	1.04	1.10
2016	Q3	CM_MC2	< 0.0050	< 0.0010	385	8.39	< 0.0020	1.76	1.73
2016	Q1	EV_HC1	< 0.0050	0.0041	294	8.31	0.0045	0.87	0.861
2016	Q1	FR_FRCP1	< 0.0050	< 0.0010	309	8.22	< 0.0020	2.51	2.52
2016	Q2	FR_FRCP1	0.0086	0.0029	324	8.32	0.0128	1.21	1.18
2016	Q4	FR_FRCP1	< 0.0050	< 0.0010	344	8.38	< 0.0020	1.48	1.44
2016	Q1	GH_FR1	< 0.0050	< 0.0010	304	8.26	< 0.0020	1.16	1.05
2016	Q2	GH_FR1	< 0.0050	0.0020	337	8.32	0.0128	1.08	1.09
2016	Q2	LC_LCDSSLCC	< 0.0050	< 0.0010	362	8.30	0.0027	0.944	0.989

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	SELENIUM-D-ug/l	SELENIUM-T-ug/l	SILICON-D-mg/l	SILICON-T-mg/l	SILVER-D-mg/l	SILVER-T-mg/l	SODIUM-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.69	0.73	1.59	1.61	0.000010	0.000010	0.706
2015	Q1	Reference (FR_UFR1)	0.69	0.73	1.59	1.61	0.000010	0.000010	0.706
2015	Q1	Reference (FR_UFR1)	0.76	0.73	1.64	1.66	0.000010	0.000010	0.712
2015	Q2	Reference (FR_UFR1)	0.477	0.492	1.74	1.88	0.000010	0.000010	0.548
2015	Q3	Reference (FR_UFR1)	0.47	0.431	2.06	2.11	0.000010	0.000010	0.699
2015	Q4	Reference (FR_UFR1)	0.685	0.622	1.49	1.57	0.000010	0.000010	0.727
2015	Q2	Reference (GH_ER2)	0.787	0.87	1.64	1.83	0.000010	0.000010	0.727
2015	Q4	Reference (GH_ER2)	0.724	0.78	1.73	1.78	0.000010	0.000010	0.634
2016	Q1	Reference (FR_UFR1)	0.799	0.781	1.77	1.82	< 0.000010	< 0.000010	0.679
2016	Q2	Reference (FR_UFR1)	0.522	0.551	1.86	2.11	< 0.000010	< 0.000010	0.603
2016	Q3	Reference (FR_UFR1)	0.557	0.63	2.07	2.06	< 0.000010	< 0.000010	0.644
2016	Q4	Reference (FR_UFR1)	0.694	0.681	1.77	1.88	< 0.000010	< 0.000010	0.644
2016	Q2	Reference (GH_ER2)	0.832	0.831	1.85	2.15	< 0.000010	< 0.000010	0.735
2016	Q4	Reference (GH_ER2)	0.868	0.826	1.67	1.71	< 0.000010	< 0.000010	0.654
Tests that were not statistically different t									
2015	Q1	CM_MC2	5.87	5.98	2.13	2.18	0.000010	0.000010	10.0
2015	Q2	EV_HC1	19.3	18.5	1.14	1.21	0.000010	0.000010	0.81
2015	Q3	EV_HC1	28.6	27.7	2.12	2.02	0.000010	0.000010	1.50
2015	Q4	EV_HC1	33.2	36.5	2.03	2.05	0.000010	0.000010	1.58
2015	Q1	EV_MC2	23.6	22.2	2.46	2.46	0.000010	0.000010	23.6
2015	Q4	EV_MC2	23.9	24.5	2.49	2.55	0.000010	0.000010	4.93
2015	Q2	FR_FRCP1	30.3	29.9	1.57	1.62	0.000010	0.000010	1.20
2015	Q3	FR_FRCP1	56.8	57.2	1.89	1.98	0.000010	0.000010	1.60
2015	Q1	GH_ERC	1.85	1.86	1.82	1.87	0.000010	0.000010	0.937
2015	Q2	GH_ERC	1.67	1.81	1.75	1.99	0.000010	0.000010	0.975
2015	Q3	GH_ERC	1.14	1.24	1.70	1.92	0.000010	0.000010	0.70
2015	Q4	GH_ERC	1.46	1.56	1.85	1.91	0.000010	0.000010	0.894
2015	Q1	GH_FR1	51.3	52.4	2.07	2.13	0.000010	0.000010	2.28
2015	Q2	GH_FR1	31.0	31.8	1.82	1.97	0.000010	0.000010	1.64
2015	Q4	GH_FR1	39.7	39.4	2.10	2.15	0.000010	0.000010	2.09
2015	Q1	LC_LCDSSLCC	72.1	70.6	2.10	2.10	0.000010	0.000010	5.85
2016	Q4	CM_MC2	4.11	4.41	2.00	2.40	< 0.000010	< 0.000010	6.42
2016	Q2	EV_HC1	30.5	31.0	1.88	2.16	< 0.000010	< 0.000010	1.31
2016	Q3	EV_HC1	30.5	31.9	2.10	2.30	< 0.000010	< 0.000010	1.54
2016	Q4	EV_HC1	32.0	32.4	2.02	2.34	< 0.000010	< 0.000010	1.87
2016	Q1	EV_MC2	22.3	21.3	2.34	2.36	< 0.000010	< 0.000010	5.10
2016	Q2	EV_MC2	3.58	3.31	2.02	2.78	< 0.000010	0.000017	1.81
2016	Q3	EV_MC2	26.3	26.3	2.79	2.83	< 0.000010	< 0.000010	6.48
2016	Q4	EV_MC2	5.41	5.97	2.09	2.55	< 0.000010	< 0.000010	2.50
2016	Q3	FR_FRCP1	53.6	56.4	1.77	1.94	< 0.000010	< 0.000010	1.50
2016	Q1	GH_ERC	2.28	2.33	1.82	1.85	< 0.000010	< 0.000010	1.01
2016	Q2	GH_ERC	2.30	1.98	1.87	2.35	< 0.000010	< 0.000010	0.952
2016	Q3	GH_ERC	0.983	0.997	1.68	1.71	< 0.000010	< 0.000010	0.724
2016	Q4	GH_ERC	1.38	1.41	1.77	1.82	< 0.000010	< 0.000010	0.796
2016	Q3	GH_FR1	34.2	36.6	2.12	2.20	< 0.000010	< 0.000010	1.79
2016	Q4	GH_FR1	40.9	39.5	2.09	2.14	<0.00001	<0.00001	1.91
2016	Q1	LC_LCDSSLCC	35.8	35.0	2.24	2.31	< 0.000010	< 0.000010	6.65
2016	Q3	LC_LCDSSLCC	26.5	26.8	2.22	2.14	< 0.000010	< 0.000010	5.34
2016	Q4	LC_LCDSSLCC	23.9	22.7	2.02	2.04	< 0.000010	< 0.000010	4.23
Tests with significant results (2015)									
2015	Q2	CM_MC2	4.32	4.32	1.80	2.38	0.000010	0.000010	4.43
2015	Q3	CM_MC2	6.18	6.41	1.99	2.10	0.000010	0.000010	8.65
2015	Q4	CM_MC2	5.98	5.77	2.19	2.10	0.000010	0.000010	10.4
2015	Q1	EV_HC1	22.5	22.4	1.30	1.33	0.000010	0.000010	1.14
2015	Q2	EV_MC2	5.17	5.04	1.67	2.30	0.000010	0.000017	2.09
2015	Q3	EV_MC2	23.3	22.8	2.45	2.29	0.000010	0.000010	4.69
2015	Q1	FR_FRCP1	490	497	2.30	2.33	0.000020	0.000020	1.98
2015	Q4	FR_FRCP1	78.2	76.3	1.73	1.75	0.000010	0.000010	2.14
2015	Q3	GH_FR1	35.4	35.7	2.00	2.07	0.000010	0.000010	1.82
2015	Q2	LC_LCDSSLCC	24.8	25.1	1.82	1.88	0.000010	0.000010	2.90
2015	Q3	LC_LCDSSLCC	37.4	39.5	2.17	2.27	0.000010	0.000010	3.75
2015	Q4	LC_LCDSSLCC	52.3	53.5	2.17	2.29	0.000050	0.000050	5.82
Tests with significant results (2016)									
2016	Q1	CM_MC2	5.36	5.76	2.22	2.30	< 0.000010	< 0.000010	12.0
2016	Q2	CM_MC2	6.20	5.74	2.10	2.59	< 0.000010	< 0.000010	5.57
2016	Q3	CM_MC2	5.94	5.95	1.76	1.77	< 0.000010	< 0.000010	11.0
2016	Q1	EV_HC1	40.4	36.7	1.99	1.99	< 0.000010	< 0.000010	1.74
2016	Q1	FR_FRCP1	214	209	2.06	2.09	< 0.000010	< 0.000010	2.16
2016	Q2	FR_FRCP1	31.9	31.6	1.71	1.95	< 0.000010	< 0.000010	1.02
2016	Q4	FR_FRCP1	54.2	51.3	1.71	1.73	< 0.000010	< 0.000010	1.41
2016	Q1	GH_FR1	52.0	50.0	2.15	2.19	< 0.000010	< 0.000010	2.22
2016	Q2	GH_FR1	27.8	29.0	2.01	2.10	< 0.000010	< 0.000010	1.41
2016	Q2	LC_LCDSSLCC	17.5	18.5	1.99	2.07	< 0.000010	< 0.000010	3.42

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	SODIUM-T-mg/l	STRONTIUM-D-mg/l	STRONTIUM-T-mg/l	SULFATE (AS SO4)-D-mg/l	THALLIUM-D-mg/l	THALLIUM-T-mg/l	TIN-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.773	0.0884	0.0907	46.8	0.000010	0.000010	0.00010
2015	Q1	Reference (FR_UFR1)	0.773	0.0884	0.0907	46.8	0.000010	0.000010	0.00010
2015	Q1	Reference (FR_UFR1)	0.716	0.0885	0.0923	46.1	0.000010	0.000010	0.00010
2015	Q2	Reference (FR_UFR1)	0.562	0.0608	0.0661	14.5	0.000010	0.000010	0.00010
2015	Q3	Reference (FR_UFR1)	0.688	0.0926	0.0926	31.8	0.000010	0.000010	0.00010
2015	Q4	Reference (FR_UFR1)	0.69	0.0954	0.0907	47.5	0.000010	0.000010	0.00010
2015	Q2	Reference (GH_ER2)	0.726	0.20	0.21	17.7	0.000010	0.000010	0.00010
2015	Q4	Reference (GH_ER2)	0.67	0.207	0.215	21.7	0.000010	0.000010	0.00010
2016	Q1	Reference (FR_UFR1)	0.683	0.0892	0.0898	49.9	< 0.000010	< 0.000010	< 0.00010
2016	Q2	Reference (FR_UFR1)	0.629	0.0628	0.0651	12.7	< 0.000010	< 0.000010	< 0.00010
2016	Q3	Reference (FR_UFR1)	0.679	0.0954	0.0984	34.6	< 0.000010	< 0.000010	< 0.00010
2016	Q4	Reference (FR_UFR1)	0.695	0.0927	0.0951	40.4	< 0.000010	< 0.000010	< 0.00010
2016	Q2	Reference (GH_ER2)	0.746	0.196	0.198	17.1	< 0.000010	< 0.000010	< 0.00010
2016	Q4	Reference (GH_ER2)	0.614	0.235	0.241	23.1	< 0.000010	< 0.000010	< 0.00010
Tests that were not statistically different t									
2015	Q1	CM_MC2	10.0	0.29	0.299	249	0.000014	0.000010	0.00010
2015	Q2	EV_HC1	0.817	0.0621	0.0607	78.8	0.000010	0.000010	0.00010
2015	Q3	EV_HC1	1.50	0.112	0.113	165	0.000010	0.000010	0.00010
2015	Q4	EV_HC1	1.71	0.126	0.131	218	0.000010	0.000010	0.00010
2015	Q1	EV_MC2	5.72	0.192	0.195	147	0.000010	0.000010	0.00018
2015	Q4	EV_MC2	4.80	0.23	0.23	183	0.000010	0.000010	0.00010
2015	Q2	FR_FRCP1	1.17	0.106	0.107	126	0.000010	0.000010	0.00010
2015	Q3	FR_FRCP1	1.61	0.131	0.134	234	0.000010	0.000010	0.00010
2015	Q1	GH_ERC	0.945	0.20	0.206	30.4	0.000010	0.000010	0.00010
2015	Q2	GH_ERC	0.97	0.21	0.21	25.2	0.000010	0.000010	0.00010
2015	Q3	GH_ERC	0.741	0.191	0.199	20.1	0.000010	0.000010	0.00010
2015	Q4	GH_ERC	0.935	0.216	0.229	37.2	0.000010	0.000010	0.00010
2015	Q1	GH_FR1	2.42	0.164	0.163	233	0.000010	0.000010	0.00010
2015	Q2	GH_FR1	1.68	0.116	0.12	136	0.000010	0.000010	0.00010
2015	Q4	GH_FR1	2.18	0.141	0.146	189	0.000010	0.000010	0.00010
2015	Q1	LC_LCDSSLCC	5.89	0.234	0.234	283	0.000010	0.000010	0.00010
2016	Q4	CM_MC2	6.70	0.221	0.222	178	0.000010	0.000017	< 0.00010
2016	Q2	EV_HC1	1.34	0.0963	0.0994	120	< 0.000010	0.000014	< 0.00010
2016	Q3	EV_HC1	1.63	0.119	0.123	176	< 0.000010	< 0.000010	< 0.00010
2016	Q4	EV_HC1	1.90	0.127	0.129	193	< 0.000010	0.000010	< 0.00010
2016	Q1	EV_MC2	4.89	0.204	0.207	174	< 0.000010	0.000010	< 0.00010
2016	Q2	EV_MC2	1.69	0.0876	0.0917	36.4	< 0.000010	0.000023	< 0.00010
2016	Q3	EV_MC2	6.63	0.234	0.24	214	0.000011	0.000012	< 0.00010
2016	Q4	EV_MC2	2.71	0.11	0.115	63.1	< 0.000010	0.000015	< 0.00010
2016	Q3	FR_FRCP1	1.60	0.14	0.142	249	< 0.000010	< 0.000010	< 0.00010
2016	Q1	GH_ERC	1.04	0.24	0.237	60.7	< 0.000010	< 0.000010	< 0.00010
2016	Q2	GH_ERC	0.936	0.208	0.203	33.2	< 0.000010	0.000014	< 0.00010
2016	Q3	GH_ERC	0.703	0.208	0.199	25.9	< 0.000010	< 0.000010	< 0.00010
2016	Q4	GH_ERC	0.848	0.248	0.236	32.1	< 0.000010	< 0.000010	< 0.00010
2016	Q3	GH_FR1	1.85	0.134	0.138	168	< 0.000010	< 0.000010	< 0.00010
2016	Q4	GH_FR1	1.98	0.143	0.145	196	<0.00001	<0.00001	<0.0001
2016	Q1	LC_LCDSSLCC	6.90	0.233	0.236	303	< 0.000010	< 0.000010	< 0.00010
2016	Q3	LC_LCDSSLCC	5.12	0.195	0.185	187	< 0.000010	< 0.000010	< 0.00010
2016	Q4	LC_LCDSSLCC	4.23	0.178	0.17	176	0.000010	< 0.000010	< 0.00010
Tests with significant results (2015)									
2015	Q2	CM_MC2	4.47	0.16	0.168	110	0.000011	0.000018	0.00010
2015	Q3	CM_MC2	8.65	0.272	0.287	249	0.000014	0.000019	0.00010
2015	Q4	CM_MC2	10.7	0.304	0.302	277	0.000011	0.000010	0.00010
2015	Q1	EV_HC1	1.17	0.0851	0.0867	130	0.000010	0.000010	0.00010
2015	Q2	EV_MC2	2.05	0.103	0.0929	41.1	0.000011	0.000025	0.00010
2015	Q3	EV_MC2	4.64	0.209	0.209	169	0.000013	0.000014	0.00010
2015	Q1	FR_FRCP1	2.07	0.223	0.231	1460	0.000030	0.000032	0.00020
2015	Q4	FR_FRCP1	2.01	0.161	0.155	327	0.000010	0.000010	0.00010
2015	Q3	GH_FR1	1.84	0.125	0.13	154	0.000010	0.000010	0.00010
2015	Q2	LC_LCDSSLCC	2.90	0.128	0.131	107	0.000010	0.000010	0.00010
2015	Q3	LC_LCDSSLCC	3.90	0.16	0.169	157	0.000010	0.000010	0.00010
2015	Q4	LC_LCDSSLCC	6.18	0.212	0.222	237	0.000050	0.000050	0.00050
Tests with significant results (2016)									
2016	Q1	CM_MC2	13.0	0.329	0.32	291	0.000010	0.000018	< 0.00010
2016	Q2	CM_MC2	5.47	0.183	0.176	131	0.000010	0.000020	< 0.00010
2016	Q3	CM_MC2	11.2	0.322	0.34	277	0.000017	0.000014	< 0.00010
2016	Q1	EV_HC1	1.71	0.129	0.131	222	< 0.000010	< 0.000010	< 0.00010
2016	Q1	FR_FRCP1	2.18	0.202	0.204	765	0.000016	0.000015	< 0.00010
2016	Q2	FR_FRCP1	1.13	0.0972	0.103	116	< 0.000010	0.000013	< 0.00010
2016	Q4	FR_FRCP1	1.49	0.139	0.139	245	< 0.000010	< 0.000010	< 0.00010
2016	Q1	GH_FR1	2.07	0.155	0.155	247	< 0.000010	< 0.000010	< 0.00010
2016	Q2	GH_FR1	1.38	0.105	0.104	121	< 0.000010	< 0.000010	< 0.00010
2016	Q2	LC_LCDSSLCC	3.62	0.13	0.134	110	0.000010	< 0.000010	< 0.00010

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	TIN-T-mg/l	TITANIUM-D-mg/l	TITANIUM-T-mg/l	TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	TOTAL KJELDAHL NITROGEN-N-mg/l	TOTAL ORGANIC CARBON-T-mg/l	TOTAL SUSPENDED SOLIDS, LAB-N-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.00010	0.010	0.010	229	0.050	0.69	1.00
2015	Q1	Reference (FR_UFR1)	0.00010	0.010	0.010	229	0.050	0.69	1.00
2015	Q1	Reference (FR_UFR1)	0.00010	0.010	0.010	222	0.050	0.50	1.00
2015	Q2	Reference (FR_UFR1)	0.00010	0.010	0.010	147	0.10	2.09	2.40
2015	Q3	Reference (FR_UFR1)	0.00010	0.010	0.010	211	0.080	1.02	1.10
2015	Q4	Reference (FR_UFR1)	0.00010	0.010	0.010	215	0.095	0.60	1.00
2015	Q2	Reference (GH_ER2)	0.00010	0.010	0.010	191	0.067	1.80	4.40
2015	Q4	Reference (GH_ER2)	0.00010	0.010	0.010	171	0.050	0.50	1.00
2016	Q1	Reference (FR_UFR1)	< 0.00010	0.011	0.011	244	< 0.050	< 0.50	< 1.0
2016	Q2	Reference (FR_UFR1)	< 0.00010	< 0.010	< 0.010	135	0.086	2.79	1.90
2016	Q3	Reference (FR_UFR1)	< 0.00010	< 0.010	< 0.010	222	0.077	0.92	1.20
2016	Q4	Reference (FR_UFR1)	< 0.00010	< 0.010	< 0.010	204	0.069	1.10	< 1.0
2016	Q2	Reference (GH_ER2)	< 0.00010	< 0.010	< 0.010	174	0.077	2.20	14.7
2016	Q4	Reference (GH_ER2)	< 0.00010	< 0.010	< 0.010	167	< 0.050	0.62	< 1.0
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.00010	0.010	0.010	551	0.050	0.82	1.70
2015	Q2	EV_HC1	0.00010	0.010	0.010	233	0.127	1.37	2.63
2015	Q3	EV_HC1	0.00010	0.010	0.010	479	0.073	1.58	2.30
2015	Q4	EV_HC1	0.00010	0.010	0.010	529	0.096	0.74	1.00
2015	Q1	EV_MC2	0.00010	0.014	0.013	438	0.134	1.18	1.20
2015	Q4	EV_MC2	0.00010	0.010	0.010	492	0.137	0.70	1.00
2015	Q2	FR_FRCP1	0.00010	0.010	0.010	372	0.050	2.17	7.70
2015	Q3	FR_FRCP1	0.00010	0.010	0.010	566	0.142	0.93	2.60
2015	Q1	GH_ERC	0.00010	0.010	0.010	203	0.050	0.50	2.60
2015	Q2	GH_ERC	0.00010	0.010	0.010	203	0.12	1.29	7.00
2015	Q3	GH_ERC	0.00016	0.010	0.010	179	0.050	0.79	5.10
2015	Q4	GH_ERC	0.00010	0.010	0.010	214	0.050	0.52	1.00
2015	Q1	GH_FR1	0.00010	0.011	0.011	621	0.050	1.08	1.00
2015	Q2	GH_FR1	0.00010	0.010	0.010	398	0.050	1.55	3.60
2015	Q4	GH_FR1	0.00010	0.010	0.010	520	0.091	0.57	1.00
2015	Q1	LC_LCDSSLCC	0.00010	0.014	0.013	690	0.050	0.90	1.00
2016	Q4	CM_MC2	< 0.00010	< 0.010	< 0.010	451	0.149	2.42	9.10
2016	Q2	EV_HC1	< 0.00010	0.013	0.015	378	0.187	2.51	5.90
2016	Q3	EV_HC1	< 0.00010	< 0.010	< 0.010	496	0.096	1.52	2.70
2016	Q4	EV_HC1	< 0.00010	< 0.010	< 0.010	480	0.103	1.66	1.80
2016	Q1	EV_MC2	< 0.00010	0.015	0.016	482	0.11	0.77	< 1.0
2016	Q2	EV_MC2	< 0.00010	< 0.010	0.015	165	0.202	3.28	24.9
2016	Q3	EV_MC2	< 0.00010	< 0.010	< 0.010	570	0.137	0.96	< 1.0
2016	Q4	EV_MC2	< 0.00010	< 0.010	< 0.010	228	0.204	3.37	6.80
2016	Q3	FR_FRCP1	< 0.00010	< 0.010	< 0.010	611	0.173	1.31	1.40
2016	Q1	GH_ERC	< 0.00010	0.012	0.012	256	< 0.050	< 0.50	< 1.0
2016	Q2	GH_ERC	< 0.00010	< 0.010	< 0.010	191	0.191	2.15	22.7
2016	Q3	GH_ERC	< 0.00010	< 0.010	< 0.010	195	0.055	0.65	< 1.0
2016	Q4	GH_ERC	< 0.00010	< 0.010	< 0.010	203	< 0.050	0.80	3.40
2016	Q3	GH_FR1	< 0.00010	< 0.010	< 0.010	477	0.154	1.30	< 1.0
2016	Q4	GH_FR1	<0.0001	<0.01	<0.01	517	0.127	1.12	<2
2016	Q1	LC_LCDSSLCC	< 0.00010	0.017	0.018	713	0.070	< 0.50	< 1.0
2016	Q3	LC_LCDSSLCC	< 0.00010	< 0.010	< 0.010	508	< 0.050	0.52	< 1.0
2016	Q4	LC_LCDSSLCC	< 0.00010	< 0.010	< 0.010	487	0.129	0.91	< 1.0
Tests with significant results (2015)									
2015	Q2	CM_MC2	0.00010	0.010	0.011	314	0.115	1.78	9.60
2015	Q3	CM_MC2	0.00010	0.010	0.010	626	0.102	0.75	1.20
2015	Q4	CM_MC2	0.00010	0.010	0.010	627	0.11	0.83	6.60
2015	Q1	EV_HC1	0.00010	0.0107	0.0107	325	0.050	0.843	1.00
2015	Q2	EV_MC2	0.00010	0.010	0.010	195	0.28	2.47	23.4
2015	Q3	EV_MC2	0.00010	0.010	0.010	477	0.158	0.83	1.20
2015	Q1	FR_FRCP1	0.00020	0.017	0.017	2580	0.050	1.46	1.00
2015	Q4	FR_FRCP1	0.00010	0.010	0.010	765	0.050	0.81	1.00
2015	Q3	GH_FR1	0.00015	0.010	0.010	473	0.050	0.86	1.20
2015	Q2	LC_LCDSSLCC	0.00010	0.010	0.010	337	0.050	1.52	1.60
2015	Q3	LC_LCDSSLCC	0.00010	0.010	0.010	447	0.122	0.64	1.40
2015	Q4	LC_LCDSSLCC	0.00050	0.010	0.010	565	0.050	0.99	1.00
Tests with significant results (2016)									
2016	Q1	CM_MC2	< 0.00010	< 0.010	< 0.010	639	0.095	0.69	< 1.0
2016	Q2	CM_MC2	< 0.00010	< 0.010	0.012	401	0.20	2.23	14.5
2016	Q3	CM_MC2	< 0.00010	< 0.010	< 0.010	644	0.134	1.15	1.50
2016	Q1	EV_HC1	< 0.00010	0.015	0.015	504	0.081	1.04	< 1.0
2016	Q1	FR_FRCP1	< 0.00010	0.021	0.021	1520	< 0.050	0.95	< 1.0
2016	Q2	FR_FRCP1	< 0.00010	< 0.010	< 0.010	354	0.212	2.85	7.10
2016	Q4	FR_FRCP1	< 0.00010	< 0.010	< 0.010	608	0.143	1.14	< 1.0
2016	Q1	GH_FR1	< 0.00010	0.017	0.017	622	< 0.050	0.71	< 1.0
2016	Q2	GH_FR1	< 0.00010	< 0.010	< 0.010	366	0.204	2.02	7.10
2016	Q2	LC_LCDSSLCC	< 0.00010	0.011	0.012	352	0.184	1.81	< 1.0

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	TURBIDITY, LAB-N-ntu	URANIUM-D-mg/l	URANIUM-T-mg/l	VANADIUM-D-mg/l	VANADIUM-T-mg/l	ZINC-D-mg/l	ZINC-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.13	0.000471	0.000467	0.0010	0.0010	0.0030	0.0030
2015	Q1	Reference (FR_UFR1)	0.13	0.000471	0.000467	0.0010	0.0010	0.0030	0.0030
2015	Q1	Reference (FR_UFR1)	0.33	0.000473	0.000472	0.0010	0.0010	0.0030	0.0030
2015	Q2	Reference (FR_UFR1)	1.51	0.000313	0.000329	0.00050	0.00050	0.0030	0.0030
2015	Q3	Reference (FR_UFR1)	0.20	0.000416	0.000417	0.00050	0.00050	0.0030	0.0030
2015	Q4	Reference (FR_UFR1)	0.26	0.000469	0.00044	0.00050	0.00050	0.0030	0.0030
2015	Q2	Reference (GH_ER2)	3.89	0.000785	0.000778	0.00050	0.00051	0.0030	0.0030
2015	Q4	Reference (GH_ER2)	0.26	0.000707	0.00072	0.00050	0.00050	0.0030	0.0030
2016	Q1	Reference (FR_UFR1)	0.17	0.000498	0.000489	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q2	Reference (FR_UFR1)	1.63	0.000317	0.000331	< 0.00050	0.00051	< 0.0030	< 0.0030
2016	Q3	Reference (FR_UFR1)	0.22	0.000423	0.000441	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q4	Reference (FR_UFR1)	0.85	0.00044	0.00046	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q2	Reference (GH_ER2)	4.73	0.000756	0.000785	< 0.00050	0.00104	< 0.0030	< 0.0030
2016	Q4	Reference (GH_ER2)	0.38	0.000761	0.000786	< 0.00050	< 0.00050	< 0.0030	< 0.0030
Tests that were not statistically different t									
2015	Q1	CM_MC2	0.53	0.00219	0.00226	0.0010	0.0010	0.0030	0.0032
2015	Q2	EV_HC1	1.15	0.00124	0.00121	0.00050	0.00050	0.0030	0.0030
2015	Q3	EV_HC1	0.77	0.0023	0.00226	0.00050	0.00050	0.0030	0.0030
2015	Q4	EV_HC1	0.29	0.00264	0.00271	0.00050	0.00050	0.0030	0.0030
2015	Q1	EV_MC2	0.31	0.00126	0.00123	0.0010	0.0010	0.0041	0.0030
2015	Q4	EV_MC2	0.36	0.00185	0.00186	0.00050	0.00050	0.0030	0.0030
2015	Q2	FR_FRCP1	2.00	0.00152	0.00156	0.00050	0.00054	0.0030	0.0030
2015	Q3	FR_FRCP1	0.47	0.00272	0.0028	0.00050	0.00050	0.0030	0.0030
2015	Q1	GH_ERC	0.41	0.000814	0.000839	0.0010	0.0010	0.0030	0.0041
2015	Q2	GH_ERC	1.58	0.00083	0.000837	0.00050	0.00070	0.0030	0.0030
2015	Q3	GH_ERC	1.25	0.00065	0.00071	0.00050	0.00058	0.0030	0.0030
2015	Q4	GH_ERC	0.26	0.000766	0.000808	0.00050	0.00050	0.0030	0.0030
2015	Q1	GH_FR1	0.18	0.00218	0.00217	0.0010	0.0010	0.0030	0.0030
2015	Q2	GH_FR1	2.22	0.00157	0.00159	0.00050	0.00050	0.0030	0.0030
2015	Q4	GH_FR1	0.30	0.00187	0.00191	0.00050	0.00050	0.0030	0.0030
2015	Q1	LC_LCDSSLCC	0.29	0.00392	0.00395	0.0010	0.0010	0.0038	0.0039
2016	Q4	CM_MC2	3.75	0.00171	0.00174	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q2	EV_HC1	3.14	0.00195	0.00208	< 0.00050	0.00077	< 0.0030	< 0.0030
2016	Q3	EV_HC1	2.63	0.00228	0.00233	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q4	EV_HC1	2.33	0.00256	0.0026	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q1	EV_MC2	0.77	0.00167	0.00173	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q2	EV_MC2	10.8	0.000515	0.000576	< 0.00050	0.00192	< 0.0030	0.0047
2016	Q3	EV_MC2	0.30	0.00148	0.00149	< 0.00050	< 0.00050	< 0.0030	0.0031
2016	Q4	EV_MC2	5.46	0.000621	0.000659	< 0.00050	0.00109	< 0.0030	< 0.0030
2016	Q3	FR_FRCP1	0.36	0.00302	0.00299	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q1	GH_ERC	0.24	0.000988	0.000951	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q2	GH_ERC	5.70	0.000846	0.000845	< 0.00050	0.00143	< 0.0030	0.0035
2016	Q3	GH_ERC	1.08	0.000702	0.000669	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q4	GH_ERC	1.19	0.000889	0.000835	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q3	GH_FR1	0.43	0.00196	0.0020	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q4	GH_FR1	0.49	0.00215	0.00215	<0.0005	<0.0005	<0.003	<0.003
2016	Q1	LC_LCDSSLCC	0.35	0.00388	0.00391	< 0.00050	< 0.00050	< 0.0030	0.0034
2016	Q3	LC_LCDSSLCC	0.28	0.00286	0.00236	< 0.00050	< 0.00050	0.0089	0.0075
2016	Q4	LC_LCDSSLCC	0.39	0.00322	0.00309	< 0.00050	< 0.00050	0.0061	0.0078
Tests with significant results (2015)									
2015	Q2	CM_MC2	5.84	0.00111	0.00111	0.00050	0.00088	0.0031	0.0059
2015	Q3	CM_MC2	0.61	0.00237	0.00245	0.00050	0.00050	0.0030	0.0030
2015	Q4	CM_MC2	0.99	0.00222	0.00223	0.00050	0.00050	0.0030	0.0030
2015	Q1	EV_HC1	0.24	0.00173	0.00175	0.0010	0.0010	0.0030	0.0030
2015	Q2	EV_MC2	4.71	0.000514	0.000478	0.00050	0.00156	0.0030	0.0041
2015	Q3	EV_MC2	0.34	0.00187	0.00185	0.00050	0.00050	0.0030	0.0031
2015	Q1	FR_FRCP1	0.12	0.0152	0.0155	0.0020	0.0020	0.0030	0.0060
2015	Q4	FR_FRCP1	0.29	0.00383	0.00368	0.00050	0.00050	0.0030	0.0030
2015	Q3	GH_FR1	0.33	0.00175	0.00177	0.00050	0.00050	0.0030	0.0030
2015	Q2	LC_LCDSSLCC	0.48	0.00198	0.0020	0.00050	0.00050	0.0061	0.0066
2015	Q3	LC_LCDSSLCC	0.35	0.00257	0.0028	0.00050	0.00050	0.0092	0.0106
2015	Q4	LC_LCDSSLCC	0.29	0.00375	0.00395	0.0025	0.0025	0.0081	0.015
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.57	0.00262	0.00244	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q2	CM_MC2	6.51	0.00132	0.0012	< 0.00050	0.00085	0.0076	0.013
2016	Q3	CM_MC2	0.37	0.0026	0.0027	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q1	EV_HC1	0.25	0.00274	0.00277	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q1	FR_FRCP1	0.28	0.00793	0.00797	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q2	FR_FRCP1	1.45	0.00156	0.00169	< 0.00050	0.00061	< 0.0030	0.0033
2016	Q4	FR_FRCP1	0.84	0.00295	0.00298	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q1	GH_FR1	0.35	0.00219	0.00223	< 0.00050	< 0.00050	< 0.0030	< 0.0030
2016	Q2	GH_FR1	2.98	0.00153	0.00148	< 0.00050	0.00060	< 0.0030	< 0.0030
2016	Q2	LC_LCDSSLCC	0.94	0.00224	0.00228	< 0.00050	< 0.00050	0.0089	0.0101

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-2: *P. subcapita* Cell Yield Paired with Water Quality

Year	Quarter	Sample ID	PCA_Factor1 (2015 and 2016 datasets)	PCA-Factor1 (2016 dataset)
Reference				
2015	Q1	Reference (FR_UFR1)	-1.06	-
2015	Q1	Reference (FR_UFR1)	-1.06	-
2015	Q1	Reference (FR_UFR1)	-1.05	-
2015	Q2	Reference (FR_UFR1)	-1.68	-
2015	Q3	Reference (FR_UFR1)	-1.04	-
2015	Q4	Reference (FR_UFR1)	-1.17	-
2015	Q2	Reference (GH_ER2)	-1.13	-
2015	Q4	Reference (GH_ER2)	-1.07	-
2016	Q1	Reference (FR_UFR1)	-1.08	-0.99
2016	Q2	Reference (FR_UFR1)	-1.74	-1.81
2016	Q3	Reference (FR_UFR1)	-1.14	-1.03
2016	Q4	Reference (FR_UFR1)	-1.29	-1.23
2016	Q2	Reference (GH_ER2)	-1.18	-1.32
2016	Q4	Reference (GH_ER2)	-1.14	-1.06
Tests that were not statistically different t				
2015	Q1	CM_MC2	0.93	-
2015	Q2	EV_HC1	-1.06	-
2015	Q3	EV_HC1	0.00	-
2015	Q4	EV_HC1	0.23	-
2015	Q1	EV_MC2	0.60	-
2015	Q4	EV_MC2	0.95	-
2015	Q2	FR_FRCP1	0.02	-
2015	Q3	FR_FRCP1	0.81	-
2015	Q1	GH_ERC	-0.86	-
2015	Q2	GH_ERC	-0.99	-
2015	Q3	GH_ERC	-1.10	-
2015	Q4	GH_ERC	-0.86	-
2015	Q1	GH_FR1	0.69	-
2015	Q2	GH_FR1	0.08	-
2015	Q4	GH_FR1	0.49	-
2015	Q1	LC_LCDSSLCC	1.14	-
2016	Q4	CM_MC2	0.31	0.18
2016	Q2	EV_HC1	-0.24	-0.32
2016	Q3	EV_HC1	-0.01	0.00
2016	Q4	EV_HC1	0.11	0.17
2016	Q1	EV_MC2	0.77	0.88
2016	Q2	EV_MC2	-1.01	-1.55
2016	Q3	EV_MC2	0.96	1.04
2016	Q4	EV_MC2	-0.75	-1.05
2016	Q3	FR_FRCP1	0.73	0.93
2016	Q1	GH_ERC	-0.66	-0.62
2016	Q2	GH_ERC	-0.94	-1.18
2016	Q3	GH_ERC	-1.13	-1.05
2016	Q4	GH_ERC	-0.97	-0.92
2016	Q3	GH_FR1	0.36	0.52
2016	Q4	GH_FR1	0.48	0.61
2016	Q1	LC_LCDSSLCC	1.32	1.43
2016	Q3	LC_LCDSSLCC	0.87	1.00
2016	Q4	LC_LCDSSLCC	0.72	0.83
Tests with significant results (2015)				
2015	Q2	CM_MC2	-0.15	-
2015	Q3	CM_MC2	0.90	-
2015	Q4	CM_MC2	0.81	-
2015	Q1	EV_HC1	-0.51	-
2015	Q2	EV_MC2	-0.96	-
2015	Q3	EV_MC2	0.93	-
2015	Q1	FR_FRCP1	3.17	-
2015	Q4	FR_FRCP1	1.08	-
2015	Q3	GH_FR1	0.39	-
2015	Q2	LC_LCDSSLCC	0.03	-
2015	Q3	LC_LCDSSLCC	0.66	-
2015	Q4	LC_LCDSSLCC	2.30	-
Tests with significant results (2016)				
2016	Q1	CM_MC2	1.07	1.09
2016	Q2	CM_MC2	0.19	-0.16
2016	Q3	CM_MC2	0.98	1.10
2016	Q1	EV_HC1	0.33	0.39
2016	Q1	FR_FRCP1	1.98	2.19
2016	Q2	FR_FRCP1	0.00	-0.01
2016	Q4	FR_FRCP1	0.66	0.83
2016	Q1	GH_FR1	0.66	0.78
2016	Q2	GH_FR1	-0.02	-0.02
2016	Q2	LC_LCDSSLCC	0.37	0.36

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	Mean Survival	Mean Dry Weight (Control Normalized)	ACIDITY TO pH 8.3 (As CaCO3)-N-mg/l	ALKALINITY, BICARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, CARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, HYDROXIDE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, TOTAL (As CaCO3), lab measured.-N-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	72.0	81.7	1.00	135	4.30	1.00	139
2015	Q2	Reference (FR_UFR1)	100	91.5	1.00	114	2.75	1.00	116
2015	Q3	Reference (FR_UFR1)	94.0	70.2	1.00	153	6.75	1.00	160
2015	Q4	Reference (FR_UFR1)	92.0	104	1.00	140	5.20	1.00	146
2016	Q1	Reference (FR_UFR1)	100	95.3	<1	139	2.95	<1	141
2016	Q2	Reference (FR_UFR1)	98.0	105	<1	114	<1	<1	114
2016	Q3	Reference (FR_UFR1)	100	110	<1	154	4.00	<1	158
2016	Q4	Reference (FR_UFR1)	94.0	113	<1	140	1.85	<1	141
Tests that were not statistically different than reference									
2015	Q1	CM_MC2	94.0	73.1	1.00	172	4.06	1.00	176
2015	Q2	CM_MC2	96.0	86.8	1.08	132	3.68	1.00	136
2015	Q4	CM_MC2	100	79.2	1.00	189	6.32	1.00	195
2015	Q1	FR_FRCP1	94.0	81.7	1.00	217	9.10	1.00	226
2015	Q3	FR_FRCP1	86.0	77.4	1.00	196	10.5	1.00	207
2015	Q4	FR_FRCP1	100	92.2	1.00	211	2.72	1.00	213
2015	Q1	GH_FR1	98.0	90.3	1.00	197	7.48	1.00	204
2015	Q2	GH_FR1	96.0	78.3	1.00	153	4.93	1.00	158
2015	Q3	GH_FR1	68.0	60.7	1.00	177	8.47	1.00	185
2015	Q4	GH_FR1	94.0	96.1	1.00	187	5.80	1.00	193
2016	Q3	CM_MC2	98.0	113	1.03	200	4.80	<1	204
2016	Q4	CM_MC2	98.0	113	<1	178	1.90	<1	179
2016	Q1	GH_FR1	94.0	87.2	1.00	198	<1	<1	198
2016	Q4	GH_FR1	86.0	92.1	1.21	191	1.95	<1	192
Tests with significant results (2015)									
2015	Q3	CM_MC2	66.0	34.5	1.05	201	8.60	1.00	210
2015	Q2	FR_FRCP1	96.0	71.7	1.00	137	5.00	1.00	142
Tests with significant results (2016)									
2016	Q1	CM_MC2	80.0	58.1	<1	203	5.60	<1	209
2016	Q2	CM_MC2	94.0	29.9	1.03	143	3.50	<1	146
2016	Q1	FR_FRCP1	100	58.1	1.38	235	1.90	<1	236
2016	Q2	FR_FRCP1	98.0	50.6	<1	151	3.45	<1	154
2016	Q3	FR_FRCP1	98.0	93.7	1.23	199	3.85	<1	202
2016	Q4	FR_FRCP1	94.0	95.2	<1	194	4.60	<1	198
2016	Q2	GH_FR1	98.0	59.8	<1	163	4.20	<1	166
2016	Q3	GH_FR1	96.0	97.5	<1	195	3.70	<1	198

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	ALUMINUM-D-mg/l	ALUMINUM-T-mg/l	ANTIMONY-D-mg/l	ANTIMONY-T-mg/l	ARSENIC-D-mg/l	ARSENIC-T-mg/l	BARIUM-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.00328	0.0244	0.00010	0.00010	0.00010	0.000118	0.0703
2015	Q2	Reference (FR_UFR1)	0.00475	0.0495	0.00010	0.00010	0.000105	0.000128	0.0426
2015	Q3	Reference (FR_UFR1)	0.0030	0.00858	0.00010	0.000105	0.00011	0.00016	0.081
2015	Q4	Reference (FR_UFR1)	0.0030	0.00556	0.00010	0.00010	0.00010	0.000108	0.0732
2016	Q1	Reference (FR_UFR1)	0.00385	0.00553	<0.0001	<0.0001	<0.0001	<0.0001	0.0763
2016	Q2	Reference (FR_UFR1)	0.00593	0.0543	<0.0001	<0.0001	0.000105	0.00012	0.0419
2016	Q3	Reference (FR_UFR1)	<0.003	0.00708	<0.0001	<0.0001	<0.0001	0.000108	0.0751
2016	Q4	Reference (FR_UFR1)	0.00823	0.0422	<0.0001	<0.0001	<0.0001	0.000123	0.064
Tests that were not statistically different than re									
2015	Q1	CM_MC2	0.0063	0.195	0.000132	0.000146	0.00016	0.00026	0.0585
2015	Q2	CM_MC2	0.0115	0.663	0.00011	0.000133	0.00016	0.00049	0.0415
2015	Q4	CM_MC2	0.00306	0.0502	0.000154	0.000168	0.00017	0.000228	0.0741
2015	Q1	FR_FRCP1	0.0030	0.0238	0.00036	0.000374	0.00010	0.00013	0.0871
2015	Q3	FR_FRCP1	0.0030	0.00815	0.00026	0.000288	0.00010	0.00017	0.0778
2015	Q4	FR_FRCP1	0.00316	0.00462	0.00025	0.000282	0.00010	0.000114	0.0796
2015	Q1	GH_FR1	0.0030	0.0692	0.000198	0.00021	0.000104	0.000152	0.108
2015	Q2	GH_FR1	0.0030	0.054	0.000153	0.000163	0.000103	0.000158	0.0827
2015	Q3	GH_FR1	0.0030	0.0325	0.00017	0.00021	0.000113	0.000163	0.0991
2015	Q4	GH_FR1	0.0030	0.00366	0.00012	0.00015	0.000102	0.00012	0.114
2016	Q3	CM_MC2	<0.003	0.00745	0.000195	0.000233	0.000185	0.000195	0.0775
2016	Q4	CM_MC2	0.00553	0.0879	0.000135	0.000155	0.000173	0.000228	0.0543
2016	Q1	GH_FR1	<0.003	0.00983	0.000138	0.000158	<0.0001	0.000125	0.121
2016	Q4	GH_FR1	<0.003	0.0105	0.000157	0.000238	0.000105	0.000138	0.101
Tests with significant results (2015)									
2015	Q3	CM_MC2	0.0030	0.0102	0.000203	0.00021	0.00019	0.000228	0.077
2015	Q2	FR_FRCP1	0.0030	0.0454	0.000205	0.000215	0.00010	0.000133	0.0599
Tests with significant results (2016)									
2016	Q1	CM_MC2	<0.003	0.0199	0.000208	0.000223	0.00016	0.000185	0.0772
2016	Q2	CM_MC2	0.00678	0.365	0.000153	0.000168	0.000165	0.000295	0.045
2016	Q1	FR_FRCP1	0.00323	0.0038	0.000263	0.000288	<0.0001	0.000105	0.0833
2016	Q2	FR_FRCP1	<0.003	0.0699	0.000173	0.00022	<0.0001	0.000138	0.0581
2016	Q3	FR_FRCP1	<0.003	0.0143	0.000215	0.000243	<0.0001	0.00011	0.0767
2016	Q4	FR_FRCP1	0.00375	0.0241	0.000188	0.000198	<0.0001	0.000135	0.0752
2016	Q2	GH_FR1	<0.003	0.0577	0.000148	0.000183	0.000103	0.000143	0.0797
2016	Q3	GH_FR1	<0.003	0.00698	0.000131	0.000154	0.000104	0.000131	0.105

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	BARIUM-T-mg/l	BERYLLIUM-D-mg/l	BERYLLIUM-T-mg/l	BISMUTH-D-mg/l	BISMUTH-T-mg/l	BORON-D-mg/l	BORON-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.0717	0.00010	0.00010	0.00032	0.00032	0.010	0.010
2015	Q2	Reference (FR_UFR1)	0.043	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q3	Reference (FR_UFR1)	0.0816	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q4	Reference (FR_UFR1)	0.0741	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2016	Q1	Reference (FR_UFR1)	0.0753	<0.0001	<0.0001	<0.00005	<0.00005	<0.01	<0.01
2016	Q2	Reference (FR_UFR1)	0.0431	<0.00004	<0.00004	<0.00005	<0.00005	<0.01	<0.01
2016	Q3	Reference (FR_UFR1)	0.0771	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01
2016	Q4	Reference (FR_UFR1)	0.0632	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01
Tests that were not statistically different than re									
2015	Q1	CM_MC2	0.0615	0.00010	0.00010	0.00032	0.00032	0.0194	0.0208
2015	Q2	CM_MC2	0.0485	0.00010	0.00011	0.000050	0.000050	0.014	0.0165
2015	Q4	CM_MC2	0.0743	0.00010	0.00010	0.000050	0.000050	0.0244	0.0274
2015	Q1	FR_FRCP1	0.0894	0.00010	0.00010	0.00032	0.00032	0.013	0.0132
2015	Q3	FR_FRCP1	0.0787	0.00010	0.00010	0.000050	0.000050	0.0128	0.014
2015	Q4	FR_FRCP1	0.0802	0.00010	0.00010	0.000050	0.000050	0.0114	0.0124
2015	Q1	GH_FR1	0.11	0.00010	0.00010	0.00032	0.00032	0.010	0.0104
2015	Q2	GH_FR1	0.0836	0.00010	0.00010	0.000050	0.000050	0.010	0.010
2015	Q3	GH_FR1	0.101	0.00010	0.00010	0.000050	0.000050	0.010	0.0107
2015	Q4	GH_FR1	0.112	0.00010	0.00010	0.000050	0.000050	0.0104	0.0122
2016	Q3	CM_MC2	0.0758	<0.00002	<0.00002	<0.00005	<0.00005	0.0283	0.0303
2016	Q4	CM_MC2	0.0563	<0.00002	<0.00002	<0.00005	<0.00005	0.0193	0.0205
2016	Q1	GH_FR1	0.12	<0.0001	<0.0001	<0.00005	<0.00005	<0.01	<0.01
2016	Q4	GH_FR1	0.101	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01
Tests with significant results (2015)									
2015	Q3	CM_MC2	0.0783	0.00010	0.00010	0.000050	0.000050	0.0265	0.027
2015	Q2	FR_FRCP1	0.0608	0.00010	0.00010	0.000050	0.000050	0.010	0.010
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.0757	<0.0001	<0.0001	<0.00005	<0.00005	0.0253	0.0268
2016	Q2	CM_MC2	0.0451	<0.00004	0.000044	<0.00005	<0.00005	0.0168	0.0173
2016	Q1	FR_FRCP1	0.0838	<0.0001	<0.0001	<0.00005	<0.00005	0.011	0.0123
2016	Q2	FR_FRCP1	0.0594	<0.00004	<0.00004	<0.00005	0.0000513	<0.01	<0.01
2016	Q3	FR_FRCP1	0.0755	<0.00002	<0.00002	<0.00005	<0.00005	0.0105	0.011
2016	Q4	FR_FRCP1	0.0743	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01
2016	Q2	GH_FR1	0.0799	<0.00004	<0.00004	<0.00005	<0.00005	<0.01	<0.01
2016	Q3	GH_FR1	0.105	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	0.0101

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	BROMIDE-D-mg/l	CADMIUM-D-mg/l	CADMIUM-T-mg/l	CALCIUM-D-mg/l	CALCIUM-T-mg/l	CARBON, DISSOLVED ORGANIC-D-mg/l	CHLORIDE-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.050	0.00000972	0.0000109	51.2	52.0	1.29	1.04
2015	Q2	Reference (FR_UFR1)	0.050	0.0000057	0.00000858	37.4	37.3	1.77	1.00
2015	Q3	Reference (FR_UFR1)	0.050	0.00000805	0.0000125	57.3	57.7	1.00	1.00
2015	Q4	Reference (FR_UFR1)	0.050	0.00000652	0.00000854	54.7	56.0	0.546	1.02
2016	Q1	Reference (FR_UFR1)	<0.05	0.0000055	0.00000818	55.2	56.7	0.523	0.915
2016	Q2	Reference (FR_UFR1)	<0.05	0.00000595	0.0000121	37.4	38.1	1.71	0.10
2016	Q3	Reference (FR_UFR1)	<0.05	0.00000778	0.00000978	50.8	52.0	0.84	0.133
2016	Q4	Reference (FR_UFR1)	<0.05	0.0000064	0.00000915	47.5	47.0	1.19	0.193
Tests that were not statistically different than re									
2015	Q1	CM_MC2	0.060	0.0000201	0.000034	80.2	81.6	1.58	2.40
2015	Q2	CM_MC2	0.050	0.0000349	0.0000885	58.9	59.7	1.47	1.43
2015	Q4	CM_MC2	0.25	0.0000118	0.0000191	108	107	1.17	3.42
2015	Q1	FR_FRCP1	0.27	0.0000367	0.0000742	144	148	1.25	2.38
2015	Q3	FR_FRCP1	0.25	0.0000434	0.0000516	122	123	0.918	1.58
2015	Q4	FR_FRCP1	0.25	0.0000432	0.0000581	140	141	0.782	2.36
2015	Q1	GH_FR1	0.10	0.000021	0.000027	112	113	1.46	2.70
2015	Q2	GH_FR1	0.075	0.0000203	0.0000277	79.8	79.5	1.37	1.58
2015	Q3	GH_FR1	0.0667	0.0000178	0.0000233	92.3	92.3	0.887	1.47
2015	Q4	GH_FR1	0.25	0.0000167	0.0000187	106	107	0.656	2.00
2016	Q3	CM_MC2	<0.25	0.00000655	0.00000923	114	116	1.01	3.42
2016	Q4	CM_MC2	<0.1	0.0000266	0.0000351	83.6	84.9	1.63	2.00
2016	Q1	GH_FR1	<0.25	0.0000163	0.0000171	119	120	0.653	2.63
2016	Q4	GH_FR1	<0.25	0.0000162	0.0000198	97.6	99.6	0.845	1.61
Tests with significant results (2015)									
2015	Q3	CM_MC2	0.213	0.00000905	0.0000166	119	121	0.993	2.75
2015	Q2	FR_FRCP1	0.050	0.0000251	0.0000392	73.5	73.5	1.42	1.13
Tests with significant results (2016)									
2016	Q1	CM_MC2	<0.25	0.0000169	0.0000161	116	118	0.695	4.96
2016	Q2	CM_MC2	<0.05	0.0000639	0.000104	69.2	67.6	1.50	1.16
2016	Q1	FR_FRCP1	<0.3125	0.0000246	0.0000547	183	187	0.758	2.98
2016	Q2	FR_FRCP1	<0.05	0.0000272	0.000045	74.4	75.3	1.47	0.51
2016	Q3	FR_FRCP1	<0.25	0.000021	0.0000494	106	114	0.96	1.64
2016	Q4	FR_FRCP1	<0.25	0.0000421	0.0000506	108	106	1.04	1.43
2016	Q2	GH_FR1	<0.05	0.0000216	0.0000316	79.5	78.9	1.44	0.963
2016	Q3	GH_FR1	<0.25	0.0000155	0.0000187	92.9	95.4	0.82	1.61

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	CHROMIUM-D-mg/l	CHROMIUM-T-mg/l	COBALT-D-mg/l	COBALT-T-mg/l	CONDUCTIVITY, LAB-N-us/cm	COPPER-D-mg/l	COPPER-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.000134	0.000192	0.00010	0.00010	328	0.00050	0.00050
2015	Q2	Reference (FR_UFR1)	0.00011	0.000258	0.00010	0.00010	234	0.00050	0.00050
2015	Q3	Reference (FR_UFR1)	0.000103	0.000135	0.00010	0.00010	348	0.00050	0.00050
2015	Q4	Reference (FR_UFR1)	0.00012	0.000184	0.00010	0.00010	356	0.00050	0.00050
2016	Q1	Reference (FR_UFR1)	0.000108	0.00018	<0.0001	<0.0001	356	<0.0005	<0.0005
2016	Q2	Reference (FR_UFR1)	0.000128	0.000198	<0.0001	<0.0001	243	<0.0005	<0.0005
2016	Q3	Reference (FR_UFR1)	0.00010	0.00017	<0.0001	<0.0001	341	<0.0005	<0.0005
2016	Q4	Reference (FR_UFR1)	0.00011	0.000198	<0.0001	<0.0001	319	<0.0005	<0.0005
Tests that were not statistically different than re									
2015	Q1	CM_MC2	0.000154	0.00046	0.000466	0.000718	599	0.00050	0.000622
2015	Q2	CM_MC2	0.000228	0.00102	0.00030	0.000828	457	0.00050	0.00127
2015	Q4	CM_MC2	0.000158	0.00026	0.000506	0.000602	821	0.00050	0.000588
2015	Q1	FR_FRCP1	0.000108	0.00017	0.000116	0.000138	1113	0.00050	0.00050
2015	Q3	FR_FRCP1	0.00010	0.00014	0.00010	0.00010	925	0.00050	0.00050
2015	Q4	FR_FRCP1	0.000124	0.000162	0.000102	0.000102	1100	0.00050	0.00050
2015	Q1	GH_FR1	0.000112	0.000222	0.000114	0.000168	823	0.00050	0.000506
2015	Q2	GH_FR1	0.000125	0.000243	0.00010	0.00010	581	0.00050	0.00050
2015	Q3	GH_FR1	0.00011	0.000197	0.00010	0.00010	686	0.00050	0.00050
2015	Q4	GH_FR1	0.000122	0.000174	0.00010	0.00010	783	0.00050	0.00050
2016	Q3	CM_MC2	0.000138	0.000173	0.00034	0.000425	915	<0.0005	<0.0005
2016	Q4	CM_MC2	0.000158	0.000333	0.000763	0.00099	669	<0.0005	<0.0005
2016	Q1	GH_FR1	0.000118	0.000148	<0.0001	<0.0001	891	<0.0005	<0.0005
2016	Q4	GH_FR1	0.000118	0.000157	<0.0001	<0.0001	758	<0.0005	<0.0005
Tests with significant results (2015)									
2015	Q3	CM_MC2	0.00014	0.000173	0.000175	0.000213	939	0.00050	0.00050
2015	Q2	FR_FRCP1	0.000105	0.000188	0.00010	0.000105	568	0.00050	0.00050
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.00016	0.000263	0.000905	0.000978	916	0.000523	<0.0005
2016	Q2	CM_MC2	0.000173	0.000595	0.00209	0.00293	537	<0.0005	0.00070
2016	Q1	FR_FRCP1	0.000103	0.00111	<0.0001	<0.0001	1450	<0.0005	0.000518
2016	Q2	FR_FRCP1	0.000105	0.000238	<0.0001	0.000103	569	<0.0005	0.00051
2016	Q3	FR_FRCP1	<0.0001	0.000128	0.00010	0.000105	907	<0.0005	<0.0005
2016	Q4	FR_FRCP1	<0.0001	0.000153	<0.0001	<0.0001	850	<0.0005	<0.0005
2016	Q2	GH_FR1	0.00011	0.000218	<0.0001	<0.0001	598	<0.0005	<0.0005
2016	Q3	GH_FR1	0.000105	0.000179	<0.0001	<0.0001	740	<0.0005	<0.0005

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	FLUORIDE-D-mg/l	Hardness, Total or Dissolved CaCO3-N-mg/l	IRON-D-mg/l	IRON-T-mg/l	LEAD-D-mg/l	LEAD-T-mg/l	LITHIUM-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.139	180	0.010	0.0174	0.000050	0.000050	0.00132
2015	Q2	Reference (FR_UFR1)	0.147	131	0.010	0.0358	0.000050	0.000050	0.00113
2015	Q3	Reference (FR_UFR1)	0.154	199	0.010	0.0113	0.0000503	0.000050	0.0018
2015	Q4	Reference (FR_UFR1)	0.154	193	0.010	0.010	0.000050	0.000050	0.00136
2016	Q1	Reference (FR_UFR1)	0.151	195	<0.01	<0.01	<0.00005	<0.00005	0.0016
2016	Q2	Reference (FR_UFR1)	0.158	133	<0.01	0.043	<0.00005	0.0000525	0.00118
2016	Q3	Reference (FR_UFR1)	0.166	181	<0.01	0.0108	<0.00005	<0.00005	0.0018
2016	Q4	Reference (FR_UFR1)	0.161	171	<0.01	0.0193	<0.00005	<0.00005	0.00133
Tests that were not statistically different than re									
2015	Q1	CM_MC2	0.113	333	0.0102	0.206	0.000050	0.000141	0.00814
2015	Q2	CM_MC2	0.099	240	0.0148	0.847	0.000050	0.00058	0.00615
2015	Q4	CM_MC2	0.114	456	0.010	0.0532	0.000050	0.0000634	0.0115
2015	Q1	FR_FRCP1	0.176	679	0.010	0.0352	0.000050	0.0000528	0.0432
2015	Q3	FR_FRCP1	0.195	541	0.010	0.0185	0.000050	0.000050	0.0351
2015	Q4	FR_FRCP1	0.176	650	0.010	0.0208	0.000050	0.000050	0.0404
2015	Q1	GH_FR1	0.146	479	0.010	0.0654	0.000050	0.0000628	0.0139
2015	Q2	GH_FR1	0.173	329	0.010	0.0765	0.000050	0.0000705	0.0146
2015	Q3	GH_FR1	0.18	385	0.010	0.052	0.000050	0.0000623	0.0152
2015	Q4	GH_FR1	0.164	445	0.010	0.0108	0.000050	0.000050	0.0156
2016	Q3	CM_MC2	0.118	504	<0.01	0.0118	<0.00005	<0.00005	0.0168
2016	Q4	CM_MC2	0.11	358	<0.01	0.0765	<0.00005	0.0000663	0.0108
2016	Q1	GH_FR1	0.173	505	<0.01	0.013	<0.00005	<0.00005	0.0149
2016	Q4	GH_FR1	0.165	431	<0.01	0.0179	<0.00005	<0.00005	0.0175
Tests with significant results (2015)									
2015	Q3	CM_MC2	0.116	534	0.010	0.012	0.000050	0.000050	0.0143
2015	Q2	FR_FRCP1	0.201	308	0.010	0.0635	0.000050	0.0000815	0.0184
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.125	493	<0.01	0.018	<0.00005	<0.00005	0.0134
2016	Q2	CM_MC2	0.104	282	<0.01	0.404	<0.00005	0.000239	0.00898
2016	Q1	FR_FRCP1	0.18	889	<0.01	0.0218	<0.00005	<0.00005	0.0587
2016	Q2	FR_FRCP1	0.209	311	<0.01	0.0895	<0.00005	0.0000775	0.0179
2016	Q3	FR_FRCP1	0.205	501	<0.01	0.0285	<0.00005	<0.00005	0.0372
2016	Q4	FR_FRCP1	0.205	478	<0.01	0.034	<0.00005	<0.00005	0.032
2016	Q2	GH_FR1	0.185	332	<0.01	0.0858	<0.00005	0.0000718	0.014
2016	Q3	GH_FR1	0.19	399	<0.01	0.0146	<0.00005	<0.00005	0.0176

Notes:
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Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	LITHIUM-T-mg/l	MAGNESIUM-D-mg/l	MAGNESIUM-T-mg/l	MAJOR ANION SUM-N-meq/l	MAJOR CATION SUM-N-meq/l	MANGANESE-D-mg/l	MANGANESE-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.00128	12.7	13.0	3.59	3.64	0.000625	0.00105
2015	Q2	Reference (FR_UFR1)	0.00115	9.21	9.24	2.62	2.66	0.000693	0.00215
2015	Q3	Reference (FR_UFR1)	0.00208	13.6	13.9	3.95	4.02	0.00068	0.00126
2015	Q4	Reference (FR_UFR1)	0.0013	13.8	14.3	3.90	3.91	0.000156	0.000308
2016	Q1	Reference (FR_UFR1)	0.0017	13.8	14.4	3.89	3.93	0.000195	0.000363
2016	Q2	Reference (FR_UFR1)	0.00133	9.63	9.97	2.60	2.69	0.00032	0.00156
2016	Q3	Reference (FR_UFR1)	0.00155	13.0	13.8	3.96	3.65	0.000193	0.000713
2016	Q4	Reference (FR_UFR1)	0.00155	12.7	12.5	3.63	3.45	0.000168	0.000555
Tests that were not statistically different than re									
2015	Q1	CM_MC2	0.0084	32.2	32.5	7.01	6.97	0.00378	0.0115
2015	Q2	CM_MC2	0.00693	22.6	23.0	4.96	4.98	0.0027	0.0283
2015	Q4	CM_MC2	0.012	45.7	45.8	9.43	9.57	0.00394	0.00647
2015	Q1	FR_FRCP1	0.0433	77.3	77.8	14.1	13.7	0.00689	0.010
2015	Q3	FR_FRCP1	0.036	57.9	58.9	11.0	10.9	0.00525	0.00712
2015	Q4	FR_FRCP1	0.0407	72.9	73.8	13.1	13.1	0.0076	0.00889
2015	Q1	GH_FR1	0.014	48.0	48.7	9.72	9.71	0.00229	0.00433
2015	Q2	GH_FR1	0.0145	31.5	31.8	6.44	6.66	0.000988	0.00469
2015	Q3	GH_FR1	0.0152	37.6	37.9	7.77	7.81	0.00201	0.00571
2015	Q4	GH_FR1	0.0159	44.0	45.3	8.85	9.01	0.00116	0.00156
2016	Q3	CM_MC2	0.0177	53.6	54.8	10.9	10.6	0.000638	0.00153
2016	Q4	CM_MC2	0.0111	36.2	36.8	7.86	7.51	0.00727	0.0112
2016	Q1	GH_FR1	0.0146	50.4	51.7	10.2	10.3	0.00119	0.00161
2016	Q4	GH_FR1	0.0176	45.3	46.0	9.00	8.72	0.000958	0.00172
Tests with significant results (2015)									
2015	Q3	CM_MC2	0.0148	57.3	58.1	11.3	11.2	0.000758	0.00166
2015	Q2	FR_FRCP1	0.0187	30.2	30.4	5.92	6.23	0.00266	0.00789
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.0136	49.0	50.3	10.6	10.4	0.00599	0.00707
2016	Q2	CM_MC2	0.00925	26.5	26.4	5.89	5.93	0.0114	0.0248
2016	Q1	FR_FRCP1	0.0599	104	108	18.4	17.9	0.00726	0.00917
2016	Q2	FR_FRCP1	0.0185	30.4	31.1	6.19	6.29	0.00218	0.0076
2016	Q3	FR_FRCP1	0.0369	57.3	56.0	10.9	10.1	0.00434	0.00754
2016	Q4	FR_FRCP1	0.033	50.5	50.0	10.1	9.68	0.00681	0.00868
2016	Q2	GH_FR1	0.0141	32.4	32.6	6.56	6.73	0.00088	0.00433
2016	Q3	GH_FR1	0.0188	40.5	41.8	8.67	8.08	0.000898	0.00177

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	MERCURY-D-mg/l	MERCURY-T-mg/l	MOLYBDENUM-D-mg/l	MOLYBDENUM-T-mg/l	NICKEL-D-mg/l	NICKEL-T-mg/l	NITRATE NITROGEN (NO3), AS N-N-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.0000090	0.0000090	0.000567	0.000569	0.00050	0.00050	0.116
2015	Q2	Reference (FR_UFR1)	0.0000050	0.0000050	0.000556	0.000597	0.00050	0.00050	0.030
2015	Q3	Reference (FR_UFR1)	0.0000050	0.0000050	0.000644	0.000653	0.00050	0.00050	0.0476
2015	Q4	Reference (FR_UFR1)	0.0000050	0.0000050	0.00061	0.000589	0.00050	0.00050	0.0743
2016	Q1	Reference (FR_UFR1)	<0.000005	<0.0000005	0.000567	0.000588	<0.0005	<0.0005	0.156
2016	Q2	Reference (FR_UFR1)	<0.000005	0.000000948	0.000628	0.000647	<0.0005	<0.0005	0.0183
2016	Q3	Reference (FR_UFR1)	<0.000005	<0.0000005	0.000631	0.000645	<0.0005	<0.0005	0.0426
2016	Q4	Reference (FR_UFR1)	<0.000005	0.00000058	0.00057	0.000578	<0.0005	<0.0005	0.097
Tests that were not statistically different than re									
2015	Q1	CM_MC2	0.0000090	0.0000090	0.000918	0.00096	0.00612	0.00672	1.58
2015	Q2	CM_MC2	0.0000050	0.00000703	0.00077	0.000967	0.00598	0.00805	1.05
2015	Q4	CM_MC2	0.0000050	0.0000051	0.00108	0.00111	0.00867	0.00897	2.39
2015	Q1	FR_FRCP1	0.0000090	0.0000090	0.0020	0.00199	0.00726	0.00769	15.0
2015	Q3	FR_FRCP1	0.0000050	0.0000050	0.00149	0.00151	0.00562	0.00581	10.4
2015	Q4	FR_FRCP1	0.0000050	0.0000050	0.00146	0.00147	0.00704	0.0072	16.3
2015	Q1	GH_FR1	0.0000090	0.0000090	0.00122	0.00124	0.00365	0.00386	10.7
2015	Q2	GH_FR1	0.0000050	0.0000050	0.000993	0.000989	0.00162	0.0018	7.75
2015	Q3	GH_FR1	0.0000050	0.0000050	0.000991	0.0010	0.00153	0.00161	9.61
2015	Q4	GH_FR1	0.0000050	0.0000050	0.000941	0.000983	0.00148	0.00147	10.4
2016	Q3	CM_MC2	<0.000005	<0.0000005	0.00117	0.0012	0.0143	0.0148	3.13
2016	Q4	CM_MC2	<0.000005	0.000000783	0.000893	0.000926	0.00983	0.0105	2.22
2016	Q1	GH_FR1	<0.000005	<0.000001625	0.000893	0.000894	0.00158	0.00161	13.0
2016	Q4	GH_FR1	<0.000005	<0.000001625	0.00106	0.00111	0.00243	0.0025	9.52
Tests with significant results (2015)									
2015	Q3	CM_MC2	0.0000050	0.0000050	0.00108	0.00109	0.0122	0.0128	3.24
2015	Q2	FR_FRCP1	0.0000050	0.0000050	0.0012	0.00122	0.00185	0.00208	8.08
Tests with significant results (2016)									
2016	Q1	CM_MC2	<0.000005	<0.00000275	0.0011	0.00111	0.0101	0.0103	2.97
2016	Q2	CM_MC2	<0.000005	0.0000010	0.000866	0.000881	0.0149	0.0169	1.98
2016	Q1	FR_FRCP1	<0.000005	<0.0000005	0.00167	0.00168	0.0092	0.00975	25.7
2016	Q2	FR_FRCP1	<0.000005	0.000000908	0.0011	0.00113	0.00193	0.00235	8.41
2016	Q3	FR_FRCP1	<0.000005	<0.0000005	0.00129	0.00135	0.00545	0.00573	12.8
2016	Q4	FR_FRCP1	<0.000005	<0.0000005	0.00131	0.00134	0.00494	0.00523	12.0
2016	Q2	GH_FR1	<0.000005	0.00000108	0.000989	0.000985	0.00162	0.00174	7.62
2016	Q3	GH_FR1	<0.000005	<0.0000010625	0.00094	0.000979	0.00151	0.00164	10.3

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	NITRITE NITROGEN (NO2), AS N-N-mg/l	NITROGEN, AMMONIA (AS N)-N-mg/l	ORTHO-PHOSPHATE-N-mg/l	OXIDATION-REDUCTION POTENTIAL, LAB N-mv	pH, LAB-N-ph units	PHOSPHORUS-N-mg/l	POTASSIUM-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.0010	0.0050	0.00298	336	8.34	0.00504	0.402
2015	Q2	Reference (FR_UFR1)	0.0010	0.0050	0.00295	383	8.34	0.00703	0.34
2015	Q3	Reference (FR_UFR1)	0.0010	0.0050	0.0036	362	8.40	0.0033	0.522
2015	Q4	Reference (FR_UFR1)	0.0010	0.0050	0.00152	377	8.40	0.00236	0.387
2016	Q1	Reference (FR_UFR1)	<0.001	<0.005	0.00308	293	8.27	0.00405	0.398
2016	Q2	Reference (FR_UFR1)	<0.001	<0.005	0.0025	292	8.34	0.00473	0.325
2016	Q3	Reference (FR_UFR1)	<0.001	<0.005	0.00265	344	8.30	0.0051	0.455
2016	Q4	Reference (FR_UFR1)	<0.001	<0.005	0.00235	322	8.28	0.00453	0.363
Tests that were not statistically different than re									
2015	Q1	CM_MC2	0.0101	0.00786	0.00148	359	8.34	0.014	1.08
2015	Q2	CM_MC2	0.00285	0.00678	0.00173	363	8.36	0.0623	0.828
2015	Q4	CM_MC2	0.0339	0.0163	0.00124	373	8.35	0.00814	1.40
2015	Q1	FR_FRCP1	0.0141	0.019	0.0010	305	8.38	0.00404	2.10
2015	Q3	FR_FRCP1	0.00713	0.00635	0.00103	364	8.39	0.00218	1.85
2015	Q4	FR_FRCP1	0.00528	0.0050	0.0010	379	8.33	0.0020	1.92
2015	Q1	GH_FR1	0.00376	0.0050	0.00144	343	8.33	0.00606	1.26
2015	Q2	GH_FR1	0.00303	0.00535	0.0010	444	8.37	0.0090	1.04
2015	Q3	GH_FR1	0.00597	0.00623	0.0010	393	8.34	0.00313	1.22
2015	Q4	GH_FR1	0.0050	0.0050	0.00108	354	8.36	0.00218	1.18
2016	Q3	CM_MC2	0.00618	<0.005	0.00103	333	8.33	0.00218	1.85
2016	Q4	CM_MC2	0.00795	0.00565	0.00133	296	8.30	0.0053	1.28
2016	Q1	GH_FR1	0.0052	<0.005	<0.001	325	8.24	0.00323	1.18
2016	Q4	GH_FR1	<0.005	0.00538	0.00113	353	8.27	0.0114	1.27
Tests with significant results (2015)									
2015	Q3	CM_MC2	0.0068	0.00618	0.0010	404	8.34	0.00293	1.74
2015	Q2	FR_FRCP1	0.00458	0.0115	0.0012	397	8.41	0.010	1.19
Tests with significant results (2016)									
2016	Q1	CM_MC2	0.0258	0.0102	0.0012	347	8.32	0.00228	1.57
2016	Q2	CM_MC2	0.00875	0.024	0.00225	307	8.29	0.0202	1.03
2016	Q1	FR_FRCP1	0.00655	<0.005	<0.001	306	8.27	0.00253	2.37
2016	Q2	FR_FRCP1	0.0027	0.0059	0.00165	331	8.34	0.00938	1.13
2016	Q3	FR_FRCP1	0.00678	0.00573	0.00143	332	8.29	0.00455	1.80
2016	Q4	FR_FRCP1	<0.005	<0.005	<0.001	330	8.34	0.00313	1.58
2016	Q2	GH_FR1	0.0027	0.00503	0.00125	318	8.35	0.00958	1.05
2016	Q3	GH_FR1	0.00571	<0.005	0.00104	331	8.32	0.00434	1.25

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	POTASSIUM-T-mg/l	SELENIUM-D-ug/l	SELENIUM-T-ug/l	SILICON-D-mg/l	SILICON-T-mg/l	SILVER-D-mg/l	SILVER-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.419	0.718	0.771	1.71	1.78	0.000010	0.000010
2015	Q2	Reference (FR_UFR1)	0.358	0.454	0.503	1.71	1.80	0.000010	0.000010
2015	Q3	Reference (FR_UFR1)	0.54	0.492	0.494	2.14	2.20	0.000010	0.000010
2015	Q4	Reference (FR_UFR1)	0.39	0.654	0.668	1.50	1.55	0.000010	0.000010
2016	Q1	Reference (FR_UFR1)	0.391	0.833	0.815	1.76	1.78	<0.00001	<0.00001
2016	Q2	Reference (FR_UFR1)	0.345	0.513	0.552	1.76	1.89	<0.00001	<0.00001
2016	Q3	Reference (FR_UFR1)	0.462	0.60	0.64	2.09	2.14	<0.00001	<0.00001
2016	Q4	Reference (FR_UFR1)	0.369	0.664	0.655	1.73	1.87	<0.00001	<0.00001
Tests that were not statistically different than re									
2015	Q1	CM_MC2	1.15	4.31	4.35	2.03	2.46	0.000010	0.000010
2015	Q2	CM_MC2	1.05	3.93	3.93	1.87	3.05	0.000010	0.0000125
2015	Q4	CM_MC2	1.38	5.23	5.22	2.15	2.24	0.000010	0.000010
2015	Q1	FR_FRCP1	2.15	112	113	1.88	1.95	0.000010	0.000010
2015	Q3	FR_FRCP1	1.89	72.0	73.0	2.00	2.05	0.000010	0.000010
2015	Q4	FR_FRCP1	2.01	91.4	91.0	1.75	1.78	0.000010	0.000010
2015	Q1	GH_FR1	1.31	50.0	49.3	2.27	2.45	0.000010	0.000010
2015	Q2	GH_FR1	1.06	30.2	30.4	1.75	1.84	0.000010	0.000010
2015	Q3	GH_FR1	1.23	36.7	37.1	2.03	2.10	0.000010	0.000010
2015	Q4	GH_FR1	1.22	41.9	42.4	2.18	2.24	0.000010	0.000010
2016	Q3	CM_MC2	1.83	6.69	6.87	1.93	2.10	<0.00001	<0.00001
2016	Q4	CM_MC2	1.31	5.67	5.78	2.13	2.35	<0.00001	<0.00001
2016	Q1	GH_FR1	1.18	51.5	50.0	2.11	2.15	<0.00001	<0.00001
2016	Q4	GH_FR1	1.32	43.4	42.2	2.09	2.15	<0.00001	<0.00001
Tests with significant results (2015)									
2015	Q3	CM_MC2	1.76	7.91	8.14	1.89	1.93	0.000010	0.000010
2015	Q2	FR_FRCP1	1.19	30.3	30.3	1.51	1.59	0.000010	0.000010
Tests with significant results (2016)									
2016	Q1	CM_MC2	1.61	5.50	5.53	2.18	2.26	<0.00001	<0.00001
2016	Q2	CM_MC2	1.14	4.58	4.47	1.98	2.58	<0.00001	<0.00001
2016	Q1	FR_FRCP1	2.38	150	148	1.93	1.95	<0.00001	<0.00001
2016	Q2	FR_FRCP1	1.15	30.5	31.0	1.58	1.72	<0.00001	<0.00001
2016	Q3	FR_FRCP1	1.73	66.4	65.5	1.90	2.02	<0.00001	<0.00001
2016	Q4	FR_FRCP1	1.58	59.1	57.6	1.72	1.84	<0.00001	<0.00001
2016	Q2	GH_FR1	1.06	28.8	29.5	1.85	1.92	<0.00001	<0.00001
2016	Q3	GH_FR1	1.24	39.4	39.8	2.12	2.25	<0.00001	<0.00001

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	SODIUM-D-mg/l	SODIUM-T-mg/l	STRONTIUM-D-mg/l	STRONTIUM-T-mg/l	SULFATE (AS SO4)-D-mg/l	THALLIUM-D-mg/l	THALLIUM-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.708	0.713	0.0843	0.0845	37.7	0.000010	0.000010
2015	Q2	Reference (FR_UFR1)	0.566	0.575	0.0634	0.0657	13.9	0.000010	0.000010
2015	Q3	Reference (FR_UFR1)	0.723	0.738	0.0952	0.0975	36.0	0.000010	0.0000163
2015	Q4	Reference (FR_UFR1)	0.681	0.681	0.0916	0.0907	46.8	0.000010	0.000010
2016	Q1	Reference (FR_UFR1)	0.707	0.709	0.0893	0.0916	48.9	<0.00001	<0.00001
2016	Q2	Reference (FR_UFR1)	0.618	0.635	0.0652	0.0673	14.9	<0.00001	<0.00001
2016	Q3	Reference (FR_UFR1)	0.683	0.738	0.0981	0.101	37.6	<0.00001	<0.00001
2016	Q4	Reference (FR_UFR1)	0.676	0.68	0.089	0.0894	38.3	<0.00001	<0.00001
Tests that were not statistically different than re									
2015	Q1	CM_MC2	6.90	6.93	0.222	0.228	159	0.0000102	0.0000166
2015	Q2	CM_MC2	3.80	3.89	0.155	0.161	103	0.0000103	0.0000343
2015	Q4	CM_MC2	9.50	9.49	0.288	0.295	252	0.0000108	0.000012
2015	Q1	FR_FRCP1	2.41	2.45	0.17	0.174	407	0.000013	0.000013
2015	Q3	FR_FRCP1	1.75	1.78	0.145	0.148	291	0.0000113	0.000010
2015	Q4	FR_FRCP1	2.00	2.06	0.165	0.167	364	0.0000102	0.0000104
2015	Q1	GH_FR1	2.34	2.39	0.151	0.155	230	0.000010	0.000010
2015	Q2	GH_FR1	1.59	1.60	0.112	0.113	129	0.000010	0.000010
2015	Q3	GH_FR1	1.83	1.87	0.13	0.134	160	0.000010	0.000010
2015	Q4	GH_FR1	2.04	2.11	0.147	0.151	202	0.000010	0.000010
2016	Q3	CM_MC2	11.5	11.5	0.356	0.364	310	0.0000163	0.0000153
2016	Q4	CM_MC2	7.51	7.68	0.235	0.24	195	0.000011	0.0000153
2016	Q1	GH_FR1	2.37	2.36	0.161	0.16	251	<0.00001	<0.00001
2016	Q4	GH_FR1	1.99	2.10	0.145	0.148	212	<0.00001	<0.00001
Tests with significant results (2015)									
2015	Q3	CM_MC2	10.3	10.4	0.31	0.316	325	0.0000185	0.0000178
2015	Q2	FR_FRCP1	1.16	1.15	0.0997	0.103	119	0.000010	0.000010
Tests with significant results (2016)									
2016	Q1	CM_MC2	12.6	13.0	0.33	0.33	291	0.0000113	0.0000158
2016	Q2	CM_MC2	6.20	5.98	0.195	0.192	134	0.000012	0.0000223
2016	Q1	FR_FRCP1	2.44	2.49	0.20	0.204	561	0.0000125	0.000015
2016	Q2	FR_FRCP1	1.04	1.09	0.0988	0.101	119	<0.00001	0.0000113
2016	Q3	FR_FRCP1	1.81	1.82	0.149	0.155	280	<0.00001	0.000010
2016	Q4	FR_FRCP1	1.54	1.56	0.145	0.146	253	0.0000108	<0.00001
2016	Q2	GH_FR1	1.48	1.48	0.111	0.112	128	<0.00001	<0.00001
2016	Q3	GH_FR1	1.91	1.97	0.142	0.143	188	<0.00001	<0.00001

Notes:
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Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	TIN-D-mg/l	TIN-T-mg/l	TITANIUM-D-mg/l	TITANIUM-T-mg/l	TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	TOTAL KJELDAHL NITROGEN-N-mg/l	TOTAL ORGANIC CARBON-T-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	0.00010	0.00010	0.010	0.010	203	0.0754	1.12
2015	Q2	Reference (FR_UFR1)	0.00010	0.00010	0.010	0.010	141	0.0943	2.00
2015	Q3	Reference (FR_UFR1)	0.00010	0.00010	0.010	0.010	221	0.0595	0.843
2015	Q4	Reference (FR_UFR1)	0.00010	0.00010	0.010	0.010	217	0.0652	0.604
2016	Q1	Reference (FR_UFR1)	<0.0001	<0.0001	0.0103	0.0103	237	0.0548	0.528
2016	Q2	Reference (FR_UFR1)	<0.0001	<0.0001	<0.01	<0.01	147	0.0768	2.00
2016	Q3	Reference (FR_UFR1)	<0.0001	<0.0001	<0.01	<0.01	218	0.0695	0.965
2016	Q4	Reference (FR_UFR1)	<0.0001	<0.0001	<0.01	<0.01	197	0.0645	1.32
Tests that were not statistically different than re									
2015	Q1	CM_MC2	0.00010	0.00010	0.0104	0.014	408	0.125	1.86
2015	Q2	CM_MC2	0.00010	0.00010	0.010	0.0178	308	0.184	2.22
2015	Q4	CM_MC2	0.00010	0.00010	0.0108	0.0116	571	0.138	1.40
2015	Q1	FR_FRCP1	0.00010	0.00010	0.013	0.0138	866	0.050	1.30
2015	Q3	FR_FRCP1	0.00010	0.00010	0.010	0.010	703	0.132	0.955
2015	Q4	FR_FRCP1	0.00010	0.00010	0.0106	0.0106	836	0.101	0.878
2015	Q1	GH_FR1	0.00010	0.00010	0.0116	0.0138	574	0.117	1.93
2015	Q2	GH_FR1	0.00010	0.00010	0.010	0.010	386	0.0728	1.59
2015	Q3	GH_FR1	0.00010	0.000117	0.010	0.010	508	0.122	0.89
2015	Q4	GH_FR1	0.00010	0.00010	0.0104	0.0106	545	0.108	0.704
2016	Q3	CM_MC2	<0.0001	<0.0001	<0.01	<0.01	704	0.142	1.17
2016	Q4	CM_MC2	<0.0001	<0.0001	<0.01	<0.01	482	0.129	1.88
2016	Q1	GH_FR1	<0.0001	<0.0001	0.0125	0.0125	618	0.084	0.88
2016	Q4	GH_FR1	<0.0001	<0.0001	<0.01	<0.01	553	0.213	1.81
Tests with significant results (2015)									
2015	Q3	CM_MC2	0.00010	0.00010	0.010	0.010	725	0.142	1.11
2015	Q2	FR_FRCP1	0.00010	0.00010	0.010	0.010	374	0.050	1.66
Tests with significant results (2016)									
2016	Q1	CM_MC2	<0.0001	<0.0001	0.0105	0.0105	642	0.118	0.80
2016	Q2	CM_MC2	<0.0001	<0.0001	0.0115	0.0165	366	0.197	1.81
2016	Q1	FR_FRCP1	<0.0001	<0.0001	0.0145	0.0148	1205	0.122	0.873
2016	Q2	FR_FRCP1	<0.0001	<0.0001	0.0108	0.011	377	0.164	1.96
2016	Q3	FR_FRCP1	<0.0001	<0.0001	<0.01	<0.01	692	0.139	1.12
2016	Q4	FR_FRCP1	<0.0001	<0.0001	<0.01	<0.01	626	0.0733	1.42
2016	Q2	GH_FR1	<0.0001	<0.0001	0.0105	0.011	394	0.173	1.78
2016	Q3	GH_FR1	<0.0001	<0.0001	<0.01	<0.01	514	0.134	1.08

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	TURBIDITY, LAB-N-ntu	URANIUM-D-mg/l	URANIUM-T-mg/l	VANADIUM-D-mg/l	VANADIUM-T-mg/l	ZINC-D-mg/l
Reference									
2015	Q1	Reference (FR_UFR1)	1.08	0.692	0.000444	0.000438	0.00080	0.00080	0.0030
2015	Q2	Reference (FR_UFR1)	2.00	1.39	0.000307	0.000313	0.00050	0.00050	0.0030
2015	Q3	Reference (FR_UFR1)	1.00	0.243	0.000431	0.000438	0.00050	0.00053	0.0030
2015	Q4	Reference (FR_UFR1)	1.00	0.22	0.000448	0.000454	0.00050	0.00050	0.0030
2016	Q1	Reference (FR_UFR1)	<1	0.20	0.000448	0.000505	<0.0005	<0.0005	<0.003
2016	Q2	Reference (FR_UFR1)	1.53	0.815	0.000323	0.000328	<0.0005	0.000503	<0.003
2016	Q3	Reference (FR_UFR1)	1.73	0.265	0.00045	0.000453	<0.0005	<0.0005	<0.003
2016	Q4	Reference (FR_UFR1)	<1	0.693	0.000431	0.000446	<0.0005	0.00050	<0.003
Tests that were not statistically different than re									
2015	Q1	CM_MC2	10.2	6.12	0.0015	0.00153	0.00080	0.00092	0.0030
2015	Q2	CM_MC2	31.9	16.1	0.00108	0.00112	0.00050	0.00164	0.00353
2015	Q4	CM_MC2	4.08	2.00	0.00235	0.00233	0.00050	0.000528	0.0030
2015	Q1	FR_FRCP1	1.90	1.30	0.00413	0.00423	0.00080	0.00080	0.0030
2015	Q3	FR_FRCP1	1.03	0.228	0.0032	0.00325	0.00050	0.000503	0.0030
2015	Q4	FR_FRCP1	1.06	0.366	0.00423	0.00425	0.00050	0.000504	0.0030
2015	Q1	GH_FR1	2.46	3.63	0.00222	0.00227	0.00080	0.000834	0.0030
2015	Q2	GH_FR1	4.35	1.77	0.00154	0.00155	0.00050	0.000555	0.0030
2015	Q3	GH_FR1	8.30	1.89	0.00184	0.00185	0.00050	0.00051	0.0030
2015	Q4	GH_FR1	1.00	0.27	0.00202	0.00213	0.00050	0.00050	0.0030
2016	Q3	CM_MC2	1.13	0.433	0.00287	0.00291	<0.0005	<0.0005	<0.003
2016	Q4	CM_MC2	4.20	2.23	0.0018	0.00185	<0.0005	<0.0005	0.00315
2016	Q1	GH_FR1	<1	0.558	0.00224	0.0022	<0.0005	<0.0005	<0.003
2016	Q4	GH_FR1	2.20	0.788	0.00231	0.00233	<0.0005	<0.0005	<0.003
Tests with significant results (2015)									
2015	Q3	CM_MC2	1.30	0.483	0.00291	0.00297	0.00050	0.00050	0.0030
2015	Q2	FR_FRCP1	5.40	1.42	0.00159	0.00164	0.00050	0.00051	0.0030
Tests with significant results (2016)									
2016	Q1	CM_MC2	1.08	0.735	0.00261	0.00258	<0.0005	<0.0005	<0.003
2016	Q2	CM_MC2	13.5	6.60	0.00138	0.00136	<0.0005	0.000878	0.00593
2016	Q1	FR_FRCP1	1.03	0.308	0.00625	0.00633	<0.0005	<0.0005	<0.003
2016	Q2	FR_FRCP1	5.98	0.978	0.00168	0.00174	<0.0005	0.000528	<0.003
2016	Q3	FR_FRCP1	1.73	0.743	0.00337	0.00347	<0.0005	<0.0005	<0.003
2016	Q4	FR_FRCP1	1.38	1.16	0.00309	0.00316	<0.0005	<0.0005	<0.003
2016	Q2	GH_FR1	4.43	1.38	0.00163	0.00161	<0.0005	0.000525	<0.003
2016	Q3	GH_FR1	<1	0.359	0.00205	0.00213	<0.0005	0.000508	<0.003

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-3: *H. azteca* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	ZINC-T-mg/l	PCA_Factor1 (2015 and 2016 datasets)	PCA-Factor1 (2016 dataset)
Reference					
2015	Q1	Reference (FR_UFR1)	0.00318	-1.41	-
2015	Q2	Reference (FR_UFR1)	0.0030	-1.86	-
2015	Q3	Reference (FR_UFR1)	0.0030	-1.29	-
2015	Q4	Reference (FR_UFR1)	0.0030	-1.43	-
2016	Q1	Reference (FR_UFR1)	<0.003	-1.44	-1.39
2016	Q2	Reference (FR_UFR1)	<0.003	-1.92	-1.84
2016	Q3	Reference (FR_UFR1)	<0.003	-1.42	-1.34
2016	Q4	Reference (FR_UFR1)	<0.00375	-1.61	-1.55
Tests that were not statistically different than re					
2015	Q1	CM_MC2	0.0036	0.34	-
2015	Q2	CM_MC2	0.00913	-0.08	-
2015	Q4	CM_MC2	0.0030	0.81	-
2015	Q1	FR_FRCP1	0.00314	1.37	-
2015	Q3	FR_FRCP1	0.0030	0.87	-
2015	Q4	FR_FRCP1	0.0030	1.01	-
2015	Q1	GH_FR1	0.0030	0.60	-
2015	Q2	GH_FR1	0.0030	-0.10	-
2015	Q3	GH_FR1	0.0030	0.24	-
2015	Q4	GH_FR1	0.0030	0.29	-
2016	Q3	CM_MC2	<0.003	0.90	0.89
2016	Q4	CM_MC2	0.00395	0.42	0.40
2016	Q1	GH_FR1	<0.003	0.41	0.39
2016	Q4	GH_FR1	<0.003	0.37	0.38
Tests with significant results (2015)					
2015	Q3	CM_MC2	0.0030	0.92	-
2015	Q2	FR_FRCP1	0.0030	-0.13	-
Tests with significant results (2016)					
2016	Q1	CM_MC2	<0.003	1.02	1.04
2016	Q2	CM_MC2	0.0107	0.34	0.38
2016	Q1	FR_FRCP1	<0.003	1.53	1.48
2016	Q2	FR_FRCP1	0.00308	-0.13	-0.13
2016	Q3	FR_FRCP1	<0.003	0.71	0.66
2016	Q4	FR_FRCP1	<0.0045	0.57	0.52
2016	Q2	GH_FR1	<0.003	-0.10	-0.09
2016	Q3	GH_FR1	<0.003	0.22	0.21

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	Mean Survival (Control Normalized)	Mean Viability (Control Normalized)	Mean Length (Control Normalized)	Mean Wet Weight (Control Normalized)	ACIDITY TO pH 8.3 (As CaCO3)-N-mg/l	ALKALINITY, BICARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, CARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, HYDROXIDE (As CaCO3), lab measured.-N-mg/l
Reference										
2015	Q2	Reference (FR_UFR1)	90.5	89.1	98.4	100	1.00	114	3.62	1.00
2015	Q4	Reference (FR_UFR1)	89.9	89.9	100	102	1.00	140	5.20	1.00
2015	Q2	Reference (GH_ER2)	61.3	61.8	102	106	1.12	146	4.18	1.00
2015	Q4	Reference (GH_ER2)	93.8	93.8	96.8	98.7	1.00	146	1.70	1.00
2016	Q2	Reference (FR_UFR1)	84.3	81.2	103	103	<1	114	<1	<1
2016	Q4	Reference (FR_UFR1)	91.1	90.8	101	103	<1	140	1.85	<1
2016	Q2	Reference (GH_ER2)	103	101	104	103	<1	140	2.00	<1
2016	Q4	Reference (GH_ER2)	95.6	97.2	101	103	<1	145	1.25	<1
Tests that were not statistically different than reference										
2015	Q2	CM_MC2	80.4	82.0	103	101	1.06	132	3.68	1.00
2015	Q2	EV_MC2	103	102	104	104	1.18	100	3.46	1.00
2015	Q4	EV_MC2	87.4	85.6	98.4	97.7	1.50	166	1.55	1.00
2015	Q2	FR_FRCP1	82.8	83.4	105	110	1.00	139	5.88	1.00
2015	Q2	GH_ERC	69.2	68.5	101	106	1.00	148	4.54	1.00
2015	Q2	GH_FR1	88.8	92.3	102	98.4	1.00	150	5.70	1.00
2015	Q2	LC_LCDSSLCC	102	101	101	101	1.14	116	4.69	1.00
2015	Q4	LC_LCDSSLCC	88.2	87.4	97.9	103	1.00	199	1.00	1.00
2016	Q4	EV_MC2	87.5	87.8	102	110	1.15	132	<1	<1
Tests with significant results (2015)										
2015	Q2	EV_HC1	74.9	75.5	100	97.8	1.22	107	6.36	1.00
2015	Q4	CM_MC2	82.1	81.2	100	103	1.00	189	6.32	1.00
2015	Q4	EV_HC1	82.4	80.5	98.4	100	1.00	188	8.30	1.00
2015	Q4	FR_FRCP1	73.0	72.1	96.3	100	1.00	211	2.72	1.00
2015	Q4	GH_ERC	77.1	74.4	96.8	95.4	1.00	151	1.70	1.00
2015	Q4	GH_FR1	80.2	79.2	94.2	98.0	1.00	187	5.80	1.00
Tests with significant results for survival and viability (2016)										
2016	Q2	CM_MC2	73.3	72.9	102	101	1.03	143	3.50	<1
2016	Q2	EV_HC1	85.9	81.3	102	111	<1	167	9.10	<1
2016	Q4	EV_HC1	60.3	58.9	97.5	104	<1	189	5.25	<1
2016	Q2	EV_MC2	68.0	66.0	105	113	1.10	100	<1	<1
2016	Q2	FR_FRCP1	80.5	79.4	99.5	102	<1	151	3.45	<1
2016	Q4	FR_FRCP1	53.6	54.6	98.5	100	<1	194	4.60	<1
2016	Q2	GH_ERC	80.5	77.3	102	108	1.05	144	1.70	<1
2016	Q2	GH_FR1	76.4	77.0	104	101	<1	163	4.20	<1
2016	Q4	GH_FR1	44.4	46.0	98.0	105	1.21	191	1.95	<1
2016	Q2	LC_LCDSSLCC	84.0	80.0	104	103	<1	155	2.70	<1
2016	Q4	LC_LCDSSLCC	69.1	69.8	104	116	1.10	181	2.65	<1
Tests with significant results for viability (2016)										
2016	Q4	CM_MC2	87.2	83.8	102	110	<1	178	1.90	<1
Tests with significant results for length (2016)										
2016	Q2	FR_FRCP1	80.5	79.4	99.5	102	<1	151	3.45	<1
2016	Q4	GH_ERC	98.3	102	97.0	103	1.10	151	1.05	<1

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	ALKALINITY, TOTAL (As CaCO3), lab measured.-N-mg/l	ALUMINUM-D-mg/l	ALUMINUM-T-mg/l	ANTIMONY-D-mg/l	ANTIMONY-T-mg/l	ARSENIC-D-mg/l	ARSENIC-T-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	118	0.0075	0.0594	0.00010	0.00010	0.000104	0.000128
2015	Q4	Reference (FR_UFR1)	146	0.0030	0.00556	0.00010	0.00010	0.00010	0.000108
2015	Q2	Reference (GH_ER2)	150	0.0030	0.0824	0.00010	0.00010	0.00011	0.000162
2015	Q4	Reference (GH_ER2)	147	0.0030	0.0139	0.00010	0.00010	0.00010	0.000115
2016	Q2	Reference (FR_UFR1)	114	0.00593	0.0543	<0.0001	<0.0001	0.000105	0.00012
2016	Q4	Reference (FR_UFR1)	141	0.00823	0.0422	<0.0001	<0.0001	<0.0001	0.000123
2016	Q2	Reference (GH_ER2)	141	0.00315	0.142	<0.0001	<0.0001	0.000103	0.000193
2016	Q4	Reference (GH_ER2)	146	<0.003	0.00763	<0.0001	<0.0001	0.000103	0.000138
Tests that were not statistically different than re									
2015	Q2	CM_MC2	138	0.0122	0.578	0.000188	0.000156	0.000228	0.000492
2015	Q2	EV_MC2	104	0.00652	0.662	0.000136	0.000166	0.000176	0.000544
2015	Q4	EV_MC2	167	0.00683	0.0807	0.00026	0.00029	0.000158	0.000215
2015	Q2	FR_FRCP1	145	0.0030	0.0471	0.000216	0.000224	0.00010	0.000132
2015	Q2	GH_ERC	153	0.00322	0.209	0.00010	0.00010	0.000104	0.000242
2015	Q2	GH_FR1	156	0.0030	0.0505	0.000162	0.000172	0.000102	0.000154
2015	Q2	LC_LCDSSLCC	121	0.0030	0.041	0.000142	0.000155	0.000116	0.000159
2015	Q4	LC_LCDSSLCC	199	0.0030	0.0052	0.00028	0.00032	0.00010	0.00013
2016	Q4	EV_MC2	132	0.0121	0.104	0.000123	0.000133	0.000178	0.00024
Tests with significant results (2015)									
2015	Q2	EV_HC1	113	0.00308	0.0545	0.00010	0.000103	0.00013	0.000167
2015	Q4	CM_MC2	195	0.00306	0.0502	0.000154	0.000168	0.00017	0.000228
2015	Q4	EV_HC1	197	0.0032	0.0226	0.00010	0.000108	0.000148	0.000183
2015	Q4	FR_FRCP1	213	0.00316	0.00462	0.00025	0.000282	0.00010	0.000114
2015	Q4	GH_ERC	152	0.0031	0.00893	0.00010	0.00010	0.00010	0.000118
2015	Q4	GH_FR1	193	0.0030	0.00366	0.00012	0.00015	0.000102	0.00012
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	146	0.00678	0.365	0.000153	0.000168	0.000165	0.000295
2016	Q2	EV_HC1	176	0.00343	0.0743	<0.0001	0.00011	0.000145	0.00020
2016	Q4	EV_HC1	195	0.00363	0.0369	<0.0001	0.00010	0.000148	0.00018
2016	Q2	EV_MC2	100	0.014	0.405	0.000115	0.00016	0.00018	0.000368
2016	Q2	FR_FRCP1	154	<0.003	0.0699	0.000173	0.00022	<0.0001	0.000138
2016	Q4	FR_FRCP1	198	0.00375	0.0241	0.000188	0.000198	<0.0001	0.000135
2016	Q2	GH_ERC	145	0.0045	0.228	<0.0001	0.000103	0.00010	0.00025
2016	Q2	GH_FR1	166	<0.003	0.0577	0.000148	0.000183	0.000103	0.000143
2016	Q4	GH_FR1	192	<0.003	0.0105	0.000157	0.000238	0.000105	0.000138
2016	Q2	LC_LCDSSLCC	157	0.0026	0.0174	0.000225	0.000263	0.00012	0.000153
2016	Q4	LC_LCDSSLCC	184	<0.003	0.0303	0.00022	0.00027	<0.0001	0.000185
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	179	0.00553	0.0879	0.000135	0.000155	0.000173	0.000228
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	154	<0.003	0.0699	0.000173	0.00022	<0.0001	0.000138
2016	Q4	GH_ERC	151	<0.003	0.0129	<0.0001	<0.0001	<0.0001	0.000138

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	BARIUM-D-mg/l	BARIUM-T-mg/l	BERYLLIUM-D-mg/l	BERYLLIUM-T-mg/l	BISMUTH-D-mg/l	BISMUTH-T-mg/l	BORON-D-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	0.0431	0.0434	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q4	Reference (FR_UFR1)	0.0732	0.0741	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q2	Reference (GH_ER2)	0.0444	0.0457	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q4	Reference (GH_ER2)	0.0474	0.0484	0.00010	0.00010	0.000050	0.000050	0.010
2016	Q2	Reference (FR_UFR1)	0.0419	0.0431	<0.00004	<0.00004	<0.00005	<0.00005	<0.01
2016	Q4	Reference (FR_UFR1)	0.064	0.0632	<0.00002	<0.00002	<0.00005	<0.00005	<0.01
2016	Q2	Reference (GH_ER2)	0.0405	0.0418	<0.00004	<0.00004	<0.00005	<0.00005	<0.01
2016	Q4	Reference (GH_ER2)	0.0454	0.0453	<0.00002	<0.00002	<0.00005	<0.00005	<0.01
Tests that were not statistically different than re									
2015	Q2	CM_MC2	0.0426	0.049	0.00018	0.000138	0.00054	0.00054	0.0212
2015	Q2	EV_MC2	0.0635	0.0765	0.00010	0.000118	0.000050	0.000050	0.010
2015	Q4	EV_MC2	0.11	0.111	0.00010	0.00010	0.000050	0.000050	0.0125
2015	Q2	FR_FRCP1	0.063	0.064	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q2	GH_ERC	0.0491	0.051	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q2	GH_FR1	0.0852	0.0861	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q2	LC_LCDSSLCC	0.0348	0.0354	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q4	LC_LCDSSLCC	0.0831	0.0865	0.00010	0.00010	0.000050	0.000050	0.015
2016	Q4	EV_MC2	0.0791	0.0826	<0.00002	<0.00002	<0.00005	<0.00005	<0.01
Tests with significant results (2015)									
2015	Q2	EV_HC1	0.0268	0.0277	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q4	CM_MC2	0.0741	0.0743	0.00010	0.00010	0.000050	0.000050	0.0244
2015	Q4	EV_HC1	0.0632	0.0643	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q4	FR_FRCP1	0.0796	0.0802	0.00010	0.00010	0.000050	0.000050	0.0114
2015	Q4	GH_ERC	0.060	0.060	0.00010	0.00010	0.000050	0.000050	0.010
2015	Q4	GH_FR1	0.114	0.112	0.00010	0.00010	0.000050	0.000050	0.0104
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	0.045	0.0451	<0.00004	0.000044	<0.00005	<0.00005	0.0168
2016	Q2	EV_HC1	0.0408	0.042	<0.00004	<0.00004	<0.00005	<0.00005	<0.01
2016	Q4	EV_HC1	0.0566	0.0556	<0.00002	<0.00002	<0.00005	<0.00005	<0.01
2016	Q2	EV_MC2	0.057	0.0621	<0.00004	0.0000468	<0.00005	<0.00005	<0.01
2016	Q2	FR_FRCP1	0.0581	0.0594	<0.00004	<0.00004	<0.00005	0.0000513	<0.01
2016	Q4	FR_FRCP1	0.0752	0.0743	<0.00002	<0.00002	<0.00005	<0.00005	<0.01
2016	Q2	GH_ERC	0.048	0.0499	<0.00004	<0.00004	<0.00005	<0.00005	<0.01
2016	Q2	GH_FR1	0.0797	0.0799	<0.00004	<0.00004	<0.00005	<0.00005	<0.01
2016	Q4	GH_FR1	0.101	0.101	<0.00002	<0.00002	<0.00005	<0.00005	<0.01
2016	Q2	LC_LCDSSLCC	0.0386	0.0397	<0.00004	<0.00004	<0.00005	<0.00005	0.0103
2016	Q4	LC_LCDSSLCC	0.0607	0.0624	<0.00002	<0.00002	<0.00005	<0.00005	0.0103
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	0.0543	0.0563	<0.00002	<0.00002	<0.00005	<0.00005	0.0193
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	0.0581	0.0594	<0.00004	<0.00004	<0.00005	0.0000513	<0.01
2016	Q4	GH_ERC	0.0546	0.054	<0.00002	<0.00002	<0.00005	<0.00005	<0.01

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	BORON-T-mg/l	BROMIDE-D-mg/l	CADMIUM-D-mg/l	CADMIUM-T-mg/l	CALCIUM-D-mg/l	CALCIUM-T-mg/l	CARBON, DISSOLVED ORGANIC-D-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	0.010	0.050	0.0000066	0.00000986	37.7	37.7	1.89
2015	Q4	Reference (FR_UFR1)	0.010	0.050	0.00000652	0.00000854	54.7	56.0	0.546
2015	Q2	Reference (GH_ER2)	0.010	0.050	0.00000564	0.0000167	47.6	49.1	1.12
2015	Q4	Reference (GH_ER2)	0.010	0.050	0.00000508	0.00000735	50.8	51.9	0.675
2016	Q2	Reference (FR_UFR1)	<0.01	<0.05	0.00000595	0.0000121	37.4	38.1	1.71
2016	Q4	Reference (FR_UFR1)	<0.01	<0.05	0.0000064	0.00000915	47.5	47.0	1.19
2016	Q2	Reference (GH_ER2)	<0.01	<0.05	0.0000059	0.0000201	47.5	48.4	1.13
2016	Q4	Reference (GH_ER2)	<0.01	<0.05	0.00000546	0.00000766	47.2	48.0	0.635
Tests that were not statistically different than re									
2015	Q2	CM_MC2	0.0182	0.050	0.0000379	0.0000814	59.7	60.4	1.33
2015	Q2	EV_MC2	0.0102	0.050	0.0000236	0.000125	45.1	46.0	2.00
2015	Q4	EV_MC2	0.0133	0.100	0.000029	0.0000448	80.5	80.8	1.49
2015	Q2	FR_FRCP1	0.010	0.050	0.0000285	0.0000421	74.9	75.4	1.46
2015	Q2	GH_ERC	0.010	0.050	0.00000726	0.0000334	51.5	52.7	1.12
2015	Q2	GH_FR1	0.010	0.070	0.0000214	0.0000281	81.3	81.4	1.38
2015	Q2	LC_LCDSSLCC	0.0102	0.060	0.000108	0.000132	57.3	57.9	1.25
2015	Q4	LC_LCDSSLCC	0.016	0.25	0.000199	0.000235	119	125	0.67
2016	Q4	EV_MC2	0.010	<0.05	0.0000249	0.0000361	54.2	55.0	2.09
Tests with significant results (2015)									
2015	Q2	EV_HC1	0.0101	0.0567	0.0000136	0.0000201	46.7	46.9	1.07
2015	Q4	CM_MC2	0.0274	0.25	0.0000118	0.0000191	108	107	1.17
2015	Q4	EV_HC1	0.0103	0.20	0.0000154	0.0000218	92.9	93.0	1.28
2015	Q4	FR_FRCP1	0.0124	0.25	0.0000432	0.0000581	140	141	0.782
2015	Q4	GH_ERC	0.010	0.050	0.00000563	0.00000633	57.0	57.9	0.58
2015	Q4	GH_FR1	0.0122	0.25	0.0000167	0.0000187	106	107	0.656
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	0.0173	<0.05	0.0000639	0.000104	69.2	67.6	1.50
2016	Q2	EV_HC1	<0.01	<0.05	0.000020	0.0000306	70.2	71.2	1.34
2016	Q4	EV_HC1	<0.01	<0.2	0.0000156	0.0000202	81.9	82.2	1.20
2016	Q2	EV_MC2	<0.01	<0.05	0.0000284	0.000082	40.1	40.1	2.26
2016	Q2	FR_FRCP1	<0.01	<0.05	0.0000272	0.000045	74.4	75.3	1.47
2016	Q4	FR_FRCP1	<0.01	<0.25	0.0000421	0.0000506	108	106	1.04
2016	Q2	GH_ERC	<0.01	<0.05	0.00000823	0.0000289	51.9	52.7	1.10
2016	Q2	GH_FR1	<0.01	<0.05	0.0000216	0.0000316	79.5	78.9	1.44
2016	Q4	GH_FR1	<0.01	<0.25	0.0000162	0.0000198	97.6	99.6	0.845
2016	Q2	LC_LCDSSLCC	0.0113	<0.1	0.000197	0.000216	74.6	75.5	1.25
2016	Q4	LC_LCDSSLCC	0.0105	<0.25	0.000148	0.00016	95.5	94.9	0.803
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	0.0205	<0.1	0.0000266	0.0000351	83.6	84.9	1.63
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	<0.01	<0.05	0.0000272	0.000045	74.4	75.3	1.47
2016	Q4	GH_ERC	<0.01	<0.05	0.00000573	0.00000683	51.4	51.8	0.535

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	CHLORIDE-D-mg/l	CHROMIUM-D-mg/l	CHROMIUM-T-mg/l	COBALT-D-mg/l	COBALT-T-mg/l	CONDUCTIVITY, LAB-N-us/cm	COPPER-D-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	1.00	0.000118	0.00026	0.00010	0.00010	239	0.00050
2015	Q4	Reference (FR_UFR1)	1.02	0.00012	0.000184	0.00010	0.00010	356	0.00050
2015	Q2	Reference (GH_ER2)	1.16	0.00020	0.000754	0.00010	0.00010	297	0.00050
2015	Q4	Reference (GH_ER2)	1.10	0.000218	0.000303	0.00010	0.00010	314	0.00050
2016	Q2	Reference (FR_UFR1)	0.10	0.000128	0.000198	<0.0001	<0.0001	243	<0.0005
2016	Q4	Reference (FR_UFR1)	0.193	0.00011	0.000198	<0.0001	<0.0001	319	<0.0005
2016	Q2	Reference (GH_ER2)	0.573	0.000193	0.000493	<0.0001	0.00010	287	<0.0005
2016	Q4	Reference (GH_ER2)	0.369	0.000238	0.000258	<0.0001	<0.0001	297	<0.0005
Tests that were not statistically different than re									
2015	Q2	CM_MC2	1.40	0.000282	0.000912	0.00034	0.00082	466	0.00050
2015	Q2	EV_MC2	3.24	0.000182	0.0012	0.00010	0.000476	321	0.000608
2015	Q4	EV_MC2	5.58	0.00014	0.000273	0.00010	0.000105	588	0.00050
2015	Q2	FR_FRCP1	1.14	0.000104	0.000184	0.00010	0.000104	580	0.00050
2015	Q2	GH_ERC	1.32	0.000242	0.000692	0.00010	0.000144	323	0.00050
2015	Q2	GH_FR1	1.62	0.00012	0.000238	0.00010	0.00010	595	0.00050
2015	Q2	LC_LCDSSLCC	1.46	0.000123	0.000319	0.00010	0.00012	436	0.00050
2015	Q4	LC_LCDSSLCC	3.80	0.00014	0.00017	0.00010	0.00010	901	0.00050
2016	Q4	EV_MC2	3.45	0.00012	0.00029	<0.0001	0.000108	410	<0.0005
Tests with significant results (2015)									
2015	Q2	EV_HC1	1.32	0.000137	0.000227	0.00010	0.000105	364	0.00050
2015	Q4	CM_MC2	3.42	0.000158	0.00026	0.000506	0.000602	821	0.00050
2015	Q4	EV_HC1	1.88	0.00014	0.000275	0.00010	0.00010	750	0.00050
2015	Q4	FR_FRCP1	2.36	0.000124	0.000162	0.000102	0.000102	1100	0.00050
2015	Q4	GH_ERC	1.20	0.000228	0.000303	0.00010	0.00010	357	0.00050
2015	Q4	GH_FR1	2.00	0.000122	0.000174	0.00010	0.00010	783	0.00050
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	1.16	0.000173	0.000595	0.00209	0.00293	537	<0.0005
2016	Q2	EV_HC1	0.743	0.00012	0.000238	<0.0001	<0.0001	545	<0.0005
2016	Q4	EV_HC1	1.18	0.000145	0.000183	<0.0001	<0.0001	661	<0.0005
2016	Q2	EV_MC2	1.66	0.00013	0.00073	<0.0001	0.000308	286	0.00051
2016	Q2	FR_FRCP1	0.51	0.000105	0.000238	<0.0001	0.000103	569	<0.0005
2016	Q4	FR_FRCP1	1.43	<0.0001	0.000153	<0.0001	<0.0001	850	<0.0005
2016	Q2	GH_ERC	0.668	0.000215	0.000665	<0.0001	0.000135	327	<0.0005
2016	Q2	GH_FR1	0.963	0.00011	0.000218	<0.0001	<0.0001	598	<0.0005
2016	Q4	GH_FR1	1.61	0.000118	0.000157	<0.0001	<0.0001	758	<0.0005
2016	Q2	LC_LCDSSLCC	3.25	0.000153	0.000188	0.0000923	0.0000948	562	0.00044
2016	Q4	LC_LCDSSLCC	6.50	0.000115	0.000205	<0.0001	<0.0001	742	<0.0005
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	2.00	0.000158	0.000333	0.000763	0.00099	669	<0.0005
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	0.51	0.000105	0.000238	<0.0001	0.000103	569	<0.0005
2016	Q4	GH_ERC	0.453	0.000225	0.000298	<0.0001	<0.0001	324	<0.0005

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	COPPER-T-mg/l	FLUORIDE-D-mg/l	Hardness, Total or Dissolved CaCO3-N-mg/l	IRON-D-mg/l	IRON-T-mg/l	LEAD-D-mg/l	LEAD-T-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	0.00050	0.146	132	0.010	0.0402	0.000050	0.000050
2015	Q4	Reference (FR_UFR1)	0.00050	0.154	193	0.010	0.010	0.000050	0.000050
2015	Q2	Reference (GH_ER2)	0.000518	0.155	162	0.010	0.093	0.000050	0.0000716
2015	Q4	Reference (GH_ER2)	0.00050	0.163	173	0.010	0.0215	0.000050	0.000050
2016	Q2	Reference (FR_UFR1)	<0.0005	0.158	133	<0.01	0.043	<0.00005	0.0000525
2016	Q4	Reference (FR_UFR1)	<0.0005	0.161	171	<0.01	0.0193	<0.00005	<0.00005
2016	Q2	Reference (GH_ER2)	<0.0005	0.158	162	<0.01	0.172	<0.00005	0.000106
2016	Q4	Reference (GH_ER2)	<0.0005	0.169	163	<0.01	0.0116	<0.00005	<0.00005
Tests that were not statistically different than re									
2015	Q2	CM_MC2	0.00112	0.0974	245	0.0218	0.737	0.000090	0.00050
2015	Q2	EV_MC2	0.00145	0.118	170	0.0104	0.822	0.000050	0.000671
2015	Q4	EV_MC2	0.000555	0.154	320	0.0125	0.0825	0.000050	0.0000773
2015	Q2	FR_FRCP1	0.00050	0.20	315	0.010	0.066	0.000050	0.0000762
2015	Q2	GH_ERC	0.00070	0.153	177	0.010	0.261	0.0000508	0.00018
2015	Q2	GH_FR1	0.00050	0.171	335	0.010	0.071	0.000050	0.0000712
2015	Q2	LC_LCDSSLCC	0.000558	0.152	232	0.010	0.0484	0.000050	0.0000806
2015	Q4	LC_LCDSSLCC	0.00050	0.22	497	0.010	0.010	0.000050	0.000050
2016	Q4	EV_MC2	0.000538	0.131	211	0.0135	0.0805	<0.00005	0.0000775
Tests with significant results (2015)									
2015	Q2	EV_HC1	0.000515	0.13	206	0.010	0.0583	0.000050	0.0000699
2015	Q4	CM_MC2	0.000588	0.114	456	0.010	0.0532	0.000050	0.0000634
2015	Q4	EV_HC1	0.000528	0.201	434	0.010	0.0278	0.000050	0.000050
2015	Q4	FR_FRCP1	0.00050	0.176	650	0.010	0.0208	0.000050	0.000050
2015	Q4	GH_ERC	0.00052	0.158	195	0.010	0.0145	0.000050	0.000050
2015	Q4	GH_FR1	0.00050	0.164	445	0.010	0.0108	0.000050	0.000050
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	0.00070	0.104	282	<0.01	0.404	<0.00005	0.000239
2016	Q2	EV_HC1	<0.0005	0.19	311	<0.01	0.0718	<0.00005	0.000063
2016	Q4	EV_HC1	<0.0005	0.206	381	<0.01	0.0355	<0.00005	<0.00005
2016	Q2	EV_MC2	0.00098	0.117	152	0.0115	0.433	<0.00005	0.000334
2016	Q2	FR_FRCP1	0.00051	0.209	311	<0.01	0.0895	<0.00005	0.0000775
2016	Q4	FR_FRCP1	<0.0005	0.205	478	<0.01	0.034	<0.00005	<0.00005
2016	Q2	GH_ERC	0.000545	0.155	180	<0.01	0.276	<0.00005	0.000158
2016	Q2	GH_FR1	<0.0005	0.185	332	<0.01	0.0858	<0.00005	0.0000718
2016	Q4	GH_FR1	<0.0005	0.165	431	<0.01	0.0179	<0.00005	<0.00005
2016	Q2	LC_LCDSSLCC	0.000508	0.226	304	<0.01	0.0203	<0.000045	<0.000045
2016	Q4	LC_LCDSSLCC	<0.0005	0.245	395	<0.01	0.0288	<0.00005	0.000052
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	<0.0005	0.11	358	<0.01	0.0765	<0.00005	0.0000663
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	0.00051	0.209	311	<0.01	0.0895	<0.00005	0.0000775
2016	Q4	GH_ERC	0.00051	0.163	178	<0.01	0.0175	<0.00005	<0.00005

Notes:

"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening

Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	LITHIUM-D-mg/l	LITHIUM-T-mg/l	MAGNESIUM-D-mg/l	MAGNESIUM-T-mg/l	MAJOR ANION SUM-N-meq/l	MAJOR CATION SUM-N-meq/l	MANGANESE-D-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	0.0012	0.00122	9.27	9.36	2.66	2.68	0.00067
2015	Q4	Reference (FR_UFR1)	0.00136	0.0013	13.8	14.3	3.90	3.91	0.000156
2015	Q2	Reference (GH_ER2)	0.00162	0.00174	10.5	10.9	3.41	3.28	0.00295
2015	Q4	Reference (GH_ER2)	0.00163	0.00163	11.1	11.5	3.44	3.48	0.00225
2016	Q2	Reference (FR_UFR1)	0.00118	0.00133	9.63	9.97	2.60	2.69	0.00032
2016	Q4	Reference (FR_UFR1)	0.00133	0.00155	12.7	12.5	3.63	3.45	0.000168
2016	Q2	Reference (GH_ER2)	0.00155	0.0017	10.5	10.8	3.20	3.27	0.00138
2016	Q4	Reference (GH_ER2)	0.00185	0.0018	11.1	10.9	3.41	3.30	0.00114
Tests that were not statistically different than re									
2015	Q2	CM_MC2	0.00632	0.0068	23.4	23.7	5.11	5.04	0.00287
2015	Q2	EV_MC2	0.00662	0.0070	14.0	14.2	3.27	3.52	0.000728
2015	Q4	EV_MC2	0.0155	0.0153	29.0	29.1	6.46	6.60	0.00127
2015	Q2	FR_FRCP1	0.0196	0.0198	31.1	31.4	6.10	6.38	0.00305
2015	Q2	GH_ERC	0.0021	0.00232	11.7	12.0	3.59	3.59	0.000544
2015	Q2	GH_FR1	0.0146	0.0145	32.0	32.5	6.53	6.79	0.00104
2015	Q2	LC_LCDSSLCC	0.014	0.0122	21.6	21.8	5.70	5.83	0.000148
2015	Q4	LC_LCDSSLCC	0.0359	0.0361	48.5	51.7	10.3	10.3	0.00037
2016	Q4	EV_MC2	0.00918	0.00918	18.4	19.4	4.51	4.36	0.000618
Tests with significant results (2015)									
2015	Q2	EV_HC1	0.00423	0.00423	21.7	21.9	6.06	6.24	0.000635
2015	Q4	CM_MC2	0.0115	0.012	45.7	45.8	9.43	9.57	0.00394
2015	Q4	EV_HC1	0.00708	0.00723	49.1	49.5	8.59	8.78	0.00187
2015	Q4	FR_FRCP1	0.0404	0.0407	72.9	73.8	13.1	13.1	0.0076
2015	Q4	GH_ERC	0.00193	0.00193	12.7	13.1	3.90	3.94	0.000568
2015	Q4	GH_FR1	0.0156	0.0159	44.0	45.3	8.85	9.01	0.00116
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	0.00898	0.00925	26.5	26.4	5.89	5.93	0.0114
2016	Q2	EV_HC1	0.00603	0.0061	32.9	33.5	6.10	6.28	0.000463
2016	Q4	EV_HC1	0.00753	0.00753	42.8	42.5	7.80	7.70	0.00154
2016	Q2	EV_MC2	0.00568	0.00578	12.5	12.5	3.04	3.13	0.00039
2016	Q2	FR_FRCP1	0.0179	0.0185	30.4	31.1	6.19	6.29	0.00218
2016	Q4	FR_FRCP1	0.032	0.033	50.5	50.0	10.1	9.68	0.00681
2016	Q2	GH_ERC	0.0021	0.00235	12.1	12.4	3.54	3.64	0.000948
2016	Q2	GH_FR1	0.014	0.0141	32.4	32.6	6.56	6.73	0.00088
2016	Q4	GH_FR1	0.0175	0.0176	45.3	46.0	9.00	8.72	0.000958
2016	Q2	LC_LCDSSLCC	0.025	0.0259	28.7	28.5	6.18	6.27	0.00249
2016	Q4	LC_LCDSSLCC	0.0328	0.0324	38.1	39.0	8.61	8.15	0.00185
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	0.0108	0.0111	36.2	36.8	7.86	7.51	0.00727
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	0.0179	0.0185	30.4	31.1	6.19	6.29	0.00218
2016	Q4	GH_ERC	0.0026	0.00265	12.1	12.3	3.73	3.61	0.000353

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	MANGANESE-T-mg/l	MERCURY-D-mg/l	MERCURY-T-mg/l	MOLYBDENUM-D-mg/l	MOLYBDENUM-T-mg/l	NICKEL-D-mg/l	NICKEL-T-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	0.00216	0.0000050	0.0000050	0.000548	0.000588	0.00050	0.00050
2015	Q4	Reference (FR_UFR1)	0.000308	0.0000050	0.0000050	0.00061	0.000589	0.00050	0.00050
2015	Q2	Reference (GH_ER2)	0.00735	0.00000546	0.0000050	0.000949	0.000961	0.00050	0.00051
2015	Q4	Reference (GH_ER2)	0.00352	0.0000050	0.0000050	0.0010	0.00102	0.00050	0.00050
2016	Q2	Reference (FR_UFR1)	0.00156	<0.000005	0.000000948	0.000628	0.000647	<0.0005	<0.0005
2016	Q4	Reference (FR_UFR1)	0.000555	<0.000005	0.00000058	0.00057	0.000578	<0.0005	<0.0005
2016	Q2	Reference (GH_ER2)	0.0125	<0.000005	0.000000725	0.000945	0.00095	<0.0005	0.000528
2016	Q4	Reference (GH_ER2)	0.0019	<0.000005	<0.000001625	0.000981	0.00101	<0.0005	<0.0005
Tests that were not statistically different than re									
2015	Q2	CM_MC2	0.0253	0.0000060	0.00000762	0.000782	0.000948	0.0062	0.00798
2015	Q2	EV_MC2	0.0241	0.0000050	0.0000050	0.000782	0.000874	0.0012	0.00292
2015	Q4	EV_MC2	0.00302			0.00162	0.00165	0.00294	0.00312
2015	Q2	FR_FRCP1	0.00833	0.0000050	0.0000050	0.0013	0.00132	0.0021	0.00235
2015	Q2	GH_ERC	0.0144	0.0000050	0.0000050	0.000961	0.000938	0.00050	0.000688
2015	Q2	GH_FR1	0.00452	0.0000050	0.0000050	0.00103	0.00104	0.00179	0.00198
2015	Q2	LC_LCDSSLCC	0.00226	0.0000050	0.0000050	0.000952	0.000956	0.00288	0.00319
2015	Q4	LC_LCDSSLCC	0.00050	0.0000050	0.0000050	0.00181	0.00187	0.0066	0.00686
2016	Q4	EV_MC2	0.00256	0.00000101	0.00000151	0.000787	0.000825	0.00127	0.00156
Tests with significant results (2015)									
2015	Q2	EV_HC1	0.00206	0.0000050	0.0000050	0.000512	0.000522	0.000729	0.000854
2015	Q4	CM_MC2	0.00647	0.0000050	0.0000051	0.00108	0.00111	0.00867	0.00897
2015	Q4	EV_HC1	0.00236			0.00100	0.00105	0.000755	0.000788
2015	Q4	FR_FRCP1	0.00889	0.0000050	0.0000050	0.00146	0.00147	0.00704	0.0072
2015	Q4	GH_ERC	0.00143	0.0000050	0.0000050	0.000997	0.00104	0.00050	0.00050
2015	Q4	GH_FR1	0.00156	0.0000050	0.0000050	0.000941	0.000983	0.00148	0.00147
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	0.0248	<0.000005	0.0000010	0.000866	0.000881	0.0149	0.0169
2016	Q2	EV_HC1	0.00266	0.000000535	0.000000673	0.000758	0.00078	0.000863	0.00101
2016	Q4	EV_HC1	0.00248	<0.0000005	0.000000618	0.000912	0.000933	0.000753	0.00082
2016	Q2	EV_MC2	0.0122	0.00000125	0.00000242	0.000729	0.000742	0.00172	0.00262
2016	Q2	FR_FRCP1	0.0076	<0.000005	0.000000908	0.0011	0.00113	0.00193	0.00235
2016	Q4	FR_FRCP1	0.00868	<0.000005	<0.0000005	0.00131	0.00134	0.00494	0.00523
2016	Q2	GH_ERC	0.0172	<0.000005	0.00000117	0.000956	0.000938	<0.0005	0.000585
2016	Q2	GH_FR1	0.00433	<0.000005	0.00000108	0.000989	0.000985	0.00162	0.00174
2016	Q4	GH_FR1	0.00172	<0.000005	<0.000001625	0.00106	0.00111	0.00243	0.0025
2016	Q2	LC_LCDSSLCC	0.00372	<0.000005	0.000000563	0.00138	0.00143	0.00461	0.00489
2016	Q4	LC_LCDSSLCC	0.00332	<0.000005	0.000000535	0.00155	0.00161	0.0044	0.00454
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	0.0112	<0.000005	0.000000783	0.000893	0.000926	0.00983	0.0105
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	0.0076	<0.000005	0.000000908	0.0011	0.00113	0.00193	0.00235
2016	Q4	GH_ERC	0.00156	<0.000005	<0.000001625	0.00101	0.00103	<0.0005	0.00059

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	NITRATE NITROGEN (NO3), AS N-N-mg/l	NITRITE NITROGEN (NO2), AS N-N-mg/l	NITROGEN, AMMONIA (AS N)-N-mg/l	ORTHO-PHOSPHATE-N-mg/l	OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	pH, LAB-N-ph units	PHOSPHORUS-N-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	0.0378	0.0010	0.0050	0.00346	361	8.35	0.00774
2015	Q4	Reference (FR_UFR1)	0.0743	0.0010	0.0050	0.00152	377	8.40	0.00236
2015	Q2	Reference (GH_ER2)	0.0823	0.0010	0.0068	0.00108	330	8.34	0.00902
2015	Q4	Reference (GH_ER2)	0.0812	0.0010	0.0050	0.0012	386	8.32	0.00303
2016	Q2	Reference (FR_UFR1)	0.0183	<0.001	<0.005	0.0025	292	8.34	0.00473
2016	Q4	Reference (FR_UFR1)	0.097	<0.001	<0.005	0.00235	322	8.28	0.00453
2016	Q2	Reference (GH_ER2)	0.0892	<0.001	<0.005	0.00108	339	8.29	0.0128
2016	Q4	Reference (GH_ER2)	0.0749	<0.001	0.00563	0.00115	352	8.26	0.00231
Tests that were not statistically different than re									
2015	Q2	CM_MC2	1.13	0.0047	0.00642	0.00158	357	8.34	0.0523
2015	Q2	EV_MC2	1.13	0.00128	0.00596	0.00288	380	8.29	0.0805
2015	Q4	EV_MC2	3.75	0.00233	0.0054	0.0052	376	8.24	0.00875
2015	Q2	FR_FRCP1	7.85	0.00524	0.0124	0.00134	372	8.41	0.00972
2015	Q2	GH_ERC	0.263	0.0010	0.0052	0.0010	433	8.36	0.0255
2015	Q2	GH_FR1	7.82	0.00336	0.00532	0.0010	433	8.39	0.00844
2015	Q2	LC_LCDSSLCC	4.76	0.00148	0.0050	0.00143	414	7.97	0.00884
2015	Q4	LC_LCDSSLCC	14.5	0.0050	0.0050	0.0010	341	8.34	0.0020
2016	Q4	EV_MC2	1.77	0.00105	<0.005	0.00648	288	8.19	0.0113
Tests with significant results (2015)									
2015	Q2	EV_HC1	0.56	0.00113	0.00639	0.00296	423	7.69	0.0082
2015	Q4	CM_MC2	2.39	0.0339	0.0163	0.00124	373	8.35	0.00814
2015	Q4	EV_HC1	1.17	0.0040	0.0050	0.00573	373	8.38	0.00688
2015	Q4	FR_FRCP1	16.3	0.00528	0.0050	0.0010	379	8.33	0.0020
2015	Q4	GH_ERC	0.494	0.0010	0.0050	0.0012	391	8.27	0.00345
2015	Q4	GH_FR1	10.4	0.0050	0.0050	0.00108	354	8.36	0.00218
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	1.98	0.00875	0.024	0.00225	307	8.29	0.0202
2016	Q2	EV_HC1	0.764	<0.001	<0.005	0.00478	330	8.39	0.0084
2016	Q4	EV_HC1	1.00	<0.004	<0.005	0.0045	318	8.35	0.00643
2016	Q2	EV_MC2	1.01	0.0012	<0.005	0.0106	339	8.20	0.0421
2016	Q2	FR_FRCP1	8.41	0.0027	0.0059	0.00165	331	8.34	0.00938
2016	Q4	FR_FRCP1	12.0	<0.005	<0.005	<0.001	330	8.34	0.00313
2016	Q2	GH_ERC	0.314	<0.001	<0.005	0.00105	356	8.29	0.0208
2016	Q2	GH_FR1	7.62	0.0027	0.00503	0.00125	318	8.35	0.00958
2016	Q4	GH_FR1	9.52	<0.005	0.00538	0.00113	353	8.27	0.0114
2016	Q2	LC_LCDSSLCC	6.28	0.00203	<0.005	0.00103	347	8.27	0.0027
2016	Q4	LC_LCDSSLCC	9.92	<0.005	<0.005	0.00145	330	8.30	0.0049
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	2.22	0.00795	0.00565	0.00133	296	8.30	0.0053
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	8.41	0.0027	0.0059	0.00165	331	8.34	0.00938
2016	Q4	GH_ERC	0.293	<0.001	<0.005	0.00118	372	8.22	0.00298

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	POTASSIUM-D-mg/l	POTASSIUM-T-mg/l	SELENIUM-D-ug/l	SELENIUM-T-ug/l	SILICON-D-mg/l	SILICON-T-mg/l	SILVER-D-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	0.343	0.362	0.462	0.503	1.72	1.83	0.000010
2015	Q4	Reference (FR_UFR1)	0.387	0.39	0.654	0.668	1.50	1.55	0.000010
2015	Q2	Reference (GH_ER2)	0.351	0.371	0.746	0.793	1.67	1.89	0.000010
2015	Q4	Reference (GH_ER2)	0.346	0.356	0.794	0.845	1.74	1.82	0.000010
2016	Q2	Reference (FR_UFR1)	0.325	0.345	0.513	0.552	1.76	1.89	<0.00001
2016	Q4	Reference (FR_UFR1)	0.363	0.369	0.664	0.655	1.73	1.87	<0.00001
2016	Q2	Reference (GH_ER2)	0.343	0.408	0.749	0.768	1.71	1.99	<0.00001
2016	Q4	Reference (GH_ER2)	0.351	0.373	0.852	0.885	1.69	1.76	<0.00001
Tests that were not statistically different than re									
2015	Q2	CM_MC2	0.846	1.05	3.99	3.97	1.86	2.84	0.000018
2015	Q2	EV_MC2	0.627	0.822	6.35	6.34	1.69	2.79	0.000010
2015	Q4	EV_MC2	1.06	1.07	15.7	16.2	2.37	2.52	0.000010
2015	Q2	FR_FRCP1	1.22	1.22	32.7	31.9	1.53	1.62	0.000010
2015	Q2	GH_ERC	0.375	0.445	1.47	1.52	1.73	2.09	0.000010
2015	Q2	GH_FR1	1.04	1.07	31.1	31.6	1.79	1.88	0.000010
2015	Q2	LC_LCDSSLCC	0.662	0.675	22.3	21.6	1.49	1.56	0.000010
2015	Q4	LC_LCDSSLCC	1.44	1.48	50.0	53.6	2.15	2.29	0.000010
2016	Q4	EV_MC2	0.705	0.788	7.74	8.06	2.09	2.34	<0.00001
Tests with significant results (2015)									
2015	Q2	EV_HC1	0.536	0.561	18.7	19.0	1.19	1.28	0.000010
2015	Q4	CM_MC2	1.40	1.38	5.23	5.22	2.15	2.24	0.000010
2015	Q4	EV_HC1	0.947	0.967	36.0	37.2	2.09	2.16	0.000010
2015	Q4	FR_FRCP1	1.92	2.01	91.4	91.0	1.75	1.78	0.000010
2015	Q4	GH_ERC	0.401	0.399	1.59	1.65	1.85	1.92	0.000010
2015	Q4	GH_FR1	1.18	1.22	41.9	42.4	2.18	2.24	0.000010
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	1.03	1.14	4.58	4.47	1.98	2.58	<0.00001
2016	Q2	EV_HC1	0.798	0.851	30.1	29.7	1.82	1.96	<0.00001
2016	Q4	EV_HC1	0.914	0.926	32.7	32.3	2.02	2.19	<0.00001
2016	Q2	EV_MC2	0.557	0.677	4.24	4.10	1.92	2.59	<0.00001
2016	Q2	FR_FRCP1	1.13	1.15	30.5	31.0	1.58	1.72	<0.00001
2016	Q4	FR_FRCP1	1.58	1.58	59.1	57.6	1.72	1.84	<0.00001
2016	Q2	GH_ERC	0.372	0.474	1.60	1.56	1.76	2.18	<0.00001
2016	Q2	GH_FR1	1.05	1.06	28.8	29.5	1.85	1.92	<0.00001
2016	Q4	GH_FR1	1.27	1.32	43.4	42.2	2.09	2.15	<0.00001
2016	Q2	LC_LCDSSLCC	0.966	1.01	20.9	21.4	1.87	1.94	<0.00001
2016	Q4	LC_LCDSSLCC	1.18	1.23	28.1	27.7	2.05	2.19	<0.00001
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	1.28	1.31	5.67	5.78	2.13	2.35	<0.00001
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	1.13	1.15	30.5	31.0	1.58	1.72	<0.00001
2016	Q4	GH_ERC	0.388	0.41	1.36	1.41	1.78	1.86	<0.00001

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	SILVER-T-mg/l	SODIUM-D-mg/l	SODIUM-T-mg/l	STRONTIUM-D-mg/l	STRONTIUM-T-mg/l	SULFATE (AS SO4)-D-mg/l	THALLIUM-D-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	0.000010	0.576	0.583	0.0637	0.0658	14.4	0.000010
2015	Q4	Reference (FR_UFR1)	0.000010	0.681	0.681	0.0916	0.0907	46.8	0.000010
2015	Q2	Reference (GH_ER2)	0.000010	0.741	0.738	0.203	0.212	17.0	0.000010
2015	Q4	Reference (GH_ER2)	0.000010	0.651	0.672	0.211	0.218	22.0	0.000010
2016	Q2	Reference (FR_UFR1)	<0.00001	0.618	0.635	0.0652	0.0673	14.9	<0.00001
2016	Q4	Reference (FR_UFR1)	<0.00001	0.676	0.68	0.089	0.0894	38.3	<0.00001
2016	Q2	Reference (GH_ER2)	<0.00001	0.722	0.718	0.202	0.205	16.8	<0.00001
2016	Q4	Reference (GH_ER2)	<0.00001	0.689	0.694	0.23	0.235	23.0	<0.00001
Tests that were not statistically different than re									
2015	Q2	CM_MC2	0.000020	4.05	4.12	0.161	0.166	107	0.0000182
2015	Q2	EV_MC2	0.0000246	2.34	2.21	0.103	0.105	49.1	0.0000114
2015	Q4	EV_MC2	0.000010	3.91	3.89	0.188	0.187	129	0.000010
2015	Q2	FR_FRCP1	0.000010	1.20	1.21	0.103	0.106	125	0.000010
2015	Q2	GH_ERC	0.0000114	0.949	0.941	0.203	0.201	22.8	0.000010
2015	Q2	GH_FR1	0.000010	1.62	1.64	0.114	0.115	134	0.000010
2015	Q2	LC_LCDSSLCC	0.000010	2.40	2.40	0.108	0.109	89.6	0.0000105
2015	Q4	LC_LCDSSLCC	0.000010	7.03	7.22	0.215	0.22	248	0.000010
2016	Q4	EV_MC2	<0.00001	2.84	3.04	0.131	0.134	79.1	<0.00001
Tests with significant results (2015)									
2015	Q2	EV_HC1	0.000010	0.844	0.857	0.0636	0.0643	82.3	0.000010
2015	Q4	CM_MC2	0.000010	9.50	9.49	0.288	0.295	252	0.0000108
2015	Q4	EV_HC1	0.000010	1.87	1.89	0.133	0.136	217	0.000010
2015	Q4	FR_FRCP1	0.000010	2.00	2.06	0.165	0.167	364	0.0000102
2015	Q4	GH_ERC	0.000010	0.924	0.93	0.222	0.227	38.9	0.000010
2015	Q4	GH_FR1	0.000010	2.04	2.11	0.147	0.151	202	0.000010
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	<0.00001	6.20	5.98	0.195	0.192	134	0.000012
2016	Q2	EV_HC1	<0.00001	1.23	1.28	0.0965	0.0986	120	<0.00001
2016	Q4	EV_HC1	<0.00001	1.68	1.68	0.126	0.128	182	<0.00001
2016	Q2	EV_MC2	0.0000148	1.83	1.76	0.0907	0.0916	43.8	<0.00001
2016	Q2	FR_FRCP1	<0.00001	1.04	1.09	0.0988	0.101	119	<0.00001
2016	Q4	FR_FRCP1	<0.00001	1.54	1.56	0.145	0.146	253	0.0000108
2016	Q2	GH_ERC	<0.00001	0.895	0.891	0.209	0.202	29.3	<0.00001
2016	Q2	GH_FR1	<0.00001	1.48	1.48	0.111	0.112	128	<0.00001
2016	Q4	GH_FR1	<0.00001	1.99	2.10	0.145	0.148	212	<0.00001
2016	Q2	LC_LCDSSLCC	<0.00001	3.74	3.89	0.133	0.138	120	0.000010
2016	Q4	LC_LCDSSLCC	<0.00001	5.18	5.33	0.186	0.187	194	0.000010
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	<0.00001	7.51	7.68	0.235	0.24	195	0.000011
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	<0.00001	1.04	1.09	0.0988	0.101	119	<0.00001
2016	Q4	GH_ERC	<0.00001	0.844	0.877	0.233	0.235	32.3	<0.00001

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	THALLIUM-T-mg/l	TIN-D-mg/l	TIN-T-mg/l	TITANIUM-D-mg/l	TITANIUM-T-mg/l	TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	TOTAL KJELDAHL NITROGEN-N-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	0.000010	0.00010	0.00010	0.010	0.010	143	0.092
2015	Q4	Reference (FR_UFR1)	0.000010	0.00010	0.00010	0.010	0.010	217	0.0652
2015	Q2	Reference (GH_ER2)	0.0000104	0.00010	0.00010	0.010	0.010	181	0.0864
2015	Q4	Reference (GH_ER2)	0.000010	0.00010	0.00010	0.010	0.010	176	0.050
2016	Q2	Reference (FR_UFR1)	<0.00001	<0.0001	<0.0001	<0.01	<0.01	147	0.0768
2016	Q4	Reference (FR_UFR1)	<0.00001	<0.0001	<0.0001	<0.01	<0.01	197	0.0645
2016	Q2	Reference (GH_ER2)	<0.00001	<0.0001	<0.0001	<0.01	0.0103	180	0.0745
2016	Q4	Reference (GH_ER2)	<0.00001	<0.0001	<0.0001	<0.01	<0.01	181	0.0551
Tests that were not statistically different than re									
2015	Q2	CM_MC2	0.0000374	0.00010	0.00013	0.010	0.0162	316	0.157
2015	Q2	EV_MC2	0.0000356	0.00010	0.00010	0.010	0.0168	208	0.287
2015	Q4	EV_MC2	0.0000108	0.00010	0.00010	0.010	0.0103	387	0.172
2015	Q2	FR_FRCP1	0.000010	0.00010	0.00010	0.010	0.010	382	0.050
2015	Q2	GH_ERC	0.0000138	0.00010	0.00010	0.010	0.0104	192	0.122
2015	Q2	GH_FR1	0.000010	0.00010	0.00010	0.010	0.010	399	0.0682
2015	Q2	LC_LCDSSLCC	0.0000115	0.00010	0.00010	0.010	0.010	280	0.0748
2015	Q4	LC_LCDSSLCC	0.000010	0.00010	0.00010	0.010	0.010	651	0.133
2016	Q4	EV_MC2	0.0000118	<0.0001	<0.0001	<0.01	<0.01	261	0.171
Tests with significant results (2015)									
2015	Q2	EV_HC1	0.0000116	0.00010	0.00010	0.010	0.010	241	0.106
2015	Q4	CM_MC2	0.000012	0.00010	0.00010	0.0108	0.0116	571	0.138
2015	Q4	EV_HC1	0.000010	0.00010	0.00010	0.0103	0.0105	519	0.10
2015	Q4	FR_FRCP1	0.0000104	0.00010	0.00010	0.0106	0.0106	836	0.101
2015	Q4	GH_ERC	0.000010	0.00010	0.00010	0.010	0.010	211	0.051
2015	Q4	GH_FR1	0.000010	0.00010	0.00010	0.0104	0.0106	545	0.108
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	0.0000223	<0.0001	<0.0001	0.0115	0.0165	366	0.197
2016	Q2	EV_HC1	0.0000115	<0.0001	<0.0001	0.011	0.012	351	0.111
2016	Q4	EV_HC1	0.000010	<0.0001	<0.0001	<0.01	<0.01	478	0.109
2016	Q2	EV_MC2	0.0000215	<0.0001	<0.0001	<0.01	0.0143	173	0.183
2016	Q2	FR_FRCP1	0.0000113	<0.0001	<0.0001	0.0108	0.011	377	0.164
2016	Q4	FR_FRCP1	<0.00001	<0.0001	<0.0001	<0.01	<0.01	626	0.0733
2016	Q2	GH_ERC	0.000012	<0.0001	<0.0001	<0.01	0.0105	189	0.118
2016	Q2	GH_FR1	<0.00001	<0.0001	<0.0001	0.0105	0.011	394	0.173
2016	Q4	GH_FR1	<0.00001	<0.0001	<0.0001	<0.01	<0.01	553	0.213
2016	Q2	LC_LCDSSLCC	0.0000103	<0.0000875	<0.0000875	0.0080	0.00825	362	0.173
2016	Q4	LC_LCDSSLCC	0.0000118	<0.0001	<0.0001	<0.01	<0.01	525	0.111
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	0.0000153	<0.0001	<0.0001	<0.01	<0.01	482	0.129
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	0.0000113	<0.0001	<0.0001	0.0108	0.011	377	0.164
2016	Q4	GH_ERC	<0.00001	<0.0001	<0.0001	<0.01	<0.01	202	<0.05

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	TOTAL ORGANIC CARBON-T-mg/l	TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	TURBIDITY, LAB-N-ntu	URANIUM-D-mg/l	URANIUM-T-mg/l	VANADIUM-D-mg/l	VANADIUM-T-mg/l
Reference									
2015	Q2	Reference (FR_UFR1)	2.03	1.94	1.43	0.000314	0.000318	0.00050	0.00050
2015	Q4	Reference (FR_UFR1)	0.604	1.00	0.22	0.000448	0.000454	0.00050	0.00050
2015	Q2	Reference (GH_ER2)	1.39	5.94	4.05	0.000772	0.00079	0.00050	0.000614
2015	Q4	Reference (GH_ER2)	0.615	1.28	0.365	0.000743	0.000754	0.00050	0.00050
2016	Q2	Reference (FR_UFR1)	2.00	1.53	0.815	0.000323	0.000328	<0.0005	0.000503
2016	Q4	Reference (FR_UFR1)	1.32	<1	0.693	0.000431	0.000446	<0.0005	0.00050
2016	Q2	Reference (GH_ER2)	1.57	10.1	2.78	0.000752	0.000771	<0.0005	0.000785
2016	Q4	Reference (GH_ER2)	0.665	<1	0.364	0.000766	0.000776	<0.0005	<0.0005
Tests that were not statistically different than re									
2015	Q2	CM_MC2	1.94	28.9	14.6	0.0011	0.00114	0.0014	0.00231
2015	Q2	EV_MC2	3.61	57.1	15.0	0.000621	0.000668	0.00050	0.00294
2015	Q4	EV_MC2	1.61	3.08	2.55	0.0014	0.00142	0.00050	0.00071
2015	Q2	FR_FRCP1	1.83	5.22	1.37	0.00162	0.00168	0.00050	0.000508
2015	Q2	GH_ERC	1.70	17.2	6.88	0.000802	0.000811	0.00050	0.00107
2015	Q2	GH_FR1	1.57	4.14	1.80	0.00158	0.00159	0.00050	0.000544
2015	Q2	LC_LCDSSLCC	1.26	5.29	1.73	0.00163	0.00166	0.00050	0.000561
2015	Q4	LC_LCDSSLCC	0.77	1.00	0.45	0.00402	0.00417	0.00050	0.00050
2016	Q4	EV_MC2	2.38	3.58	2.89	0.000829	0.000837	<0.0005	0.000758
Tests with significant results (2015)									
2015	Q2	EV_HC1	1.32	2.22	1.31	0.00127	0.00129	0.00050	0.000581
2015	Q4	CM_MC2	1.40	4.08	2.00	0.00235	0.00233	0.00050	0.000528
2015	Q4	EV_HC1	1.23	1.05	0.693	0.00272	0.00276	0.00050	0.000518
2015	Q4	FR_FRCP1	0.878	1.06	0.366	0.00423	0.00425	0.00050	0.000504
2015	Q4	GH_ERC	0.58	3.18	0.498	0.000819	0.000835	0.00050	0.00050
2015	Q4	GH_FR1	0.704	1.00	0.27	0.00202	0.00213	0.00050	0.00050
Tests with significant results for survival and vi									
2016	Q2	CM_MC2	1.81	13.5	6.60	0.00138	0.00136	<0.0005	0.000878
2016	Q2	EV_HC1	1.73	3.05	1.71	0.00194	0.00199	<0.0005	0.000568
2016	Q4	EV_HC1	1.38	1.35	1.24	0.00256	0.00259	<0.0005	<0.0005
2016	Q2	EV_MC2	3.04	22.7	8.25	0.000581	0.000597	<0.0005	0.00177
2016	Q2	FR_FRCP1	1.96	5.98	0.978	0.00168	0.00174	<0.0005	0.000528
2016	Q4	FR_FRCP1	1.42	1.38	1.16	0.00309	0.00316	<0.0005	<0.0005
2016	Q2	GH_ERC	1.59	16.3	3.37	0.00083	0.000816	<0.0005	0.00105
2016	Q2	GH_FR1	1.78	4.43	1.38	0.00163	0.00161	<0.0005	0.000525
2016	Q4	GH_FR1	1.81	2.20	0.788	0.00231	0.00233	<0.0005	<0.0005
2016	Q2	LC_LCDSSLCC	1.55	1.13	0.55	0.00225	0.00232	<0.0005	<0.0005
2016	Q4	LC_LCDSSLCC	0.89	1.28	1.09	0.00327	0.00329	<0.0005	0.000563
Tests with significant results for viability (2016)									
2016	Q4	CM_MC2	1.88	4.20	2.23	0.0018	0.00185	<0.0005	<0.0005
Tests with significant results for length (2016)									
2016	Q2	FR_FRCP1	1.96	5.98	0.978	0.00168	0.00174	<0.0005	0.000528
2016	Q4	GH_ERC	0.688	1.68	0.548	0.000838	0.000837	<0.0005	<0.0005

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-4: *O. mykiss* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	ZINC-D-mg/l	ZINC-T-mg/l	PCA_Factor1 (2015 and 2016 datasets)	PCA-Factor1 (2016 dataset)
Reference						
2015	Q2	Reference (FR_UFR1)	0.0030	0.0030	-1.58	
2015	Q4	Reference (FR_UFR1)	0.0030	0.0030	-0.98	
2015	Q2	Reference (GH_ER2)	0.0030	0.0030	-1.05	
2015	Q4	Reference (GH_ER2)	0.0030	0.0030	-0.97	
2016	Q2	Reference (FR_UFR1)	<0.003	<0.003	-1.60	-1.59
2016	Q4	Reference (FR_UFR1)	<0.003	<0.00375	-1.19	-1.16
2016	Q2	Reference (GH_ER2)	<0.003	<0.003	-1.14	-1.11
2016	Q4	Reference (GH_ER2)	0.00336	0.00348	-0.99	-1.02
Tests that were not statistically different than re						
2015	Q2	CM_MC2	0.00582	0.0103	-0.01	
2015	Q2	EV_MC2	0.0030	0.00872	-0.77	
2015	Q4	EV_MC2	0.0030	0.0030	0.78	
2015	Q2	FR_FRCP1	0.0030	0.00304	0.50	
2015	Q2	GH_ERC	0.0030	0.00382	-0.95	
2015	Q2	GH_FR1	0.0030	0.0030	0.46	
2015	Q2	LC_LCDSSLCC	0.00517	0.00702	-0.03	
2015	Q4	LC_LCDSSLCC	0.0085	0.0092	1.85	
2016	Q4	EV_MC2	<0.003	<0.003	-0.24	-0.28
Tests with significant results (2015)						
2015	Q2	EV_HC1	0.0030	0.00307	-0.78	
2015	Q4	CM_MC2	0.0030	0.0030	1.32	
2015	Q4	EV_HC1	0.0030	0.0030	0.66	
2015	Q4	FR_FRCP1	0.0030	0.0030	1.79	
2015	Q4	GH_ERC	0.0030	0.0030	-0.73	
2015	Q4	GH_FR1	0.0030	0.0030	1.01	
Tests with significant results for survival and vi						
2016	Q2	CM_MC2	0.00593	0.0107	0.52	0.58
2016	Q2	EV_HC1	<0.003	<0.003	0.00	0.06
2016	Q4	EV_HC1	<0.003	<0.003	0.49	0.56
2016	Q2	EV_MC2	<0.003	0.00463	-0.95	-1.02
2016	Q2	FR_FRCP1	<0.003	0.00308	0.40	0.45
2016	Q4	FR_FRCP1	<0.003	<0.0045	1.30	1.38
2016	Q2	GH_ERC	<0.003	0.0032	-0.94	-0.93
2016	Q2	GH_FR1	<0.003	<0.003	0.44	0.47
2016	Q4	GH_FR1	<0.003	<0.003	1.04	1.04
2016	Q2	LC_LCDSSLCC	0.00875	0.00973	0.93	1.09
2016	Q4	LC_LCDSSLCC	0.00603	0.00795	1.37	1.43
Tests with significant results for viability (2016)						
2016	Q4	CM_MC2	0.00315	0.00395	0.87	0.92
Tests with significant results for length (2016)						
2016	Q2	FR_FRCP1	<0.003	0.00308	0.40	0.45
2016	Q4	GH_ERC	<0.003	<0.003	-0.83	-0.87

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % = percent.

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-5: *P. prometas* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	Mean Hatch (%)	Mean Survival (%)	Mean Normal Development (%)	Mean Biomass (Control Normalized)	Mean Length (Control Normalized)	ACIDITY TO pH 8.3 (As CaCO3)-N-mg/l	ALKALINITY, BICARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, CARBONATE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, HYDROXIDE (As CaCO3), lab measured.-N-mg/l	ALKALINITY, TOTAL (As CaCO3), lab measured.-N-mg/l	ALUMINUM-D-mg/l	ALUMINUM-T-mg/l	ANTIMONY-D-mg/l	ANTIMONY-T-mg/l	ARSENIC-D-mg/l	ARSENIC-T-mg/l
Reference																		
2016	Q3	Reference (FR_UFR1)	98.3	83.3	100	100	102	<1	154	3.40	<1	156	<0.003	0.0063	<0.0001	<0.0001	<0.0001	0.000108
2016	Q4	Reference (FR_UFR1)	100	53.3	100	57.5	97.4	<1	139	2.24	<1	141	0.00728	0.0377	<0.0001	<0.0001	<0.0001	0.000118
2016	Q2	Reference (FR_UFR1)	100	93.3	98.2	95.5	94.8	<1	116	<1	<1	116	0.0056	0.0592	<0.0001	<0.0001	0.000104	0.000124
Tests that were not statistically different than reference																		
2016	Q2	CM_MC2	100	96.7	100	100	96.9	1.02	142	3.00	<1	144	0.00624	0.335	0.000152	0.000162	0.000166	0.000284
2016	Q4	CM_MC2	100	96.7	100	91.8	103	<1	173	1.72	<1	174	0.0065	0.104	0.000208	0.000224	0.000238	0.000282
2016	Q2	FR_FRCP1	98.3	93.3	100	86.4	95.9	<1	153	2.96	<1	155	<0.003	0.0643	0.000174	0.00022	<0.0001	0.000134
2016	Q3	FR_FRCP1	96.7	80.0	100	111	105	1.50	o	3.28	<1	201	<0.003	0.0151	0.00021	0.000238	<0.0001	0.000114
2016	Q4	FR_FRCP1	96.7	80.0	100	94.5	103	<1	192	5.28	<1	197	0.0036	0.0227	0.000186	0.000196	<0.0001	0.000128
2016	Q2	GH_FR1	96.7	90.0	100	90.9	99.0	<1	165	3.56	<1	168	<0.003	0.0652	0.000156	0.000194	0.000104	0.000148
2016	Q3	GH_FR1	98.3	88.3	100	88.9	101	<1	195	4.32	<1	199	<0.003	0.00722	0.000127	0.000149	0.000103	0.000129
2016	Q4	GH_FR1	98.3	81.7	100	91.8	101	1.17	193	1.76	<1	194	<0.003	0.010	0.000159	0.00022	0.000104	0.000136
Tests with significant results																		
2016	Q3	CM_MC2	86.7	63.3	100	88.9	106	1.02	197	4.04	<1	200	0.00342	0.0118	0.000256	0.000286	0.000248	0.000256

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % =

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-5: *P. prometas* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	BARIUM-D-mg/l	BARIUM-T-mg/l	BERYLLIUM-D-mg/l	BERYLLIUM-T-mg/l	BISMUTH-D-mg/l	BISMUTH-T-mg/l	BORON-D-mg/l	BORON-T-mg/l	BROMIDE-D-mg/l	CADMIUM-D-mg/l	CADMIUM-T-mg/l	CALCIUM-D-mg/l	CALCIUM-T-mg/l	CARBON, DISSOLVED ORGANIC-D-mg/l	CHLORIDE-D-mg/l	CHROMIUM-D-mg/l	CHROMIUM-T-mg/l
Reference																			
2016	Q3	Reference (FR_UFR1)	0.0758	0.0774	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01	<0.05	0.00000788	0.000010	49.7	50.7	0.796	0.136	0.00010	0.000158
2016	Q4	Reference (FR_UFR1)	0.0632	0.0628	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01	<0.05	0.00000632	0.0000089	47.9	47.8	1.14	0.186	0.00011	0.000184
2016	Q2	Reference (FR_UFR1)	0.0424	0.0439	<0.000036	<0.000036	<0.00005	<0.00005	<0.01	<0.01	<0.05	0.0000060	0.0000118	37.7	38.5	1.73	0.10	0.000122	0.000206
Tests that were not statistically different than reference																			
2016	Q2	CM_MC2	0.0442	0.0452	<0.000036	0.0000392	<0.00005	<0.00005	0.0164	0.0172	<0.05	0.0000589	0.0000964	68.4	67.6	1.45	1.25	0.000178	0.000576
2016	Q4	CM_MC2	0.0535	0.056	<0.000036	<0.000036	<0.00009	<0.00009	0.0254	0.0264	<0.09	0.0000289	0.0000365	82.1	83.4	1.61	1.83	0.000226	0.000366
2016	Q2	FR_FRCP1	0.0576	0.0591	<0.000036	<0.000036	<0.00005	0.000051	<0.01	<0.01	<0.05	0.0000265	0.0000441	74.7	76.2	1.48	0.51	0.000104	0.000226
2016	Q3	FR_FRCP1	0.0765	0.0768	<0.00002	<0.00002	<0.00005	<0.00005	0.0106	0.011	<0.25	0.0000198	0.0000508	105	113	0.938	1.68	<0.0001	0.000126
2016	Q4	FR_FRCP1	0.0755	0.0748	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01	<0.25	0.0000437	0.0000523	110	110	1.00	1.43	<0.0001	0.000148
2016	Q2	GH_FR1	0.0789	0.0796	<0.000036	<0.000036	<0.00005	<0.00005	<0.01	<0.01	<0.05	0.0000203	0.0000325	80.1	80.0	1.43	0.982	0.000116	0.000226
2016	Q3	GH_FR1	0.107	0.106	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	0.0101	<0.25	0.0000147	0.0000182	94.2	95.3	0.848	1.61	0.000106	0.000169
2016	Q4	GH_FR1	0.0996	0.0987	<0.00002	<0.00002	<0.00005	<0.00005	<0.01	<0.01	<0.25	0.0000161	0.0000193	97.8	99.7	0.852	1.64	0.000115	0.000148
Tests with significant results																			
2016	Q3	CM_MC2	0.0765	0.076	<0.000036	<0.000036	<0.00009	<0.00009	0.0326	0.0342	<0.21	0.0000102	0.0000124	110	113	1.03	3.24	0.00021	0.000238

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % =

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-5: *P. prometas* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	COBALT-D-mg/l	COBALT-T-mg/l	CONDUCTIVITY, LAB-N-us/cm	COPPER-D-mg/l	COPPER-T-mg/l	FLUORIDE-D-mg/l	Hardness, Total or Dissolved CaCO3-N-mg/l	IRON-D-mg/l	IRON-T-mg/l	LEAD-D-mg/l	LEAD-T-mg/l	LITHIUM-D-mg/l	LITHIUM-T-mg/l	MAGNESIUM-D-mg/l	MAGNESIUM-T-mg/l	MAJOR ANION SUM-N-meq/l	MAJOR CATION SUM-N-meq/l
Reference																			
2016	Q3	Reference (FR_UFR1)	<0.0001	<0.0001	341	<0.0005	0.0105	0.166	178	<0.01	0.0106	<0.00005	<0.00005	0.00178	0.00154	13.2	13.9	3.95	3.61
2016	Q4	Reference (FR_UFR1)	<0.0001	<0.0001	318	<0.0005	0.0105	0.16	172	<0.01	0.0174	<0.00005	<0.00005	0.00126	0.00152	12.9	12.8	3.62	3.48
2016	Q2	Reference (FR_UFR1)	<0.0001	<0.0001	245	0.000606	0.0108	0.157	134	<0.01	0.043	<0.00005	0.000052	0.00114	0.00132	9.72	10.1	2.64	2.72
Tests that were not statistically different than reference																			
2016	Q2	CM_MC2	0.00195	0.00271	532	<0.0005	0.0107	0.104	278	<0.01	0.362	0.0000528	0.000225	0.00884	0.00918	26.1	26.3	5.81	5.85
2016	Q4	CM_MC2	0.00106	0.00132	648	<0.0006	0.0109	0.106	349	<0.018	0.102	<0.00009	0.000103	0.0107	0.011	34.9	35.8	7.60	7.32
2016	Q2	FR_FRCP1	<0.0001	0.000102	570	0.00061	0.0109	0.207	312	<0.01	0.0824	<0.00005	0.000072	0.018	0.019	30.5	31.4	6.18	6.30
2016	Q3	FR_FRCP1	0.00010	0.000106	909	<0.0005	0.0105	0.204	497	<0.01	0.029	<0.00005	<0.00005	0.0369	0.0369	57.2	56.6	10.9	10.1
2016	Q4	FR_FRCP1	<0.0001	<0.0001	855	<0.0005	0.0105	0.202	489	<0.01	0.0322	<0.00005	<0.00005	0.0325	0.0337	51.9	51.8	10.2	9.88
2016	Q2	GH_FR1	<0.0001	<0.0001	603	<0.0005	0.0105	0.186	336	<0.01	0.0912	<0.00005	0.0000734	0.0139	0.0141	33.0	33.4	6.64	6.80
2016	Q3	GH_FR1	<0.0001	<0.0001	744	<0.00052	0.0105	0.186	406	<0.01	0.0147	<0.00005	<0.00005	0.0176	0.0184	41.4	42.2	8.74	8.22
2016	Q4	GH_FR1	<0.0001	<0.0001	763	<0.0005	0.0105	0.166	429	<0.01	0.0175	<0.00005	<0.00005	0.0177	0.0178	44.8	45.6	9.07	8.69
Tests with significant results																			
2016	Q3	CM_MC2	0.000372	0.000468	896	0.00062	0.0109	0.11	489	<0.018	0.0194	<0.00009	<0.00009	0.0157	0.0167	52.1	53.5	10.4	10.3

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % =

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-5: *P. prometas* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	MANGANESE-D-mg/l	MANGANESE-T-mg/l	MERCURY-D-mg/l	MERCURY-T-mg/l	MOLYBDENUM-D-mg/l	MOLYBDENUM-T-mg/l	NICKEL-D-mg/l	NICKEL-T-mg/l	NITRATE NITROGEN (NO3), AS N-N-mg/l	NITRITE NITROGEN (NO2), AS N-N-mg/l	NITROGEN, AMMONIA (AS N)-N-mg/l	ORTHO-PHOSPHATE-N-mg/l	OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	pH, LAB-N-ph units	PHOSPHORUS-N-mg/l	POTASSIUM-D-mg/l	POTASSIUM-T-mg/l
Reference																			
2016	Q3	Reference (FR_UFR1)	0.000192	0.00066	<0.000005	<0.0000005	0.000614	0.000623	<0.0005	<0.0005	0.0411	<0.001	<0.005	0.0026	328	8.29	0.00478	0.445	0.451
2016	Q4	Reference (FR_UFR1)	0.000158	0.000524	<0.000005	0.000000564	0.000573	0.00058	<0.0005	<0.0005	0.102	<0.001	<0.005	0.00228	315	8.29	0.00442	0.357	0.365
2016	Q2	Reference (FR_UFR1)	0.000306	0.00156	<0.000005	0.00000096	0.000626	0.000645	<0.0005	<0.0005	0.0156	<0.001	<0.005	0.00258	295	8.33	0.00474	0.33	0.358
Tests that were not statistically different than reference																			
2016	Q2	CM_MC2	0.0108	0.023	<0.000005	0.00000096	0.000863	0.000887	0.0147	0.0163	1.91	0.00804	0.0202	0.00204	312	8.29	0.0182	1.01	1.11
2016	Q4	CM_MC2	0.00896	0.0136	<0.000005	0.000000858	0.000924	0.000953	0.0108	0.0116	2.15	0.00964	0.0122	0.0015	307	8.27	0.0071	1.27	1.33
2016	Q2	FR_FRCP1	0.00221	0.0074	<0.000005	0.000000858	0.00109	0.00115	0.00194	0.00236	8.25	0.00264	0.00572	0.00152	328	8.34	0.0086	1.14	1.16
2016	Q3	FR_FRCP1	0.00438	0.00773	<0.000005	<0.0000005	0.00126	0.00131	0.00546	0.00576	12.9	0.00654	0.00558	0.00134	320	8.26	0.00512	1.79	1.75
2016	Q4	FR_FRCP1	0.00693	0.00872	<0.000005	<0.0000005	0.00131	0.00134	0.00508	0.00538	12.5	<0.005	<0.005	<0.001	322	8.34	0.0036	1.58	1.59
2016	Q2	GH_FR1	0.000822	0.00474	<0.000005	0.00000118	0.00101	0.00101	0.00176	0.00204	7.55	0.00272	0.0052	0.00124	329	8.33	0.00892	1.05	1.07
2016	Q3	GH_FR1	0.000872	0.00177	<0.000005	<0.00000095	0.000946	0.000969	0.00156	0.00167	10.4	0.00557	<0.005	0.00103	343	8.31	0.00407	1.28	1.25
2016	Q4	GH_FR1	0.000959	0.00165	<0.000005	<0.0000014	0.00106	0.0011	0.00244	0.0025	9.60	<0.005	0.0053	0.00111	343	8.27	0.010	1.25	1.29
Tests with significant results																			
2016	Q3	CM_MC2	0.000688	0.00202	<0.000005	<0.0000005	0.00116	0.00117	0.0139	0.0145	2.99	0.00642	<0.005	0.00102	324	8.18	0.0056	1.77	1.77

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % =

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-5: *P. prometas* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	SELENIUM-D-ug/l	SELENIUM-T-ug/l	SILICON-D-mg/l	SILICON-T-mg/l	SILVER-D-mg/l	SILVER-T-mg/l	SODIUM-D-mg/l	SODIUM-T-mg/l	STRONTIUM-D-mg/l	STRONTIUM-T-mg/l	SULFATE (AS SO4)-D-mg/l	THALLIUM-D-mg/l	THALLIUM-T-mg/l	TIN-D-mg/l	TIN-T-mg/l	TITANIUM-D-mg/l	TITANIUM-T-mg/l
Reference																			
2016	Q3	Reference (FR_UFR1)	0.60	0.648	2.08	2.11	<0.00001	<0.00001	0.689	0.738	0.0959	0.0984	38.6	<0.00001	<0.00001	<0.0001	<0.0001	<0.01	<0.01
2016	Q4	Reference (FR_UFR1)	0.672	0.668	1.72	1.85	<0.00001	<0.00001	0.676	0.683	0.0889	0.0898	37.8	<0.00001	<0.00001	<0.0001	<0.0001	<0.01	<0.01
2016	Q2	Reference (FR_UFR1)	0.51	0.552	1.75	1.90	<0.00001	<0.00001	0.626	0.652	0.0658	0.0682	15.2	<0.00001	<0.00001	<0.0001	<0.0001	<0.01	<0.01
Tests that were not statistically different than reference																			
2016	Q2	CM_MC2	4.33	4.22	1.97	2.53	<0.00001	<0.00001	6.14	5.98	0.195	0.193	132	0.0000124	0.0000212	<0.0001	<0.0001	0.0112	0.0152
2016	Q4	CM_MC2	5.35	5.45	2.16	2.42	<0.000018	<0.000018	7.41	7.64	0.235	0.241	187	0.0000188	0.0000222	<0.00018	<0.00018	<0.01	<0.01
2016	Q2	FR_FRCP1	29.9	30.8	1.58	1.72	<0.00001	<0.00001	1.06	1.10	0.0985	0.103	119	<0.00001	0.000011	<0.0001	<0.0001	0.0106	0.0108
2016	Q3	FR_FRCP1	67.7	66.5	1.89	2.01	<0.00001	<0.00001	1.81	1.83	0.146	0.154	284	<0.00001	0.000010	<0.0001	<0.0001	<0.01	<0.01
2016	Q4	FR_FRCP1	59.9	58.7	1.72	1.84	<0.00001	<0.00001	1.56	1.59	0.146	0.147	256	0.0000106	<0.00001	<0.0001	<0.0001	<0.01	<0.01
2016	Q2	GH_FR1	29.1	29.5	1.84	1.94	<0.00001	<0.00001	1.50	1.52	0.112	0.113	130	<0.00001	0.0000102	<0.0001	<0.0001	0.0104	0.0108
2016	Q3	GH_FR1	39.5	40.2	2.11	2.25	<0.00001	<0.00001	1.95	1.99	0.143	0.144	190	<0.00001	<0.00001	<0.0001	<0.0001	<0.01	<0.01
2016	Q4	GH_FR1	43.5	42.6	2.12	2.19	<0.00001	<0.00001	1.97	2.07	0.145	0.148	214	<0.00001	<0.00001	<0.0001	<0.0001	<0.01	<0.01
Tests with significant results																			
2016	Q3	CM_MC2	6.28	6.49	1.94	2.12	<0.000018	<0.000018	11.1	11.2	0.346	0.355	295	0.000023	0.0000222	<0.00018	<0.00018	<0.01	<0.01

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % =

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-5: *P. prometas* Endpoints Paired with Water Quality

Year	Quarter	Sample ID	TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	TOTAL KJELDAHL NITROGEN-N-mg/l	TOTAL ORGANIC CARBON-T-mg/l	TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	TURBIDITY, LAB-N-ntu	URANIUM-D-mg/l	URANIUM-T-mg/l	VANADIUM-D-mg/l	VANADIUM-T-mg/l	ZINC-D-mg/l	ZINC-T-mg/l	PCA-Factor1 (2016 dataset)
Reference														
2016	Q3	Reference (FR_UFR1)	221	0.0678	0.922	1.58	0.29	0.00044	0.000444	<0.0005	<0.0005	<0.003	<0.003	-1.32
2016	Q4	Reference (FR_UFR1)	198	0.0626	1.26	<1	0.652	0.000431	0.000444	<0.0005	0.00050	<0.003	<0.0036	-1.43
2016	Q2	Reference (FR_UFR1)	147	0.0808	2.05	1.72	0.886	0.000329	0.000339	<0.0005	0.000502	<0.003	<0.003	-1.60
Tests that were not statistically different than reference														
2016	Q2	CM_MC2	365	0.194	1.75	12.0	5.94	0.00138	0.00137	<0.0005	0.000824	0.0054	0.00992	0.65
2016	Q4	CM_MC2	462	0.136	1.87	4.64	2.91	0.00174	0.0018	<0.0009	<0.0009	0.00352	0.00616	1.23
2016	Q2	FR_FRCP1	377	0.152	1.91	6.28	0.996	0.00171	0.0018	<0.0005	0.000522	<0.003	0.00306	-0.11
2016	Q3	FR_FRCP1	700	0.142	1.10	2.14	1.81	0.00333	0.00344	<0.0005	<0.0005	<0.003	<0.003	0.48
2016	Q4	FR_FRCP1	636	0.0954	1.34	1.34	1.07	0.0031	0.00317	<0.0005	<0.0005	<0.003	<0.0042	0.37
2016	Q2	GH_FR1	401	0.175	1.81	15.5	2.55	0.00169	0.00168	<0.0005	0.00052	<0.003	0.0030	-0.05
2016	Q3	GH_FR1	522	0.132	1.06	<1	0.355	0.00207	0.00212	<0.0005	0.000506	<0.003	<0.003	0.05
2016	Q4	GH_FR1	562	0.199	1.64	1.96	0.713	0.00232	0.00234	<0.0005	<0.0005	<0.003	<0.003	0.21
Tests with significant results														
2016	Q3	CM_MC2	674	0.205	1.14	1.52	0.512	0.00274	0.0028	<0.0009	<0.0009	<0.0034	<0.0054	1.52

Notes:
"-D-" = dissolved concentration; "-T-" = total concentration; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; ug/l = micrograms per litre; % =

Screening
Concentrations of parameters in 2016 tests with significant results are shaded if the concentration is greater than the maximum concentration measured in references or tests that are not statistically different than reference. Tests were identified as having a significant result if endpoint was significantly reduced relative to one or both reference waters (based on pairwise tests in laboratory reports).

Table C-6: Spearman Rank Order Correlation for *C. dubia* Reproduction

Parameter	Rs[1]		Is parameter greater than the chronic BC WQG or lowest L1 benchmark from EVWQP in at least one test with significant adverse effects?[2]	Retain Parameter for Concentration-Response Analysis?[3]
	2015 and 2016 Datasets	2016 Dataset		
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-0.130	-0.130	-	-
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/	0.010	0.010	-	-
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-0.240	-0.240	No WQG	No - parameter included in TDS
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	-0.043	-0.043	-	-
ALUMINUM-D-mg/l	-0.323	-0.323	No	No
ANTIMONY-T-mg/l	-0.376	-0.376	No	No
ARSENIC-T-mg/l	-0.428	-0.428	No	No
BARIUM-T-mg/l	0.159	0.159	-	-
BERYLLIUM-T-mg/l	-0.057	-0.057	-	-
BISMUTH-T-mg/l	nc	nc	-	-
BORON-T-mg/l	-0.231	-0.231	No	No
BROMIDE-D-mg/l	0.061	0.061	-	-
CADMIUM-D-mg/l	-0.335	-0.335	No	Yes
CALCIUM-T-mg/l	-0.061	-0.061	-	-
CARBON, DISSOLVED ORGANIC-D-mg/l	-0.503	-0.503	No WQG	Yes
CHLORIDE-D-mg/l	-0.099	-0.099	-	-
CHROMIUM-T-mg/l	-0.231	-0.231	No	No
COBALT-T-mg/l	-0.459	-0.459	No	No
CONDUCTIVITY, LAB-N-us/cm	-0.125	-0.125	-	-
COPPER-T-mg/l	-0.367	-0.367	No	No
FLUORIDE-D-mg/l	0.150	0.150	-	-
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-0.107	-0.107	-	-
IRON-D-mg/l	-0.251	-0.251	No	No
IRON-T-mg/l	-0.497	-0.497	No	No
LEAD-T-mg/l	-0.400	-0.400	No	No
LITHIUM-T-mg/l	-0.307	-0.307	No WQG	Yes
MAGNESIUM-T-mg/l	-0.117	-0.117	-	-
MAJOR ANION SUM-N-meq/l	-0.107	-0.107	-	-
MAJOR CATION SUM-N-meq/l	-0.113	-0.113	-	-
MANGANESE-T-mg/l	-0.622	-0.622	No	No
MERCURY-T-mg/l	-0.214	-0.214	No	No
MOLYBDENUM-T-mg/l	-0.182	-0.182	-	-
NICKEL-T-mg/l	-0.538	-0.538	No	No
NITRATE NITROGEN (NO_3), AS N-N-mg/l	-0.317	-0.317	Yes	Yes
NITRITE NITROGEN (NO_2), AS N-N-mg/l	-0.053	-0.053	-	-
NITROGEN, AMMONIA (AS N)-N-mg/l	-0.147	-0.147	-	-
ORTHO-PHOSPHATE-N-mg/l	0.111	0.111	-	-
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-0.084	-0.084	-	-
pH, LAB-N-ph units	-0.170	-0.170	-	-
PHOSPHORUS-N-mg/l	-0.166	-0.166	-	-
POTASSIUM-T-mg/l	-0.366	-0.366	No WQG	No - parameter included in TDS
SELENIUM-T-ug/l	-0.246	-0.246	Yes	Yes
SILICON-T-mg/l	-0.130	-0.130	-	-
SILVER-T-mg/l	-0.106	-0.106	-	-
SODIUM-T-mg/l	-0.259	-0.259	No WQG	No - parameter included in TDS
STRONTIUM-T-mg/l	-0.080	-0.080	-	-
SULFATE (AS SO_4)-D-mg/l	-0.181	-0.181	Yes	Yes
THALLIUM-T-mg/l	-0.510	-0.510	No	No
TIN-T-mg/l	nc	nc	-	-
TITANIUM-T-mg/l	0.016	0.016	-	-
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-0.131	-0.131	-	-
TOTAL KJELDAHL NITROGEN-N-mg/l	-0.463	-0.463	No WQG	Yes
TOTAL ORGANIC CARBON-T-mg/l	-0.537	-0.537	No WQG	Yes
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-0.493	-0.493	No WQG	Yes
TURBIDITY, LAB-N-ntu	-0.485	-0.485	No WQG	Yes
URANIUM-T-mg/l	-0.216	-0.216	No	No
VANADIUM-T-mg/l	-0.405	-0.405	No WQG	Yes
ZINC-T-mg/l	-0.160	-0.160	No	No
PCA_Factor1	-0.180	-0.180	-	-
PCA-2016_Factor1	n/a	-0.080	-	-

Notes:

1) Statistical significance is based on one-tailed comparisons. Significant negative correlations for combined dataset ($\alpha < 0.05$; $rs < -0.279$) and 2016 dataset ($\alpha < 0.05$; $rs < -0.198$) are highlighted. NC = rs could not be calculated because parameter concentration was the same in all tests.

2) Concentrations of parameters with significant rank order correlations were screeened against chronic BC WQGs in Table D-11.

3) Parameters were retained for graphical analysis if they met one of the following conditions: 1) order constituent, 2) significant negative correlation and concentration was greater than the chronic BC WQG, or 3) significant negative correlation and there is no chronic BC WQG.

BC = British Columbia; WQG = Water Quality Guideline; EVWQP = Elk Valley Water Quality Plan; TDS = total dissolved solids; % = percent; $CaCO_3$ = calcium carbonate; "-D-" = dissolved concentration; mg/l = milligrams per litre; "-T-" = total concentration; ug/l = micrograms per litre.

Table C-7: Spearman Rank Order Correlation for *P. subcapita* Cell Yield

Parameter	Rs[1]		Is parameter greater than the chronic BC WQG or lowest L1 benchmark from EVWQP in at least one test with significant adverse effects?[2]	Retain Parameter for Concentration-Response Analysis?[3]
	2015 and 2016 Datasets	2016 Dataset		
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-0.131	-0.131	-	-
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-0.029	-0.029	-	-
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	0.138	0.138	-	-
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	-0.022	-0.022	-	-
ALUMINUM-D-mg/l	0.066	0.066	-	-
ANTIMONY-T-mg/l	-0.225	-0.225	No	No
ARSENIC-T-mg/l	-0.119	-0.119	-	-
BARIUM-T-mg/l	0.118	0.118	-	-
BERYLLIUM-T-mg/l	-0.576	-0.576	No	No
BISMUTH-T-mg/l	NC	NC	-	-
BORON-T-mg/l	-0.155	-0.155	-	-
BROMIDE-D-mg/l	0.115	0.115	-	-
CADMIUM-D-mg/l	-0.235	-0.235	No	Yes
CALCIUM-T-mg/l	-0.031	-0.031	-	-
CARBON, DISSOLVED ORGANIC-D-mg/l	-0.295	-0.295	No WQG	Yes
CHLORIDE-D-mg/l	0.057	0.057	-	-
CHROMIUM-T-mg/l	-0.104	-0.104	-	-
COBALT-T-mg/l	-0.178	-0.178	-	-
CONDUCTIVITY, LAB-N-us/cm	0.003	0.003	-	-
COPPER-T-mg/l	-0.156	-0.156	-	-
FLUORIDE-D-mg/l	-0.088	-0.088	-	-
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	0.025	0.025	-	-
IRON-D-mg/l	0.124	0.124	-	-
IRON-T-mg/l	-0.223	-0.223	No	No
LEAD-T-mg/l	-0.362	-0.362	No	No
LITHIUM-T-mg/l	-0.137	-0.137	-	-
MAGNESIUM-T-mg/l	0.004	0.004	-	-
MAJOR ANION SUM-N-meq/l	0.035	0.035	-	-
MAJOR CATION SUM-N-meq/l	0.029	0.029	-	-
MANGANESE-T-mg/l	-0.289	-0.289	No	No
MERCURY-T-mg/l	0.088	0.088	-	-
MOLYBDENUM-T-mg/l	-0.064	-0.064	-	-
NICKEL-T-mg/l	-0.233	-0.233	No	No
NITRATE NITROGEN (NO_3), AS N-N-mg/l	-0.112	-0.112	-	Yes
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.078	0.078	-	-
NITROGEN, AMMONIA (AS N)-N-mg/l	-0.177	-0.177	-	-
ORTHO-PHOSPHATE-N-mg/l	-0.001	-0.001	-	-
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	0.083	0.083	-	-
pH, LAB-N-ph units	0.052	0.052	-	-
PHOSPHORUS-N-mg/l	-0.360	-0.360	No WQG	Yes
POTASSIUM-T-mg/l	-0.137	-0.137	-	-
SELENIUM-T-ug/l	-0.052	-0.052	-	Yes
SILICON-T-mg/l	-0.104	-0.104	-	-
SILVER-T-mg/l	-0.133	-0.133	-	-
SODIUM-T-mg/l	-0.009	-0.009	-	-
STRONTIUM-T-mg/l	0.104	0.104	-	-
SULFATE (AS SO_4)-D-mg/l	0.053	0.053	-	Yes
THALLIUM-T-mg/l	-0.286	-0.286	No	No
TIN-T-mg/l	NC	NC	-	-
TITANIUM-T-mg/l	-0.250	-0.250	No WQG	Yes
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	0.036	0.036	-	-
TOTAL KJELDAHL NITROGEN-N-mg/l	-0.276	-0.276	No WQG	Yes
TOTAL ORGANIC CARBON-T-mg/l	-0.347	-0.347	No WQG	Yes
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-0.231	-0.231	No WQG	Yes
TURBIDITY, LAB-N-ntu	-0.151	-0.151	-	-
URANIUM-T-mg/l	-0.006	-0.006	-	-
VANADIUM-T-mg/l	-0.445	-0.445	No WQG	Yes
ZINC-T-mg/l	-0.363	-0.363	No	No
PCA_Factor1	-0.053	-0.053	-	-
PCA-2016_Factor1	0.008	0.008	-	-

Notes:

1) Statistical significance is based on one-tailed comparisons. Significant negative correlations for combined dataset ($\alpha < 0.05$; $rs < -0.279$) and 2016 dataset ($\alpha < 0.05$; $rs < -0.198$) are highlighted. NC = rs could not be calculated because parameter concentration was the same in all tests.

2) Concentrations of parameters with significant rank order correlations were screeened against chronic BC WQGs in Table D-11.

3) Parameters were retained for graphical analysis if they met one of the following conditions: 1) order constituent, 2) significant negative correlation and concentration was greater than the chronic BC WQG, or 3) significant negative correlation and there is no chronic BC WQG.

BC = British Columbia; WQG = Water Quality Guideline; EVWQP = Elk Valley Water Quality Plan; TDS = total dissolved solids; % = percent; $CaCO_3$ = calcium carbonate; "-D-" = dissolved concentration; mg/l = milligrams per litre; "-T-" = total concentration; ug/l = micrograms per litre.

Table C-8: Spearman Rank Order Correlation for *H. azteca* Growth

Parameter	Rs[1]		Is parameter greater than the chronic BC WQG or lowest L1 benchmark from EVWQP in at least one test with significant adverse effects?[2]	Retain Parameter for Concentration-Response Analysis?[3]
	2015 and 2016 Datasets	2016 Dataset		
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-0.285	-0.285	-	-
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/	-0.212	-0.212	-	-
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-0.145	-0.145	-	-
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	-0.209	-0.209	-	-
ALUMINUM-D-mg/l	0.253	0.253	-	-
ANTIMONY-T-mg/l	-0.524	-0.524	No	-
ARSENIC-T-mg/l	-0.168	-0.168	-	-
BARIUM-T-mg/l	-0.127	-0.127	-	-
BERYLLIUM-T-mg/l	-0.643	-0.643	No	-
BISMUTH-T-mg/l	-0.365	-0.365	No WQG	No - low detection frequency[4]
BORON-T-mg/l	-0.039	-0.039	-	-
BROMIDE-D-mg/l	-0.129	-0.129	-	-
CADMIUM-D-mg/l	-0.596	-0.596	No	Yes
CALCIUM-T-mg/l	-0.345	-0.345	No WQG	No - parameter included in TDS
CARBON, DISSOLVED ORGANIC-D-mg/l	0.140	0.140	-	-
CHLORIDE-D-mg/l	-0.202	-0.202	-	-
CHROMIUM-T-mg/l	-0.298	-0.298	No	-
COBALT-T-mg/l	-0.178	-0.178	-	-
CONDUCTIVITY, LAB-N-us/cm	-0.323	-0.323	No WQG	No - parameter included in TDS
COPPER-T-mg/l	-0.661	-0.661	No	-
FLUORIDE-D-mg/l	-0.249	-0.249	-	-
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-0.300	-0.300	No WQG	No - parameter included in TDS
IRON-D-mg/l	NC	NC	-	-
IRON-T-mg/l	-0.402	-0.402	No	-
LEAD-T-mg/l	-0.328	-0.328	No	-
LITHIUM-T-mg/l	-0.363	-0.363	No WQG	Yes
MAGNESIUM-T-mg/l	-0.289	-0.289	-	-
MAJOR ANION SUM-N-meq/l	-0.287	-0.287	-	-
MAJOR CATION SUM-N-meq/l	-0.297	-0.297	No WQG	No - parameter included in TDS
MANGANESE-T-mg/l	-0.532	-0.532	No	-
MERCURY-T-mg/l	-0.399	-0.399	No	-
MOLYBDENUM-T-mg/l	-0.386	-0.386	No	-
NICKEL-T-mg/l	-0.330	-0.330	No	-
NITRATE NITROGEN (NO_3), AS N-N-mg/l	-0.436	-0.436	Yes	Yes
NITRITE NITROGEN (NO_2), AS N-N-mg/l	-0.354	-0.354	No	-
NITROGEN, AMMONIA (AS N)-N-mg/l	-0.560	-0.560	No	-
ORTHO-PHOSPHATE-N-mg/l	0.226	0.226	-	-
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-0.075	-0.075	-	-
pH, LAB-N-ph units	0.060	0.060	-	-
PHOSPHORUS-N-mg/l	-0.175	-0.175	-	-
POTASSIUM-T-mg/l	-0.222	-0.222	-	-
SELENIUM-T-ug/l	-0.398	-0.398	Yes	Yes
SILICON-T-mg/l	-0.060	-0.060	-	-
SILVER-T-mg/l	NC	NC	-	-
SODIUM-T-mg/l	-0.268	-0.268	-	-
STRONTIUM-T-mg/l	-0.242	-0.242	-	-
SULFATE (AS SO_4)-D-mg/l	-0.277	-0.277	-	Yes
THALLIUM-T-mg/l	-0.317	-0.317	No	-
TIN-T-mg/l	NC	NC	-	-
TITANIUM-T-mg/l	-0.820	-0.820	No WQG	Yes
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-0.270	-0.270	-	Yes
TOTAL KJELDAHL NITROGEN-N-mg/l	-0.480	-0.480	No WQG	Yes
TOTAL ORGANIC CARBON-T-mg/l	0.044	0.044	-	-
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-0.330	-0.330	No WQG	Yes
TURBIDITY, LAB-N-ntu	-0.264	-0.264	-	-
URANIUM-T-mg/l	-0.292	-0.292	-	-
VANADIUM-T-mg/l	-0.440	-0.440	No WQG	Yes
ZINC-T-mg/l	-0.016	-0.016	-	-
PCA_Factor1	-0.283	-0.283	-	-
PCA-2016_Factor1	n/a	-0.300	-	-

Notes:

1) Statistical significance is based on one-tailed comparisons. Significant negative correlations for combined dataset ($\alpha < 0.05$; $rs < -0.296$) and 2016 dataset ($\alpha < 0.05$; $rs < -0.429$) are highlighted. NC = rs could not be calculated because parameter concentration was the same in all tests.

2) Concentrations of parameters with significant rank order correlations were screeened against chronic BC WQGs in Table D-11.

3) Parameters were retained for graphical analysis if they met one of the following conditions: 1) order constituent, 2) significant negative correlation and concentration was greater than the chronic BC WQG, or 3) significant negative correlation and there is no chronic BC WQG.

4) Of 16 samples, one had a detected concentration of bismuth (Table C-3),

BC = British Columbia; WQG = Water Quality Guideline; EVWQP = Elk Valley Water Quality Plan; TDS = total dissolved solids; % = percent; $CaCO_3$ = calcium carbonate; "-D-" = dissolved concentration; mg/l = milligrams per litre; "-T-" = total concentration; ug/l = micrograms per litre.

Table C-9: Spearman Rank Order Correlation for *O. mykiss* Survival, Variability, and Length

Parameter	Survival Rs[1]		Viability Rs[1]		Length Rs[1]	
	2015 and 2016 Datasets	2016 Dataset	2015 and 2016 Datasets	2016 Dataset	2015 and 2016 Datasets	2016 Dataset
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-0.243	-0.243	-0.230	-0.230	-0.039	-0.039
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-0.493	-0.493	-0.480	-0.480	-0.374	-0.374
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-0.406	-0.406	-0.411	-0.411	-0.072	-0.072
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	-0.494	-0.494	-0.480	-0.480	-0.376	-0.376
ALUMINUM-D-mg/l	-0.001	-0.001	-0.016	-0.016	0.100	0.100
ANTIMONY-T-mg/l	-0.619	-0.619	-0.611	-0.611	0.251	0.251
ARSENIC-T-mg/l	-0.127	-0.127	-0.151	-0.151	0.427	0.427
BARIUM-T-mg/l	-0.424	-0.424	-0.408	-0.408	-0.242	-0.242
BERYLLIUM-T-mg/l	-0.104	-0.104	-0.122	-0.122	0.651	0.651
BISMUTH-T-mg/l	-0.047	-0.047	-0.023	-0.023	-0.211	-0.211
BORON-T-mg/l	-0.074	-0.074	-0.074	-0.074	0.285	0.285
BROMIDE-D-mg/l	-0.599	-0.599	-0.598	-0.598	-0.223	-0.223
CADMIUM-D-mg/l	-0.570	-0.570	-0.564	-0.564	0.346	0.346
CALCIUM-T-mg/l	-0.588	-0.588	-0.581	-0.581	-0.227	-0.227
CARBON, DISSOLVED ORGANIC-D-mg/l	-0.064	-0.064	-0.069	-0.069	0.412	0.412
CHLORIDE-D-mg/l	-0.474	-0.474	-0.480	-0.480	0.242	0.242
CHROMIUM-T-mg/l	0.382	0.382	0.371	0.371	0.341	0.341
COBALT-T-mg/l	-0.090	-0.090	-0.093	-0.093	0.077	0.077
CONDUCTIVITY, LAB-N-us/cm	-0.603	-0.603	-0.591	-0.591	-0.280	-0.280
COPPER-T-mg/l	-0.052	-0.052	-0.038	-0.038	0.124	0.124
FLUORIDE-D-mg/l	-0.266	-0.266	-0.249	-0.249	-0.138	-0.138
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-0.620	-0.620	-0.608	-0.608	-0.301	-0.301
IRON-D-mg/l	-0.015	-0.015	-0.015	-0.015	0.220	0.220
IRON-T-mg/l	-0.152	-0.152	-0.181	-0.181	0.516	0.516
LEAD-T-mg/l	0.002	0.002	-0.023	-0.023	0.491	0.491
LITHIUM-T-mg/l	-0.608	-0.608	-0.591	-0.591	-0.027	-0.027
MAGNESIUM-T-mg/l	-0.709	-0.709	-0.699	-0.699	-0.224	-0.224
MAJOR ANION SUM-N-meq/l	-0.572	-0.572	-0.556	-0.556	-0.310	-0.310
MAJOR CATION SUM-N-meq/l	-0.620	-0.620	-0.608	-0.608	-0.301	-0.301
MANGANESE-T-mg/l	-0.229	-0.229	-0.262	-0.262	0.453	0.453
MERCURY-T-mg/l	0.111	0.111	0.125	0.125	-0.047	-0.047
MOLYBDENUM-T-mg/l	-0.261	-0.261	-0.249	-0.249	-0.148	-0.148
NICKEL-T-mg/l	-0.564	-0.564	-0.553	-0.553	0.149	0.149
NITRATE NITROGEN (NO_3), AS N-N-mg/l	-0.688	-0.688	-0.674	-0.674	-0.001	-0.001
NITRITE NITROGEN (NO_2), AS N-N-mg/l	-0.683	-0.683	-0.675	-0.675	-0.052	-0.052
NITROGEN, AMMONIA (AS N)-N-mg/l	-0.104	-0.104	-0.091	-0.091	-0.149	-0.149
ORTHO-PHOSPHATE-N-mg/l	-0.001	-0.001	0.013	0.013	0.118	0.118
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	0.038	0.038	0.043	0.043	-0.139	-0.139
pH, LAB-N-ph units	-0.281	-0.281	-0.290	-0.290	0.073	0.073
PHOSPHORUS-N-mg/l	-0.303	-0.303	-0.333	-0.333	0.335	0.335
POTASSIUM-T-mg/l	-0.666	-0.666	-0.655	-0.655	-0.119	-0.119
SELENIUM-T-ug/l	-0.700	-0.700	-0.686	-0.686	-0.262	-0.262
SILICON-T-mg/l	-0.289	-0.289	-0.313	-0.313	0.362	0.362
SILVER-T-mg/l	-0.257	-0.257	-0.257	-0.257	0.399	0.399
SODIUM-T-mg/l	-0.481	-0.481	-0.478	-0.478	0.160	0.160
STRONTIUM-T-mg/l	0.248	0.248	0.240	0.240	-0.201	-0.201
SULFATE (AS SO_4)-D-mg/l	-0.690	-0.690	-0.678	-0.678	-0.183	-0.183
THALLIUM-T-mg/l	-0.152	-0.152	-0.157	-0.157	0.403	0.403
TIN-T-mg/l	-0.023	-0.023	-0.023	-0.023	-0.234	-0.234
TITANIUM-T-mg/l	-0.147	-0.147	-0.158	-0.158	0.351	0.351
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-0.593	-0.593	-0.577	-0.577	-0.317	-0.317
TOTAL KJELDAHL NITROGEN-N-mg/l	-0.541	-0.541	-0.547	-0.547	0.373	0.373
TOTAL ORGANIC CARBON-T-mg/l	-0.205	-0.205	-0.212	-0.212	0.318	0.318
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-0.117	-0.117	-0.134	-0.134	0.340	0.340
TURBIDITY, LAB-N-ntu	-0.215	-0.215	-0.249	-0.249	0.438	0.438
URANIUM-T-mg/l	-0.574	-0.574	-0.560	-0.560	-0.234	-0.234
VANADIUM-T-mg/l	-0.045	-0.045	-0.075	-0.075	0.603	0.603
ZINC-T-mg/l	-0.256	-0.256	-0.257	-0.257	0.295	0.295
PCA_Factor1	-0.635	-0.635	-0.622	-0.622	-0.107	-0.107
PCA-2016_Factor1	-0.616	-0.616	-0.604	-0.604	-0.083	-0.083

Notes:

1) Statistical significance is based on one-tailed comparisons. Significant negative correlations for combined dataset ($\alpha < 0.05$; $rs < -0.296$) and 2016 dataset ($\alpha < 0.05$; $rs < -0.429$) are highlighted. NC = rs could not be calculated because parameter concentration was the same in all tests.

2) Concentrations of parameters with significant rank order correlations were screeened against chronic BC WQGs in Table D-11.

3) Parameters were retained for graphical analysis if they met one of the following conditions: 1) order constituent, 2) significant negative correlation and concentration was greater than the chronic BC WQG, or 3) significant negative correlation and there is no chronic BC WQG.

4) Bromide was below the detection limit in all 2016 tests.

BC = British Columbia; WQG = Water Quality Guideline; EVWQP = Elk Valley Water Quality Plan; TDS = total dissolved solids; % = percent; $CaCO_3$ = calcium carbonate; "-D-" = dissolved concentration; mg/l = milligrams per litre; "-T-" = total concentration; ug/l = micrograms per litre.

Table C-9: Spearman Rank Order Correlation for *O. mykiss* Survival, Variability, and Length

Parameter	Is parameter greater than the chronic BC WQG or lowest L1 benchmark from EVWQP in at least one test with significant adverse effects?[2]	Retain Parameter for Concentration-Response Analysis?[3]		
		Survival	Viability	Lenth
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-			
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/	No WQG	No - parameter included in TDS		
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	No WQG	No - parameter included in TDS		-
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	No WQG	No - parameter included in TDS		
ALUMINUM-D-mg/l	-	-		
ANTIMONY-T-mg/l	No	-		
ARSENIC-T-mg/l	-	-		
BARIUM-T-mg/l	No	-		
BERYLLIUM-T-mg/l	-	-		
BISMUTH-T-mg/l	-	-		
BORON-T-mg/l	-	-		
BROMIDE-D-mg/l	No WQG	No - low detection frequency[4]		-
CADMIUM-D-mg/l	No	Yes		
CALCIUM-T-mg/l	No WQG	No - parameter included in TDS		-
CARBON, DISSOLVED ORGANIC-D-mg/l	-	-		
CHLORIDE-D-mg/l	No	-		
CHROMIUM-T-mg/l	-	-		
COBALT-T-mg/l	-	-		
CONDUCTIVITY, LAB-N-us/cm	No WQG	No - parameter included in TDS		-
COPPER-T-mg/l	-	-		
FLUORIDE-D-mg/l	-	-		
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	No WQG	No - parameter included in TDS		
IRON-D-mg/l	-	-		
IRON-T-mg/l	-	-		
LEAD-T-mg/l	-	-		
LITHIUM-T-mg/l	No WQG	Yes	Yes	-
MAGNESIUM-T-mg/l	No WQG	No - parameter included in TDS		-
MAJOR ANION SUM-N-meq/l	No WQG	No - parameter included in TDS		
MAJOR CATION SUM-N-meq/l	No WQG	No - parameter included in TDS		
MANGANESE-T-mg/l	-	-		
MERCURY-T-mg/l	-	-		
MOLYBDENUM-T-mg/l	-	-		
NICKEL-T-mg/l	No	-		
NITRATE NITROGEN (NO_3), AS N-N-mg/l	Yes	Yes		
NITRITE NITROGEN (NO_2), AS N-N-mg/l	No	-		
NITROGEN, AMMONIA (AS N)-N-mg/l	-	-		
ORTHO-PHOSPHATE-N-mg/l	-	-		
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-	-		
pH, LAB-N-ph units	-	-		
PHOSPHORUS-N-mg/l	No WQG	Yes	Yes	-
POTASSIUM-T-mg/l	No WQG	No - parameter included in TDS		-
SELENIUM-T-ug/l	Yes	Yes		
SILICON-T-mg/l	No WQG	-	Yes	-
SILVER-T-mg/l	-	-		
SODIUM-T-mg/l	No WQG	No - parameter included in TDS		-
STRONTIUM-T-mg/l	-	-		
SULFATE (AS SO_4)-D-mg/l	No	Yes		
THALLIUM-T-mg/l	-	-		
TIN-T-mg/l	-	-		
TITANIUM-T-mg/l	-	-		
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	No WQG	Yes		
TOTAL KJELDAHL NITROGEN-N-mg/l	No WQG	Yes	Yes	-
TOTAL ORGANIC CARBON-T-mg/l	-	-		
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-	-		
TURBIDITY, LAB-N-ntu	-	-		
URANIUM-T-mg/l	No	-		
VANADIUM-T-mg/l	-	-		
ZINC-T-mg/l	-	-		
PCA_Factor1	No WQG	Yes	Yes	-
PCA-2016_Factor1	No WQG	Yes	Yes	-

Notes:

1) Statistical significance is based on one-tailed comparisons. Significant negative correlations for combined dataset ($\alpha < 0.05$; $rs < -0.296$) and 2016 dataset ($\alpha < 0.05$; $rs < -0.429$) are highlighted. NC = rs could not be calculated because parameter concentration was the same in all tests.

2) Concentrations of parameters with significant rank order correlations were screeened against chronic BC WQGs in Table D-11.

3) Parameters were retained for graphical analysis if they met one of the following conditions: 1) order constituent, 2) significant negative correlation and concentration was greater than the chronic BC WQG, or 3) significant negative correlation and there is no chronic BC WQG.

4) Bromide was below the detection limit in all 2016 tests.

BC = British Columbia; WQG = Water Quality Guideline; EVWQP = Elk Valley Water Quality Plan; TDS = total dissolved solids; % = percent; $CaCO_3$ = calcium carbonate; "-D-" = dissolved concentration; mg/l = milligrams per litre; "-T-" = total concentration; ug/l = micrograms per litre.

Table C-10: Spearman Rank Correlation for *P. promelas* Hatch

Parameter	Rs[1]	Is parameter greater than the chronic BC WQG or lowest L1 benchmark from EVWQP in at least one test with significant adverse effects?[2]	Retain Parameter for Concentration-Response Analysis?[3]
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-0.294	-	
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-0.727	No WQG	No - parameter included in
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-0.738	No WQG	No - parameter included in
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	-0.753	No WQG	No - parameter included in
ALUMINUM-D-mg/l	0.601	-	
ANTIMONY-T-mg/l	-0.544	No	
ARSENIC-T-mg/l	0.066	-	
BARIUM-T-mg/l	-0.574	No	
BERYLLIUM-T-mg/l	0.232	-	
BISMUTH-T-mg/l	-0.094	-	
BORON-T-mg/l	-0.077	-	
BROMIDE-D-mg/l	-0.476	-	
CADMIUM-D-mg/l	-0.095	-	
CALCIUM-T-mg/l	-0.764	No WQG	No - parameter included in
CARBON, DISSOLVED ORGANIC-D-mg/l	0.464	-	
CHLORIDE-D-mg/l	-0.431	-	
CHROMIUM-T-mg/l	0.343	-	
COBALT-T-mg/l	0.077	-	
CONDUCTIVITY, LAB-N-us/cm	-0.749	No WQG	No - parameter included in
COPPER-T-mg/l	0.231	-	-
FLUORIDE-D-mg/l	-0.511	No	-
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-0.749	No WQG	No - parameter included in
IRON-D-mg/l	-0.102	-	-
IRON-T-mg/l	0.205	-	-
LEAD-T-mg/l	0.179	-	-
LITHIUM-T-mg/l	-0.672	No WQG	Yes
MAGNESIUM-T-mg/l	-0.749	No WQG	No - parameter included in
MAJOR ANION SUM-N-meq/l	-0.749	No WQG	No - parameter included in
MAJOR CATION SUM-N-meq/l	-0.764	No WQG	No - parameter included in
MANGANESE-T-mg/l	-0.117	-	-
MERCURY-T-mg/l	0.389	-	-
MOLYBDENUM-T-mg/l	-0.789	No	-
NICKEL-T-mg/l	-0.246	-	-
NITRATE NITROGEN (NO_3), AS N-N-mg/l	-0.628	No	Yes
NITRITE NITROGEN (NO_2), AS N-N-mg/l	-0.123	-	-
NITROGEN, AMMONIA (AS N)-N-mg/l	0.253	-	-
ORTHO-PHOSPHATE-N-mg/l	0.694	-	-
pH, LAB-N-ph units	0.161	-	-
PHOSPHORUS-N-mg/l	0.073	-	-
POTASSIUM-T-mg/l	-0.625	No WQG	No - parameter included in
SELENIUM-T-ug/l	-0.628	No	Yes
SILICON-T-mg/l	0.223	-	-
SILVER-T-mg/l	-0.102	-	-
SODIUM-T-mg/l	-0.241	-	-
STRONTIUM-T-mg/l	-0.318	-	-
SULFATE (AS SO_4)-D-mg/l	-0.679	No	Yes
THALLIUM-T-mg/l	0.029	-	-
TIN-T-mg/l	-0.102	-	-
TITANIUM-T-mg/l	0.084	-	-
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-0.749	No WQG	Yes
TOTAL KJELDAHL NITROGEN-N-mg/l	-0.409	-	-
TOTAL ORGANIC CARBON-T-mg/l	0.402	-	-
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	0.055	-	-
TURBIDITY, LAB-N-ntu	0.153	-	-
URANIUM-T-mg/l	-0.709	No	-
VANADIUM-T-mg/l	0.074	-	-
ZINC-T-mg/l	0.211	-	-
PCA_Factor1	-0.343	-	-

Notes:

1) Statistical significance is based on one-tailed comparisons. Significant negative correlations ($\alpha < 0.05$; $rs < -0.503$) are highlighted.

2) Concentrations of parameters with significant rank order correlations were screeened against chronic BC WQGs in Table D-11.

3) Parameters were retained for graphical analysis if they met one of the following conditions: 1) order constituent, 2) significant negative correlation and concentration was greater than the chronic BC WQG, or 3) significant negative correlation and there is no chronic BC WQG.

BC = British Columbia; WQG = Water Quality Guideline; EVWQP = Elk Valley Water Quality Plan; TDS = total dissolved solids; % = percent; $CaCO_3$ = calcium carbonate; "-D-" = dissolved concentration; mg/l = milligrams per litre; "-T-" = total concentration; ug/l = micrograms per litre.

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q1	Q1	Q2
Test Species			C. dubia	C. dubia	C. dubia
Sample ID			FR_FRCP1	CM_MC2	FR_FRCP1
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		2.20	< 1.0	< 1.0
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		254	199	147
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	7.00	< 1.0
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	< 1.0
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		254	206	147
ALUMINUM-D-mg/l	0.05	1	< 0.0030	< 0.0030	< 0.0030
ALUMINUM-T-mg/l	-		< 0.0030	0.0122	0.106
ANTIMONY-D-mg/l	-		0.00027	0.00018	0.00018
ANTIMONY-T-mg/l	0.009	Working	0.00030	0.00018	0.00025
ARSENIC-D-mg/l	-		< 0.00010	0.00015	< 0.00010
ARSENIC-T-mg/l	0.005		0.00010	0.00021	0.00016
BARIUM-D-mg/l	-		0.0747	0.0771	0.0645
BARIUM-T-mg/l	1	Working	0.0745	0.0754	0.0676
BERYLLIUM-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010
BERYLLIUM-T-mg/l	0.00013	Working	< 0.00010	< 0.00010	< 0.00010
BISMUTH-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050
BISMUTH-T-mg/l	-		< 0.000050	< 0.000050	< 0.000050
BORON-D-mg/l	-		0.010	0.026	< 0.010
BORON-T-mg/l	1.2		0.011	0.026	< 0.010
BROMIDE-D-mg/l	-		< 0.50	< 0.25	< 0.050
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000363	0.0000164	0.0000305
CADMIUM-T-mg/l	-		0.0000482	0.0000181	0.0000516
CALCIUM-D-mg/l	-		221	117	70.9
CALCIUM-T-mg/l	-		221	117	73.2
CARBON, DISSOLVED ORGANIC-D-mg/l	-		0.80	0.58	2.03
CHLORIDE-D-mg/l	150		3.50	4.90	0.51
CHROMIUM-D-mg/l	-		< 0.00010	0.00018	0.00010
CHROMIUM-T-mg/l	0.001	3, Working	< 0.00010	< 0.00030	0.00027
COBALT-D-mg/l	-		< 0.00010	0.00072	< 0.00010
COBALT-T-mg/l	0.004		< 0.00010	0.00081	0.00011
CONDUCTIVITY, LAB-N-us/cm	-		1720	927	555
COPPER-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050
COPPER-T-mg/l	0.01	4	< 0.00050	< 0.00050	0.00054
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	< 0.20	0.14	0.196
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		1120	500	305
IRON-D-mg/l	0.35		< 0.010	< 0.010	< 0.010
IRON-T-mg/l	1		< 0.020	0.011	0.131
LEAD-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050
LEAD-T-mg/l	0.01 - 0.02	6	< 0.000050	< 0.000050	0.000099
LITHIUM-D-mg/l	-		0.058	0.0138	0.016
LITHIUM-T-mg/l	-		0.0585	0.0139	0.0175
MAGNESIUM-D-mg/l	-		137	50.4	31.0
MAGNESIUM-T-mg/l	-		142	51.9	32.0
MAJOR ANION SUM-N-meq/l	-		23.1	10.5	5.91
MAJOR CATION SUM-N-meq/l	-		22.5	10.5	6.16
MANGANESE-D-mg/l	-		0.00675	0.00454	0.00282
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00749	0.00523	0.00973
MERCURY-D-mg/l	-		< 0.0000050	< 0.0000050	< 0.0000050
MERCURY-T-mg/l	0.00002	8	< 0.00000050	< 0.0000050	0.00000121
MOLYBDENUM-D-mg/l	-		0.00174	0.000996	0.00119
MOLYBDENUM-T-mg/l	1		0.00176	0.000997	0.00126
NICKEL-D-mg/l	-		0.0129	0.00935	0.00214
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.0133	0.00979	0.00296
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	27.9	2.94	7.35
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	< 0.010	0.0124	0.0033
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	< 0.0050	< 0.0050	0.0086
ORTHO-PHOSPHATE-N-mg/l	-		< 0.0010	< 0.0010	0.0029
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		309	500	324
pH, LAB-N-ph units	6.5 - 9		8.22	8.33	8.32
PHOSPHORUS-N-mg/l	-		< 0.0020	< 0.0020	0.0128
POTASSIUM-D-mg/l	-		2.51	1.48	1.21
POTASSIUM-T-mg/l	-		2.52	1.58	1.18
SELENIUM-D-ug/l	-		214	5.36	31.9
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	209	5.76	31.6
SILICON-D-mg/l	-		2.06	2.22	1.71
SILICON-T-mg/l	-		2.09	2.30	1.95
SILVER-D-mg/l	-		< 0.000010	< 0.000010	< 0.000010
SILVER-T-mg/l	0.002	13	< 0.000010	< 0.000010	< 0.000010
SODIUM-D-mg/l	-		2.16	12.0	1.02
SODIUM-T-mg/l	-		2.18	13.0	1.13
STRONTIUM-D-mg/l	-		0.202	0.329	0.0972
STRONTIUM-T-mg/l	-		0.204	0.32	0.103
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	765	291	116
THALLIUM-D-mg/l	-		0.000016	0.000010	< 0.000010
THALLIUM-T-mg/l	0.0008	Working	0.000015	0.000018	0.000013
TIN-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010
TIN-T-mg/l	-		< 0.00010	< 0.00010	< 0.00010
TITANIUM-D-mg/l	-		0.021	< 0.010	< 0.010
TITANIUM-T-mg/l	-		0.021	< 0.010	< 0.010
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		1520	639	354
TOTAL KJELDAHL NITROGEN-N-mg/l	-		< 0.050	0.095	0.212
TOTAL ORGANIC CARBON-T-mg/l	-		0.95	0.69	2.85
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		< 1.0	< 1.0	7.10
TURBIDITY, LAB-N-ntu	*		0.28	0.57	1.45
URANIUM-D-mg/l	-		0.00793	0.00262	0.00156
URANIUM-T-mg/l	0.0085		0.00797	0.00244	0.00169
VANADIUM-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050
VANADIUM-T-mg/l	-		< 0.00050	< 0.00050	0.00061
ZINC-D-mg/l	-		< 0.0030	< 0.0030	< 0.0030
ZINC-T-mg/l	0.046 - 0.78	14	< 0.0030	< 0.0030	0.0033

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q2	Q2	Q2
Test Species			C. dubia	C. dubia	C. dubia
Sample ID			GH_FR1	GH_ERC	EV_MC2
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		< 1.0	< 1.0	1.40
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		160	146	98.0
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	< 1.0
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	< 1.0
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		160	146	98.0
ALUMINUM-D-mg/l	0.05	1	< 0.0030	0.0045	0.0176
ALUMINUM-T-mg/l	-		0.0895	0.305	0.419
ANTIMONY-D-mg/l	-		0.00017	< 0.00010	< 0.00010
ANTIMONY-T-mg/l	0.009	Working	0.00023	0.00011	0.00020
ARSENIC-D-mg/l	-		0.00011	< 0.00010	0.00017
ARSENIC-T-mg/l	0.005		0.00017	0.00030	0.00037
BARIUM-D-mg/l	-		0.0792	0.0506	0.0579
BARIUM-T-mg/l	1	Working	0.0779	0.0525	0.0629
BERYLLIUM-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010
BERYLLIUM-T-mg/l	0.00013	Working	< 0.00010	< 0.00010	< 0.00010
BISMUTH-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050
BISMUTH-T-mg/l	-		< 0.000050	< 0.000050	< 0.000050
BORON-D-mg/l	-		< 0.010	< 0.010	< 0.010
BORON-T-mg/l	1.2		< 0.010	< 0.010	< 0.010
BROMIDE-D-mg/l	-		< 0.050	< 0.050	< 0.050
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000245	0.0000108	0.0000376
CADMIUM-T-mg/l	-		0.0000352	0.0000348	0.0000783
CALCIUM-D-mg/l	-		73.5	52.9	37.6
CALCIUM-T-mg/l	-		71.2	52.5	36.9
CARBON, DISSOLVED ORGANIC-D-mg/l	-		1.95	1.32	2.58
CHLORIDE-D-mg/l	150		0.99	0.79	1.24
CHROMIUM-D-mg/l	-		< 0.00010	0.00019	0.00014
CHROMIUM-T-mg/l	0.001	3, Working	0.00029	0.00085	0.00076
COBALT-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010
COBALT-T-mg/l	0.004		< 0.00010	0.00015	0.00027
CONDUCTIVITY, LAB-N-us/cm	-		573	342	266
COPPER-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050
COPPER-T-mg/l	0.01	4	< 0.00050	0.00065	0.0010
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.182	0.156	0.111
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		312	185	141
IRON-D-mg/l	0.35		< 0.010	< 0.010	0.012
IRON-T-mg/l	1		0.127	0.375	0.462
LEAD-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050
LEAD-T-mg/l	0.01 - 0.02	6	0.000096	0.000221	0.000386
LITHIUM-D-mg/l	-		0.0117	0.0021	0.0052
LITHIUM-T-mg/l	-		0.0116	0.0025	0.0056
MAGNESIUM-D-mg/l	-		31.3	12.8	11.5
MAGNESIUM-T-mg/l	-		31.0	12.8	11.4
MAJOR ANION SUM-N-meq/l	-		6.21	3.66	2.81
MAJOR CATION SUM-N-meq/l	-		6.33	3.75	2.92
MANGANESE-D-mg/l	-		0.00152	0.00133	0.00014
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00559	0.0179	0.0127
MERCURY-D-mg/l	-		< 0.0000050	< 0.0000050	0.00000152
MERCURY-T-mg/l	0.00002	8	0.00000251	0.00000157	0.00000177
MOLYBDENUM-D-mg/l	-		0.00104	0.000908	0.000643
MOLYBDENUM-T-mg/l	1		0.00104	0.000921	0.000693
NICKEL-D-mg/l	-		0.00191	< 0.00050	0.00137
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.00221	0.00067	0.00221
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	6.45	0.411	0.776
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	0.0025	< 0.0010	< 0.0010
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	< 0.0050	< 0.0050	< 0.0050
ORTHO-PHOSPHATE-N-mg/l	-		0.0020	< 0.0010	0.0133
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		337	337	312
pH, LAB-N-ph units	6.5 - 9		8.32	8.26	8.11
PHOSPHORUS-N-mg/l	-		0.0128	0.0274	0.039
POTASSIUM-D-mg/l	-		1.08	0.409	0.547
POTASSIUM-T-mg/l	-		1.09	0.548	0.644
SELENIUM-D-ug/l	-		27.8	2.30	3.58
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	29.0	1.98	3.31
SILICON-D-mg/l	-		2.01	1.87	2.02
SILICON-T-mg/l	-		2.10	2.35	2.78
SILVER-D-mg/l	-		< 0.000010	< 0.000010	< 0.000010
SILVER-T-mg/l	0.002	13	< 0.000010	< 0.000010	0.000017
SODIUM-D-mg/l	-		1.41	0.952	1.81
SODIUM-T-mg/l	-		1.38	0.936	1.69
STRONTIUM-D-mg/l	-		0.105	0.208	0.0876
STRONTIUM-T-mg/l	-		0.104	0.203	0.0917
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	121	33.2	36.4
THALLIUM-D-mg/l	-		< 0.000010	< 0.000010	< 0.000010
THALLIUM-T-mg/l	0.0008	Working	< 0.000010	0.000014	0.000023
TIN-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010
TIN-T-mg/l	-		< 0.00010	< 0.00010	< 0.00010
TITANIUM-D-mg/l	-		< 0.010	< 0.010	< 0.010
TITANIUM-T-mg/l	-		< 0.010	< 0.010	0.015
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		366	191	165
TOTAL KJELDAHL NITROGEN-N-mg/l	-		0.204	0.191	0.202
TOTAL ORGANIC CARBON-T-mg/l	-		2.02	2.15	3.28
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		7.10	22.7	24.9
TURBIDITY, LAB-N-ntu	*		2.98	5.70	10.8
URANIUM-D-mg/l	-		0.00153	0.000846	0.000515
URANIUM-T-mg/l	0.0085		0.00148	0.000845	0.000576
VANADIUM-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050
VANADIUM-T-mg/l	-		0.00060	0.00143	0.00192
ZINC-D-mg/l	-		< 0.0030	< 0.0030	< 0.0030
ZINC-T-mg/l	0.046 - 0.78	14	< 0.0030	0.0035	0.0047

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q2	Q2	Q2	Q3
Test Species			C. dubia	C. dubia	C. dubia	C. dubia
Sample ID			EV_HC1	CM_MC2	LC_LCDSSLCC	FR_FRCP1
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		< 1.0	1.10	< 1.0	< 1.0
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		173	152	153	193
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		6.00	< 1.0	< 1.0	4.80
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	< 1.0	< 1.0
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		179	152	153	198
ALUMINUM-D-mg/l	0.05	1	0.0046	0.0076	< 0.0030	< 0.0030
ALUMINUM-T-mg/l	-		0.151	0.344	0.0288	0.0144
ANTIMONY-D-mg/l	-		< 0.00010	0.00014	0.00024	0.00020
ANTIMONY-T-mg/l	0.009	Working	0.00013	0.00015	0.00033	0.00022
ARSENIC-D-mg/l	-		0.00013	0.00017	0.00012	< 0.00010
ARSENIC-T-mg/l	0.005		0.00024	0.00029	0.00015	0.00012
BARIUM-D-mg/l	-		0.0379	0.050	0.0369	0.071
BARIUM-T-mg/l	1	Working	0.0402	0.0518	0.0384	0.0727
BERYLLIUM-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.000020
BERYLLIUM-T-mg/l	0.00013	Working	< 0.00010	< 0.00010	< 0.00010	< 0.000020
BISMUTH-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
BISMUTH-T-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
BORON-D-mg/l	-		< 0.010	0.016	< 0.010	< 0.010
BORON-T-mg/l	1.2		< 0.010	0.017	0.011	0.011
BROMIDE-D-mg/l	-		< 0.050	< 0.050	< 0.050	< 0.25
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000268	0.0000692	0.000199	0.0000242
CADMIUM-T-mg/l	-		0.000047	0.00011	0.000221	0.000042
CALCIUM-D-mg/l	-		69.5	68.7	71.1	101
CALCIUM-T-mg/l	-		71.6	67.1	72.1	103
CARBON, DISSOLVED ORGANIC-D-mg/l	-		1.94	1.93	1.55	0.99
CHLORIDE-D-mg/l	150		0.79	1.50	2.83	1.47
CHROMIUM-D-mg/l	-		0.00011	0.00016	0.00014	< 0.00010
CHROMIUM-T-mg/l	0.001	3, Working	0.00031	0.00058	0.00021	0.00012
COBALT-D-mg/l	-		< 0.00010	0.00077	< 0.00010	< 0.00010
COBALT-T-mg/l	0.004		< 0.00010	0.00126	< 0.00010	< 0.00010
CONDUCTIVITY, LAB-N-us/cm	-		547	549	557	874
COPPER-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050	< 0.00050
COPPER-T-mg/l	0.01	4	< 0.00050	0.00079	< 0.00050	< 0.00050
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.186	0.104	0.217	0.22
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		306	283	293	455
IRON-D-mg/l	0.35		< 0.010	< 0.010	< 0.010	< 0.010
IRON-T-mg/l	1		0.143	0.387	0.027	0.032
LEAD-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
LEAD-T-mg/l	0.01 - 0.02	6	0.000095	0.000212	< 0.000050	< 0.000050
LITHIUM-D-mg/l	-		0.0064	0.0083	0.0233	0.0322
LITHIUM-T-mg/l	-		0.0068	0.0085	0.0239	0.032
MAGNESIUM-D-mg/l	-		32.3	27.0	28.1	49.1
MAGNESIUM-T-mg/l	-		33.2	26.1	28.4	48.0
MAJOR ANION SUM-N-meq/l	-		6.16	5.96	5.88	10.0
MAJOR CATION SUM-N-meq/l	-		6.20	5.92	6.04	9.20
MANGANESE-D-mg/l	-		0.00048	0.00623	0.00155	0.00446
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00365	0.0194	0.00325	0.00736
MERCURY-D-mg/l	-		0.00000062	< 0.0000050	< 0.0000050	< 0.0000050
MERCURY-T-mg/l	0.00002	8	0.00000077	0.00000108	0.00000069	< 0.00000050
MOLYBDENUM-D-mg/l	-		0.000741	0.000762	0.00136	0.00126
MOLYBDENUM-T-mg/l	1		0.000774	0.000741	0.0014	0.00127
NICKEL-D-mg/l	-		0.00097	0.0105	0.00453	0.00485
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.00123	0.0113	0.00482	0.00516
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	0.818	1.97	6.33	11.9
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	< 0.0010	0.0037	< 0.0010	< 0.0050
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	< 0.0050	0.0074	< 0.0050	< 0.0050
ORTHO-PHOSPHATE-N-mg/l	-		0.0054	0.0028	< 0.0010	0.0011
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		323	345	362	365
pH, LAB-N-ph units	6.5 - 9		8.31	8.20	8.30	8.38
PHOSPHORUS-N-mg/l	-		0.0102	0.0215	0.0027	0.0027
POTASSIUM-D-mg/l	-		0.783	1.04	0.944	1.53
POTASSIUM-T-mg/l	-		0.867	1.10	0.989	1.59
SELENIUM-D-ug/l	-		30.5	6.20	17.5	53.6
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	31.0	5.74	18.5	56.4
SILICON-D-mg/l	-		1.88	2.10	1.99	1.77
SILICON-T-mg/l	-		2.16	2.59	2.07	1.94
SILVER-D-mg/l	-		< 0.000010	< 0.000010	< 0.000010	< 0.000010
SILVER-T-mg/l	0.002	13	< 0.000010	< 0.000010	< 0.000010	< 0.000010
SODIUM-D-mg/l	-		1.31	5.57	3.42	1.50
SODIUM-T-mg/l	-		1.34	5.47	3.62	1.60
STRONTIUM-D-mg/l	-		0.0963	0.183	0.13	0.14
STRONTIUM-T-mg/l	-		0.0994	0.176	0.134	0.142
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	120	131	110	249
THALLIUM-D-mg/l	-		< 0.000010	0.000010	0.000010	< 0.000010
THALLIUM-T-mg/l	0.0008	Working	0.000014	0.000020	< 0.000010	< 0.000010
TIN-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
TIN-T-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
TITANIUM-D-mg/l	-		0.013	< 0.010	0.011	< 0.010
TITANIUM-T-mg/l	-		0.015	0.012	0.012	< 0.010
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		378	401	352	611
TOTAL KJELDAHL NITROGEN-N-mg/l	-		0.187	0.20	0.184	0.173
TOTAL ORGANIC CARBON-T-mg/l	-		2.51	2.23	1.81	1.31
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		5.90	14.5	< 1.0	1.40
TURBIDITY, LAB-N-ntu	*		3.14	6.51	0.94	0.36
URANIUM-D-mg/l	-		0.00195	0.00132	0.00224	0.00302
URANIUM-T-mg/l	0.0085		0.00208	0.0012	0.00228	0.00299
VANADIUM-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050	< 0.00050
VANADIUM-T-mg/l	-		0.00077	0.00085	< 0.00050	< 0.00050
ZINC-D-mg/l	-		< 0.0030	0.0076	0.0089	< 0.0030
ZINC-T-mg/l	0.046 - 0.78	14	< 0.0030	0.013	0.0101	< 0.0030

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q3	Q4	Q4	Q4
Test Species			C. dubia	C. dubia	C. dubia	C. dubia
Sample ID			CM_MC2	FR_FRCP1	EV_MC2	CM_MC2
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		< 1.0	< 1.0	1.10	< 1.0
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		193	190	122	165
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		8.80	3.40	< 1.0	< 1.0
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	< 1.0	< 1.0
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		201	193	122	165
ALUMINUM-D-mg/l	0.05	1	< 0.0030	0.0046	0.0234	0.0088
ALUMINUM-T-mg/l	-		0.0053	0.0148	0.225	0.149
ANTIMONY-D-mg/l	-		0.00019	0.00019	< 0.00010	0.00014
ANTIMONY-T-mg/l	0.009	Working	0.00025	0.00020	0.00011	0.00016
ARSENIC-D-mg/l	-		0.00019	< 0.00010	0.00019	0.00017
ARSENIC-T-mg/l	0.005		0.00020	0.00018	0.00027	0.00026
BARIUM-D-mg/l	-		0.077	0.0718	0.0737	0.054
BARIUM-T-mg/l	1	Working	0.0754	0.0673	0.0812	0.0566
BERYLLIUM-D-mg/l	-		< 0.000020	< 0.000020	< 0.000020	< 0.000020
BERYLLIUM-T-mg/l	0.00013	Working	< 0.000020	< 0.000020	< 0.000020	< 0.000020
BISMUTH-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
BISMUTH-T-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
BORON-D-mg/l	-		0.028	< 0.010	< 0.010	0.018
BORON-T-mg/l	1.2		0.029	< 0.010	< 0.010	0.020
BROMIDE-D-mg/l	-		< 0.25	< 0.25	< 0.050	< 0.050
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000075	0.0000449	0.0000252	0.0000129
CADMIUM-T-mg/l	-		0.0000086	0.0000505	0.0000387	0.0000162
CALCIUM-D-mg/l	-		101	104	45.3	79.4
CALCIUM-T-mg/l	-		105	96.8	47.5	79.2
CARBON, DISSOLVED ORGANIC-D-mg/l	-		0.99	0.90	2.84	2.31
CHLORIDE-D-mg/l	150		3.37	1.25	2.85	2.10
CHROMIUM-D-mg/l	-		0.00011	< 0.00010	0.00012	0.00017
CHROMIUM-T-mg/l	0.001	3, Working	0.00018	0.00015	0.00045	0.00035
COBALT-D-mg/l	-		0.00026	< 0.00010	< 0.00010	0.00065
COBALT-T-mg/l	0.004		0.00034	< 0.00010	0.00013	0.00108
CONDUCTIVITY, LAB-N-us/cm	-		901	810	359	622
COPPER-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050	< 0.00050
COPPER-T-mg/l	0.01	4	< 0.00050	< 0.00050	0.00065	< 0.00050
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.12	0.19	0.12	0.107
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		465	453	177	328
IRON-D-mg/l	0.35		< 0.010	< 0.010	0.023	< 0.010
IRON-T-mg/l	1		< 0.010	0.027	0.163	0.148
LEAD-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
LEAD-T-mg/l	0.01 - 0.02	6	< 0.000050	< 0.000050	0.000117	0.000098
LITHIUM-D-mg/l	-		0.0161	0.0291	0.0064	0.010
LITHIUM-T-mg/l	-		0.0171	0.0303	0.0068	0.0103
MAGNESIUM-D-mg/l	-		51.6	46.8	15.6	31.5
MAGNESIUM-T-mg/l	-		52.5	45.0	16.7	32.7
MAJOR ANION SUM-N-meq/l	-		10.1	9.73	3.92	7.19
MAJOR CATION SUM-N-meq/l	-		9.81	9.16	3.67	6.86
MANGANESE-D-mg/l	-		0.00052	0.00634	0.00101	0.00623
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00131	0.00829	0.00435	0.0136
MERCURY-D-mg/l	-		< 0.0000050	< 0.0000050	0.00000163	< 0.0000050
MERCURY-T-mg/l	0.00002	8	< 0.00000050	< 0.0000005	0.00000246	0.00000124
MOLYBDENUM-D-mg/l	-		0.00112	0.00124	0.000599	0.000966
MOLYBDENUM-T-mg/l	1		0.00117	0.00124	0.000651	0.000979
NICKEL-D-mg/l	-		0.0119	0.00445	0.00078	0.00732
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.0127	0.00468	0.00116	0.00831
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	2.67	10.0	1.24	1.82
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	< 0.0050	< 0.0050	0.0010	0.010
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	< 0.0050	< 0.0050	< 0.0050	0.0076
ORTHO-PHOSPHATE-N-mg/l	-		< 0.0010	< 0.0010	0.0081	0.0016
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		385	344	281	339
pH, LAB-N-ph units	6.5 - 9		8.39	8.38	8.17	8.33
PHOSPHORUS-N-mg/l	-		< 0.0020	< 0.0020	0.0142	0.0063
POTASSIUM-D-mg/l	-		1.76	1.48	0.633	1.22
POTASSIUM-T-mg/l	-		1.73	1.44	0.748	1.26
SELENIUM-D-ug/l	-		5.94	54.2	5.41	4.11
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	5.95	51.3	5.97	4.41
SILICON-D-mg/l	-		1.76	1.71	2.09	2.00
SILICON-T-mg/l	-		1.77	1.73	2.55	2.40
SILVER-D-mg/l	-		< 0.000010	< 0.000010	< 0.000010	< 0.000010
SILVER-T-mg/l	0.002	13	< 0.000010	< 0.000010	< 0.000010	< 0.000010
SODIUM-D-mg/l	-		11.0	1.41	2.50	6.42
SODIUM-T-mg/l	-		11.2	1.49	2.71	6.70
STRONTIUM-D-mg/l	-		0.322	0.139	0.11	0.221
STRONTIUM-T-mg/l	-		0.34	0.139	0.115	0.222
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	277	245	63.1	178
THALLIUM-D-mg/l	-		0.000017	< 0.000010	< 0.000010	0.000010
THALLIUM-T-mg/l	0.0008	Working	0.000014	< 0.000010	0.000015	0.000017
TIN-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
TIN-T-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
TITANIUM-D-mg/l	-		< 0.010	< 0.010	< 0.010	< 0.010
TITANIUM-T-mg/l	-		< 0.010	< 0.010	< 0.010	< 0.010
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		644	608	228	451
TOTAL KJELDAHL NITROGEN-N-mg/l	-		0.134	0.143	0.204	0.149
TOTAL ORGANIC CARBON-T-mg/l	-		1.15	1.14	3.37	2.42
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		1.50	< 1.0	6.80	9.10
TURBIDITY, LAB-N-ntu	*		0.37	0.84	5.46	3.75
URANIUM-D-mg/l	-		0.0026	0.00295	0.000621	0.00171
URANIUM-T-mg/l	0.0085		0.0027	0.00298	0.000659	0.00174
VANADIUM-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050	< 0.00050
VANADIUM-T-mg/l	-		< 0.00050	< 0.00050	0.00109	< 0.00050
ZINC-D-mg/l	-		< 0.0030	< 0.0030	< 0.0030	< 0.0030
ZINC-T-mg/l	0.046 - 0.78	14	< 0.0030	< 0.0030	< 0.0030	< 0.0030

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q1	Q1	Q1	Q1
Test Species			P. subcapitata	P. subcapitata	P. subcapitata	P. subcapitata
Sample ID			FR_FRCP1	GH_FR1	EV_HC1	CM_MC2
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		2.20	< 1.0	< 1.0	< 1.0
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		254	190	191	199
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	< 1.0	7.00
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	< 1.0	< 1.0
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		254	190	191	206
ALUMINUM-D-mg/l	0.05	1	< 0.0030	< 0.0030	< 0.0030	< 0.0030
ALUMINUM-T-mg/l	-		< 0.0030	0.0040	0.0096	0.0122
ANTIMONY-D-mg/l	-		0.00027	0.00012	< 0.00010	0.00018
ANTIMONY-T-mg/l	0.009	Working	0.00030	0.00014	< 0.00010	0.00018
ARSENIC-D-mg/l	-		< 0.00010	< 0.00010	0.00015	0.00015
ARSENIC-T-mg/l	0.005		0.00010	< 0.00010	0.00016	0.00021
BARIUM-D-mg/l	-		0.0747	0.118	0.0672	0.0771
BARIUM-T-mg/l	1	Working	0.0745	0.111	0.0654	0.0754
BERYLLIUM-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
BERYLLIUM-T-mg/l	0.00013	Working	< 0.00010	< 0.00010	< 0.00010	< 0.00010
BISMUTH-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
BISMUTH-T-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
BORON-D-mg/l	-		0.010	< 0.010	< 0.010	0.026
BORON-T-mg/l	1.2		0.011	< 0.010	< 0.010	0.026
BROMIDE-D-mg/l	-		< 0.50	< 0.25	< 0.25	< 0.25
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000363	0.0000144	0.0000173	0.0000164
CADMIUM-T-mg/l	-		0.0000482	0.0000175	0.0000186	0.0000181
CALCIUM-D-mg/l	-		221	119	96.0	117
CALCIUM-T-mg/l	-		221	119	94.6	117
CARBON, DISSOLVED ORGANIC-D-mg/l	-		0.80	0.51	0.65	0.58
CHLORIDE-D-mg/l	150		3.50	2.50	2.10	4.90
CHROMIUM-D-mg/l	-		< 0.00010	0.00012	0.00016	0.00018
CHROMIUM-T-mg/l	0.001	3, Working	< 0.00010	0.00013	< 0.00020	< 0.00030
COBALT-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010	0.00072
COBALT-T-mg/l	0.004		< 0.00010	< 0.00010	< 0.00010	0.00081
CONDUCTIVITY, LAB-N-us/cm	-		1720	885	745	927
COPPER-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050	< 0.00050
COPPER-T-mg/l	0.01	4	< 0.00050	< 0.00050	< 0.00050	< 0.00050
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	< 0.20	0.18	0.21	0.14
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		1120	507	443	500
IRON-D-mg/l	0.35		< 0.010	< 0.010	< 0.010	< 0.010
IRON-T-mg/l	1		< 0.020	< 0.010	< 0.020	0.011
LEAD-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
LEAD-T-mg/l	0.01 - 0.02	6	< 0.000050	< 0.000050	< 0.000050	< 0.000050
LITHIUM-D-mg/l	-		0.058	0.0145	0.0066	0.0138
LITHIUM-T-mg/l	-		0.0585	0.0144	0.0065	0.0139
MAGNESIUM-D-mg/l	-		137	50.8	49.4	50.4
MAGNESIUM-T-mg/l	-		142	52.4	50.7	51.9
MAJOR ANION SUM-N-meq/l	-		23.1	9.93	8.60	10.5
MAJOR CATION SUM-N-meq/l	-		22.5	10.3	8.95	10.5
MANGANESE-D-mg/l	-		0.00675	0.00103	0.00127	0.00454
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00749	0.00115	0.00159	0.00523
MERCURY-D-mg/l	-		< 0.0000050	< 0.0000050	< 0.00000050	< 0.0000050
MERCURY-T-mg/l	0.00002	8	< 0.00000050	< 0.0000050	< 0.00000050	< 0.0000050
MOLYBDENUM-D-mg/l	-		0.00174	0.000835	0.000917	0.000996
MOLYBDENUM-T-mg/l	1		0.00176	0.000856	0.000924	0.000997
NICKEL-D-mg/l	-		0.0129	0.00137	0.00062	0.00935
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.0133	0.00143	< 0.0010	0.00979
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	27.9	12.7	1.20	2.94
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	< 0.010	< 0.0050	< 0.0050	0.0124
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	< 0.0050	< 0.0050	< 0.0050	< 0.0050
ORTHO-PHOSPHATE-N-mg/l	-		< 0.0010	< 0.0010	0.0041	< 0.0010
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		309	304	294	500
pH, LAB-N-ph units	6.5 - 9		8.22	8.26	8.31	8.33
PHOSPHORUS-N-mg/l	-		< 0.0020	< 0.0020	0.0045	< 0.0020
POTASSIUM-D-mg/l	-		2.51	1.16	0.87	1.48
POTASSIUM-T-mg/l	-		2.52	1.05	0.861	1.58
SELENIUM-D-ug/l	-		214	52.0	40.4	5.36
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	209	50.0	36.7	5.76
SILICON-D-mg/l	-		2.06	2.15	1.99	2.22
SILICON-T-mg/l	-		2.09	2.19	1.99	2.30
SILVER-D-mg/l	-		< 0.000010	< 0.000010	< 0.000010	< 0.000010
SILVER-T-mg/l	0.002	13	< 0.000010	< 0.000010	< 0.000010	< 0.000010
SODIUM-D-mg/l	-		2.16	2.22	1.74	12.0
SODIUM-T-mg/l	-		2.18	2.07	1.71	13.0
STRONTIUM-D-mg/l	-		0.202	0.155	0.129	0.329
STRONTIUM-T-mg/l	-		0.204	0.155	0.131	0.32
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	765	247	222	291
THALLIUM-D-mg/l	-		0.000016	< 0.000010	< 0.000010	0.000010
THALLIUM-T-mg/l	0.0008	Working	0.000015	< 0.000010	< 0.000010	0.000018
TIN-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
TIN-T-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
TITANIUM-D-mg/l	-		0.021	0.017	0.015	< 0.010
TITANIUM-T-mg/l	-		0.021	0.017	0.015	< 0.010
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		1520	622	504	639
TOTAL KJELDAHL NITROGEN-N-mg/l	-		< 0.050	< 0.050	0.081	0.095
TOTAL ORGANIC CARBON-T-mg/l	-		0.95	0.71	1.04	0.69
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		< 1.0	< 1.0	< 1.0	< 1.0
TURBIDITY, LAB-N-ntu	*		0.28	0.35	0.25	0.57
URANIUM-D-mg/l	-		0.00793	0.00219	0.00274	0.00262
URANIUM-T-mg/l	0.0085		0.00797	0.00223	0.00277	0.00244
VANADIUM-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050	< 0.00050
VANADIUM-T-mg/l	-		< 0.00050	< 0.00050	< 0.00050	< 0.00050
ZINC-D-mg/l	-		< 0.0030	< 0.0030	< 0.0030	< 0.0030
ZINC-T-mg/l	0.046 - 0.78	14	< 0.0030	< 0.0030	< 0.0030	< 0.0030

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q2	Q2	Q2	Q2
Test Species			P. subcapitata	P. subcapitata	P. subcapitata	P. subcapitata
Sample ID			FR_FRCP1	GH_FR1	CM_MC2	LC_LCDSSLCC
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		< 1.0	< 1.0	1.10	< 1.0
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		147	160	152	153
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	< 1.0	< 1.0
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	< 1.0	< 1.0
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		147	160	152	153
ALUMINUM-D-mg/l	0.05	1	< 0.0030	< 0.0030	0.0076	< 0.0030
ALUMINUM-T-mg/l	-		0.106	0.0895	0.344	0.0288
ANTIMONY-D-mg/l	-		0.00018	0.00017	0.00014	0.00024
ANTIMONY-T-mg/l	0.009	Working	0.00025	0.00023	0.00015	0.00033
ARSENIC-D-mg/l	-		< 0.00010	0.00011	0.00017	0.00012
ARSENIC-T-mg/l	0.005		0.00016	0.00017	0.00029	0.00015
BARIUM-D-mg/l	-		0.0645	0.0792	0.050	0.0369
BARIUM-T-mg/l	1	Working	0.0676	0.0779	0.0518	0.0384
BERYLLIUM-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
BERYLLIUM-T-mg/l	0.00013	Working	< 0.00010	< 0.00010	< 0.00010	< 0.00010
BISMUTH-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
BISMUTH-T-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
BORON-D-mg/l	-		< 0.010	< 0.010	0.016	< 0.010
BORON-T-mg/l	1.2		< 0.010	< 0.010	0.017	0.011
BROMIDE-D-mg/l	-		< 0.050	< 0.050	< 0.050	< 0.050
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000305	0.0000245	0.0000692	0.000199
CADMIUM-T-mg/l	-		0.0000516	0.0000352	0.00011	0.000221
CALCIUM-D-mg/l	-		70.9	73.5	68.7	71.1
CALCIUM-T-mg/l	-		73.2	71.2	67.1	72.1
CARBON, DISSOLVED ORGANIC-D-mg/l	-		2.03	1.95	1.93	1.55
CHLORIDE-D-mg/l	150		0.51	0.99	1.50	2.83
CHROMIUM-D-mg/l	-		0.00010	< 0.00010	0.00016	0.00014
CHROMIUM-T-mg/l	0.001	3, Working	0.00027	0.00029	0.00058	0.00021
COBALT-D-mg/l	-		< 0.00010	< 0.00010	0.00077	< 0.00010
COBALT-T-mg/l	0.004		0.00011	< 0.00010	0.00126	< 0.00010
CONDUCTIVITY, LAB-N-us/cm	-		555	573	549	557
COPPER-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050	< 0.00050
COPPER-T-mg/l	0.01	4	0.00054	< 0.00050	0.00079	< 0.00050
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.196	0.182	0.104	0.217
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		305	312	283	293
IRON-D-mg/l	0.35		< 0.010	< 0.010	< 0.010	< 0.010
IRON-T-mg/l	1		0.131	0.127	0.387	0.027
LEAD-D-mg/l	-		< 0.000050	< 0.000050	< 0.000050	< 0.000050
LEAD-T-mg/l	0.01 - 0.02	6	0.000099	0.000096	0.000212	< 0.000050
LITHIUM-D-mg/l	-		0.016	0.0117	0.0083	0.0233
LITHIUM-T-mg/l	-		0.0175	0.0116	0.0085	0.0239
MAGNESIUM-D-mg/l	-		31.0	31.3	27.0	28.1
MAGNESIUM-T-mg/l	-		32.0	31.0	26.1	28.4
MAJOR ANION SUM-N-meq/l	-		5.91	6.21	5.96	5.88
MAJOR CATION SUM-N-meq/l	-		6.16	6.33	5.92	6.04
MANGANESE-D-mg/l	-		0.00282	0.00152	0.00623	0.00155
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00973	0.00559	0.0194	0.00325
MERCURY-D-mg/l	-		< 0.0000050	< 0.0000050	< 0.0000050	< 0.0000050
MERCURY-T-mg/l	0.00002	8	0.00000121	0.00000251	0.00000108	0.00000069
MOLYBDENUM-D-mg/l	-		0.00119	0.00104	0.000762	0.00136
MOLYBDENUM-T-mg/l	1		0.00126	0.00104	0.000741	0.0014
NICKEL-D-mg/l	-		0.00214	0.00191	0.0105	0.00453
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.00296	0.00221	0.0113	0.00482
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	7.35	6.45	1.97	6.33
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	0.0033	0.0025	0.0037	< 0.0010
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	0.0086	< 0.0050	0.0074	< 0.0050
ORTHO-PHOSPHATE-N-mg/l	-		0.0029	0.0020	0.0028	< 0.0010
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		324	337	345	362
pH, LAB-N-ph units	6.5 - 9		8.32	8.32	8.20	8.30
PHOSPHORUS-N-mg/l	-		0.0128	0.0128	0.0215	0.0027
POTASSIUM-D-mg/l	-		1.21	1.08	1.04	0.944
POTASSIUM-T-mg/l	-		1.18	1.09	1.10	0.989
SELENIUM-D-ug/l	-		31.9	27.8	6.20	17.5
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	31.6	29.0	5.74	18.5
SILICON-D-mg/l	-		1.71	2.01	2.10	1.99
SILICON-T-mg/l	-		1.95	2.10	2.59	2.07
SILVER-D-mg/l	-		< 0.000010	< 0.000010	< 0.000010	< 0.000010
SILVER-T-mg/l	0.002	13	< 0.000010	< 0.000010	< 0.000010	< 0.000010
SODIUM-D-mg/l	-		1.02	1.41	5.57	3.42
SODIUM-T-mg/l	-		1.13	1.38	5.47	3.62
STRONTIUM-D-mg/l	-		0.0972	0.105	0.183	0.13
STRONTIUM-T-mg/l	-		0.103	0.104	0.176	0.134
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	116	121	131	110
THALLIUM-D-mg/l	-		< 0.000010	< 0.000010	0.000010	0.000010
THALLIUM-T-mg/l	0.0008	Working	0.000013	< 0.000010	0.000020	< 0.000010
TIN-D-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
TIN-T-mg/l	-		< 0.00010	< 0.00010	< 0.00010	< 0.00010
TITANIUM-D-mg/l	-		< 0.010	< 0.010	< 0.010	0.011
TITANIUM-T-mg/l	-		< 0.010	< 0.010	0.012	0.012
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		354	366	401	352
TOTAL KJELDAHL NITROGEN-N-mg/l	-		0.212	0.204	0.20	0.184
TOTAL ORGANIC CARBON-T-mg/l	-		2.85	2.02	2.23	1.81
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		7.10	7.10	14.5	< 1.0
TURBIDITY, LAB-N-ntu	*		1.45	2.98	6.51	0.94
URANIUM-D-mg/l	-		0.00156	0.00153	0.00132	0.00224
URANIUM-T-mg/l	0.0085		0.00169	0.00148	0.0012	0.00228
VANADIUM-D-mg/l	-		< 0.00050	< 0.00050	< 0.00050	< 0.00050
VANADIUM-T-mg/l	-		0.00061	0.00060	0.00085	< 0.00050
ZINC-D-mg/l	-		< 0.0030	< 0.0030	0.0076	0.0089
ZINC-T-mg/l	0.046 - 0.78	14	0.0033	< 0.0030	0.013	0.0101

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q3	Q4	Q1	Q1
Test Species			P. subcapitata	P. subcapitata	H. azteca	H. azteca
Sample ID			CM_MC2	FR_FRCP1	FR_FRCP1	CM_MC2
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		< 1.0	< 1.0	1.38	<1
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		193	190	235	203
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		8.80	3.40	1.90	5.60
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		< 1.0	< 1.0	<1	<1
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		201	193	236	209
ALUMINUM-D-mg/l	0.05	1	< 0.0030	0.0046	0.00323	<0.003
ALUMINUM-T-mg/l	-		0.0053	0.0148	0.0038	0.0199
ANTIMONY-D-mg/l	-		0.00019	0.00019	0.000263	0.000208
ANTIMONY-T-mg/l	0.009	Working	0.00025	0.00020	0.000288	0.000223
ARSENIC-D-mg/l	-		0.00019	< 0.00010	<0.0001	0.00016
ARSENIC-T-mg/l	0.005		0.00020	0.00018	0.000105	0.000185
BARIUM-D-mg/l	-		0.077	0.0718	0.0833	0.0772
BARIUM-T-mg/l	1	Working	0.0754	0.0673	0.0838	0.0757
BERYLLIUM-D-mg/l	-		< 0.000020	< 0.000020	<0.0001	<0.0001
BERYLLIUM-T-mg/l	0.00013	Working	< 0.000020	< 0.000020	<0.0001	<0.0001
BISMUTH-D-mg/l	-		< 0.000050	< 0.000050	<0.00005	<0.00005
BISMUTH-T-mg/l	-		< 0.000050	< 0.000050	<0.00005	<0.00005
BORON-D-mg/l	-		0.028	< 0.010	0.011	0.0253
BORON-T-mg/l	1.2		0.029	< 0.010	0.0123	0.0268
BROMIDE-D-mg/l	-		< 0.25	< 0.25	<0.3125	<0.25
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000075	0.0000449	0.0000246	0.0000169
CADMIUM-T-mg/l	-		0.0000086	0.0000505	0.0000547	0.0000161
CALCIUM-D-mg/l	-		101	104	183	116
CALCIUM-T-mg/l	-		105	96.8	187	118
CARBON, DISSOLVED ORGANIC-D-mg/l	-		0.99	0.90	0.758	0.695
CHLORIDE-D-mg/l	150		3.37	1.25	2.98	4.96
CHROMIUM-D-mg/l	-		0.00011	< 0.00010	0.000103	0.00016
CHROMIUM-T-mg/l	0.001	3, Working	0.00018	0.00015	0.00111	0.000263
COBALT-D-mg/l	-		0.00026	< 0.00010	<0.0001	0.000905
COBALT-T-mg/l	0.004		0.00034	< 0.00010	<0.0001	0.000978
CONDUCTIVITY, LAB-N-us/cm	-		901	810	1450	916
COPPER-D-mg/l	-		< 0.00050	< 0.00050	<0.0005	0.000523
COPPER-T-mg/l	0.01	4	< 0.00050	< 0.00050	0.000518	<0.0005
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.12	0.19	0.18	0.125
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		465	453	889	493
IRON-D-mg/l	0.35		< 0.010	< 0.010	<0.01	<0.01
IRON-T-mg/l	1		< 0.010	0.027	0.0218	0.018
LEAD-D-mg/l	-		< 0.000050	< 0.000050	<0.00005	<0.00005
LEAD-T-mg/l	0.01 - 0.02	6	< 0.000050	< 0.000050	<0.00005	<0.00005
LITHIUM-D-mg/l	-		0.0161	0.0291	0.0587	0.0134
LITHIUM-T-mg/l	-		0.0171	0.0303	0.0599	0.0136
MAGNESIUM-D-mg/l	-		51.6	46.8	104	49.0
MAGNESIUM-T-mg/l	-		52.5	45.0	108	50.3
MAJOR ANION SUM-N-meq/l	-		10.1	9.73	18.4	10.6
MAJOR CATION SUM-N-meq/l	-		9.81	9.16	17.9	10.4
MANGANESE-D-mg/l	-		0.00052	0.00634	0.00726	0.00599
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00131	0.00829	0.00917	0.00707
MERCURY-D-mg/l	-		< 0.0000050	< 0.0000050	<0.000005	<0.000005
MERCURY-T-mg/l	0.00002	8	< 0.00000050	< 0.0000005	<0.0000005	<0.00000275
MOLYBDENUM-D-mg/l	-		0.00112	0.00124	0.00167	0.0011
MOLYBDENUM-T-mg/l	1		0.00117	0.00124	0.00168	0.00111
NICKEL-D-mg/l	-		0.0119	0.00445	0.0092	0.0101
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.0127	0.00468	0.00975	0.0103
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	2.67	10.0	25.7	2.97
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	< 0.0050	< 0.0050	0.00655	0.0258
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	< 0.0050	< 0.0050	<0.005	0.0102
ORTHO-PHOSPHATE-N-mg/l	-		< 0.0010	< 0.0010	<0.001	0.0012
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		385	344	306	347
pH, LAB-N-ph units	6.5 - 9		8.39	8.38	8.27	8.32
PHOSPHORUS-N-mg/l	-		< 0.0020	< 0.0020	0.00253	0.00228
POTASSIUM-D-mg/l	-		1.76	1.48	2.37	1.57
POTASSIUM-T-mg/l	-		1.73	1.44	2.38	1.61
SELENIUM-D-ug/l	-		5.94	54.2	150	5.50
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	5.95	51.3	148	5.53
SILICON-D-mg/l	-		1.76	1.71	1.93	2.18
SILICON-T-mg/l	-		1.77	1.73	1.95	2.26
SILVER-D-mg/l	-		< 0.000010	< 0.000010	<0.00001	<0.00001
SILVER-T-mg/l	0.002	13	< 0.000010	< 0.000010	<0.00001	<0.00001
SODIUM-D-mg/l	-		11.0	1.41	2.44	12.6
SODIUM-T-mg/l	-		11.2	1.49	2.49	13.0
STRONTIUM-D-mg/l	-		0.322	0.139	0.20	0.33
STRONTIUM-T-mg/l	-		0.34	0.139	0.204	0.33
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	277	245	561	291
THALLIUM-D-mg/l	-		0.000017	< 0.000010	0.0000125	0.0000113
THALLIUM-T-mg/l	0.0008	Working	0.000014	< 0.000010	0.000015	0.0000158
TIN-D-mg/l	-		< 0.00010	< 0.00010	<0.0001	<0.0001
TIN-T-mg/l	-		< 0.00010	< 0.00010	<0.0001	<0.0001
TITANIUM-D-mg/l	-		< 0.010	< 0.010	0.0145	0.0105
TITANIUM-T-mg/l	-		< 0.010	< 0.010	0.0148	0.0105
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		644	608	1205	642
TOTAL KJELDAHL NITROGEN-N-mg/l	-		0.134	0.143	0.122	0.118
TOTAL ORGANIC CARBON-T-mg/l	-		1.15	1.14	0.873	0.80
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		1.50	< 1.0	1.03	1.08
TURBIDITY, LAB-N-ntu	*		0.37	0.84	0.308	0.735
URANIUM-D-mg/l	-		0.0026	0.00295	0.00625	0.00261
URANIUM-T-mg/l	0.0085		0.0027	0.00298	0.00633	0.00258
VANADIUM-D-mg/l	-		< 0.00050	< 0.00050	<0.0005	<0.0005
VANADIUM-T-mg/l	-		< 0.00050	< 0.00050	<0.0005	<0.0005
ZINC-D-mg/l	-		< 0.0030	< 0.0030	<0.003	<0.003
ZINC-T-mg/l	0.046 - 0.78	14	< 0.0030	< 0.0030	<0.003	<0.003

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q2	Q2	Q2	Q3
Test Species			H. azteca	H. azteca	H. azteca	H. azteca
Sample ID			FR_FRCP1	GH_FR1	CM_MC2	FR_FRCP1
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		<1	<1	1.03	1.23
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		151	163	143	199
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		3.45	4.20	3.50	3.85
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		<1	<1	<1	<1
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		154	166	146	202
ALUMINUM-D-mg/l	0.05	1	<0.003	<0.003	0.00678	<0.003
ALUMINUM-T-mg/l	-		0.0699	0.0577	0.365	0.0143
ANTIMONY-D-mg/l	-		0.000173	0.000148	0.000153	0.000215
ANTIMONY-T-mg/l	0.009	Working	0.00022	0.000183	0.000168	0.000243
ARSENIC-D-mg/l	-		<0.0001	0.000103	0.000165	<0.0001
ARSENIC-T-mg/l	0.005		0.000138	0.000143	0.000295	0.00011
BARIUM-D-mg/l	-		0.0581	0.0797	0.045	0.0767
BARIUM-T-mg/l	1	Working	0.0594	0.0799	0.0451	0.0755
BERYLLIUM-D-mg/l	-		<0.00004	<0.00004	<0.00004	<0.00002
BERYLLIUM-T-mg/l	0.00013	Working	<0.00004	<0.00004	0.000044	<0.00002
BISMUTH-D-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
BISMUTH-T-mg/l	-		0.0000513	<0.00005	<0.00005	<0.00005
BORON-D-mg/l	-		<0.01	<0.01	0.0168	0.0105
BORON-T-mg/l	1.2		<0.01	<0.01	0.0173	0.011
BROMIDE-D-mg/l	-		<0.05	<0.05	<0.05	<0.25
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000272	0.0000216	0.0000639	0.000021
CADMIUM-T-mg/l	-		0.000045	0.0000316	0.000104	0.0000494
CALCIUM-D-mg/l	-		74.4	79.5	69.2	106
CALCIUM-T-mg/l	-		75.3	78.9	67.6	114
CARBON, DISSOLVED ORGANIC-D-mg/l	-		1.47	1.44	1.50	0.96
CHLORIDE-D-mg/l	150		0.51	0.963	1.16	1.64
CHROMIUM-D-mg/l	-		0.000105	0.00011	0.000173	<0.0001
CHROMIUM-T-mg/l	0.001	3, Working	0.000238	0.000218	0.000595	0.000128
COBALT-D-mg/l	-		<0.0001	<0.0001	0.00209	0.00010
COBALT-T-mg/l	0.004		0.000103	<0.0001	0.00293	0.000105
CONDUCTIVITY, LAB-N-us/cm	-		569	598	537	907
COPPER-D-mg/l	-		<0.0005	<0.0005	<0.0005	<0.0005
COPPER-T-mg/l	0.01	4	0.00051	<0.0005	0.00070	<0.0005
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.209	0.185	0.104	0.205
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		311	332	282	501
IRON-D-mg/l	0.35		<0.01	<0.01	<0.01	<0.01
IRON-T-mg/l	1		0.0895	0.0858	0.404	0.0285
LEAD-D-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
LEAD-T-mg/l	0.01 - 0.02	6	0.0000775	0.0000718	0.000239	<0.00005
LITHIUM-D-mg/l	-		0.0179	0.014	0.00898	0.0372
LITHIUM-T-mg/l	-		0.0185	0.0141	0.00925	0.0369
MAGNESIUM-D-mg/l	-		30.4	32.4	26.5	57.3
MAGNESIUM-T-mg/l	-		31.1	32.6	26.4	56.0
MAJOR ANION SUM-N-meq/l	-		6.19	6.56	5.89	10.9
MAJOR CATION SUM-N-meq/l	-		6.29	6.73	5.93	10.1
MANGANESE-D-mg/l	-		0.00218	0.00088	0.0114	0.00434
MANGANESE-T-mg/l	1.23 - 2.59	7	0.0076	0.00433	0.0248	0.00754
MERCURY-D-mg/l	-		<0.000005	<0.000005	<0.000005	<0.000005
MERCURY-T-mg/l	0.00002	8	0.000000908	0.00000108	0.0000010	<0.0000005
MOLYBDENUM-D-mg/l	-		0.0011	0.000989	0.000866	0.00129
MOLYBDENUM-T-mg/l	1		0.00113	0.000985	0.000881	0.00135
NICKEL-D-mg/l	-		0.00193	0.00162	0.0149	0.00545
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.00235	0.00174	0.0169	0.00573
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	8.41	7.62	1.98	12.8
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	0.0027	0.0027	0.00875	0.00678
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	0.0059	0.00503	0.024	0.00573
ORTHO-PHOSPHATE-N-mg/l	-		0.00165	0.00125	0.00225	0.00143
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		331	318	307	332
pH, LAB-N-ph units	6.5 - 9		8.34	8.35	8.29	8.29
PHOSPHORUS-N-mg/l	-		0.00938	0.00958	0.0202	0.00455
POTASSIUM-D-mg/l	-		1.13	1.05	1.03	1.80
POTASSIUM-T-mg/l	-		1.15	1.06	1.14	1.73
SELENIUM-D-ug/l	-		30.5	28.8	4.58	66.4
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	31.0	29.5	4.47	65.5
SILICON-D-mg/l	-		1.58	1.85	1.98	1.90
SILICON-T-mg/l	-		1.72	1.92	2.58	2.02
SILVER-D-mg/l	-		<0.00001	<0.00001	<0.00001	<0.00001
SILVER-T-mg/l	0.002	13	<0.00001	<0.00001	<0.00001	<0.00001
SODIUM-D-mg/l	-		1.04	1.48	6.20	1.81
SODIUM-T-mg/l	-		1.09	1.48	5.98	1.82
STRONTIUM-D-mg/l	-		0.0988	0.111	0.195	0.149
STRONTIUM-T-mg/l	-		0.101	0.112	0.192	0.155
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	119	128	134	280
THALLIUM-D-mg/l	-		<0.00001	<0.00001	0.000012	<0.00001
THALLIUM-T-mg/l	0.0008	Working	0.0000113	<0.00001	0.0000223	0.000010
TIN-D-mg/l	-		<0.0001	<0.0001	<0.0001	<0.0001
TIN-T-mg/l	-		<0.0001	<0.0001	<0.0001	<0.0001
TITANIUM-D-mg/l	-		0.0108	0.0105	0.0115	<0.01
TITANIUM-T-mg/l	-		0.011	0.011	0.0165	<0.01
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		377	394	366	692
TOTAL KJELDAHL NITROGEN-N-mg/l	-		0.164	0.173	0.197	0.139
TOTAL ORGANIC CARBON-T-mg/l	-		1.96	1.78	1.81	1.12
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		5.98	4.43	13.5	1.73
TURBIDITY, LAB-N-ntu	*		0.978	1.38	6.60	0.743
URANIUM-D-mg/l	-		0.00168	0.00163	0.00138	0.00337
URANIUM-T-mg/l	0.0085		0.00174	0.00161	0.00136	0.00347
VANADIUM-D-mg/l	-		<0.0005	<0.0005	<0.0005	<0.0005
VANADIUM-T-mg/l	-		0.000528	0.000525	0.000878	<0.0005
ZINC-D-mg/l	-		<0.003	<0.003	0.00593	<0.003
ZINC-T-mg/l	0.046 - 0.78	14	0.00308	<0.003	0.0107	<0.003

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q3	Q4	Q3	Q2
Test Species			H. azteca	H. azteca	P. promelas	O. mykiss
Sample ID			GH_FR1	FR_FRCP1	CM_MC2	FR_FRCP1
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		<1	<1	1.02	<1
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		195	194	197	151
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		3.70	4.60	4.04	3.45
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		<1	<1	<1	<1
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		198	198	200	154
ALUMINUM-D-mg/l	0.05	1	<0.003	0.00375	0.00342	<0.003
ALUMINUM-T-mg/l	-		0.00698	0.0241	0.0118	0.0699
ANTIMONY-D-mg/l	-		0.000131	0.000188	0.000256	0.000173
ANTIMONY-T-mg/l	0.009	Working	0.000154	0.000198	0.000286	0.00022
ARSENIC-D-mg/l	-		0.000104	<0.0001	0.000248	<0.0001
ARSENIC-T-mg/l	0.005		0.000131	0.000135	0.000256	0.000138
BARIUM-D-mg/l	-		0.105	0.0752	0.0765	0.0581
BARIUM-T-mg/l	1	Working	0.105	0.0743	0.076	0.0594
BERYLLIUM-D-mg/l	-		<0.00002	<0.00002	<0.000036	<0.00004
BERYLLIUM-T-mg/l	0.00013	Working	<0.00002	<0.00002	<0.000036	<0.00004
BISMUTH-D-mg/l	-		<0.00005	<0.00005	<0.00009	<0.00005
BISMUTH-T-mg/l	-		<0.00005	<0.00005	<0.00009	0.0000513
BORON-D-mg/l	-		<0.01	<0.01	0.0326	<0.01
BORON-T-mg/l	1.2		0.0101	<0.01	0.0342	<0.01
BROMIDE-D-mg/l	-		<0.25	<0.25	<0.21	<0.05
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000155	0.0000421	0.0000102	0.0000272
CADMIUM-T-mg/l	-		0.0000187	0.0000506	0.0000124	0.000045
CALCIUM-D-mg/l	-		92.9	108	110	74.4
CALCIUM-T-mg/l	-		95.4	106	113	75.3
CARBON, DISSOLVED ORGANIC-D-mg/l	-		0.82	1.04	1.03	1.47
CHLORIDE-D-mg/l	150		1.61	1.43	3.24	0.51
CHROMIUM-D-mg/l	-		0.000105	<0.0001	0.00021	0.000105
CHROMIUM-T-mg/l	0.001	3, Working	0.000179	0.000153	0.000238	0.000238
COBALT-D-mg/l	-		<0.0001	<0.0001	0.000372	<0.0001
COBALT-T-mg/l	0.004		<0.0001	<0.0001	0.000468	0.000103
CONDUCTIVITY, LAB-N-us/cm	-		740	850	896	569
COPPER-D-mg/l	-		<0.0005	<0.0005	0.00062	<0.0005
COPPER-T-mg/l	0.01	4	<0.0005	<0.0005	<0.0009	0.00051
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.19	0.205	0.11	0.209
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		399	478	489	311
IRON-D-mg/l	0.35		<0.01	<0.01	<0.018	<0.01
IRON-T-mg/l	1		0.0146	0.034	0.0194	0.0895
LEAD-D-mg/l	-		<0.00005	<0.00005	<0.00009	<0.00005
LEAD-T-mg/l	0.01 - 0.02	6	<0.00005	<0.00005	<0.00009	0.0000775
LITHIUM-D-mg/l	-		0.0176	0.032	0.0157	0.0179
LITHIUM-T-mg/l	-		0.0188	0.033	0.0167	0.0185
MAGNESIUM-D-mg/l	-		40.5	50.5	52.1	30.4
MAGNESIUM-T-mg/l	-		41.8	50.0	53.5	31.1
MAJOR ANION SUM-N-meq/l	-		8.67	10.1	10.4	6.19
MAJOR CATION SUM-N-meq/l	-		8.08	9.68	10.3	6.29
MANGANESE-D-mg/l	-		0.000898	0.00681	0.000688	0.00218
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00177	0.00868	0.00202	0.0076
MERCURY-D-mg/l	-		<0.000005	<0.000005	<0.000005	<0.000005
MERCURY-T-mg/l	0.00002	8	<0.0000010625	<0.0000005	<0.0000005	0.000000908
MOLYBDENUM-D-mg/l	-		0.00094	0.00131	0.00116	0.0011
MOLYBDENUM-T-mg/l	1		0.000979	0.00134	0.00117	0.00113
NICKEL-D-mg/l	-		0.00151	0.00494	0.0139	0.00193
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.00164	0.00523	0.0145	0.00235
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	10.3	12.0	2.99	8.41
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	0.00571	<0.005	0.00642	0.0027
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	<0.005	<0.005	<0.005	0.0059
ORTHO-PHOSPHATE-N-mg/l	-		0.00104	<0.001	0.00102	0.00165
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		331	330	324	331
pH, LAB-N-ph units	6.5 - 9		8.32	8.34	8.18	8.34
PHOSPHORUS-N-mg/l	-		0.00434	0.00313	0.0056	0.00938
POTASSIUM-D-mg/l	-		1.25	1.58	1.77	1.13
POTASSIUM-T-mg/l	-		1.24	1.58	1.77	1.15
SELENIUM-D-ug/l	-		39.4	59.1	6.28	30.5
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	39.8	57.6	6.49	31.0
SILICON-D-mg/l	-		2.12	1.72	1.94	1.58
SILICON-T-mg/l	-		2.25	1.84	2.12	1.72
SILVER-D-mg/l	-		<0.00001	<0.00001	<0.000018	<0.00001
SILVER-T-mg/l	0.002	13	<0.00001	<0.00001	<0.000018	<0.00001
SODIUM-D-mg/l	-		1.91	1.54	11.1	1.04
SODIUM-T-mg/l	-		1.97	1.56	11.2	1.09
STRONTIUM-D-mg/l	-		0.142	0.145	0.346	0.0988
STRONTIUM-T-mg/l	-		0.143	0.146	0.355	0.101
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	188	253	295	119
THALLIUM-D-mg/l	-		<0.00001	0.0000108	0.000023	<0.00001
THALLIUM-T-mg/l	0.0008	Working	<0.00001	<0.00001	0.0000222	0.0000113
TIN-D-mg/l	-		<0.0001	<0.0001	<0.00018	<0.0001
TIN-T-mg/l	-		<0.0001	<0.0001	<0.00018	<0.0001
TITANIUM-D-mg/l	-		<0.01	<0.01	<0.01	0.0108
TITANIUM-T-mg/l	-		<0.01	<0.01	<0.01	0.011
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		514	626	674	377
TOTAL KJELDAHL NITROGEN-N-mg/l	-		0.134	0.0733	0.205	0.164
TOTAL ORGANIC CARBON-T-mg/l	-		1.08	1.42	1.14	1.96
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		<1	1.38	1.52	5.98
TURBIDITY, LAB-N-ntu	*		0.359	1.16	0.512	0.978
URANIUM-D-mg/l	-		0.00205	0.00309	0.00274	0.00168
URANIUM-T-mg/l	0.0085		0.00213	0.00316	0.0028	0.00174
VANADIUM-D-mg/l	-		<0.0005	<0.0005	<0.0009	<0.0005
VANADIUM-T-mg/l	-		0.000508	<0.0005	<0.0009	0.000528
ZINC-D-mg/l	-		<0.003	<0.003	<0.0034	<0.003
ZINC-T-mg/l	0.046 - 0.78	14	<0.003	<0.0045	<0.0054	0.00308

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q2	Q2	Q2	Q2
Test Species			O. mykiss	O. mykiss	O. mykiss	O. mykiss
Sample ID			GH_FR1	GH_ERC	EV_MC2	EV_HC1
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		<1	1.05	1.10	<1
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		163	144	100	167
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		4.20	1.70	<1	9.10
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		<1	<1	<1	<1
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		166	145	100	176
ALUMINUM-D-mg/l	0.05	1	<0.003	0.0045	0.014	0.00343
ALUMINUM-T-mg/l	-		0.0577	0.228	0.405	0.0743
ANTIMONY-D-mg/l	-		0.000148	<0.0001	0.000115	<0.0001
ANTIMONY-T-mg/l	0.009	Working	0.000183	0.000103	0.00016	0.00011
ARSENIC-D-mg/l	-		0.000103	0.00010	0.00018	0.000145
ARSENIC-T-mg/l	0.005		0.000143	0.00025	0.000368	0.00020
BARIUM-D-mg/l	-		0.0797	0.048	0.057	0.0408
BARIUM-T-mg/l	1	Working	0.0799	0.0499	0.0621	0.042
BERYLLIUM-D-mg/l	-		<0.00004	<0.00004	<0.00004	<0.00004
BERYLLIUM-T-mg/l	0.00013	Working	<0.00004	<0.00004	0.0000468	<0.00004
BISMUTH-D-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
BISMUTH-T-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
BORON-D-mg/l	-		<0.01	<0.01	<0.01	<0.01
BORON-T-mg/l	1.2		<0.01	<0.01	<0.01	<0.01
BROMIDE-D-mg/l	-		<0.05	<0.05	<0.05	<0.05
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000216	0.00000823	0.0000284	0.000020
CADMIUM-T-mg/l	-		0.0000316	0.0000289	0.000082	0.0000306
CALCIUM-D-mg/l	-		79.5	51.9	40.1	70.2
CALCIUM-T-mg/l	-		78.9	52.7	40.1	71.2
CARBON, DISSOLVED ORGANIC-D-mg/l	-		1.44	1.10	2.26	1.34
CHLORIDE-D-mg/l	150		0.963	0.668	1.66	0.743
CHROMIUM-D-mg/l	-		0.00011	0.000215	0.00013	0.00012
CHROMIUM-T-mg/l	0.001	3, Working	0.000218	0.000665	0.00073	0.000238
COBALT-D-mg/l	-		<0.0001	<0.0001	<0.0001	<0.0001
COBALT-T-mg/l	0.004		<0.0001	0.000135	0.000308	<0.0001
CONDUCTIVITY, LAB-N-us/cm	-		598	327	286	545
COPPER-D-mg/l	-		<0.0005	<0.0005	0.00051	<0.0005
COPPER-T-mg/l	0.01	4	<0.0005	0.000545	0.00098	<0.0005
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.185	0.155	0.117	0.19
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		332	180	152	311
IRON-D-mg/l	0.35		<0.01	<0.01	0.0115	<0.01
IRON-T-mg/l	1		0.0858	0.276	0.433	0.0718
LEAD-D-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
LEAD-T-mg/l	0.01 - 0.02	6	0.0000718	0.000158	0.000334	0.000063
LITHIUM-D-mg/l	-		0.014	0.0021	0.00568	0.00603
LITHIUM-T-mg/l	-		0.0141	0.00235	0.00578	0.0061
MAGNESIUM-D-mg/l	-		32.4	12.1	12.5	32.9
MAGNESIUM-T-mg/l	-		32.6	12.4	12.5	33.5
MAJOR ANION SUM-N-meq/l	-		6.56	3.54	3.04	6.10
MAJOR CATION SUM-N-meq/l	-		6.73	3.64	3.13	6.28
MANGANESE-D-mg/l	-		0.00088	0.000948	0.00039	0.000463
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00433	0.0172	0.0122	0.00266
MERCURY-D-mg/l	-		<0.000005	<0.000005	0.00000125	0.000000535
MERCURY-T-mg/l	0.00002	8	0.00000108	0.00000117	0.00000242	0.000000673
MOLYBDENUM-D-mg/l	-		0.000989	0.000956	0.000729	0.000758
MOLYBDENUM-T-mg/l	1		0.000985	0.000938	0.000742	0.00078
NICKEL-D-mg/l	-		0.00162	<0.0005	0.00172	0.000863
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.00174	0.000585	0.00262	0.00101
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	7.62	0.314	1.01	0.764
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	0.0027	<0.001	0.0012	<0.001
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	0.00503	<0.005	<0.005	<0.005
ORTHO-PHOSPHATE-N-mg/l	-		0.00125	0.00105	0.0106	0.00478
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		318	356	339	330
pH, LAB-N-ph units	6.5 - 9		8.35	8.29	8.20	8.39
PHOSPHORUS-N-mg/l	-		0.00958	0.0208	0.0421	0.0084
POTASSIUM-D-mg/l	-		1.05	0.372	0.557	0.798
POTASSIUM-T-mg/l	-		1.06	0.474	0.677	0.851
SELENIUM-D-ug/l	-		28.8	1.60	4.24	30.1
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	29.5	1.56	4.10	29.7
SILICON-D-mg/l	-		1.85	1.76	1.92	1.82
SILICON-T-mg/l	-		1.92	2.18	2.59	1.96
SILVER-D-mg/l	-		<0.00001	<0.00001	<0.00001	<0.00001
SILVER-T-mg/l	0.002	13	<0.00001	<0.00001	0.0000148	<0.00001
SODIUM-D-mg/l	-		1.48	0.895	1.83	1.23
SODIUM-T-mg/l	-		1.48	0.891	1.76	1.28
STRONTIUM-D-mg/l	-		0.111	0.209	0.0907	0.0965
STRONTIUM-T-mg/l	-		0.112	0.202	0.0916	0.0986
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	128	29.3	43.8	120
THALLIUM-D-mg/l	-		<0.00001	<0.00001	<0.00001	<0.00001
THALLIUM-T-mg/l	0.0008	Working	<0.00001	0.000012	0.0000215	0.0000115
TIN-D-mg/l	-		<0.0001	<0.0001	<0.0001	<0.0001
TIN-T-mg/l	-		<0.0001	<0.0001	<0.0001	<0.0001
TITANIUM-D-mg/l	-		0.0105	<0.01	<0.01	0.011
TITANIUM-T-mg/l	-		0.011	0.0105	0.0143	0.012
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		394	189	173	351
TOTAL KJELDAHL NITROGEN-N-mg/l	-		0.173	0.118	0.183	0.111
TOTAL ORGANIC CARBON-T-mg/l	-		1.78	1.59	3.04	1.73
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		4.43	16.3	22.7	3.05
TURBIDITY, LAB-N-ntu	*		1.38	3.37	8.25	1.71
URANIUM-D-mg/l	-		0.00163	0.00083	0.000581	0.00194
URANIUM-T-mg/l	0.0085		0.00161	0.000816	0.000597	0.00199
VANADIUM-D-mg/l	-		<0.0005	<0.0005	<0.0005	<0.0005
VANADIUM-T-mg/l	-		0.000525	0.00105	0.00177	0.000568
ZINC-D-mg/l	-		<0.003	<0.003	<0.003	<0.003
ZINC-T-mg/l	0.046 - 0.78	14	<0.003	0.0032	0.00463	<0.003

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q2	Q2	Q4	Q4
Test Species			O. mykiss	O. mykiss	O. mykiss	O. mykiss
Sample ID			CM_MC2	LC_LCDSSLCC	FR_FRCP1	GH_FR1
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		1.03	<1	<1	1.21
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		143	155	194	191
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		3.50	2.70	4.60	1.95
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		<1	<1	<1	<1
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		146	157	198	192
ALUMINUM-D-mg/l	0.05	1	0.00678	0.0026	0.00375	<0.003
ALUMINUM-T-mg/l	-		0.365	0.0174	0.0241	0.0105
ANTIMONY-D-mg/l	-		0.000153	0.000225	0.000188	0.000157
ANTIMONY-T-mg/l	0.009	Working	0.000168	0.000263	0.000198	0.000238
ARSENIC-D-mg/l	-		0.000165	0.00012	<0.0001	0.000105
ARSENIC-T-mg/l	0.005		0.000295	0.000153	0.000135	0.000138
BARIUM-D-mg/l	-		0.045	0.0386	0.0752	0.101
BARIUM-T-mg/l	1	Working	0.0451	0.0397	0.0743	0.101
BERYLLIUM-D-mg/l	-		<0.00004	<0.00004	<0.00002	<0.00002
BERYLLIUM-T-mg/l	0.00013	Working	0.000044	<0.00004	<0.00002	<0.00002
BISMUTH-D-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
BISMUTH-T-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
BORON-D-mg/l	-		0.0168	0.0103	<0.01	<0.01
BORON-T-mg/l	1.2		0.0173	0.0113	<0.01	<0.01
BROMIDE-D-mg/l	-		<0.05	<0.1	<0.25	<0.25
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.0000639	0.000197	0.0000421	0.0000162
CADMIUM-T-mg/l	-		0.000104	0.000216	0.0000506	0.0000198
CALCIUM-D-mg/l	-		69.2	74.6	108	97.6
CALCIUM-T-mg/l	-		67.6	75.5	106	99.6
CARBON, DISSOLVED ORGANIC-D-mg/l	-		1.50	1.25	1.04	0.845
CHLORIDE-D-mg/l	150		1.16	3.25	1.43	1.61
CHROMIUM-D-mg/l	-		0.000173	0.000153	<0.0001	0.000118
CHROMIUM-T-mg/l	0.001	3, Working	0.000595	0.000188	0.000153	0.000157
COBALT-D-mg/l	-		0.00209	0.0000923	<0.0001	<0.0001
COBALT-T-mg/l	0.004		0.00293	0.0000948	<0.0001	<0.0001
CONDUCTIVITY, LAB-N-us/cm	-		537	562	850	758
COPPER-D-mg/l	-		<0.0005	0.00044	<0.0005	<0.0005
COPPER-T-mg/l	0.01	4	0.00070	0.000508	<0.0005	<0.0005
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.104	0.226	0.205	0.165
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		282	304	478	431
IRON-D-mg/l	0.35		<0.01	<0.01	<0.01	<0.01
IRON-T-mg/l	1		0.404	0.0203	0.034	0.0179
LEAD-D-mg/l	-		<0.00005	<0.000045	<0.00005	<0.00005
LEAD-T-mg/l	0.01 - 0.02	6	0.000239	<0.000045	<0.00005	<0.00005
LITHIUM-D-mg/l	-		0.00898	0.025	0.032	0.0175
LITHIUM-T-mg/l	-		0.00925	0.0259	0.033	0.0176
MAGNESIUM-D-mg/l	-		26.5	28.7	50.5	45.3
MAGNESIUM-T-mg/l	-		26.4	28.5	50.0	46.0
MAJOR ANION SUM-N-meq/l	-		5.89	6.18	10.1	9.00
MAJOR CATION SUM-N-meq/l	-		5.93	6.27	9.68	8.72
MANGANESE-D-mg/l	-		0.0114	0.00249	0.00681	0.000958
MANGANESE-T-mg/l	1.23 - 2.59	7	0.0248	0.00372	0.00868	0.00172
MERCURY-D-mg/l	-		<0.000005	<0.000005	<0.000005	<0.000005
MERCURY-T-mg/l	0.00002	8	0.0000010	0.000000563	<0.0000005	<0.000001625
MOLYBDENUM-D-mg/l	-		0.000866	0.00138	0.00131	0.00106
MOLYBDENUM-T-mg/l	1		0.000881	0.00143	0.00134	0.00111
NICKEL-D-mg/l	-		0.0149	0.00461	0.00494	0.00243
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.0169	0.00489	0.00523	0.0025
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	1.98	6.28	12.0	9.52
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	0.00875	0.00203	<0.005	<0.005
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	0.024	<0.005	<0.005	0.00538
ORTHO-PHOSPHATE-N-mg/l	-		0.00225	0.00103	<0.001	0.00113
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		307	347	330	353
pH, LAB-N-ph units	6.5 - 9		8.29	8.27	8.34	8.27
PHOSPHORUS-N-mg/l	-		0.0202	0.0027	0.00313	0.0114
POTASSIUM-D-mg/l	-		1.03	0.966	1.58	1.27
POTASSIUM-T-mg/l	-		1.14	1.01	1.58	1.32
SELENIUM-D-ug/l	-		4.58	20.9	59.1	43.4
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	4.47	21.4	57.6	42.2
SILICON-D-mg/l	-		1.98	1.87	1.72	2.09
SILICON-T-mg/l	-		2.58	1.94	1.84	2.15
SILVER-D-mg/l	-		<0.00001	<0.00001	<0.00001	<0.00001
SILVER-T-mg/l	0.002	13	<0.00001	<0.00001	<0.00001	<0.00001
SODIUM-D-mg/l	-		6.20	3.74	1.54	1.99
SODIUM-T-mg/l	-		5.98	3.89	1.56	2.10
STRONTIUM-D-mg/l	-		0.195	0.133	0.145	0.145
STRONTIUM-T-mg/l	-		0.192	0.138	0.146	0.148
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	134	120	253	212
THALLIUM-D-mg/l	-		0.000012	0.000010	0.0000108	<0.00001
THALLIUM-T-mg/l	0.0008	Working	0.0000223	0.0000103	<0.00001	<0.00001
TIN-D-mg/l	-		<0.0001	<0.0000875	<0.0001	<0.0001
TIN-T-mg/l	-		<0.0001	<0.0000875	<0.0001	<0.0001
TITANIUM-D-mg/l	-		0.0115	0.0080	<0.01	<0.01
TITANIUM-T-mg/l	-		0.0165	0.00825	<0.01	<0.01
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		366	362	626	553
TOTAL KJELDAHL NITROGEN-N-mg/l	-		0.197	0.173	0.0733	0.213
TOTAL ORGANIC CARBON-T-mg/l	-		1.81	1.55	1.42	1.81
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		13.5	1.13	1.38	2.20
TURBIDITY, LAB-N-ntu	*		6.60	0.55	1.16	0.788
URANIUM-D-mg/l	-		0.00138	0.00225	0.00309	0.00231
URANIUM-T-mg/l	0.0085		0.00136	0.00232	0.00316	0.00233
VANADIUM-D-mg/l	-		<0.0005	<0.0005	<0.0005	<0.0005
VANADIUM-T-mg/l	-		0.000878	<0.0005	<0.0005	<0.0005
ZINC-D-mg/l	-		0.00593	0.00875	<0.003	<0.003
ZINC-T-mg/l	0.046 - 0.78	14	0.0107	0.00973	<0.0045	<0.003

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Quarter	Chronic BC WQG - Freshwater Aquatic Life [a,b,c]	Notes	Q4	Q4	Q4	Q4
Test Species			O. mykiss	O. mykiss	O. mykiss	O. mykiss
Sample ID			GH_ERC	EV_HC1	CM_MC2	LC_LCDSSLCC
ACIDITY TO pH 8.3 (As $CaCO_3$)-N-mg/l	-		1.10	<1	<1	1.10
ALKALINITY, BICARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		151	189	178	181
ALKALINITY, CARBONATE (As $CaCO_3$), lab measured.-N-mg/l	-		1.05	5.25	1.90	2.65
ALKALINITY, HYDROXIDE (As $CaCO_3$), lab measured.-N-mg/l	-		<1	<1	<1	<1
ALKALINITY, TOTAL (As $CaCO_3$), lab measured.-N-mg/l	*		151	195	179	184
ALUMINUM-D-mg/l	0.05	1	<0.003	0.00363	0.00553	<0.003
ALUMINUM-T-mg/l	-		0.0129	0.0369	0.0879	0.0303
ANTIMONY-D-mg/l	-		<0.0001	<0.0001	0.000135	0.00022
ANTIMONY-T-mg/l	0.009	Working	<0.0001	0.00010	0.000155	0.00027
ARSENIC-D-mg/l	-		<0.0001	0.000148	0.000173	<0.0001
ARSENIC-T-mg/l	0.005		0.000138	0.00018	0.000228	0.000185
BARIUM-D-mg/l	-		0.0546	0.0566	0.0543	0.0607
BARIUM-T-mg/l	1	Working	0.054	0.0556	0.0563	0.0624
BERYLLIUM-D-mg/l	-		<0.00002	<0.00002	<0.00002	<0.00002
BERYLLIUM-T-mg/l	0.00013	Working	<0.00002	<0.00002	<0.00002	<0.00002
BISMUTH-D-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
BISMUTH-T-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
BORON-D-mg/l	-		<0.01	<0.01	0.0193	0.0103
BORON-T-mg/l	1.2		<0.01	<0.01	0.0205	0.0105
BROMIDE-D-mg/l	-		<0.05	<0.2	<0.1	<0.25
CADMIUM-D-mg/l	0.00018 - 0.001	2, EVWQP Benchmark (d)	0.00000573	0.0000156	0.0000266	0.000148
CADMIUM-T-mg/l	-		0.00000683	0.0000202	0.0000351	0.00016
CALCIUM-D-mg/l	-		51.4	81.9	83.6	95.5
CALCIUM-T-mg/l	-		51.8	82.2	84.9	94.9
CARBON, DISSOLVED ORGANIC-D-mg/l	-		0.535	1.20	1.63	0.803
CHLORIDE-D-mg/l	150		0.453	1.18	2.00	6.50
CHROMIUM-D-mg/l	-		0.000225	0.000145	0.000158	0.000115
CHROMIUM-T-mg/l	0.001	3, Working	0.000298	0.000183	0.000333	0.000205
COBALT-D-mg/l	-		<0.0001	<0.0001	0.000763	<0.0001
COBALT-T-mg/l	0.004		<0.0001	<0.0001	0.00099	<0.0001
CONDUCTIVITY, LAB-N-us/cm	-		324	661	669	742
COPPER-D-mg/l	-		<0.0005	<0.0005	<0.0005	<0.0005
COPPER-T-mg/l	0.01	4	0.00051	<0.0005	<0.0005	<0.0005
FLUORIDE-D-mg/l	1.47 - 2.31	5, Maximum	0.163	0.206	0.11	0.245
Hardness, Total or Dissolved $CaCO_3$-N-mg/l	-		178	381	358	395
IRON-D-mg/l	0.35		<0.01	<0.01	<0.01	<0.01
IRON-T-mg/l	1		0.0175	0.0355	0.0765	0.0288
LEAD-D-mg/l	-		<0.00005	<0.00005	<0.00005	<0.00005
LEAD-T-mg/l	0.01 - 0.02	6	<0.00005	<0.00005	0.0000663	0.000052
LITHIUM-D-mg/l	-		0.0026	0.00753	0.0108	0.0328
LITHIUM-T-mg/l	-		0.00265	0.00753	0.0111	0.0324
MAGNESIUM-D-mg/l	-		12.1	42.8	36.2	38.1
MAGNESIUM-T-mg/l	-		12.3	42.5	36.8	39.0
MAJOR ANION SUM-N-meq/l	-		3.73	7.80	7.86	8.61
MAJOR CATION SUM-N-meq/l	-		3.61	7.70	7.51	8.15
MANGANESE-D-mg/l	-		0.000353	0.00154	0.00727	0.00185
MANGANESE-T-mg/l	1.23 - 2.59	7	0.00156	0.00248	0.0112	0.00332
MERCURY-D-mg/l	-		<0.000005	<0.0000005	<0.000005	<0.000005
MERCURY-T-mg/l	0.00002	8	<0.000001625	0.000000618	0.000000783	0.000000535
MOLYBDENUM-D-mg/l	-		0.00101	0.000912	0.000893	0.00155
MOLYBDENUM-T-mg/l	1		0.00103	0.000933	0.000926	0.00161
NICKEL-D-mg/l	-		<0.0005	0.000753	0.00983	0.0044
NICKEL-T-mg/l	0.124 - 0.15	9, Working	0.00059	0.00082	0.0105	0.00454
NITRATE NITROGEN (NO_3), AS N-N-mg/l	3 - 17	10, EVWQP Benchmark (d)	0.293	1.00	2.22	9.92
NITRITE NITROGEN (NO_2), AS N-N-mg/l	0.02 - 0.08	11	<0.001	<0.004	0.00795	<0.005
NITROGEN, AMMONIA (AS N)-N-mg/l	0.321	12	<0.005	<0.005	0.00565	<0.005
ORTHO-PHOSPHATE-N-mg/l	-		0.00118	0.0045	0.00133	0.00145
OXIDATION-REDUCTION POTENTIAL, LAB-N-mv	-		372	318	296	330
pH, LAB-N-ph units	6.5 - 9		8.22	8.35	8.30	8.30
PHOSPHORUS-N-mg/l	-		0.00298	0.00643	0.0053	0.0049
POTASSIUM-D-mg/l	-		0.388	0.914	1.28	1.18
POTASSIUM-T-mg/l	-		0.41	0.926	1.31	1.23
SELENIUM-D-ug/l	-		1.36	32.7	5.67	28.1
SELENIUM-T-ug/l	19	EVWQP Benchmark (d)	1.41	32.3	5.78	27.7
SILICON-D-mg/l	-		1.78	2.02	2.13	2.05
SILICON-T-mg/l	-		1.86	2.19	2.35	2.19
SILVER-D-mg/l	-		<0.00001	<0.00001	<0.00001	<0.00001
SILVER-T-mg/l	0.002	13	<0.00001	<0.00001	<0.00001	<0.00001
SODIUM-D-mg/l	-		0.844	1.68	7.51	5.18
SODIUM-T-mg/l	-		0.877	1.68	7.68	5.33
STRONTIUM-D-mg/l	-		0.233	0.126	0.235	0.186
STRONTIUM-T-mg/l	-		0.235	0.128	0.24	0.187
SULFATE (AS SO_4)-D-mg/l	481	EVWQP Benchmark (d)	32.3	182	195	194
THALLIUM-D-mg/l	-		<0.00001	<0.00001	0.000011	0.000010
THALLIUM-T-mg/l	0.0008	Working	<0.00001	0.000010	0.0000153	0.0000118
TIN-D-mg/l	-		<0.0001	<0.0001	<0.0001	<0.0001
TIN-T-mg/l	-		<0.0001	<0.0001	<0.0001	<0.0001
TITANIUM-D-mg/l	-		<0.01	<0.01	<0.01	<0.01
TITANIUM-T-mg/l	-		<0.01	<0.01	<0.01	<0.01
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)-N-mg/l	-		202	478	482	525
TOTAL KJELDAHL NITROGEN-N-mg/l	-		<0.05	0.109	0.129	0.111
TOTAL ORGANIC CARBON-T-mg/l	-		0.688	1.38	1.88	0.89
TOTAL SUSPENDED SOLIDS, LAB-N-mg/l	-		1.68	1.35	4.20	1.28
TURBIDITY, LAB-N-ntu	*		0.548	1.24	2.23	1.09
URANIUM-D-mg/l	-		0.000838	0.00256	0.0018	0.00327
URANIUM-T-mg/l	0.0085		0.000837	0.00259	0.00185	0.00329
VANADIUM-D-mg/l	-		<0.0005	<0.0005	<0.0005	<0.0005
VANADIUM-T-mg/l	-		<0.0005	<0.0005	<0.0005	0.000563
ZINC-D-mg/l	-		<0.003	<0.003	0.00315	0.00603
ZINC-T-mg/l	0.046 - 0.78	14	<0.003	<0.003	0.00395	0.00795

APPENDIX C: CONCENTRATION-RESPONSE ANALYSIS

Table C-11: Screening of Constituents Agains Chronic BC WQGs

Notes

a. BC MOE (British Columbia Ministry of Environment). 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life. Summary Report. Accessed 27 February 2017 http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/final_approved_wqg_summary_march_2016.pdf.

b. BC MOE. 2015. Working Water Quality Guidelines for British Columbia (2015). Accessed 27 February 2017 from http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/bc_env_working_water_quality_guidelines.pdf.

c. If minimum predicted hardness was less than the hardness for which the water quality guideline applies, then the maximum hardness for which the water quality guideline app

d. Teck (Teck Coal Limited). 2014. Elk Valley Water Quality Plan. Submitted to the British Columbia Ministry of Environment, July 22, 2014. Approved on November 18, 2014.

For guidelines dependent on other parameters (e.g., hardness), sample-specific parameters were used unless specified otherwise.

BC = British Columbia; WQG = Water Quality Guideline; EVWQP = Elk Valley Water Quality Plan; TDS = total dissolved solids; - = no water quality guideline; mg/l = milligrams fraction; D = dissolved fraction; EVWQP benchmark = lowest level 1 benchmark from the EVWQP; Working = working water quality guideline; Maximum = maximum water quali

Water Quality Guidelines

1. pH-dependent guideline: WQG (mg/L) = EXP(1.6-3.327*(pH)+0.402*(pH)^2) when pH <6.5, 0.05 when pH ≥6.5.
2. Lowest level 1 benchmark from the EVWQP: Benchmark (mg/L) = (10^((0.83)*(LOG(hardness))-2.53))/1000
3. BC WQG for chromium VI (0.001 mg/L) was selected for screening because it's lower than the BC WQG for chromium III (0.0089 mg/L).
4. Hardness-dependent guideline: WQG (mg/L) = (0.04*hardness)/1000 when hardness >50 mg/L, 0.002 when hardness ≤50 mg/L. applies to water hardnesses (mg/L $CaCO_3$) I
5. Hardness-dependent guideline: WQG (mg/L) = (-51.73+92.57*LOG(hardness))*0.01 when hardness >10 mg/L, 0.4 when hardness ≤10 mg/L.
6. Hardness-dependent guideline: WQG (mg/L) = (3.31 + EXP(1.273*LN(hardness) - 4.704))/1000. applies to water hardnesses (mg/L $CaCO_3$) between 8 – 360 mg/L.
7. Hardness-dependent guideline: WQG (mg/L) = 0.0044*hardness + 0.605. applies to water hardnesses (mg/L CaCO3) between 37 – 450 mg/L.
8. Assumes 0.5% methylmercury.
9. Hardness-dependent guideline: WQG (mg/L) = 0.025 when hardness ≤60 mg/L, EXP(0.76[ln(hardness)]+1.06)/1000 when hardness 60 - 180 mg/L, 0.15 mg/L for hardness >
10. Lowest level 1 benchmark from the EVWQP: Benchmark (mg/L) = 10^((1.0003)*(LOG(hardness))-1.82)
11. Chloride-dependent guideline: WQG (mg/L) = 0.02 when Cl <2 mg/L, 0.04 when Cl 2 - 4 mg/L, 0.06 when Cl 4 - 6 mg/L, 0.08 when Cl 6 to 8 mg/L, 0.10 when Cl 8 - 10 mg/L,
12. pH and temperature-dependent guideline: maximum pH of 8.4 and maximum temperature of 20 C used.
13. Hardness-dependent guideline: WQG (mg/L) = 0.0015 when hardness >100 mg/L $CaCO_3$, 0.00005 when hardness ≤100 mg/L $CaCO_3$.
14. Hardness-dependent guideline: WQG (mg/L) = (7.5+0.75*(hardness-90))/1000 when hardness >90, 0.0075 when hardness ≤90.

Screening:

Shaded cells indicate value greater than the chronic BC WQG.

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