REPORT

ANNUAL TECK COAL LTD. REGIONAL AIR QUALITY MONITORING PROGRAM REPORT

SPARWOOD, BC

2021 ANNUAL REPORT

RWDI #2202935
March 29, 2022

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., QSTI
Senior Scientist
Mukund.Venkitachalam@rwdi.com

Matthew Sawycky, B.Sc.
Senior Project Manager / Associate
mts@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 (CM). 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. These permits also require a Regional Air Quality Monitoring Program (RAQMP) 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.

This report covers results of monitoring of the following parameters: particulate matter 10 micrometers in diameter and smaller (PM_{10}), particulate matter 2.5 micrometers in diameter and smaller ($PM_{2.5}$), nitrogen dioxide (NO_2) and ozone (O_3) at the five stations that are part of the RAQMP, namely, Hosmer, Sparwood Centennial Square (EV_SCS), Whispering Winds Trailer Park (EV_WWTP), Elkford Rocky Mountain Elementary School (GH_ERMES), and Line Creek (LC_02). Results of the monitoring were compared to British Columbia Ambient Air Quality Objectives (BCAAQO).

Results show that exceedances in 24-hour PM_{10} and $PM_{2.5}$ were most frequent (nearly 20 days at two stations) and highest from the middle of July to the middle of August 2021, coinciding with the period when the Elk Valley region was under smoke advisories due to wildfires. As a result of high concentrations during this period, the BCAAQO for annual average $PM_{2.5}$ was also exceeded at two stations. Exceedances or excursions of these parameters outside this period were rare (three days at two stations in total). No exceedances of NO_2 or O_3 were recorded.

Trends in annual average PM_{10} show GH_ERMES, which has the longest record, to exhibit a clear rising trend since monitoring started in 2010. PM_{10} trends in other stations are less pronounced due to strong annual variability. Annual trends in $PM_{2.5}$ in all stations are mostly not well-defined except at LC_02 whose 3-year record indicates a sharp rise. The location and specification of the LC_02 monitor is currently being discussed with BC ENV.

The annual completeness requirement of 75% and the quarterly requirement of 60% for PM_{10} measurements were met at GH_ERMES and EV_WWTP. EV_SCS met the annual target but was short of the quarterly completeness objective in the third quarter by less than 5%. Other than routine maintenance, the most common reason for gaps in the data is low flow to the sampler often caused by power supply issues and sample pump failures. $PM_{2.5}$ annual and quarterly completeness targets were met by all four stations. LC_02 and Hosmer are not required to meet these objectives because they are not part of any mine site's permit. For NO_2 (measured only at EV_SCS), data was more than 87% complete for the year.

Meteorological monitoring at four sites shows winds to be influenced by the topography, which also generate upslope winds manifested as higher mean wind speeds in the afternoon. Total monthly precipitation was within 1 standard deviation of the 30-year mean at Sparwood, except in August 2021 when twice the normal was recorded at GH_ERMES. Cooler than average temperatures were observed in February and December, while June, July, and November saw temperatures consistently above the mean.

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., QSTI
Senior Scientist
RWDI AIR Inc.

1 INTRODUCTION

Teck Coal Limited (Teck) operates four active open pit coal mines (the Sites) and one closed mine in care and maintenance in the Elk Valley (Figure 1). The Elk Valley is characterized by rugged terrain and localized mountain weather patterns, which define the dispersion of pollutants in the region. The communities of Elkford and Sparwood, both with populations of more than 2,500, are in the vicinity of the Sites.

Each mine is authorized by the following 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:

- 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

Site permits contain a condition which states:

> *Regional Air Quality 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 Quality Monitoring Program (RAQMP) aims to satisfy this condition. 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 satisfies part of the requirements of the RAQMP by presenting the results of air quality and meteorological monitoring conducted by Teck in the Elk Valley under the RAQMP. It integrates and supplements the reporting by each Site as required by their individual permits.

This report includes information on:

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

As required to provide context for the ambient monitoring results, this report also 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.

As part of the adaptive management framework, this annual report will also make recommendations to adjust the RAQMP where needed.

The criteria air contaminants (CACs) measured at these stations covered by the RAQMP include:

- Particulate matter smaller than 10 µm in diameter (PM_{10})
- Particulate matter smaller than 2.5 µm in diameter ($PM_{2.5}$)
- Nitrogen dioxide (NO_2)
- Ozone (O_3)

Monitoring results are compared to British Columbia Ambient Air Quality Objectives (BCAAQO) for each air contaminant in Table 1. With the following exceptions, any value above the objectives for these contaminants is called an exceedance at a station. For $PM_{2.5}$, the BCAAQO is applied to the 98th percentile. The 1-hour NO_2 objective is based on the annual 98th percentile of the daily 1-hour maximum averaged over 3 consecutive years, while the 8-hour objective for O_3 is based on the annual 4th-highest daily 8-hour value averaged over 3 consecutive years. For these contaminants at these averaging periods, a value above the BCAAQO is termed an excursion, and an exceedance only occurs if these specific ranks or percentiles are above the BCAAQO.

Table 1: Applicable BC Ambient Air Quality Objectives

Contaminant	BCAAQO (µg/m^3)			
	1-Hour	8-Hour	24-Hour	Annual
$PM_{2.5}$			25[1]	8
PM_{10}			50	
NO_2	113[2]			32
O_3	160	123[3]		

Notes:
[1] Applies to the 98th percentile
[2] Applies to the 98th percentile of daily 1-hour maximum over three years.
[3] Applies to 4th-highest daily 8-hour maximum averaged over three consecutive years
Blank cells mean there is no BCAAQO at that averaging period for that contaminant.

2 MONITORING LOCATIONS

Air quality and meteorological monitoring is conducted at the Sites and in three communities in the Elk Valley. Tech operates several continuous air monitoring stations, whose results are used for research and guiding fugitive dust management plans.

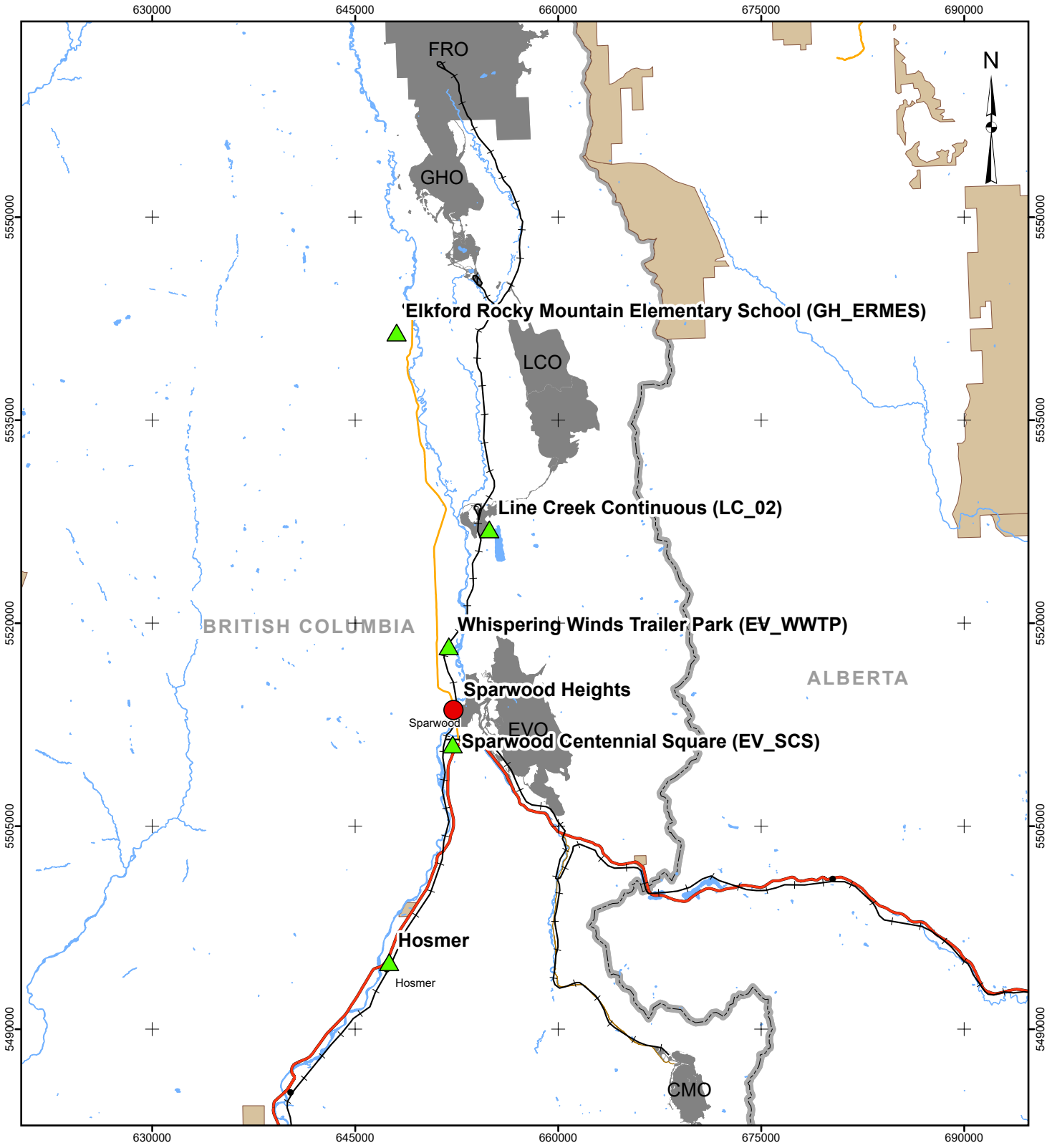
This section describes the five stations and parameters that are included in the RAQMP. Figure 1 presents the locations of the monitoring stations, whose coordinates are listed in Table 2. Table 3 lists the parameters measured at each of the monitoring stations.

Table 2: Locations of stations in the Regional Air Monitoring Program.

Station ID and Name		Latitude (°N)	Longitude (°W)	Elevation (m)
Hosmer	Hosmer	49.590260	114.959234	1057
EV_SCS	Sparwood Centennial Square	49.732786	114.88766	1138
EV_WWTP	Whispering Winds Trailer Park	49.798506	114.888639	1160
LC_02[1]	Line Creek Continuous	49.891053	114.845684	1298
GH_ERMES	Elkford Rocky Mountain Elementary School	50.007794	114.933420	1333

Note:

[1] Teck is currently in conversation with BC ENV to finalize the location of LC_02 (RWDI, 2022). The coordinates provided indicate the location of the temporary station from which particulate matter concentrations were obtained for use in this report. Data from the temporary station is being provided at BC ENV's request.



LEGEND

Air Monitoring Stations
- RAQMP
- NON-RAQMP
- 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 Quality 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 3: Parameters measured at each station in the Regional Air Monitoring Program.

Station ID and Name		Air Quality				Meteorology				
		PM_{10}	$PM_{2.5}$	NO_2	O_3	Wind Speed and Direction	Temperature	Relative Humidity	Barometric Pressure	Precipitation
Hosmer	Hosmer	X[1]	X[1]			X	X	X	X	
EV_SCS	Sparwood Centennial Square	X[1]	X[1]	X	X	X	X	X		
EV_WWTP	Whispering Winds Trailer Park	X[1]	X[1]			X	X	X		
LC_02[3]	Line Creek Continuous	X[2]	X[2]							
GH_ERMES	Elkford Rocky Mountain Elementary School	X	X			X	X		X	X

Notes:
[1] PM_{10} and $PM_{2.5}$ measured continuously using a Thermo 5030i SHARP
[2] PM_{10} and $PM_{2.5}$ measured continuously using a DustTrak.
[3] Meteorological parameters were not measured at this station in 2021. This may be subject to change upon updating of Permit 5352.

A comprehensive list of all of the monitoring stations operated by Teck Coal Limited in the Elk Valley, including the parameters measured at each station, is provided in Appendix F. The list includes the monitoring objectives at each station, and whether the monitoring is a requirement of the RAQMP, a permit condition, or if it is being done independently by Teck Coal.

3 AIR QUALITY MONITORING RESULTS

This section discusses results of air quality monitoring at the five stations in 2021 for comparison with applicable BCAAQO. Additional statistics on concentrations and data completeness are provided in Appendix A.

3.1 Annual Averages

Annual average concentrations are presented in Table 4. Two stations were found to exceed the annual objective for $PM_{2.5}$, while the other three reach more than 80% of the BCAAQO. However, annual average NO_2 concentrations were only approximately 50% of the objective.

Table 4: Annual average concentrations in 2021.

Station ID	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	NO_2 (µg/m^3)
		BCAAQO = 8 µg/m^3	BCAAQO = 32µg/m^3
Hosmer	11.0	7.0	-
EV_SCS	16.5	**9.1**	16.2
EV_WWTP	10.7	6.6	-
GH_ERMES	11.4	7.2	-
LC_02	19.1	**16.8**	-

Notes:
[1] Values in boldface are above applicable objective.
[2] NO_2 is monitored only at EV_SCS.

3.2 Exceedances and Excursions

A summary of exceedances and excursions is found in Table 5. Exceedances and excursions are most frequent at LC_02, which is closest to LCO's Coal Refuse Pile. This station also uses a non-reference instrument and is used to provide supplemental data to the network only.

Among the other stations EV_SCS and GH_ERMES register the most exceedances and excursions, which will be discussed further.

Table 5: Excursions and exceedances in 2021.

Station Name	Contaminant	Averaging period	Applicable BCAAQO	Excursions or exceedances[4]	
				Number	Percentage of days[3]
Hosmer	PM_{10}	24 hours	50 µg/m^3	4	1.49
	$PM_{2.5}$	24 hours	25 µg/m^3[1]	13	3.76
EV_SCS	PM_{10}	24 hours	50 µg/m^3	8	2.93
	$PM_{2.5}$	24 hours	25 µg/m^3	20	7.04
	NO_2	1 hour	113 µg/m^3[2]	0	0.00
	O_3	8 hours	123 µg/m^3	0	0.00
EV_WWTP	PM_{10}	24 hours	50 µg/m^3	7	2.09
	$PM_{2.5}$	24 hours	25 µg/m^3	11	3.14
GH_ERMES	PM_{10}	24 hours	50 µg/m^3	10	3.05
	$PM_{2.5}$	24 hours	25 µg/m^3	19	5.40
LC_02	PM_{10}	24 hours	50 µg/m^3	20	11.83
	$PM_{2.5}$	24 hours	25 µg/m^3	26	15.38

Notes:
[1] The 24-hour $PM_{2.5}$ BC AAQO is based on 98th percentile of daily values.
[2] The 24-hour NO_2 BC AAQO is based on the Canadian Ambient Air Quality Standard (CAAQS) of 113 µg/m^3 applied to the 98th percentile of daily 1-hour maxima averaged over 3 years.
[3] Percentage based on valid periods.
[4] Exceedances are concentrations that are greater than the BC AAQO in cases where the BC AAQO is based on the maximum value. Excursions are daily aggregated concentrations that exceed the BC AAQO in cases where the BC AAQO is based on a more complex annual calculation. Not all excursions are exceedances but they do provide information regarding trends of that contaminant over time. For example, the 8-hour BC AQQO for Ozone is based on the 4th highest daily 8-hour maximum, averaged over 3 consecutive years. This defines an exceedance. Whereas an excursion would be any daily 8-hour maximum concentration exceeding the threshold.

3.3 PM_{10}

Figure 2 shows the time series of the 24-hour average PM_{10} concentrations at the five stations.

In March 2021 there were several days of elevated PM_{10} concentrations resulting in two exceedances at EV_SCS. Since no other stations exhibited an increase, they were likely caused by windblown dust from open areas around the station.

Between late July and early August 2021, all five stations registered exceedances in PM_{10}. A check with air quality advisories for Elk Valley from Environment Canada indicates that this period coincides with wildfire events in the province that affected this area.

Polar concentration plots depicting hourly concentrations averaged by wind speed and direction at each station are provided in Figure 3. The distance from the center of each coloured bar forming each wedge indicates the wind speed. The polar concentration plots exclude LC_02, which does not have meteorological monitoring.

Highest values (around 100 µg/m³, indicated as orange to red) were at EV_SCS during moderate winds from the southeast and north, suggesting the impact from Teck EVO at those general directions. Moderately elevated averages were also at EV_WWTP during winds from the southwest and southeast, where emissions from the road and Teck EVO are likely to be the causes.

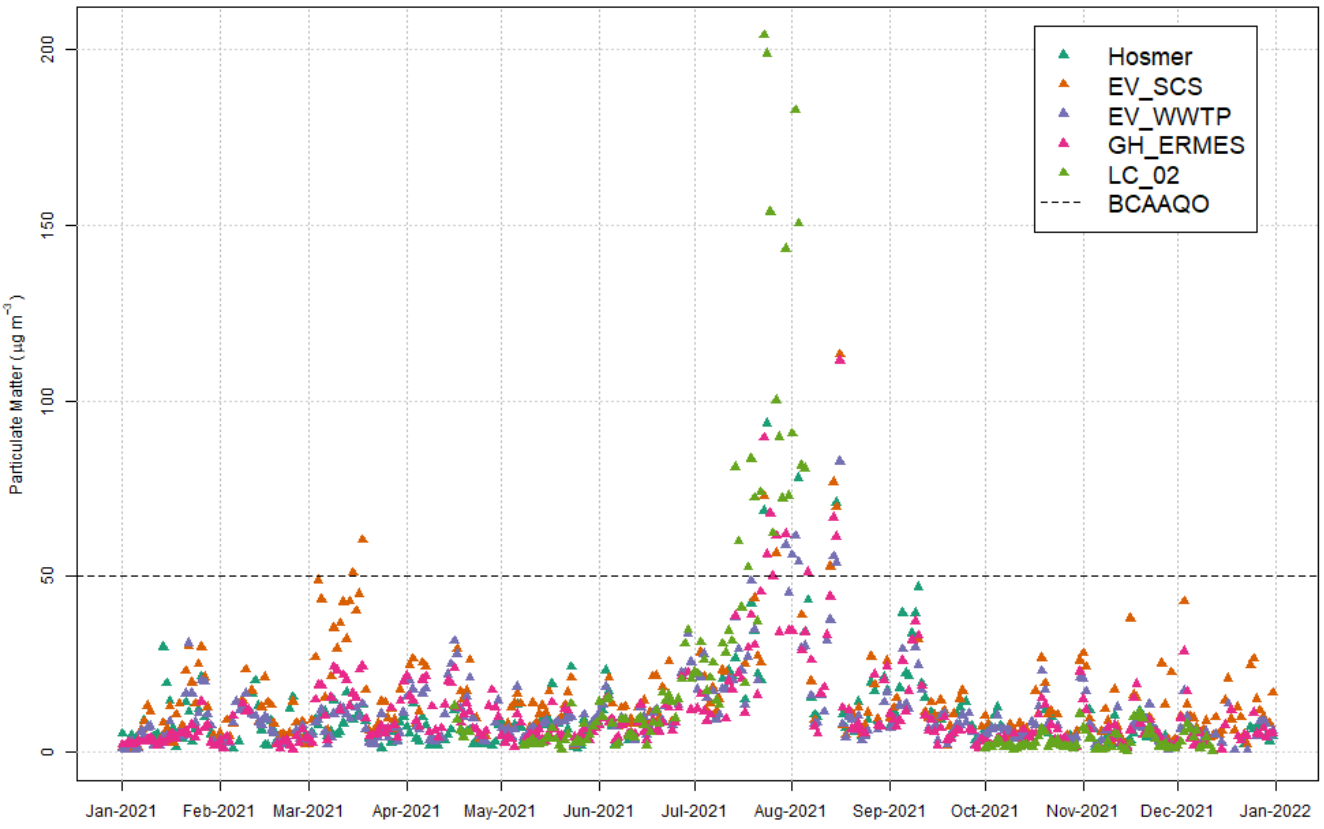


Figure 2: Daily averaged PM_{10} concentrations.

Note: Dashed line indicates BCAAQO of 50 µg/m^3.

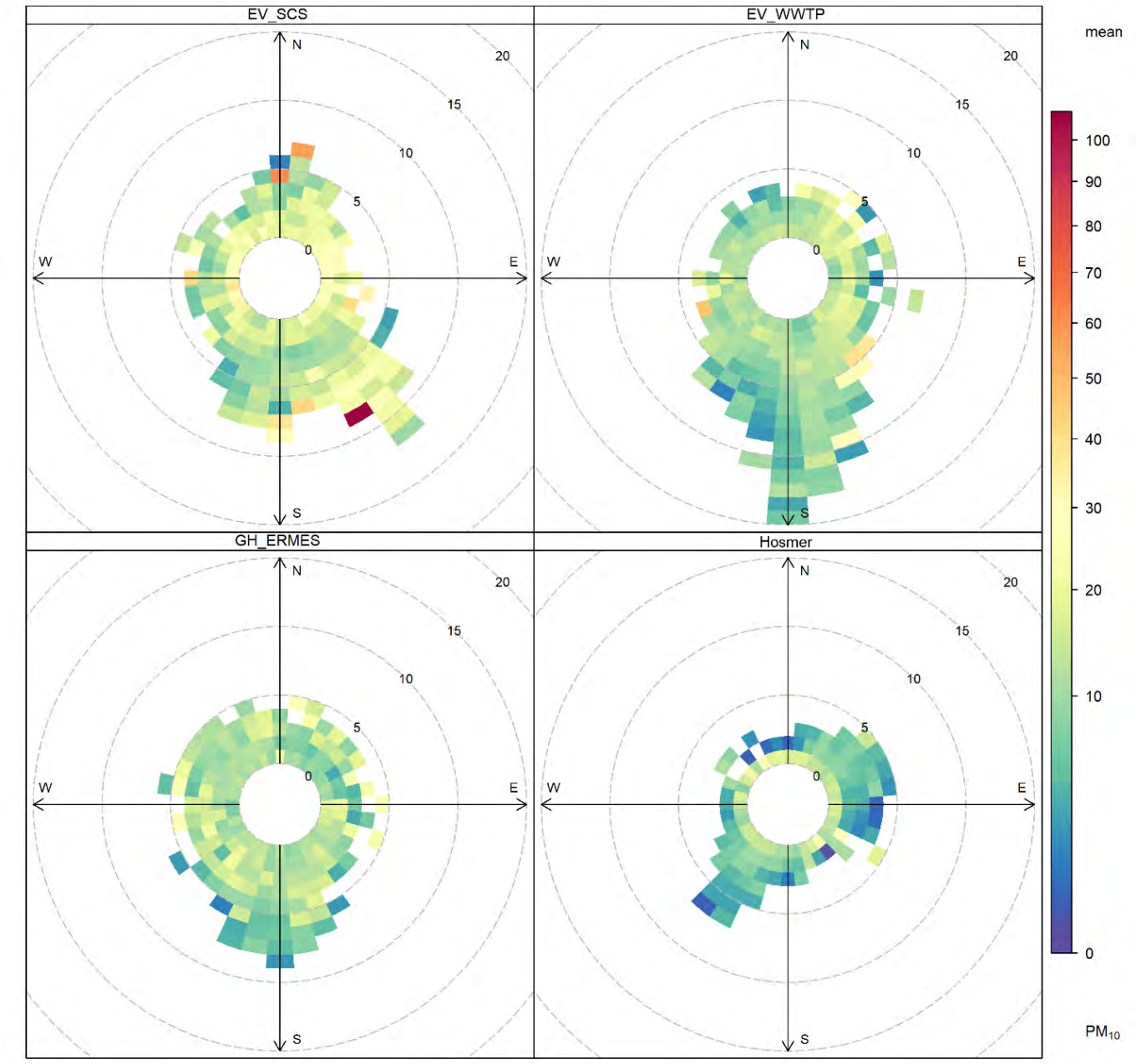


Figure 3: Polar concentration plots of PM_{10} concentrations (µg/m³) in 2021.

3.4 $PM_{2.5}$

Figure 4 shows the time series of the 24-hour average $PM_{2.5}$ concentrations at the five stations. Excursions in all stations took place in the same period in late July and early August when wildfire related PM_{10} exceedances also occurred. High concentrations during this period cause the annual average $PM_{2.5}$ concentrations at EV_SCS and LC_02 to exceed the BCAAQO.

From the polar concentration plots in Figure 5 the highest average concentrations occurred at EV_SCS during winds of about 4 m/s with a northerly or westerly component.

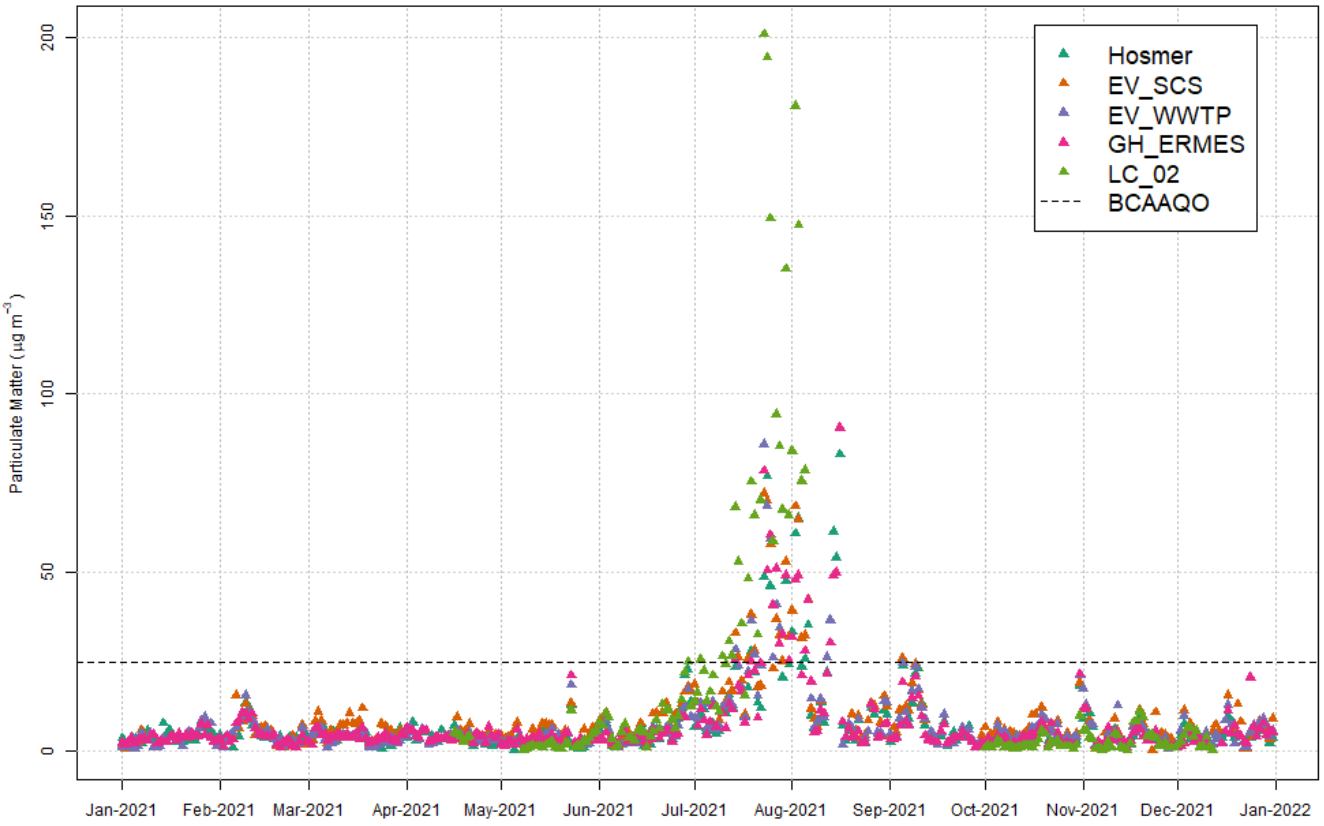


Figure 4: Daily averaged $PM_{2.5}$ concentrations.

Note: Dashed line indicates BCAAQO of 25 µg/m^3.

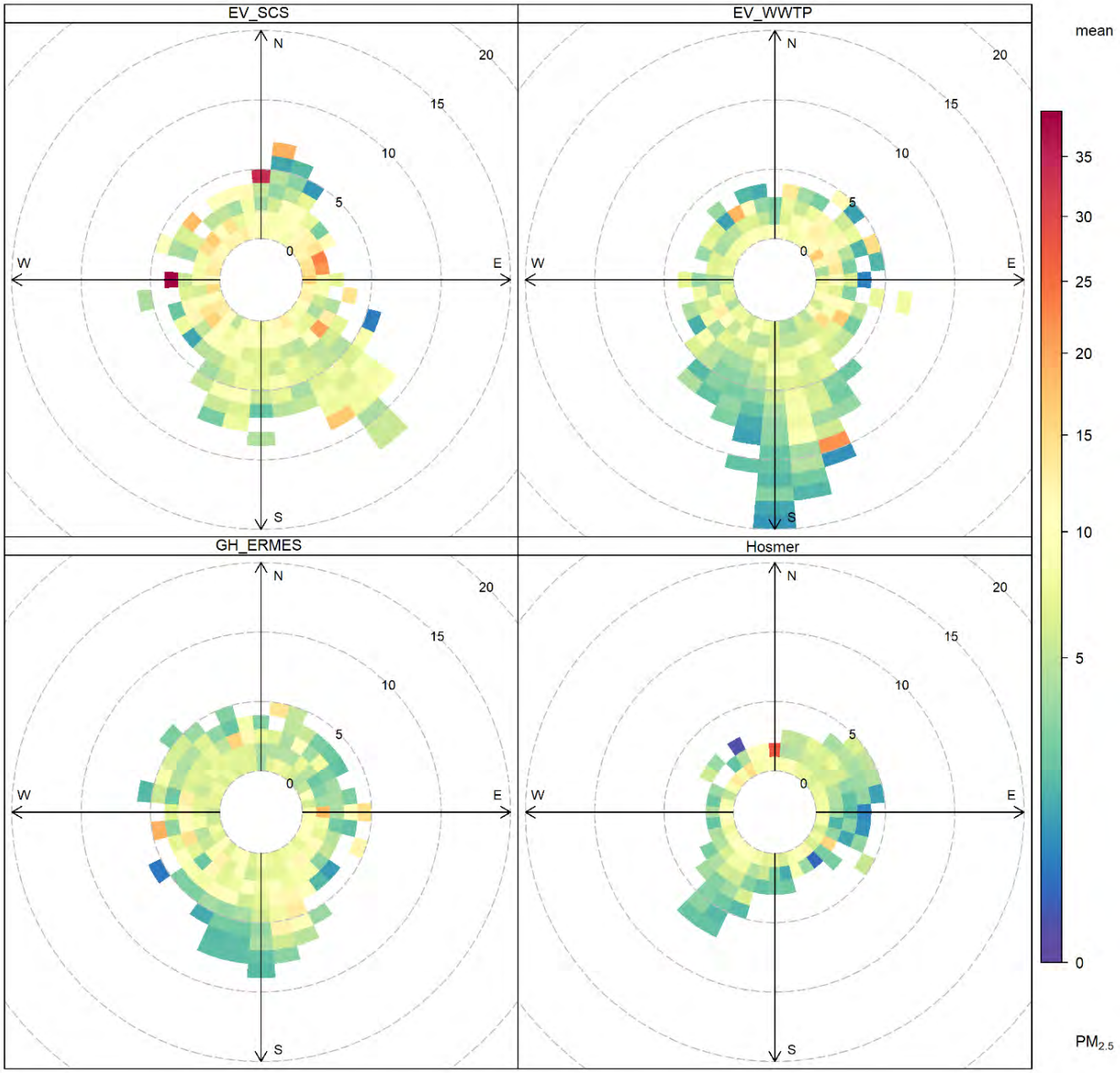


Figure 5: Polar concentration plots of $PM_{2.5}$ concentrations ($\mu g/m^3$) in 2021.

3.5 Nitrogen Dioxide (NO_2)

Figure 6 shows the time series of the daily 1-hour maximum concentration of NO_2 at the EV_SCS station in 2021. All the values are well below the BCAAQO.

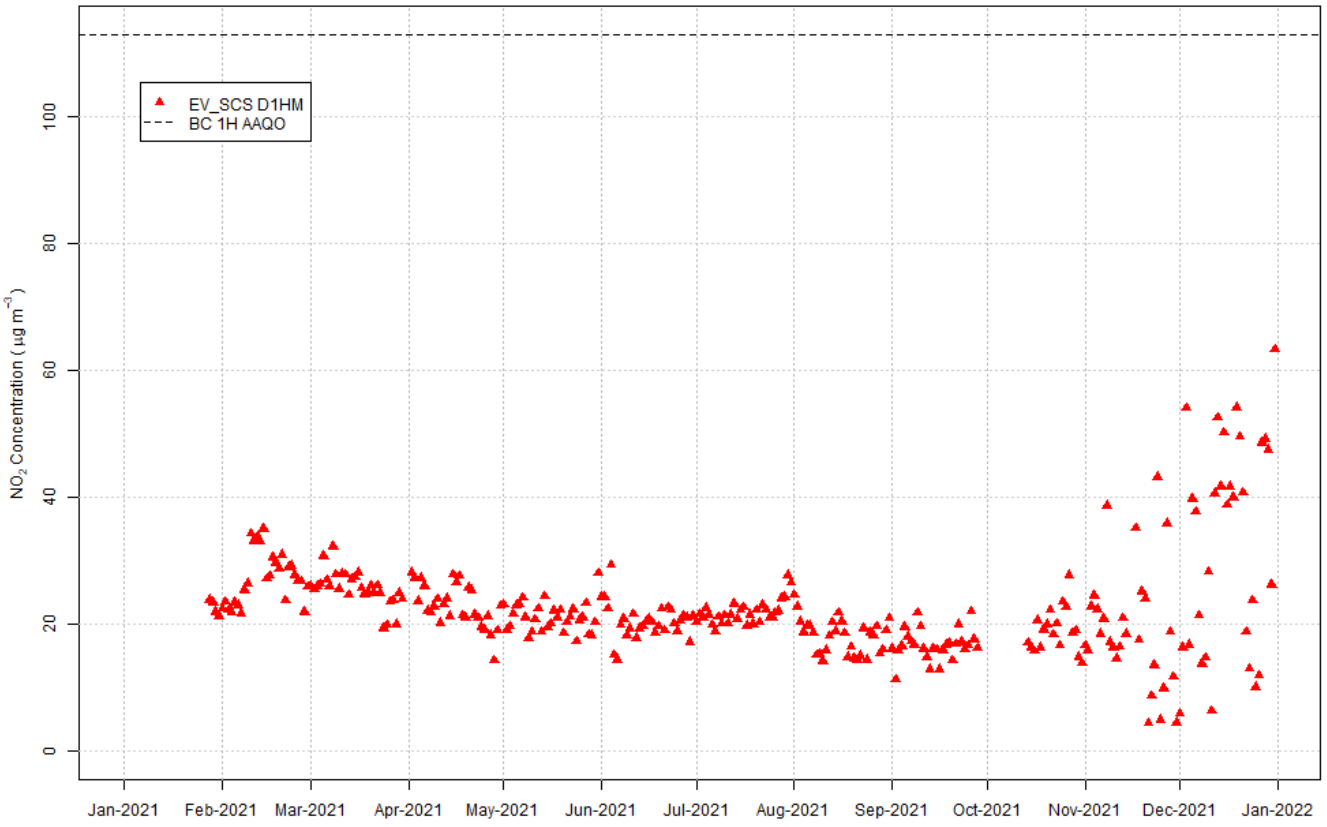


Figure 6: Daily 1-hour maximum NO_2 concentrations from EV_SCS.

Note: Dashed line indicates BCAAQO of 113 µg/m^3.

3.6 Ozone (O_3)

One-hour and 8-hour rolling average concentrations of O_3 are presented in Figure 7 and Figure 8 respectively. There were no readings above the BCAAQO at both averaging periods for this substance.

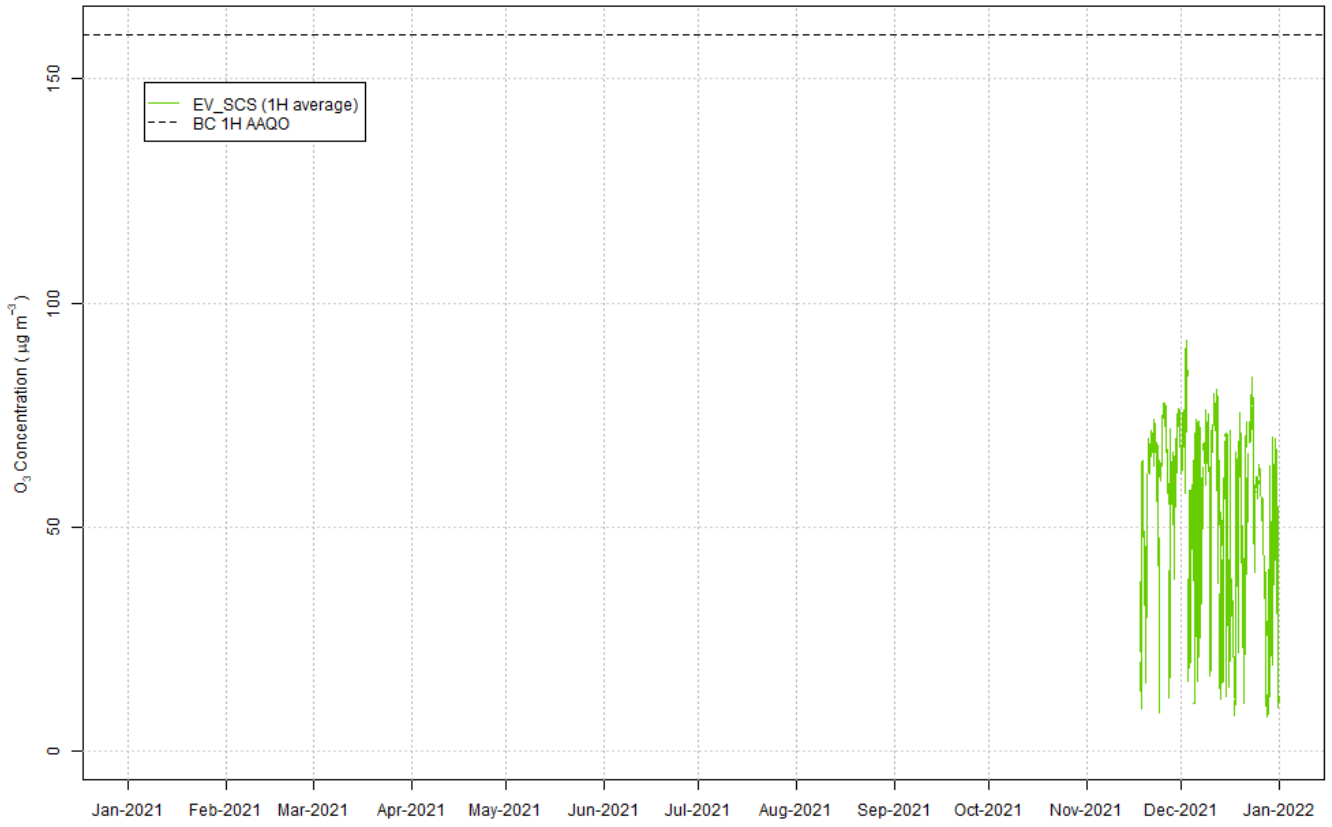


Figure 7: One-hour averages of O_3 at EV_SCS.

Note: Dashed line indicates 1-hour BCAAQO of 160 µg/m^3.

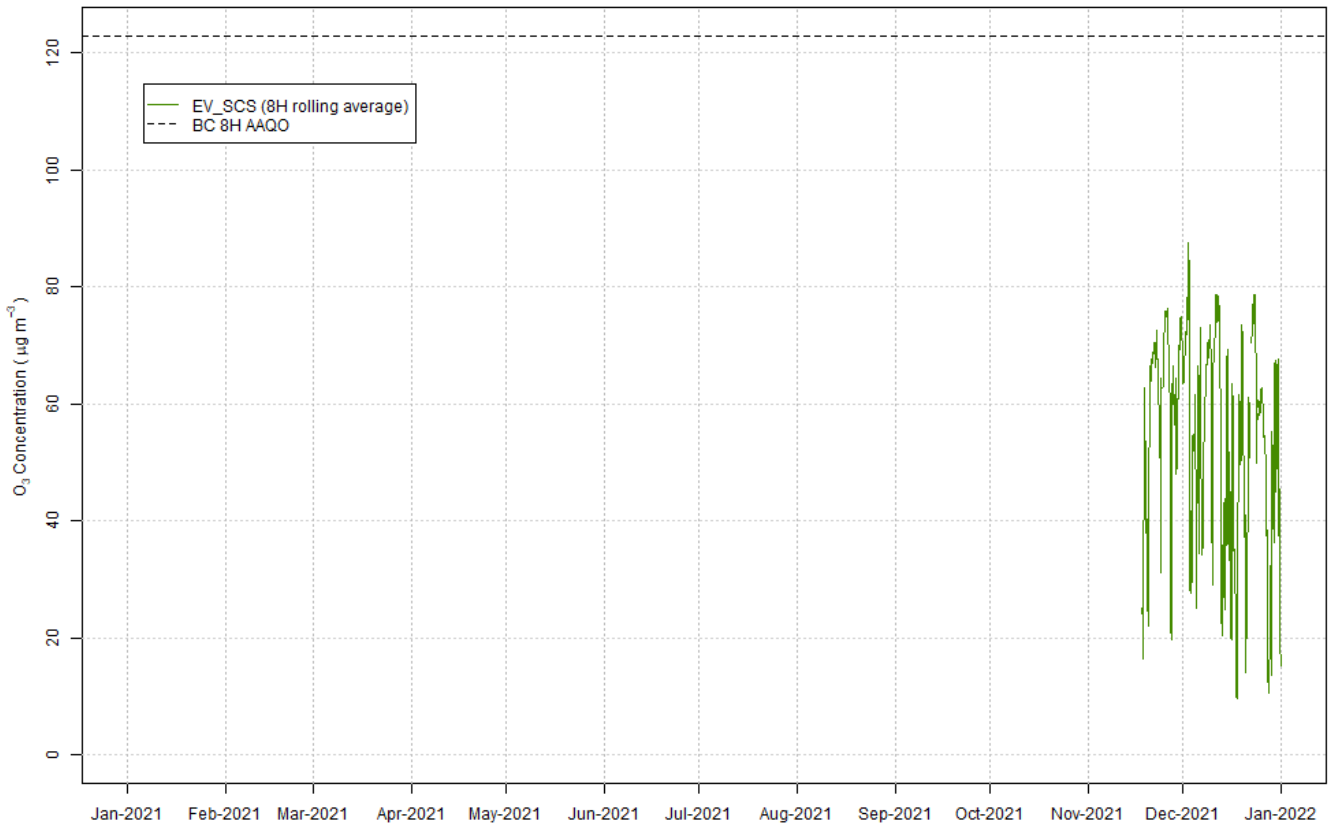


Figure 8: Rolling 8-hour averages of O_3 at EV_SCS.

Note: Dashed line indicates 8-hour BCAAQO of 123 µg/m^3.

3.7 Inter-annual Variability

An examination of inter-annual variability in annual average concentrations of PM_{10} and $PM_{2.5}$ at all stations is presented below.

Figure 9 shows the plot of annual average PM_{10} concentrations at the five stations. GH_ERMES, which has the longest record, exhibits a clear rising trend. The LC_02 station also shows a yearly increase, but its data covers only three years. Data at other stations suggest a positive trend but the variability among the years is too large to establish a trend.

For $PM_{2.5}$ in Figure 10, annual trends are not well-defined except at LC_02 whose 3-year record indicates a sharp rise.

Data from LC_02 tends to be different from the other stations as it is close to a Teck facility and has had poor data completeness since inception. Its data is also more complete in summer, which biases the annual averages to periods often affected by wildfires. Data from the station is collected using a continuous non-reference instrument and is mainly supplemental.

Figure 9: Time series of annual averages PM_{10} concentrations.

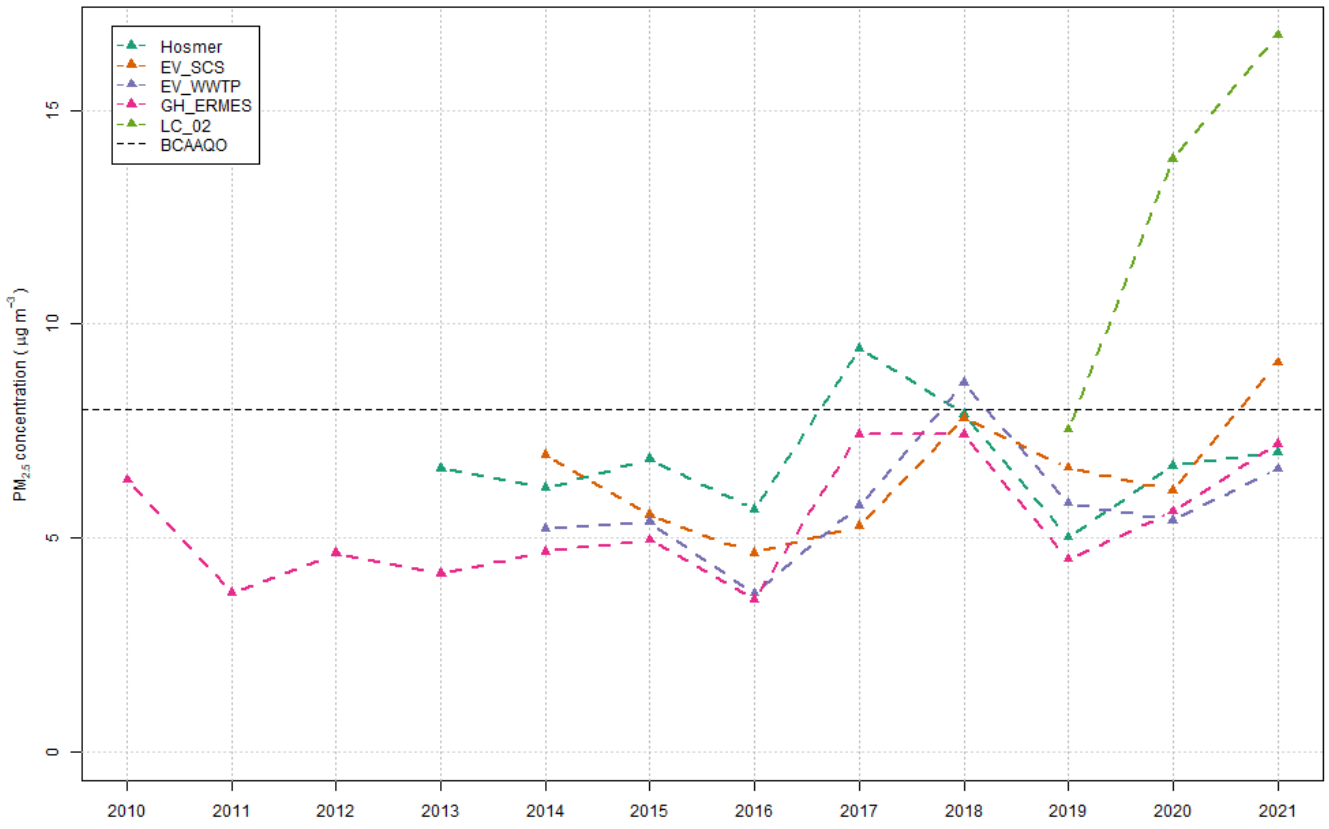


Figure 10: Time series of annual average $PM_{2.5}$ concentrations.

Note: Dashed line indicates the annual BCAAQO of 8 µg/m^3.

3.8 Data Completeness

The permits for each of the Sites state that a daily average concentration is valid only if it is based on at least 18 valid 1-hour readings during that day. Over a longer term, completeness is the percentage of valid daily data readings for a period divided by the total number of days in the same period. Permit conditions state that within each quarter, the daily data should be 60% complete. Within each year, the data must be 75% complete. Quarterly and annual completeness requirements apply to $PM_{2.5}$ and PM_{10}.

Tables A-1 through A-10 in Appendix A provide the number of valid days of data per time period for PM_{10}, $PM_{2.5}$ and for the gases. There are no completeness requirements for gases, and there are no monthly nor hourly completeness requirements for any substance. However, they are also presented in the Appendix for reference and to inform discussion of annual and seasonal averages.

3.8.1 PM_{10}

As seen in Table A-1, the completeness requirements of 75% for annual and 60% for quarterly PM_{10} data were met at GH_ERMES and EV_WWTP. EV_SCS met the annual target but was short of the quarterly completeness objective in the third quarter by less than 5%. Other than routine maintenance, the most common reason for gaps in the data is low flow to the sampler, possibly caused by power supply issues and sample pump failures.

LC_02 and Hosmer are not required to meet these objectives because they not part of any mine site's permit.

3.8.2 $PM_{2.5}$

Data completeness for $PM_{2.5}$ is presented in Table A-2 in Appendix A. All key stations satisfy their completeness objectives in all periods. The station with the most gaps in quarterly and monthly data is again EV_SCS for the same reasons as those stated for PM_{10}.

3.8.3 Gases

Data completeness for NO_2 and O_3 is found in Table A-3 in Appendix A. Only the EV_SCS station monitors these parameters. There are also no minimum completeness requirements for these gases but are discussed for reference.

Annual completeness for NO_2 reached 87%. Lower data capture rates were achieved in January due to the sampler being removed for annual maintenance and in October when the pump failed, requiring offsite repair.

Ozone data collection at EV_SCS only started on November 18, 2021. December, which was the only full month in 2021 during which the O_3 analyser was installed, saw an uptime of 96%.

4 METEOROLOGY RESULTS

4.1 Wind Speed and Direction

Figure 11 shows annual wind roses for the four stations in the RAQMP that collect meteorological data. Due to issues with the anemometer siting at the EV_SCS station, wind speed and direction data for this station are provided from Elkview's Sparwood Heights station as described in Appendix E. Winds are predominantly from the south except at Hosmer, where southwesterly winds are common. Northwesterly winds are also pronounced at GH_ERMES. These flow patterns follow the channeling by the topography.

Of the four stations, winds are weakest at Hosmer, whose annual mean wind speed is only 1.1 m/s and calms occur more than 20% of the time. Winds are strongest at EV_WWTP where winds average 3 m/s.

None of the four stations show strong monthly or seasonal variation in wind patterns. However, all four exhibit an increase in wind speeds in the afternoon, as seen in Figure 12.

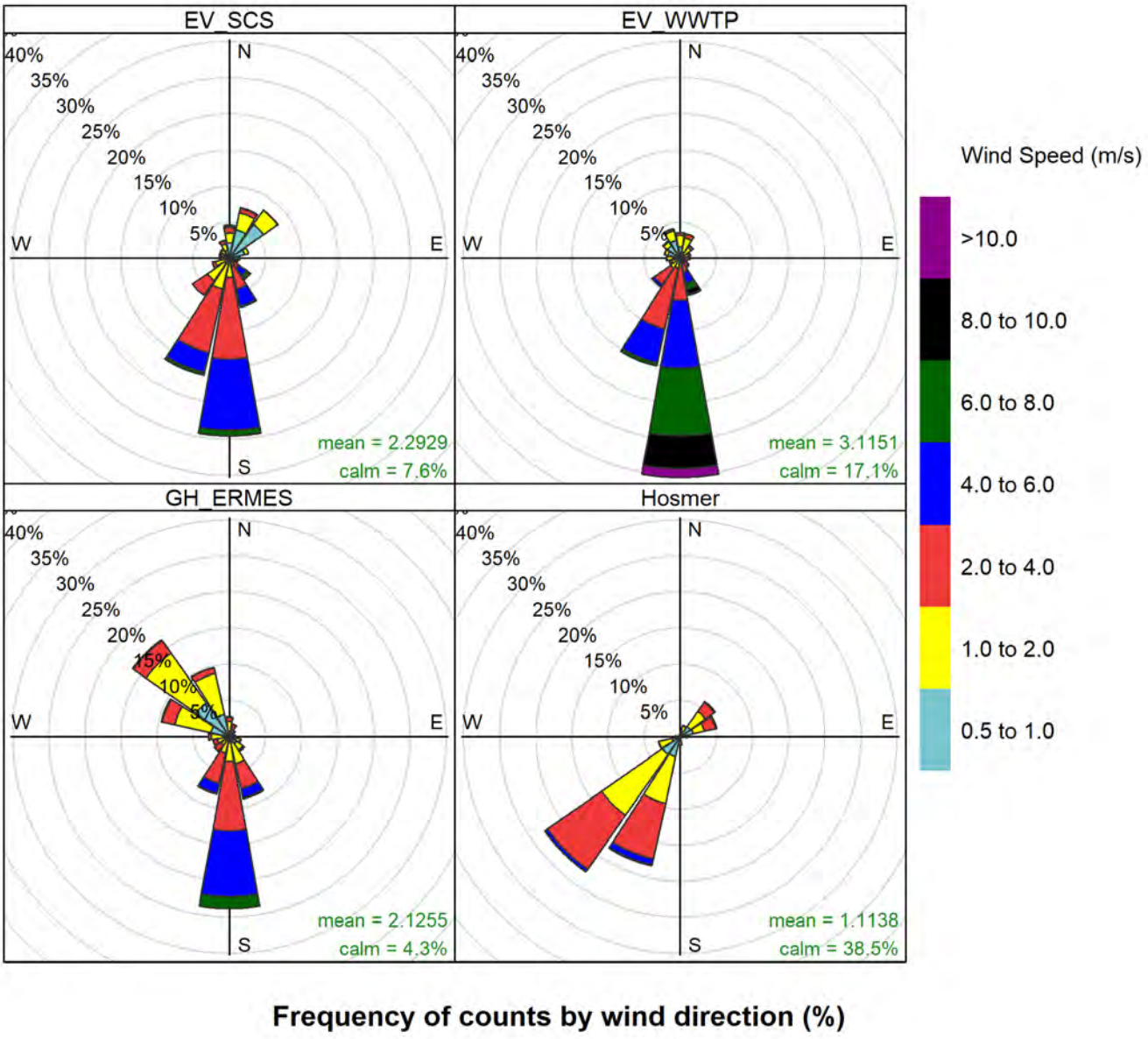


Figure 11: Wind roses at the stations in the RAQMP for 2021.

Note: EV_SCS data is from Sparwood Heights station. See Appendix E.

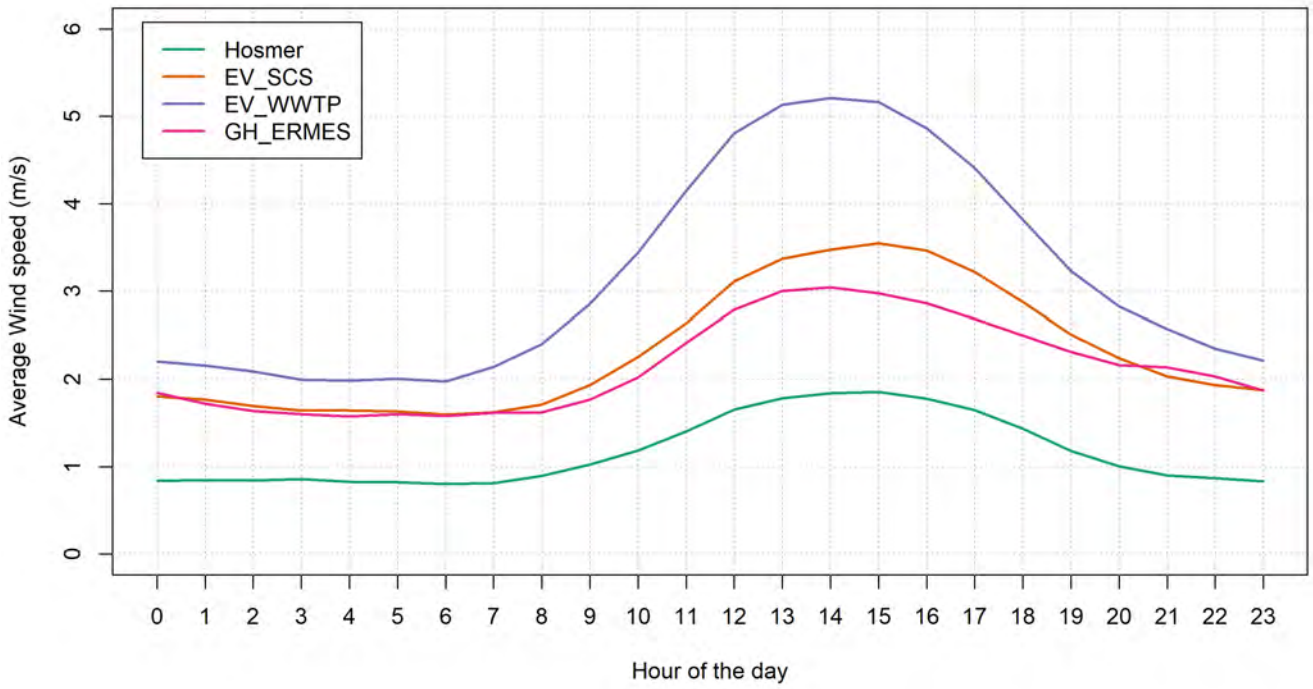


Figure 12: Mean hourly wind speed at the stations in the RAQMP for 2021.

4.2 Precipitation

Total monthly precipitation in 2021 within the RAQMP as represented by the GH_ERMES station are shown in Figure 13. 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) are also shown.

Precipitation totals are within one standard deviation of the 30-year mean except in August when more than twice as much rain as the mean was received.

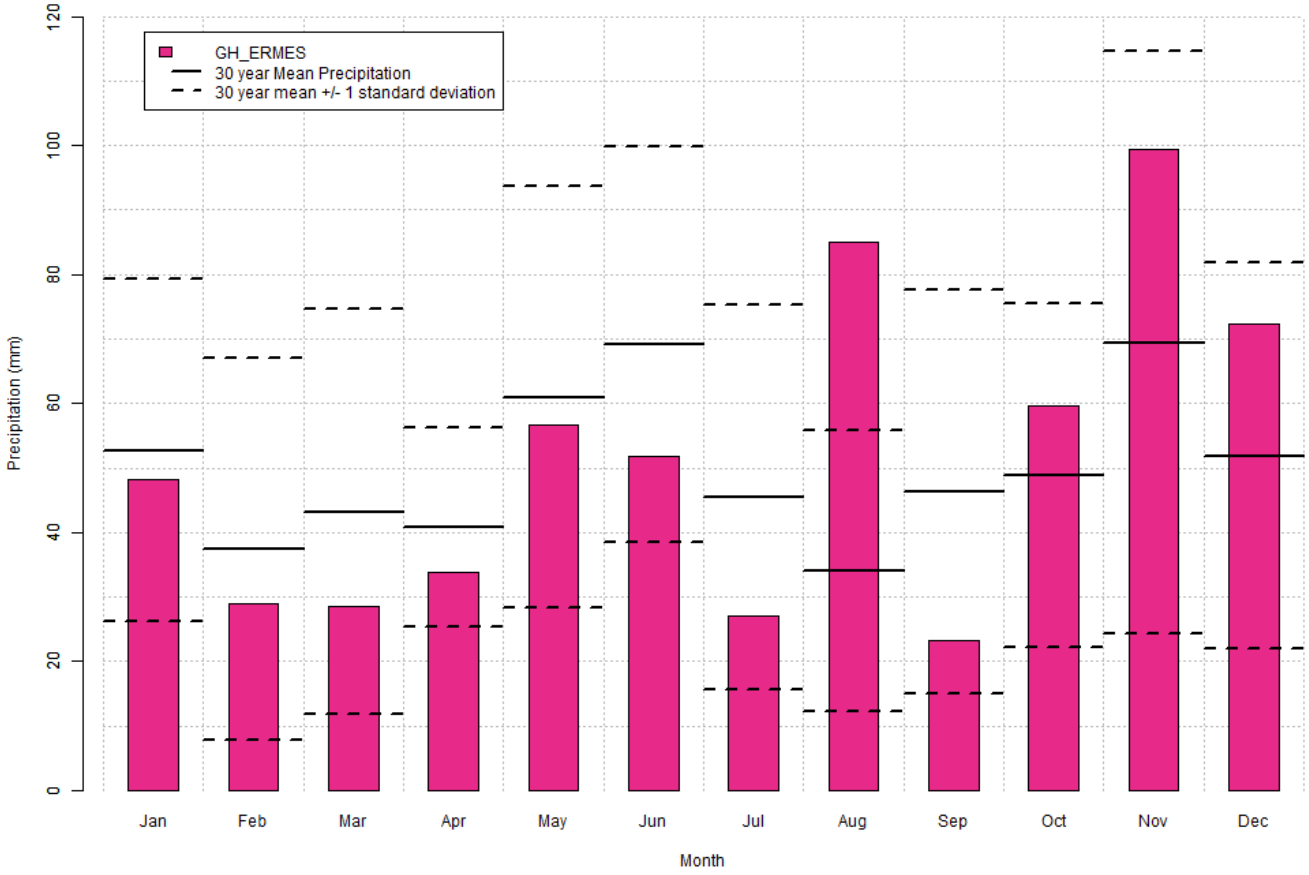


Figure 13: Monthly precipitation totals for stations in the RAQMP for 2021 compared to the 30-year mean +/- 1 standard deviation at the Environment Canada Weather Station in Sparwood.

4.3 Air Temperature

Daily averaged air temperatures are presented in Figure 14 where they are compared to the 30-year mean and standard deviation at Sparwood. Inter-station variation is small compared to daily fluctuations, with expected differences due to elevation. Strong negative anomalies were observed in February and December, while June, July, and November saw temperatures consistently above the mean.

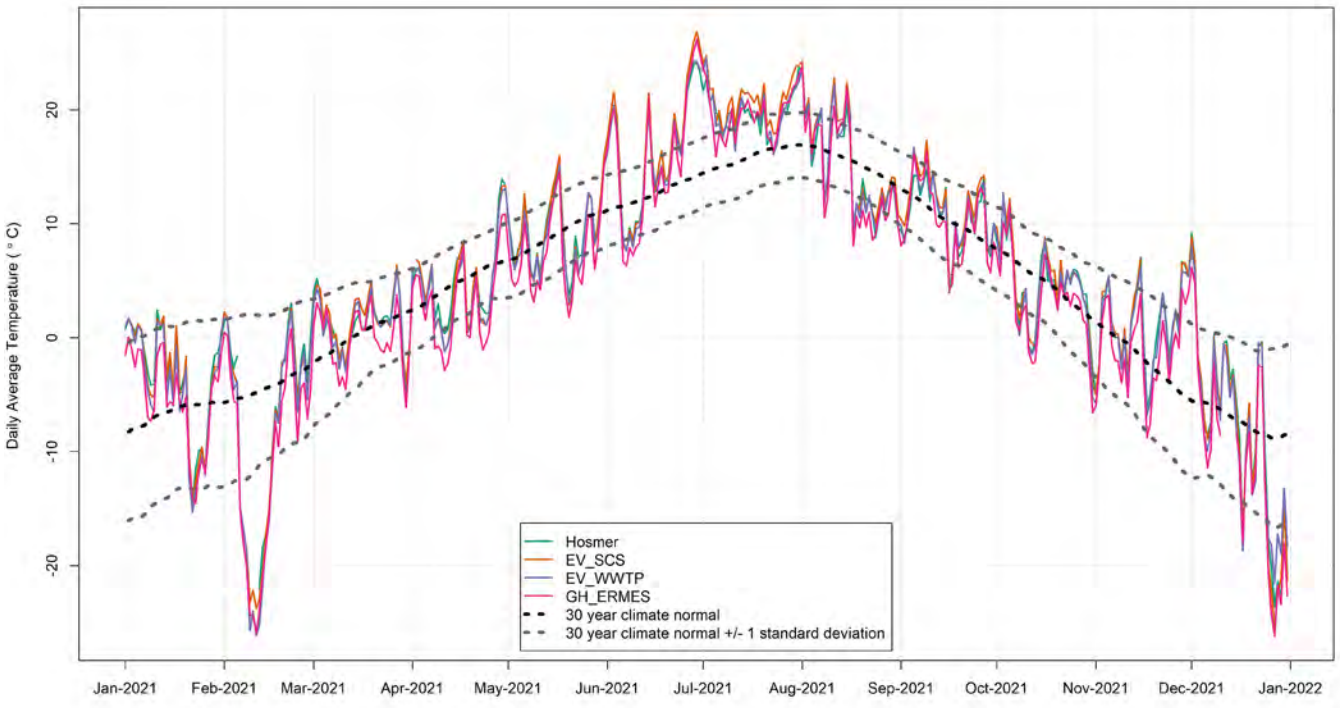


Figure 14: Daily averaged temperature for RAQMP Stations compared to the 30-year mean +/- 1 standard deviation at the Environment Canada Station in Sparwood.

5 MANAGEMENT OF AIR QUALITY

5.1 Excursions and Exceedances

As required in the monitoring plan, excursions and exceedances resulting from fugitive dust events and other causes are discussed in this section. To provide insights into these events, hourly concentrations are plotted together with hourly wind vectors where data are available. These plots are presented in Appendix B for PM_{10} and Appendix C for $PM_{2.5}$.

5.1.1 PM_{10} Events

A list of PM_{10} exceedances and the daily average concentrations is provided in Table B-1 and plots of hourly PM_{10} concentrations during the listed exceedances are provided in Figure B-1 to B-24 in Appendix B.

The earliest PM_{10} exceedances of the BCAAQO of 50 µg/m^3 occurred on March 15 and 18, 2021 at the EV_SCS station. The exceedances were mild (the highest at 60 µg/m^3), although the concentrations on days prior to exceedances were also elevated. No increases were seen with $PM_{2.5}$ or PM_{10} at the other RAQMP stations on those days. As the events are specific to this station, particulates such as salt and gravel used on the town's roadways are the suspected cause. Windblown fugitive coal dust is also a possibility because the exceedances took place early in spring before Teck's active dust control measures were in regular operation.

Several exceedances were recorded in July and August, starting in July 14 at LC_02. This was then followed by significant PM_{10} concentrations at all stations that persisted well into the middle of August. This period coincides with frequent smoke advisories for the Elk Valley region triggered by extensive wildfires in BC in 2021, which was reported to be the third worst year since record keeping began in 1950.

5.1.2 $PM_{2.5}$ Events

A list of $PM_{2.5}$ excursions and the daily average concentrations is provided in Table C-1 and plots of hourly $PM_{2.5}$ concentrations are provided in Figure C-1 to C-38 in Appendix C.

As with PM_{10}, nearly all excursions of $PM_{2.5}$ above the BCAAQO occurred in the summer of 2021 from the middle of July to the middle of August. Excursions were highest and most frequent at LC_02 and EV_SCS stations.

The only other excursion outside the peak of the wildfire season (on September 5 at EV_SCS) can be considered minor (just 1 µg/m^3 above the BCAAQO of 25 µg/m^3) and limited to this station. As seen in Figure C-14, the hours that contributed to the exceedance coincides with a period with slightly above normal southerly winds, suggesting that windblown dust was a possible cause.

5.2 Public Air Quality Feedback

Teck records and investigates all feedback it receives from the public regarding air quality. Community feedback is received through a Teck Feedback Mechanism, a process which applies to the activities of Teck's coal operations and all personnel, including both employees and contractors. The process allows each of Teck's coal operations to receive feedback from communities about matters related to the operations that are of interest to them (including fugitive dust), and to effectively organize a response to that feedback. Teck's operations in the Elk Valley continue to recognize dust as a primary concern to nearby communities and takes all feedback seriously. The following is a summary of air-quality related feedback from the community in 2021.

***March**:* A voicemail from one person complaining of extensive coal dust in the valley was registered on March 14. There were no other complaints on this date, and a follow-up by Teck with the submitter to obtain details was unsuccessful. This complaint coincided with a PM_{10} exceedance at EV_SCS discussed earlier.

On March 20, an email was received from a Sparwood business owner notifying Teck of dust deposits on their property and inquiring about the resumption of dustfall monitoring at their location. Teck responded by presenting some key features of its new real-time monitoring program and invited the owner to participate in its community initiatives.

***May**:* Two complaints were filed regarding coal dust at Grave Lake. For the first incident on May 5, LCO prepared an incident report containing the results of an inspection of the location at the beach, and a review of operating conditions at LCO. The report stated that it could not conclude if the alleged coal dust in the area of Grave Lake main beach came from LCO. The second complaint on May 15 included pictures of a film on the surface of Grave Lake and algae with black material attached. LCO later submitted an Incident Report and End-of-Spill report for fugitive dust on its findings.

On May 30, a message was received from a Sparwood resident notifying Teck of black dust deposits on their backyard and at a friend's home on a different street. Teck met with the resident, and no further responses were required.

***October**:* Reports of coal dust on Grave Lake were again reported on October 11. Teck's incident report and End-of-Spill report confirmed the complaints.

Two non-specific complaints related to a haze in the valley presumed to be coal dust were registered. One complaint was sent through voicemail, the other through a social media post. Dry conditions with moderate winds followed by calm, stable conditions likely produced dust from operations that lingered in the area.

Other: Although no complaints were registered, an End-of-Spill report was filed by EVO for an incident on July 11 when a gusty period lasting 15 minutes generated windblown dust from clean coal stockpiles. A sprinkler system was installed at the clean coal stockpiles as an additional dust suppressant as a protective measure.

Following an increased number of complaints of dust on properties in Sparwood and its vicinity beginning in 2018, an exterior house cleaning program was launched in 2020 to mitigate some of the impacts of dust. In 2021, the program was expanded to homes in Elkford in response to increasing number of complaints in other communities. Since the program started, more than 350 homes have been cleaned, including 14 cabins at Grave Lake in 2021. Community response to Teck's house cleaning program has been wholly positive.

5.3 Fugitive Dust Management Plans

Updated Fugitive Dust Management Plans (FDMPs) were submitted to BC ENV in August 2021. The FDMPs follow the Guidance on "Developing a Fugitive Dust Management Plan for Industrial Projects (BC EMPR and BC ENV, 2018)". These updated plans address questions from BC ENV and include Trigger Action Response Plans (TARPS) for fugitive dust sources, details of the Community Feedback process at Teck, and the effect of fugitive dust on Human Health. In 2022, Teck looks forward to finalizing the FDMPs for all Teck facilities in the Elk Valley.

6 RECOMMENDATIONS

The RAQMP very recently completed its prescribed 5-year review. Because the monitoring program is achieving its objectives, no changes to the monitoring locations, equipment or schedules are recommended at this time. The review period has been revised to 3 years for the next review.

7 REFERENCES

BC Ministry of Environment and Climate Change Strategy. 2021. British Columbia Ambient Air Quality Objectives.

British Columbia Ministries of Energy, Mines and Petroleum Resources and British Columbia Ministry of Environment and Climate Change Strategy. 2018. Developing a Fugitive Dust Management Plan for Industrial Projects. Accessed 2022-03-23.

Campbell Scientific. 2019. CS106 Barometric Pressure Sensor Product Manual. https://s.campbellsci.com/documents/us/manuals/cs106.pdf. Accessed 2022-03-23.

RWDI. 2022. Memorandum: Air Quality DustTrak Monitoring Site Selection; Teck Line Creek Operations. RWDI Reference #2202085. Written 2022-03-04.

Teck Coal. 2021. Regional Air Quality Monitoring Program.

APPENDIX A

Table A-1: Number of valid PM_{10} data.

Period	Period (Month / Quarter / Year)	Hosmer[3] (Days / Hours)	EV_SCS (Days / Hours)	EV_WWTP (Days / Hours)	GH_ERMES (Days / Hours)	LC_02[3] (Days / Hours)
		Collected	Collected	Collected	Collected	Collected
# Valid Monitoring Days per month	January	31	30	31	31	0
	February	22	24	27	18	0
	March	30	30	30	31	0
	April	28	16	28	30	6
	May	31	21	28	30	24
	June	11	19	30	29	30
	July	15	15	22	25	31
	August	22	20	28	26	5
	September	27	17	29	28	0
	October	17	23	31	27	31
	November	25	27	30	29	30
	December	10	31	21	24	12
# Valid Monitoring Days per Quarter[1]	Q1	83	84	88	80	0
	Q2	70	56	86	89	60
	Q3	64	52	79	79	36
	Q4	52	81	82	80	73
# Valid Monitoring Days for entire year[2]	2021	269	273	335	328	169
# Valid Monitoring Hours per Quarter	Q1	2004	2024	2114	1903	0
	Q2	1657	1561	2090	2091	1479
	Q3	1747	1613	1959	1889	881
	Q4	1302	1941	2048	1984	1767
# Valid Monitoring Hours for entire year	2021	6710	7139	8211	7867	4127

Note: [1]: Highlighted cells indicate quarters with completeness below 60%
[2]: Highlighted cells indicate stations with annual completeness below 75%
[3]: Hosmer and LC_02 are not subject to any operation's permit and do not have a minimum completeness requirement.

Table A-2: Number of valid $PM_{2.5}$ data.

Period	Period (Month / Quarter / Year)	Hosmer[3] (Days / Hours)	EV_SCS (Days / Hours)	EV_WWTP (Days / Hours)	GH_ERMES (Days / Hours)	LC_02[3] (Days / Hours)
# Valid Monitoring Days per month	January	30	7	31	31	0
	February	25	24	28	28	0
	March	26	30	31	31	0
	April	29	14	30	30	6
	May	29	31	31	31	24
	June	30	30	30	28	30
	July	28	25	28	29	31
	August	30	23	21	30	5
	September	30	14	30	29	0
	October	30	31	31	28	31
	November	30	28	30	30	30
	December	29	27	29	27	12
# Valid Monitoring Days per Quarter[1]	2021 Q1	81	61	90	90	0
	2021 Q2	88	75	91	89	60
	2021 Q3	88	62	79	88	36
	2021 Q4	89	86	90	85	73
# Valid Monitoring Days for entire year[2]	2021	346	284	350	352	169
# Valid Monitoring Hours per Quarter	2021 Q1	1982	1475	2140	2138	0
	2021 Q2	2073	1775	2170	2147	1479
	2021 Q3	2056	1531	1920	2115	881
	2021 Q4	2144	2063	2120	2086	1765
# Valid Monitoring Hours for entire year	2021	8255	6844	8350	8486	4125

Note: [1]: Highlighted cells indicate quarters with completeness below 60%
[2]: Highlighted cells indicate stations with annual completeness below 75%
[3]: Hosmer and LC_02 are not subject to any operation's permit and do not have a minimum completeness requirement.

Table A-3: Number of valid gas data.

Period	Period (Month / Quarter / Year)	EV_SCS	
		NO_2 (days / hours)	O_3 (days / hours)
# Valid Monitoring Hours per month	January	102	N/A
	February	668	
	March	725	
	April	704	
	May	741	
	June	716	
	July	742	
	August	739	
	September	678	
	October	429	
	November	688	283
	December	718	700
# Valid Monitoring Hours per Quarter	2021 Q1	1495	N/A
	2021 Q2	2161	
	2021 Q3	2159	
	2021 Q4	1835	983
# Valid Monitoring Hours for entire year	2021	7650	983

Notes: N/A = Not applicable as ozone monitoring started only on November 18, 2021.
NO_2 and O_3 monitoring are not included under EVO's permit and are not subject to data completeness requirements.

Table A-4: PM_{10} averaged by period.

	Period	Hosmer ($\mu g/m^3$)	EV_SCS ($\mu g/m^3$)	EV_WWTP ($\mu g/m^3$)	GH_ERMES ($\mu g/m^3$)	LC_02 ($\mu g/m^3$)
Annual Hourly Mean	2021	11.0	16.5	10.7	11.4	19.1
Annual Hourly Standard Deviation	2021	16.1	20.0	12.6	16.8	39.1
Annual Daily Mean	2021	9.9	14.7	10.7	11.2	19.3
Annual Daily Standard Deviation	2021	11.4	13.8	10.7	13.4	36.4
Daily average by day of week	Monday	7.7	14.1	11.0	11.1	20.6
	Tuesday	11.4	15.8	10.9	10.7	21.2
	Wednesday	8.8	14.0	10.1	10.9	17.4
	Thursday	9.9	14.1	10.1	11.0	17.6
	Friday	11.2	18.0	11.6	13.4	21.7
	Saturday	10.4	14.3	10.5	10.8	18.0
	Sunday	9.5	12.1	10.3	10.2	18.3
Daily average by season	Spring (MAM)	6.6	18.0	8.9	10.1	4.8
	Summer (JJA)	20.4	22.4	19.6	22.0	43.6
	Autumn (SON)	9.4	10.9	7.8	7.3	3.1
	Winter (DJF)	7.1	10.2	6.8	5.1	3.7

Table A-5: $PM_{2.5}$ averaged by period.

	Period	Hosmer (µg/m³)	EV_SCS (µg/m³)	EV_WWTP (µg/m³)	GH_ERMES (µg/m³)	LC_02 (µg/m³)
Annual Hourly Mean	2021	7.0	9.1	6.6	7.2	16.8
Annual Hourly Standard Deviation	2021	11.3	12.1	9.9	12.8	37.8
Annual Daily Mean	2021	7.1	9.2	6.5	7.2	17.0
Annual Daily Standard Deviation	2021	10.3	10.8	8.5	10.8	35.3
Daily average by day of week	Monday	8.1	9.1	5.9	8.1	18.3
	Tuesday	7.1	9.3	6.4	7.0	18.6
	Wednesday	5.6	9.1	6.2	5.7	14.9
	Thursday	5.9	8.7	6.2	6.5	15.4
	Friday	7.5	10.3	7.7	8.5	19.5
	Saturday	8.0	8.4	6.4	7.0	15.8
	Sunday	7.7	9.3	6.8	7.8	16.3
Daily average by season	Spring (MAM)	3.7	5.3	3.7	3.9	2.6
	Summer (JJA)	15.1	18.1	13.1	16.2	39.2
	Autumn (SON)	5.2	6.9	5.6	4.7	2.7
	Winter (DJF)	4.4	5.2	4.5	4.3	3.3

Table A-6: Gas concentrations averaged by period.

	Period	EV_SCS	
		NO_2 ($\mu g/m^3$)	O_3[2] ($\mu g/m^3$)
Annual Hourly Mean	2021	16.2	53.5
Annual Hourly Standard Deviation	2021	6.1	20.0
Annual Daily[1] Mean	2021	22.4	67.2
Annual Daily[1] Standard Deviation	2021	7.9	9.9
Daily average[1] by day of week	Monday	23.7	65.9
	Tuesday	22.4	59.6
	Wednesday	23.0	67.8
	Thursday	21.0	72.8
	Friday	24.1	67.7
	Saturday	21.1	66.2
	Sunday	21.7	69.3
Daily average[1] by season	Spring (MAM)	23.1	-
	Summer (JJA)	20.1	-
	Autumn (SON)	18.3	68.7
	Winter (DJF)	29.7	66.5

Notes:

- Indicates that no data was collected during the period

[1] Refers to daily 1-hour maximum concentration for NO_2 and daily 8-hour maximum for O_3.

[2] O_3 results cover only the period from November 18 to December 31, 2021 and are for indicative purposes only as they are biased toward winter conditions.

Table A-7: Percentiles of PM_{10}.

Averaging period	Percentile	Hosmer (µg/m³)	EV_SCS (µg/m³)	EV_WWTP (µg/m³)	GH_ERMES (µg/m³)	LC_02 (µg/m³)
Hourly	0	0.0	0.0	0.0	0.0	0.0
	10	0.9	1.8	1.5	1.5	0.8
	25	2.3	4.8	3.3	2.8	1.6
	50	5.8	10.9	6.8	5.7	4.8
	75	12.3	20.2	13.3	13.1	15.3
	90	25.9	36.6	23.4	26.7	49.6
	95	40.6	52.9	33.4	39.5	97.1
	98	66.1	80.3	51.4	68.0	185.2
	100	181.0	357.9	165.6	213.1	324.5
Daily	0	0.9	0.5	0.4	0.4	0.4
	10	2.3	3.2	2.6	2.4	1.2
	25	3.7	6.3	4.2	4.0	2.1
	50	6.5	10.8	7.6	6.4	5.1
	75	11.4	17.9	12.4	13.1	14.9
	90	19.6	27.9	21.2	23.2	64.2
	95	25.8	42.7	29.9	34.3	87.2
	98	42.9	54.9	50.3	58.7	152.5
	100	93.7	113.1	82.8	111.4	204.2

Table A-8: Percentiles of $PM_{2.5}$.

Averaging period	Percentile	Hosmer (µg/m³)	EV_SCS (µg/m³)	EV_WWTP (µg/m³)	GH_ERMES (µg/m³)	LC_02 (µg/m³)
Hourly	0	0.0	0.0	0.0	0.0	0.0
	10	0.9	1.2	0.9	1.3	0.5
	25	1.8	2.7	1.8	2.1	1.0
	50	3.6	5.3	3.7	3.2	3.2
	75	7.3	10.1	7.3	6.4	11.3
	90	15.1	20.0	13.9	15.1	43.9
	95	24.6	30.9	21.8	27.4	90.8
	98	45.4	51.8	38.0	53.3	181.1
	100	141.3	107.0	114.2	173.3	321.2
Daily	0	0.3	0.2	0.6	0.5	0.2
	10	1.9	2.1	1.8	2.1	0.9
	25	2.8	3.8	2.7	2.8	1.4
	50	4.2	5.8	4.2	4.0	3.9
	75	6.6	10.3	6.7	6.0	11.4
	90	13.1	18.0	12.9	13.1	60.3
	95	23.1	31.1	18.1	25.4	81.8
	98	47.5	46.1	28.6	49.3	148.5
	100	83.1	72.1	85.9	90.6	200.8

Table A-9: Percentiles of gas concentrations.

Averaging period	Percentile	EV_SCS	
		NO_2 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)[2]
Hourly	0	0.0	7.5
	10	9.3	21.0
	25	12.7	38.3
	50	16.2	60.0
	75	19.2	69.2
	90	22.9	74.4
	95	25.7	77.1
	98	30.2	79.6
	100	63.3	91.7
		Daily 1-hour Maximum	Daily 8-hour Maximum
Daily	0	4.3	32.2
	10	15.3	56.4
	25	18.4	62.6
	50	21.2	67.7
	75	24.7	73.4
	90	29.2	77.9
	95	38.9	78.7
	98	49.0	83.7
	100	63.3	87.6
	4^{th} highest[1]	-	78.6

Notes:

[1] Provided for comparison with BCAAQO of 123 $\mu g/m^3$ for the daily 8-hour maximum O_3 concentration.

[2] O_3 results cover only the period from November 18 to December 31, 2021 and are for indicative purposes only as they are biased toward winter conditions.

Table A-10: Ninety-eighth percentile values of daily averaged $PM_{2.5}$. Highlighted values are above BCAAQO of 25 µg/m³.

Station Name	98th percentile of daily averaged $PM_{2.5}$ (µg/m³)
Hosmer	47.5
EV_SCS	46.1
EV_WWTP	28.6
GH_ERMES	49.3
LC_02	148.5

APPENDIX B

Table B-1: List of Days with PM_{10} Exceedances in 2021

Station Name	Month	Day	PM_{10} Concentration ($\mu g/m^3$)
Hosmer	July	23	69
	July	24	94
	August	3	78
	August	15	71
EV_SCS	March	15	51
	March	18	60
	July	23	73
	July	27	57
	August	13	53
	August	14	77
	August	15	70
	August	16	113
EV_WWTP	July	30	59
	August	1	56
	August	2	62
	August	3	54
	August	14	56
EV_WWTP	August	15	54
	August	16	83
LC_02	July	14	83
	July	15	58
	July	18	52
	July	19	86
	July	20	70
	July	22	81
	July	23	205
	July	24	198
	July	25	147
	July	26	62
	July	27	104
	July	28	87
	July	29	77
	July	30	140
	July	31	72
LC_02	August	1	98
	August	2	180
	August	3	147
	August	4	80
	August	5	82
GH_ERMES	July	23	90
	July	24	56
	July	25	68
	July	26	50
	July	27	61
	July	30	62
	August	6	51
	August	14	67
	August	15	61
	August	16	111

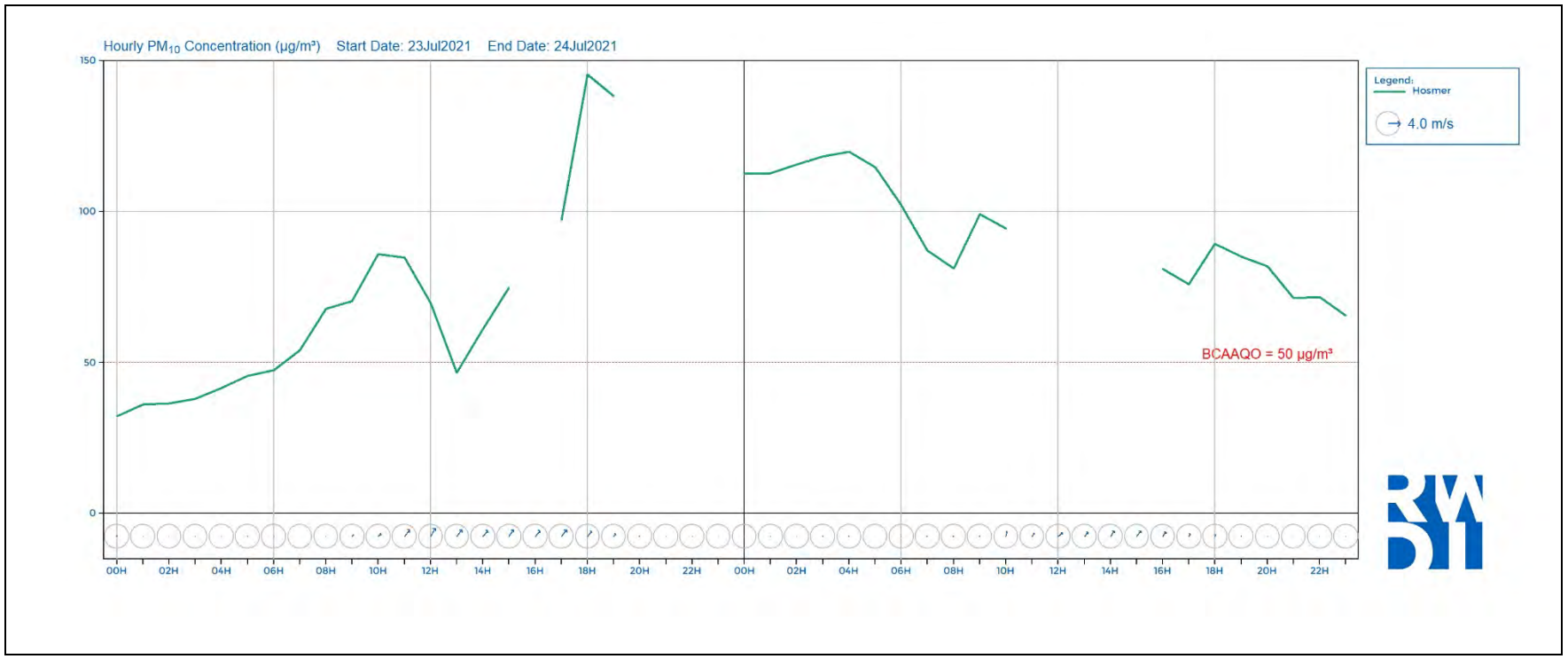


Figure B-1: Hourly PM_{10} Concentrations at Hosmer on July 23-24, 2021.

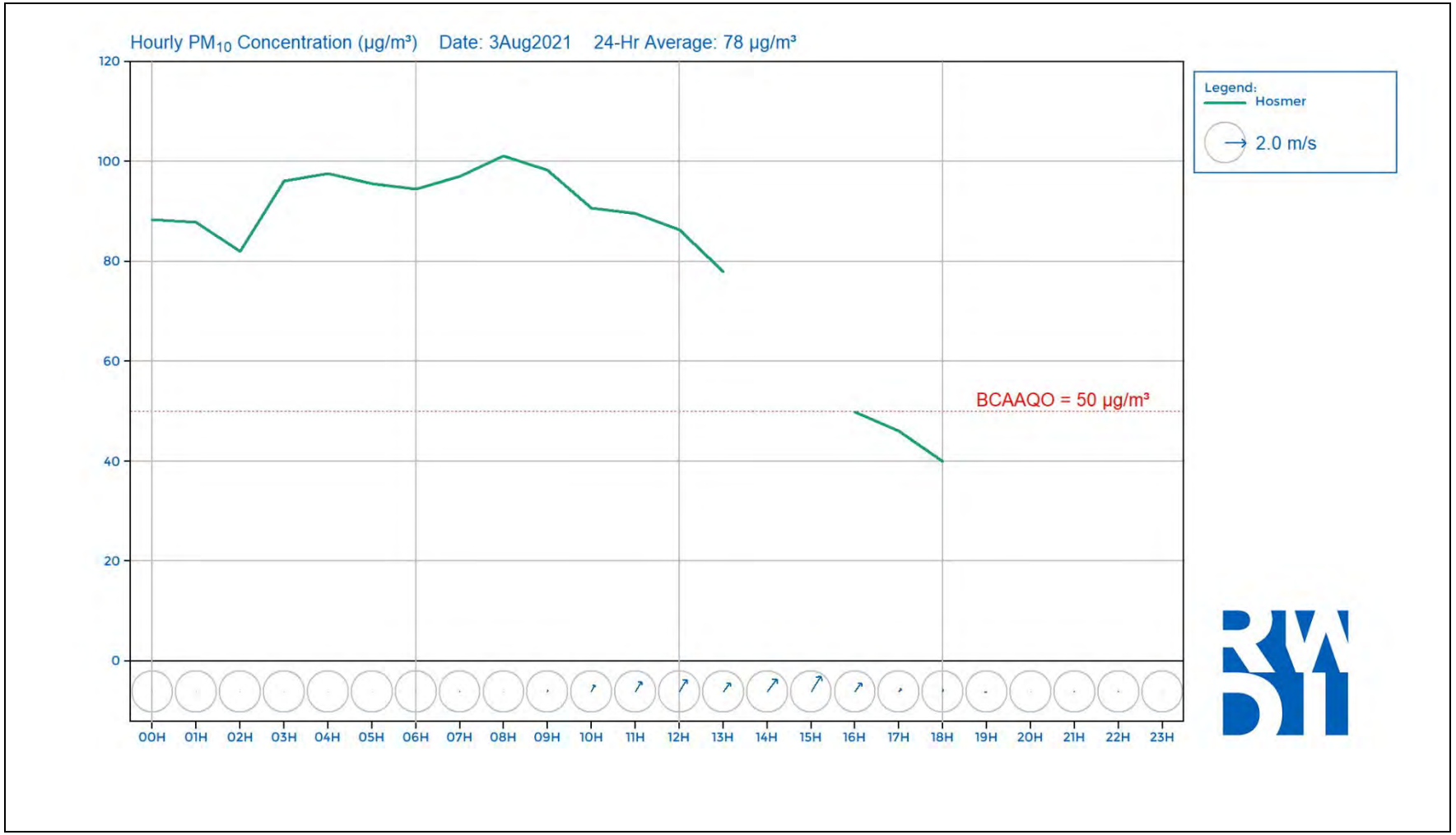


Figure B-2: Hourly PM_{10} Concentration at Hosmer on August 3, 2021.

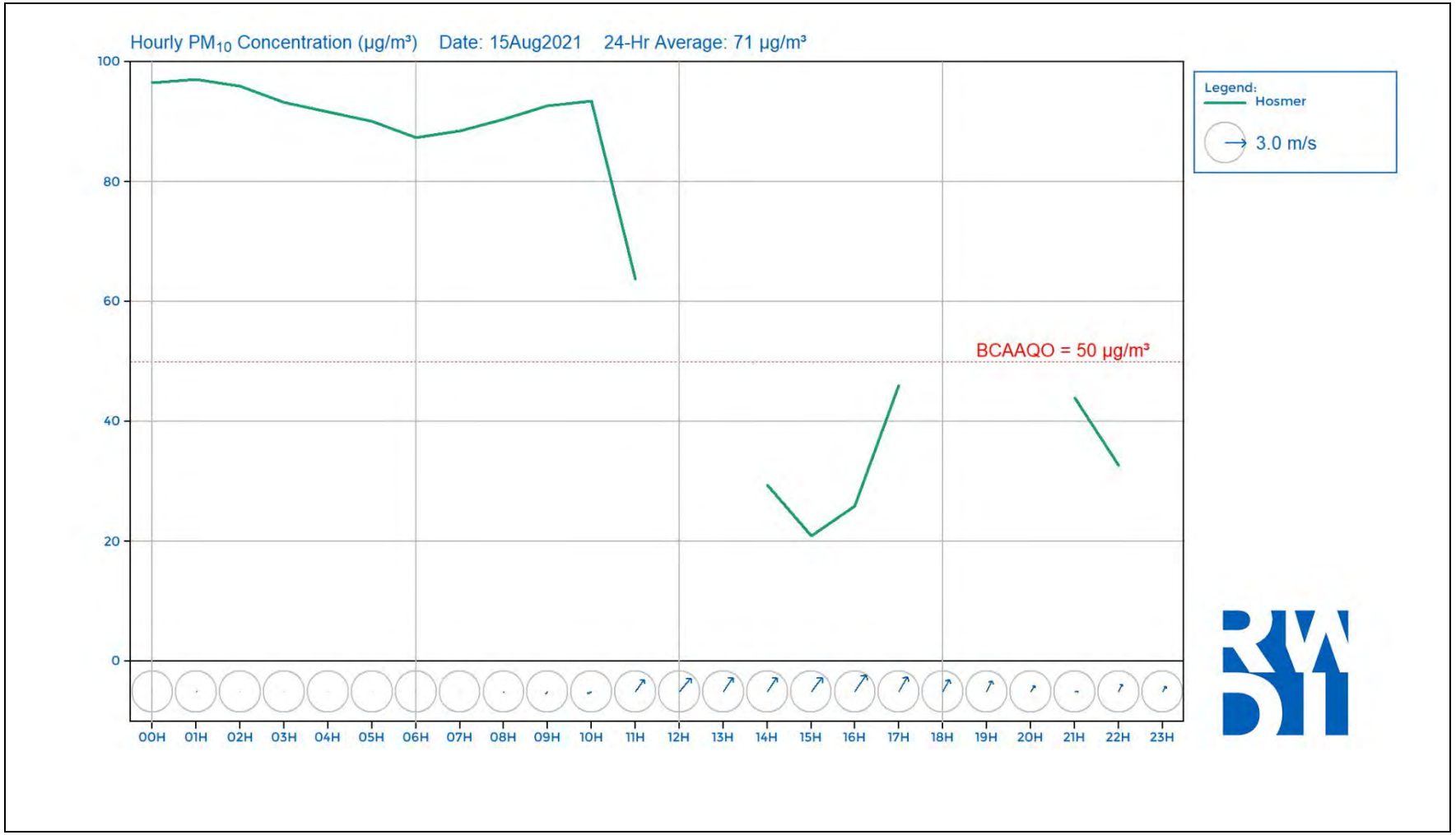


Figure B-3: Hourly PM_{10} Concentration at Hosmer on August 15, 2021.

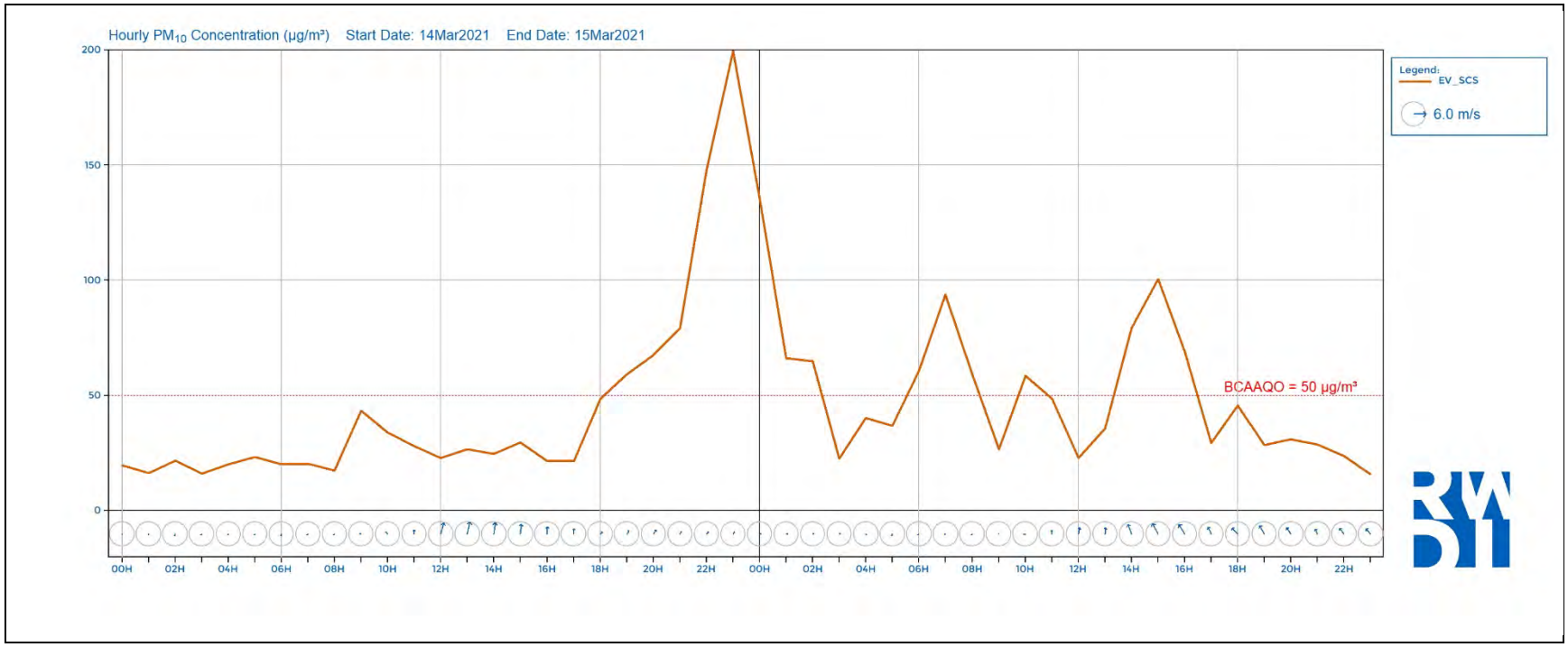


Figure B-4: Hourly PM_{10} Concentration at EV_SCS on March 14-15, 2021.

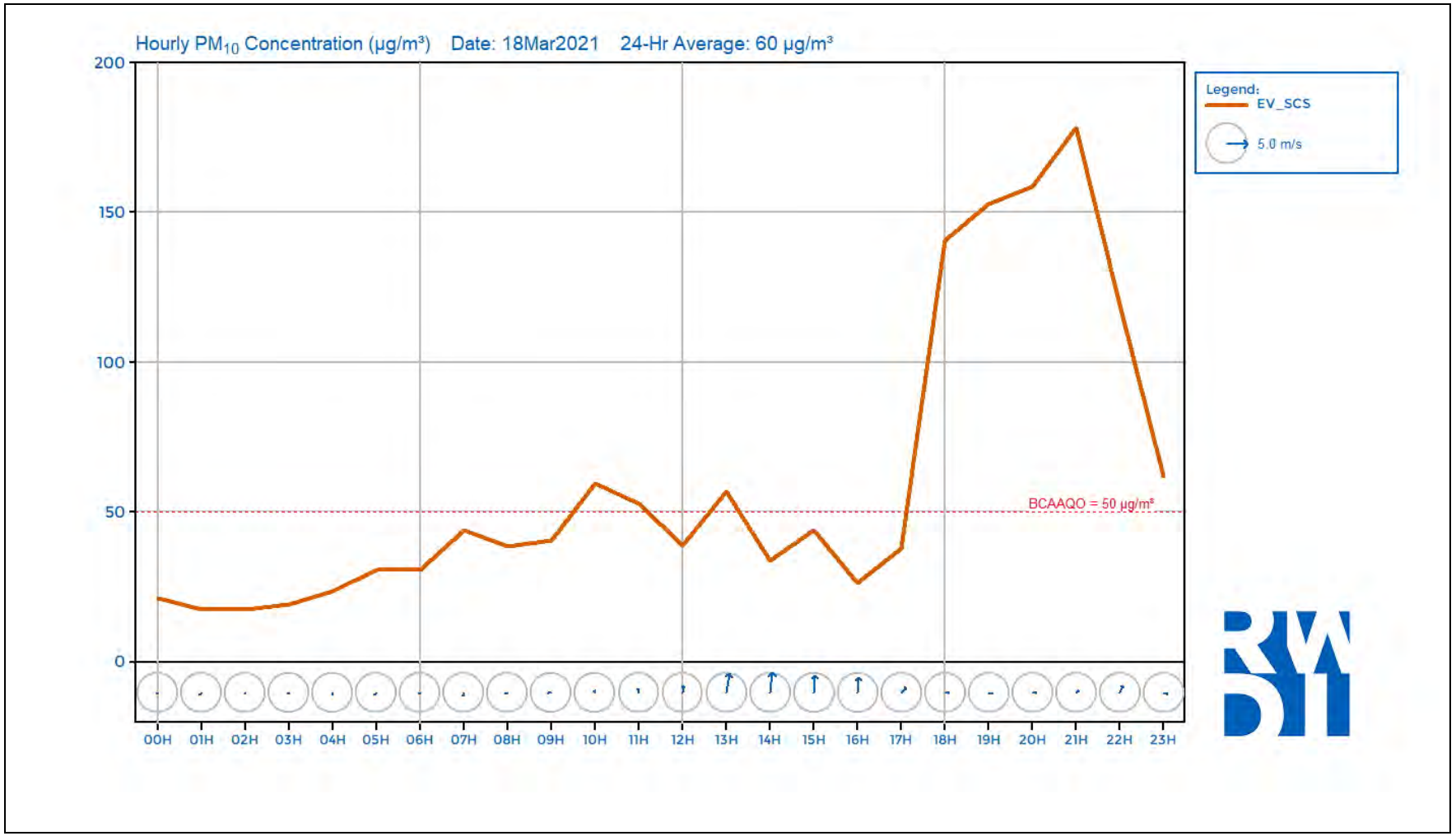


Figure B-5: Hourly PM_{10} Concentration at EV_SCS on March 18, 2021.

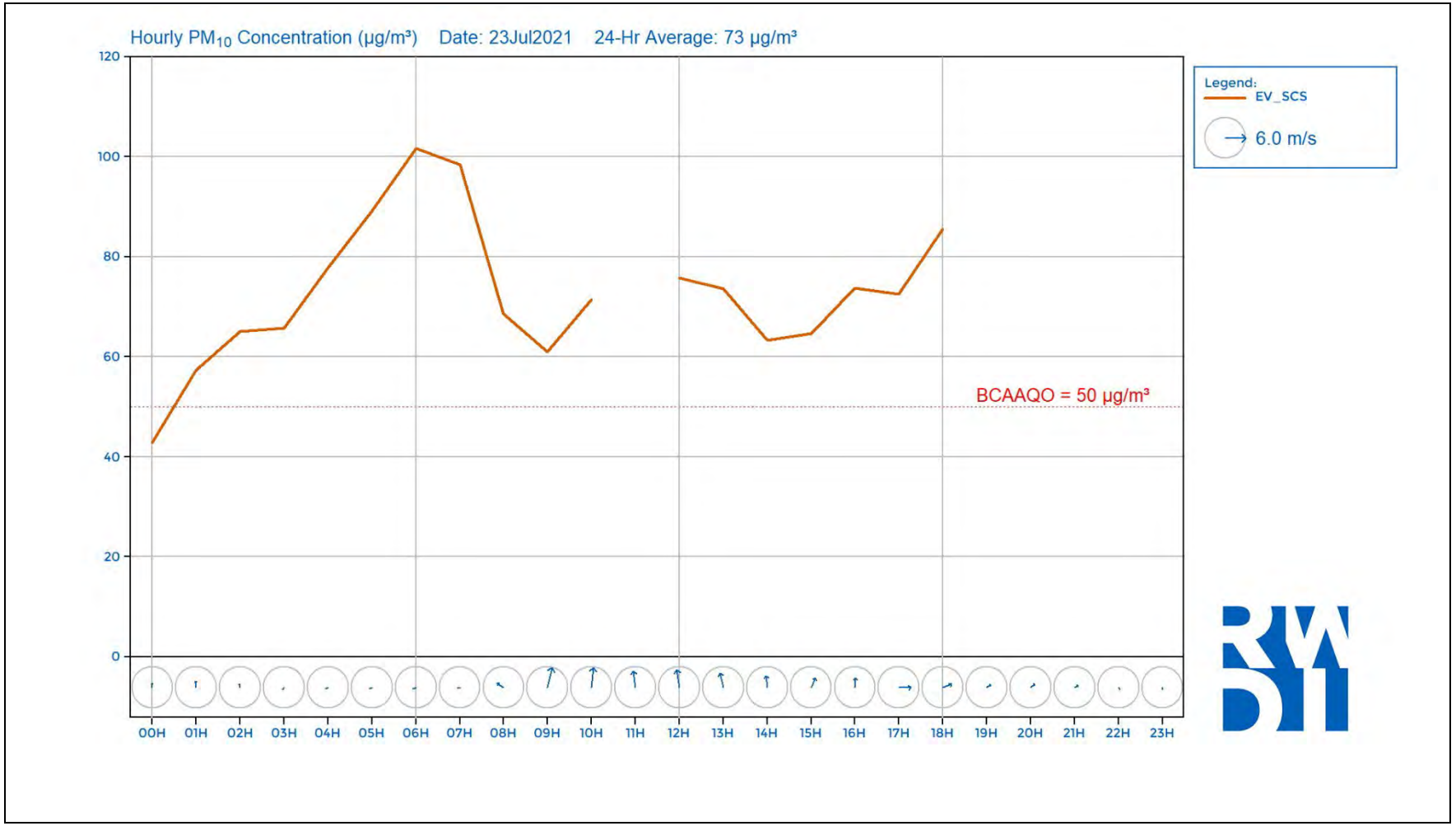


Figure B-6: Hourly PM_{10} Concentration at EV_SCS on July 23, 2021.

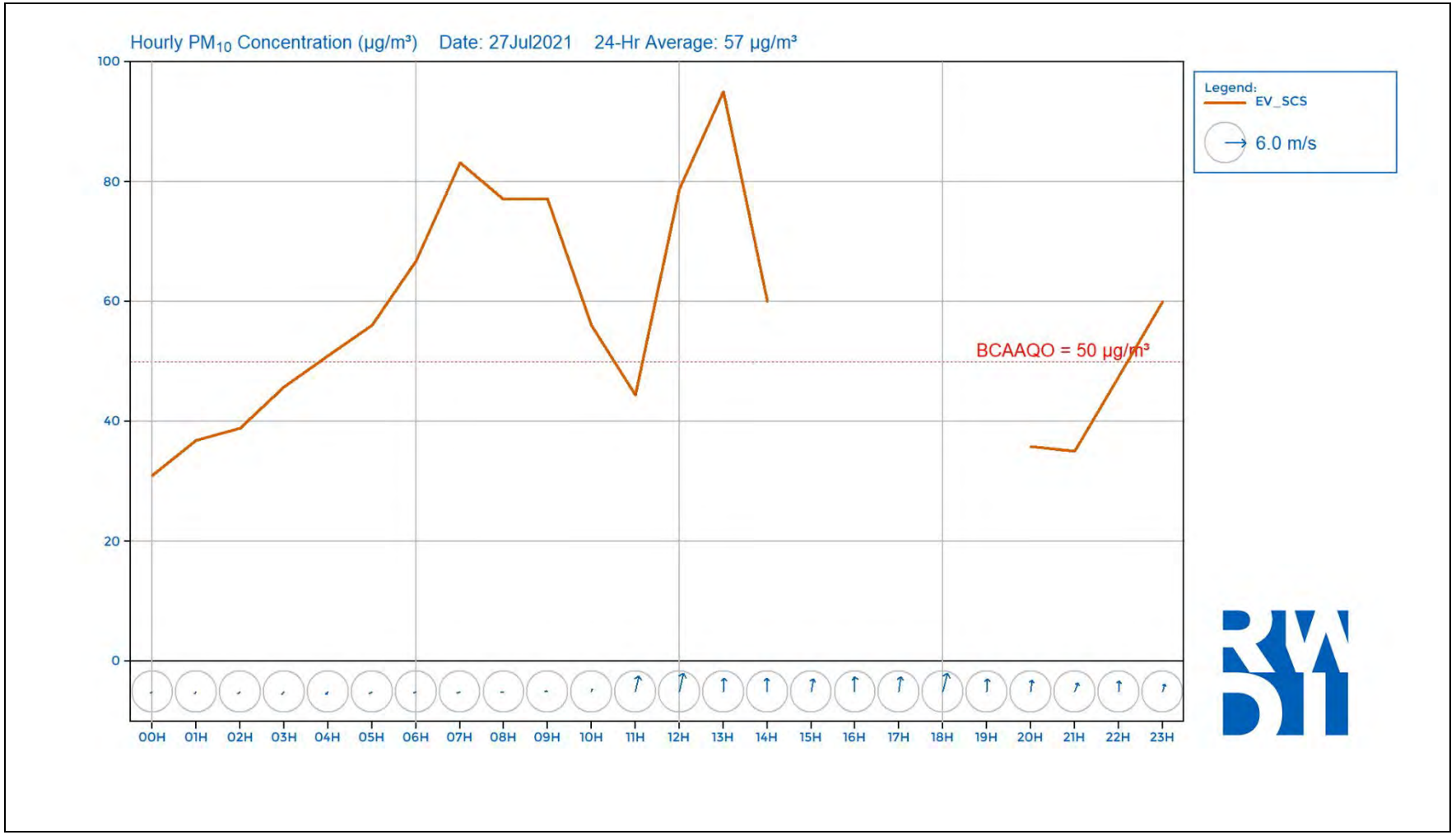


Figure B-7: Hourly PM_{10} Concentration at EV_SCS on July 27, 2021.

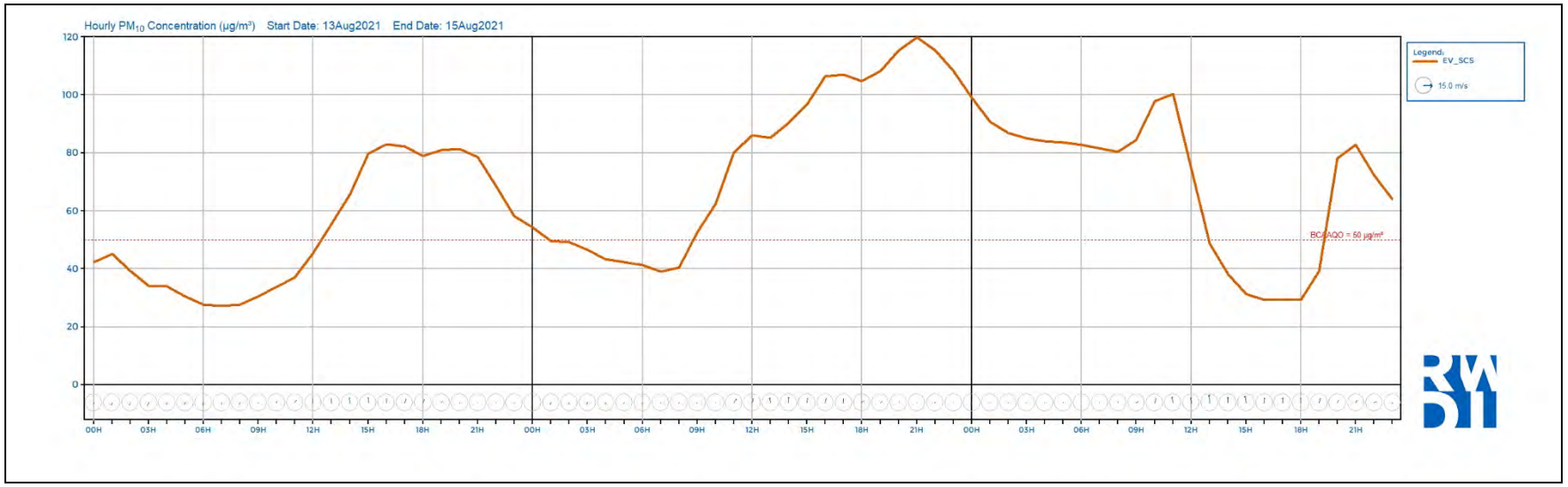


Figure B-8: Hourly PM_{10} Concentration at EV_SCS on August 13-15, 2021.

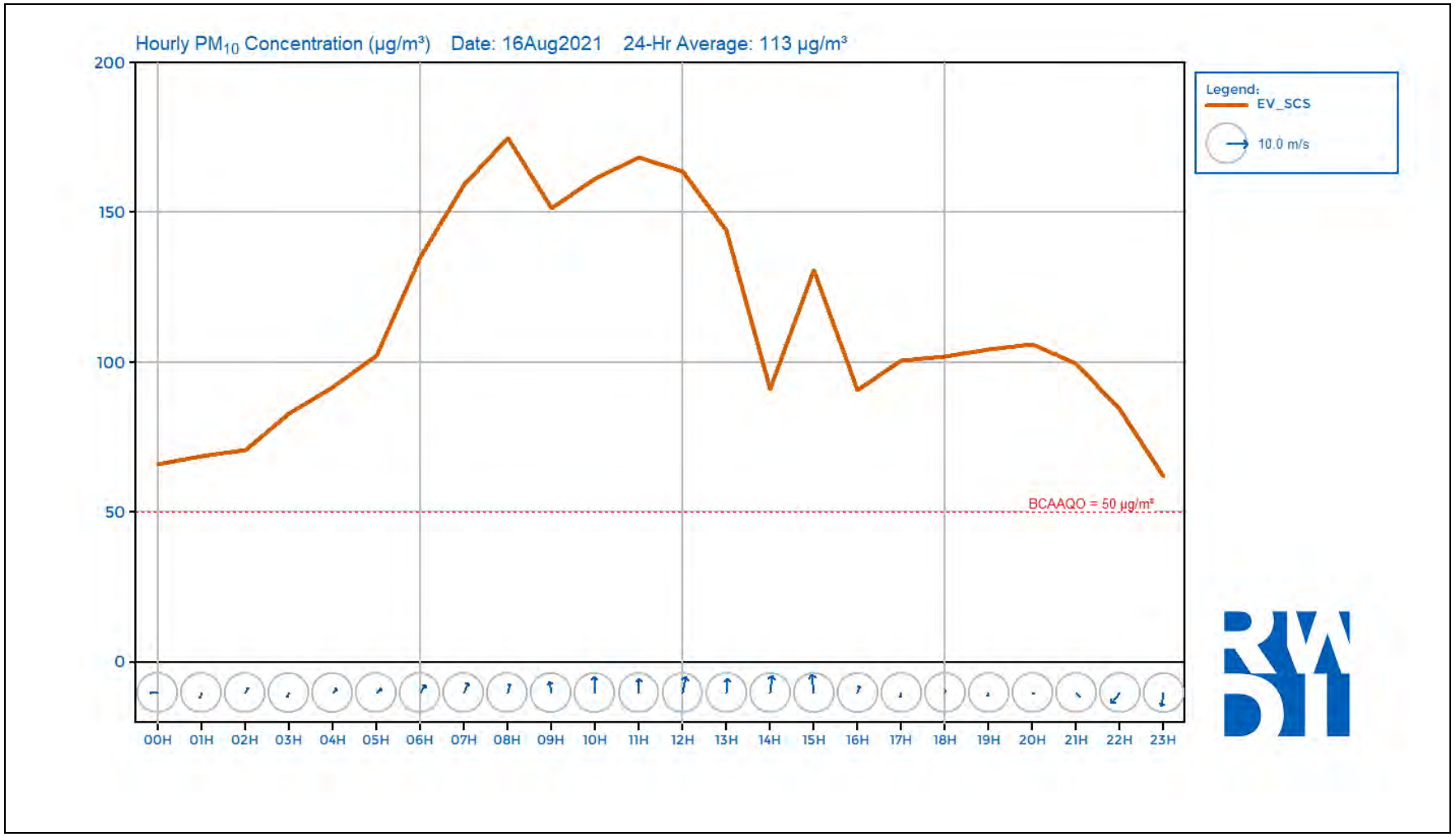


Figure B-9: Hourly PM_{10} Concentration at EV_SCS on August 16, 2021.

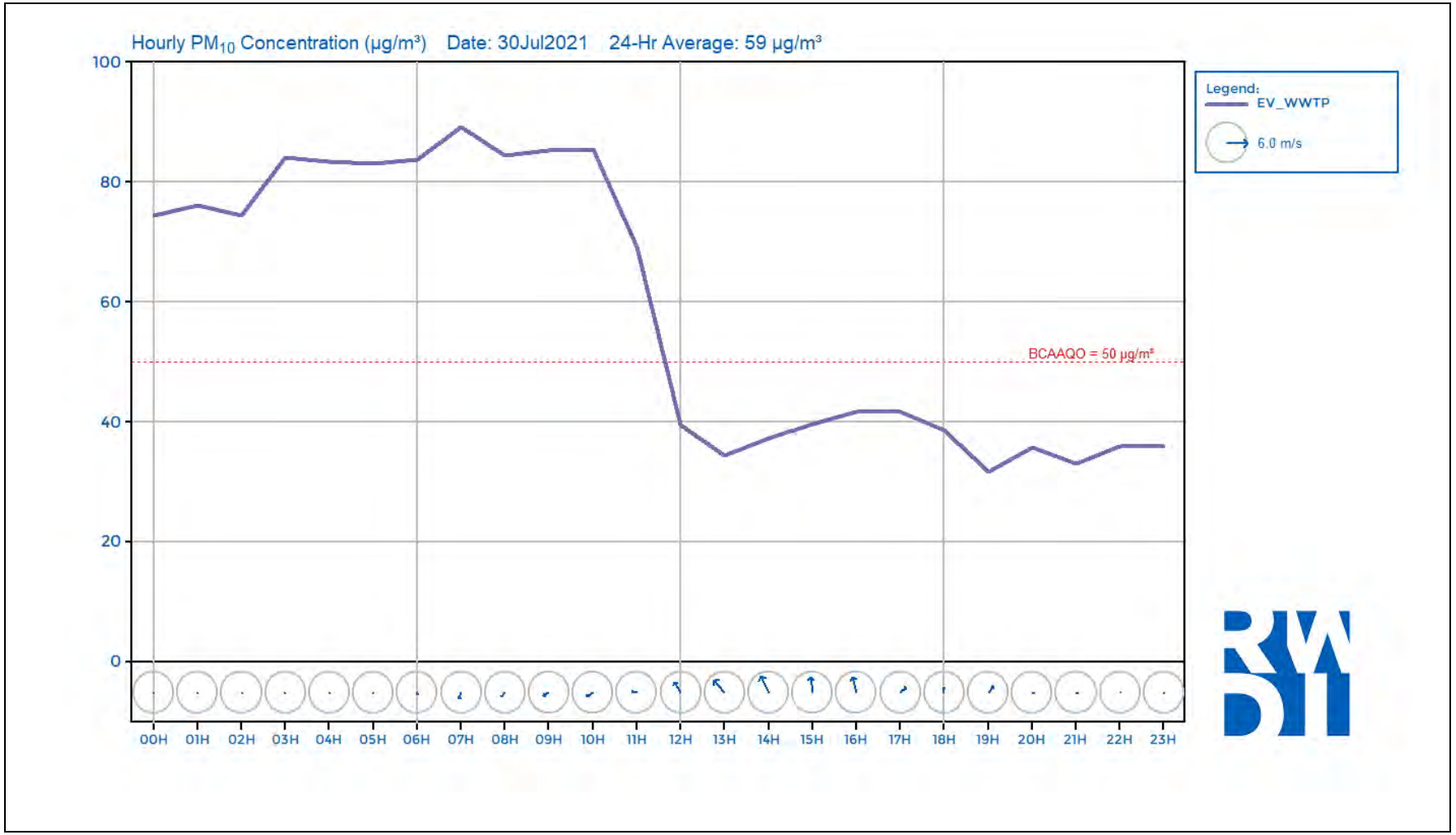


Figure B-10: Hourly PM_{10} Concentrations at EV_WWTP on July 30, 2021.

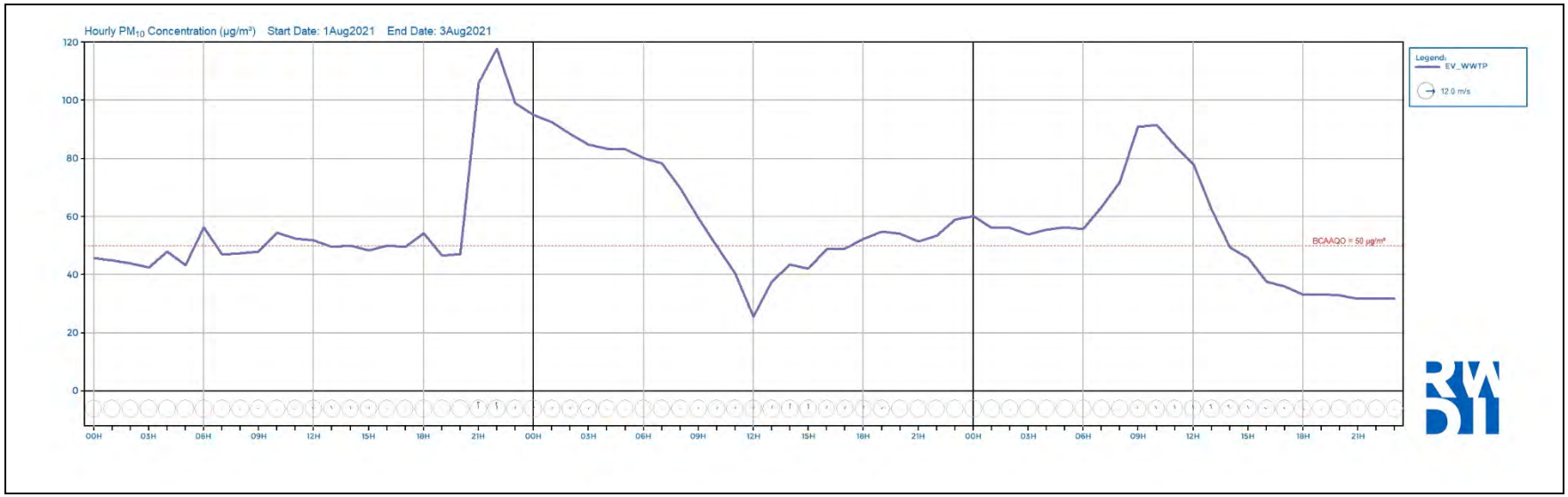


Figure B-11: Hourly PM_{10} Concentration at EV_WWTP on August 1-3, 2021.

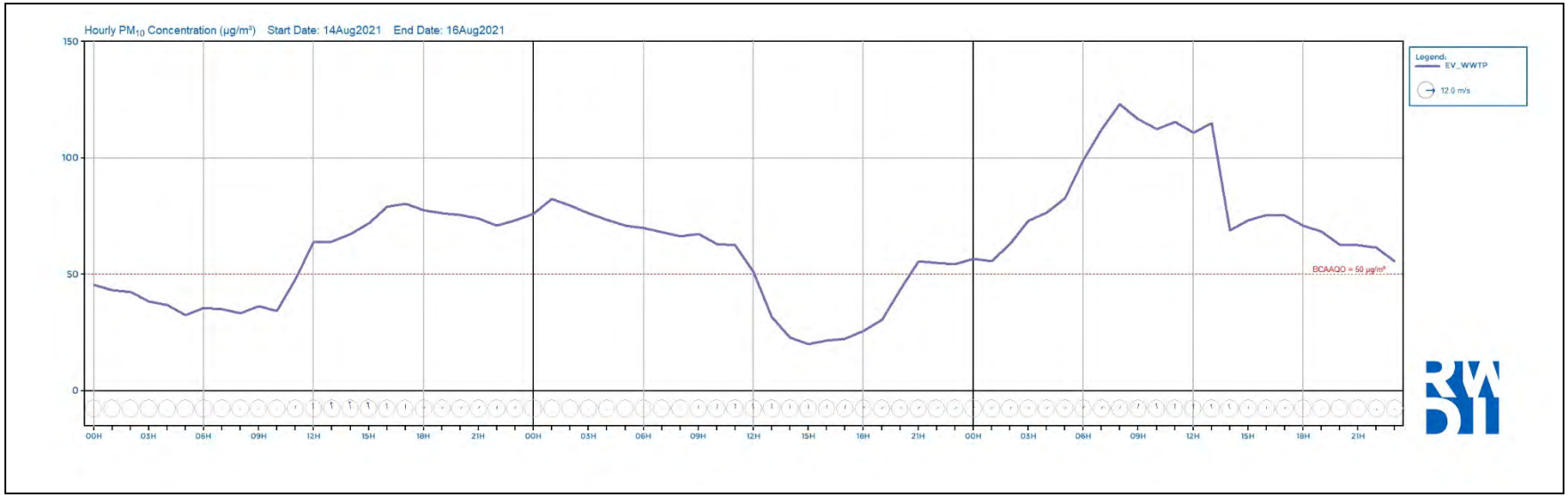


Figure B-12: Hourly PM_{10} Concentrations at EV_WWTP on August 14-16, 2021.

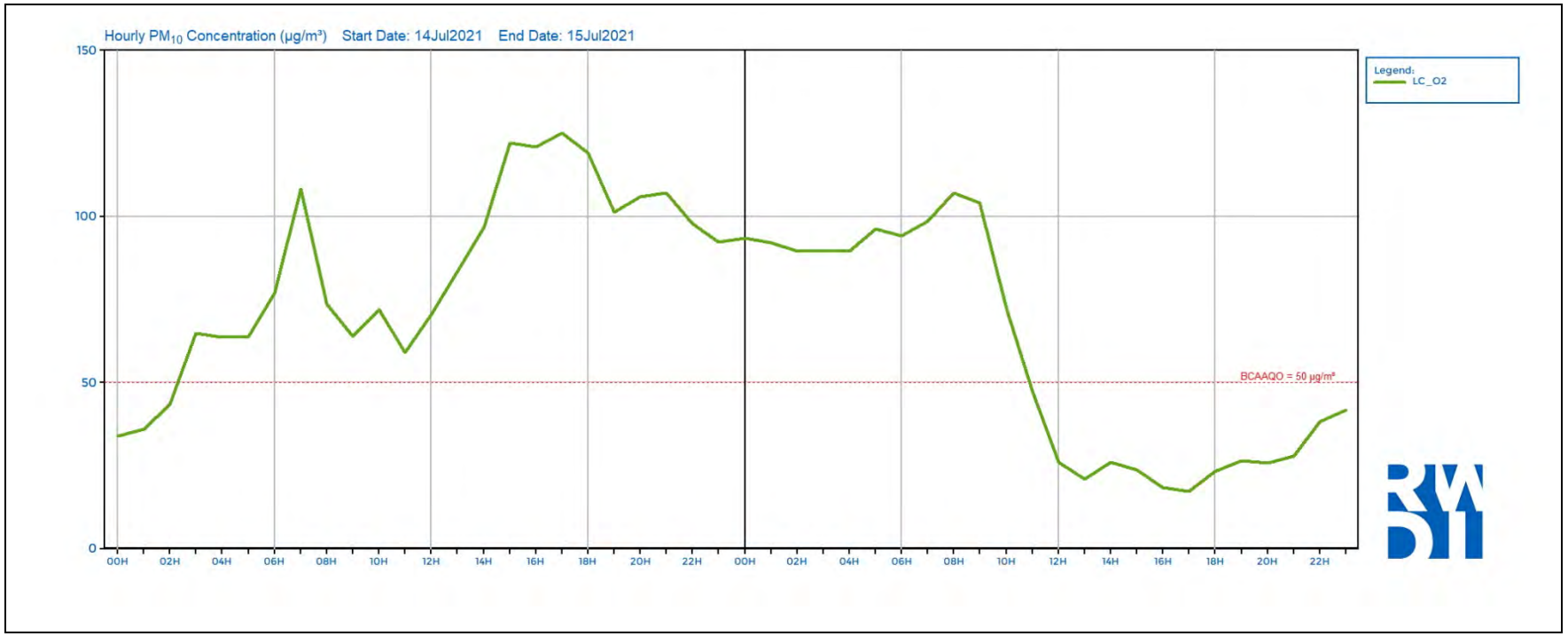


Figure B-13: Hourly PM_{10} Concentrations at LC_02 on July 14-15, 2021.

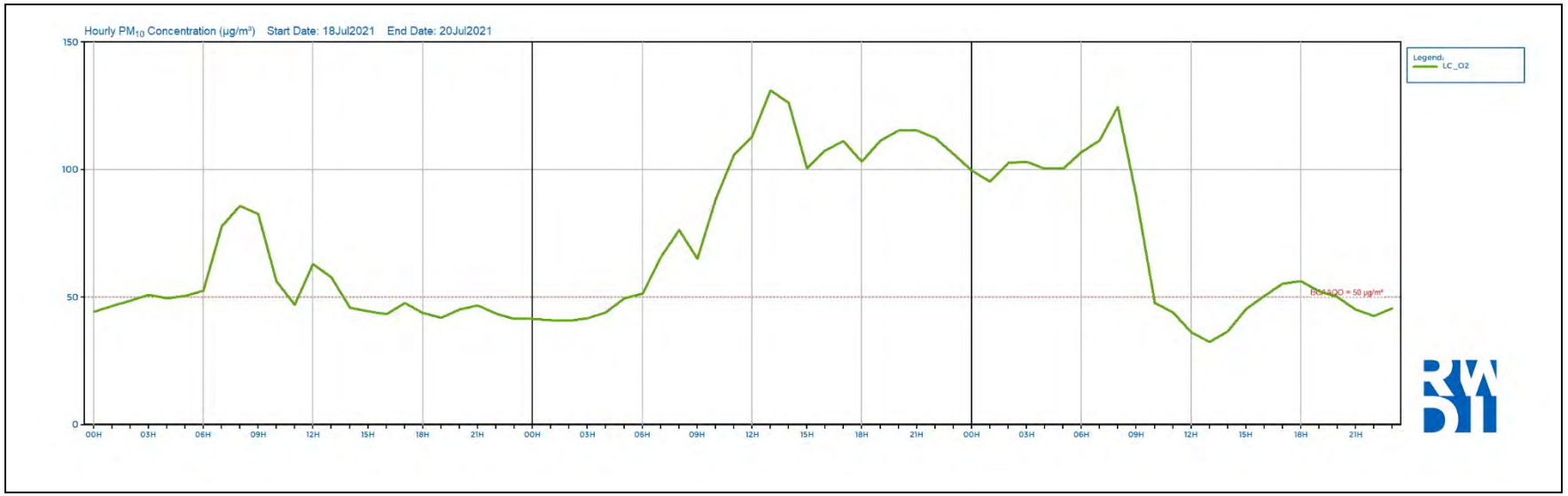


Figure B-14: Hourly PM_{10} Concentrations at LC_02 on July 18-20, 2021.

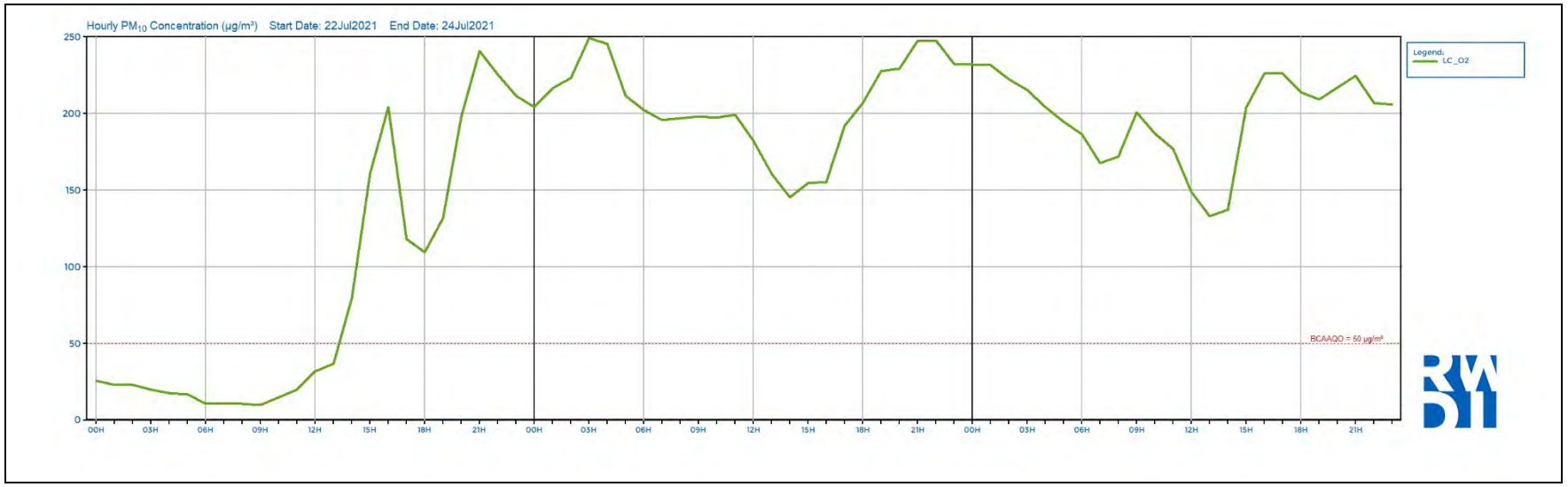


Figure B-15: Hourly PM_{10} Concentrations at LC_02 on July 22-24, 2021.

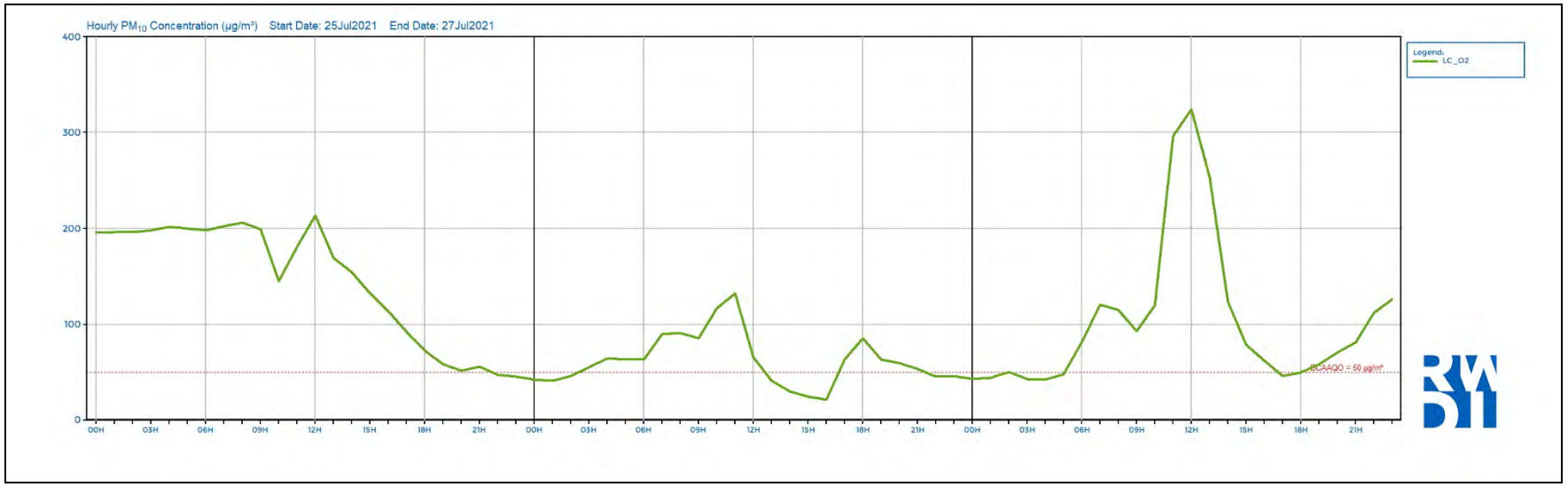


Figure B-16: Hourly PM_{10} Concentrations at LC-02 on July 25-27, 2021.

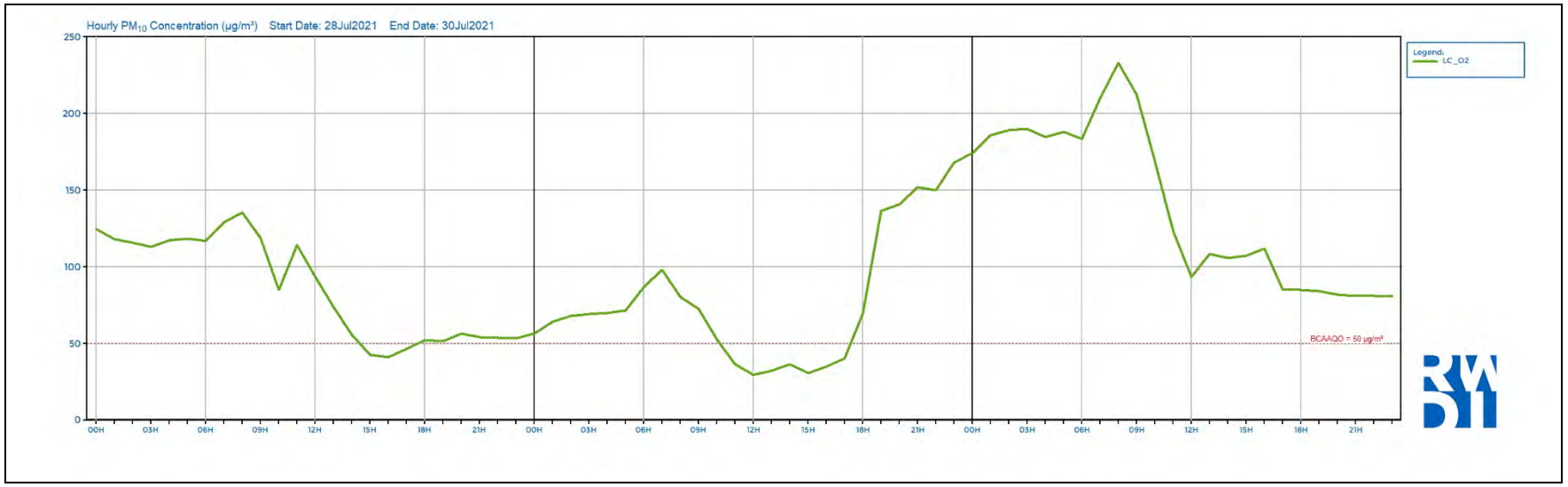


Figure B-17: Hourly PM_{10} Concentrations at LC-02 on July 28-30, 2021.

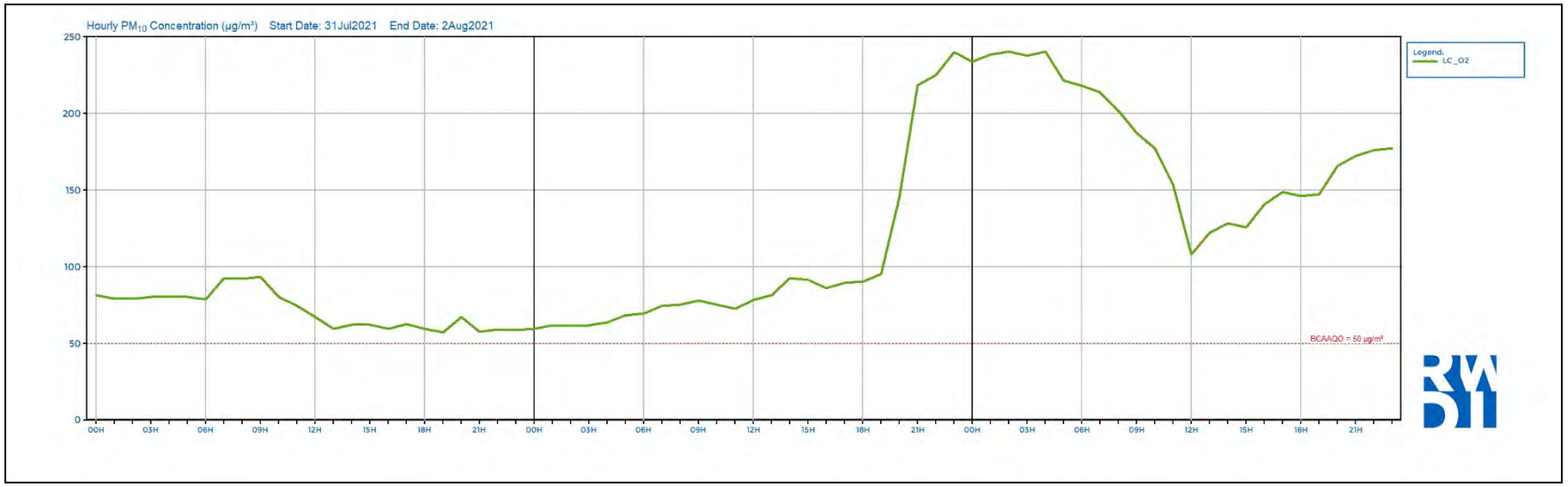


Figure B-18: Hourly PM_{10} Concentrations at LC-02 on July 31 to August 2, 2021.

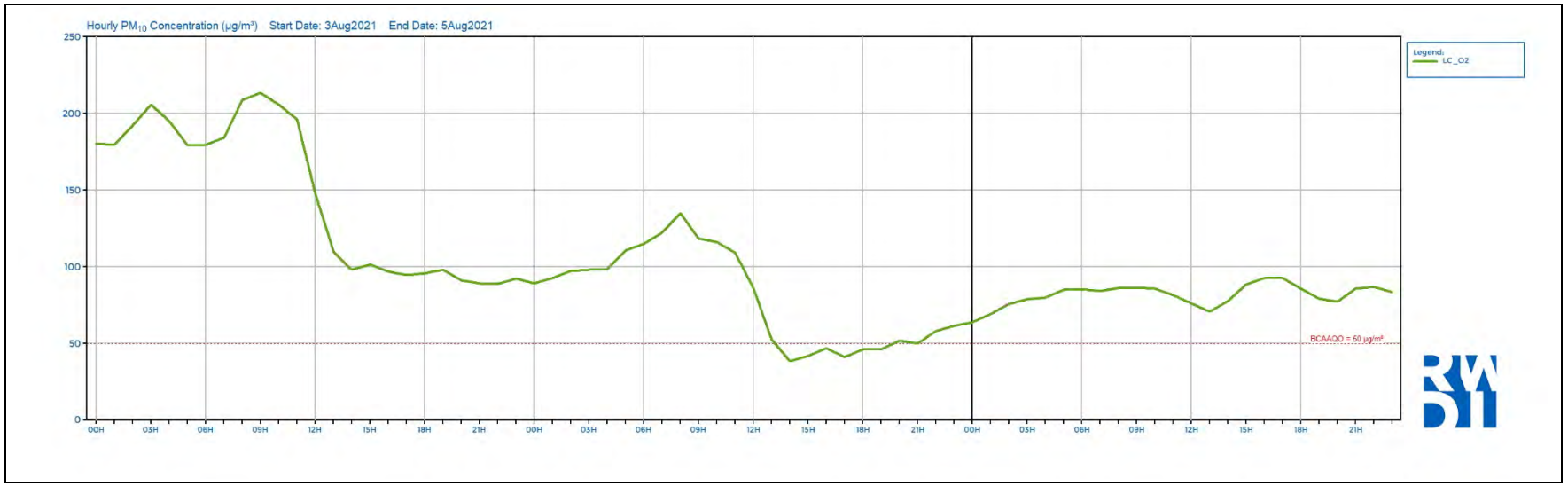


Figure B-19: Hourly PM_{10} Concentrations at LC-02 on August 3-5, 2021.

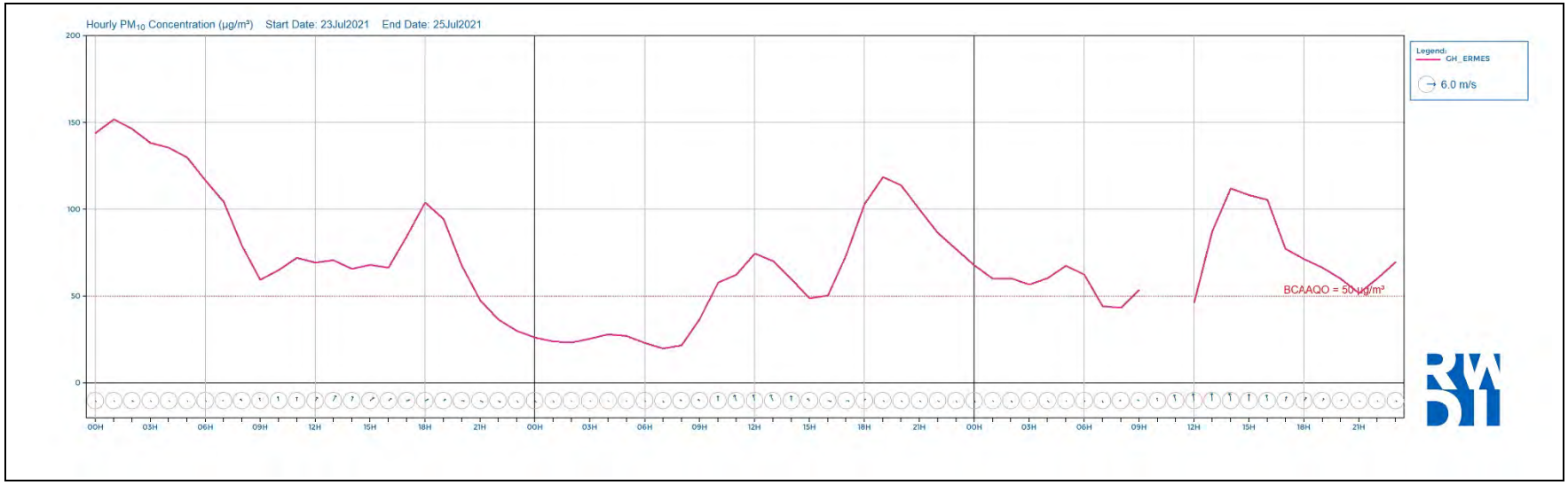


Figure B-20: Hourly PM_{10} Concentrations at GH-ERMES on July 23-25, 2021.

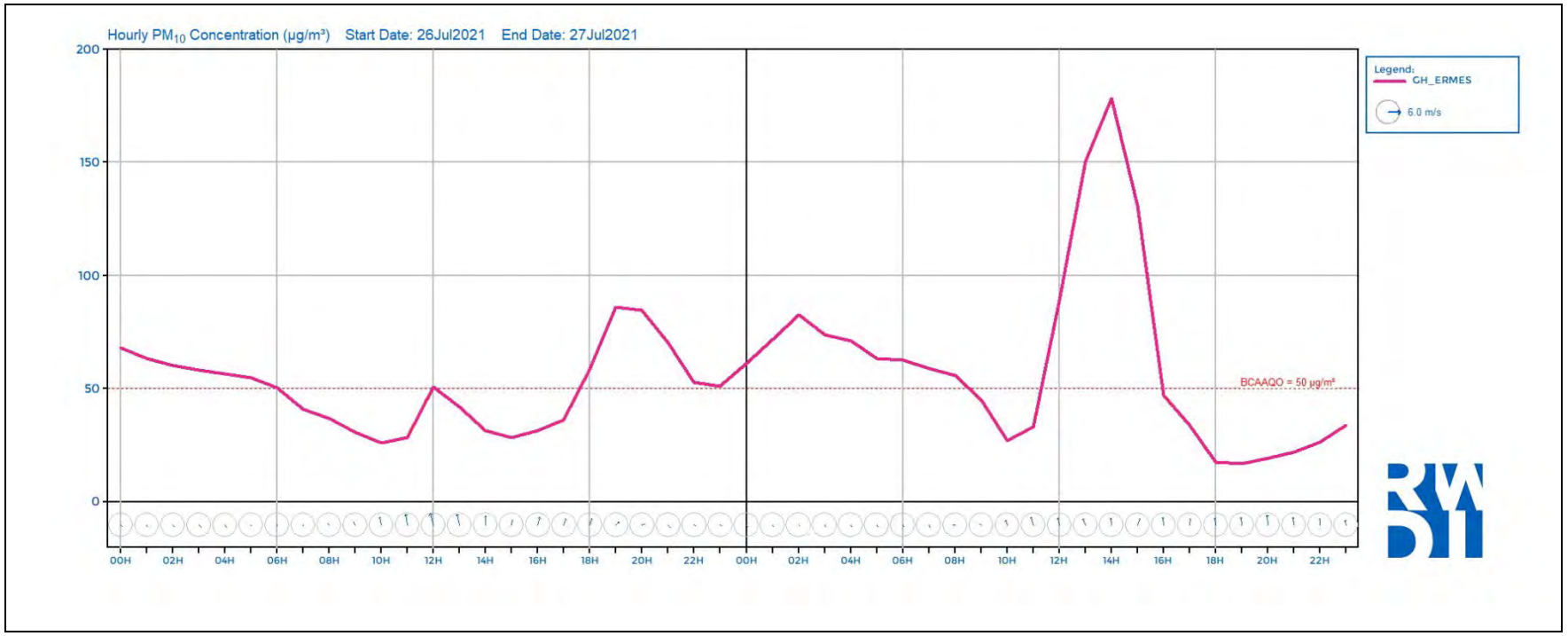


Figure B-21: Hourly PM_{10} Concentrations at GH-ERMES on July 26-27, 2021.

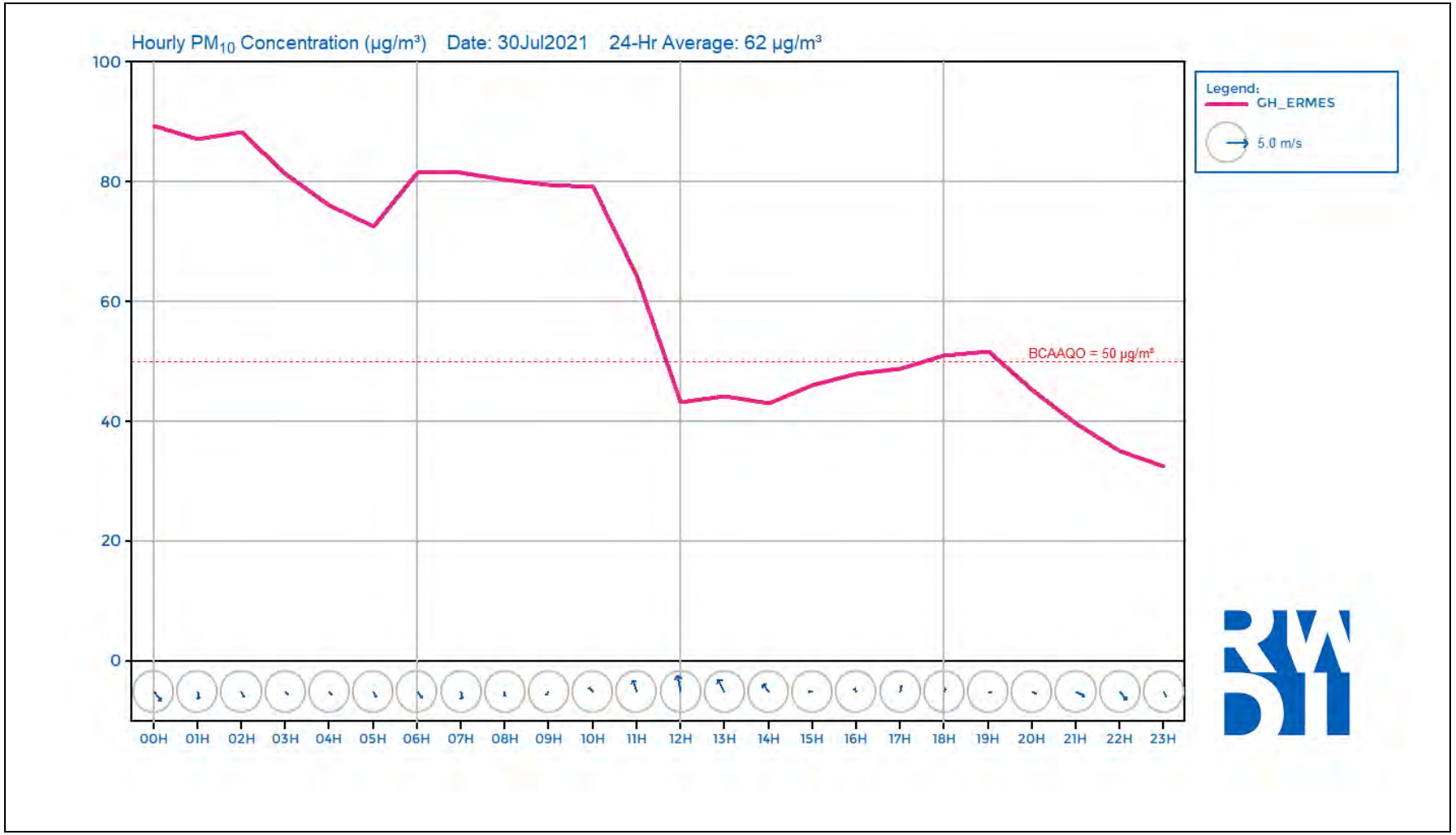


Figure B-22: Hourly PM_{10} Concentration at GH-ERMES on July 30, 2021.

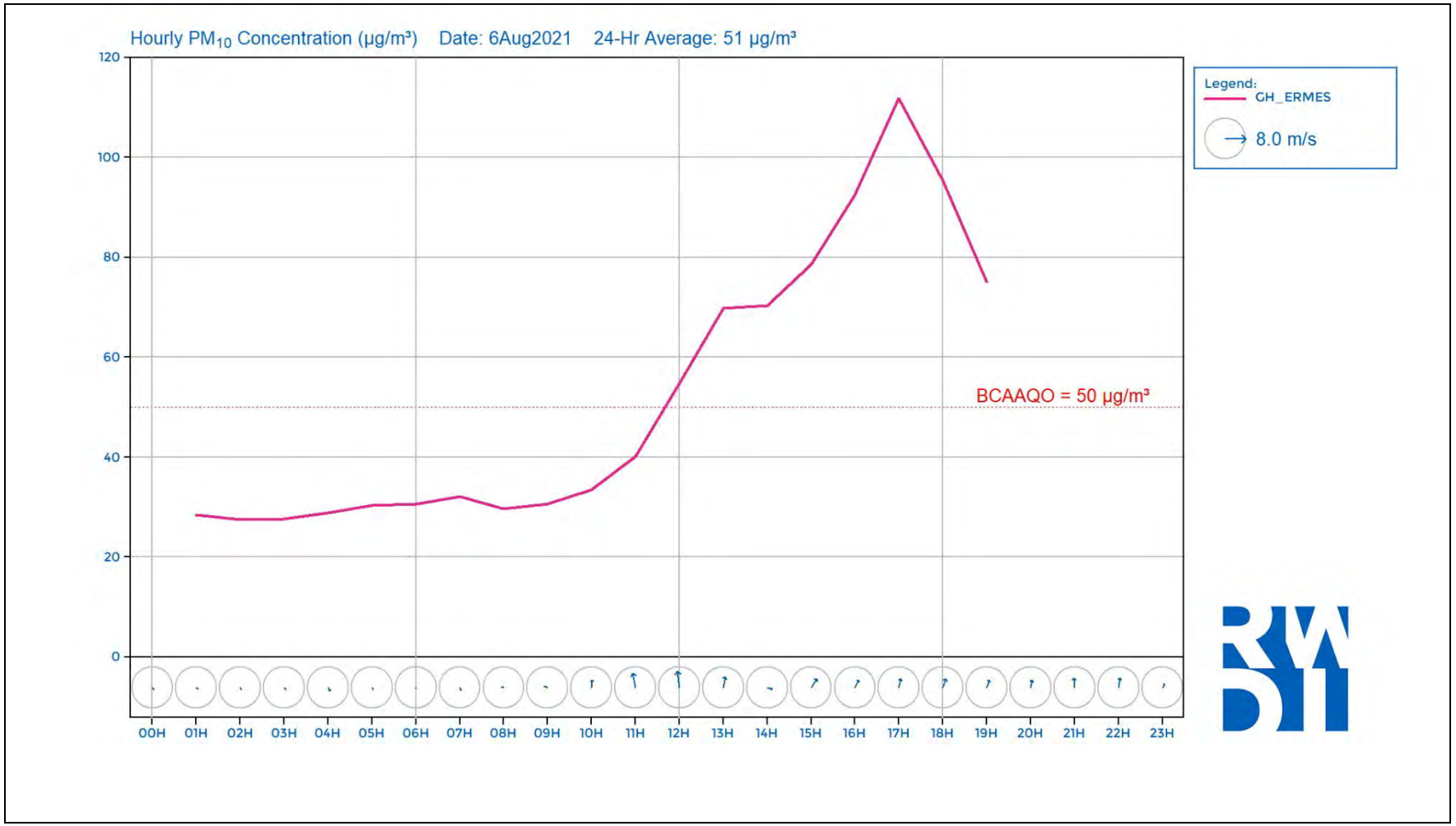


Figure B-23: Hourly PM_{10} Concentration at GH-ERMES on August 6, 2021.

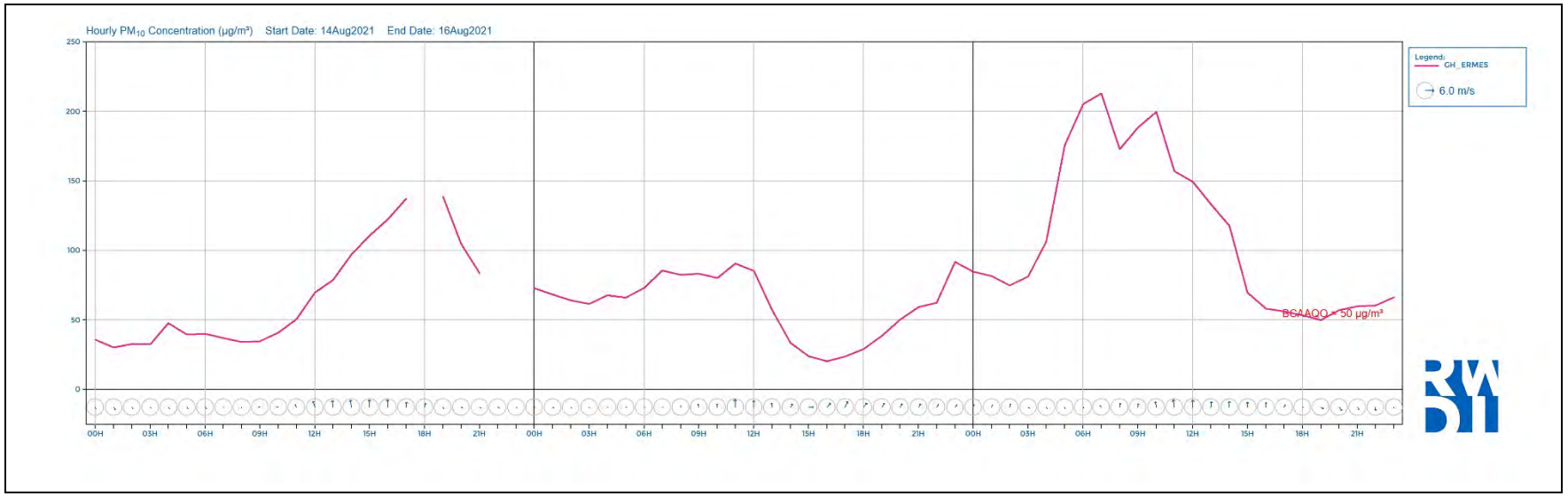


Figure B-24: Hourly PM_{10} Concentration at GH-ERMES on August 14-16, 2021.

APPENDIX C

Table C-1: List of Days with $PM_{2.5}$ Excursions in 2021

Station Name	Month	Day	$PM_{2.5}$ Concentration ($\mu g/m^3$)	Station Name	Month	Day	$PM_{2.5}$ Concentration ($\mu g/m^3$)	Station Name	Month	Day	$PM_{2.5}$ Concentration ($\mu g/m^3$)
Hosmer	July	19	28	EV_SCS	August	5	32	LC_O2	July	27	98
	July	23	49		August	6	43		July	28	82
	July	24	77		September	5	26		July	29	72
	July	25	46	EV_WWTP	July	14	28		July	30	131
	July	30	47		July	19	36		July	31	65
	August	1	33		July	20	27		August	1	92
	August	2	61		July	23	86		August	2	178
	August	3	65		July	24	69		August	3	144
	August	5	26		July	25	59		August	4	74
	August	6	35		July	26	26		August	5	79
	August	14	62		July	27	41	GH_ERMES	July	14	26
	August	15	54		July	28	35		July	23	78
	August	16	83		August	12	26		July	24	51
EV_SCS	July	14	33		August	13	37		July	25	60
	July	15	26	LC_O2	July	3	26		July	26	41
	July	18	26		July	10	28		July	27	51
	July	19	38		July	12	31		July	28	30
	July	20	28		July	13	27		July	29	33
	July	23	72		July	14	71		July	30	49
	July	24	70		July	15	51		July	31	25
	July	25	58		July	16	35		August	1	32
	July	27	37		July	18	48		August	2	48
	July	28	32		July	19	78		August	3	49
	July	29	25		July	20	64		August	5	28
	July	30	53		July	21	32		August	6	42
	July	31	32		July	22	78		August	13	30
	August	1	39		July	23	202		August	14	49
	August	2	68		July	24	193		August	15	50
	August	3	65		July	25	143		August	16	91
	August	4	32		July	26	59				

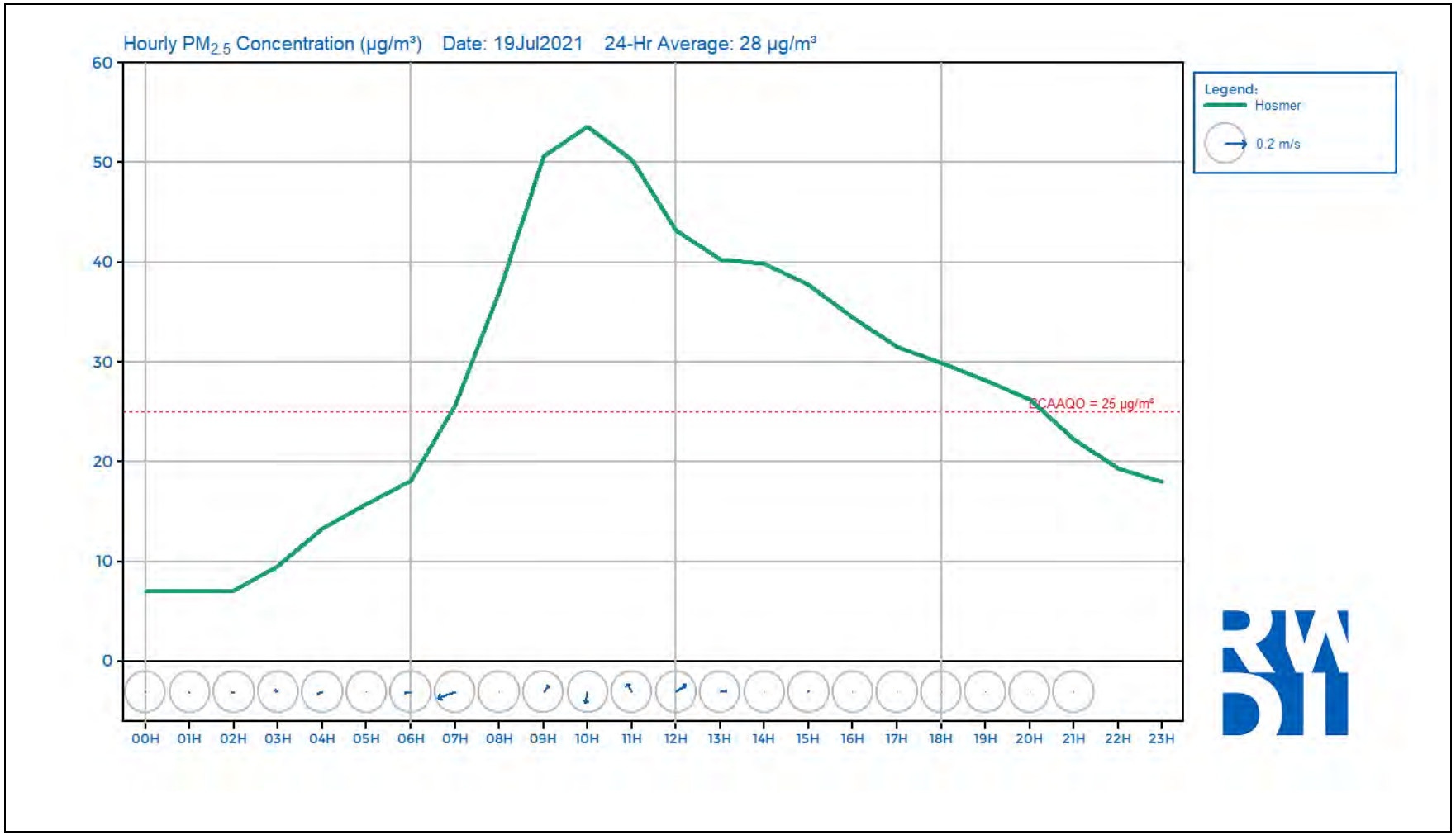


Figure C-1: Hourly $PM_{2.5}$ Concentrations at Hosmer on July 19, 2021.

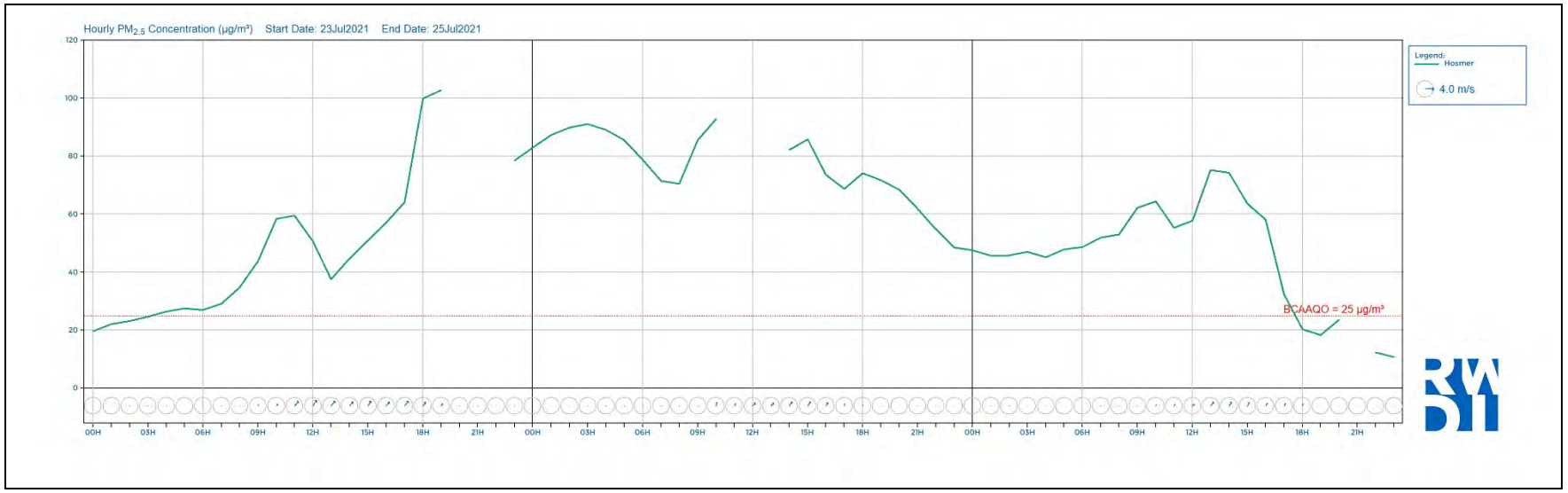


Figure C-2: Hourly $PM_{2.5}$ Concentrations at Hosmer on July 23-25, 2021.

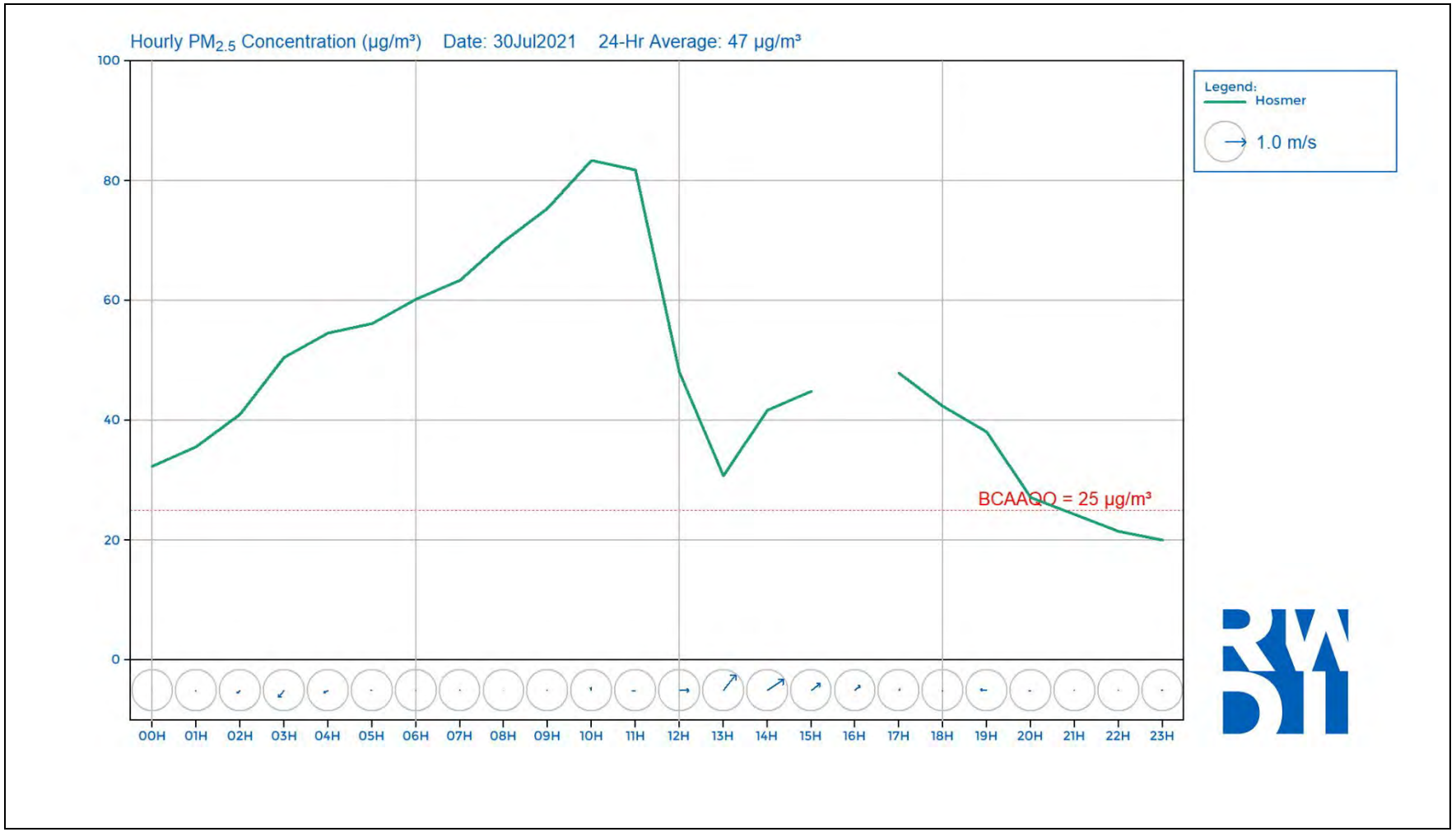


Figure C-3: Hourly $PM_{2.5}$ Concentration at Hosmer on July 30, 2021.

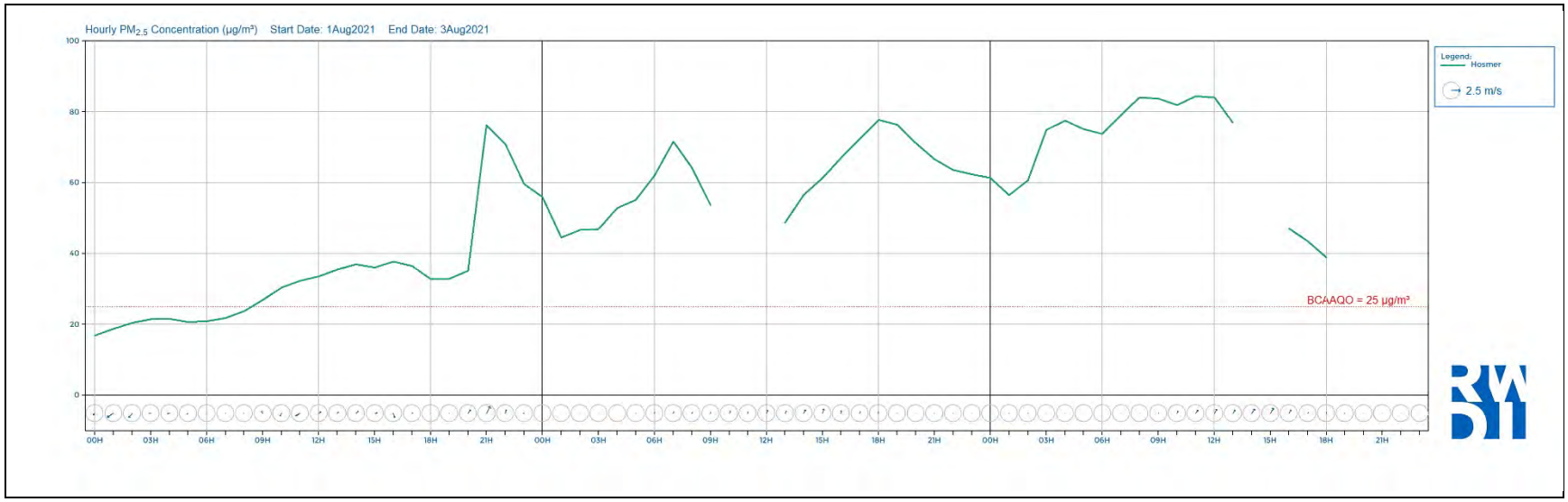


Figure C-4: Hourly $PM_{2.5}$ Concentration at Hosmer on August 1-3, 2021.

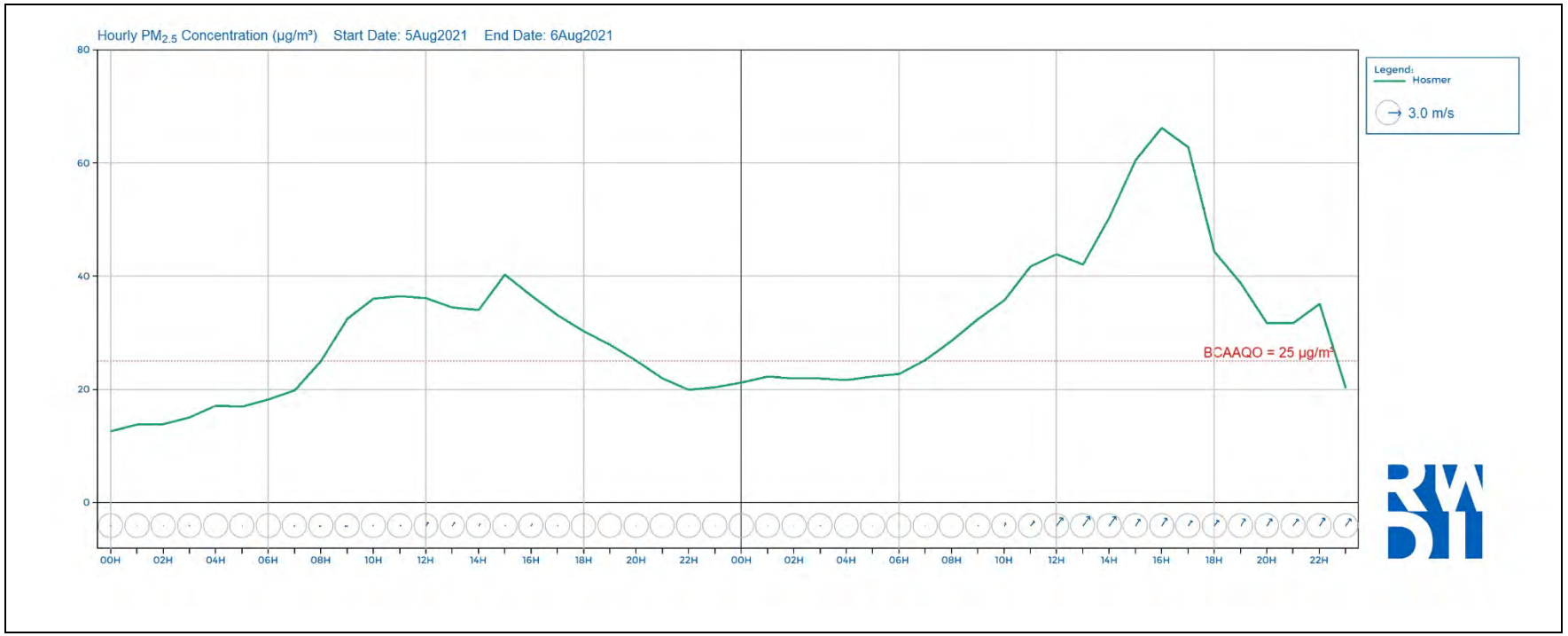


Figure C-5: Hourly $PM_{2.5}$ Concentration at Hosmer on August 5-6, 2021.

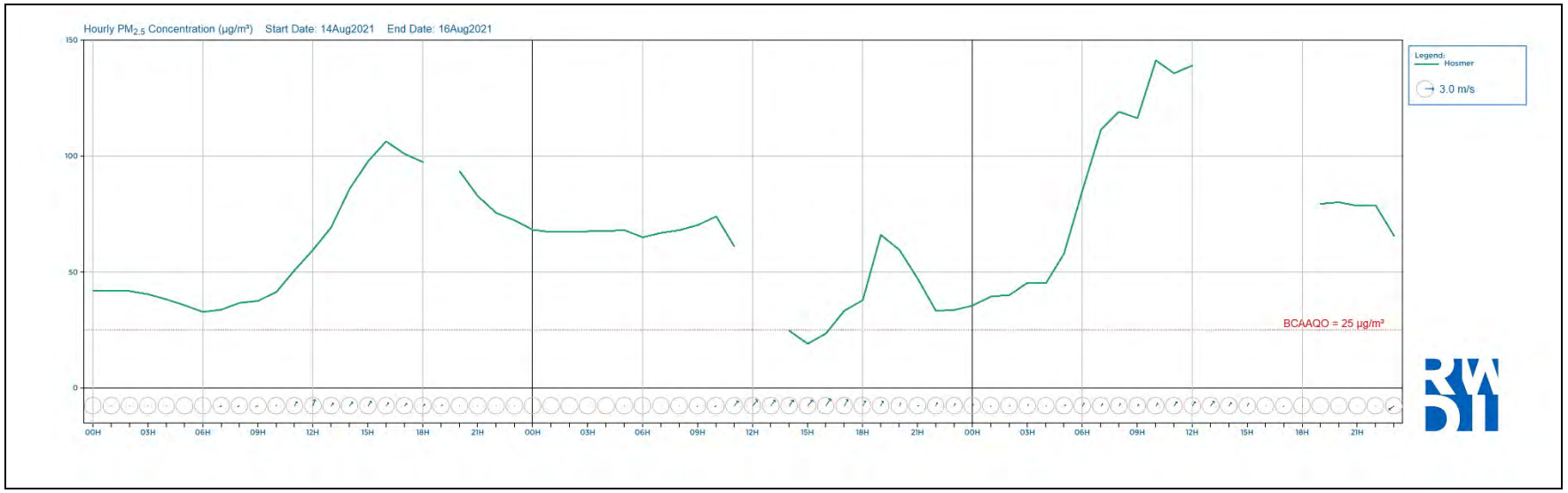


Figure C-6: Hourly $PM_{2.5}$ Concentrations at Hosmer on August 14-16, 2021.

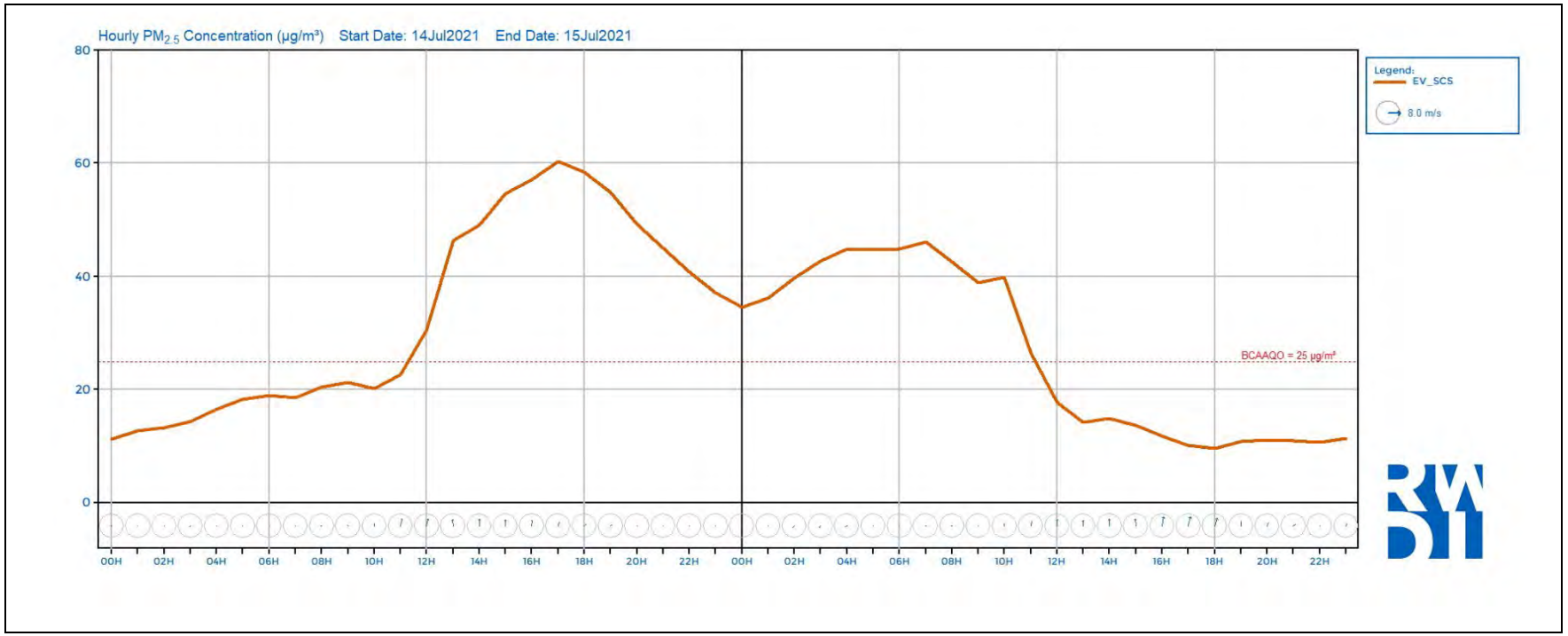


Figure C-7: Hourly $PM_{2.5}$ Concentration at EV_SCS on July 14, 2021.

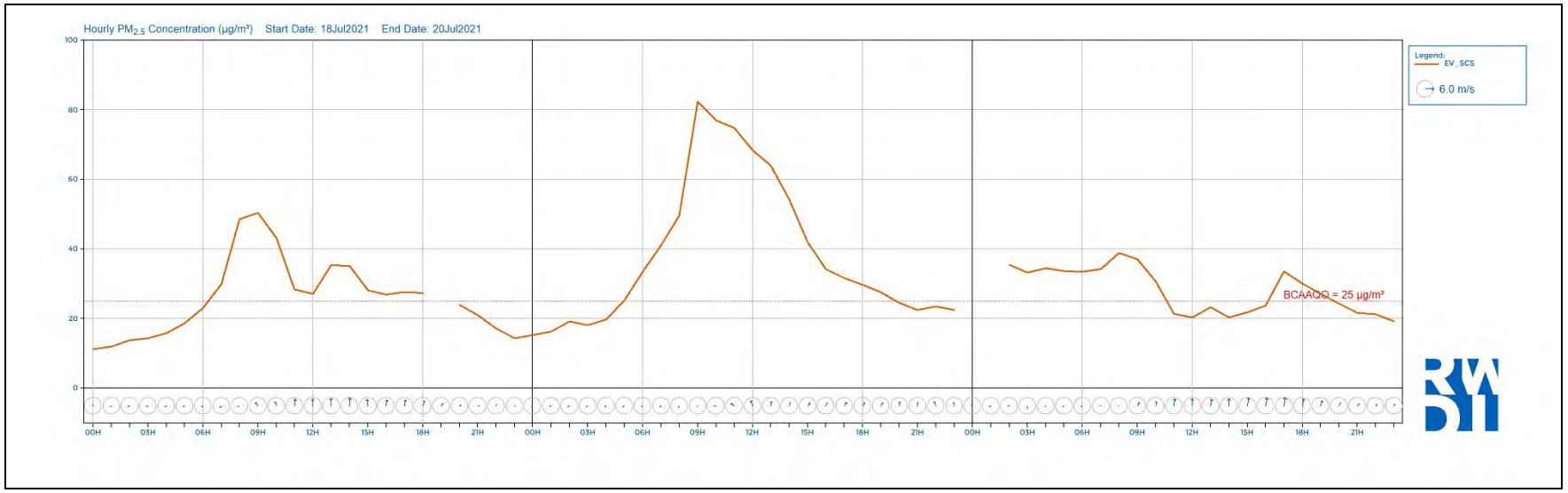


Figure C-8: Hourly $PM_{2.5}$ Concentration at EV_SCS on July 18-20, 2021.

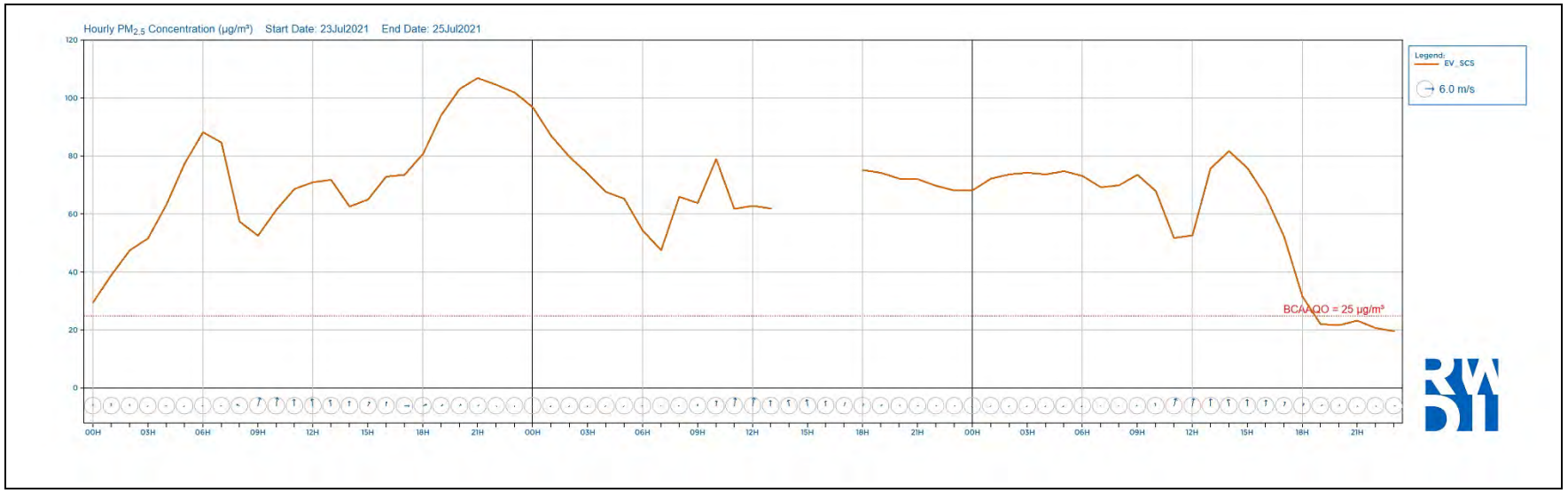


Figure C-9: Hourly $PM_{2.5}$ Concentration at EV_SCS on July 23-25, 2021.

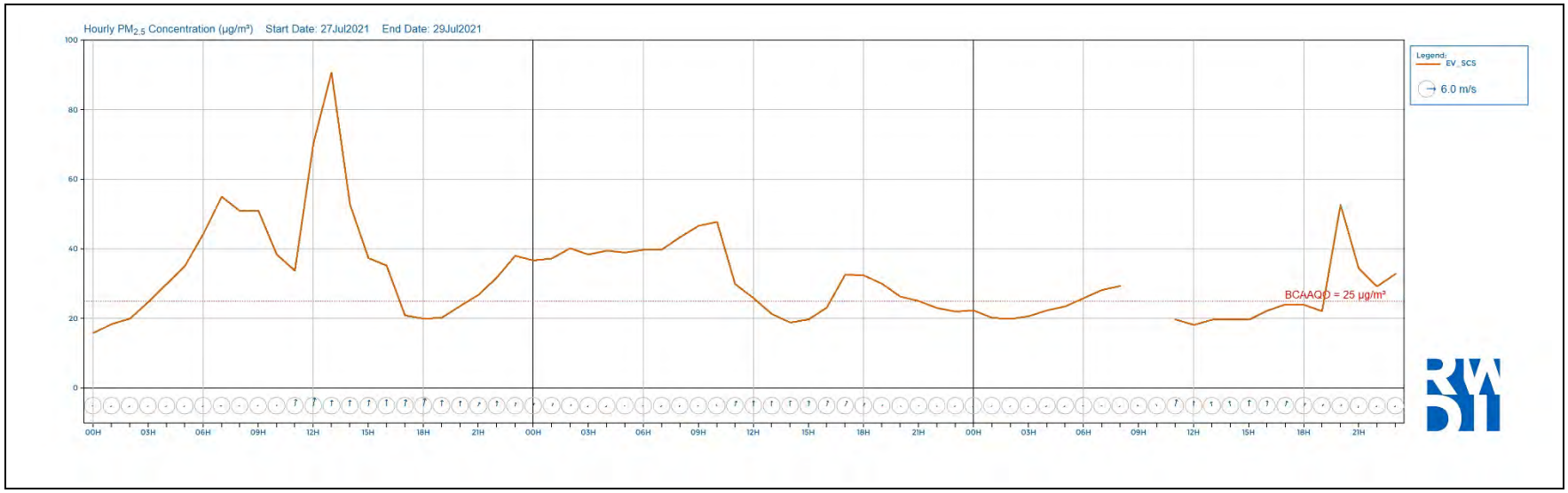


Figure C-10: Hourly $PM_{2.5}$ Concentrations at EV_SCS on July 27-29, 2021.

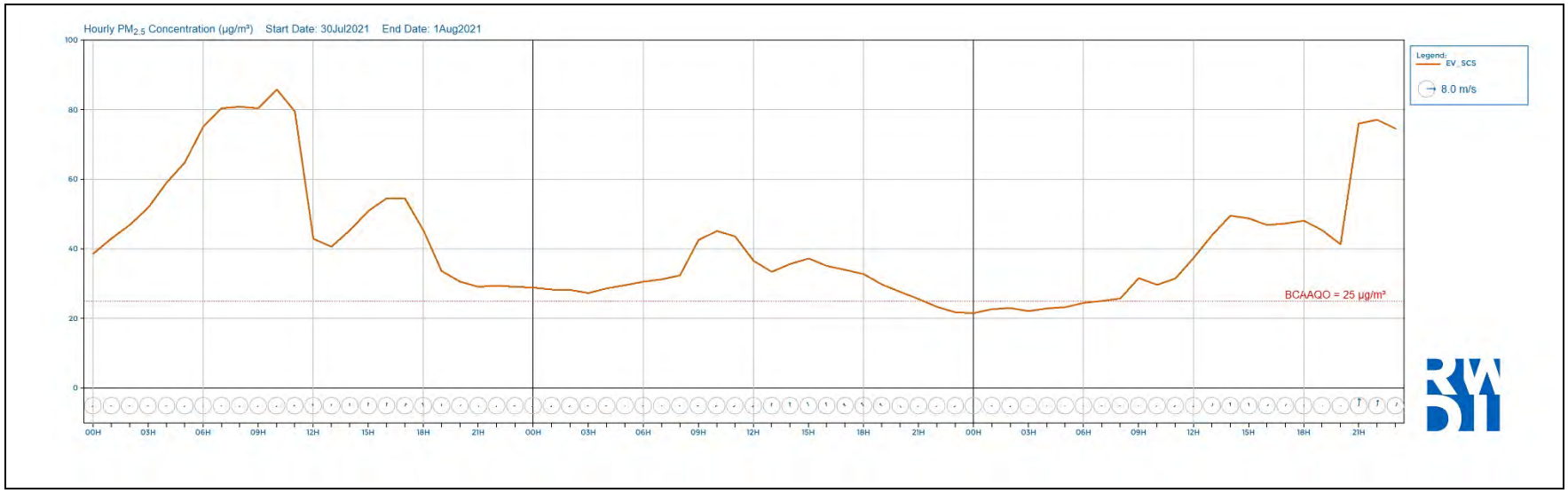


Figure C-11: Hourly $PM_{2.5}$ Concentration at EV_SCS on July 30-August 1, 2021.

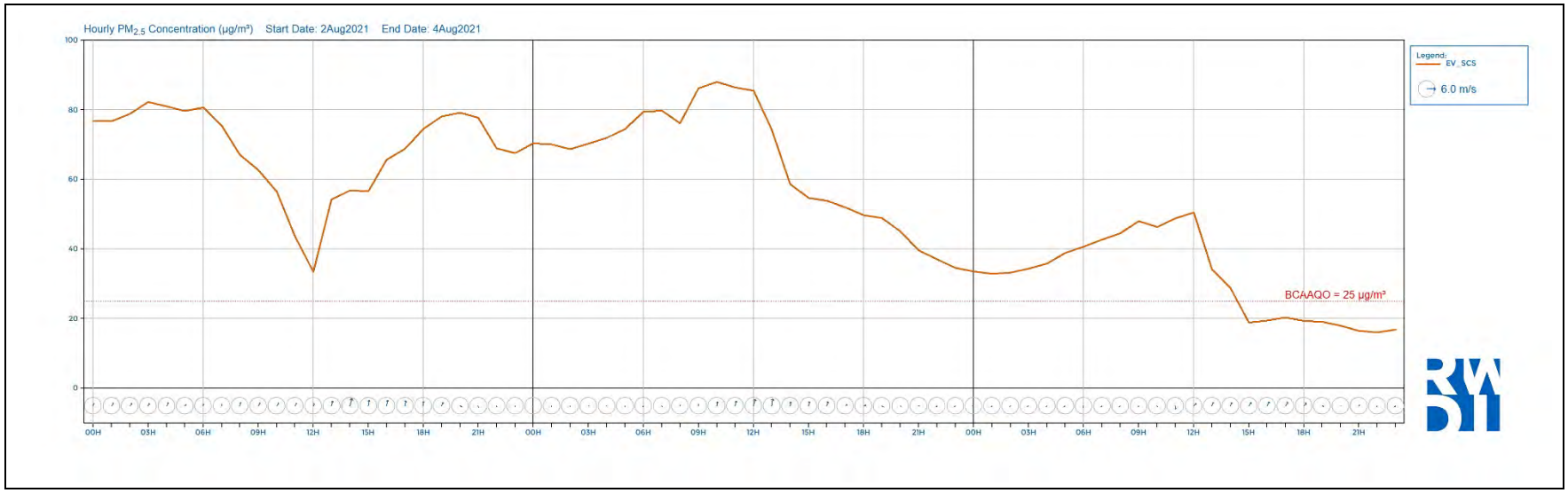


Figure C-12: Hourly $PM_{2.5}$ Concentrations at EV_SCS on August 2-4, 2021.

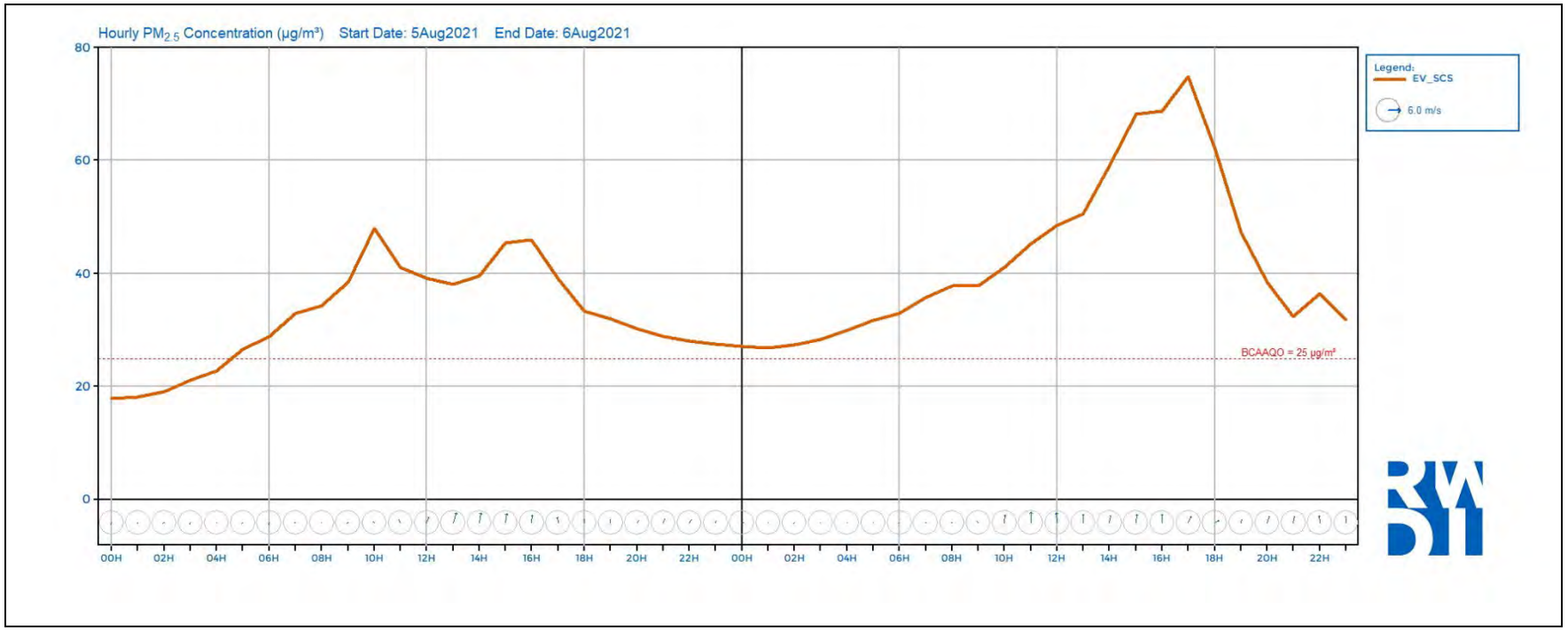


Figure C-13: Hourly $PM_{2.5}$ Concentrations at EV_SCS on August 5-6, 2021.

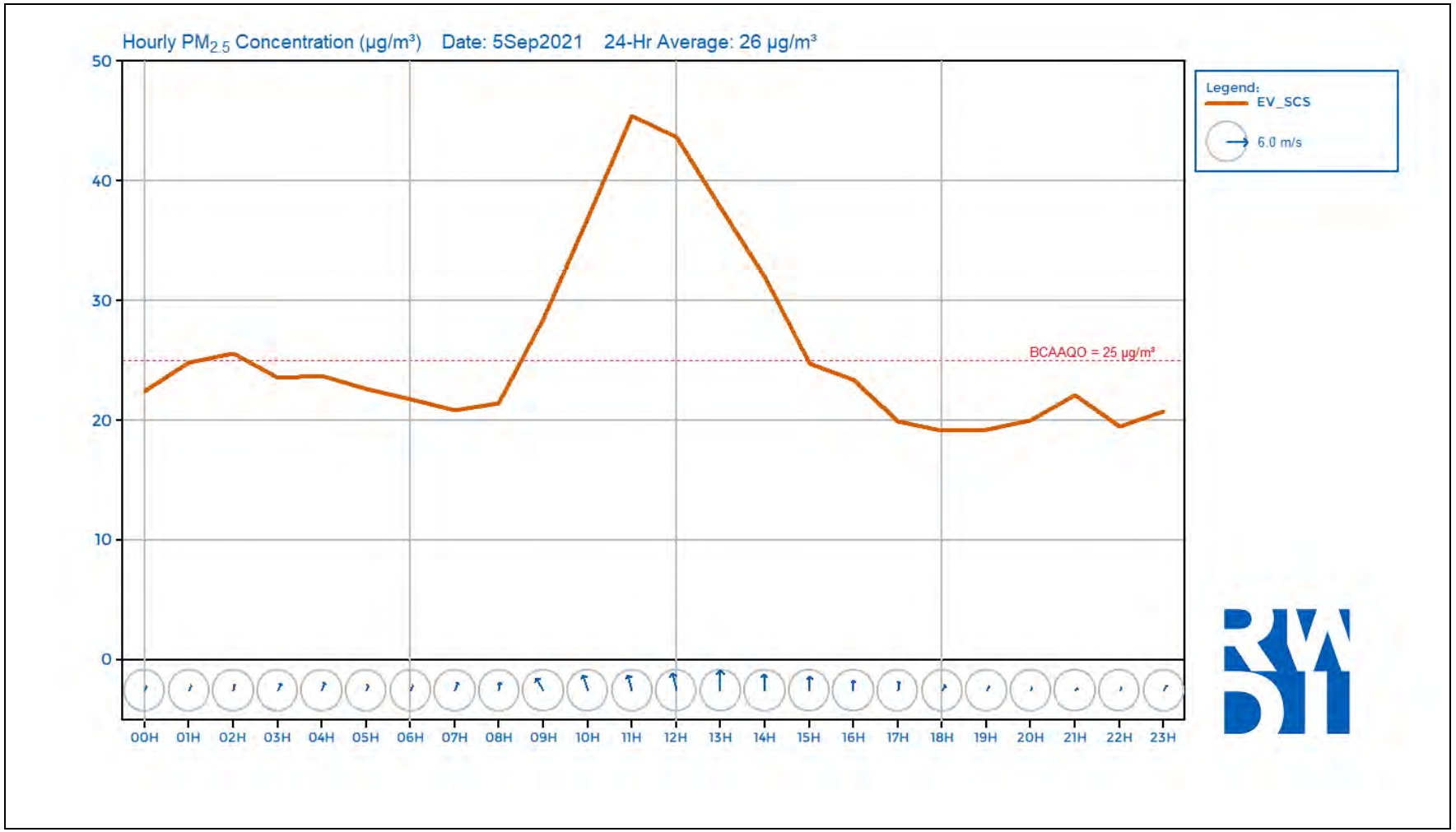


Figure C-14: Hourly $PM_{2.5}$ Concentrations at EV_SCS on September 5, 2021.

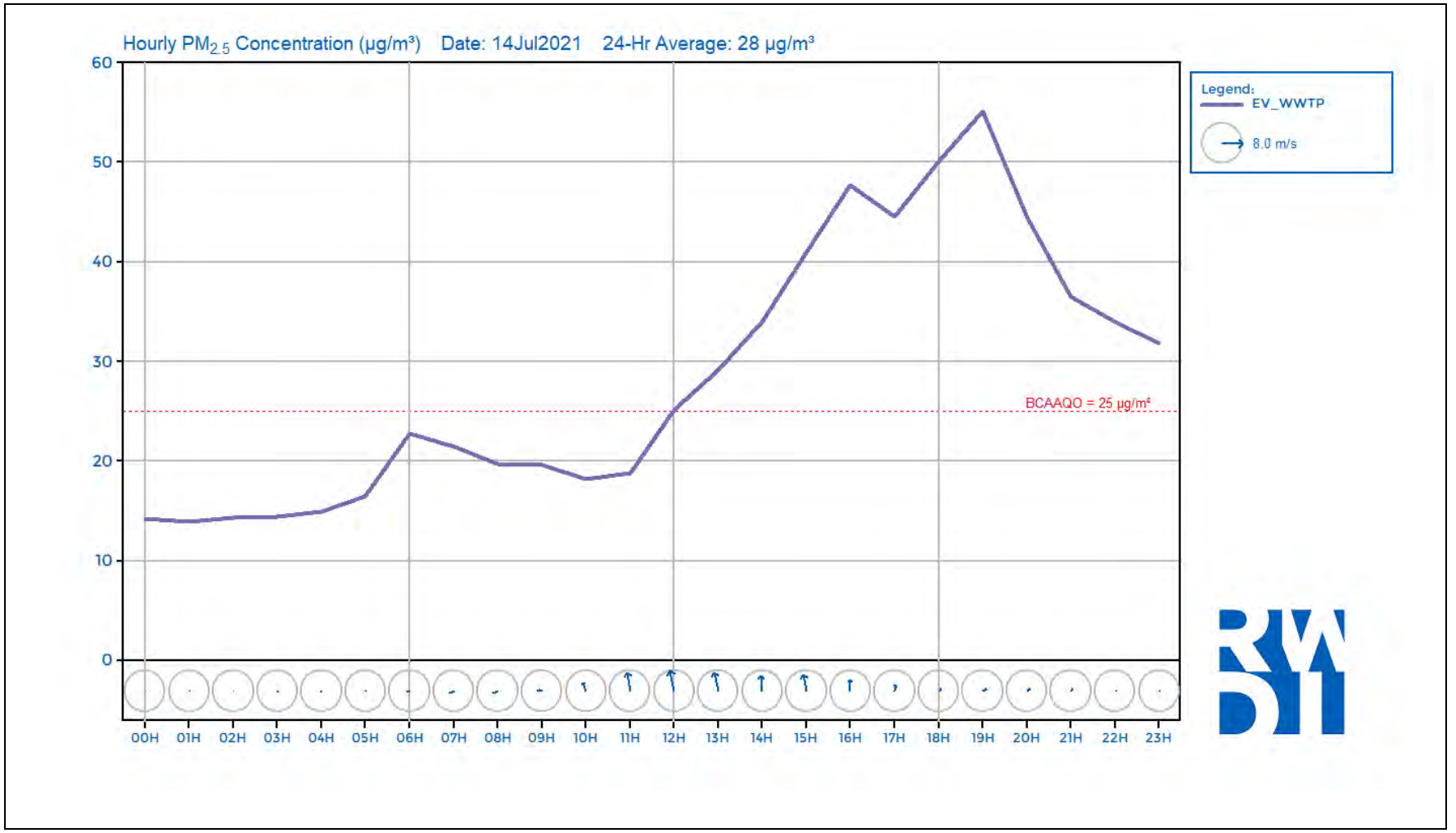


Figure C-15: Hourly $PM_{2.5}$ Concentrations at EV_WWTP on July 14, 2021.

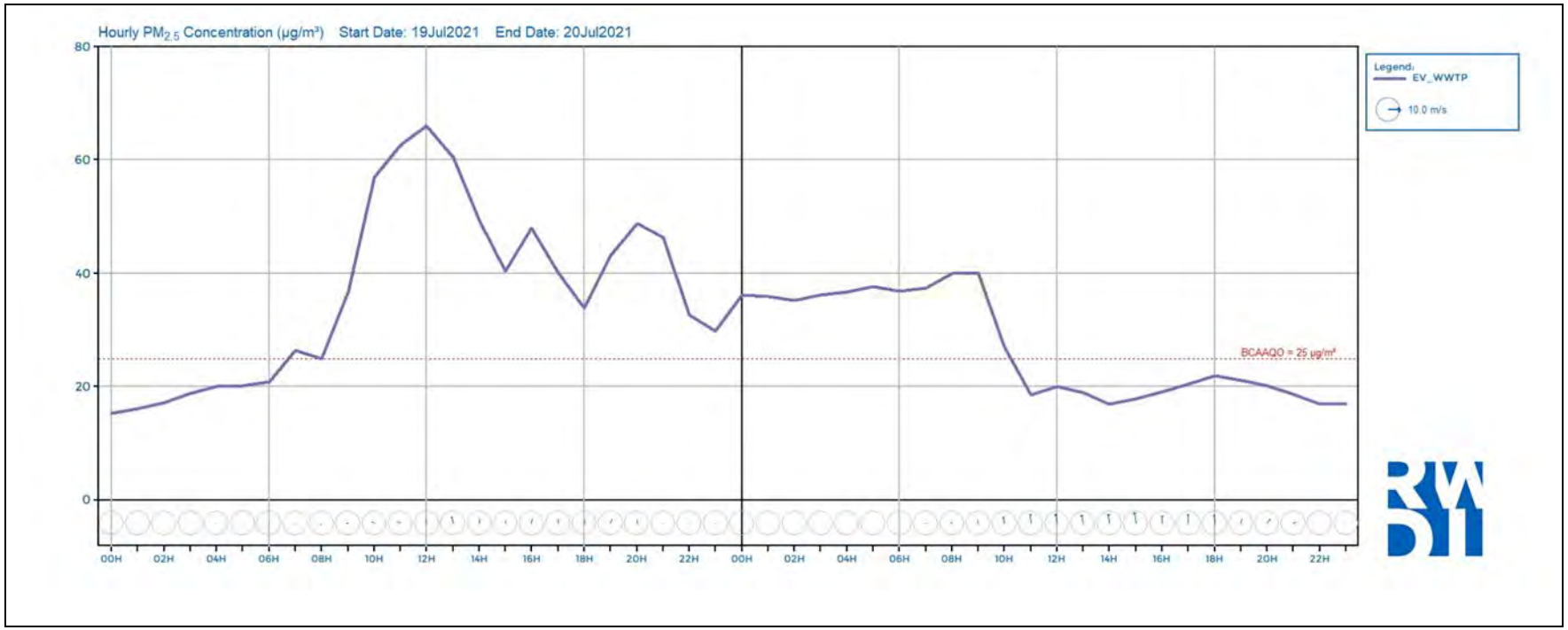


Figure C-16: Hourly $PM_{2.5}$ Concentrations at EV_WWTP on July 19-20, 2021.

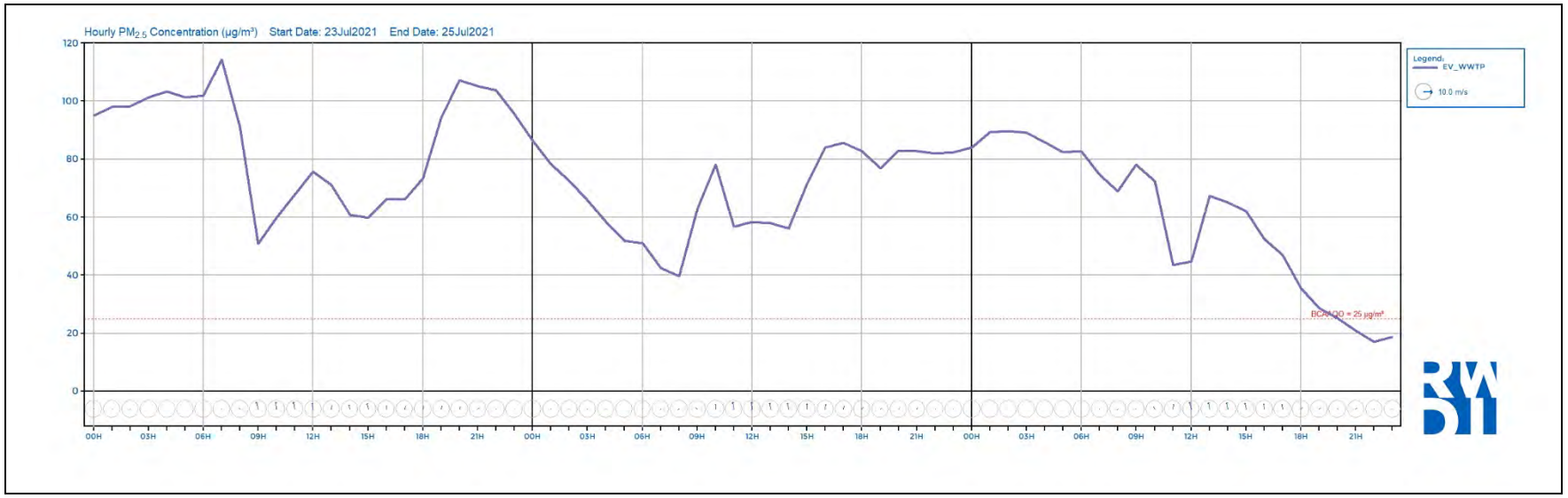


Figure C-17: Hourly $PM_{2.5}$ Concentrations at EV_WWTP on July 23-25, 2021.

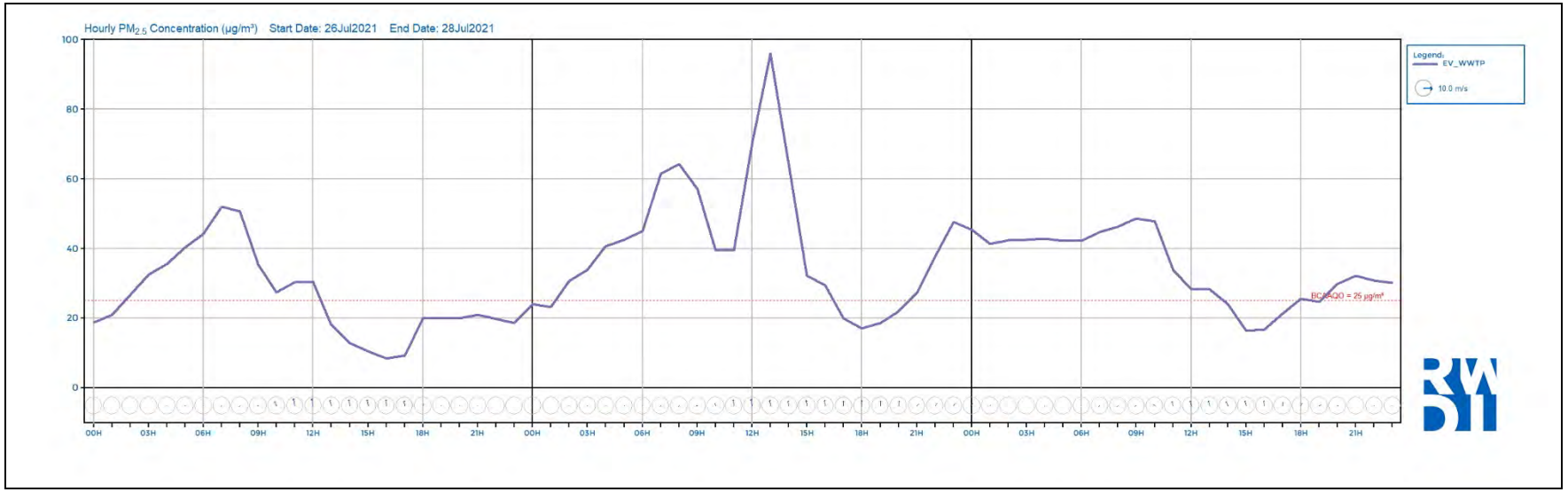


Figure C-18: Hourly $PM_{2.5}$ Concentrations at EV_WWTP on July 26, 2021.

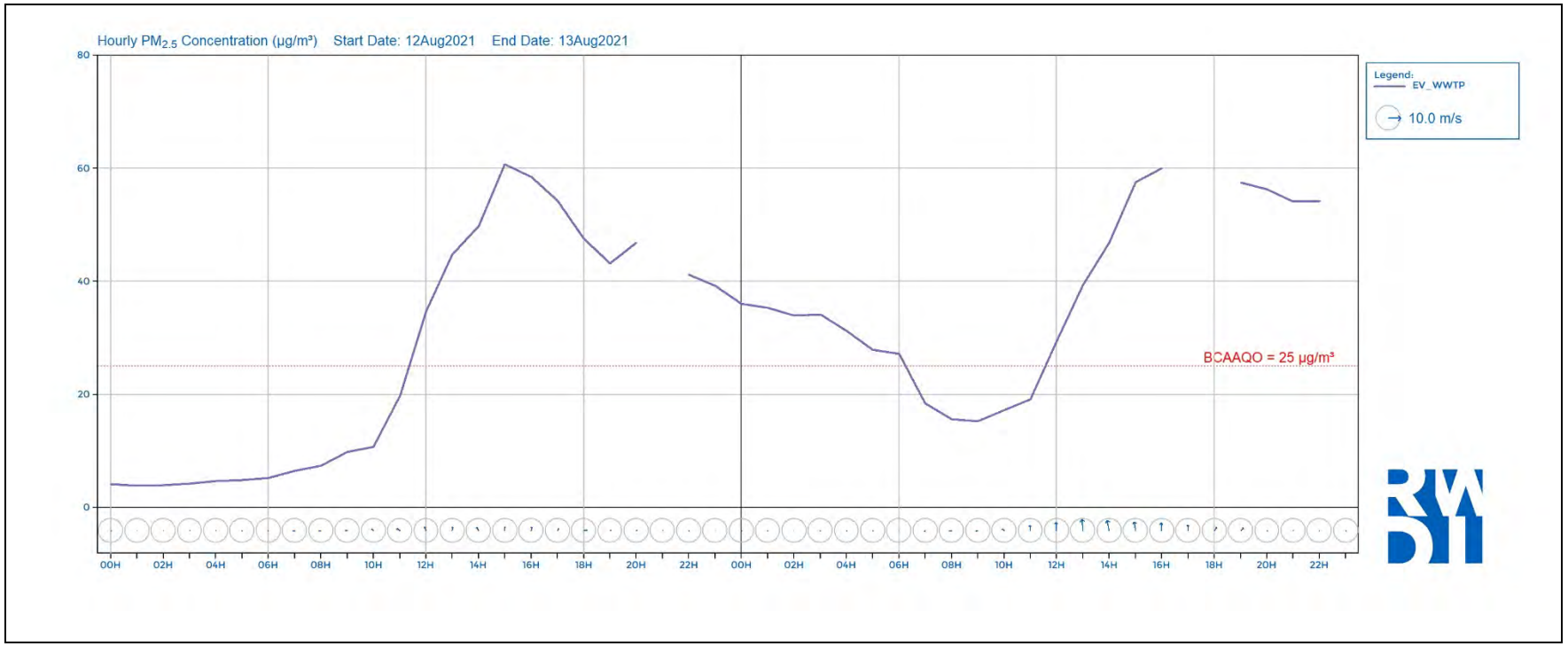


Figure C-19: Hourly $PM_{2.5}$ Concentrations at EV_WWTP on August 12-13, 2021.

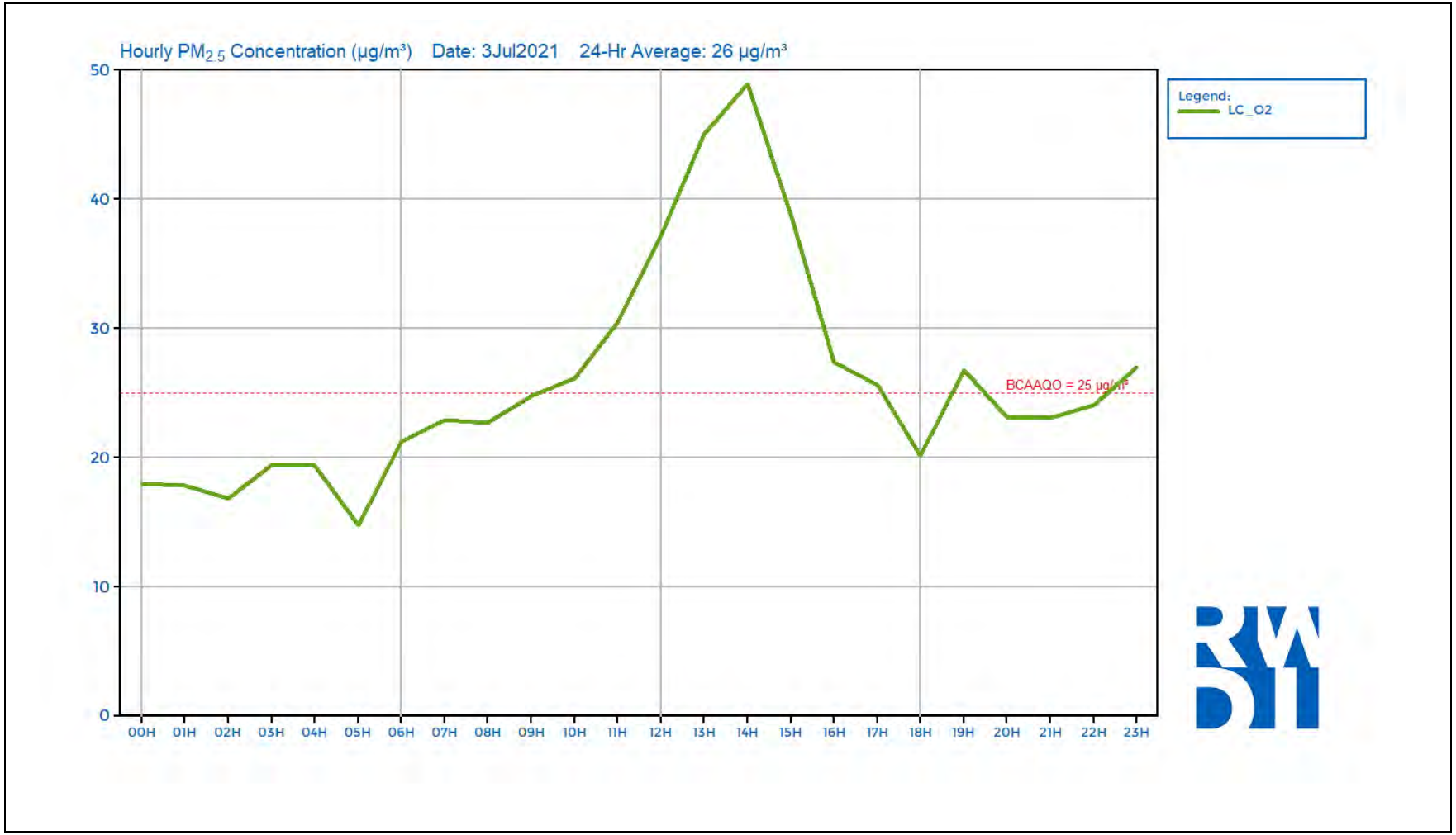


Figure C-20: Hourly $PM_{2.5}$ Concentrations at LC_02 on July 3, 2021.

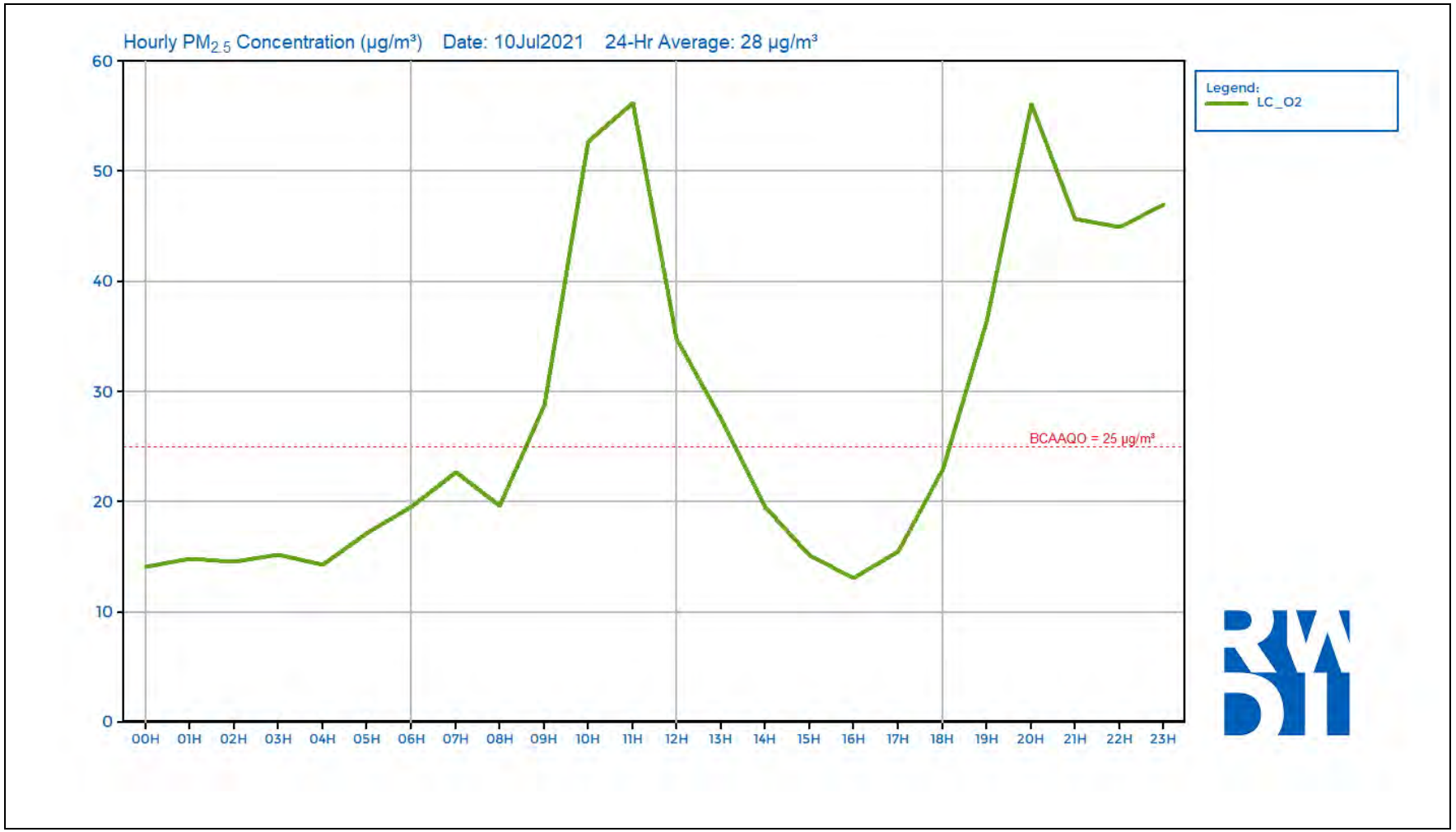


Figure C-21: Hourly $PM_{2.5}$ Concentrations at LC_02 on July 10, 2021.

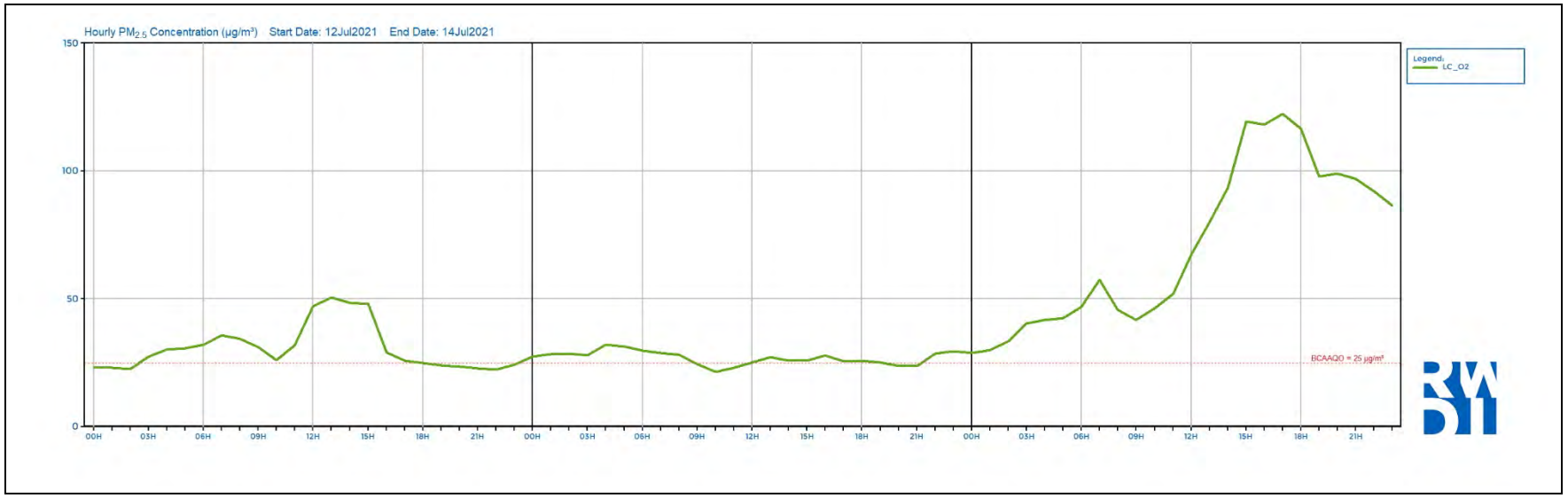


Figure C-22: Hourly $PM_{2.5}$ Concentrations at LC_02 on July 12-14, 2021.

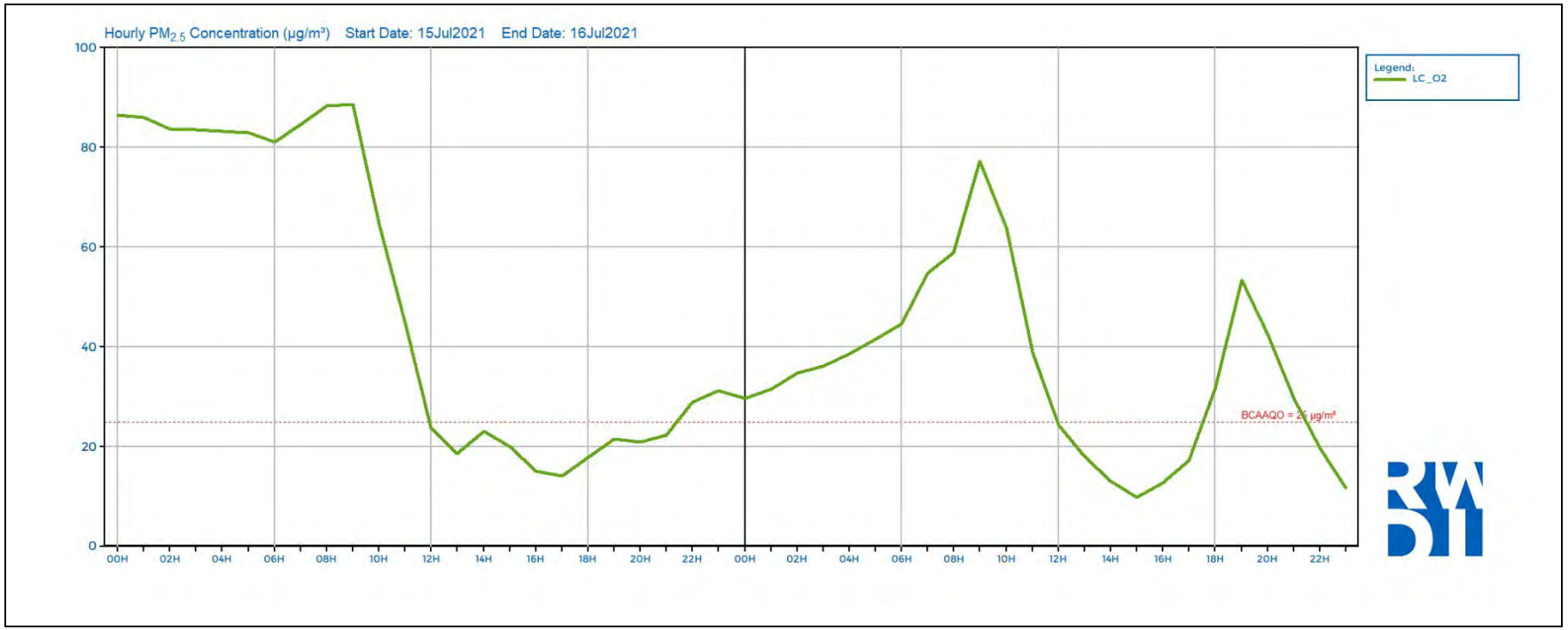


Figure C-23: Hourly $PM_{2.5}$ Concentrations at LC_02 on July 15-16, 2021.

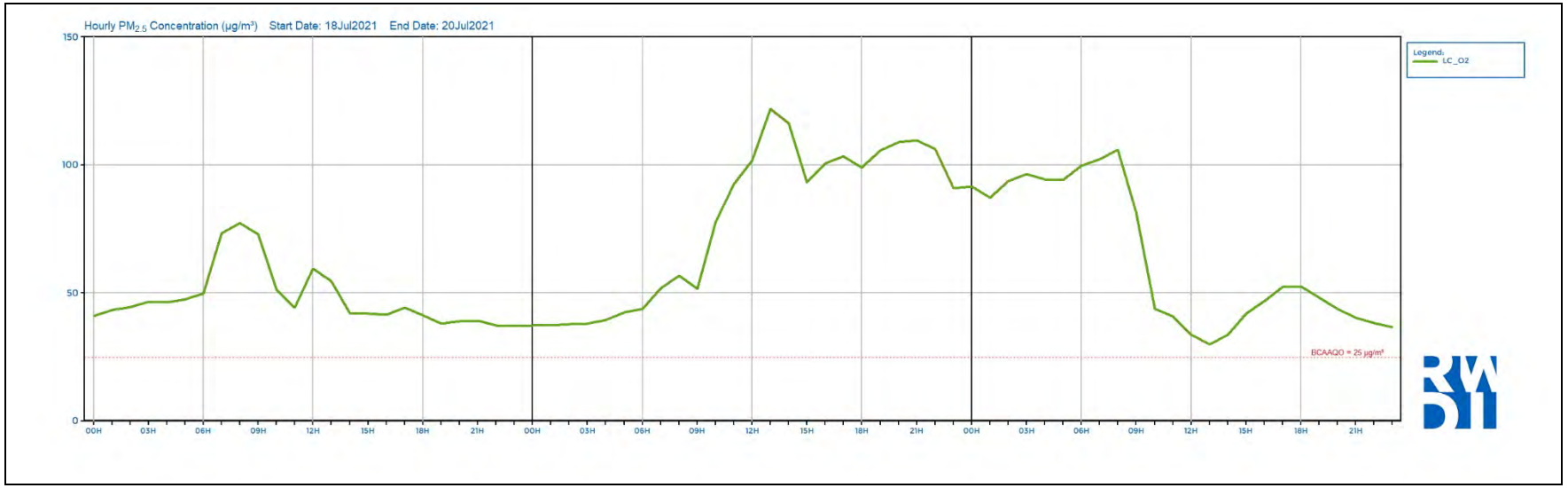


Figure C-24: Hourly $PM_{2.5}$ Concentrations at LC_02 on July 18-20, 2021.

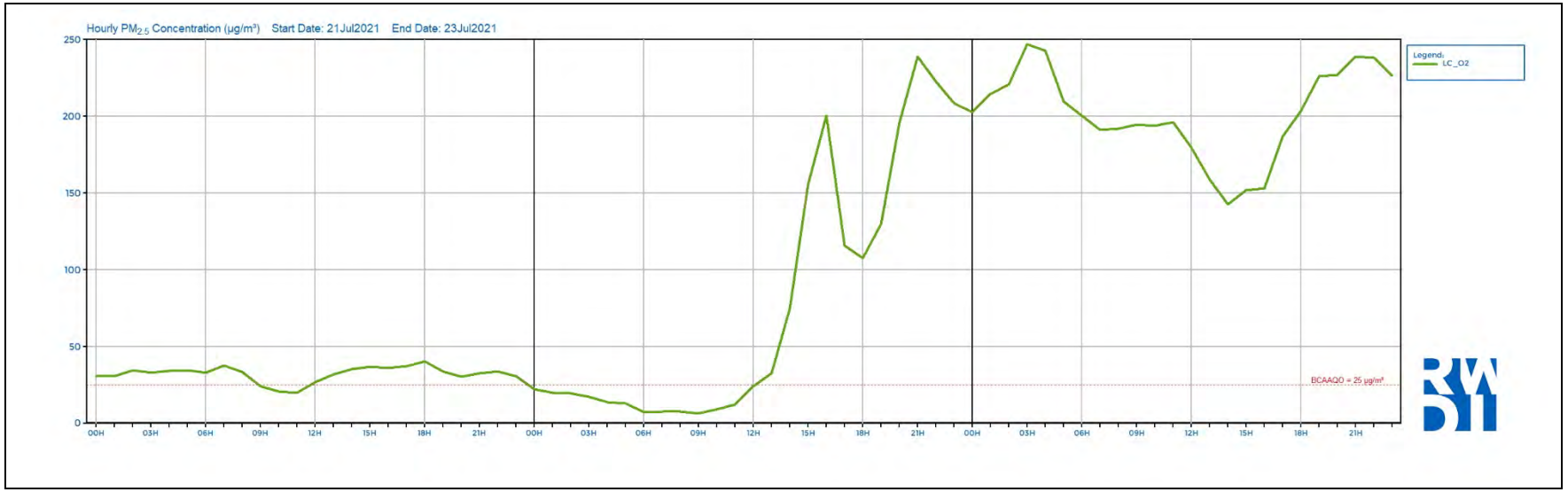


Figure C-25: Hourly $PM_{2.5}$ Concentrations at LC_02 on July 21-23, 2021.

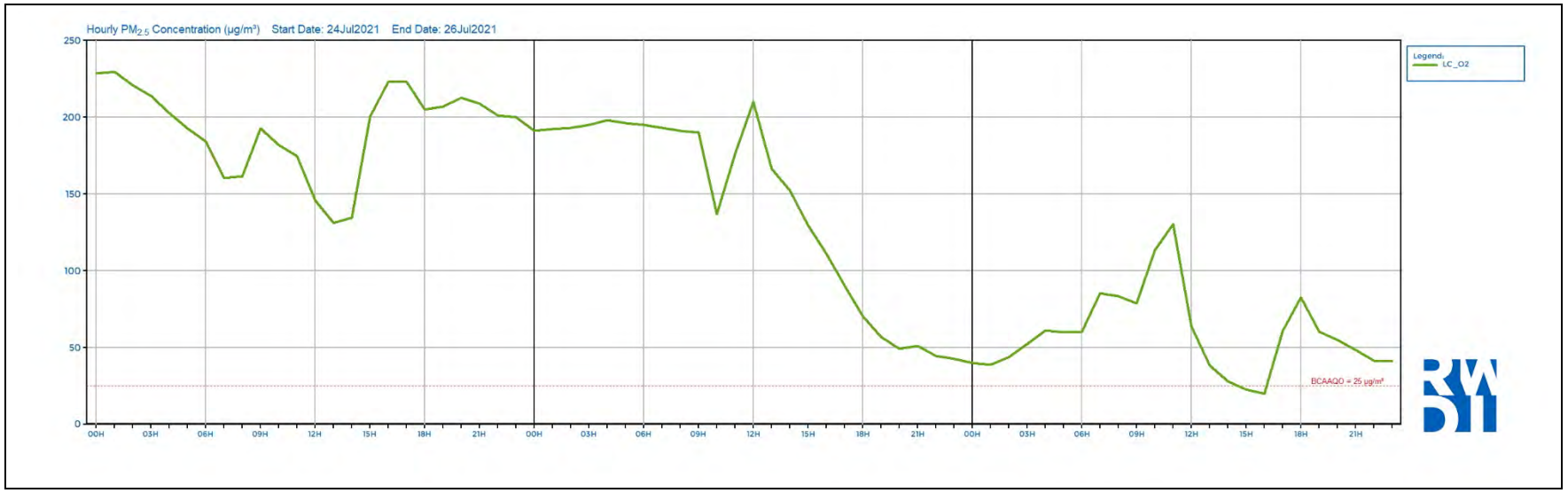


Figure C-26: Hourly $PM_{2.5}$ Concentrations at LC_02 on July 24-26, 2021.

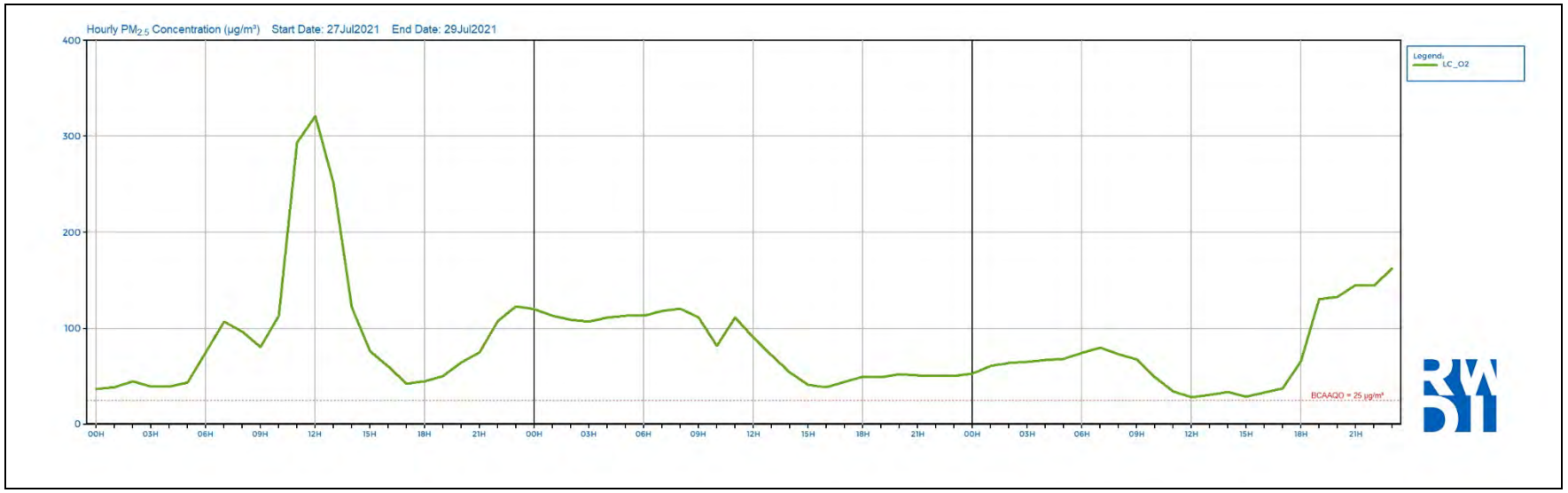


Figure C-27: Hourly $PM_{2.5}$ Concentrations at LC_02 on July 27-29, 2021.

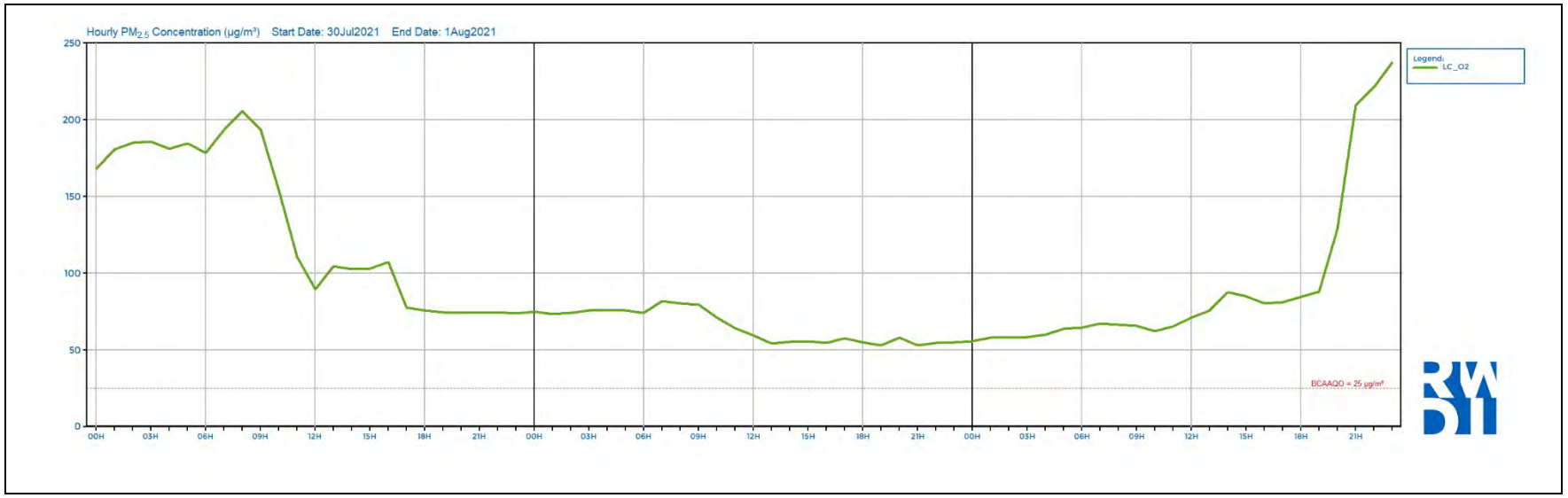


Figure C-28: Hourly $PM_{2.5}$ Concentrations at LC_02 on July 30-August 1, 2021.

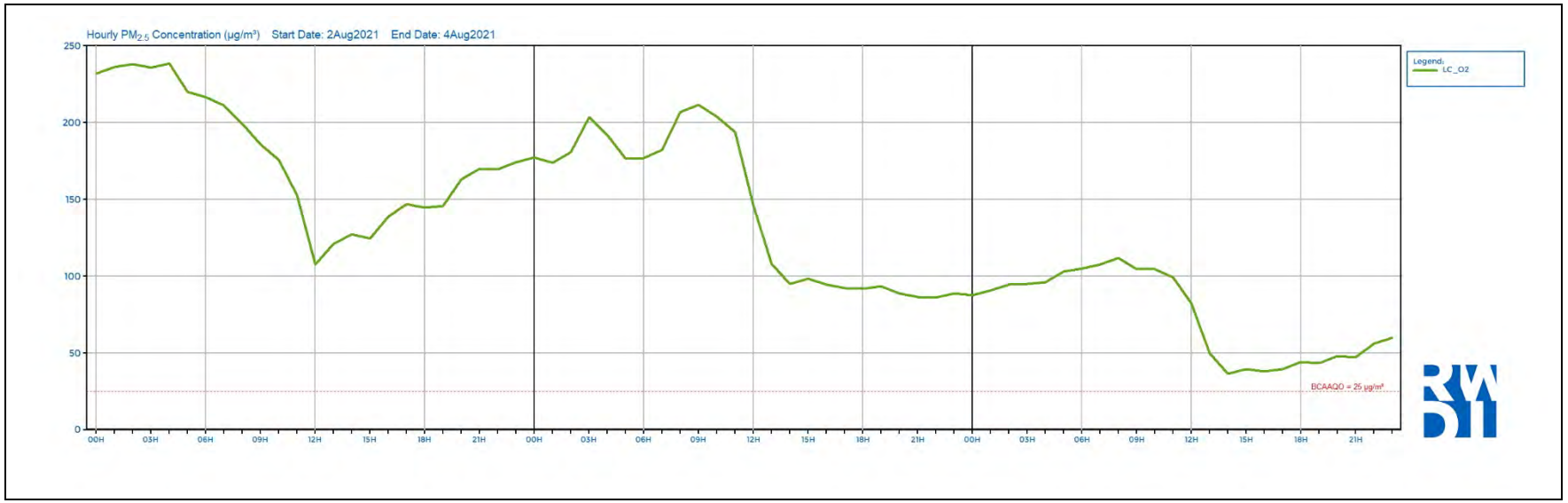


Figure C-29: Hourly $PM_{2.5}$ Concentrations at LC_02 on August 2-4, 2021.

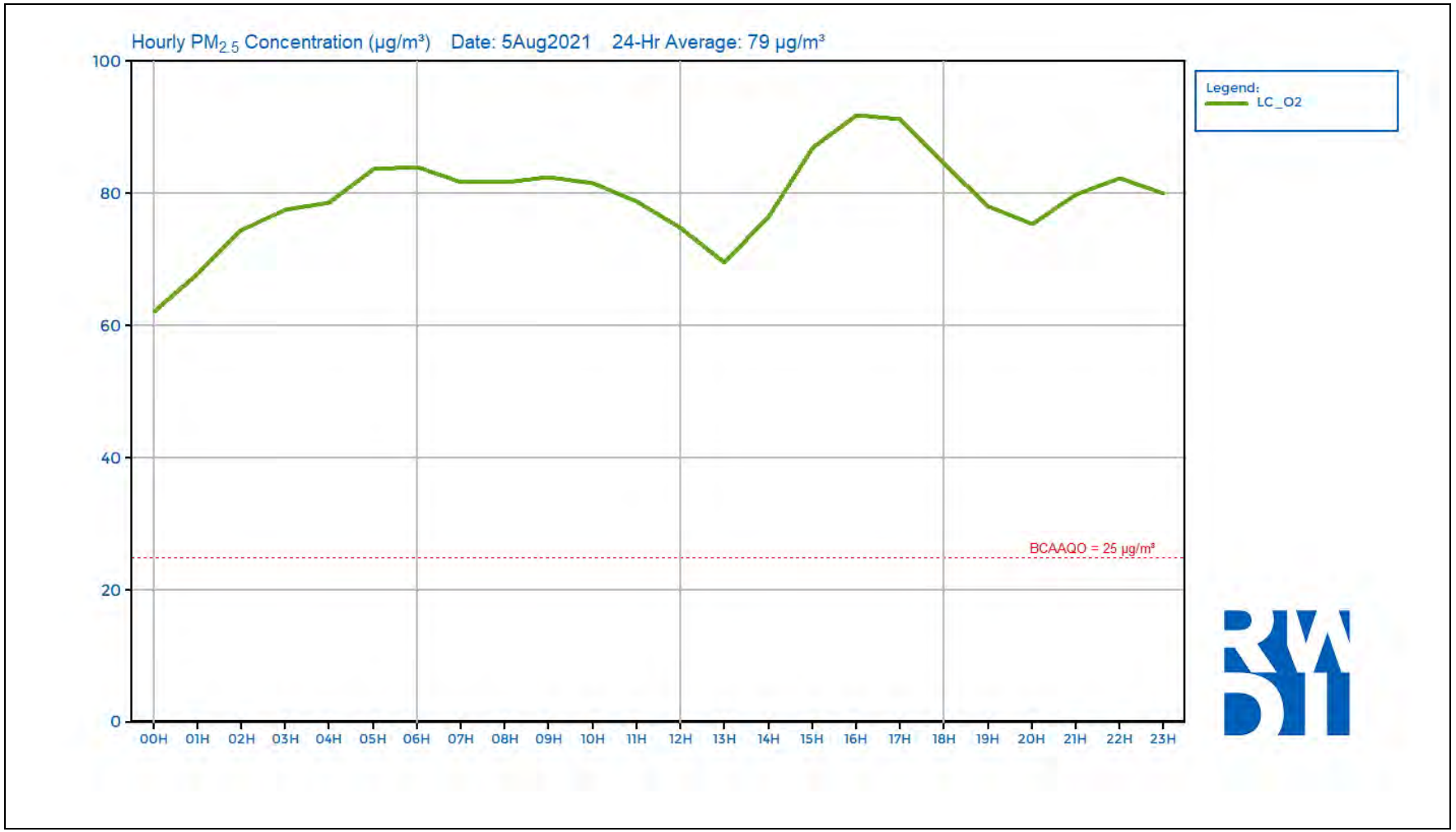


Figure C-30: Hourly $PM_{2.5}$ Concentrations at LC_02 on August 5, 2021.

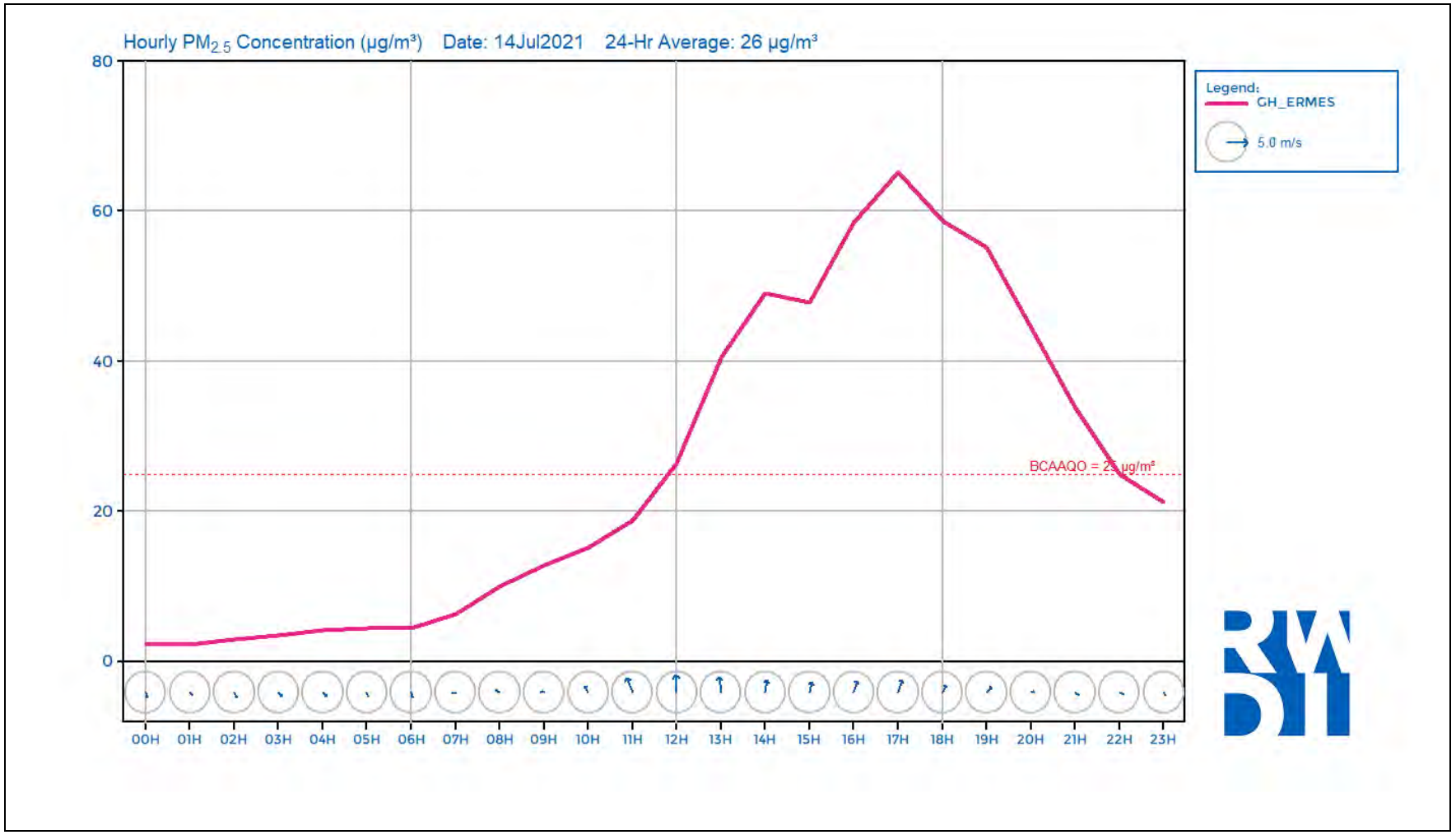


Figure C-31: Hourly $PM_{2.5}$ Concentration at GH_ERMES on July 14, 2021.

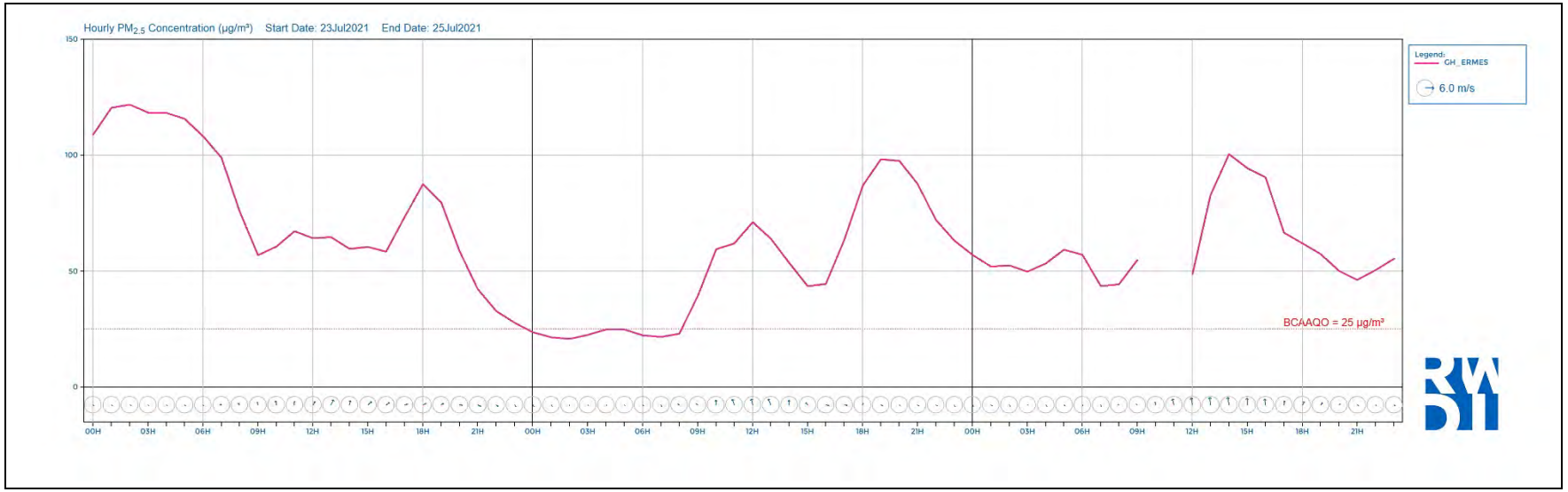


Figure C-32: Hourly $PM_{2.5}$ Concentration at GH_ERMES on July 23-25, 2021.

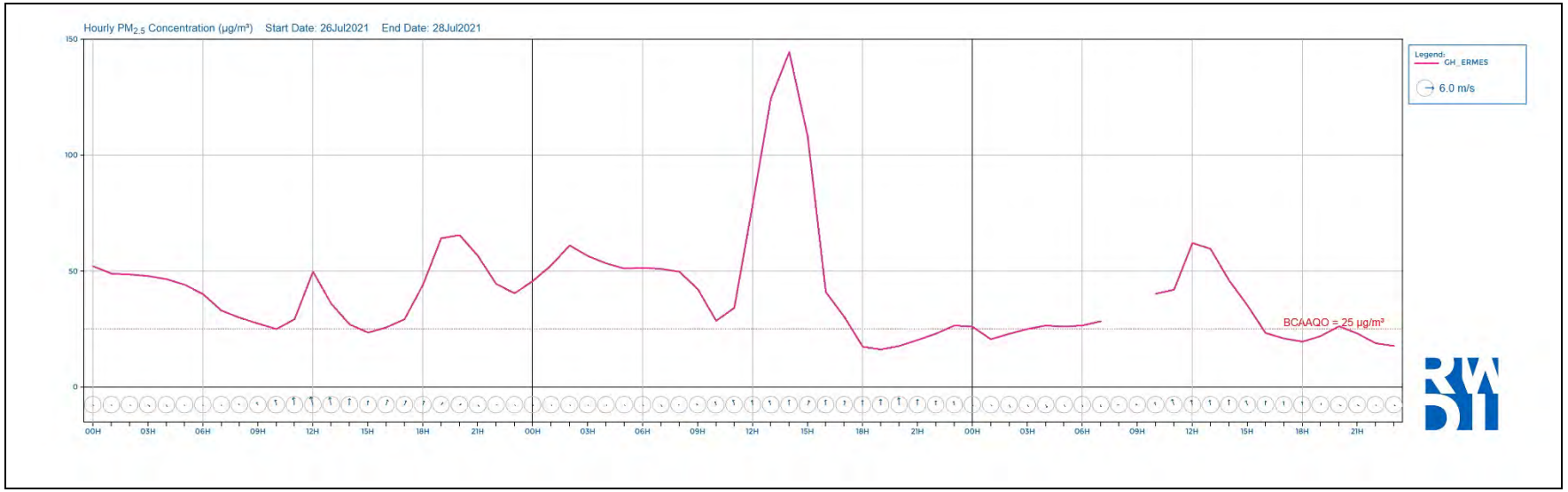


Figure C-33: Hourly $PM_{2.5}$ Concentration at GH_ERMES on July 26-28, 2021.

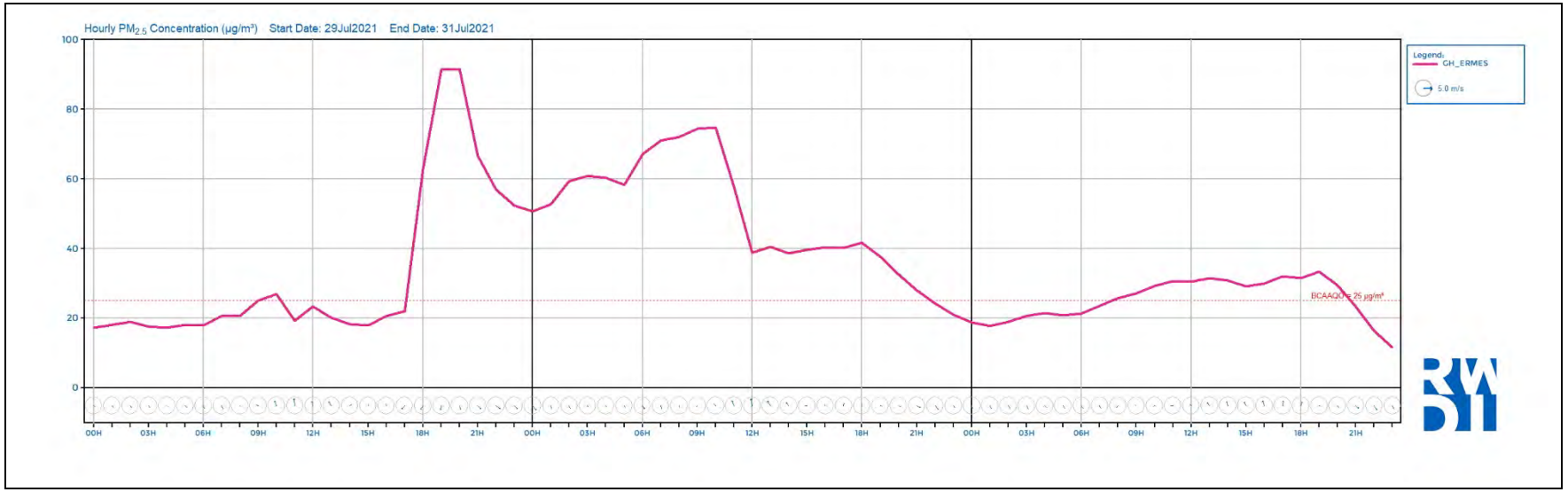


Figure C-34: Hourly $PM_{2.5}$ Concentration at GH_ERMES on July 29-31, 2021.

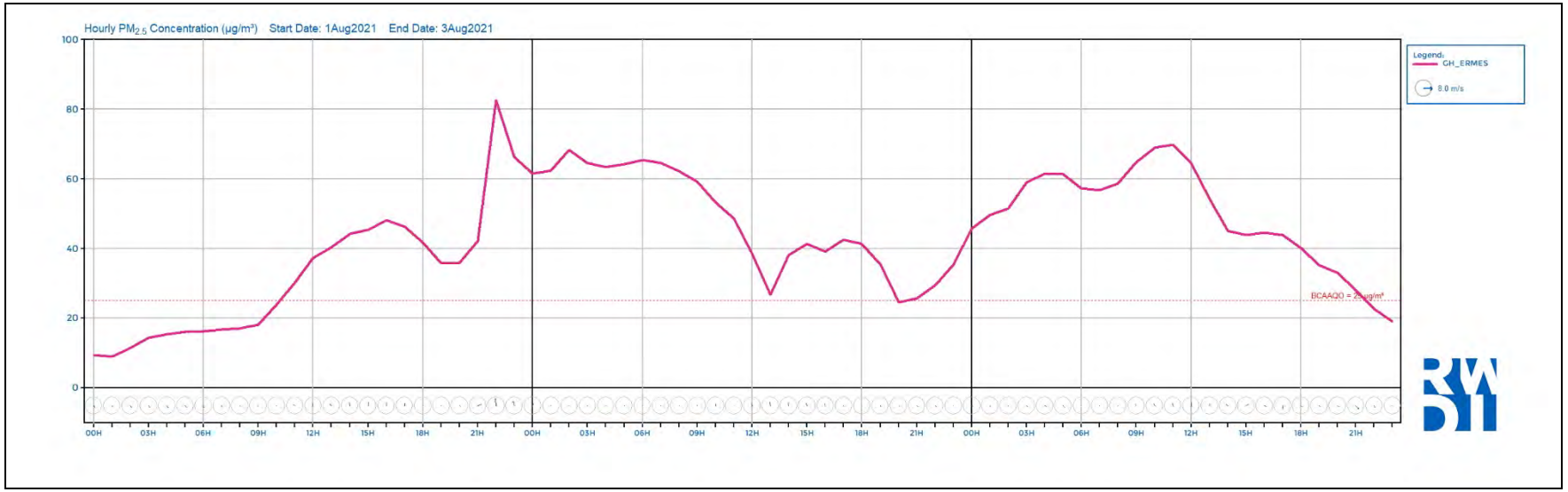


Figure C-35: Hourly $PM_{2.5}$ Concentration at GH_ERMES on August 1-3, 2021.

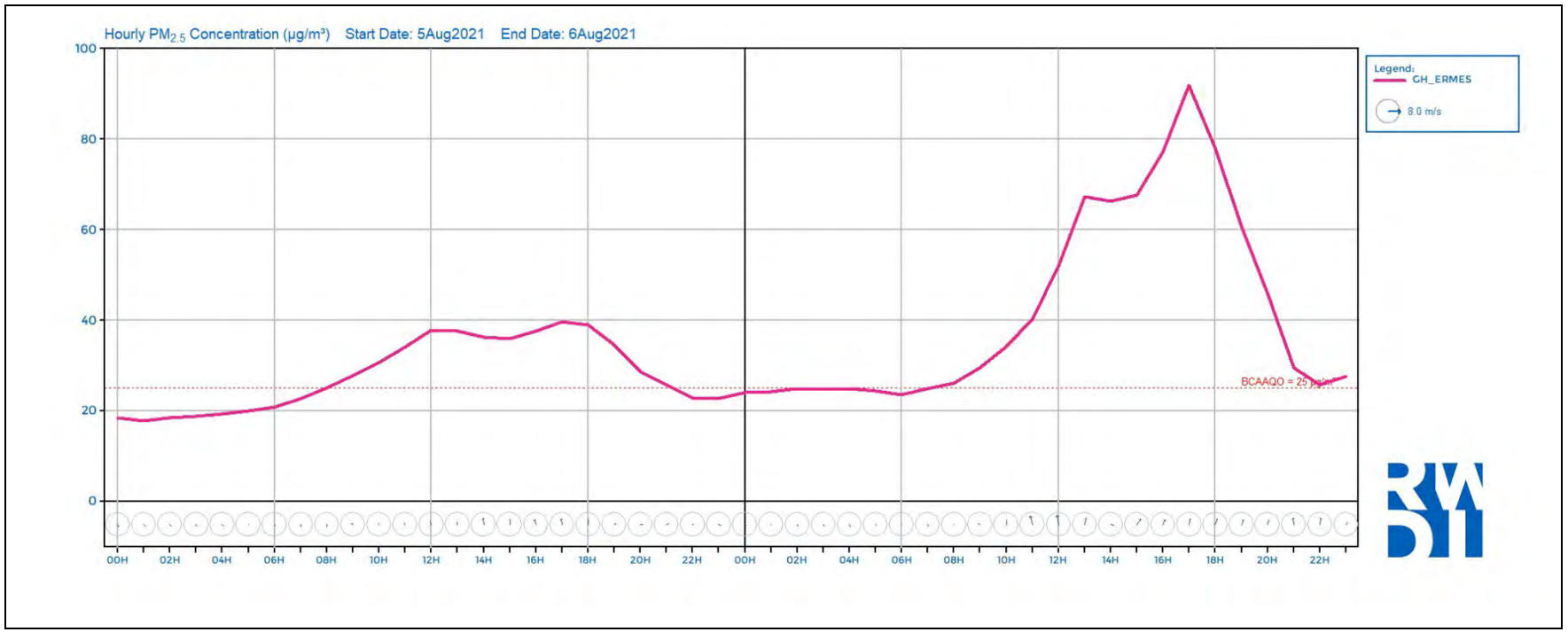


Figure C-36: Hourly $PM_{2.5}$ Concentration at GH_ERMES on August 5-6, 2021.

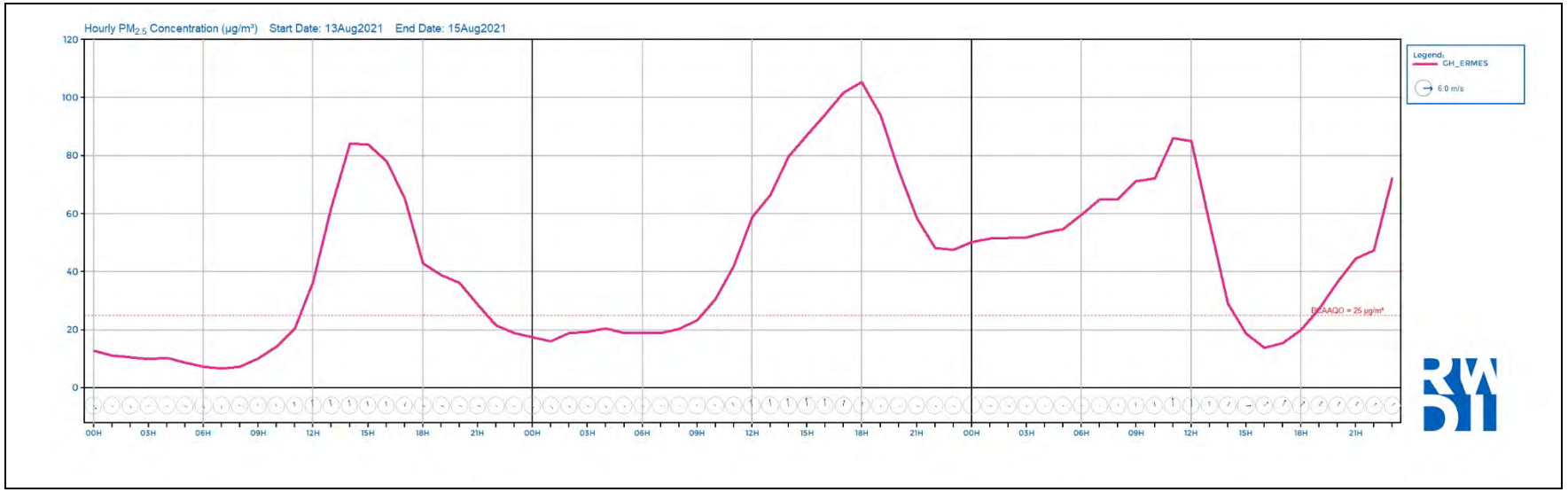


Figure C-37: Hourly $PM_{2.5}$ Concentration at GH_ERMES on August 13-15, 2021.

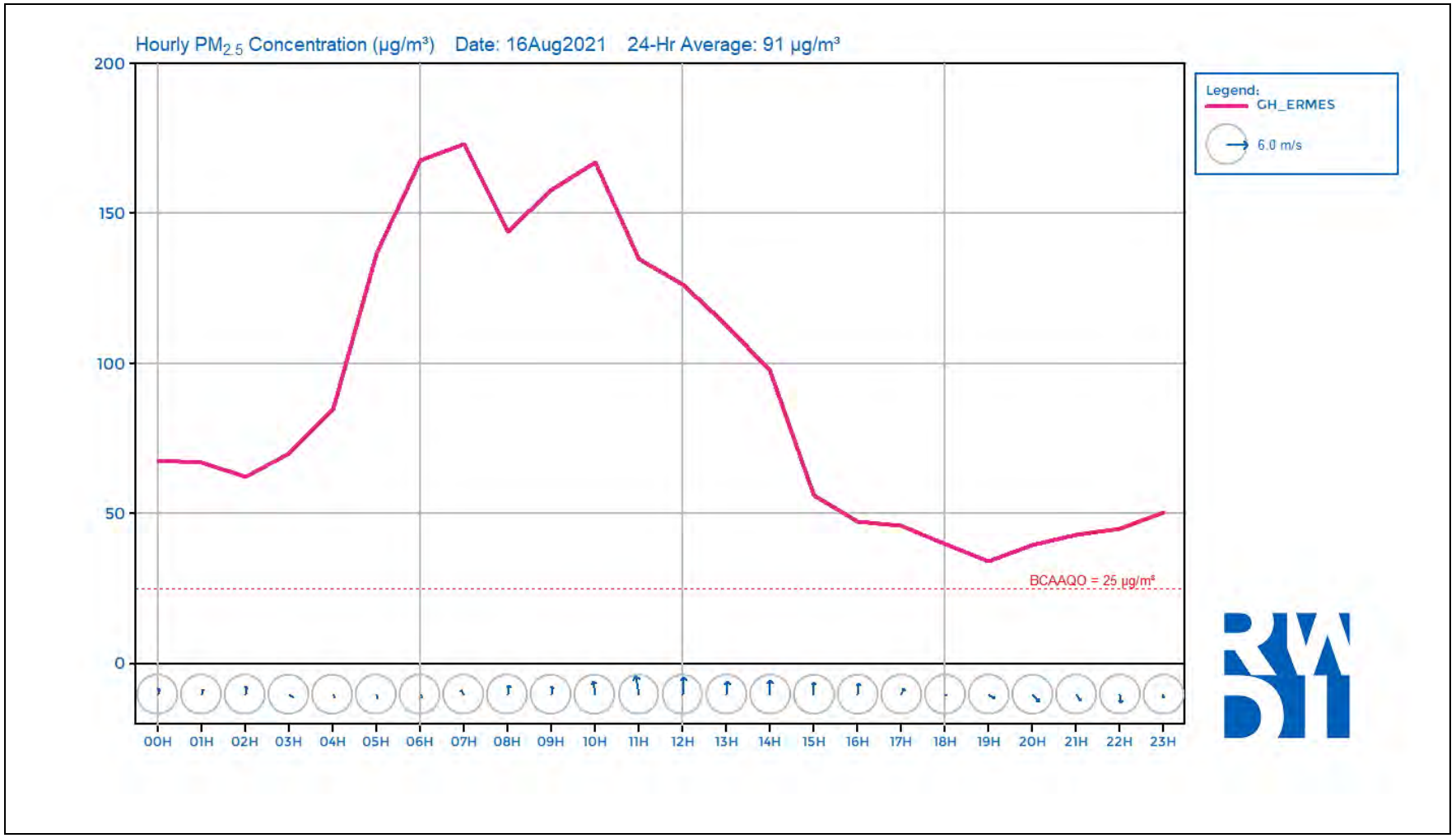


Figure C-38: Hourly $PM_{2.5}$ Concentration at GH_ERMES on August 16, 2021.

APPENDIX D

APPENDIX D: REPRESENTATIVENESS OF BAROMETRIC PRESSURE READINGS AT HOSMER STATION

Teck's Regional Air Quality Monitoring Program states that barometric pressure is to be measured at the Hosmer regional monitoring station (Figure 1). BC ENV requires that a technical appendix be provided to justify the use of barometric pressure measurements at this station to represent conditions in the whole of the Elk Valley.

Barometric pressure typically shows little variation over horizontal differences on the scale of the Elk Valley. Much greater changes are expected with differences in elevation between stations. These changes due to elevation can be accounted for by correcting barometric pressure measurements to equivalent sea level pressures. This is done using the following empirical relationship (Campbell Scientific, 2019):

$$dP = 1013.25\left\{1 - \left(1 - \frac{E}{44307.69231}\right)^{5.25328}\right\} \quad (1)$$

where dP is the estimated difference in pressure between mean sea-level and the site and E is the elevation in m.

Barometric pressures corrected to sea level from the Hosmer regional station are compared to corrected pressures at the GHO-Office station in Figure D-1. The latter is not part of the RAQMP but is the station in the network with the highest elevation (1,976 m above mean sea level). Hosmer (elevation 1,058 m) is 55 km from GHO-Office and has the lowest elevation among Teck Coal's Elk Valley stations.

Figure D-1 includes a linear fit on which the slope has been set to 1 to better reflect the expected relationship between stations. Constraining the slope of the fit has very little effect on the distribution of residuals and was therefore considered permissible. An offset of 3.4 hPa is found and is likely due to a difference in temperatures between the two stations additional to that expected due to elevation and not accounted for by the equation (1).

Similar comparisons were performed between Hosmer and the remaining stations operated by Teck Coal measuring barometric pressure in the Elk Valley: FRO's South Station (1,582 m asl) and EVO's Sparwood Heights station (1,147 m asl) in Figure D-2 and Figure D-3. Similarly small offsets of 3.6 and 2.3 hPa respectively were found. Figure D-4 presents a timeseries of barometric pressure measurements at each of the four stations to allow for visual inspection. Twenty-four hour rolling averages are used to smooth the data for presentation. For the most part, the difference between stations remains constant, further supporting the slope of 1 to fit the comparison between stations and deviations from this trend are rare, mostly occurring in the winter months when the weather patterns are dominated by frontal activity.

Figure D-5 is a correlation plot of the 2021 barometric pressure data from all four stations. The intersections represent the pairwise Pearson correlation coefficients (*r*). The bottom row are comparisons between Hosmer and the other three stations. Correlation coefficients range from 0.86 for the Office station to 0.96 for the Sparwood Heights station which indicates good agreement of the barometric pressure measured at all of these

stations to the pressure at the Hosmer regional station. As expected, the best agreement is found at the Sparwood Heights station whose location and elevation are closest to Hosmer.

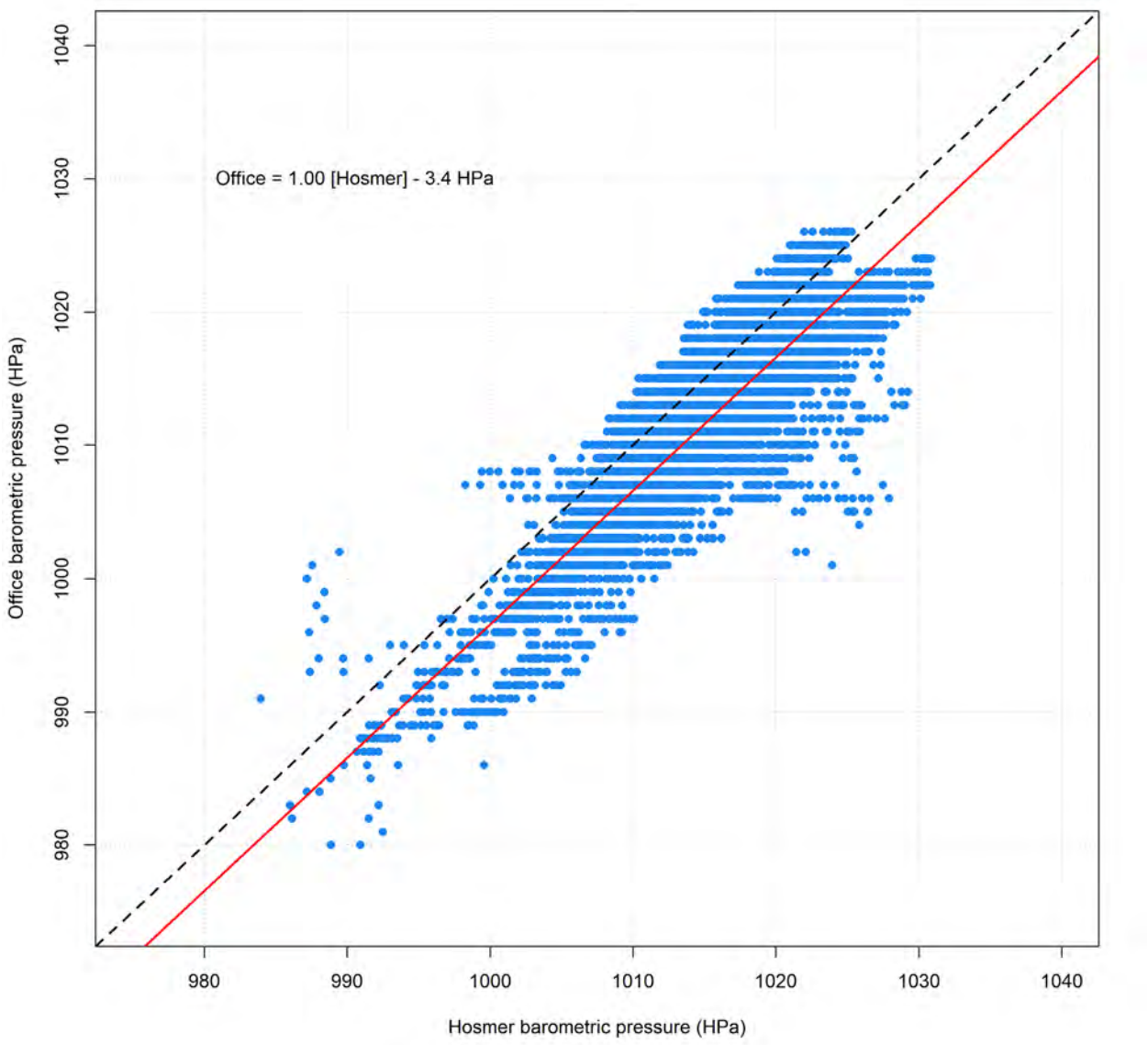


Figure D-1: Scatterplot of barometric pressure measurements taken at the GHO-Office station compared to pressure measured at the Hosmer regional monitoring station in 2021.

Notes: - The red solid line is a linear fit to the data and the black dashed line is a 1:1 line for comparison.
- Barometric pressure from both stations is corrected to sea-level.

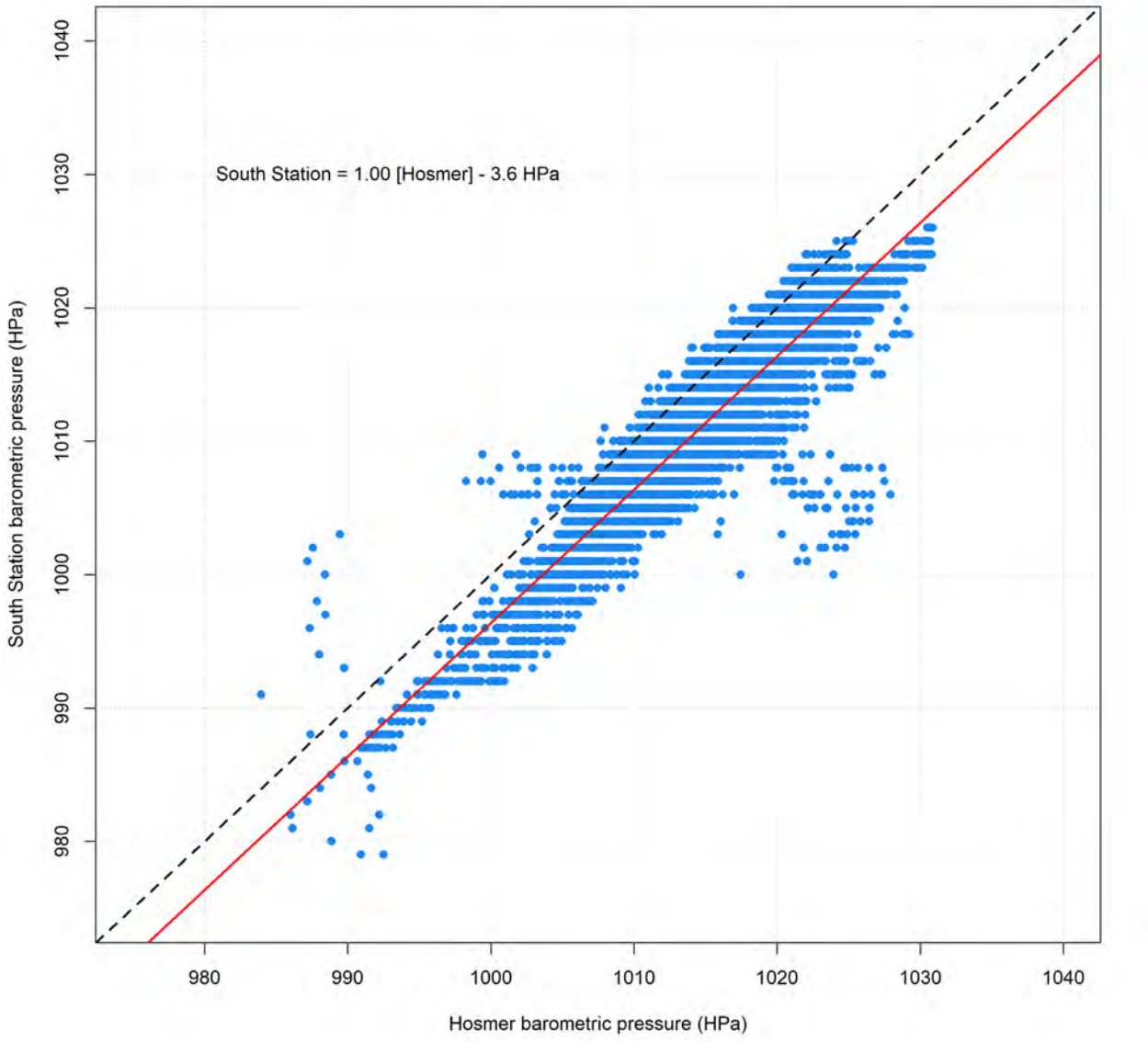


Figure D-2: Scatterplot of barometric pressure measurements taken at FRO's South Station compared to pressure measured at the Hosmer regional monitoring station in 2021.

Notes: - The red solid line is a linear fit to the data and the black dashed line is a 1:1 line for comparison.
- Barometric pressure from both stations is corrected to sea-level.

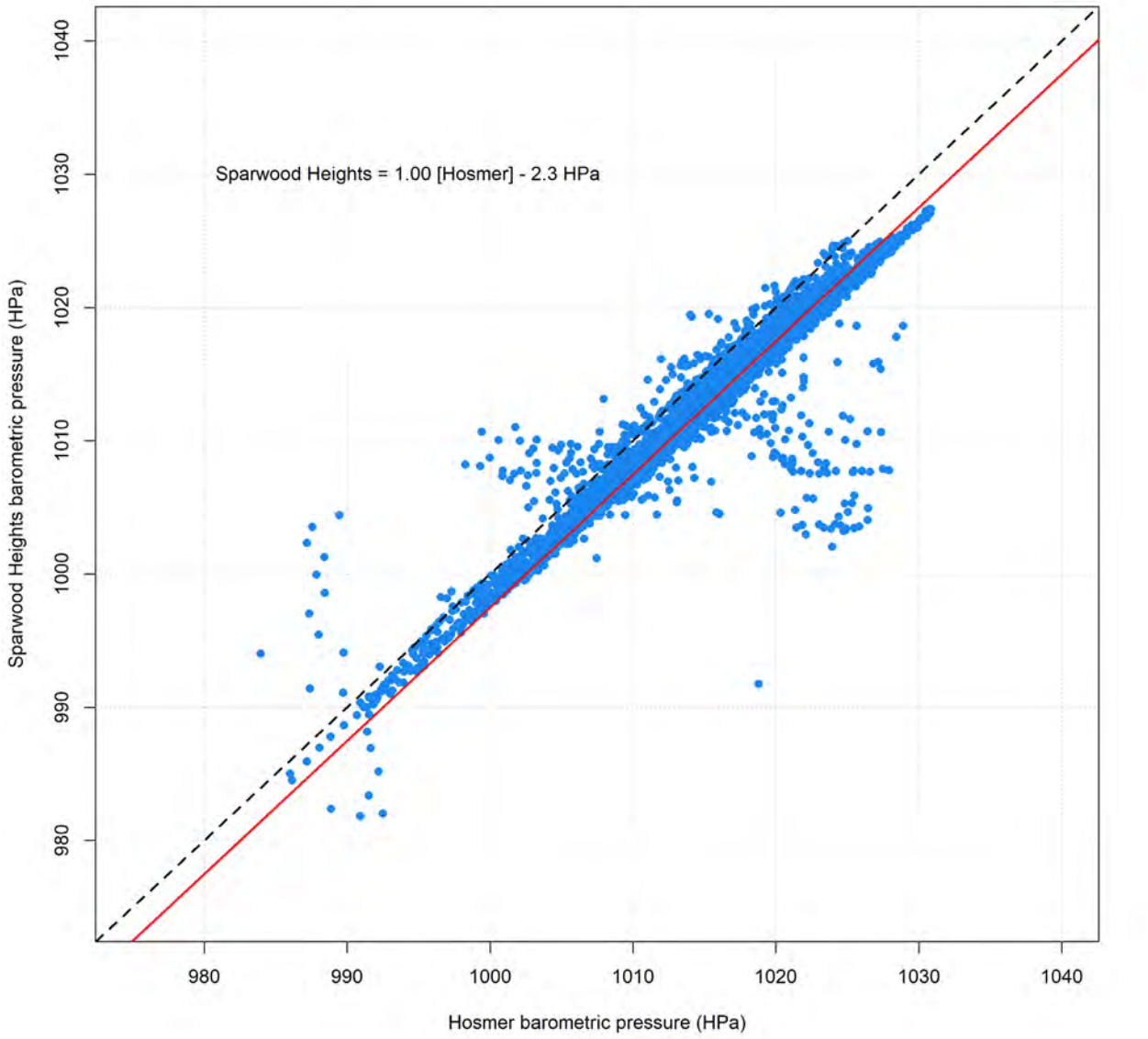


Figure D-3: Scatterplot of barometric pressure measurements taken at EVO's Sparwood Heights station compared to pressure measured the Hosmer regional monitoring station in 2021.

Notes: - The red solid line is a linear fit to the data and the black dashed line is a 1:1 line for comparison.
- Barometric pressure from both stations is corrected to sea-level.

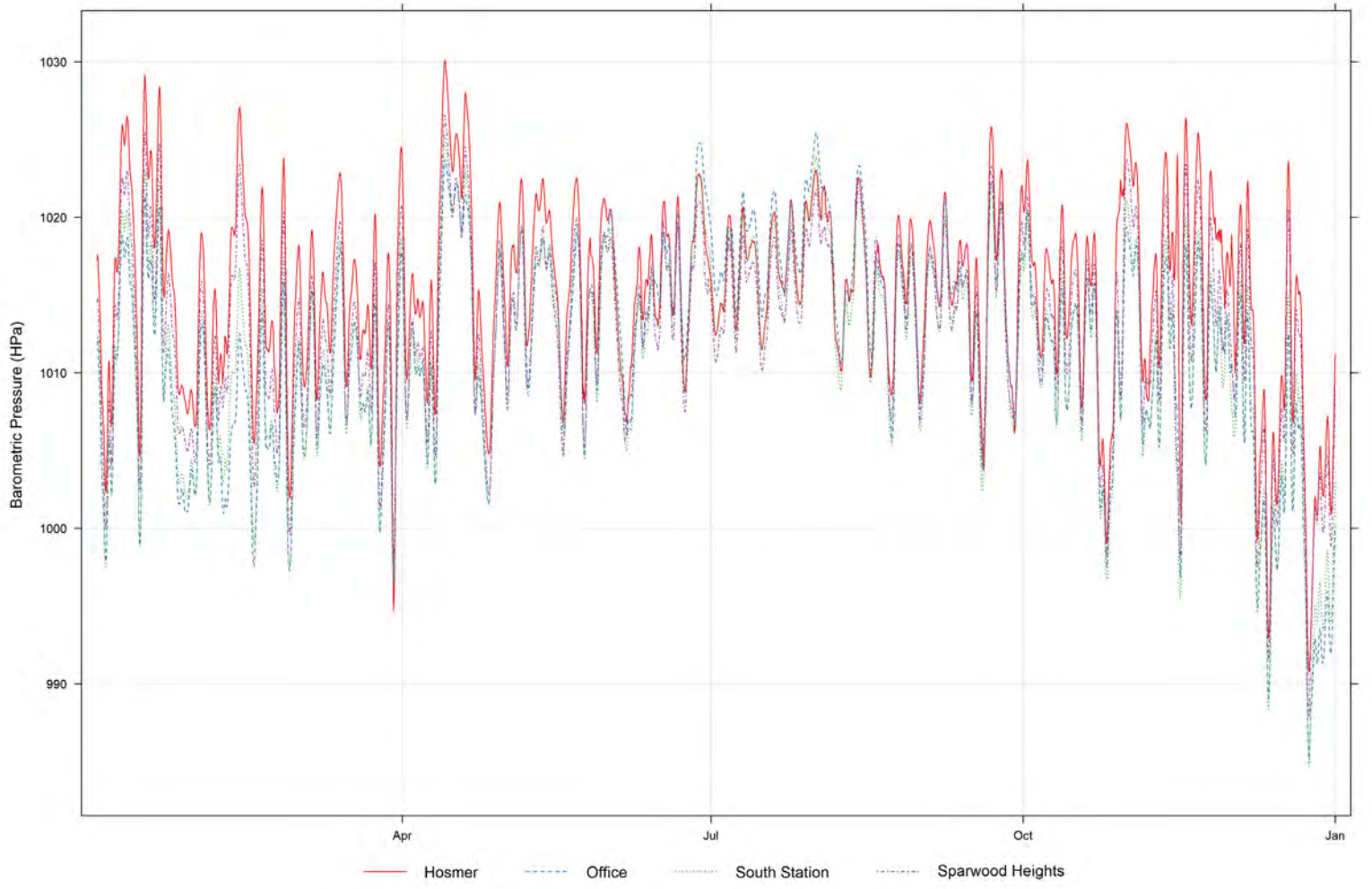


Figure D-4: Timeseries of barometric pressure measurements at Hosmer, Office, South Station and Sparwood Heights.

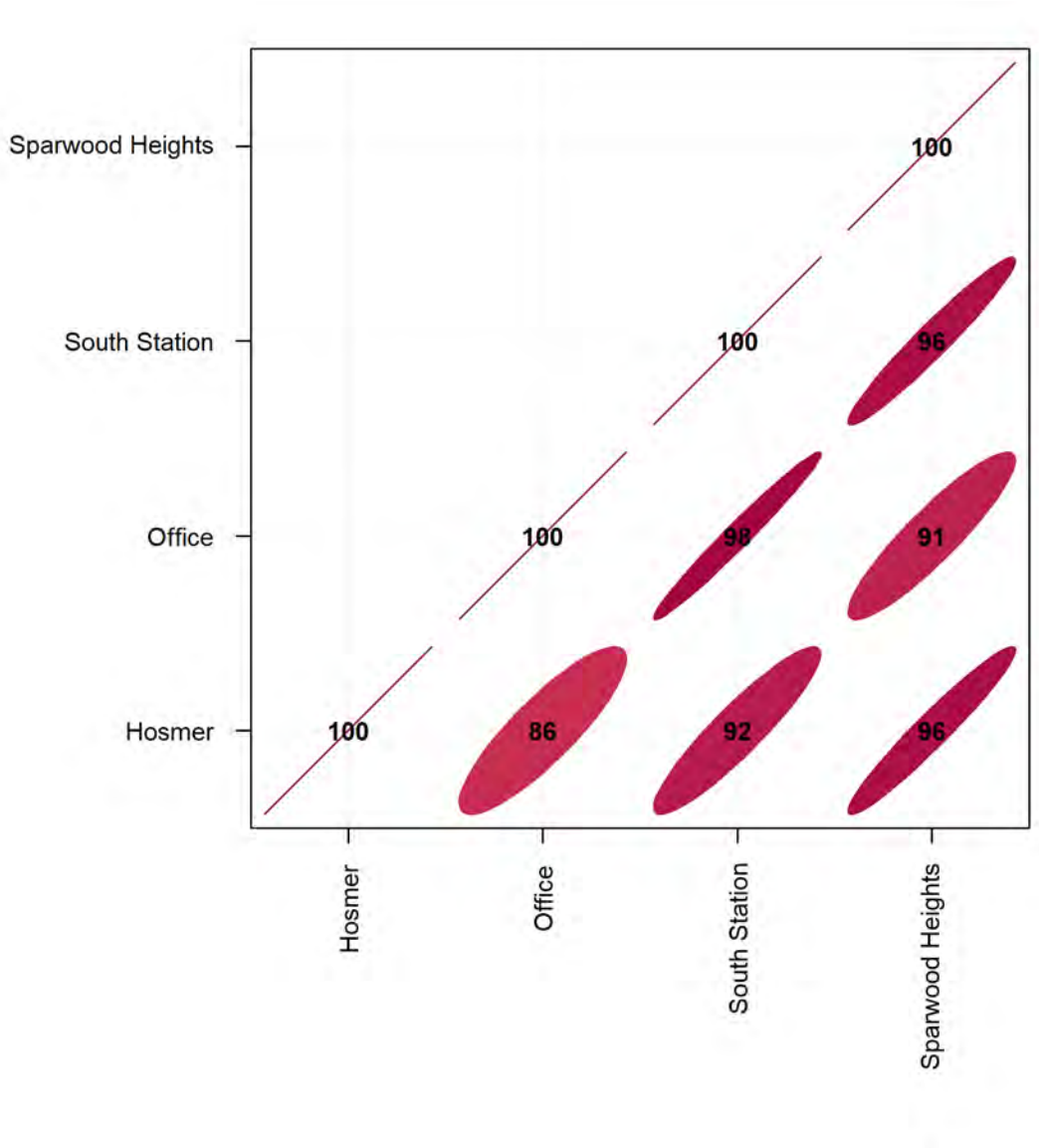


Figure D-5: Correlation plot inter-comparing the 2021 barometric pressure measurements from the four available stations. The number in each ellipse is the Pearson's correlation coefficient (r) of the specific station pairing.

Conclusion

These results show that the Hosmer station accurately captures pressure variations at three of Teck Coal's stations that record this parameter. Therefore, the barometric pressure measurements recorded at the Hosmer regional station can be used for all of the stations included in Teck Coal's RAQMP.

APPENDIX E

APPENDIX E: SUBSTITUTION OF WIND DATA AT EV_SCS STATION

During the conversion of the Elkview – Sparwood Centennial Square (EV_SCS) station to a BC Air Quality Database Site, it was observed that wind monitoring at that site did not satisfy the measurement height siting criteria (Teck Coal, 2021). The site's rooftop location and short mast can result in the anemometer being subjected to changes in the wind field caused by flow over and around the building, making its readings not representative of the surrounding area. This appendix serves to present an option to substitute EV_SCS wind monitoring data with that of another station that conforms to siting criteria.

The Sparwood Heights station (Figure 1 in main report) located approximately 2.5 km from EV_SCS is not part of the regional air quality monitoring program but is also equipped to measure wind speed and direction. It is in the same general area as EV_SCS and is subject to the same local flow conditions. Figure E-1 compares the three-year (2019 to 2021) wind roses at the two stations. Both have predominant winds from the south and south-southwest and have nearly equal mean wind speeds and the proportion of calms are within 1% of each other. The key difference is in the higher frequency of winds from the north-northeast at EV_SCS than at Sparwood Heights, where winds from the northeast sector are more evenly distributed. This difference may be due to the effect of the building wake at EV_SCS.

To further demonstrate the similarity between the two stations, a scatter plot of wind speeds is presented in Figure E-2. The correlation is positive and high ($R = 0.93$, $p < 0.001$). The slope of 0.864 indicates that wind speeds are lower at EV_SCS than at Sparwood Heights, possibly also a consequence of the building wake, and differences in ground cover and topography. These same factors likely explain the moderate spread in the scatter plot.

The agreement in wind direction is demonstrated in Figure E-3, which is a bubble diagram of chi-square residuals of the wind directions binned into 8 cardinal directions. The blue circles found along the diagonal (where the two stations register the same general wind direction), and red circles found where winds are nearly perpendicular to each other, indicate there is strong agreement between the wind direction readings at the two stations. The chi-square statistic ($\chi^2 = 26{,}895$, $df = 49$, $p < 0.001$) of the residuals also suggests the same.

The similarity between the winds at these two stations suggests that the Sparwood Heights data can be used to replace those of EV_SCS. Since the Sparwood Heights station has better exposure than EV_SCS, it can be used as the representative wind station for the area despite not being co-located with the air quality measurements at EV_SCS.

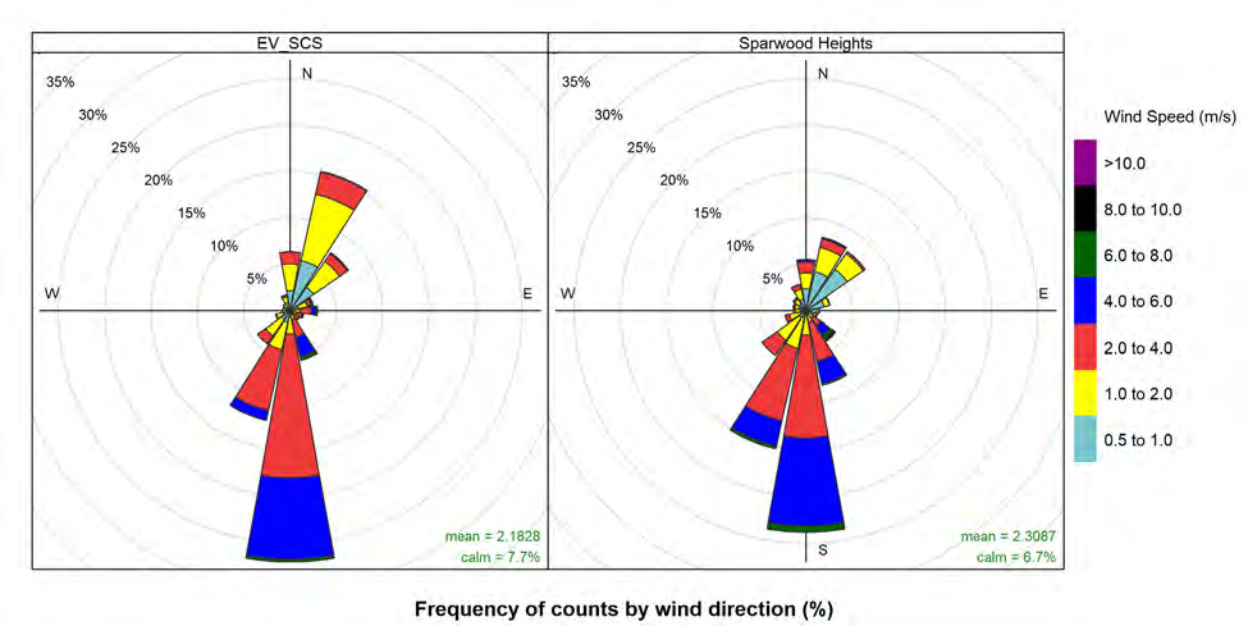


Figure E-1: Comparison of wind roses at EV_SCS and Sparwood Heights.

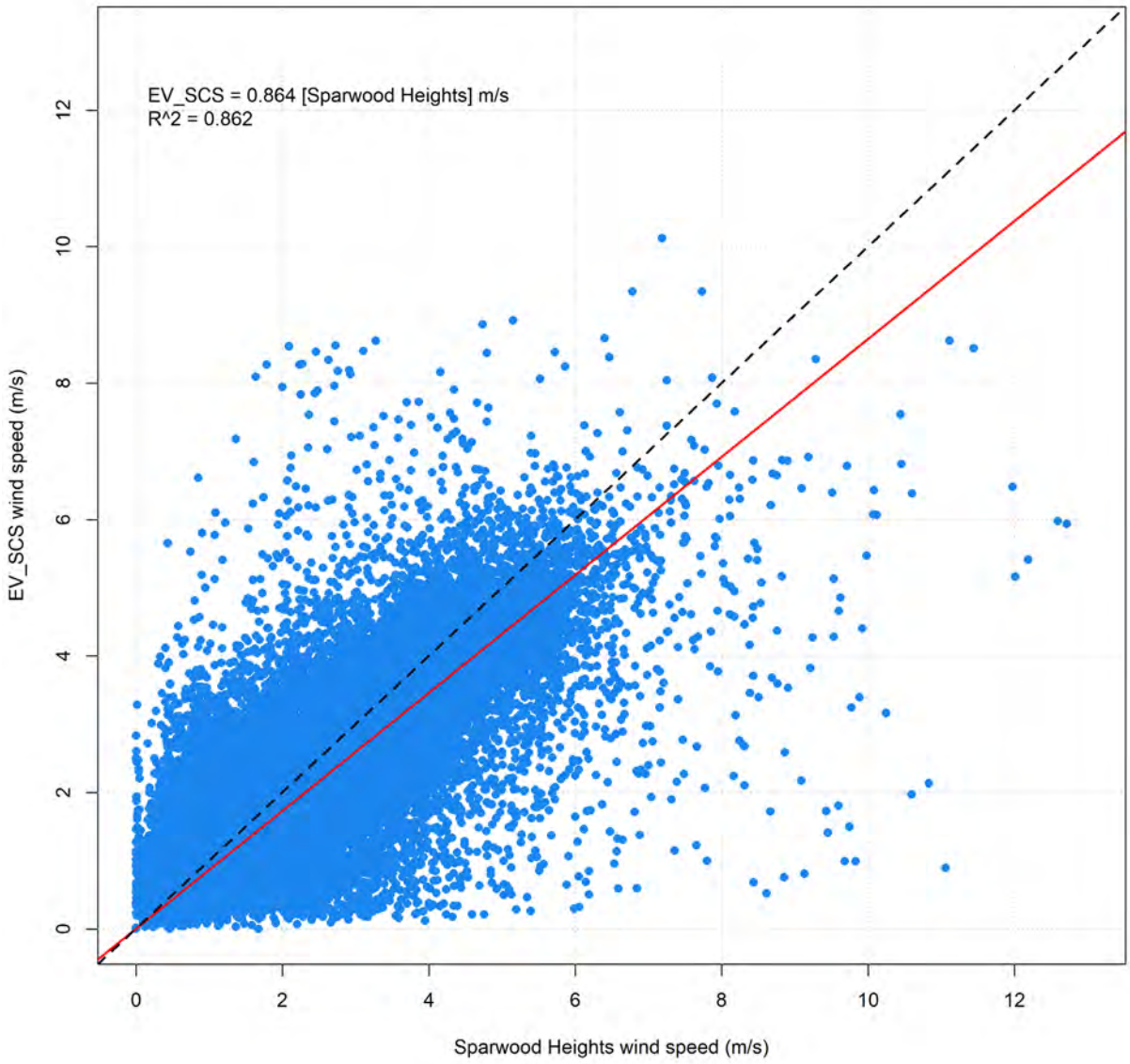


Figure E-2: Scatter plot of wind speeds at EV_SCS vs. Sparwood Heights. The red line is the linear fit to the data and the black dashed line is a 1:1 line for comparison.

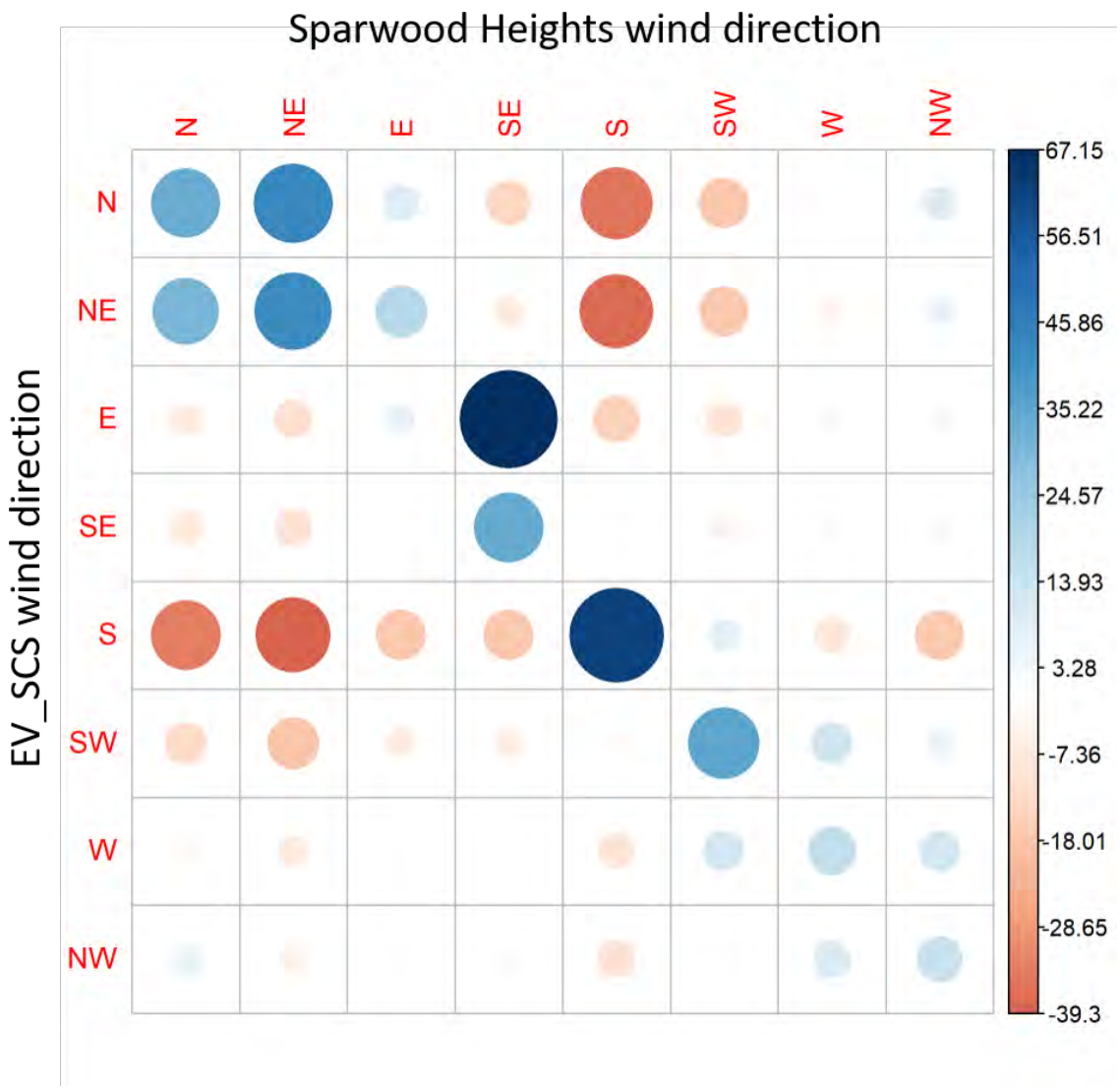


Figure E-3: Plot of Chi-square residuals of the wind directions at Sparwood Heights vs. EV_SCS. Blue circles (positive residuals) denote a positive association between the rows (EV_SCS) and the columns (Sparwood Heights) whereas red circles (negative residuals) denote a negative association or lack of association between the rows and columns.

APPENDIX F

Operation	Station Name	Station location (Latitude, Longitude)	Permit, RAQMP, or independent	Monitoring Objectives	Air quality								Meteorology								
					TSP	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	O_3	PAH	Wind speed and direction	Air temperature	Relative Humidity	Barometric Pressure	Precipitation	Snow depth	Snow Water Equivalent	Net radiation	Incoming Solar Radiation
Fording River	Aspoil	50.19797°N, 114.88866°W	Independent	Monitoring meteorological parameters across the mine									X	X	X		X	X			
	Brownie	50.19916°N, 114.81633°W	Independent	Monitoring meteorological parameters across the mine									X	X	X		X	X		X	
	South Station (E297832)	50.14868°N, 114.85660°W	Permit (1501)	Monitoring meteorological parameters across the mine		X								X	X	X	X	X			X
Greenhills	Office (E297170)	50.08483°N, 114.87085°W	Permit (6249)	Monitoring meteorological parameters across the mine									X	X	X	X	X				
	Pumphouse Greenhills Creek (E206190)	50.04490°N, 114.85612°W	Permit (6249)	Monitoring Particulate concentrations and temperature	X									X							
	Elkford Rocky Mountain Elementary School (GH_ERMES / E290310)	50.007794°N, 114.933420°W	Permit (6249) and RAQMP	Monitoring particulate concentrations and met parameters in and around Elkford	X	X	X						X	X			X				
Line Creek	LCO Plant Continuous (LCO1)	49.88685°N, 114.84479°W	Independent	Monitoring particulate concentrations and meteorological parameters in and around plant	X	X	X						X	X	X						
	L10A (E206189) [1]	49.891055°N, 114.845795°W	Permit (5352)	Monitoring TSP concentrations around the plant	X																
	LCO Plant Weather (E297050)	49.891053°N, 114.845684°W	Permit (5352)	Monitoring meteorological parameters in the vicinity of the plant									X	X			X				
	MSA Hi Vol (E304612) [1]	49.954°N, 114.753°W	Permit (5352)	Monitoring TSP concentrations around the plant	X																
	MSA Weather Station (E297052)	49.953°N, 114.753°W	Permit (5352)	Monitoring meteorological parameters in the vicinity of the plant									X	X			X				
	Line Creek Continuous (LC_02) [2]	TBD	RAQMP	Monitoring particulate concentrations in and around local community and Grave Lake.	X	X	X														

Operation	Station Name	Station location (Latitude, Longitude)	Permit, RAQMP, or independent	Monitoring Objectives	Air quality								Meteorology								
					TSP	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	O_3	PAH	Wind speed and direction	Air temperature	Relative Humidity	Barometric Pressure	Precipitation	Snow depth	Snow Water Equivalent	Net radiation	Incoming Solar Radiation
Elkview	Whispering Winds Trailer Park (EV_WWTP / E0250184)	49.79851°N, 114.88864°W	Permit (1807) and RAQMP	Monitoring particulate concentrations and met parameters in and around local community									X	X	X						
	Sparwood Heights (SH)	49.75541°N, 114.88604°W	Independent	Monitoring particulate concentrations and met parameters in and around local community	X	X	X						X	X	X	X	X				
	Michel Creek Road Residences (MCRR)	49.74288°N, 114.87084°W	Independent	Monitoring particulate concentrations and met parameters in and around local community	X	X	X						X	X	X						
	Sparwood Centennial Square (EV_SCS / E262137)	49.732786°N, 114.88766°W	Permit (1807) and RAQMP	Monitoring particulate concentrations and met parameters in and around local community	X	X	X	X	X	X	X	X	X	X	X						X
	Michel By-Products Plant (E206193)	49.70575°N, 114.82867°W	Permit (1807)	Monitoring particulate concentrations and met parameters in and around local community	X	X	X						X	X	X						
	Soil Treatment Facility	49.77284°N, 114.81936°W	Independent	Monitoring meteorological parameters across the mine									X	X			X	X			
	Erickson Creek	49.68871°N, 114.77261°W	Independent	Monitoring meteorological parameters across the mine										X	X		X	X	X		
Coal Mountain (Care and Maintenance)	Andy Good Spoil (E297251)	49.52367°N, 114.68423°W	Permit (4751)	Monitoring particulate concentrations and met parameters in the Michel basin.	X	X	X						X	X			X	X			
Hosmer Regional Station		49.59026°N, 114.95923°W	Independent	Monitoring background concentration in the Elk Valley and located away from the mine.	X	X	X					X	X	X	X	X					

Notes:

(1): TSP at these locations are measured using a Hi-Volume sampler per the National Air Pollution Surveillance schedule.

(2): Teck is currently in conversation with ENV to finalize the location of LC_02 (RWDI, 2022). The coordinates provided indicate the location of the temporary station from which particulate matter concentrations were obtained for use in this report. Data from the temporary station is being provided at ENV's request.