REPORT

ANNUAL TECK COAL LTD. REGIONAL AIR MONITORING PROGRAM REPORT

SPARWOOD, BC

2020 ANNUAL REPORT

RWDI #2102146
March 30, 2021

SUBMITTED TO

Tapashree Tah
Regional Lead Environmental (Air)
Teck Coal Limited
T: 250.425.8229
tapashree.tah@teck.com

SUBMITTED BY

Mukund Venkitachalam, M.Sc.
Senior Scientist
mukund.venkitachalam@rwdi.com

Matthew Sawycky, B.Sc.
Senior Project Manager / Associate
matthew.sawycky@rwdi.com

RWDI
Suite 280 - 1385 West 8th Avenue
Vancouver, BC, V6H 3V9
T: 604.730.5688

EXECUTIVE SUMMARY

Teck Coal Ltd. (Teck) operates four open pit coal mine operations: Elkview (EVO), Line Creek (LCO), Greenhills (GHO) and Fording River (FRO) and one open pit coal mine operation in care & maintenance in the Elk Valley: Coal Mountain (CMO). Each mine is authorized by permits issued by the British Columbia Ministry of Environment & Climate Change Strategy (BC ENV) under the *Environmental Management Act* to discharge emissions to the air. There is also a requirement under these permits for a Regional Air Monitoring Program (RAMP) that allows for an ongoing assessment of the efficacy of monitoring and to provide annual reporting summarizing the state of air quality and meteorology in the region.

There are eight monitoring sites that are part of the RAMP where Particulate Matter 10 micrometer diameter and less (PM_{10}), Particulate Matter 2.5 micrometer diameter and less ($PM_{2.5}$) and Total Suspended Particulate (TSP) concentrations are measured. The meteorological conditions of 2020 largely impacted particulate concentrations and exceedances. Decreased forest fire activity in British Columbia led to a significant decrease in TSP compared to previous years. During 2020, there were six (6) daily averaged TSP readings above British Columbia Ambient Air Quality Objectives (BCAAQO); three (3) at LCO-L10A (E206189), two (2) at CMO-AGWS (E297251) and one (1) at GHO-Elkford (E290310).

Eighty-five (85) daily average concentrations of PM_{10} were observed above the BCAAQO at 6 stations: Fifty-four (54) at FRO- South Station, six (6) at GHO – Elkford, five (5) at EVO-WWTP, nine (9) at EVO – MCRR, seven (7) at CMO – Hosmer and four (4) at CMO – AGWS. PM_{10} concentrations above the BCAAQO were recorded most often in the Fall (September, October) and spring (March and April) months and this is reflected in the seasonal average concentrations in Table A-6 of Appendix A. This is a departure from the usual trend of the greatest number of concentrations above the BCAAQO being recorded in August, when there is normally an active forest fire season in British Columbia; 2020 was less severe than normal. The BCAAQO for $PM_{2.5}$ is evaluated against the 98^{th} percentile of the daily average $PM_{2.5}$ over 365 days. Out of the six stations that record $PM_{2.5}$, five stations observed 98^{th} percentile results below the BCAAQO. Only EVO-MCRR station observed $PM_{2.5}$ 98^{th} percentile results above the BCAAQO. In addition, daily average data is compared to the BCAAQO to inform performance. Forty-six (46) excursions above the 24-hour $PM_{2.5}$ BCAAQO, nine (9) at GHO-Elkford (2.54%), seven (7) at EVO-WWTP (2.05%), eight (8) at EVO-MCRR (2.52%), three (3) at EVO-DTAM (0.95%), eleven (11) at CMO-Hosmer (3.38%), and eight (8) at CMO-AGWS (2.31%). The annually averaged $PM_{2.5}$ concentration at all stations were less than the BCAAQO standards.

NO_2 and SO_2 were compared to the updated BCAAQO based on the 2020 CAAQS. There were no 1-hour average concentrations above the 1-hour BCAAQO for NO_2, SO_2 or the 1-hour PCO for CO. The annual average SO_2 and NO_2 concentration, and the 8-hour rolling average CO concentrations were both below the annual BCAAQO and 8-hour PCO respectively.

There were some quarters where data completeness did not achieve the 75% requirement of the BC ENV, outlined in site specific permits. This was a result of instrument malfunctions or annual maintenance. There were no parameters that did not meet the 75% completeness requirement on an annual basis at any station.

Meteorological monitoring at sites include: wind speed and direction, air temperature (measured at seven stations) and precipitation (measured at four stations). Meteorological data were compared against 30 – year climate normals measured in Sparwood. Overall, 2020 was found to be warmer and drier than normal. All variability in meteorological monitoring between stations can be mainly attributed to differences in elevation, local topography and the siting of each station.

In 2020, there were 276 pieces of feedback related to air quality and dust management. The feedback was related to specific train dusting, complaints relating to visual impacts, dirty vehicles and dust on personal property (267). Teck's Coal Operations in the Elk Valley continue to recognize dust as a primary concern to nearby communities and takes all feedback seriously.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Tapashree Tah

Tapashree Tah, M.S.
Environment, Regional Lead
Teck Coal Ltd.

Mukund Venkitachalam, M.Sc.
Senior Scientist
RWDI AIR Inc.

1 INTRODUCTION

Teck Coal Limited (Teck) operates four open pit coal mines (the Sites) within the Elk Valley and one open pit coal mine operation in care & maintenance in the Elk Valley: Coal Mountain (CMO) located in the southeastern Kootenay region of British Columbia (Figure 1). The Elk Valley is characterized by rugged terrain and localized mountain weather patterns. As with similar valleys in British Columbia, the mixing of air and dispersion of any pollutants it may contain is limited by a combination of topographic constraints and meteorological conditions. The communities of Elkford (population 2,500) and Sparwood (population 3,800) are the largest communities located in the vicinity of the Sites. Each mine, as outlined below, is authorized by permits issued by the British Columbia Ministry of Environment & Climate Change Strategy (ENV) under the *Environmental Management Act* to discharge emissions to the air:

- Coal Mountain Operations (CMO) – PA-4751
- Elkview Operations (EVO) – PA-1807
- Fording River Operations (FRO) – PA-1501
- Greenhills Operations (GHO) – PA-6249
- Line Creek Operations (LCO) – PA-5352

In 2014, site specific permits were amended to include a condition which states:

Valley Wide Monitoring Plan

The Permittee must participate in a comprehensive ambient monitoring program that considers emissions from all Teck Coal Limited mines in the Elk Valley. This program must be prepared and implemented by a qualified professional. This program must be conducted to the satisfaction of the Director.

The Regional Air Monitoring Program (RAMP) aims to satisfy this requirement of the Site's individual permits. The monitoring program uses an Adaptive Management Framework to allow for continual assessment and adjustment of the program to ensure it continues to efficiently meet objectives over time.

This report forms part of the requirements of the RAMP. This report will cover air quality and meteorological monitoring conducted by Teck in the Elk Valley under the RAMP, as well as draw in outside sources where necessary and if available. This report will supplement the Mines' reporting according to their individual permits by providing an overall summary and linking back to site specific monitoring and mining activities as required, providing context for the monitoring results for the Elk Valley.

This report includes information on:

- results above provincial or federal ambient air quality objectives or guidelines and,
- temporal trends in ambient air quality concentrations.

In addition, as required to provide context for the ambient results, this report includes:

- public input to visibility or nuisance dusting issues,
- changes in Teck mining operations that may impact air quality,
- changes in Teck's dust management plan, and
- changes in Teck's ambient monitoring program.

Using an adaptive management framework, this annual report will also make recommendations to adjust the RAMP where needed.

2 MONITORING LOCATIONS

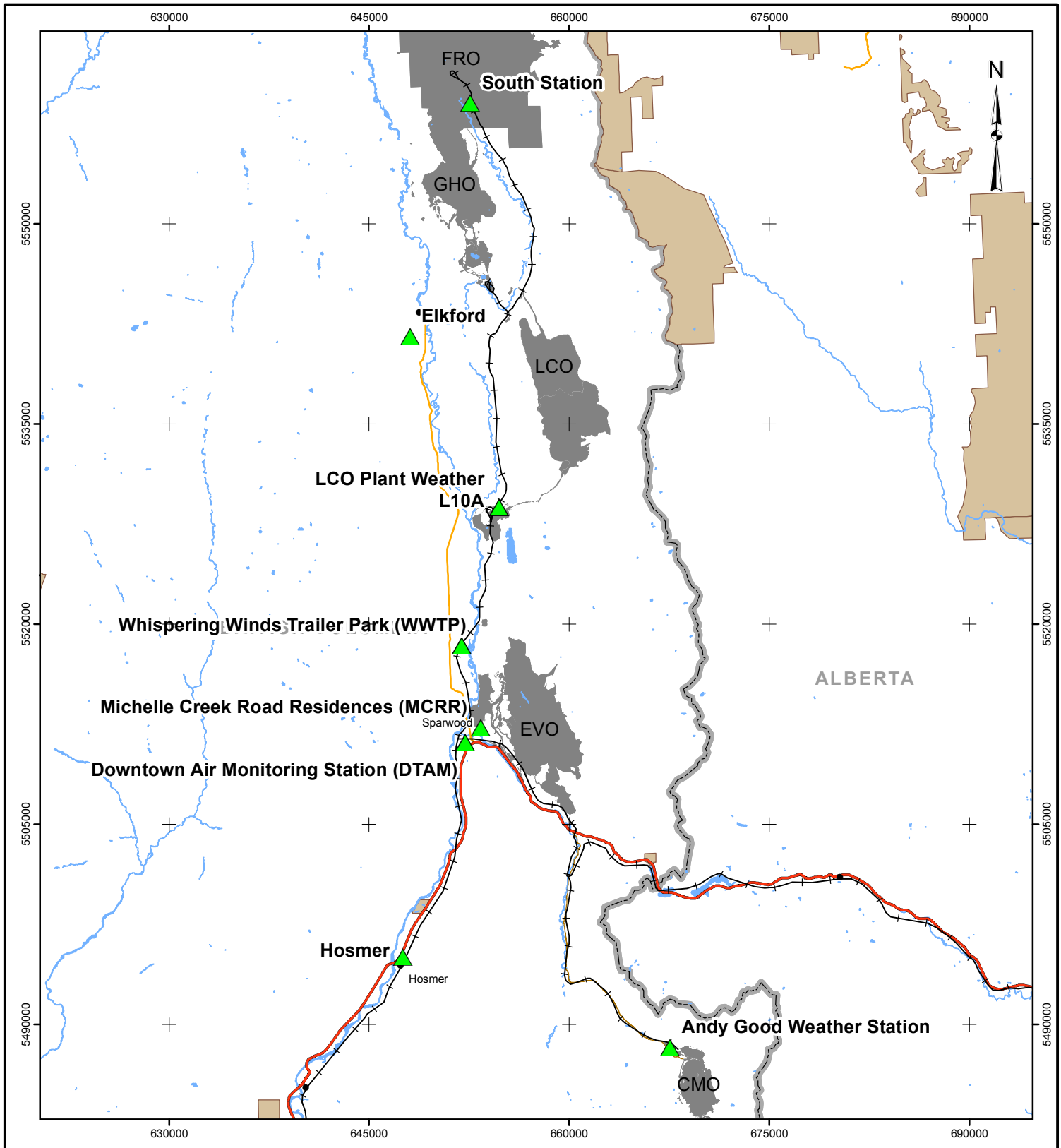
Air quality and meteorological monitoring is conducted at the Sites and in three different communities in the Elk Valley. There are currently seven continuous regional air monitoring stations operated by Teck, at which various parameters are measured and used for different purposes, including research and development, site fugitive dust management plans and ambient air quality monitoring. This section describes the seven stations and all parameters that are included in the RAMP that focus on monitoring and assessing ambient air quality. These seven stations were chosen to provide a representative assessment of air quality and meteorology throughout the Elk Valley region. See Table 1 and Figure 1 for the locations of the monitoring stations and Table 2 for a description of the parameters measured at each of those monitoring stations as required under the RAMP. The criteria air contaminants (CACs) measured at these stations include:

- TSP – Total Suspended Particulate
- PM_{10} – Particulate matter smaller than 10 µm in diameter
- $PM_{2.5}$ – Particulate matter smaller than 2.5 µm in diameter
- NO_2 – Nitrogen dioxide
- SO_2 – Sulphur dioxide
- CO – Carbon monoxide

Table 1: Location in decimal degrees and elevation in metres of the monitoring stations in the Regional Air Monitoring Program.

Station Name		Latitude (decimal degrees)	Longitude (decimal degrees)	Elevation (m)
CMO	Andy Good Weather Station (CMO - AGWS/E297251) [1]	49.523678	-114.684289	1493
	Hosmer	49.590260	-114.959234	1057
EVO	Downtown Air Monitoring Station (EVO - DTAM/E262137))	49.732811	-114.887683	1138
	Whispering Winds Trailer Park (EVO - WWTP/E0250184)	49.798506	-114.888639	1160
	Michel Creek Road Residences (EVO - MCRR)	49.743520	-114.872577	1150
LCO	L10A (LCO - L10A/E206189)	49.891055	-114.845795	1298
	LCO Plant Weather (E297050)	49.891053	-114.845684	1298
GHO	Elkford School (GHO – Elkford/E290310) [2]	50.007808	-114.933668	1333
FRO	South Station (FRO - SS/E297832) [3]	50.148679	-114.856601	1582

Notes: Station name abbreviations along with station identifiers are included in parentheses beside the station name. Station names with regards to the valley wide monitoring program differ from those specified in the permits.
(1)- Named "Andy Good Spoils" in the Teck CMO permit PA 4751.
(2)- Named "Rocky Mountain Elementary" in the Teck GHO permit PA 6249.
(3)- Named "Sewage Treatment Facility Air Quality Station" in the Teck FRO permit PA 1501.



LEGEND

- AIR MONITORING STATION
- CITY / TOWN / COMMUNITY
- CANADIAN PACIFIC RAILWAY
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- ROAD
- BRITISH COLUMBIA / ALBERTA PROVINCIAL BOUNDARY
- MINE OPERATIONS
- PROVINCIAL PARK
- WATERBODY

10 0 10

SCALE 1:400,000 KILOMETRES

REFERENCE

Provincial Boundary and communities obtained from The Atlas of Canada, Natural Resources Canada. Alberta Hydrography obtained from CanVec, Government of Canada, Natural Resources Canada. BC Hydrography, Dominion Coal Blocks and project data obtained from Teck Coal Limited. Roads obtained from Geobase. Provincial parks and Railroad data obtained from Geogratis. Projection: UTM Zone 11 Datum: NAD 83

PROJECT

TECK COAL REGIONAL
AIR MONITORING PROGRAM

TITLE

AIR MONITORING STATIONS

PROJECT No. 12-1349-0003			SCALE AS SHOWN	REV. 0
DESIGN	DR	03 Jan. 2014	FIGURE 1	
GIS	DJH	16 Mar. 2017		
CHECK	ABS	16 Mar. 2017		
REVIEW	TAD	16 Mar. 2017		

1500459_Teck_Monitoring_Figure 1_Monitoring Stations.mxd

Table 2: Parameters measured at each of the stations that are part of the Regional Air Monitoring Program.

Station Name		Air Quality Parameters							Meteorological Parameters						
		TSP	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	Visual Viewshed	Wind Speed and Direction	Temperature	Relative Humidity	Barometric Pressure	Precipitation	Solar Radiation	Snow Depth
CMO	Andy Good Weather Station (CMO - AGWS/E297251) [3]	X	X	X				X	X	X			X		X
	Hosmer		X	X					X	X	X	X			
EVO	Downtown Air Monitoring Station (EVO - DTAM/E262137)		X[1]	X[1]	X	X	X	X	X	X	X				
	Whispering Winds Trailer Park (EVO - WWTP/E0250184)		X[1]	X[1]					X	X	X				
	Michel Creek Road Residences		X	X					X	X	X				
LCO	L10A (LCO - L10A/E206189)	X[2]													
	LCO Plant Weather (E297050)								X	X			X		
GHO	Elkford (GHO – Elkford/E290310) [4]	X	X	X				X	X	X			X		
FRO	South Station (FRO - SS/E297832) [5]		X[1]						X	X	X	X	X	X	X

Notes: Station name abbreviations along with station identifiers are included in parentheses beside the station name. Station names with regards to the valley wide monitoring program differ from those specified in the permits.
(1)- PM_{10} and $PM_{2.5}$ at these locations measured continuously using a Thermo 5030i SHARP.
(2)- TSP at these locations are measured using a Hi-Volume sampler per the National Air Pollution Surveillance schedule.
(3)- Named “Andy Good Spoils” in the Teck CMO permit PA 4751.
(4)- Named “Rocky Mountain Elementary” in the Teck GHO permit PA 6249.
(5)- Named “Sewage Treatment Facility Air Quality Station” in the Teck FRO permit PA 1501.

3 AIR QUALITY RESULTS

As shown in Table 3, six air quality parameters were measured across Teck's regional monitoring network. The results of the monitoring in 2020 and the longer-term trends are discussed in this section. These results include a discussion of the number of excursions and/or results above applicable BC Provincial Ambient Air Quality Objectives (BCAAQO) for each air contaminant that is monitored (see Table 3 and Table 5), as well as the completeness of the datasets for PM and gases at the monitoring stations. Appendices A and B also provide more detailed information on air quality for 2020.

Figure 2 through Figure 10 and figures in Appendix B show time series of CAC concentrations measured at all stations within the regional monitoring network and Table 4 shows the annual means of particulate matter concentrations at all stations.

Table 3: BC Ambient Air Quality Objectives for each air contaminant that is monitored at any of the stations covered by this report.

Contaminant	BCAAQO / BC PCO	1-Hour	8-Hour	24-Hour	Annual
$PM_{2.5}$ (µg/m^3)	BCAAQO [2]			25[3]	8
PM_{10} (µg/m^3)	BCAAQO [2]			50	
TSP (µg/m^3)	BCAAQO [2]			120	60[6]
NO_2 (µg/m^3)	BCAAQO [2]	113[4]			60
SO_2 (µg/m^3)	BCAAQO [2]	183[5]			5
CO (µg/m^3)	BC PCO [1]	14,300	5,500		

Notes:

(1)- BC PCO refers to the BC Pollution Control Objective (BC MOE, 2016).
(2)- BCAAQO refers to the Provincial Ambient Air Quality Objective (BC MOE, 2016).
(3)- The $PM_{2.5}$ BCAAQO is based on 98th percentile values; therefore, an exceedance is defined as occurring only after six excursions have occurred.
(4)- The NO_2 BC interim AAQO is based on the 98th percentile of the daily maximum 1-hour value. Therefore, an exceedance is defined as occurring only after six excursions have occurred.
(5)- The SO_2 BC interim AAQO is based on the 98th percentile of the daily maximum 1-hour value. Therefore, an exceedance is defined as occurring only after six excursions have occurred.
(6)- The annual TSP BCAAQO is based on the geometric mean.

3.1 Total Suspended Particulate (TSP)

Figure 2 shows the time series of 24-hour average TSP concentrations for the three stations at which TSP is measured as well as the BCAAQO for TSP of 120 µg/m^3. Figure 2 and Table 5 show that there were 6 values greater than the 24-hour objective: three at LCO-L10A, two at CMO-AGWS and one at GHO-Elkford. The daily averaged TSP concentration above the BACAAQO limits were recorded at all three stations and occurred in the month of September when there was localized forest fire activity in Alberta. Annual geometric means of TSP concentrations at all three locations remained below the annual BCAAQO of 60 µg/m^3 (see Table 4 and Table 6) in 2020.

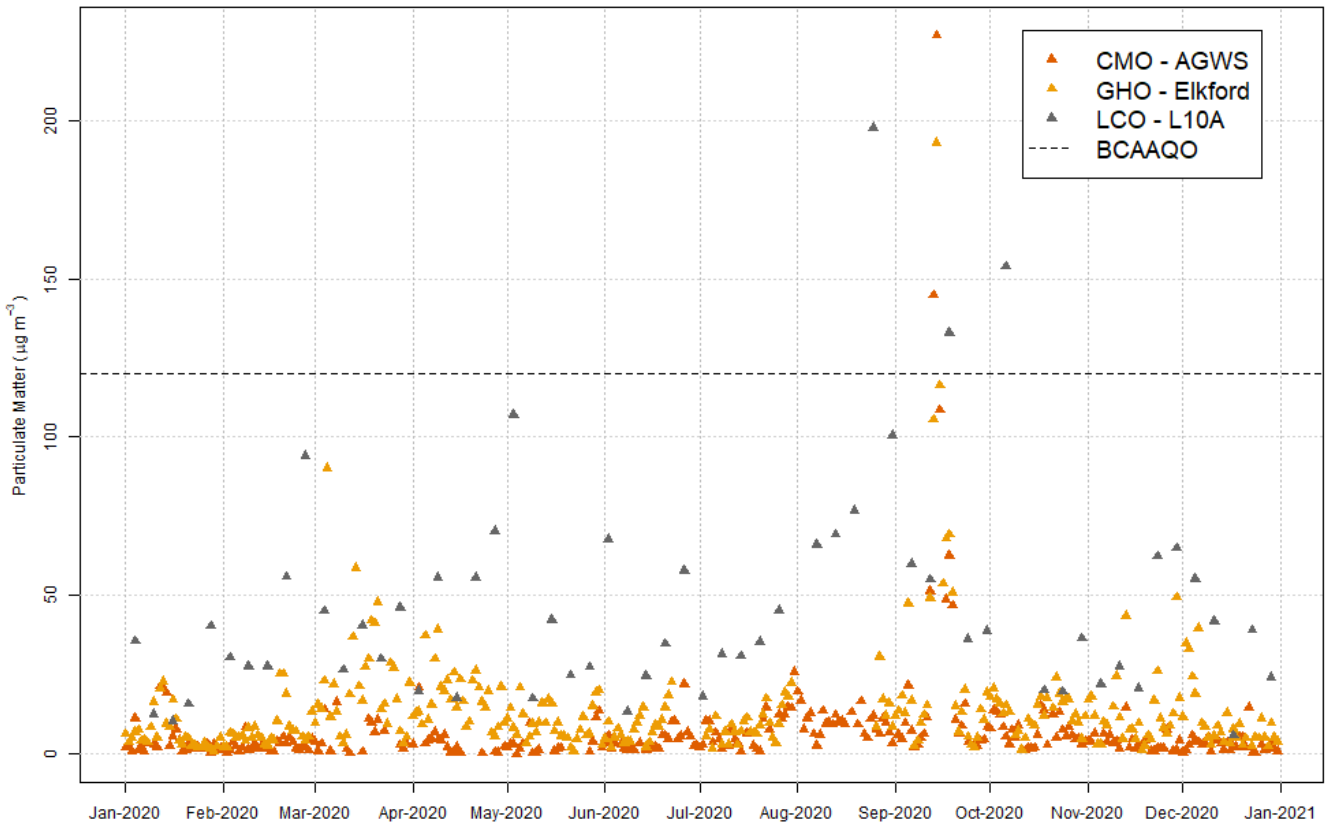


Figure 2: Daily averaged TSP concentrations.
Note: The BCAAQO of 120 µg/m^3 is indicated by a dashed line.

Table 4: Annual means of particulate matter concentrations from each station for 2020.

Station Name		TSP [1](µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)
		Annual BCAAQO of 60 µg/m³		Annual BCAAQO of 8 µg/m³
CMO	AGWS	2.4	5.9	4.7
	Hosmer		9.8	6.7
EVO	DTAM		10.9	6.1
	MCRR		14.6	6.7
	WWTP		9.1	5.4
LCO[2]	L10A	37.4		
GHO	Elkford	7.3	9.5	5.6
FRO	SS		28.6	

Notes: Annual means for all parameters and stations.
(1)- Annual average of TSP is calculated as the geometric mean to allow comparison with the BCAAQO.
(2)- Annual average of daily means was used for LCO due to it being a non-continuous particulate monitor.

Table 5: Total number results above BCAAQO for 2020.

Station Name		Contaminant	Threshold		Excursions or exceedances	
					Total number	Percentage
CMO	AGWS	TSP	BCAAQO	(120 µg/m^3)	2	0.64
		PM_{10}	BCAAQO	(50 µg/m^3)	4	1.20
		$PM_{2.5}$	BCAAQO[1]	(25 µg/m^3)	8	2.31
	Hosmer	PM_{10}	BCAAQO	(50 µg/m^3)	7	2.28
		$PM_{2.5}$	BCAAQO[1]	(25 µg/m^3)	11	3.38
EVO	DTAM	PM_{10}	BCAAQO	(50 µg/m^3)	0	0.00
		$PM_{2.5}$	BCAAQO[1]	(25 µg/m^3)	3	0.95
		NO_2	BCAAQO[2]	(113 µg/m^3)	0	0.00
		CO (1-hour avg)	BCPCO	(14,300 µg/m^3)	0	0.00
		CO (8-hour avg)	BCPCO	(5,500 µg/m^3)	0	0.00
		SO_2	BCAAQO[3]	(183 µg/m^3)	0	0.00
	MCRR	PM_{10}	BCAAQO	(50 µg/m^3)	9	2.79
		$PM_{2.5}$	BCAAQO[1]	(25 µg/m^3)	8	2.52
	WWTP	PM_{10}	BCAAQO	(50 µg/m^3)	5	1.43
		$PM_{2.5}$	BCAAQO[1]	(25 µg/m^3)	7	2.05
LCO	L10A	TSP	BCAAQO	(120 µg/m^3)	3	5.08
GHO	Elkford	TSP	BCAAQO	(120 µg/m^3)	1	0.31
		PM_{10}	BCAAQO	(50 µg/m^3)	6	1.72
		$PM_{2.5}$	BCAAQO[1]	(25 µg/m^3)	9	2.54
FRO	SS	PM_{10}	BCAAQO	(50 µg/m^3)	54	16.88

Notes:

(1) The $PM_{2.5}$ BCAAQO is based on 98th percentile values; therefore, an exceedance is defined as occurring only after six excursions have occurred.

(2) The NO_2 BCAAQO is based on the Canadian Ambient Air Quality Standard (CAAQS): 113 µg/m^3, annual 98th percentile daily 1-hour maximum, averaged over 3 years. The CAAQS is set to be adopted in 2020 however it is used in this report to be conservative. Excursions are used because 3 years of data are needed to determine if there was an exceedance.

(3) The SO_2 BCAAQO is based on the CAAQS: 183 µg/m^3, annual 99th percentile daily 1-hour maximum averaged over three years. The CAAQS is set to be adopted in 2020 however it is used in this report to be conservative. Excursions are used because 3 years of data are needed to determine if there was an exceedance.

Table 6: Annual means of TSP concentrations (geometric means).

Year	CMO AGWS	GHO ElkFord	LCO L10A
	TSP (µg/m³)	TSP (µg/m³)	(µg/m³)
2000			42.5
2001			45.4
2002			49.2
2003			39.1
2004			40.8
2005			43.5
2006			41.1
2007			41.0
2008			44.9
2009			47.4
2010		1.7	48.0
2011	7.0	2.6	61.9
2012	7.9	6.2	76.3
2013	7.8	5.9	63.4
2014	7.0	5.9	61.8
2015	8.5	6.9	47.3
2016	5.7	7.1	43.5
2017	5.8	7.9	42.8
2018	4.4	8.6	53.3
2019	3.0	8.4	48.0
2020	2.4	7.3	37.4

Notes: Cells highlighted in pink and red denote values for which the data was less than 75% complete.
GHO – Elkford TSP measurements began on 2010-11-03.

3.2 PM_{10}

Figure 3 shows the time series of the 24-hour average PM_{10} concentrations at seven stations as well as the BCAAQO of 50 µg/m^3. Figure 3 and Table 5 show that there were eighty-five (85) daily average concentrations of PM_{10} were observed above the BCAAQO at 6 stations: Fifty-four (54) at FRO- South Station, six (6) at GHO – Elkford, five (5) at EVO-WWTP, nine (9) at EVO – MCRR, seven (7) at CMO – Hosmer and four (4) at CMO – AGWS. No exceedances were reported at EVO – DTAM station.

PM_{10} concentrations above the BCAAQO were recorded most often in the Fall (September, October) and spring (March and April) months and this is reflected in the seasonal average concentrations in Table A-5 of Appendix A. This is a departure from the usual trend of the greatest number of concentrations above the BCAAQO being recorded in August, when there is normally an active forest fire season in British Columbia; 2020 was less severe than normal. The elevated particulate matter concentrations at FRO – SS in 2020 could be related wildfire season in British Columbia especially between April 1 and October 1.

Elevated PM_{10} concentrations in August and September don't appear to be associated with any particular wind direction and are likely the result of particulate emissions from both GHO and FRO being mixed throughout the area by up and down valley winds as well as upslope (anabatic) and downslope (katabatic) local flows. Elevated PM_{10} concentrations in November are associated with strong winds from the northwest.

Elevated mean PM_{10} concentrations at GHO – Elkford in March and April were associated with light winds from the south are likely related to road-dust emissions in the community of Elkford related to the spreading of abrasives in winter. There are no obvious sources located to the northwest of the station, so it is likely related to regionally elevated PM_{10} concentrations on that day. The highest PM_{10} concentrations in April were associated with light winds from the southeast and are likely related to road-dust emissions within the community due to accumulated abrasives following the winter.

Elevated mean PM_{10} concentrations at EVO – MCRR in January were associated with strong winds from the southeast (8 to 12m/s) and low winds from the southeast in February. A number of homes across Michel Creek road lie in this direction and the increased concentrations are likely related to increased emissions due to smoke from heating with wood stoves.

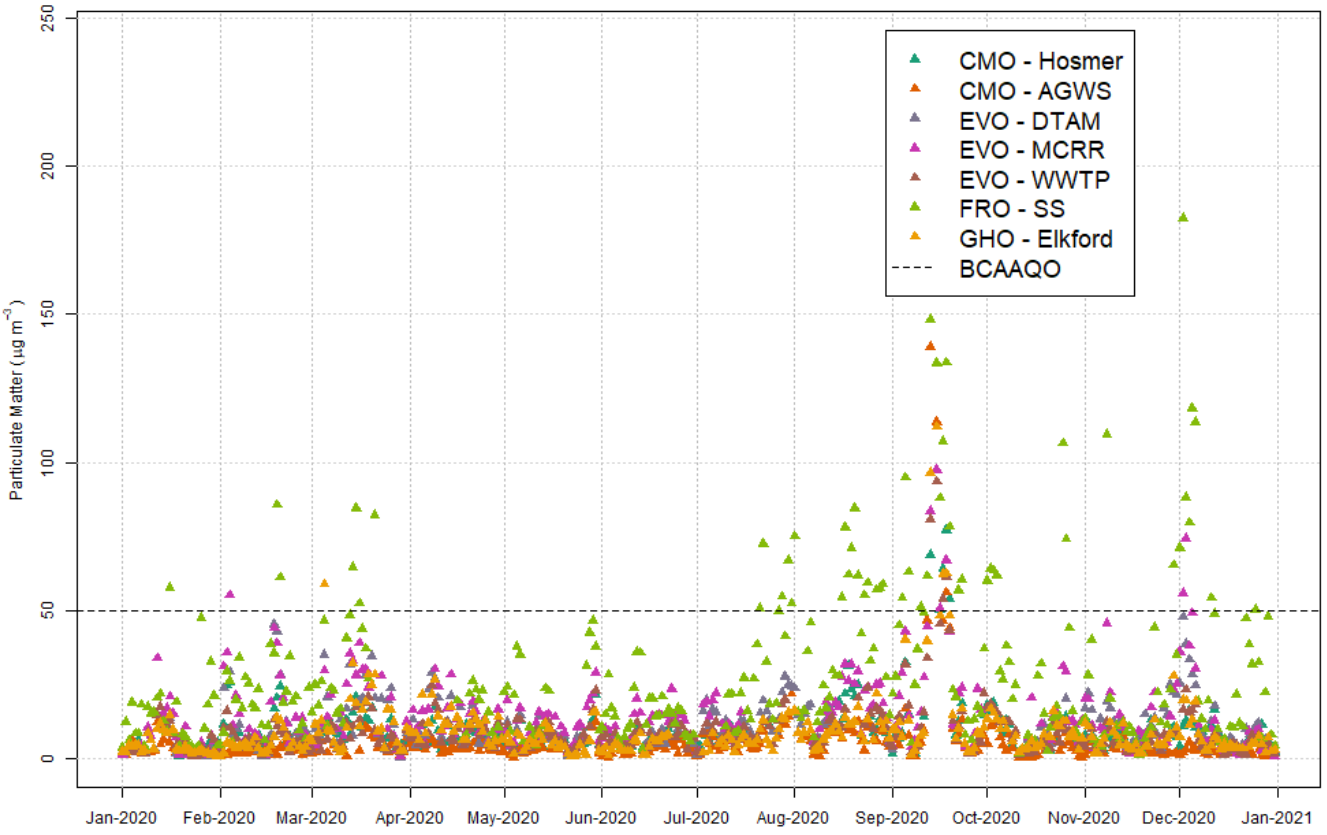


Figure 3: Daily averaged PM_{10} concentrations.

Note: The BCAAQO of 50 µg/m^3 is indicated by a dashed line.

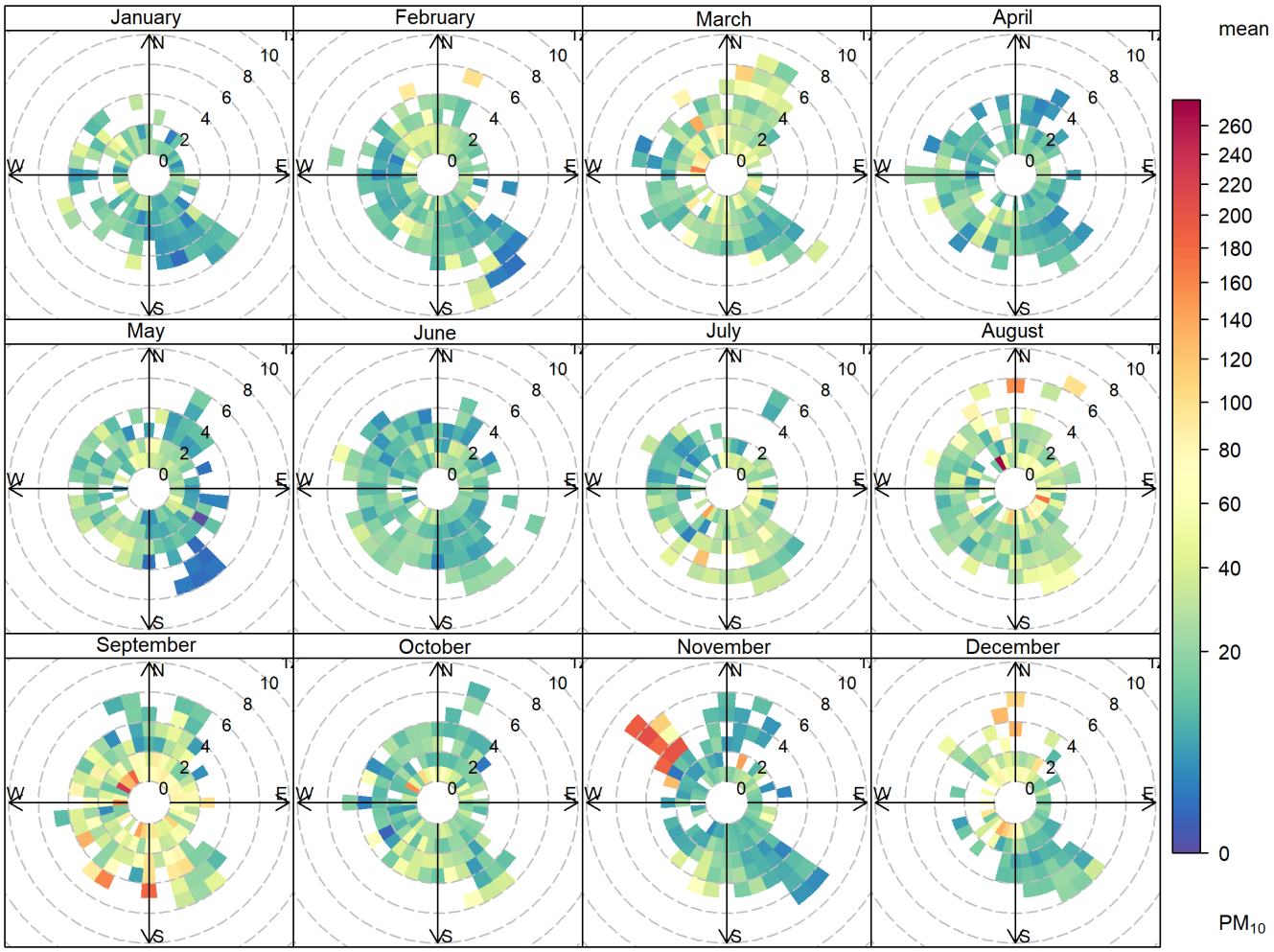


Figure 4: Mean PM_{10} concentrations ($\mu g/m^3$) observed at FRO – SS by wind speed and direction for each month of 2020.

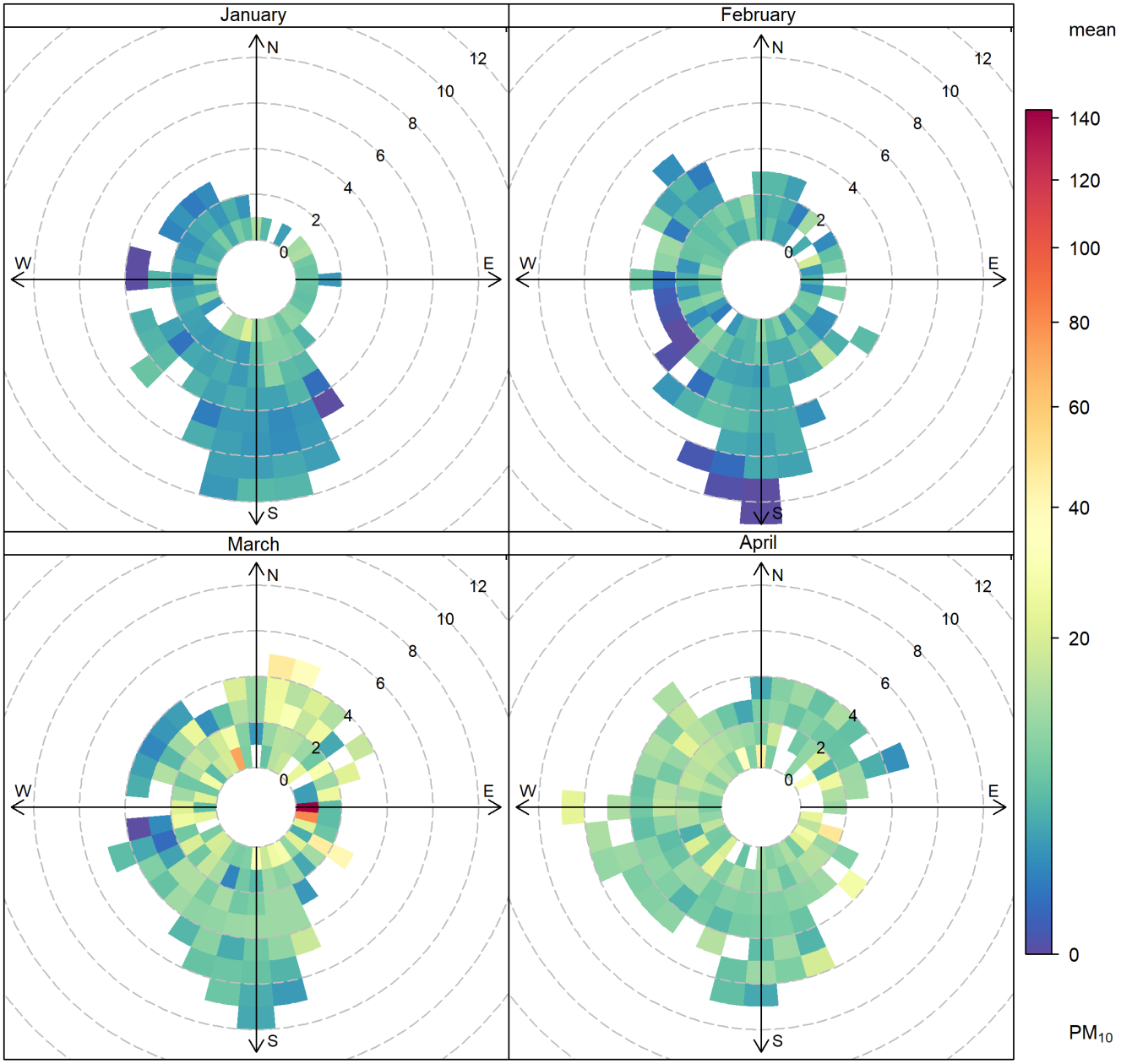


Figure 5: **Mean PM_{10} concentrations (µg/m³) observed at GHO - Elkford by wind speed and direction for January through April, 2020.**

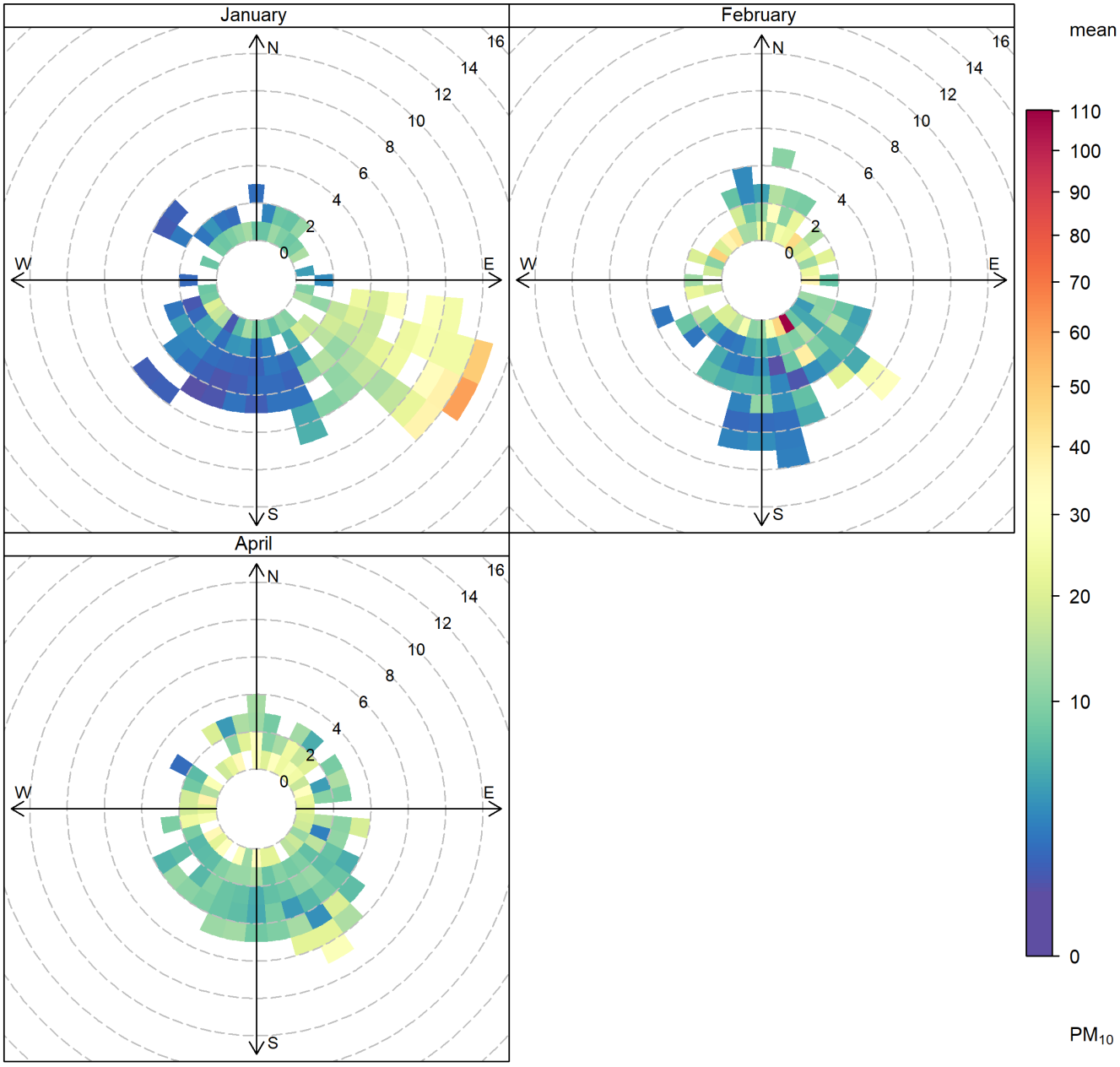


Figure 6: Mean PM_{10} concentrations (µg/m³) observed at EVO - MCRR by wind speed and direction for January through April, 2020.

3.3 $PM_{2.5}$

The term excursion is used here to describe a single 24-hour average that exceeds the BCAAQO. The 24-hour objective for $PM_{2.5}$ defines an exceedance based on the 98th percentile of the daily average over one year. Table A-13 in Appendix A provides the 98th percentile of $PM_{2.5}$ for each station. It is shown that the $PM_{2.5}$ 98th percentiles were below the BCAAQO at all stations for 2020.

Figure 7 shows the time series of the 24-hour average $PM_{2.5}$ concentrations at six stations as well as the BCAAQO of 25 µg/m^3. Figure 4 and Table 5 show that there were forty-six (46) excursions above the 24-hour $PM_{2.5}$ BCAAQO, nine (9) at GHO-Elkford (2.54%), seven (7) at EVO-WWTP (2.05%), eight (8) at EVO-MCRR (2.52%), three (3) at EVO-DTAM (0.95%), eleven (11) at CMO-Hosmer (3.38%), and eight (8) at CMO-AGWS (2.31%). The annually averaged $PM_{2.5}$ concentration at all stations were less than the BCAAQO of 8 µg/m^3 and the annually averaged $PM_{2.5}$ concentrations at EVO – DTAM and CMO – Hosmer were greater than the BC planning goal of 6 µg/m^3 (see Table 4).

Forty-six (46) excursions above the 24-hour $PM_{2.5}$ BCAAQO, nine (9) at GHO-Elkford (2.54%), seven (7) at EVO-WWTP (2.05%), eight (8) at EVO-MCRR (2.52%), three (3) at EVO-DTAM (0.95%), eleven (11) at CMO-Hosmer (3.38%), and eight (8) at CMO-AGWS (2.31%).

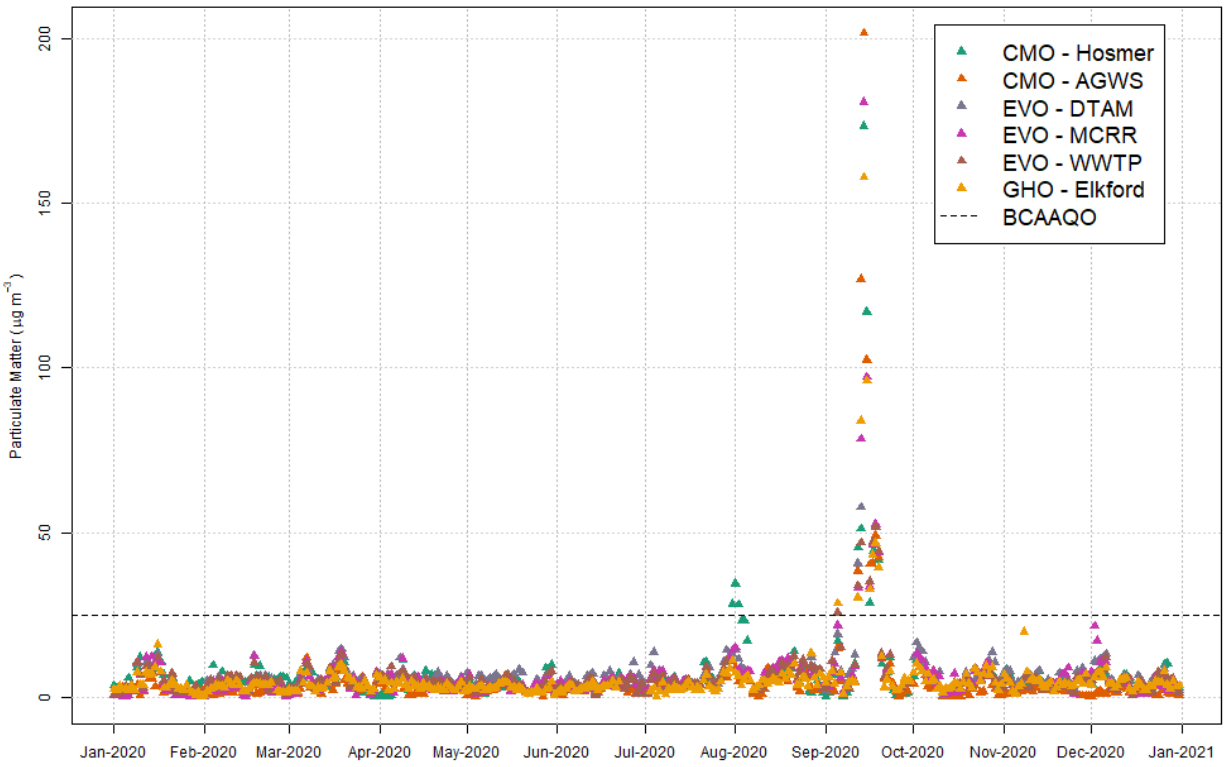


Figure 7: Daily averaged $PM_{2.5}$ concentrations.
Note: The BCAAQO of 25 µg/m^3 is indicated by a dashed line.

3.4 Gases

Figure 8 through Figure 10 show the time series of concentrations of NO_2, CO and SO_2 respectively at the EVO – DTAM station as well as the relevant BCAAQO for each gas (specified in Table 5). These three figures as well as Table 5 show that the 1-hour NO_2 and SO_2 concentrations (Daily 1-hour Maxima) were below the respective 1-hour BCAAQO for each contaminant, the 1-hour and 8-hour rolling average CO concentrations were below the 1-hour and 8-hour PCO for CO and the annual average SO_2 and NO_2 concentration was below the annual BCAAQO for NO_2.

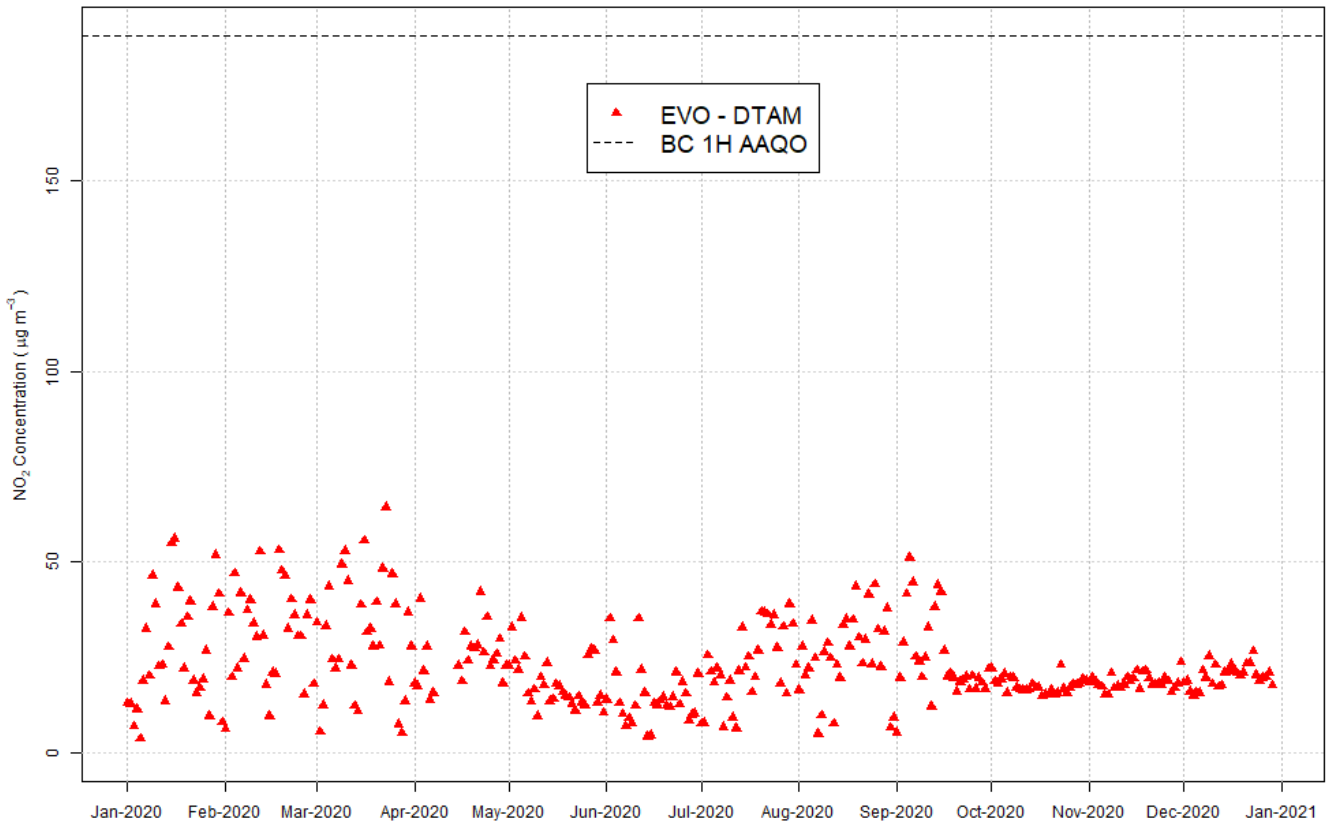


Figure 8: Daily 1-hour maximum NO_2 concentrations from EVO – DTAM.
Note: The BCAAQO of 188 µg/m^3 is indicated by a dashed line.

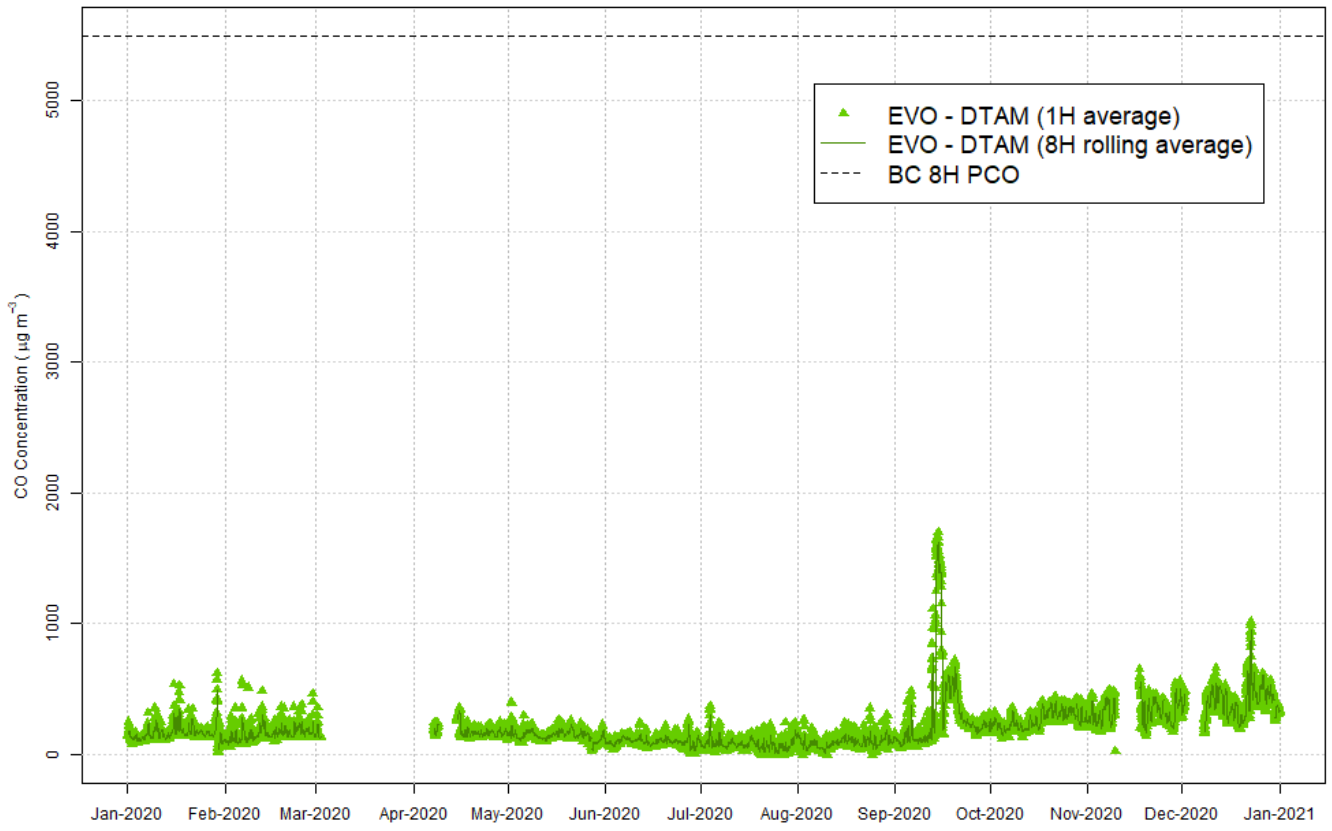


Figure 9: 1-hour and 8-hour rolling averaged CO concentrations from EVO – DTAM.

Notes: The BC 8H PCO of 5500 µg/m^3 is indicated by a dashed line.
The BC 1H PCO of 14300 µg/m^3 was omitted for better presentation of the data.

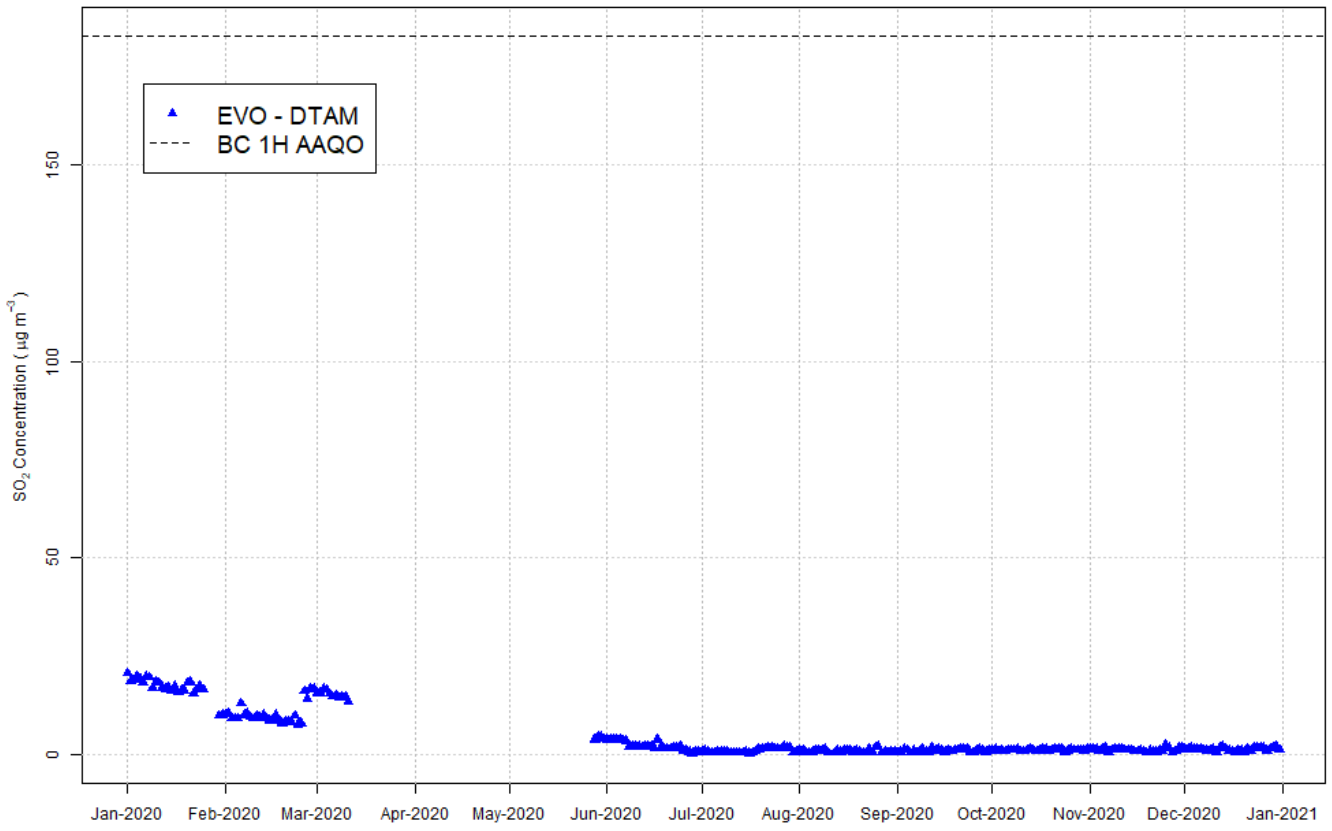


Figure 10: Daily 1-hour maximum SO_2 concentrations from EVO – DTAM.
Note: The BCAAQO of 183 µg/m^3 is indicated by a dashed line.

3.5 Inter-annual Variability of Air Quality Measurements

As part of the analysis of air quality within the Elk Valley region, an examination of inter-annual variability in annual average CAC concentrations at all stations is presented below. Monitoring at CMO Andy Good Spoils (CM_AGS) was excluded as per the TECK RAMP 2020 update. The location at GHO – Elkford uses a continuous Thermo Scientific SHARP PM monitor. Records for this sampler at GHO – Elkford, dates back to late 2010 when it began operations. Table 6 and Figure 11 show the inter-annual trends of TSP concentrations. GHO – Elkford has shown a slight increasing trend in TSP concentrations since inception. There was a marginal drop in 2020 as compared to 2019.

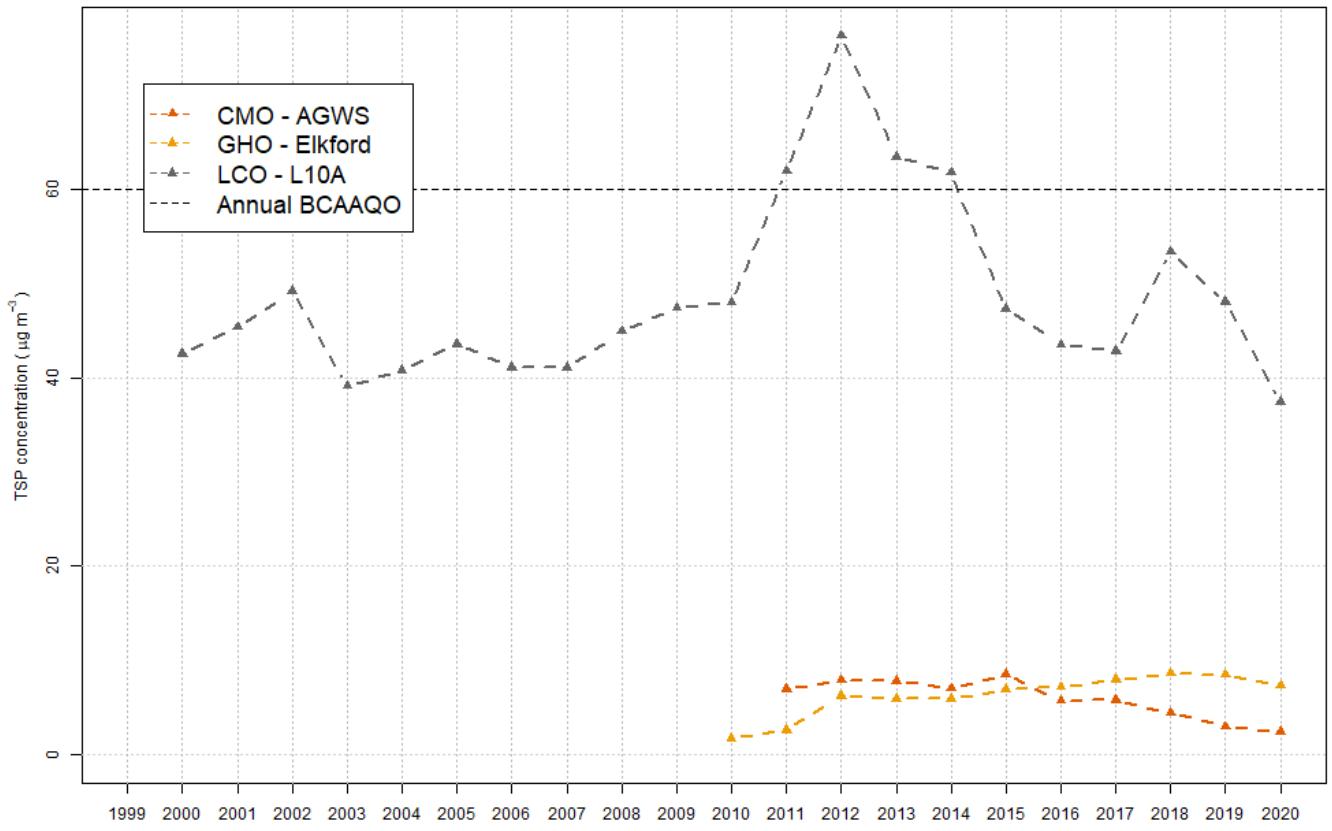


Figure 11: Time Series of Annual Averages of TSP Concentration since Station Inception (geometric mean).

Note: The annual BCAAQO of 60 µg/m^3 is indicated by a dashed line.

Table 7 and Figure 12 show the inter-annual trends of PM_{10} concentrations. All stations except CMO – AGWS show a decreasing trend in annually averaged PM_{10} concentrations over the period of record. Annual average PM_{10} concentrations in 2018 increased at all stations, reflecting, in part, the higher regional PM_{10} concentrations observed through the intense forest fire season of that year, but they returned to near 2017 levels in 2019. EVO-MCRR and EVO-DTAM observed a significant drop in 2020 concentration compared to 2019. This can be partly attributed to the intense forest fire season in 2019 attributing to the higher numbers.

Table 7: Annual means of PM_{10} concentrations (geometric means).

Year	CMO		EVO			FRO	GHO
	Hosmer	AGWS	DTAM	MCRR	WWTP	SS	Elkford
	PM_{10} (µg/m³)	PM_{10} (µg/m³)	PM_{10} (µg/m³)	PM_{10} (µg/m³)	PM_{10} (µg/m³)	PM_{10} (µg/m³)	PM_{10} (µg/m³)
2010							5.8
2011		8.9					7.3
2012		10.4					8.4
2013	6.7	8.9				12.7	8.3
2014	10.0	9.3	14.3	15.1	9.9	25.5	9.8
2015	10.2	12.1	10.1	15.4	7.8	25.1	9.6
2016	8.2	8.4	10.8	12.4	6.4	17.0	7.0
2017	9.3	8.6	14.3	16.7	8.9	31.1	10.6
2018	14.2	8.6	17.2	19.5	9.2	30.0	11.5
2019	10.1	4.6	13.5	18.0	9.8	28.9	9.4
2020	9.8	5.9	10.9	14.6	9.1	28.6	9.5

Notes: Cells highlighted in pink and red denote values for which the data was less than 75% complete for the year.
CMO – Hosmer PM_{10} measurements began on 2013-11-07.
EVO – DTAM PM_{10} measurements began on 2014-01-18.
EVO – MCRR PM_{10} measurements began on 2014-01-23.
EVO – WWTP PM_{10} measurements began on 2014-01-23.
FRO – SS PM_{10} measurements began on 2013-12-21.
GHO – Elkford PM_{10} measurements began on 2010-11-03.

Figure 12: Time series of annual averages of PM_{10} concentration since station inception.

Table 8 and Figure 13 show the inter-annual trends of $PM_{2.5}$ concentrations. Annual average $PM_{2.5}$ concentrations in 2019 decreased at all stations following the intense forest fire season in 2018. Besides a slight jump at CMO-Hosmer, there were no significant trends observed in the data for 2020 as compared to 2019 $PM_{2.5}$ concentrations.

Table 9 shows the annual average gas concentrations for the five years available at the EVO – DTAM location. There are no discernable year-to-year trends in the annual averaged concentrations of NO_2 and CO. There was a marked increase in 2019 in the annual averaged concentration of SO_2 over previous years which have been caused by the station move. However, in 2020, there was a significant reduction in SO_2 once the system was stabilized after the move.

Table 8: Annual means of $PM_{2.5}$ concentrations.

Year	CMO		EVO			GHO
	Hosmer	AGWS	DTAM	MCRR	WWTP	Elkford
	$PM_{2.5}$ (µg/m³)	$PM_{2.5}$ (µg/m³)	$PM_{2.5}$ (µg/m³)	$PM_{2.5}$ (µg/m³)	$PM_{2.5}$ (µg/m³)	$PM_{2.5}$ (µg/m³)
2010						6.4
2011		3.2				3.7
2012		4.2				4.6
2013	6.6	3.9				4.2
2014	6.2	4.2	6.9	5.1	5.2	4.7
2015	6.8	6.1	5.5	5.8	5.4	4.9
2016	5.7	3.7	4.6	4.8	3.7	3.6
2017	9.4	4.2	5.3	7.6	5.8	7.4
2018	7.9	5.1	7.8	7.8	8.6	7.4
2019	5.0	2.4	6.6	6.6	5.8	4.5
2020	6.7	4.7	6.1	6.7	5.4	5.6

Notes: Cells highlighted in pink and red denote values for which the data was less than 75% complete for the year.
CMO – Hosmer $PM_{2.5}$ measurements began on 2013-11-07.
CMO – AGWS $PM_{2.5}$ measurements began on 2011-10-03.
EVO – DTAM $PM_{2.5}$ measurements began on 2014-01-18.
EVO – MCRR $PM_{2.5}$ measurements began on 2014-01-23.
EVO – WWTP $PM_{2.5}$ measurements began on 2014-01-23.
GHO – Elkford $PM_{2.5}$ measurements began on 2010-11-03.

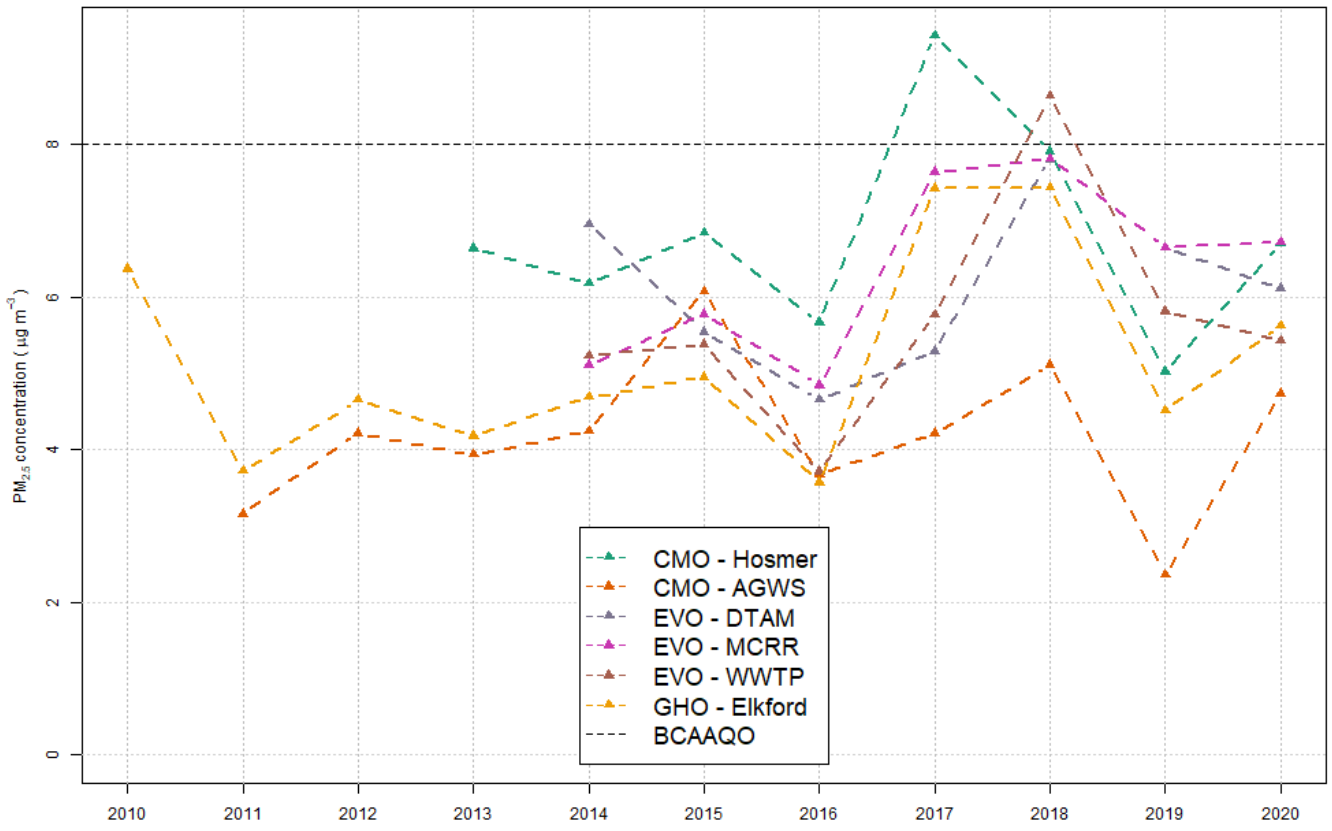


Figure 13: Time series of annual averages of $PM_{2.5}$ concentration since station inception.
Note: The annual BCAAQO of 8 µg/m^3 is indicated by a dashed line.

Table 9: Annual means of gas concentrations.

Year	EVO - DTAM		
	NO_2	CO	SO_2
	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
2014	8.5	189	0.1
2015	7.6	190	0.2
2016	6.2	287	0.2
2017	10.4	130	0.06
2018	8.1	193	0.3
2019	11.1	162	21.6
2020	11.1	198.7	3.6

Note: Cells highlighted in pink and red denote values for which the data was less than 75% complete.

3.6 Data Completeness

The permit for each of the Sites states that continuous data for a given time period will be considered valid if 75% of the data for that time period has been captured. Non-continuous data for a given time period will be considered valid if 85% of the data for that time period has been captured. Tables A-1 through A-4 (Appendix A) provide the number of valid hours and days of data per time period for TSP, PM_{10}, $PM_{2.5}$ and for the gases respectively.

Following an agreement between the Sites and ENV, the days during which annual maintenance were performed or extended maintenance involving notification to the ENV were removed from the possible number of days. The maximum possible time was not adjusted for the maintenance hours and the total number of days in any month was considered for completeness calculations. The following periods were removed from the data completeness calculations for an instrument at a given station due to that instrument being removed for annual maintenance:

- CMO – Hosmer: August 06 to August 13.
- CMO – AGWS: May 19 to May 26
- GHO – Elkford School:
  - TSP: June 23 to July 02
  - PM_{10}: June 23 to July 02
  - $PM_{2.5}$: June 23 to July 02
- FRO – Wastewater Treatment:
  - PM_{10}: July 02 to July 07

- EVO – DTAM:
  - PM_{10} and $PM_{2.5}$: August 13 to August 26.
- EVO – MCRR:
  - PM_{10}: July 09 to July 16.
- EVO – WWTP:
  - PM_{10}: July 30 to August 06
- LCO – L10A:
  - PM_{10}: July 02 to July 09

3.6.1 TSP

TSP measurements at CMO – AGWS, LCO-L10A and GHO – Elkford met the objective for data completeness during all quarters and the year.

3.6.2 PM_{10}

PM_{10} measurements at CMO-AGWS, EVO – WWTP and GHO – EHS met the 75% completeness objectives for all quarters and the year.

PM_{10} measurements at CMO – Hosmer did not meet the 75% completeness objective in the third quarter of 2020 due to annual maintenance in August and a damaged pump in October.

PM_{10} measurements at EVO – DTAM did not meet the 75% completeness for monitoring days in Quarter 3 and the entire year mainly due to annual maintenance and power outage issues at the shelter.

Lastly, PM_{10} measurements at FRO – WWT could not meet the 75% completeness objective in the second quarter of 2020 due to a malfunction on the tape sensor.

3.6.3 $PM_{2.5}$

$PM_{2.5}$ measurements at both stations CMO – Hosmer and GHO – Elkford, met the objective for data completeness during all quarters and for the year.

$PM_{2.5}$ measurements at EVO – DTAM saw reduced completeness for the third quarter due to annual maintenance and power outage in the shelter.

3.6.4 Gases

All gases at EVO – DTAM (Nitrogen Dioxide (NO_2), Carbon Monoxide (CO) and Sulphur Dioxide (SO_2)) met the 75% completeness objective for all quarters of 2020 when planned outages are removed from the total possible number of days and hours.

This increase in uptime from 2018 may be partially due to the station move from the rooftop to a room on the top floor of the building in November 2018 which allows for better climate control of the instruments and less exposure to the elements which in turn has resulted in more accurate calibrations, more stable measurements and less wear and tear on the sample pumps and cooler assemblies.

4 METEOROLOGY RESULTS

4.1 Wind Speed and Direction

Figure 14 shows wind roses for the eight stations included in the RAMP. The differences between stations in wind speed and direction that are apparent in the wind roses are mainly attributed to differences between local topography and, to a lesser extent, small scale surface features such as proximity to trees and surrounding land use.

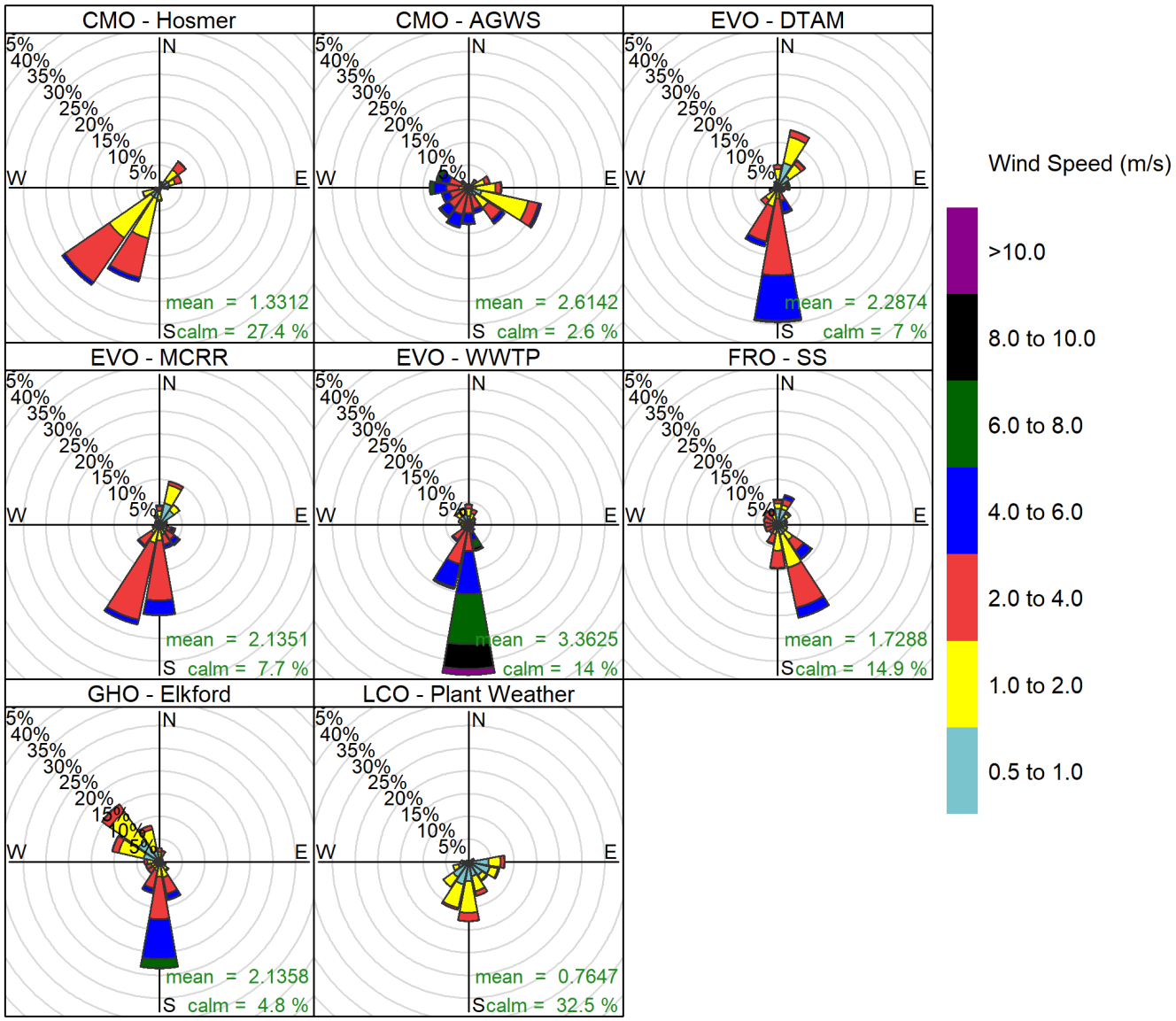


Figure 14: Wind roses for all stations in the Regional Air Monitoring Program for 2020.

4.2 Precipitation

Monthly precipitation totals are shown in Figure 15 where they are compared to the 30 year mean and standard deviation of monthly precipitation totals observed at the Environment and Climate Change Canada meteorological station in Sparwood (1981 – 2010).

Precipitation totals for all four stations are included in the plot as per the TECK RAMP guidance document. Highest monthly precipitation was observed in the month of June followed by November. The lowest precipitation was observed in the month of August. Monthly totals were more than or equal to one standard deviation below the 30 year mean in April and August.

The annual precipitation at the Environment and Climate Change Canada (ECC) station in Sparwood was 72 mm for 2020 (data only available from January 1st to February 22nd, 2020) Teck's Sparwood Heights station is located roughly 1.2km from the ECC Station at Sparwood and was compared against the available 2020 ECC station data. The precipitation data measured at Sparwood Heights closely trends the ECC Station at Sparwood for the days that data was recorded (January 1st to February 22nd, 2020) as shown in Figure 16.

Teck's Sparwood Heights station recorded an annual precipitation of 528 mm for 2020. As compared to the 30-year normal recorded at the ECC station, 613.3 mm; there was less precipitation in 2020 than the 30-year normal.

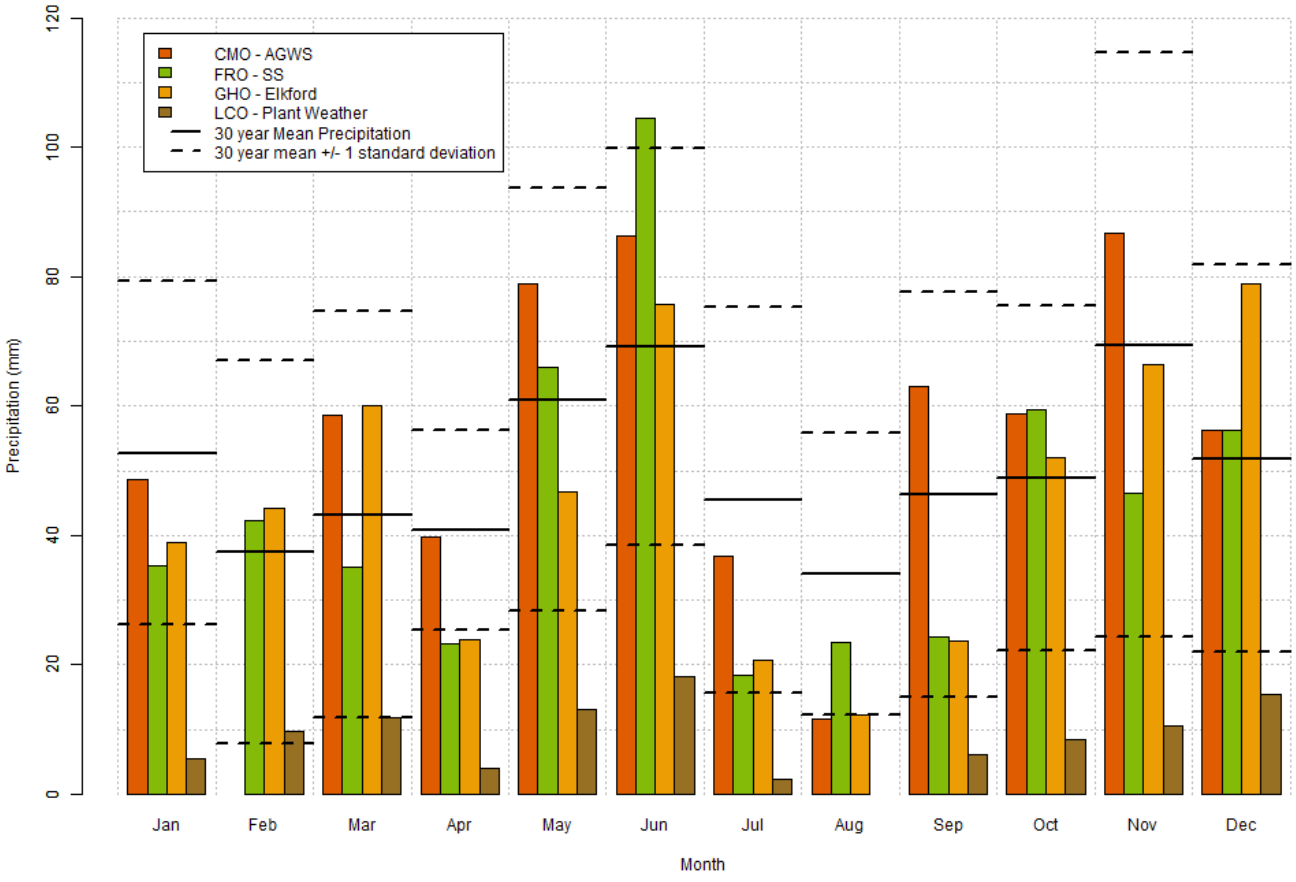


Figure 15: Monthly precipitation totals for stations in the Regional Air Monitoring Program for 2020 as compared to the 30-year mean +/- 1 standard deviation calculated from the Environment Canada Weather Station in Sparwood.

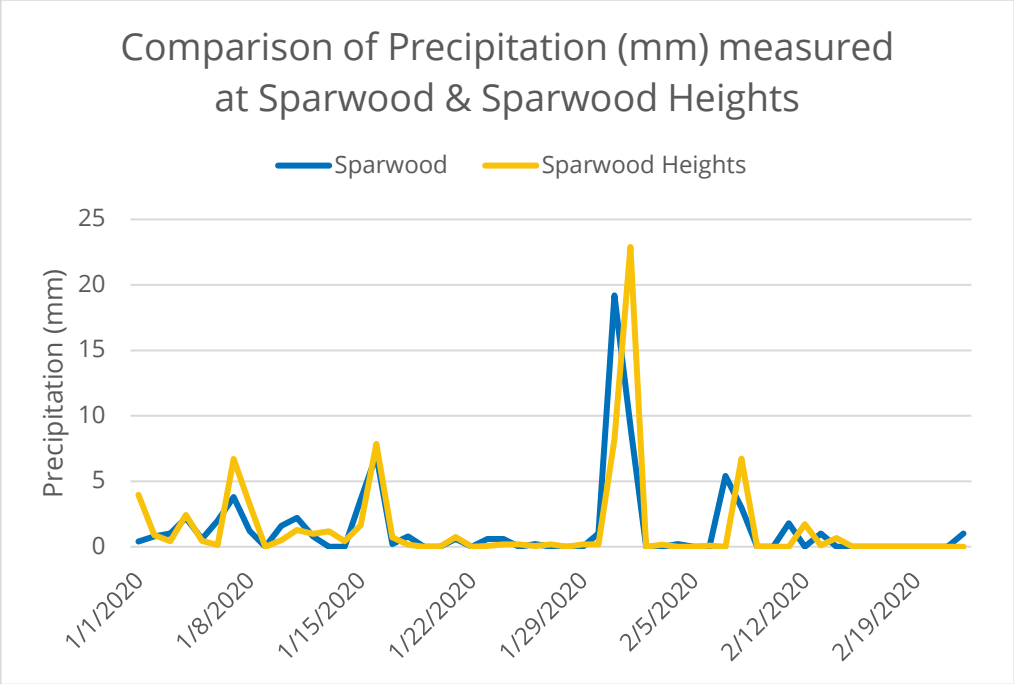


Figure 16: Precipitation data (mm) measured at ECC Station Sparwood and Sparwood Heights Station.

4.3 Air Temperature

Daily averaged air temperatures are presented in Figure 17 where they are compared to the 30 year mean and standard deviation of air temperature measured at the Environment and Climate Change Canada station in Sparwood. Inter-station variation is generally small compared to daily fluctuations, but some change is discernible. Greater day to day variability is observed in the winter months (January to March, and November and December) than in the summer months (April to October). This is also observed in the 30-year averaged data from Sparwood and can be attributed to the passage of warm and cold weather fronts in the winter, bringing with them large variations in temperature. In the summer, the cold arctic air masses which dominate in winter are much farther north and there is less frontal activity in the region, resulting in less extreme temperature fluctuations.

Differences in elevation between stations drives the inter-station differences in temperature that can be observed: CMO – Hosmer, EVO – DTAM, and EVO – MBPP are among the lowest-lying stations in the monitoring program and they consistently record higher temperatures than the rest. FRO – WWT is one of the highest elevation stations and consistently records lower temperatures. This may be explained by the local topography which considerably reduces sun exposure on site.

All stations observed temperatures lower than one standard deviation of the 30-year climate normal during the greater part of January and periods in March, April, May, and October. The annual average temperature in Sparwood in 2020 was 4.9°C versus the normal value of 4.4 °C.

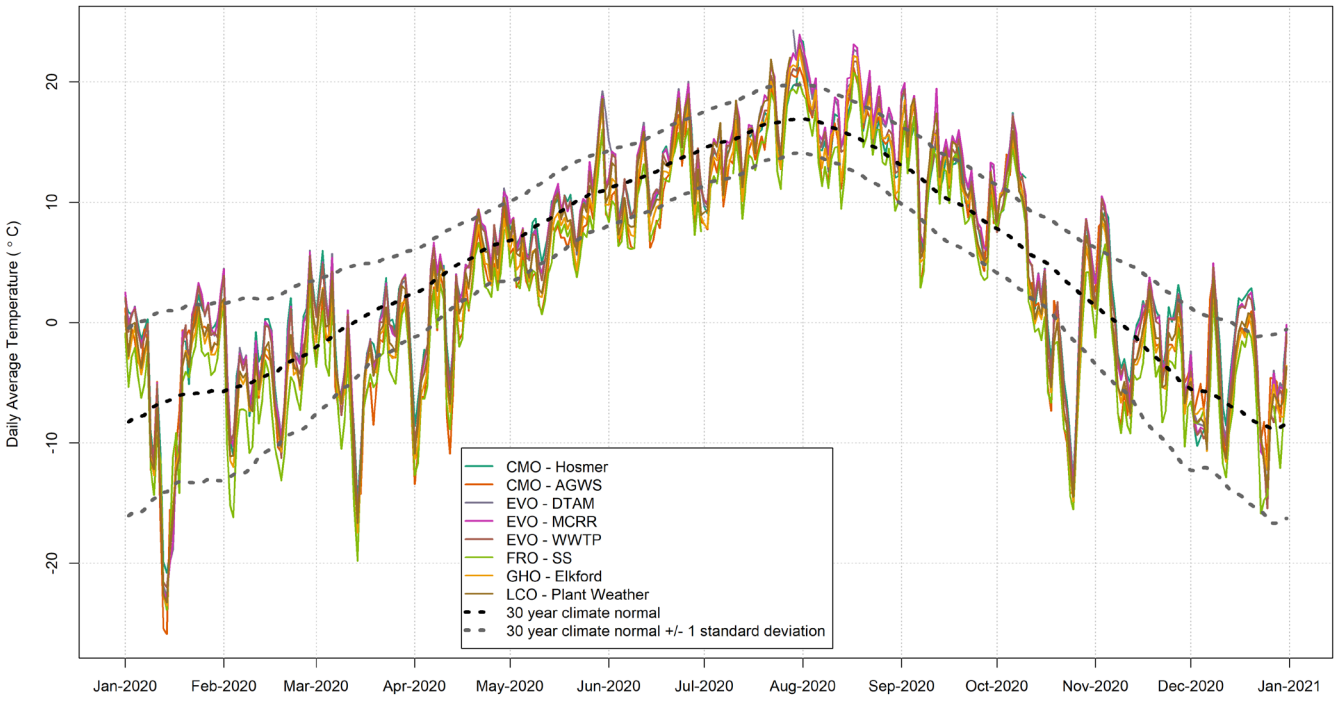


Figure 17: Daily averaged temperature for Regional Air Monitoring Program Stations as compared to the 30-year mean +/- 1 standard deviation calculated from the Environment Canada Weather Station in Sparwood.

5 MANAGEMENT OF AIR QUALITY

5.1 Public Air Quality Feedback

The Teck Elk Valley Feedback Mechanism helps Teck consistently respond to feedback and maintain strong relationships with community members. Dust related feedback are either forwarded (by mine sites) or received directly by the Teck Social Responsibility group, which has an office in Sparwood. When feedback is received about Teck's activity, Teck's Social Responsibility group works with the relevant operation(s) to investigate the cause and the effect. If contact details have been provided, the Feedback Coordinator or designated respondent will respond to the community member.

Engagement is tracked in Teck's Trackline database, used for documenting engagement with Communities of Interest (residents of local communities, First Nations, etc.) and Regulators. Emails, letters, phone calls, and other communications are tracked here, as are follow-up actions. Teck looks for trends in feedback and uses this information to monitor the effectiveness of mitigations and to gauge the need for further public updates on our work.

In 2020, there were 276 pieces of feedback related to air quality and dust management. The feedback was related to specific train dusting, complaints relating to visual impacts, dirty vehicles and dust on personal property (267). Teck's Coal Operations in the Elk Valley continue to recognize dust as a primary concern to nearby communities and takes all feedback seriously.

Due to an increasing amount of feedback and concern from the community on dust management, the following additional measures were taken in 2019 to provide information on current dust management practices and continual improvement opportunities:

- Ongoing work with the District of Sparwood to respond to community concerns and jointly develop a Socio-Community and Economic Effects Management Plan.
- A pilot exterior house cleaning program was launched for Sparwood and area with a total of 348 homes cleaned from mid-July through mid-October 2020.
- Due to COVID-19 restrictions, all face to face/in person meetings were cancelled.

Teck appreciates the opportunity to hear the community's feedback and to talk about the work being undertaken to resolve this issue and will continue to update the community on dust management initiatives in future.

5.2 Fugitive Dust Management Plans

Four of the five mine sites (EVO, LCO, GHO and FRO) are required to maintain Fugitive Dust Management Plans per their site-specific permits. CMO maintains an Air Quality and Dust Control Management Plan as a voluntary commitment. Each mine in the Elk Valley participates in a Regional Air Working Group to identify continual improvement opportunities for fugitive dust management. The mine sites continue to investigate methods to suppress and manage fugitive dust sources from site. As per the draft guidance released in joint by the BC ENV and Ministry of Energy, Mines and Petroleum Resources (BC EMPR) for *Developing a Fugitive Dust Management Plan for Industrial Projects*, TECK Coal is currently working on updating their site specific Fugitive Dust Management Plans (FDMP) as per comments received from BC ENV in the first quarter of 2021.

6 SUMMARY

TECK will be updating the RAMP in 2021 to implement the recommendations from ENV per feedback received on January 27, 2021. Please refer to Appendix C for ENV's review memo with recommendations to TECK's 2021 RAMP.

7 REFERENCES

BC Ministry of Environment. 2018. British Columbia Ambient Air Quality Objectives.

APPENDIX A

AIR QUALITY DATA SUMMARY TABLES

Table A-1: Number of valid TSP data.

	Period (Month / Quarter / Year)	CMO	GHO	LCO
		AGWS (days / hours)	ElkFord (days / hours)	L10A (days)
		Collected	Collected	Collected
# Valid Monitoring Days per month	January	30	31	5
	February	29	28	5
	March	17	31	5
	April	18	30	5
	May	19	31	5
	June	28	22	5
	July	27	27	5
	August	29	6	5
	September	28	30	5
	October	30	29	4
	November	29	29	5
	December	30	30	5
# Valid Monitoring Days per Quarter	Q1	76	90	15
	Q2	65	83	15
	Q3	84	63	15
	Q4	89	88	14
# Valid Monitoring Days for entire year	2020	314	324	59
# Valid Monitoring Hours per Quarter	Q1	1941	2150	
	Q2	1706	1973	
	Q3	2018	1522	
	Q4	2114	2128	
# Valid Monitoring Hours for entire year	2020	7779	7773	

Table A-2: Number of valid PM_{10} data.

Period	Period (Month / Quarter / Year)	CMO		EVO			FRO	GHO
		AGWS (days / hours)	Hosmer (days / hours)	DTAM (Days / Hours)	MCRR (Days / Hours)	WWTP (Days / Hours)	SS (Days / Hours)	ElkFord (Days / Hours)
		Collected	Collected	Collected	Collected	Collected	Collected	Collected
# Valid Monitoring Days per month	January	27	19	27	30	31	31	31
	February	29	28	28	29	29	29	28
	March	23	31	29	29	31	20	31
	April	30	30	30	29	30	15	30
	May	22	31	21	31	31	20	31
	June	28	26	20	30	30	30	22
	July	28	19	29	14	26	22	27
	August	29	17	13	25	20	31	30
	September	28	27	1	29	30	30	30
	October	30	19	12	18	30	31	29
	November	28	30	28	28	30	30	29
	December	30	30	30	31	31	31	30
# Valid Monitoring Days per Quarter	Q1	79	78	84	88	91	80	90
	Q2	80	87	71	90	91	65	83
	Q3	85	63	43	68	76	83	87
	Q4	88	79	70	77	91	92	88
# Valid Monitoring Days for entire year	2020	332	307	268	323	349	320	348
# Valid Monitoring Hours per Quarter	Q1	1968	1872	2032	2121	2157	1938	2141
	Q2	1968	2118	1810	2161	2171	1573	1967
	Q3	1992	1555	1091	1667	1879	1998	2102
	Q4	2104	1905	1735	1824	2166	2202	2122
# Valid Monitoring Hours for entire year	2020	8032	7450	6668	7773	8373	7711	8332

Table A-3: Number of valid $PM_{2.5}$ data.

Period	Period (Month / Quarter / Year)	CMO		EVO			GHO
		AGWS (days / hours)	Hosmer (days / hours)	DTAM (days / hours)	MCRR (days / hours)	WWTP (days / hours)	ElkFord (days / hours)
		Collected	Collected	Collected	Collected	Collected	Collected
# Valid Monitoring Days per month	January	28	25	30	30	31	31
	February	29	28	28	29	29	28
	March	27	31	30	29	31	31
	April	30	28	30	29	30	30
	May	23	31	27	31	31	31
	June	29	27	25	30	30	22
	July	30	24	30	17	29	29
	August	30	23	15	31	24	31
	September	29	28	13	23	27	30
	October	31	19	28	27	18	31
	November	29	30	30	13	30	30
	December	31	31	31	29	31	31
# Valid Monitoring Days per Quarter	2020 Q1	84	84	88	88	91	90
	2020 Q2	82	86	82	90	91	83
	2020 Q3	89	75	58	71	80	90
	2020 Q4	91	80	89	69	79	92
# Valid Monitoring Days for entire year	2020	346	325	317	318	341	355
# Valid Monitoring Hours per Quarter	2020 Q1	2042	2058	2082	2123	2164	2152
	2020 Q2	1975	2111	1950	2166	2170	1987
	2020 Q3	2135	1854	1443	1732	1956	2158
	2020 Q4	2177	1953	2133	1670	1876	2168
# Valid Monitoring Hours for entire year	2020	8329	7976	7608	7691	8166	8465

Table A-4: Number of valid gas data.

Period	Period (Month / Quarter / Year)	EVO - DTAM		
		NO_2	CO	SO_2
# Valid Monitoring Days per month	January	31	31	27
	February	29	29	29
	March	31	1	11
	April	23	16	0
	May	31	31	4
	June	30	30	30
	July	31	31	31
	August	31	31	30
	September	30	30	30
	October	31	31	31
	November	30	22	30
	December	29	25	31
# Valid Monitoring Days per Quarter	2020 Q1	91	61	67
	2020 Q2	84	77	34
	2020 Q3	92	92	91
	2020 Q4	90	78	92
# Valid Monitoring Days for entire year	2020	357	308	284
# Valid Monitoring Hours per Quarter	2020 Q1	2179	1466	1611
	2020 Q2	2028	1878	827
	2020 Q3	2174	2191	2159
	2020 Q4	2152	1869	2198
# Valid Monitoring Hours for entire year	2020	8533	7404	6795

Table A-5: TSP averaged annually, seasonally and by day of the week.

	Period (Month / Quarter / Year / Day of the Week / Season)	CMO	GHO	LCO
		AGWS	ElkFord	L10A
		(µg/m³)	(µg/m³)	(µg/m³)
Annual Hourly Mean	2020	2.4	7.3	
Annual Hourly Standard Deviation	2020	22.9	23.3	
Annual Daily Mean	2020	3.5	9.4	37.4
Annual Daily Standard Deviation	2020	17.3	17.2	35.2
Daily average by day of week	Monday	8.4	14.0	50.3
	Tuesday	7.5	14.2	63.2
	Wednesday	4.7	12.4	37.9
	Thursday	5.2	15.5	37.3
	Friday	8.6	13.6	51.7
	Saturday	8.2	14.3	36.4
	Sunday	8.0	13.6	47.4
Daily average by season	Spring (MAM)	4.1	16.6	41.7
	Summer (JJA)	7.3	9.6	57.9
	Autumn (SON)	13.2	19.7	53.6
	Winter (DJF)	3.3	8.1	34.3

Note: Annual Hourly and Daily means are calculated as geometric means so they are comparable to the provincial pollution control objectives for TSP.

Table A-6: PM_{10} averaged annually, seasonally and by day of the week.

	Period (Month / Quarter / Year / Day of the Week / Season)	CMO		EVO			FRO	GHO
		AGWS	Hosmer	DTAM	MCRR	WWTP	SS	ElkFord
		(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
Annual Hourly Mean	2020	5.9	9.8	10.9	14.6	9.1	28.6	9.5
Annual Hourly Standard Deviation	2020	18.3	17.6	11.3	19.7	14.2	38.5	17.2
Annual Daily Mean	2020	6.0	9.9	10.8	14.6	9.1	28.7	9.5
Annual Daily Standard Deviation	2020	16.1	15.9	8.4	16.0	12.6	29.2	14.3
Daily average by day of week	Monday	7.7	12.0	10.0	16.6	10.4	27.8	10.0
	Tuesday	6.4	10.8	12.0	16.0	9.0	27.0	9.6
	Wednesday	4.2	8.4	11.7	12.9	8.4	28.8	8.6
	Thursday	4.8	9.1	11.9	15.3	9.4	29.7	10.7
	Friday	6.2	10.4	12.2	14.3	9.2	26.6	8.7
	Saturday	6.5	9.5	9.2	13.1	8.8	30.1	9.7
	Sunday	6.3	8.9	8.5	14.1	8.5	31.1	9.1
Daily average by season	Spring (MAM)	4.0	7.7	11.8	13.5	8.3	24.5	10.2
	Summer (JJA)	5.7	9.2	11.2	13.8	8.8	28.5	7.3
	Autumn (SON)	11.6	16.2	11.3	20.1	13.4	34.7	14.9
	Winter (DJF)	2.6	6.7	9.4	11.8	6.0	25.5	5.4

Table A-7: $PM_{2.5}$ averaged annually, seasonally and by day of the week.

	Period (Month / Quarter / Year / Day of the Week / Season)	CMO		EVO			GHO
		AGWS	Hosmer	DTAM	MCRR	WWTP	ElkFord
		(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
Annual Hourly Mean	2020	4.7	6.7	6.1	6.7	5.4	5.6
Annual Hourly Standard Deviation	2020	16.5	13.9	7.4	14.6	7.1	12.9
Annual Daily Mean	2020	4.8	6.8	6.0	6.7	5.4	5.6
Annual Daily Standard Deviation	2020	14.5	12.9	5.3	13.1	5.9	11.4
Daily average by day of week	Monday	6.8	8.9	5.0	8.2	4.5	6.8
	Tuesday	5.1	7.6	5.4	6.9	4.6	5.9
	Wednesday	3.9	5.3	5.6	5.5	5.1	4.7
	Thursday	3.7	5.5	6.0	6.6	6.1	5.5
	Friday	4.2	6.9	6.1	6.5	5.9	5.0
	Saturday	4.8	7.3	7.5	6.9	6.2	5.4
	Sunday	5.1	6.2	6.4	6.3	5.7	6.0
Daily average by season	Spring (MAM)	3.2	4.3	5.5	4.3	4.5	3.5
	Summer (JJA)	3.9	6.3	6.2	6.0	5.0	4.2
	Autumn (SON)	10.1	11.8	8.3	14.6	8.2	10.7
	Winter (DJF)	1.9	5.3	4.5	4.1	4.5	3.9

Table A-8: Gas concentrations averaged annually, seasonally and by day of the week.

	Period (Month / Quarter / Year / Day of the Week / Season)	EVO - DTAM		
		NO_2	CO	SO_2
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
Annual Hourly Mean	2020	11.1	198.7	3.6
Annual Hourly Standard Deviation	2020	8.0	160.1	5.3
Annual Daily Mean	2020	11.1	198.2	3.6
Annual Daily Standard Deviation	2020	5.2	145.9	5.3
Daily average by day of week	Monday	11.2	217.9	3.3
	Tuesday	11.4	205.7	3.5
	Wednesday	11.8	192.1	3.7
	Thursday	12.0	190.6	3.7
	Friday	10.8	190.7	3.8
	Saturday	10.1	198.8	3.7
	Sunday	10.6	192.4	3.4
Daily average by season	Spring (MAM)	9.6	155.0	10.8
	Summer (JJA)	7.0	91.8	0.9
	Autumn (SON)	14.1	301.5	0.6
	Winter (DJF)	13.9	236.8	8.2

Table A-9: Percentiles of TSP.

Averaging period of data	Percentile	CMO	GHO	LCO
		AGWS	ElkFord	L10A
		(µg/m³)	(µg/m³)	(µg/m³)
Hourly	0	0.0	0.0	
	10	0.3	1.8	
	25	0.9	3.5	
	50	2.5	7.4	
	75	6.2	15.5	
	90	14.1	29.6	
	95	21.5	45.6	
	98	45.9	77.0	
	100	799.0	624.9	
Daily (24H)	0	0.0	0.7	5.8
	10	0.9	3.0	17.6
	25	1.8	5.2	24.7
	50	3.6	9.7	36.4
	75	7.7	16.8	56.7
	90	13.1	25.0	80.2
	95	16.6	39.5	109.5
	98	41.3	56.4	150.6
	100	226.9	193.0	197.6

Table A-10: Percentiles of PM_{10}.

Averaging period of data	Percentile	CMO		EVO			FRO	GHO
		AGWS	Hosmer	DTAM	MCRR	WWTP	SS	ElkFord
		(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
Hourly	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	10	0.7	1.4	1.6	1.7	1.4	3.3	1.6
	25	1.6	2.9	3.7	4.0	3.0	7.1	2.6
	50	2.7	5.7	7.7	8.8	6.0	14.7	5.2
	75	5.5	10.8	14.4	17.8	10.8	33.5	10.4
	90	9.8	18.5	23.7	31.6	17.4	68.8	18.3
	95	14.1	26.4	31.5	46.7	23.4	103.7	27.5
	98	29.3	48.3	43.9	68.8	39.5	161.6	51.6
	100	377.9	241.2	146.4	243.3	203.4	402.5	379.3
Daily (24H)	0	0.1	0.9	0.1	0.7	0.8	1.4	0.5
	10	1.2	2.7	2.3	2.7	2.3	6.1	2.3
	25	2.0	4.4	4.9	5.5	4.1	10.2	3.8
	50	3.1	6.9	8.5	10.5	6.6	19.4	6.4
	75	5.6	10.7	13.9	18.4	10.6	37.1	10.7
	90	9.1	15.8	22.4	29.5	16.1	61.7	15.5
	95	11.6	21.3	28.3	38.7	18.7	82.3	21.7
	98	30.2	48.0	34.1	55.6	34.2	112.0	48.1
	100	217.9	204.8	47.7	180.4	171.7	242.7	180.7

Table A-11: Percentiles of $PM_{2.5}$.

Averaging period of data	Percentile	CMO		EVO			GHO
		AGWS	Hosmer	DTAM	MCRR	WWTP	ElkFord
		(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
Hourly	0	0.0	0.0	0.0	0.0	0.0	0.0
	10	0.5	0.8	1.2	0.7	1.0	1.2
	25	1.3	1.8	2.4	1.8	1.8	2.0
	50	2.2	3.6	4.5	3.9	3.7	3.1
	75	3.9	7.2	7.9	7.6	6.6	5.3
	90	7.1	12.6	11.9	12.1	10.7	9.0
	95	10.1	18.6	15.2	16.2	14.5	13.6
	98	24.6	33.2	20.3	31.4	22.6	30.5
	100	347.7	204.3	166.0	212.3	151.2	206.6
Daily (24H)	0	0.1	0.0	0.4	0.2	0.5	0.2
	10	0.8	1.9	2.0	1.2	1.7	1.9
	25	1.5	3.0	3.3	2.6	2.8	2.6
	50	2.6	4.4	5.1	4.5	4.4	3.7
	75	3.9	6.5	7.0	6.8	6.1	5.2
	90	6.2	10.0	10.7	10.9	8.9	7.7
	95	9.5	13.6	13.1	12.5	10.9	9.3
	98	38.5	38.1	14.6	33.5	17.3	30.1
	100	201.5	173.2	57.7	180.5	51.6	157.8

Table A-12: Percentiles of gas concentrations.

Averaging period of data	Percentile	EVO - DTAM		
		NO_2	CO	SO_2
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
Hourly	0	0.0	0.0	0.0
	10	2.5	72.1	0.2
	25	4.2	105.5	0.4
	50	10.4	154.3	0.9
	75	15.7	244.3	3.5
	90	19.6	378.8	14.2
	95	24.7	465.9	16.1
	98	34.0	564.5	17.5
	100	64.3	1699.9	20.7
Daily (24H)	0	2.2	34.1	0.1
	10	4.4	82.5	0.3
	25	6.9	107.3	0.4
	50	10.7	160.0	0.9
	75	14.8	243.0	3.5
	90	17.5	358.6	14.3
	95	18.7	449.8	15.8
	98	21.2	553.8	17.3
	100	33.4	1521.5	18.6

Table A-13: 98th percentile values of daily averaged PM2.5. Values above BCAAQO are highlighted in red.

	Station Name	98th percentile of $PM_{2.5}$
CMO	AGWS	38.5
	Hosmer	38.1
EVO	DTAM	14.6
	MCRR	33.5
	WWTP	17.3
GHO	Elkford	30.1

APPENDIX B

PLOTS OF PARTICULATE MATTER CONCENTRATIONS

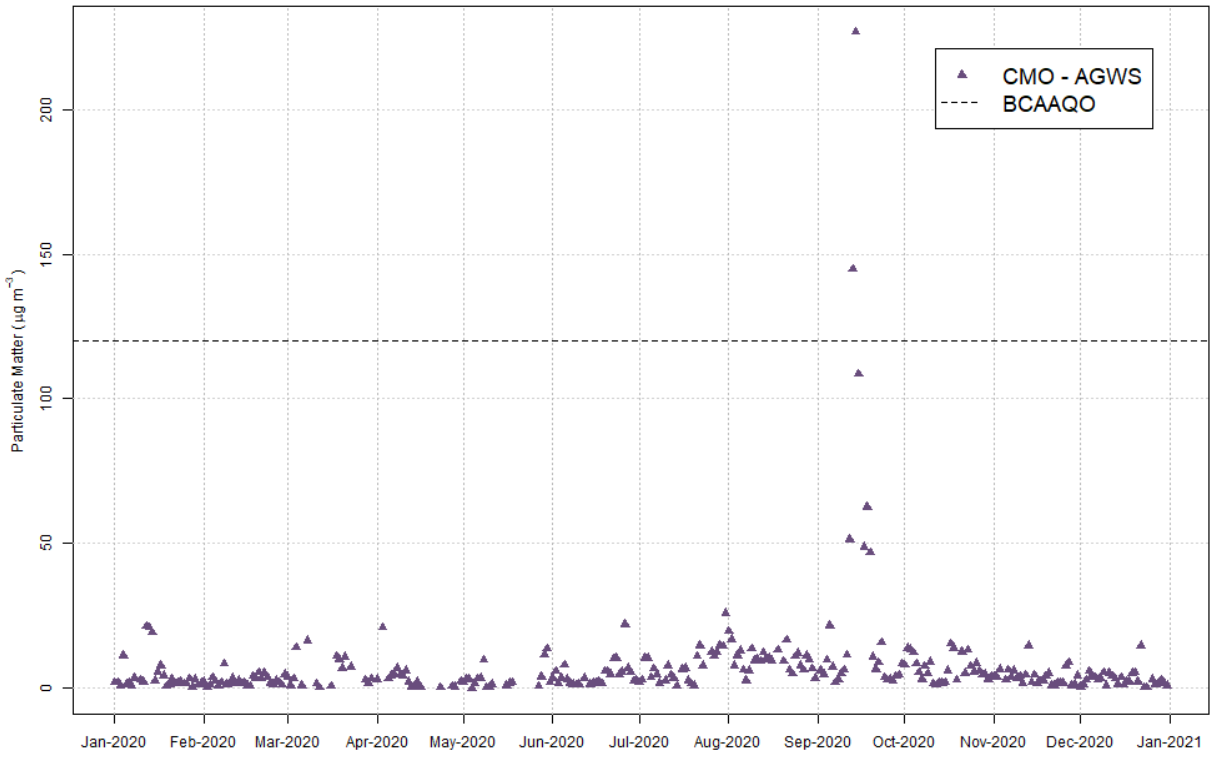


Figure B-1: Daily averaged TSP concentrations from CMO – AGWS.

Note: The BCAAQO of 120 µg/m^3 is indicated by a dashed line.

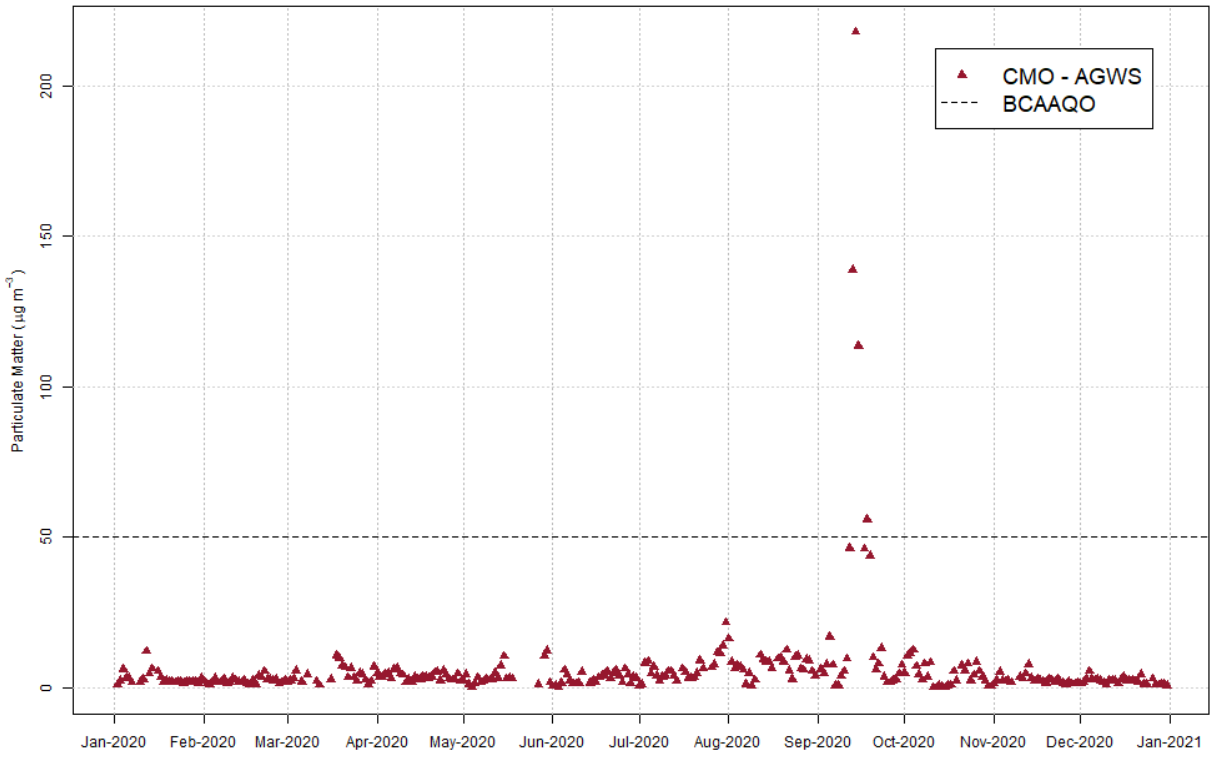


Figure B-2: Daily averaged PM_{10} concentrations from CMO – AGWS.

Note: The BCAAQO of 50 µg/m^3 is indicated by a dashed line.

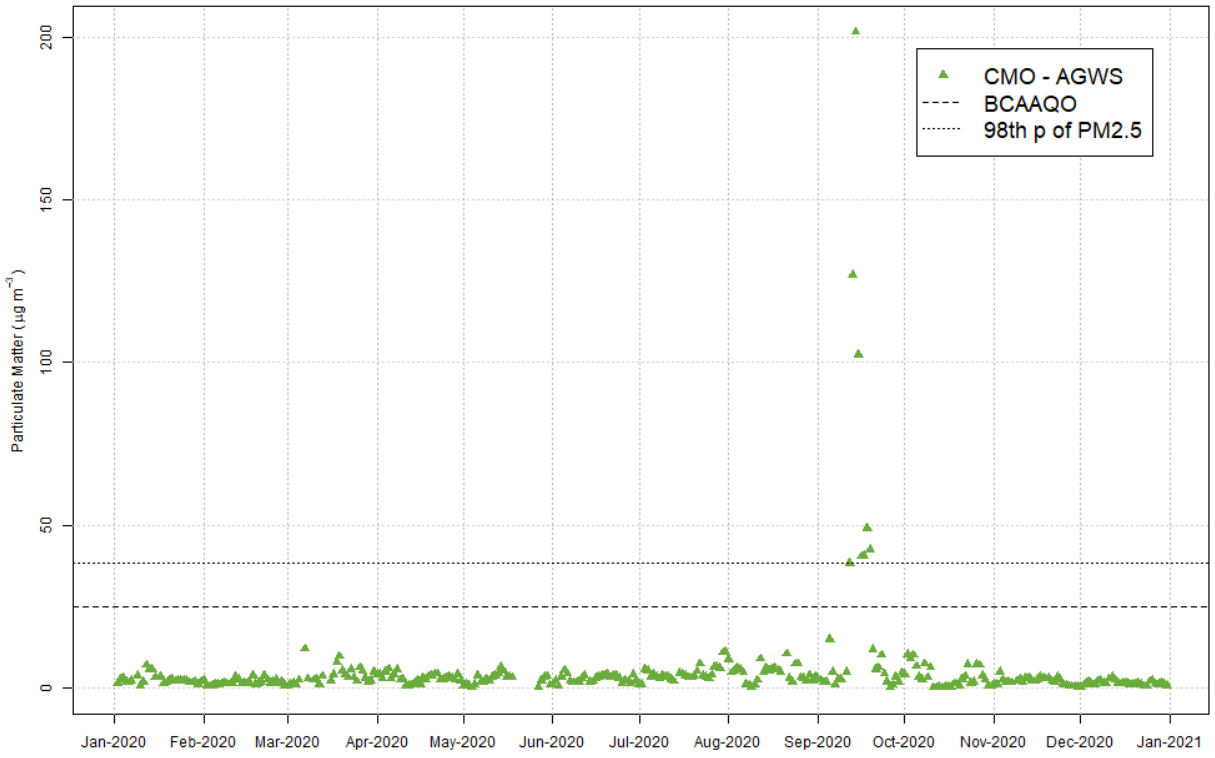


Figure B-3: Daily averaged $PM_{2.5}$ concentrations from CMO – AGWS.

Notes:

1) The BCAAQO of 25 µg/m^3 is indicated by a dashed line.
2) The dotted line indicates the 98th percentile of $PM_{2.5}$.

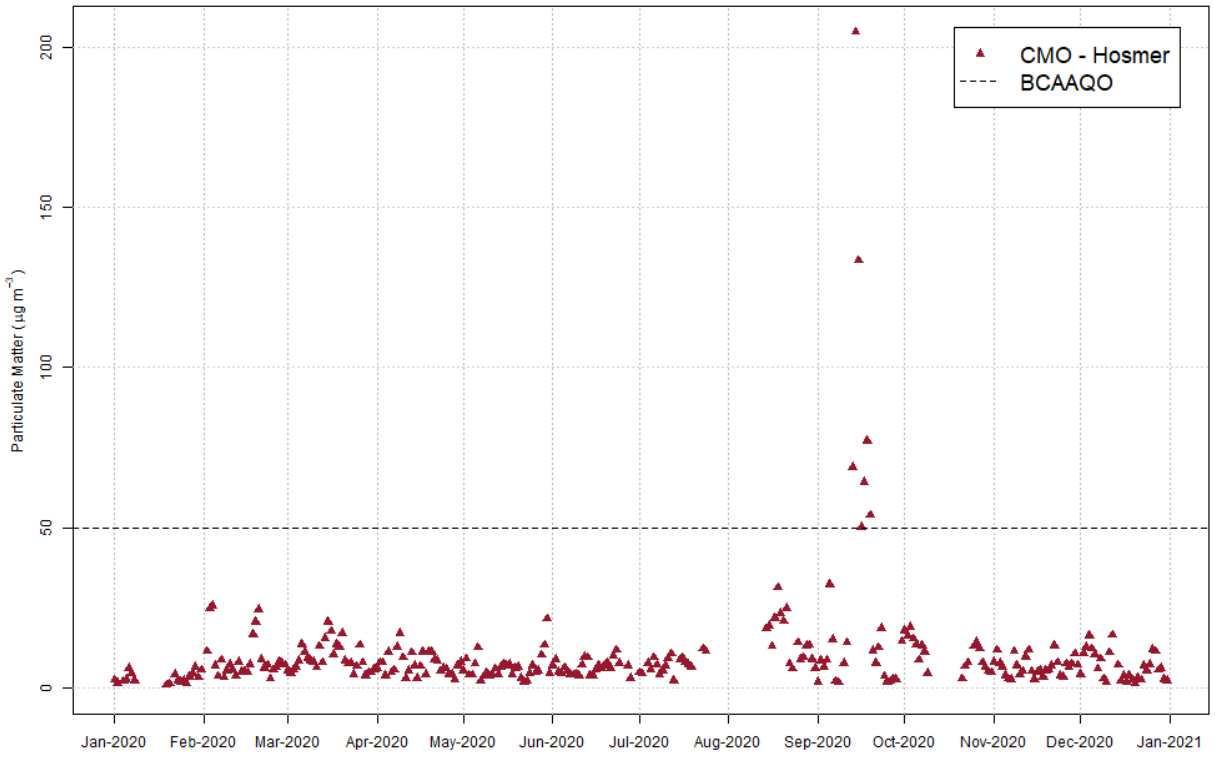


Figure B-4: Daily averaged PM_{10} concentrations from CMO – Hosmer.

Note: The BCAAQO of 50 µg/m^3 is indicated by a dashed line.

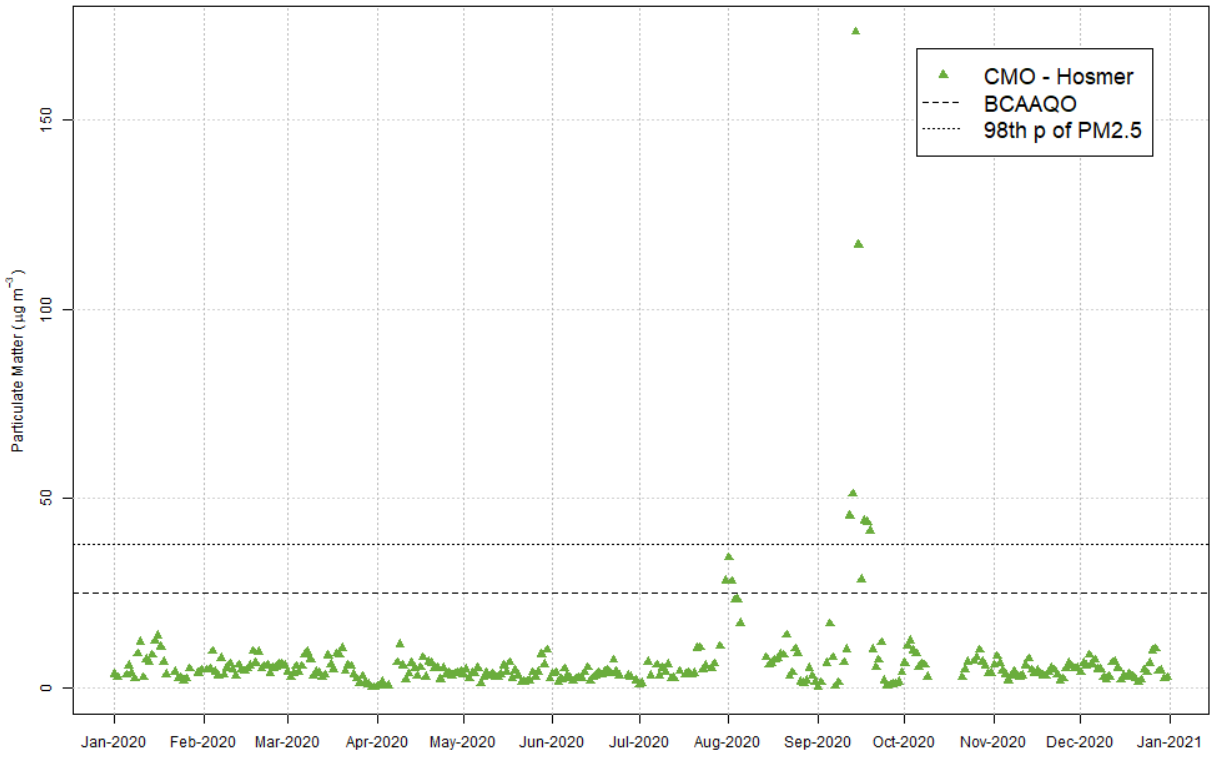


Figure B-5: Daily averaged $PM_{2.5}$ concentrations from CMO – Hosmer.

Notes:

1) The BCAAQO of 25 µg/m^3 is indicated by a dashed line.
2) The dotted line indicates the 98th percentile of $PM_{2.5}$.

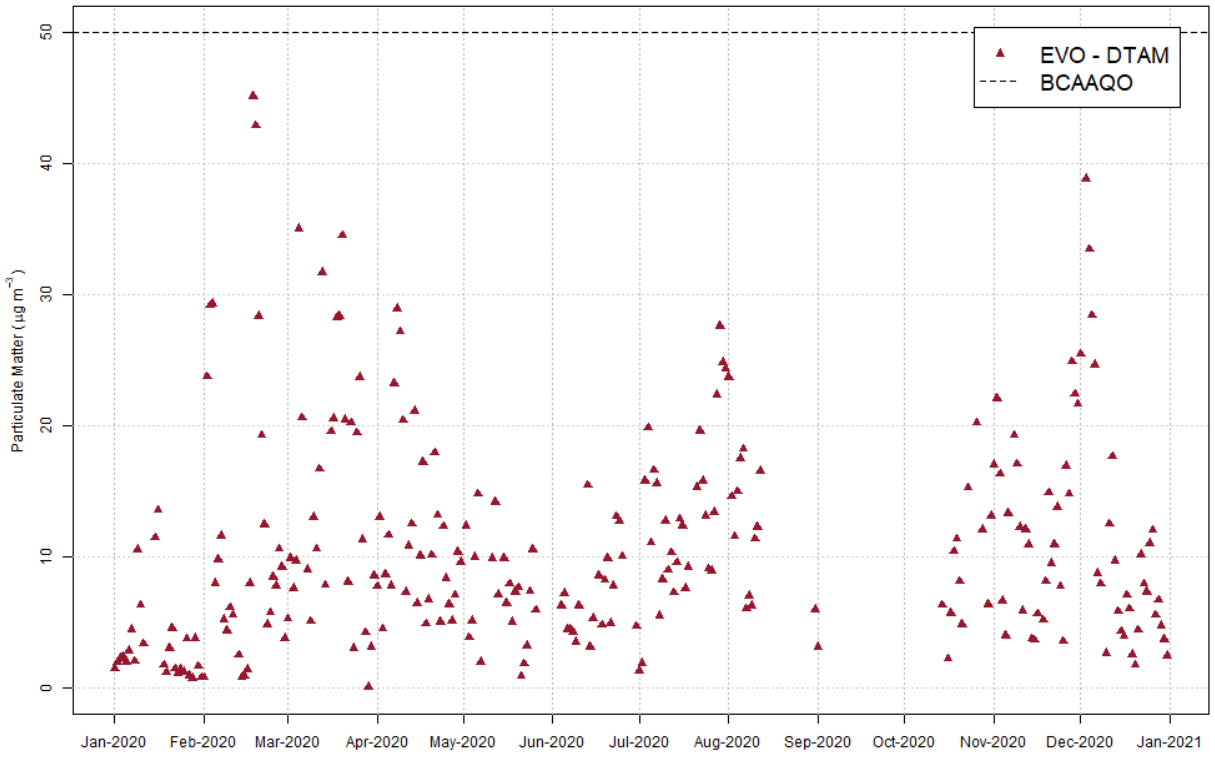


Figure B-6: Daily averaged PM_{10} concentrations from EVO – DTAM.

Note: The BCAAQO of 50 µg/m^3 is indicated by a dashed line.

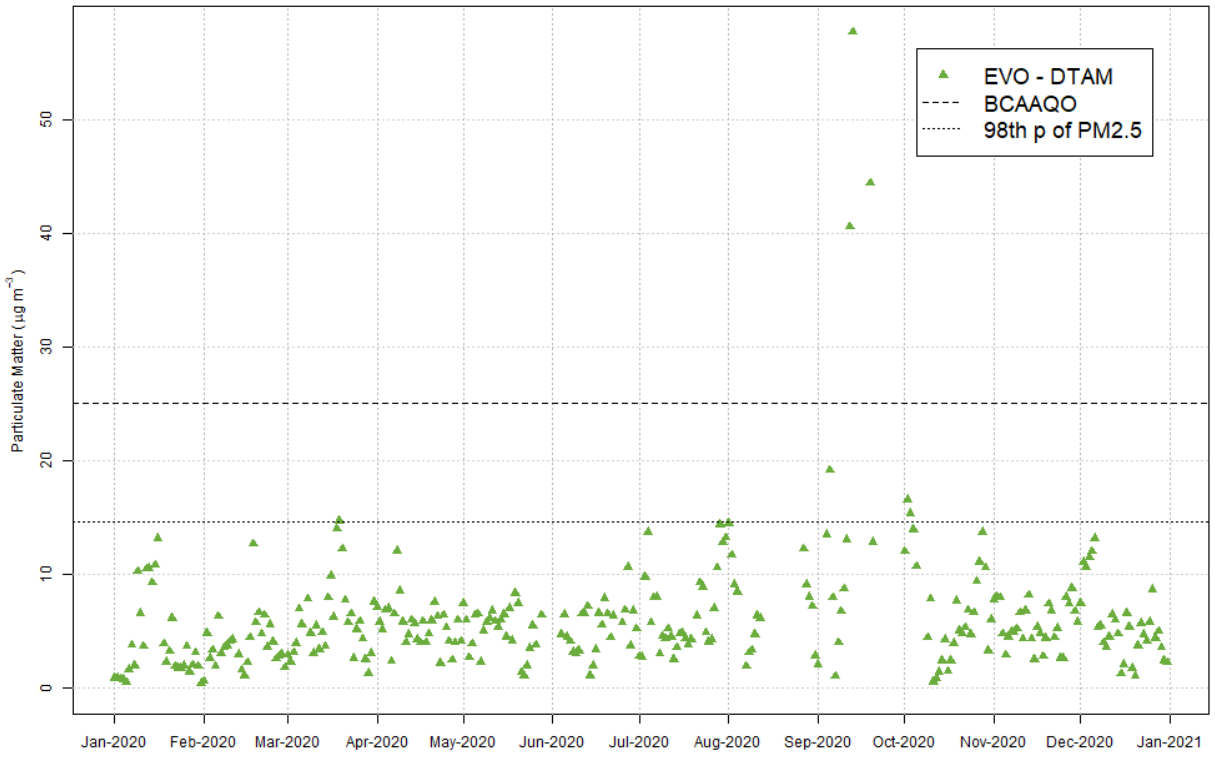


Figure B-7: Daily averaged $PM_{2.5}$ concentrations from EVO – DTAM.

Notes:

1) The BCAAQO of 25 µg/m^3 is indicated by a dashed line.
2) The dotted line indicates the 98th percentile of $PM_{2.5}$.

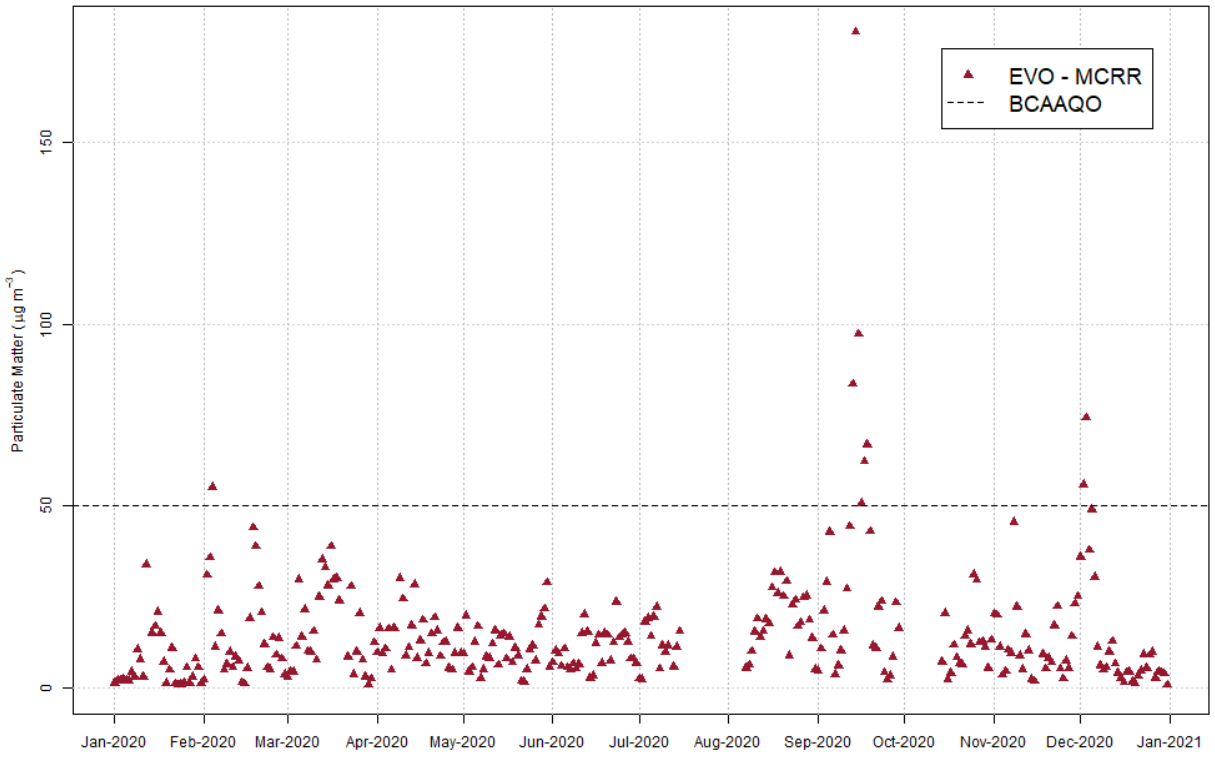


Figure B-8: Daily averaged PM_{10} concentrations from EVO – MCRR.

Note: The BCAAQO of 50 µg/m^3 is indicated by a dashed line.

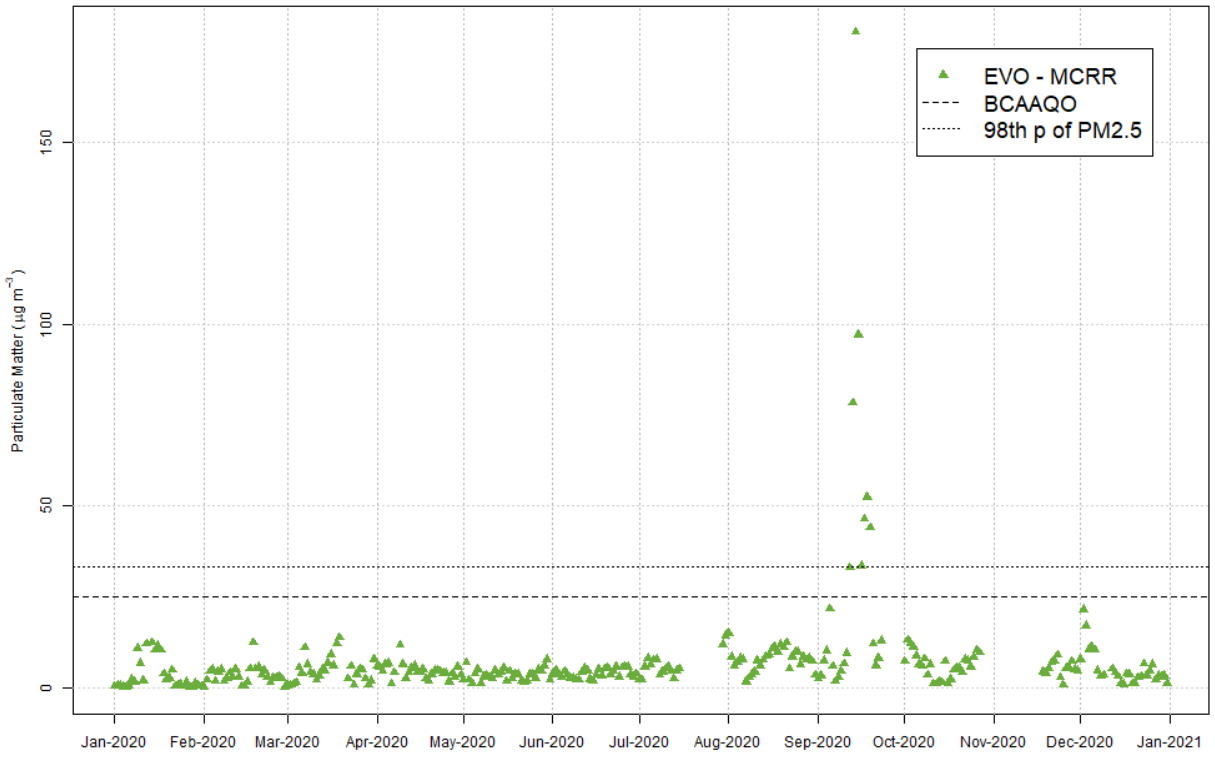


Figure B-9: Daily averaged $PM_{2.5}$ concentrations from EVO-MCRR.

Notes:

1) The BCAAQO of 25 µg/m^3 is indicated by a dashed line.
2) The dotted line indicates the 98th percentile of $PM_{2.5}$.

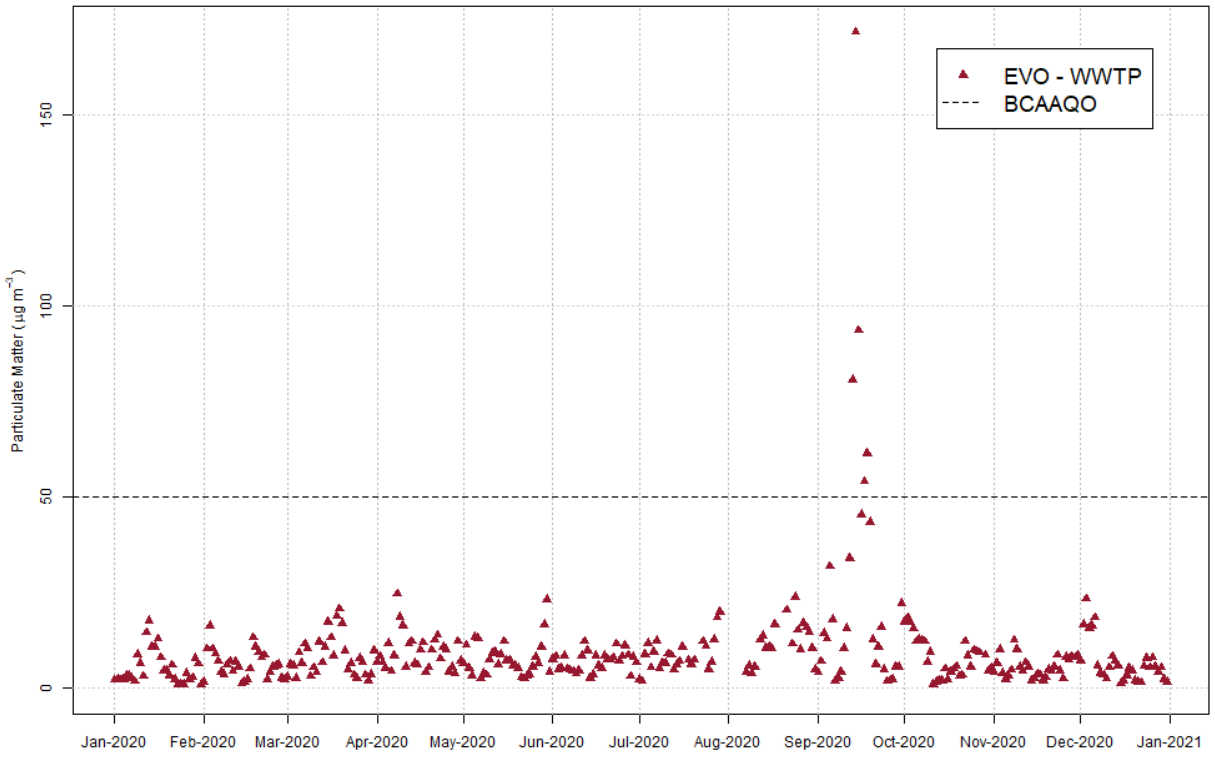


Figure B-10: Daily averaged PM_{10} concentrations from EVO – WWTP.

Note: The BCAAQO of 50 µg/m^3 is indicated by a dashed line.

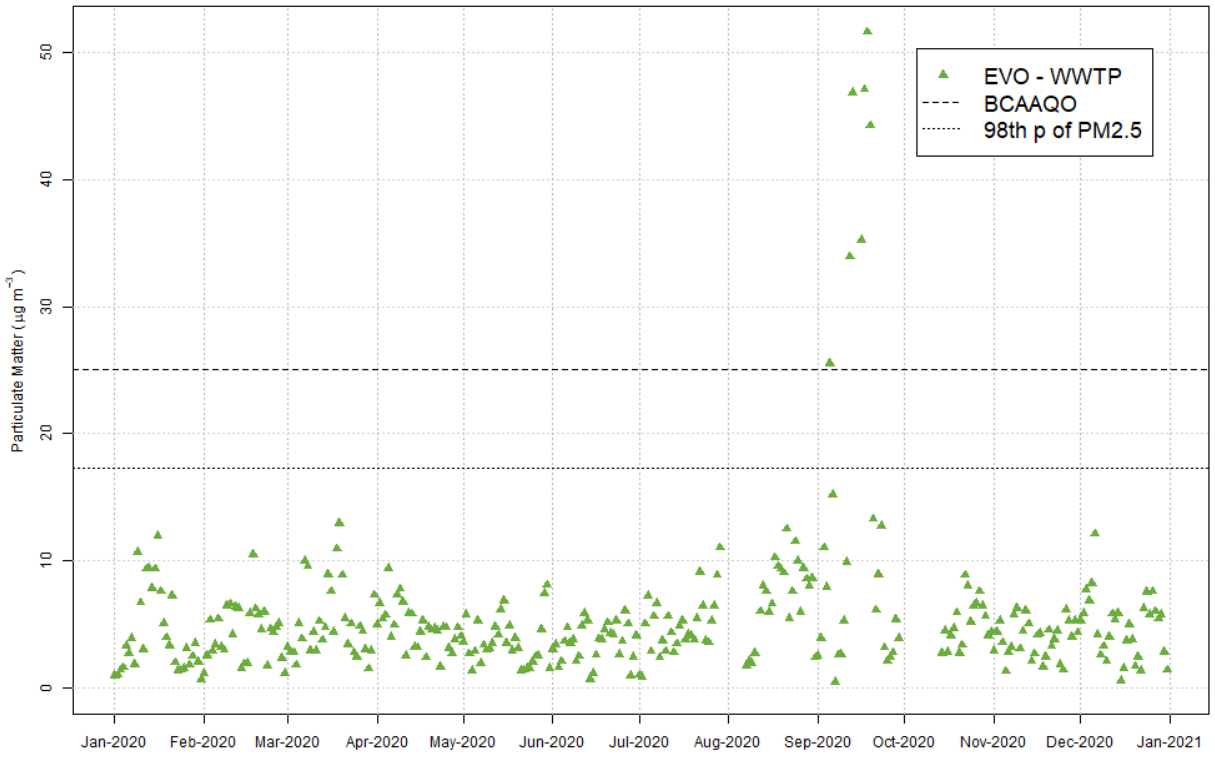


Figure B-11: Daily averaged $PM_{2.5}$ concentrations from EVO – WWTP.

Notes:

1) The BCAAQO of 25 µg/m^3 is indicated by a dashed line.
2) The dotted line indicates the 98th percentile of $PM_{2.5}$.

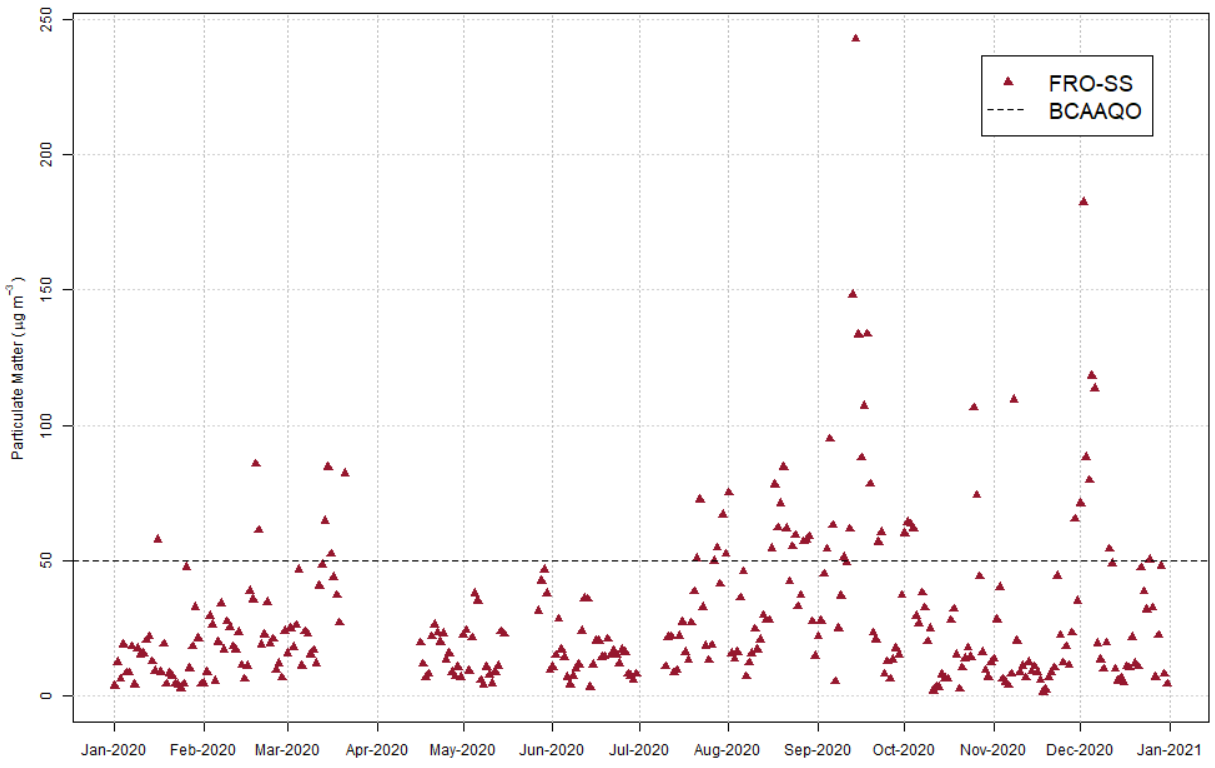


Figure B-12: Daily averaged PM_{10} concentrations from FRO – SS.

Note: The BCAAQO of 50 µg/m^3 is indicated by a dashed line.

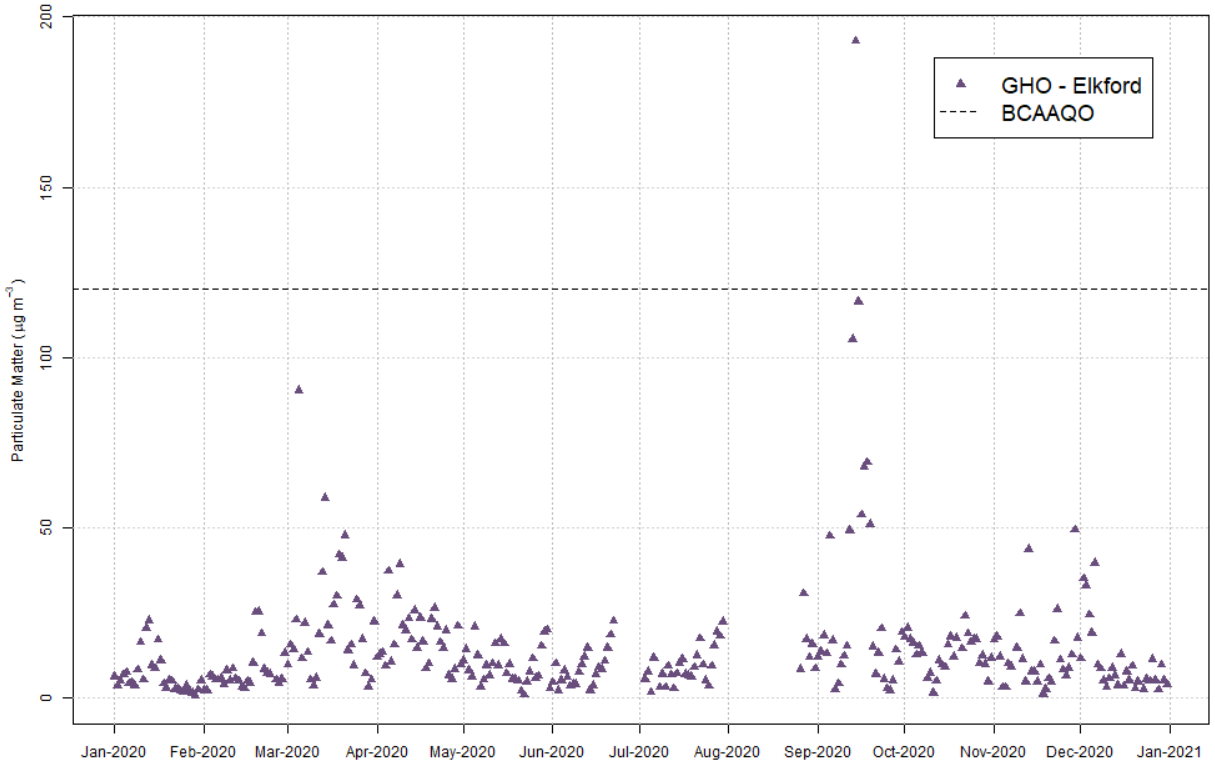


Figure B-13: Daily averaged TSP concentrations from GHO – Elkford.

Note: The BCAAQO of 120 µg/m^3 is indicated by a dashed line.

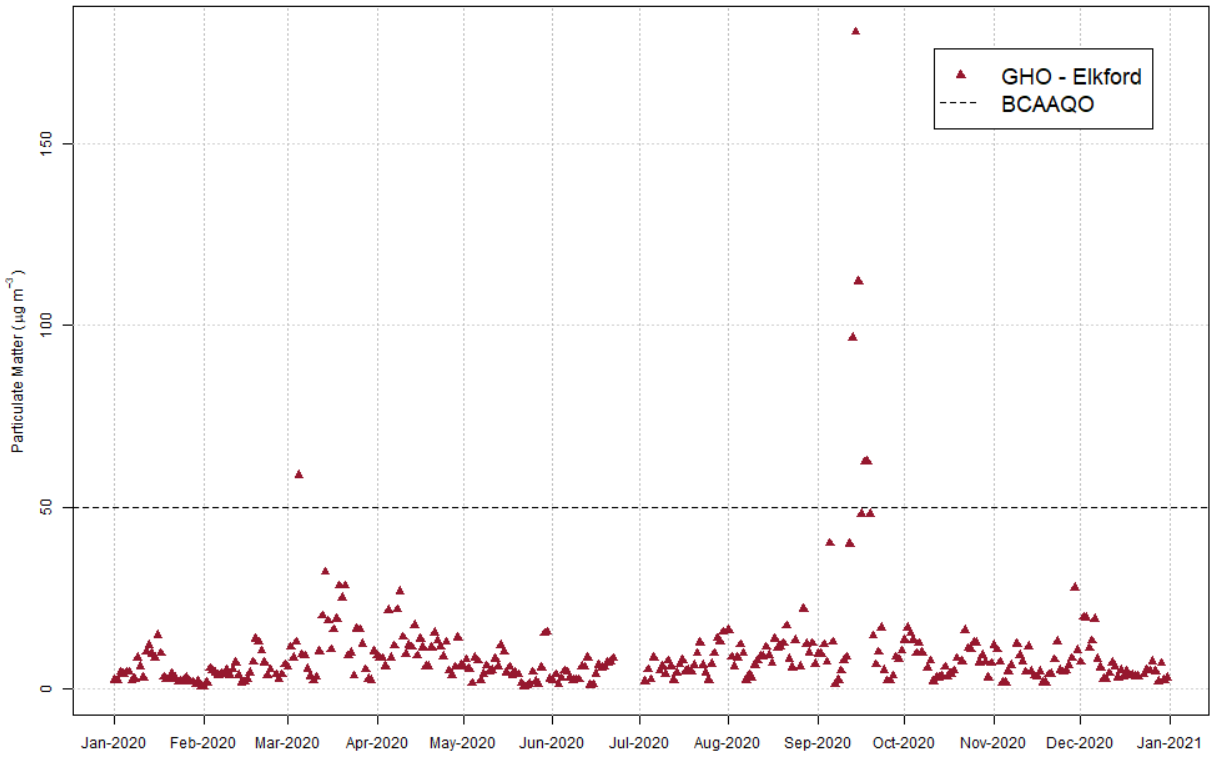


Figure B-14: Daily averaged PM_{10} concentrations from GHO – Elkford.

Note: The BCAAQO of 50 µg/m^3 is indicated by a dashed line.

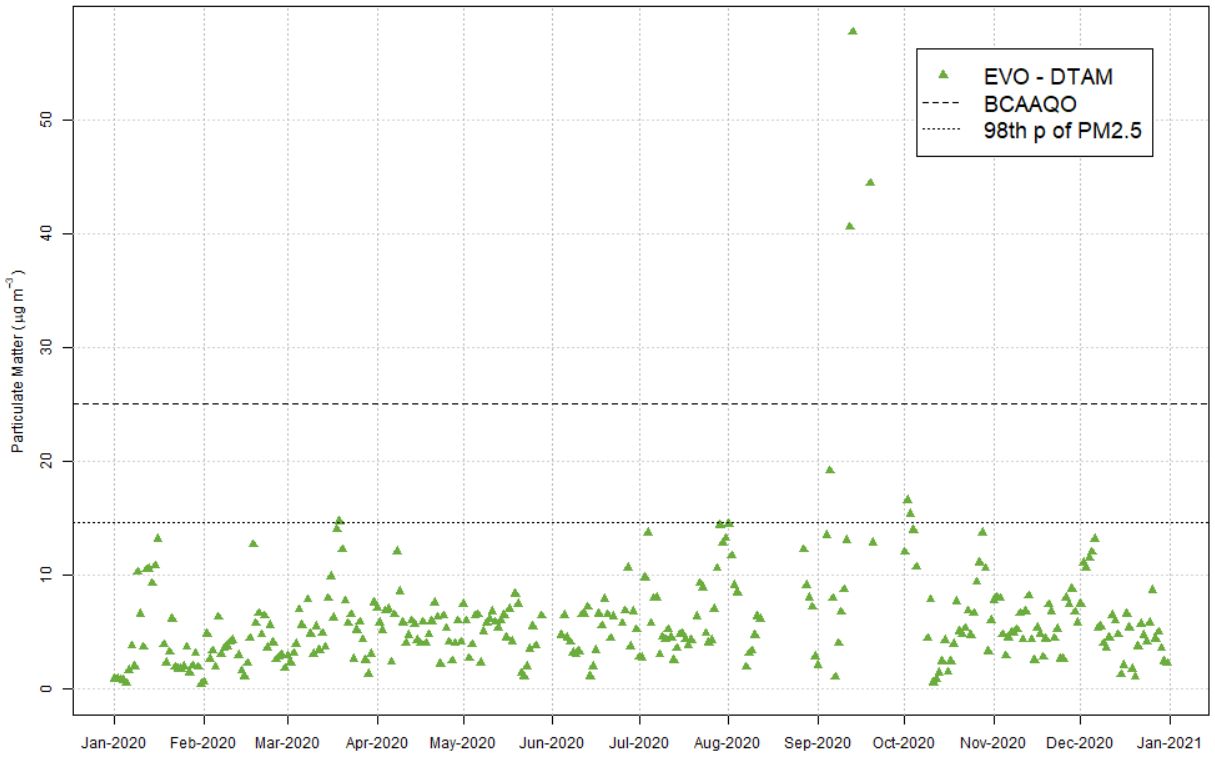


Figure B-15: Daily averaged $PM_{2.5}$ concentrations from GHO – Elkford.

Notes:

1) The BCAAQO of 25 µg/m^3 is indicated by a dashed line.
2) The dotted line indicates the 98th percentile of $PM_{2.5}$.

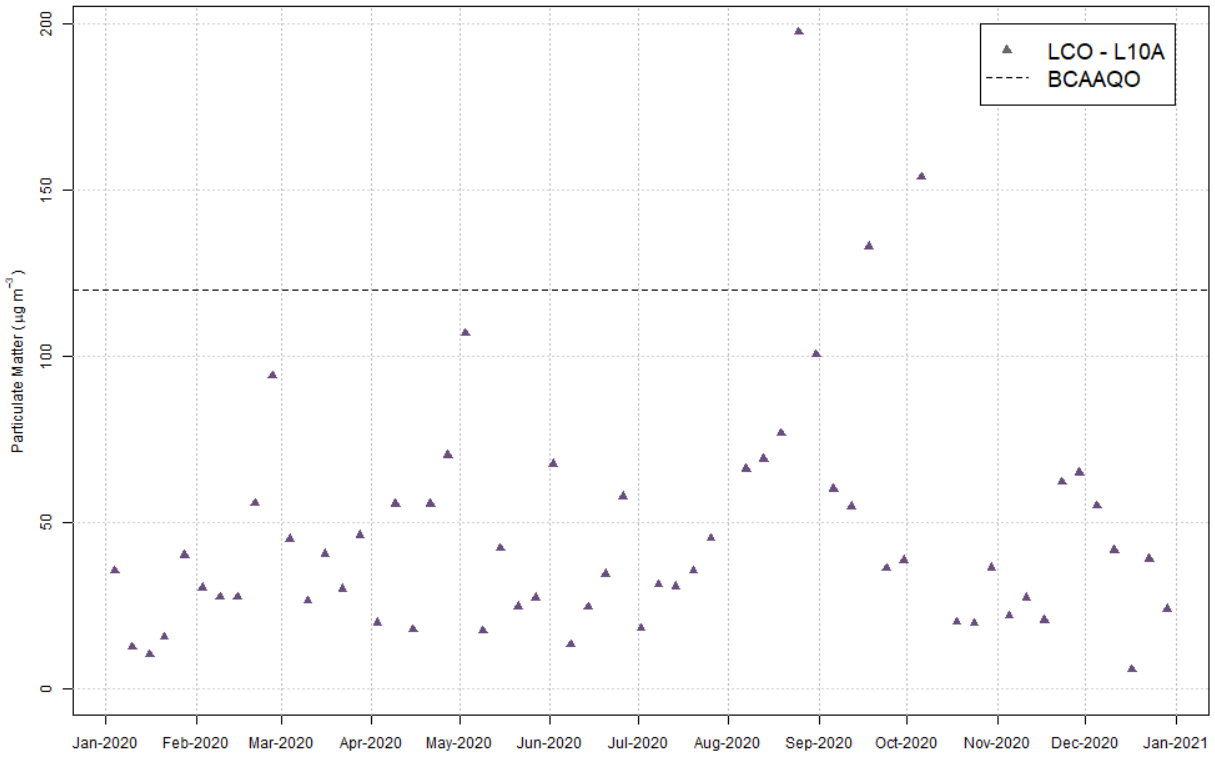


Figure B-16: TSP concentrations from LCO - L10A.

Notes:

1) Concentrations are collected for 24-hour periods every 6 days based on the NAPS schedule.
2) The BCAAQO of 120 µg/m^3 is indicated by a dashed line.

APPENDIX C

ENV'S REVIEW MEMO OF TECK RAMP 2021

Ministry of Environment and Climate Change Strategy

MEMORANDUM

P-1501 Fording River Operations
P-1807 Elkview Operations
P-4751 Coal Mountain Operations
P-5352 Line Creek Operations
P-6249 Greenhills Operations

January 11, 2021

Teck Coal Limited
3300-550 Burrard ST
Vancouver, BC V6C 0B3

RE: Review of Teck Coal Regional Air Monitoring Program

The Air Quality Section (AQS) has completed a review of the Teck Coal Regional Air Monitoring Program (RAMP) in the Elk Valley of South-East British Columbia (BC). The RAMP is a permit requirement for each of Teck Coal's sites - Greenhills Operations (GHO), Ford River Operations (FRO), Elkview Operations (EVO), Line Creek Operations (LCO), and Coal Mountain Operations (CMO) - as follows:

> The Permittee must participate in a comprehensive ambient air monitoring program that considers impacts from emissions from all Teck Coal Limited Mines in the Elk Valley. This program must be prepared and implemented by a Qualified Professional. This program must be conducted to the satisfaction of the Director. Updates to the terms of reference or to the monitoring plan for the ambient air monitoring program must be submitted to the Director within 30 days of adoption.

This review was initiated as per the 2015 RAMP: "Every five years an external audit (review and evaluation) will be conducted by a third party to further evaluate how the monitoring program is achieving the defined objectives." The AQS has included the documents listed below in this review; they were prepared by Barr Engineering and Environmental Science Canada, Ltd and submitted to the Ministry of Environment and Climate Change Strategy (ENV) in June, 2020.

- **Elk Valley Regional Air Monitoring Program (RAMP) Review: Monitoring Review and Benchmarking**. This document contains a detailed review of the RAMP since its inception in 2015, including several recommendations for changes to the program and it will be referred to as the 5-year RAMP review throughout this memo.

- **Regional Air Monitoring Program (June 2020)**. This document incorporates the recommendations from the *5-year RAMP review* and outlines the proposed RAMP for the next 5 years (2020-2025) and it will be referred to as the proposed 2020 RAMP throughout this memo.

This memo is structured as follows:

- Section 1 (Recommendations for the RAMP) lists the findings of this review that need to be addressed by Teck Coal Ltd. The AQS requests an updated RAMP from Teck Coal Ltd. based on these recommendations, accompanied by a comment tracking table that indicates how and where each recommendation has been addressed in the updated RAMP. The AQS will need to review and approve the updated RAMP.
- Appendix A gives a history of air quality complaints received by Teck Coal; Appendix B shows maps of the current monitoring networks; and Appendix C explains the framework used to complete this review.

1 Recommendations for the RAMP

The AQS request an updated RAMP be prepared based on the information below, including a comment tracking table indicating how and where each item been addressed in the updated RAMP. The AQS will need to review and approve the updated RAMP.

1. The AQS supports many of the recommendations that were made in the *5-year RAMP review* which have been implemented in the *proposed 2020 RAMP*. In particular, the AQS agrees that the monitoring network could be condensed to maximize coverage for the sensitive human receptors in Sparwood, Elkford and at the Grave Lake Recreation Site (located to the south of LCO). The AQS suggests the RAMP network be as shown in Figures 1 and 2, and Table 1.

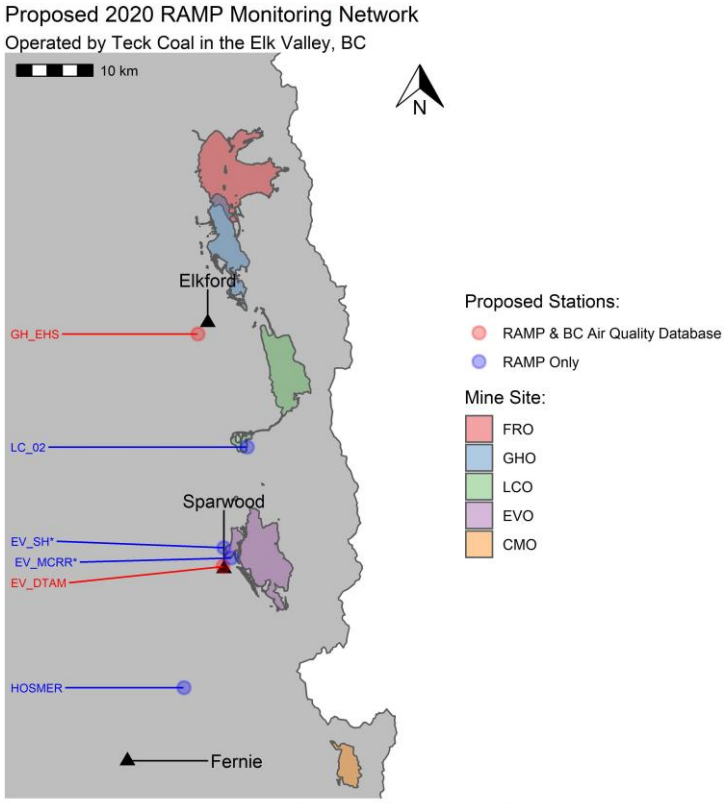


Figure 1: The proposed 2020 RAMP monitoring network. ENV requests that Teck Coal select one of EV_SH or EV_MCRR (indicated by * in the figure) to retain in the network, that siting concerns are resolved as detailed below, and that EV_DTAM and GH_EHS (indicated by red symbols in the figure) be registered in the BC Air Quality Database. The Air Quality Health Index (AQHI) at EV_DTAM would be calculated from hourly $PM_{2.5}$, O_3, and NO_2 concentrations. A key to the station ID's shown in the figure is provided in Table 1.

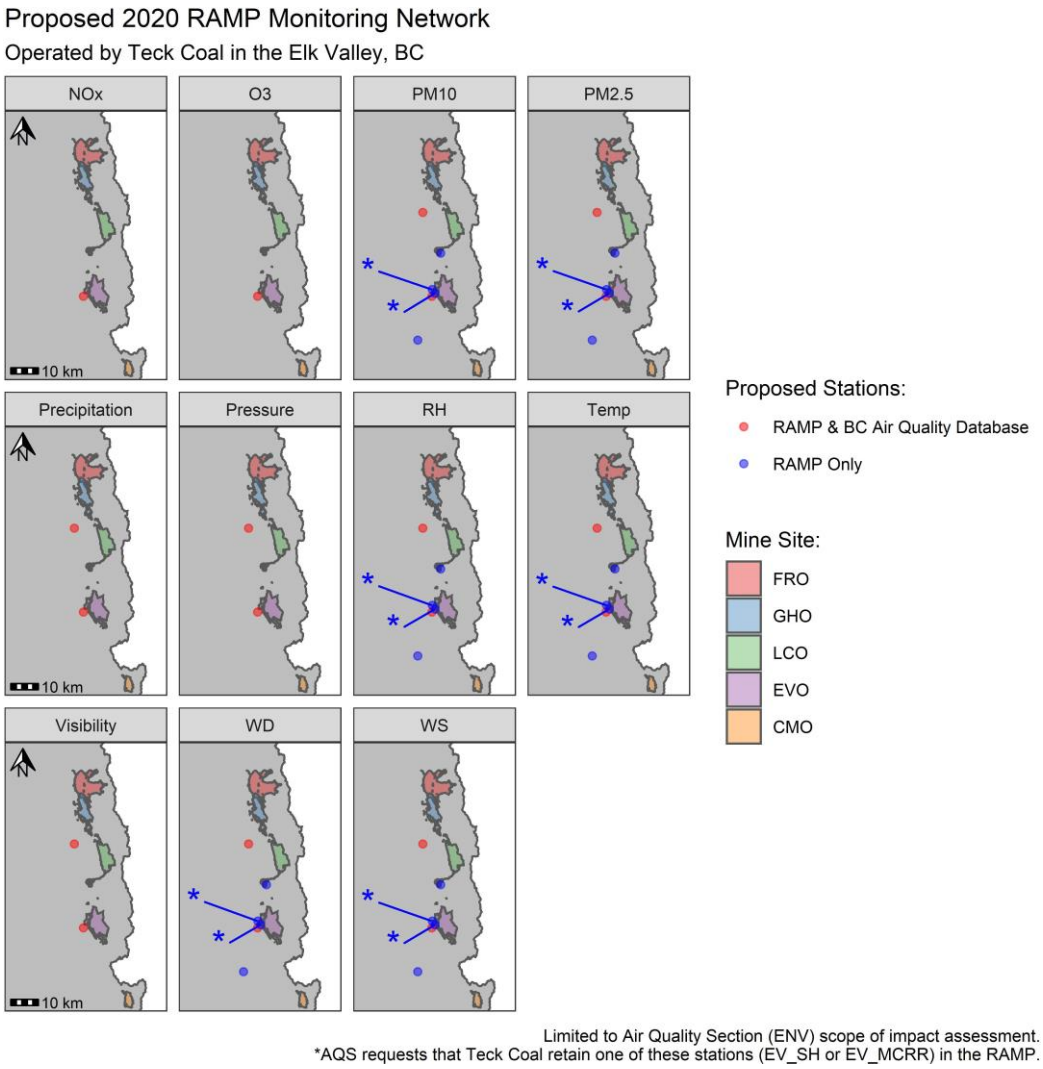


Figure 2: The proposed 2020 RAMP monitoring network. ENV requests that Teck Coal select one of EV_SH or EV_MCRR (indicated by * in the figure) to retain in the network, that siting concerns are resolved as detailed below, and that EV_DTAM and GH_EHS (indicated by red symbols in the figure) be registered in the BC Air Quality Database. The Air Quality Health Index (AQHI) at EV_DTAM would be calculated from hourly $PM_{2.5}$, O_3, and NO_2 concentrations. A key to the station ID's is provided in Table 1 and the location of each station ID can be found in Figure 1.

Table 1: Proposed 2020 RAMP monitoring network. Figures 1 and 2 show where these stations are located.

Teck Site	Station ID	Station Name	Parameters
Fording River[a]	-	-	-
Greenhills	GH_EHS[b]	Greenhills Rocky Mountain Elementary School	$PM_{2.5}$, PM_{10}, RH[c], Temperature, WS[d], WD[e], Visibility, Precipitation, Pressure
Line Creek	LC_02	Line Creek Continuous (Grave Lake)	$PM_{2.5}$, PM_{10}, RH[c], Temperature, WS[d], WD[e]
Elkview	EV_DTAM[b]	Sparwood Downtown	$PM_{2.5}$, PM_{10}, RH[c], Temperature, WS[d], WD[e], Visibility, Precipitation, Pressure, O_3[f], NOx[g], AQHI[h]
	EV_SH[i]	Sparwood Heights	$PM_{2.5}$, PM_{10}, RH[c], Temperature, WS[d], WD[e]
	EV_MCRR[i]	Michel Creek Road Residences	$PM_{2.5}$, PM_{10}, RH[c], Temperature, WS[d], WD[e]
Coal Mountain[a]	-	-	-
-	Hosmer	Hosmer	$PM_{2.5}$, PM_{10}, RH[c], Temperature, WS[d], WD[e]

[a]Retain RAMP clause in permit and report out on any non-RAMP monitoring.
[b]BC Air Quality Database Site
[c]Relative humidity (RH)
[d]wind speed (WS)
[e]wind direction (WD)
[f]Ozone (O_3)
[g]oxides of nitrogen (NO_x): NO_2 & NO
[h]Air Quality Health Index (AQHI): calculated from hourly $PM_{2.5}$, O_3, and NO_2 concentrations.
[i]AQS requests that Teck Coal retain one of these stations in the RAMP.

2. The AQS is aware of several concerns about dust deposition to the receiving environment of importance to the KNC. The AQS does not have the in-house expertise to address these concerns but does recognize them as outstanding until such a time as they are resolved to the satisfaction of the KNC.
3. There is a strong emphasis in the *5-year RAMP review* on differentiating impacts from mining sources and other sources. There is value in removing wildfire events based on an accepted quantitative method, and ENV uses this approach when reporting out on particulate matter (PM) levels at Ministry stations. The AQS acknowledges that it is important to understand the emissions profile from Teck Coal's operations. Although predictably, Teck Coal's emissions from all of its sites are overwhelmingly from fugitive dust, as is unequivocally the case at most open-pit mine sites in BC. The RAMP should align with the province-wide approach to airshed management which acknowledges that there are usually many sources that may impact a community, and that all emitters should follow best practices to reduce impacts.
4. Removing smoke from a PM dataset prior to analysis is a nuanced and tedious process. The AQS appreciates the effort that was made in the *5-year RAMP review* to do so. The AQS has not completed an in-depth review of this analysis (*5-year RAMP review* Section 2.2.4 and Attachment 2), which included the source apportionment of particulate matter with aerodynamic diameters less than 2.5 micrometers ($PM_{2.5}$) into wildfire and mining emissions sources. However, the AQS does generally agree with the time periods attributed to wildfire smoke episodes in the Elk Valley and can say with certainty that these episodes were at times severe and unprecedented. In future reporting, the method outlined by the Canadian Council of Ministers of the Environment, 2012 should be used to account for transboundary flows and exceptional events.
5. Implementing the recommendations above would result in the removal of RAMP monitoring by FRO and CMO, and a reduction in RAMP monitoring by EVO, LCO, and GHO. The AQS requests that:

    (a) All mine sites retain the RAMP clause in their permits, and that
    (b) all future annual and 5-year RAMP reporting include a comprehensive list of all the monitoring stations and parameters operated by Teck Coal in the Elk Valley. This should include clearly defined monitoring objectives for each station and should also indicate whether the monitoring is required by the RAMP, by permit, or if the monitoring is being done independently by Teck Coal.

6. The Sparwood Downtown and Elkford Rocky Mountain Elementary School stations should be registered in the BC Air Quality Database, making the data reportable to the public in near real-time. Registered sites are also subject to routine ENV audits and data validation protocols. Teck Coal's air monitoring service provider can rely on support from ENV staff moving forward with this request by contacting AQHIDSI@Victoria1.gov.bc.ca. Upon first contact, please submit a completed start-up form (enclosed: Air_Startup.dot).
7. The proposed 2020 RAMP (Figures 1 and 2, and Table 1) would result in AQHI reporting at the Sparwood Downtown station.

8. The AQS has become aware of monitoring programs led by Teck Coal in the Elk Valley that are not included in the RAMP or prescribed by permit. These include a HHRA study on ambient levels of hexavalent chromium and other metals in dust, visibility monitoring, and the implementation of a predictive dust monitoring and forecasting program. Programs with relevance to the objectives of the RAMP, even if the monitoring is not required by the RAMP, should be reported. The AQS expects that the HHRA study would be meaningful to the RAMP overarching objective of being protective of sensitive human receptors. The third objective of the *proposed 2020 RAMP* focusses in part on mining impacts on visual quality; it follows that a visibility monitoring program would be directly applicable to this objective. The AQS requests that information on the HHRA and visibility monitoring programs be included in the updated version of the 2020 RAMP.
9. The following two bullets (items 10 and 11) are related to technical aspects of the monitoring network, and were informed by the Air and Climate Networks group and the AQS Monitoring team within ENV.
10. $PM_{2.5}$ instrumentation:

    (a) ENV supports PM monitoring in accordance with the United States of America (USA) Environmental Protection Agency (EPA) protocols for Federal Equivalency Method (FEM) certification, as stated in the BC Field Sampling manual (FSM) (The Province of British Columbia, 2018 - Part B: Air and Air Emissions Testing). The list of USA EPA approved PM monitoring does include the Tapered Element Oscillating Microbalance (TEOM) Filter Dynamics Measurement Systems (FDMS) configuration, but ENV encountered several issues testing this instrumentation and is not aware of it being used in Canada by any government agencies.

    (b) ENV has transitioned from what it considers to be outdated technology in the TEOM instruments to the Beta Attenuation Monitor (BAM), often in combination with nephelometry (for $PM_{2.5}$). As of August 2020, there are no longer any TEOM instruments at ENV stations.

    (c) The Teck Coal network currently relies on Thermo Scientific Synchronized Hybrid Ambient Real-time Particulate Monitor (SHARP) 5030i instruments with nephelometry to monitor PM in the Elk Valley. This aligns well with the ENV network that includes several SHARP instruments, including at nearby stations in the Kootenay region (Golden, Cranbrook, Castlegar, and Grand Forks). With an appropriate maintenance program and scheduled diagnostic checks, ENV does not consider the maintenance or filter tape change requirements on the SHARP 5030i technology to be a significant hinderance to data collection.

    (d) ENV maintains a provincial air quality database supported by a commercial polling and display system - Envitech's Envista which is supported in North America through DR DAS Limited. For near real-time data feeds, it is essential that the Ministry's Envista communications system be able to interact with Teck Coal Data logging components maintained on site. ENV currently supports data communications with a number of data loggers and software packages available, but for ease of data transparency and management, it is preferred if the logger is operated using Envista Ultimate Software. If Teck Coal is not utilizing Envista Ultimate as the logging technology, please contact

DR DAS Ltd for a list of alternative technologies available (note that there may be very limited experience with some of these technologies within ENV and, therefore, they may not be supportable for troubleshooting). Please consult with the ENV Air Data System's team (AQHIDSI@Victoria1.gov.bc.ca) as to the path forward before making a final decision.

(e) Once Sparwood Downtown and Elkford Rocky Mountain Elementary School stations are registered in BC's Air Quality Database and the data is made reportable to the public, both sites would be subject to ENV Air Audits. Please note that an Air Auditing Protocol for TEOM FDMS may need development if prior protocols for TEOM instrumentation are not applicable.

11. Station siting:

(a) Some stations in the Teck Coal network do not have a fence to prevent tampering or vandalism (e.g. Sparwood Heights station).

(b) The inlet for the gas analyzers at the Sparwood Downtown station needs to be placed away from any obstacle to air flow (i.e. the rooftop).

(c) There are siting concerns at the Hosmer station due to a lack of clearance from surrounding vegetation for the air quality instrumentation; this does not apply to the siting of the meteorological station.

(d) Some wind instruments are not at the appropriate height (i.e. they are <10 m), and others are located in areas highly affected by nearby topography. This results in inconsistent wind profiles when comparing stations that may be in close proximity to each other and wind measurements that may not be representative of the area.

(e) It will be important to ensure that the wind sensor on the roof of the Sparwood Downtown station be installed at the appropriate height (>10 m) if the station is to be added to the ENV network.

(f) Station GH_101 has a temperature/RH probe located very near to an HVAC vent for the building.

12. Regarding the determination of achievement for the BCAAQO and CAAQS:

(a) The *5-year RAMP review* does not cite the guidance documents for achievement determination: Canadian Council of Ministers of the Environment, 2012, British Columbia Ministry of Environment, 2009, British Columbia Ministry of Environment, 2017a, Canadian Council of Ministers of the Environment, 2020a, British Columbia Ministry of Environment, 2017b, Canadian Council of Ministers of the Environment, 2020b. These are the accepted methods by which to determine achievement of the BCAAQO and CAAQS, and the most current version of these documents should also be cited in the RAMP. Please confirm whether these methods were followed.

(b) Table 2-2 of the *5-year RAMP review*, footnotes 2 and 3, state incorrectly that the nitrogen dioxide (NO_2) BCAAQO and CAAQS are based on daily averages. These metrics should be calculated using daily 1-hour maximum (D1HM) concentrations.

(c) Table 2-3 of the *5-year RAMP review* (particulate matter with aerodynamic diameters less than 10 micrometers (PM_{10}) Data Summary) has a column that reports the

"Annual Average" values. It is assumed this column is the annual average of 24-hour concentrations, but it is not clear. Regardless of the metric used, the BCAAQO for PM_{10} is based on a 24-hour averaging period and so reporting an annual value is not meaningful.

(d) Table 2-5 of the *5-year RAMP review* (Gaseous Pollutant Data Summary for EV_DTAM): the reporting for NO_2 and sulphur dioxide (SO_2) appear to be erroneous and are not based on the relevant BCAAQO and CAAQS.

13. Detailed Comments on the *proposed 2020 RAMP*:

(a) Table 1 of the *proposed 2020 RAMP*: the BCAAQO, CAAQS, and National Ambient Air Quality Objectives (NAAQO) are not regulations.

(b) p. 3 of the *proposed 2020 RAMP*: the objectives of the RAMP should not be limited to evaluation against BCAAQO for PM, but should include all criteria air contaminants (CAC)s that are included in the RAMP.

(c) p. 6 of the *proposed 2020 RAMP* should make reference to the accepted method for differentiating wildfire impacts (Canadian Council of Ministers of the Environment, 2012).

(d) p. 6 of the *proposed 2020 RAMP* states that "Previous complaints were reviewed as part of the 5-year RAMP review and no consistent pattern of impacts was noted." AQS does not agree with this statement. Fugitive dust is the dominant emissions source at all of Teck Coal's mines in the Elk Valley, and this is reflected in the history of complaints (Figure 3). Fugitive dust management will be the key to successfully managing ambient air quality impacts to sensitive human receptors in the Elk Valley.

(e) p. 6 of the *proposed 2020 RAMP*: "....according to the applicable guidance." The guidance should be cited and further clarification is requested. Is this referring to the instrumentation that will be used, the data validation procedures, etc.?

(f) p. 7 of the *proposed 2020 RAMP*: the summaries of complaints and events should not be limited to fugitive dust, although it is expected that fugitive dust will be the primary cause for complaints and air quality events.

(g) p. 8 of the *proposed 2020 RAMP*: consultation with ENV is required before making any changes to the RAMP.

Closing

Thank you for the opportunity to complete this review. Please contact me should you wish to discuss further.

Donna Haga, PhD
Senior Air Quality Meteorologist
Air Quality Section (Assessment and Stewardship)
B.C. Ministry of Environment and Climate Change Strategy
250.420.6320

cc: Earle Plain, Head, Air Quality Section, Environmental Protection
cc: Ben McKinnon, Environmental Protection Officer, SE Mining, Environmental Protection
cc: James Smithson, Lands Project Officer, Ktunaxa Nation Council

enclosed: Air_Startup.dot

References

British Columbia Ministry of Environment (2009). *Guidance on Application of Provincial Air Quality Criteria for $PM_{2.5}$*. Accessed on December 16, 2020. Available from: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/pm25-implement-guide.pdf.

British Columbia Ministry of Environment (2017a). *Guidance on Application of Provincial Air Quality Objectives for NO_2*. Accessed on December 16, 2020. Available from: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/no2_aqo-implementation_guide.pdf.

British Columbia Ministry of Environment (2017b). *Guidance on Application of Provincial Air Quality Objectives for SO_2*. Accessed on December 16, 2020. Available from: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/so2_aqo-implementation_guide.pdf.

Canadian Council of Ministers of the Environment (2012). *Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone*. Accessed on December 4, 2020. Available from: https://www.ccme.ca/files/Resources/air/aqms/pn_1483_gdad_eng.pdf.

Canadian Council of Ministers of the Environment (2020a). *Guidance Document on Achievement Determination For Canadian Ambient Air Quality Standards for Nitrogen Dioxide*. Accessed on December 16, 2020. Available from: https://www.ccme.ca/files/Resources/air/GDAD%20for%20CAAQS%20for%20nitrogen%20dioxide_EN%201.0.pdf.

Canadian Council of Ministers of the Environment (2020b). *Guidance Document on Achievement Determination For Canadian Ambient Air Quality Standards for Sulphur Dioxide*. Accessed on December 16, 2020. Available from: https://www.ccme.ca/files/Resources/air/GDAD%20for%20CAAQS%20for%20sulphur%20dioxide_EN%201.0.pdf.

Ministry of Energy, Mines and Petroleum Resources, Ministry of Environment and Climate Change Strategy (2018). *Developing a Fugitive Dust Management Plan for Industrial Projects*. Accessed on December 4, 2020. Available from: https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/guidance-documents/dust_management_plan_guidance.pdf.

The Province of British Columbia (2018). *The British Columbia Field Sampling Manual*. Accessed on December 9, 2020. Available from: https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/guidance-documents/dust_management_plan_guidance.pdf.

Appendix

A History of Air Quality Complaints

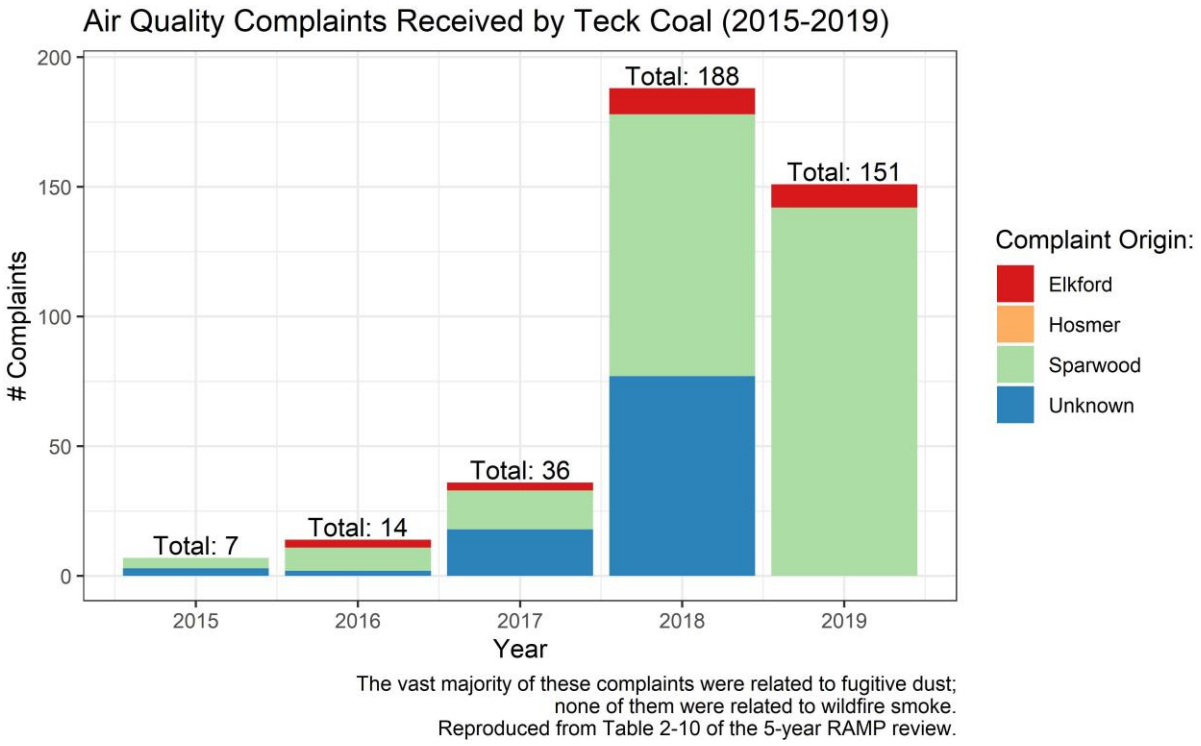


Figure 3: History of air quality complaints received by Teck Coal between 2015-2019. This figure was reproduced using the information in Table 2-10 of the *5-year RAMP review*.

B Current Monitoring Maps

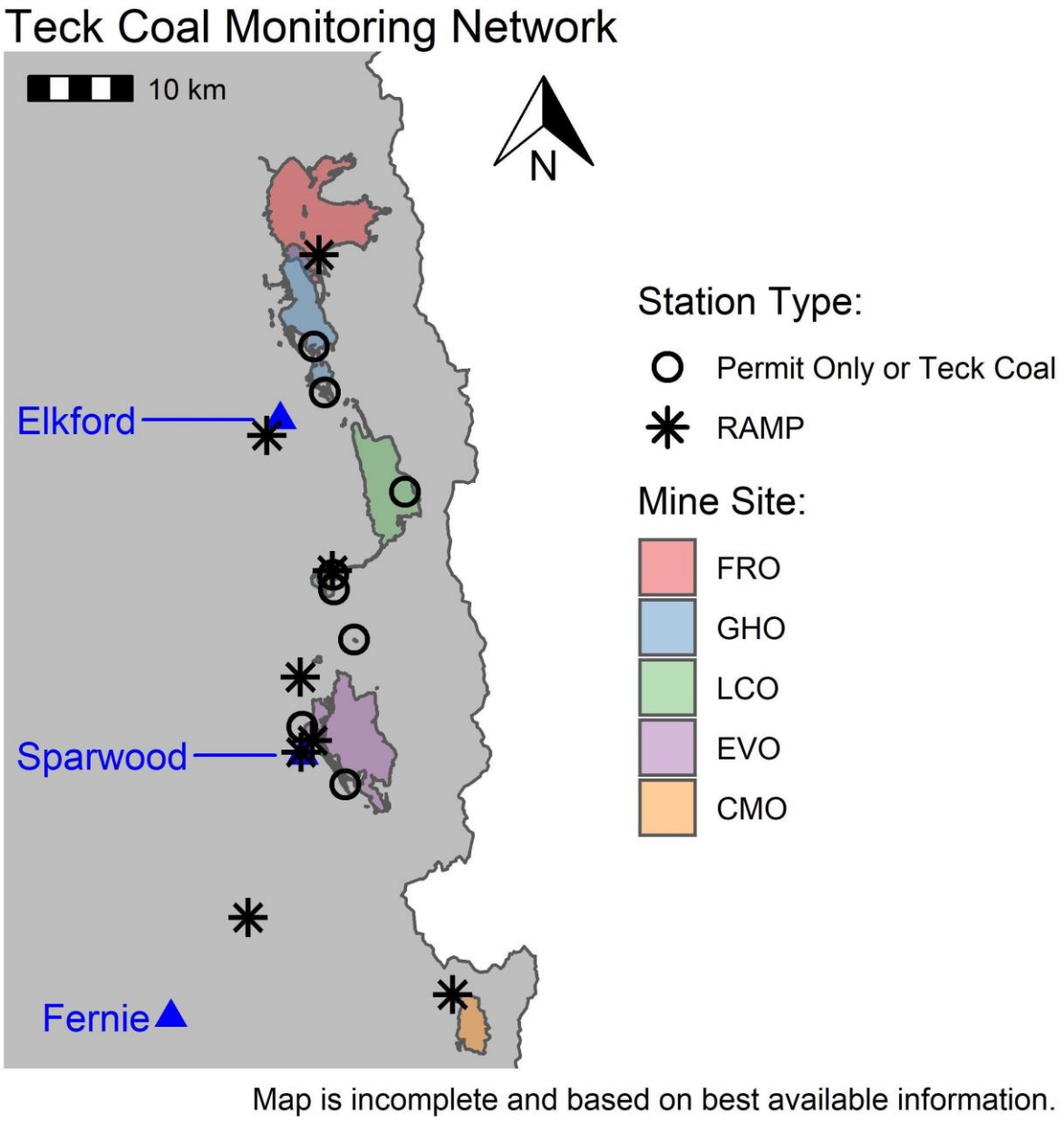


Figure 4: Teck Coal's current monitoring network, including RAMP sites, permitted sites, and sites that are independently operated Teck Coal. The map shows 16 stations which measure 81 parameters across the network. This map is incomplete based on a network tour in September 2020, but is based on the best available knowledge.

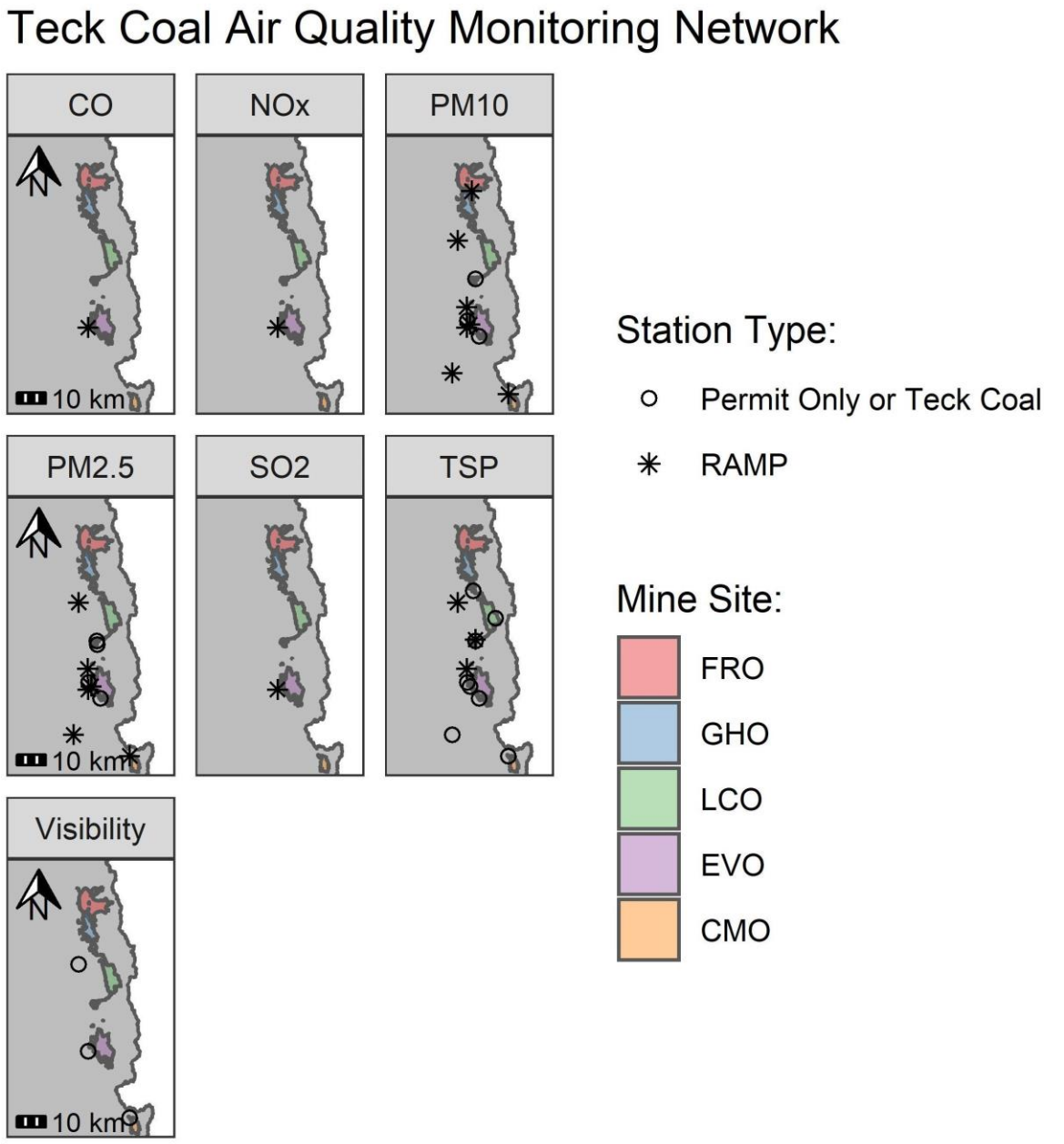


Figure 5: Teck Coal's current air quality monitoring network, including RAMP sites, permitted sites, and sites that are independently operated Teck Coal. The map shows one panel for each air quality parameter that is measured in the network. This map is incomplete based on a network tour in September 2020, but is based on the best available knowledge.

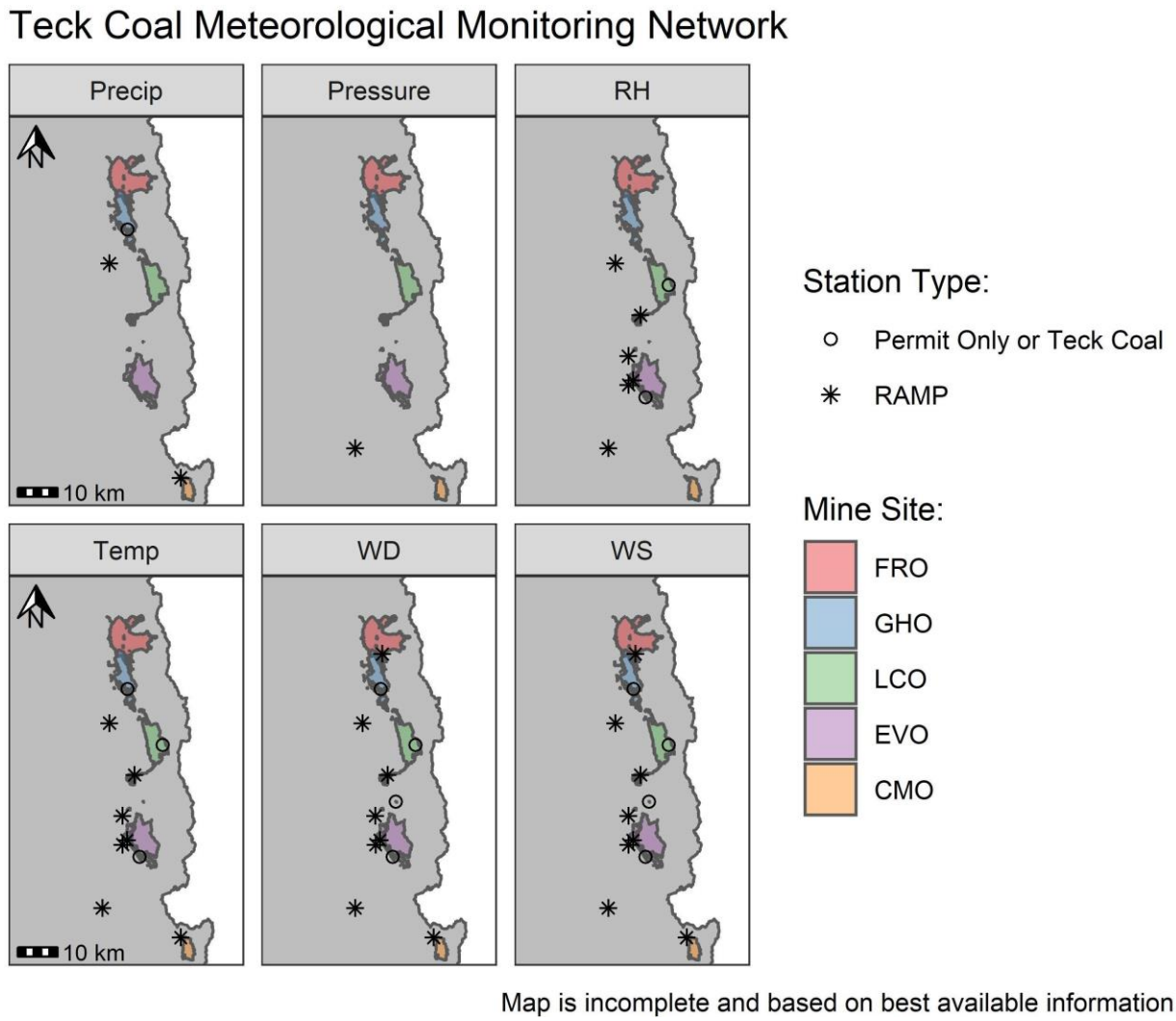


Figure 6: Teck Coal's current meteorological monitoring network, including RAMP sites, permitted sites, and sites that are independently operated Teck Coal. The map shows one panel for each meteorological parameter that is measured in the network. This map is incomplete based on a network tour in September 2020, but is based on the best available knowledge.

C Air Quality Impact Assessment Approach

The framework used to evaluate the effectiveness of the RAMP is provided below. Key questions that are applied to all air quality impact assessments are listed, followed by answers specific to Teck Coal's impacts in the Elk Valley:

1. What are the major emissions sources? What are the CAC of concern?

   The dominant emissions source from mine sites is fugitive dust and it follows that the CAC of concern are $PM_{2.5}$ and PM_{10}.
   The *5-year RAMP review* states that: "The emissions calculations for each of the Teck Elk Valley operations indicate the amount of fugitive emissions is considerably larger (i.e. at least 100 times) than the stack driven emissions.". This is a typical emissions profile for mines across BC and it is for this reason that the AQS has been focusing air quality management efforts at mine sites on the development of robust FDMPs.

2. What are the sensitive human and environmental receptors and where are they with respect to the mine site(s)?

   Impact assessments done by the AQS typically focus on sensitive human receptors in populated areas; in the Elk Valley, the municipalities of Sparwood and Elkford, and the Grave Lake Recreation Site to the south of LCO have been identified as areas where sensitive human receptors are located. **Experts from other disciplines, agencies and governments require consultation on whether the RAMP provides adequate coverage for environmental receptors**. In particular, I understand the KNC has several concerns related to dust deposition in the receiving environment and I want to be clear that AQS does not have the expertise to encompass these concerns in the scope of this review. These concerns are considered to be outstanding until such a time as they are deemed otherwise by the KNC.

3. What are the benchmarks used to assess impacts to the sensitive receptors?

   The BCAAQO and CAAQS are applied as benchmarks to assess impacts to human receptors. However, an important caveat about fugitive dust events should be noted here. Dust events often occur on a sub-hourly timescale and do not always result in exceedances of the BCAAQO or CAAQS, the latter of which are defined on a longer timescale (hourly, daily, annually). This discrepancy underscores the importance of robust FDMPs for mine sites, in particular those that are close to sensitive receptors. Public complaints are often the best indicator of impacts from fugitive dust on sensitive human receptors, and Table 2-10 of the *5-year RAMP review* indicates that:

   (a) The number of air quality complaints in the Elk Valley has consistently increased since 2015 (Figure 3), and
   (b) the complaints are predominately related to fugitive dust emissions from Teck Coal's mines in the Elk Valley.

4. Are the benchmarks being exceeded?

   The *5-year RAMP review* points to wildfire events as the major cause of BCAAQO and CAAQS exceedances. The Elk Valley certainly would have experienced impacts, at times severe, during the wildfire seasons of 2015-2019. But, it should also be noted that the hot and dry conditions that are conducive to wildfires are also conducive to dust events; a reasonable effort was presented in the *5-year RAMP review* to delineate events from wildfire smoke and other emissions sources, but the method of Canadian Council of Ministers of the Environment, 2012 was not followed and is recommended in future reporting. Furthermore, there were exceedances of the BCAAQO and CAAQS at other times of the year that cannot be attributed to wildfires, especially during the spring when road dust advisories are often issued across BC.