

SITE C CLIMATE & AIR QUALITY MONITORING

FORT ST. JOHN, BC

2021 ANNUAL REPORT

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SUBMITTED TO

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VERSION HISTORY

Index	Date	Pages	Authors
DRAFT	18-Feb-2022	All	David Chadder, Hon. B.Sc., QEP Laura Dailyde, P.Eng. Iain Hawthorne, Ph.D. Qamar Iqbal, M.Sc., EP
DRAFT	08-Mar-2022	All	David Chadder, Hon. B.Sc., QEP Laura Dailyde, P.Eng. Iain Hawthorne, Ph.D. Qamar Iqbal, M.Sc., EP



LIST OF ACRONYMS

AAQO	Ambient Air Quality Objective
ACMT	Active Compliance Management Tool
BC	British Columbia
CEMP	Construction Environmental Management Plan
CO	Carbon Monoxide
EAC	Environmental Assessment Certificate
ECCC	Environment and Climate Change Canada
ENV	BC Ministry of the Environment and Climate Change Strategy
EPP	Environmental Protection Plan
FDS	Federal Decision Statement
MOU	Memorandum of Understanding
NO ₂	Nitrogen Dioxide
PCIC	Pacific Climate Impacts Consortium
PCO	Pollution Control Objective
PM	Particulate Matter
PM _{2.5}	Particulate Matter consisting of particles 2.5 µm in equivalent diameter or smaller
PM ₁₀	Particulate Matter consisting of particles 10 µm in equivalent diameter or smaller
QA	Quality Assurance
QEP	Qualified Environmental Professional
SO ₂	Sulphur Dioxide



1 INTRODUCTION

BC Hydro's Site C Clean Energy Project (the Project) in British Columbia's Peace region will create a new hydroelectric dam and generating station on the Peace River in the vicinity of the City of Fort St. John. To characterize the microclimate and to provide a baseline against which to compare future changes brought on as a result of the Project, BC Hydro installed a network of climate and air quality monitoring stations in the Peace River Valley. This network has been active since 2011, through the preparation and submission of the Project's Environmental Impact Statement, and throughout Project construction to date, which began in mid-2015. We acknowledge this work is being conducted on the traditional territory of Treaty 8 First Nations of Dunne Zaa, Cree and Tse'khene cultural descent.

Approval of the Project in 2014 by the Joint Review Panel comprised of the Canadian Environmental Assessment Agency and the British Columbia Environmental Assessment Office was contingent upon BC Hydro satisfying a number of conditions (CEAA, 2014; EAO, 2014).

Condition 12 of the Federal Decision Statement (FDS) is concerned with the health of Indigenous peoples as it relates to air quality. This Condition mandates proper management, monitoring and reporting of air quality to minimize the potential effects on Indigenous health. Condition 12.6 of the FDS requires BC Hydro to "implement the [management] plan and provide to the Agency an analysis and summary of the implementation of the plan, as well as any amendments made to the plan in response to the results, on an annual basis during construction and the first year of operation."

Condition 57 of the provincial Environmental Assessment Certificate (EAC) dictates the management plans (Air Quality Management Plan, Smoke Management Plan) that were developed for the Project to minimize air emissions, monitor the ambient air quality and provide these readings to the BC Ministry of the Environment and Climate Change Strategy (ENV) to notify sensitive populations (in collaboration with Northern Health) if air quality conditions warrant. In addition, EAC Condition 31 requires that microclimate monitoring is also conducted to support an understanding of how the Project might affect agricultural activities. An example includes changes to ambient humidity levels that could affect crop drying as well as other climatic factors to estimate moisture deficits.

Throughout 2021, there were five ambient air quality and nine meteorological monitoring stations in operation by the Project. The air quality stations provided continuous ambient measurements that were used to monitor effects of the Project on Indigenous and public health, and to inform construction activities, while the meteorological stations provided continuous measurements for several meteorological parameters (discussed further in Section 2). Data from Station 8 (Old Fort), Station 9 (85th Avenue) and Station 12 (Hudson's Hope) are used to inform air quality advisories issued publicly by ENV.

A summary of the the applicable FDS Conditions and the provincial EAC Conditions and their status of the Project with respect to complying with the Air Quality Management Plan and Smoke Management Plan for the calendar year are presented in Appendix A. A summary of the meteorological data collected by the program is included herein but reporting to satisfy EAC Condition 31 will be done under separate cover.



This document serves to describe the state of the climate and air quality for the tenth year of observations and the sixth year of project construction, coinciding with the 2021 calendar year. Eight previous annual monitoring reports describing the state of the climate and air quality for the years of observations, coinciding with the 2012 through 2020 calendar years have been released (RWDI AIR Inc. 2015a, 2015b, 2015c, 2016, 2017, 2018, 2019, 2020, 2021). The initial monitoring established baseline conditions that were in effect until the summer of 2015 when construction activities began. The network has remained in operation and has continued to collect valuable climate and air quality data in the Peace region. Air quality parameters such as concentrations of particulate matter (PM), specifically PM_{2.5} and PM₁₀, nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and carbon monoxide (CO) are presented in this report. Also included in this report is a review of the annual climate conditions.

1.1 Managing Air Quality

BC Hydro developed a Construction Environmental Management Plan (CEMP), (Rev. 9, BC Hydro 2022), which includes a component of an Air Quality Management Plan (Section 4.1) and a description of the Air Quality Monitoring Program (Appendix B, Rev 2, 2020) to avoid or minimize exceedances of the BC Ambient Air Quality Objectives (ENV, 2021) (FDS, Section 12.1). Section 4.1 of the CEMP details the management practices that will be implemented to minimize emissions criteria of air contaminants. Contractors are required to produce site-specific Environmental Protection Plans (EPPs) that explain how the Contractor will meet the CEMP requirements. As of December 2020, construction activities, particularly the Main Civil Works, Generating Station and Spillways Civil Works, clearing for the future Site C reservoir, realignment of several segments of Highway 29, and construction of shoreline protection measures in Hudson's Hope are well underway involving elements of the majority of activities listed in Section 4.1 of the CEMP.

BC Hydro conducts environmental audits during construction to verify implementation of EPPs, including implementation of appropriate mitigation measures in response to air quality alerts. BC Hydro implemented the Active Compliance Management Tool (ACMT) in 2017, which is a database to house environmental inspection data.

BC Hydro has also developed a Smoke Management Plan (Rev. 5, BC Hydro 2021), which is another component of the CEMP (Appendix A), and which satisfies Section 12.3.2 of the FDS conditions and Condition 57 of the provincial EAC.

Open burning of piles of vegetation cleared in the footprint of the future Site C reservoir occurred in 2021. All ignition events were based on custom venting forecasts which were used to inform brush burning events. Further details are discussed in Section 3.2.



2 MONITORING NETWORK

Condition 12.3.4 of the FDS approval of the Project requires BC Hydro to develop a plan that includes procedures to monitor air quality effects at locations used by Indigenous groups. To this end, BC Hydro developed an Air Quality Monitoring Program (BC Hydro, 2016). As part of the monitoring program, BC Hydro has installed and continuously operates a network of ambient air quality stations in areas that may be affected by Project construction activities.

BC Hydro currently operates five ambient air quality monitoring stations in the Peace River area. Three of these stations are located in the vicinity of the Project construction including:

- Station 1 – Attachie Flat Upper Terrace;
- Station 8 – Old Fort; and
- Station 12 – Hudson’s Hope.

Two of these five stations are located directly within Project construction work areas including:

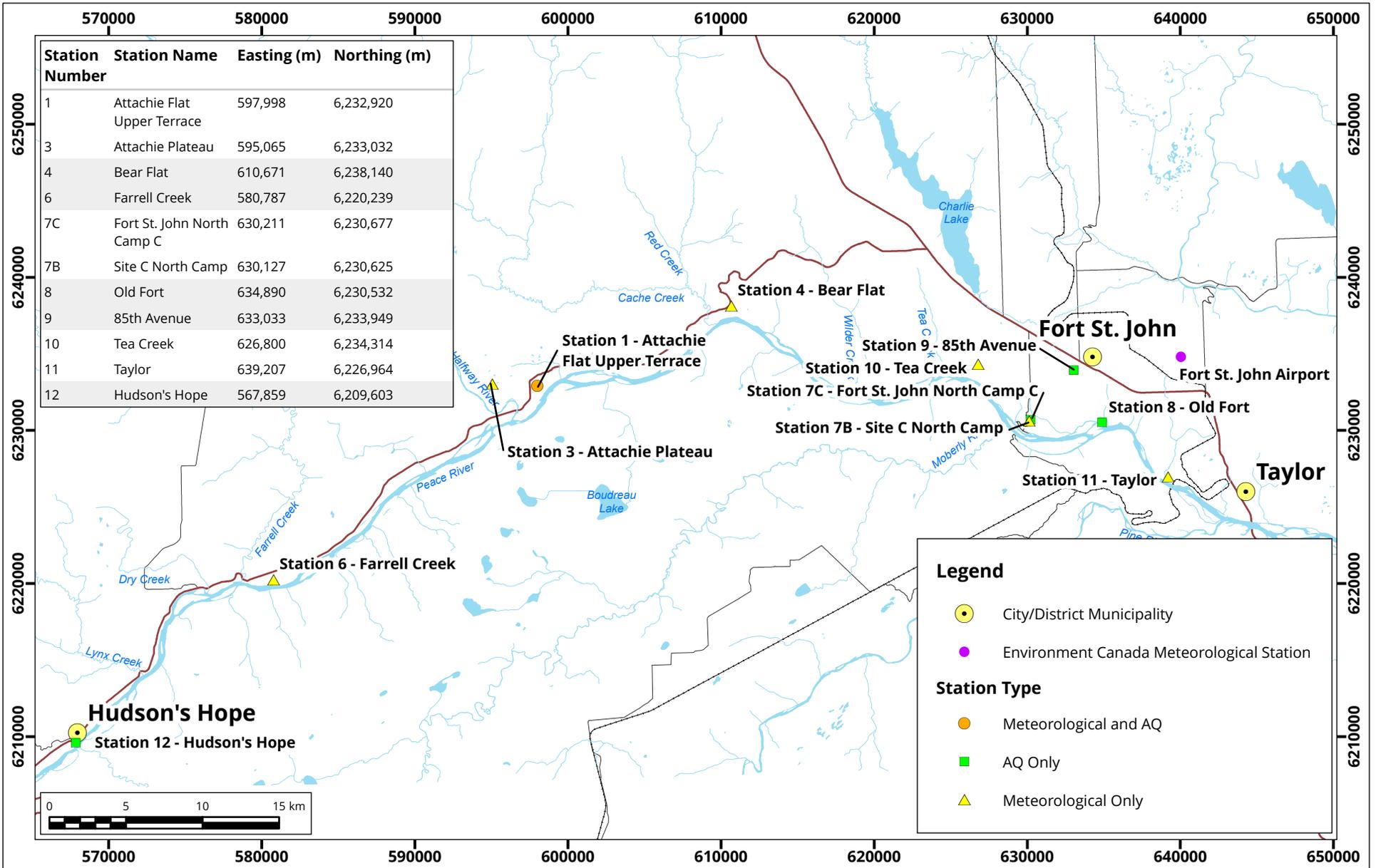
- Station 7C –Fort St. John North Camp C; and
- Station 9 – 85th Avenue.

Stations 1 (Attachie Flat Upper Terrace), 8 (Old Fort) and 7C (Fort St. John North Camp C) have continuous Thermo Scientific SHARP 5030 monitors and Station 9 (85th Avenue) and 12 (Hudson’s Hope) have Thermo Scientific SHARP 5030i monitors. These monitors measure particulate matter with diameters less than 10 µm (PM₁₀) and diameters less than 2.5 µm (PM_{2.5}). Station 7C (Fort St. John North Camp C) and Station 12 (Hudson’s Hope) both measure NO_x (using a Thermo Scientific 42i analyzer) and SO₂ (using a Thermo Scientific 43i analyzer). Station 7C (Fort St. John North Camp C) additionally measures CO (using a Thermo Scientific 48i analyzer).

In addition to air quality, the Site C monitoring Network also measures a number of meteorological parameters.

Figure 2-1 shows the location of the network stations in relation to local communities and the Peace River, as well as the station run by Environment and Climate Change Canada (ECCC) located at Fort St. John Airport.

Table 2-1 and Table 2-2 show the coordinates and elevations for the station locations, and parameters measured at these stations, respectively.



BC Hydro - Site C Meteorological and Air Quality Stations



Drawn by: DJH | Figure: 2-1

Approx. Scale: 1:350,000

Date Revised: Dec 3, 2020



Project #: 2002352



Table 2-1: BC Hydro Site C network station locations and elevations.

Station Name	UTM NAD 83 (m)	Latitude, Longitude (decimal degrees)	Elevation (m)
Station 1 - Attachie Flat Upper Terrace	597999 E, 6232919 N	56.23N, -121.42W	479
Station 3 - Attachie Plateau	595065 E, 6233032 N	56.23N, -121.46W	645
Station 4 - Bear Flat	610669 E, 6238135 N	56.27N, -121.21W	474
Station 6 - Farrell Creek	580779 E, 6220238 N	56.12N, -121.70W	471
Station 7B/C - Site C North Camp/Fort St. John North Camp C ⁽¹⁾	630206 E, 6230688 N	56.20 N, -120.90W	584
Station 8 - Old Fort	634890 E, 6230532 N	56.20N, -120.82W	423
Station 9 - 85 th Avenue	633033 E, 6233949 N	56.23N, -120.85W	686
Station 10 - Tea Creek	626798 E, 6234314 N	56.24 N, -120.95W	653
Station 11 - Taylor	639206 E, 6226964 N	56.17N, -120.76W	411
Station 12 - Hudson's Hope	567932 E, 6209604 N	56.03N, -121.91W	494
Fort St. John Airport (ECCC)	640053 E, 6234872 N	56.24N, -120.74W	695

NOTES: (1) Meteorology parameters are measured at a tower that is located approximately 100 m to the North-East of the trailer where the air quality analyzers are located. The meteorology instrument tower is considered Station 7B, the air quality trailer is considered Station 7C. Coordinates provided are for the air quality analyzer location (7C).



Table 2-2: BC Hydro Site C network stations and the Fort St. John Airport ECCC station with parameters measured.

Station	Air Temperature and Relative Humidity	Wind Speed and Direction	Precipitation	Barometric Pressure	All Radiation Components	Solar Radiation	Net radiation	Turbulent Fluxes	Visibility	Soil Temperature	Soil Moisture	Soil heat Flux	PM ₁₀ and PM _{2.5}	SO ₂ , NO ₂	CO
Station 1 – Attachie Flat Upper Terrace	X	X	X	X	X			X	X	X	X	X	X		
Station 3 – Attachie Plateau	X	X	X	X		X	X			X	X	X			
Station 4 – Bear Flat	X	X	X	X	X			X		X	X	X			
Station 6 – Farrell Creek	X	X	X	X		X	X			X	X	X			
Station 7B/C – Site C North Camp/Fort St. John North Camp C	X	X	X	X		X	X			X	X	X	X	X	X
Station 8 – Old Fort													X		
Station 9 – 85 th Avenue		X											X		
Station 10 – Tea Creek	X	X	X	X	X		X			X	X	X			
Station 11 – Taylor	X	X	X	X		X	X			X	X	X			
Station 12 – Hudson’s Hope	X	X											X	X	
Fort St. John Airport (ECCC)	X	X	X	X	X										

2.1 Equipment Maintenance

Scheduled monthly calibration and maintenance checks are performed on all Thermo Scientific gas analyzers and Sharp PM units. Gas instruments (Models 42i, 43i, 48i, 42iQ, 43iQ) run daily span and zero checks that are used to guide the need for unscheduled maintenance. This process exceeds the recommendations in the BC Field Sampling Manual (ENV, 2020).



2.2 Data Collection and Quality Assurance / Quality Control (QA/QC)

Measurements from the Site C network stations were remotely downloaded to RWDI servers using Campbell Scientific's LoggerNet software over cellular modem connections at the following intervals:

- The following stations with AC power had download intervals of one hour:
 - Station 1 (Attachie Flat Upper Terrace)
 - Station 4 (Bear Flat)
 - Station 7C (Fort St. John North Camp C)
 - Station 8 (Old Fort)
 - Station 9 (85th Avenue)
 - Station 12 (Hudson's Hope)
- The following solar powered stations had their data collected hourly when battery power was >12.7 V:
 - Station 3 (Attachie Plateau)
 - Station 6 (Farrell Creek)
- The following solar powered stations had their data collected only at specific times during daylight hours to preserve battery charge
 - Station 7B (Site C North Camp)
 - Station 10 (Tea Creek)
 - Station 11 (Taylor)

The first stage of data quality assurance (QA) applied to the readings involved diagnostic monitoring in the data logger by continually reading in and checking all instrumental diagnostics available from the air quality equipment for signs of an instrumental malfunction. If a problem is detected, the data logger can issue commands to the air quality instrument to rectify the problem and notify RWDI personnel so the issue can be addressed. This first level of data QA was included in the data logger programs at Station 1 (Attachie Flat Upper Terrace), Station 7C (Fort St. John North Camp C, air quality), Station 8 (Old Fort), Station 9 (85th Avenue), and Station 12 (Hudson's Hope). In 2021 all climate stations were upgraded to include diagnostic monitoring as well.

Secondly, manually assisted and automated quality control was carried out on the raw data weekly. This involved plotting the readings over the past month and the previous 10 to 30 days to allow for a visual inspection of the time history so the operator can detect anomalous trends or data outliers. This frequency of QA was maintained to allow rapid detection and repair of any instrument malfunctions or drift.

As part of the RWDI data validation process, a third QA/QC operation was conducted monthly to invalidate any data from an instrument known to be malfunctioning based on the results of routine monthly visits for maintenance, calibrations and checks. Results from both checks performed by RWDI personnel as well as equipment performance audits performed by the ENV were used to increase confidence in the validity of the data.



3 METEOROLOGY AND AIR QUALITY RESULTS

An overview of results for meteorology and air quality parameters associated with the 2021 field monitoring are presented in the following subsections.

3.1 Meteorology

Table 3-1 provides a summary of some of the climate parameters discussed in this report as well as 30-year climate normals from Fort St. John Airport for the period, 1981 to 2010 (ECCC, 2016). Climate normals were calculated from 30-year records of meteorological observations of wind speed, temperature, precipitation and other related weather conditions at the location of interest. Climate normals are updated by ECCC on a 10-year basis and the most recent reporting period available is from 1981 to 2010. The 30-year climate normals for the maximum and minimum temperatures differ from what are reported in the published normals, because ECCC takes the daily maximum/daily minimum and averages that occur over the month for all years. These numbers are averaged over the 30-year annual maxima/minima in the period so they are more extreme and more comparable to the maximum and minimum temperatures at any one site for this year. The year 2021 was extremely warm and dry. The maximum mean temperature difference of 2.8°C and maximum precipitation difference of 166 mm when compared to the 30-year normal will illustrate this. The maximum temperature measured in July at station 7B (39°C) was 8.8°C greater than any in the 30-year normal record.

The airport precipitation data was also not included due to insufficient and erroneous data through 2021-2022 (G. Bramwell, pers. comm., Jan 25, 2021). The Station 10 relative humidity and temperature sensor was sent for calibration in December. The extreme cold temperature measured at other stations in late December are the reason that Station 10 annual temperature is noticeably higher than other stations.

Table 3-1: Summary of measured climate parameters during 2021 and comparison with climate normals.

Monitoring Station	Mean Temp (°C)	Max Temp (°C)	Min Temp (°C)	Total Precipitation (mm)	Mean Wind Speed (m/s)
Station 1 – Attachie Flat Upper Terrace	2.8	38.9	-37.5	279	2.5
Station 3 – Attachie Plateau	3.1	37.9	-39.4	283	2.6
Station 4 – Bear Flat	2.9	37.8	-38.2	289	2.0
Station 6 – Farrell Creek	3.4	37.8	-38.7	316	1.7
Station 7B – Site C North Camp	3.6	39.0	-36.8	335	2.9
Station 9 – 85 th Avenue	-	-	-	-	3.7
Station 10 – Tea Creek	5.1	37.3	-37.7	323	2.6
Station 11 – Taylor	3.3	37.9	-38.0	287	1.6
Station 12 – Hudson’s Hope	4.5	37.5	-35.9	-	1.1
Fort St. John Airport	2.4	37.8	-35.8	-	4.6
30-year climate normals (1981 – 2010)	2.3	30.2	-36.6	445	3.8
Max difference from normals	2.8	8.8	2.8	166	2.2

NOTE: - indicates insufficient or no data collected



3.1.1 Wind Characteristics

Wind speed and wind direction were measured at all stations except Station 8 (Old Fort). Figure 3-1 shows wind roses for all stations with a complete year of records including Fort St. John Airport for 2021. Mean annual wind speed for 2021 ranged from 1.1 m/s (Station 12 – Hudson’s Hope) to 3.7 m/s (Station 9 – 85th Avenue) at the Site C network stations. Fort St. John Airport recorded a mean annual wind speed of 4.6 m/s which was 13% greater than the 30-year climate normal of 3.8 m/s (Table 3-1) and the same as measured in 2020.

The differences between stations in wind speed and wind direction that are apparent in the wind roses are attributed to small scale surface features such as proximity of trees and local topography to the network stations and their location within the meandering Peace River Valley. The higher wind speed at Fort St. John Airport is likely due to this station being on the plateau above the Peace River Valley and its very open location with a large fetch in all directions. There was a wide difference of the proportion of calms as well: ranging from 0.4 % to 26.9 % of the 12-month period. Higher calm measurements were noted at lower elevation stations beside the Peace River in more enclosed areas of the valley, with site values similar to previous years.

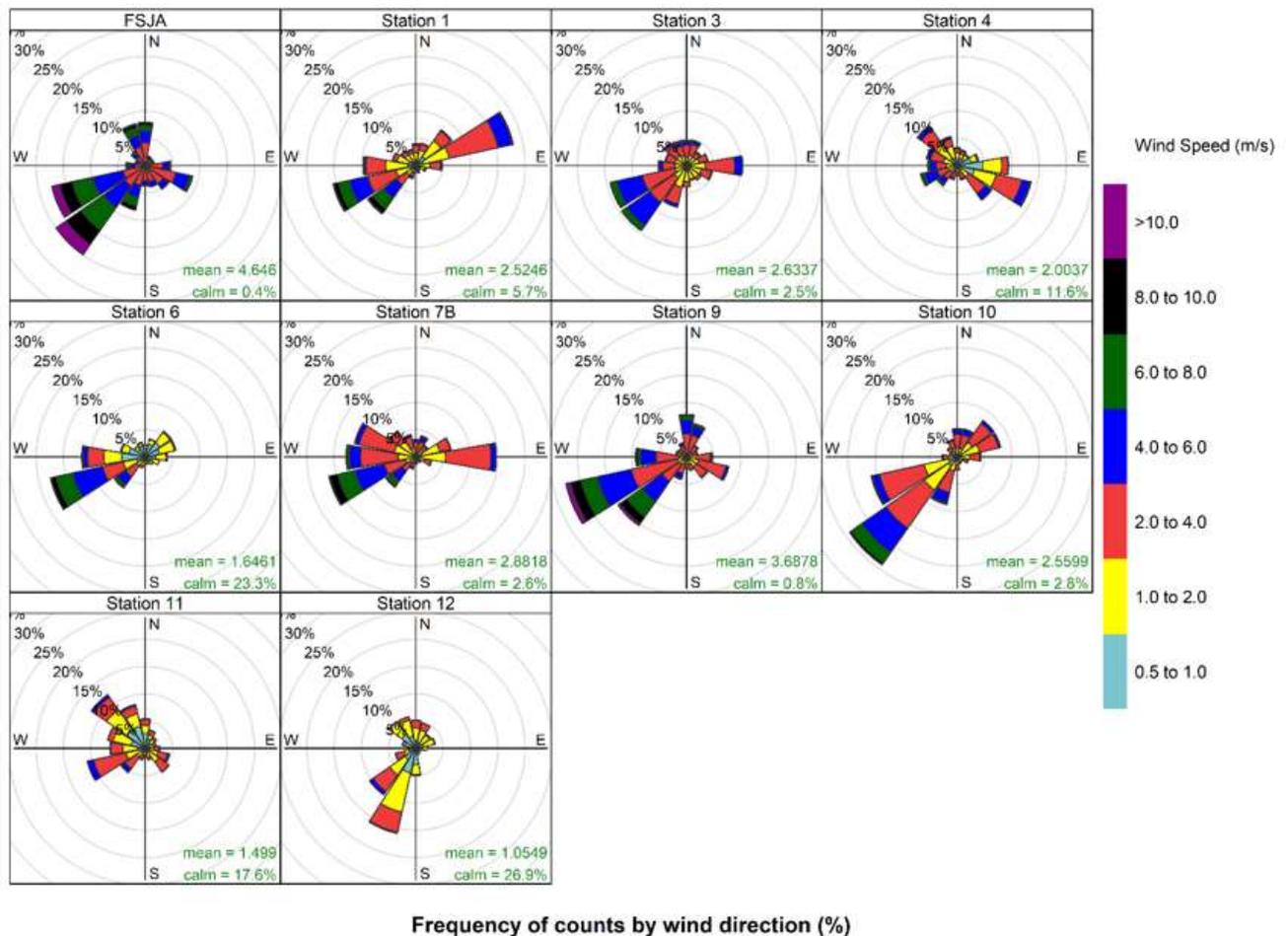


Figure 3-1: Wind roses for all Site C stations with 12-month records and Fort St John Airport for 2021.



3.2 Particulate Matter

Table 3-2 gives an overview of the completeness of the datasets for PM₁₀ and PM_{2.5} at each station as well as the number of excursions and/or exceedances above the provincial 24-hour Ambient Air Quality Objectives (AAQOs) and a comparison of the annual averages with the provincial AAQOs. Excursions and exceedances are defined as follows:

Excursions occur when the concentration for a contaminant at a certain averaging period exceeds the AAQO. Per ENV, a 24-hour average is averaged from midnight to midnight.

Exceedances are defined by the AAQO and may require certain conditions to be met before an excursion is called an exceedance. For example, an exceedance for PM_{2.5} requires that the annual 98th percentile of the 24-hour average > AAQO. PM₁₀ has no such conditions (i.e., calculated annual percentiles) so any 24-hour excursions for PM₁₀ are always exceedances.

The lower percentage data completeness for 24-hour averages than for hourly data stems from a requirement that, to consider a 24-hour average to be valid, it must contain at least 75% (18 hours) of valid hourly data. This ensures that 24-hour averages are not biased toward one single time of the day. Unless specified otherwise, the 24-hour average refers to the daily block average from the 01:00 hour to the 00:00 hour-ending time stamp of the following day. The 75% data completeness criteria established by the Government of Canada for fine particulate matter (PM_{2.5}) can be found at: <http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=BA9D8D27-1&offset=4&toc=hide&pedisable=true>.

Per the Memorandum of Understanding (MOU) with ENV, there is a data polling requirement of 90%. In other words, 90% of the time the province will successfully poll data from BC Hydro's sites and display air quality readings on the Ministry's air quality public portal within an hour of when the observation is collected at the site. In 2021, the 90% data polling criteria was met.

All PM monitors had a data completeness of greater than 75% (typical of ENV permit requirements). Many of the excursions and exceedances in 2021 were related to smoke from forest fires or community specific events such as road dust. Under these conditions, ENV issued Smoky Skies Bulletins and Air Quality Advisories, respectively. Specific dates for these in 2021 are provided later in this section.



Table 3-2: Summary of measured PM results for 2021 (in $\mu\text{g}/\text{m}^3$).

Parameter	Station 1 Attachie Flat Upper Terrace		Station 7C Fort St. John North Camp C		Station 8 Old Fort		Station 9 85 th Avenue		Station 12 Hudson's Hope	
	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀
Percentage data complete of hourly data	95.2	93.1	96.6	95.1	96.3	97.6	98.0	98.8	98.5	99.3
Percentage data complete (24-hour averages)	95.1	91.8	95.6	93.4	95.9	97.8	97.5	98.9	98.6	100
24-hour AAQO	25	50	25	50	25	50	25	50	25	50
24-hour AAQO excursions (PM _{2.5}) / exceedances (PM ₁₀)	4	1	5	16	2	0	6	16	8	3
98 th percentile of 24-hour daily averages	19.4	27.0	22.8	67.0	20.1	27.8	24.0	58.9	25.5	39.6
Annual AAQO	8	NA ⁽¹⁾	8	NA ⁽¹⁾	8	NA ⁽¹⁾	8	NA ⁽¹⁾	8	NA ⁽¹⁾
Annual average	4.2	7.2	4.8	16.3	4.5	8.8	5.1	15.5	5.2	10.2

NOTES: **Bolded** PM values indicates measured concentrations that exceeded their respective AAQO
 (1) NA is used where the quantity in question is not applicable to the measurement.

In 2021, Station 1 (Attachie Flat Upper Terrace) had four excursions for PM_{2.5} above the 25 $\mu\text{g}/\text{m}^3$ AAQO for a 24-hour averaging period and one exceedance above the AAQO for PM₁₀. Five excursions above the AAQO for PM_{2.5} and 16 exceedances above the AAQO for PM₁₀ over 24-hour averaging periods were observed at Station 7C (Fort St. John North Camp C). At Station 8 (Old Fort), two excursions above the 24-hour AAQO for PM_{2.5} were observed. There were no exceedances above the AAQO for PM₁₀ observed at Station 8 (Old Fort). There were six excursions above the 24-hour AAQO for PM_{2.5} observed at Station 9 (85th Avenue) and sixteen exceedances above the AAQO for PM₁₀. Lastly, there were eight exceedances above the 24-hour AAQO for PM_{2.5} observed at Station 12 (Hudson's Hope) and three exceedances above the AAQO for PM₁₀.

Table 3-3 provides percentile levels of note for PM concentrations at each of the air quality stations. Measured PM₁₀ and PM_{2.5} levels at Stations 1 (Attachie Flat Upper Terrace) and 8 (Old Fort) were all below their applicable AAQO for 99% valid days or more in 2021. At Station 12, the PM₁₀ values were also below the AAQO for 99% valid days or more. At Stations 7C (Fort St. John - North Camp) and 9 (85th Avenue) PM_{2.5} levels were all below the AAQO for 98% valid days or more in 2021. Station 12 (Hudson's Hope) PM_{2.5} levels were above the AAQO for 98% valid days or more in 2021, and no excursions were considered to be exceedances in this case. Measured PM₁₀ levels at Stations 7C (Fort St. John North Camp C) and 9 (85th Avenue) were all below the AAQO for 95% valid days or more.



Table 3-3: Percentile values of 24-hour averaged PM concentrations for 2021 (in $\mu\text{g}/\text{m}^3$).

Percentile	Station 1 Attachie Flat Upper Terrace		Station 7C Fort St. John North Camp C		Station 8 Old Fort		Station 9 85 th Avenue		Station 12 Hudson's Hope	
	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀
0	0.04	0.5	0.1	0.7	0.009	1.0	0.2	0.6	0.1	0.2
0.1	0.9	2.4	1.4	4.0	0.8	2.8	1.4	3.0	1.5	3.5
0.25	1.9	3.8	2.1	6.3	1.7	4.6	2.3	6.2	2.4	5.2
0.5	3.3	5.7	3.5	11.7	3.4	7.0	3.6	10.8	3.8	8.0
0.75	5.0	8.6	5.4	20.4	5.7	11.3	5.5	17.9	5.4	11.5
0.9	7.1	12.4	8.9	34.2	8.6	15.9	9.7	33.9	9.4	20.1
0.95	12.3	16.7	15.6	48.4	12.9	21.0	15.6	46.5	14.2	26.1
0.975	17.4	24.9	22.6	60.4	19.3	25.9	23.6	55.0	24.2	36.7
0.98	19.4	27.0	22.8	67.0	20.1	27.8	24.0	58.9	25.5	39.6
0.99	23.0	33.2	28.1	71.1	22.0	36.3	29.4	77.2	32.1	46.2
0.999	34.4	55.4	33.2	88.5	32.2	41.5	35.6	124	44.9	55.8

NOTES: Red cells denote values greater than the AAQO

Figure 3-2 through Figure 3-6 show the time series of the 24-hour averages of both PM₁₀ and PM_{2.5} at each of the five stations, respectively.

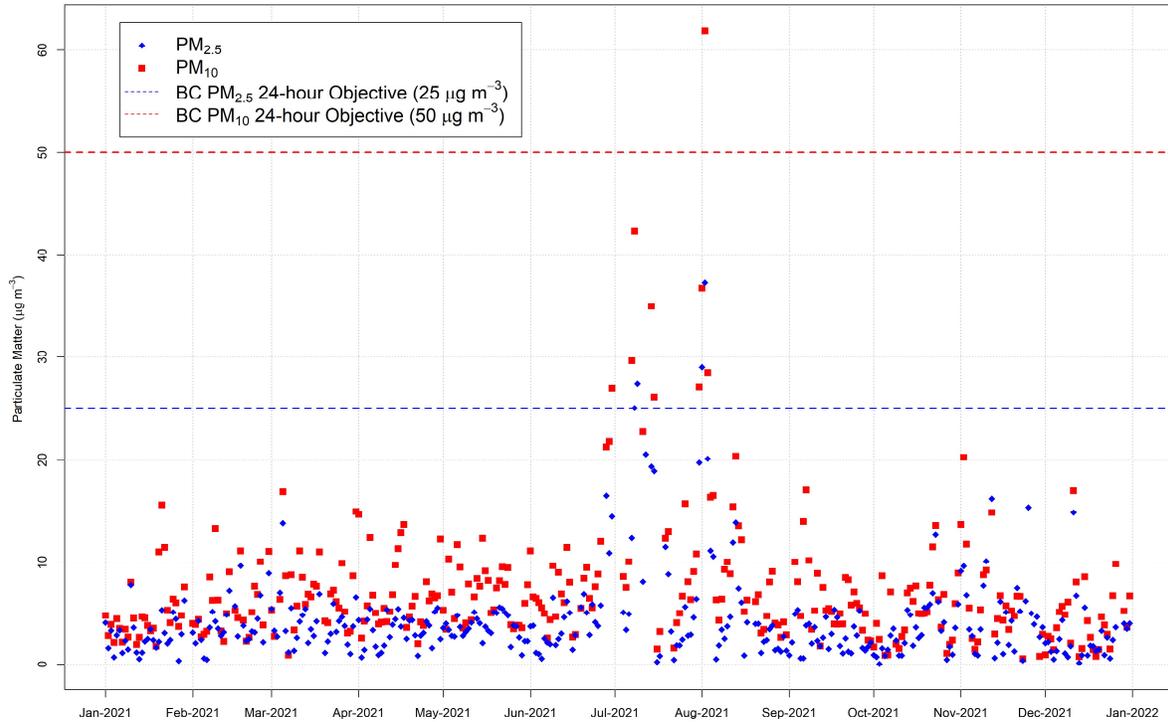


Figure 3-2: Daily average PM_{2.5} and PM₁₀ measurements from Station 1 – Attachie Flat Upper Terrace for 2021 (in µg/m³). The target AAQO's are plotted as broken lines. The annual daily 98th percentile PM_{2.5} concentration of 19.4 µg/m³ was less than the AAQO (25 µg/m³) so all PM_{2.5} events were considered to be excursions.

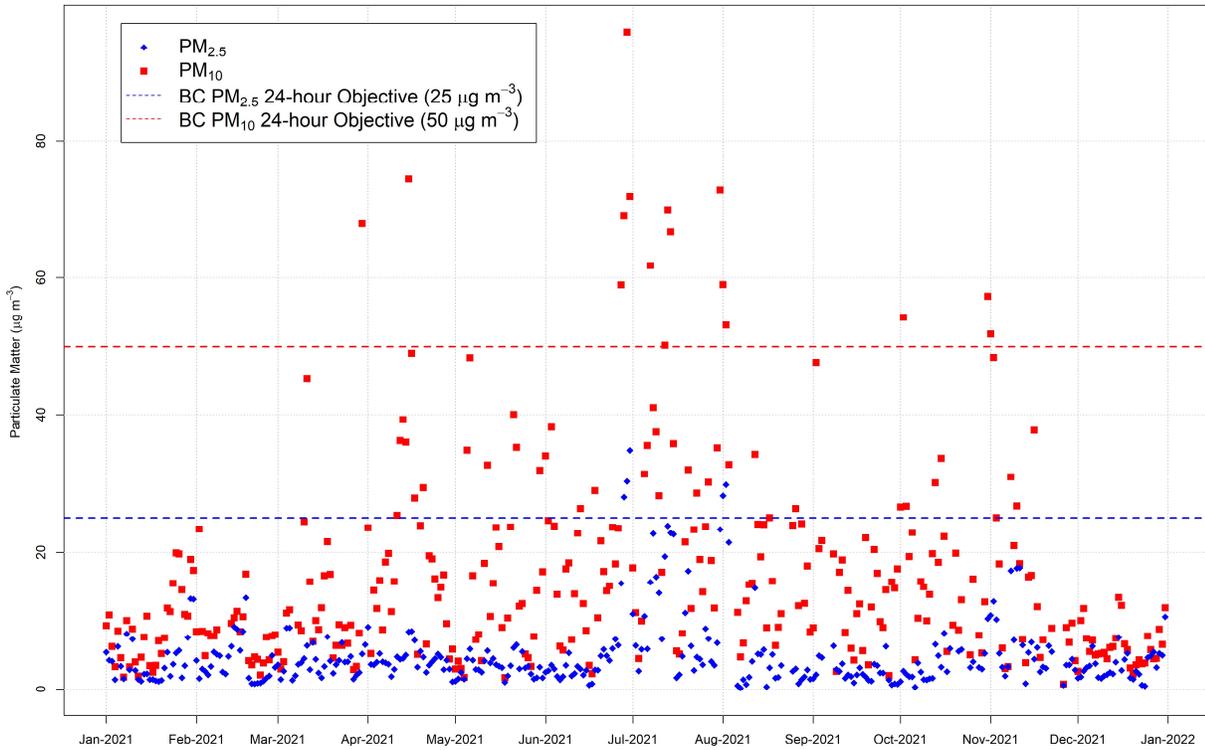


Figure 3-3: Daily average PM_{2.5} and PM₁₀ measurements from Station 7C – Fort St. John North Camp C for 2021 (in µg/m³). The target AAQO's are plotted as broken lines. The annual daily 98th percentile PM_{2.5} concentration of 22.8 µg/m³ was less than the AAQO (25 µg/m³) so all PM_{2.5} events were excursions.

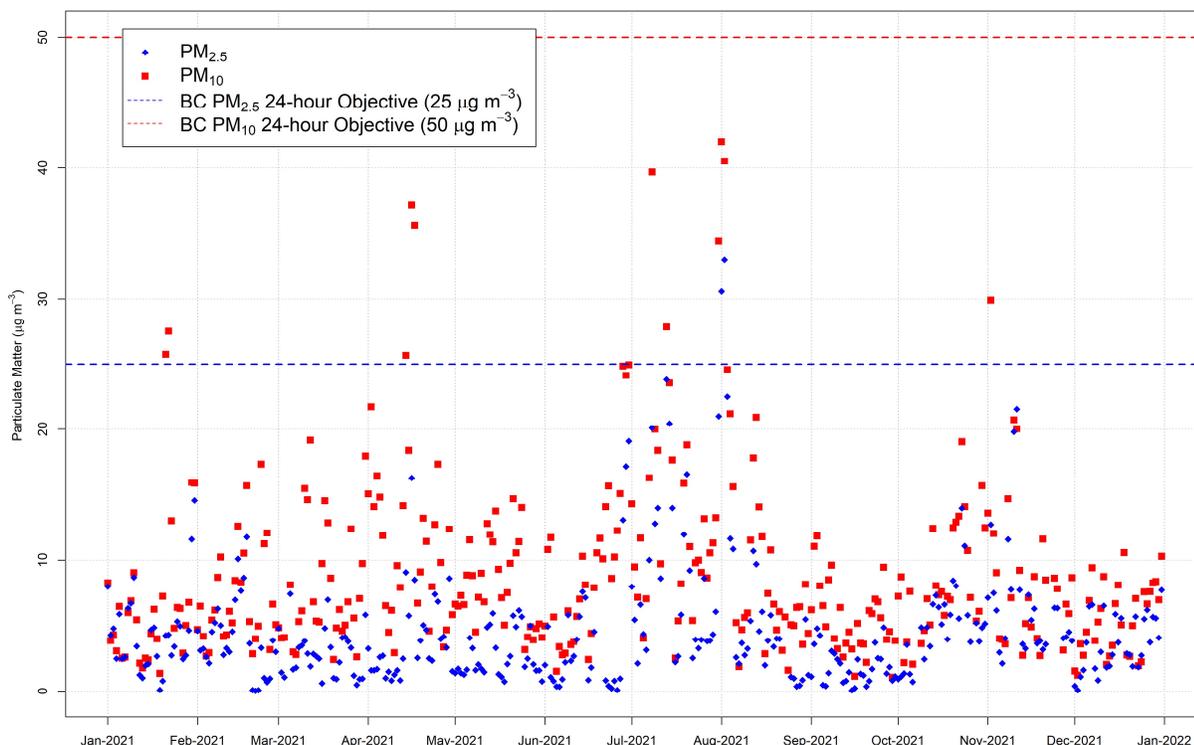


Figure 3-4: Daily average PM_{2.5} and PM₁₀ measurements from Station 8 – Old Fort for 2021 (in µg/m³). The target AAQO's are plotted as broken lines. The annual daily 98th percentile PM_{2.5} concentration of 20.1 µg/m³ was less than the AAQO (25 µg/m³) so all PM_{2.5} events were excursions.

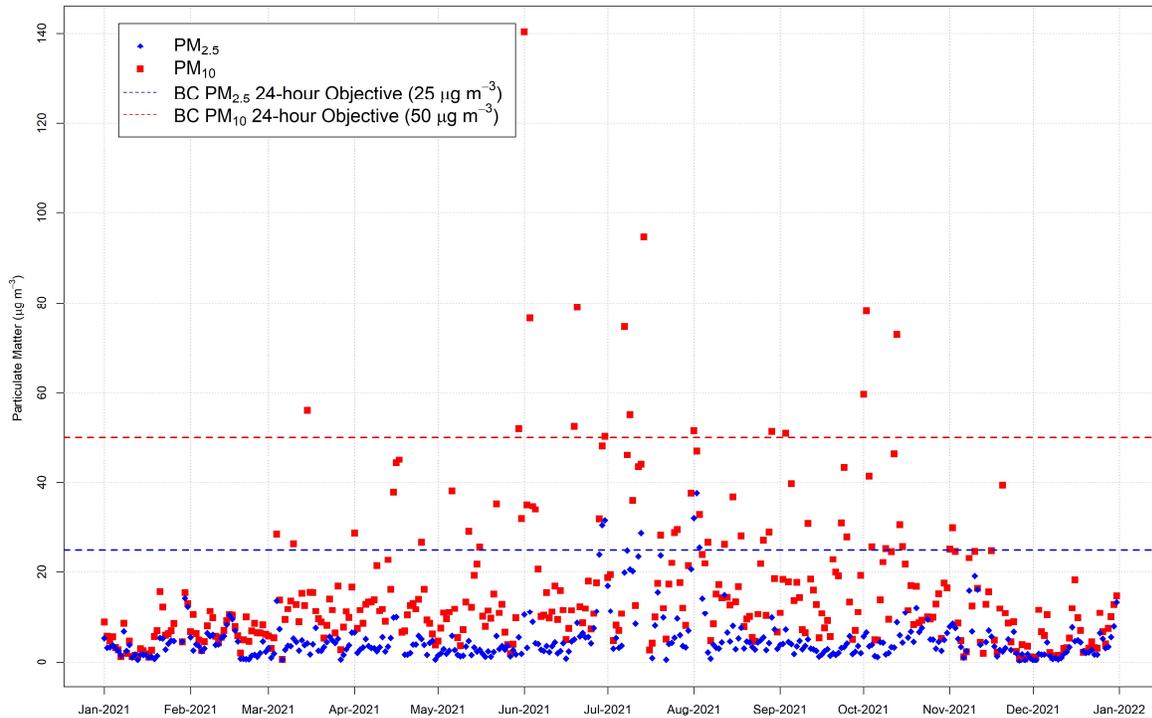


Figure 3-5: Daily average PM_{2.5} and PM₁₀ measurements from Station 9 - 85th Avenue for 2021 (in µg/m³). The target AAQO's are plotted as broken lines. The annual daily 98th percentile PM_{2.5} concentration of 24 µg/m³ was less than the AAQO (25 µg/m³) so all PM_{2.5} events were excursions.

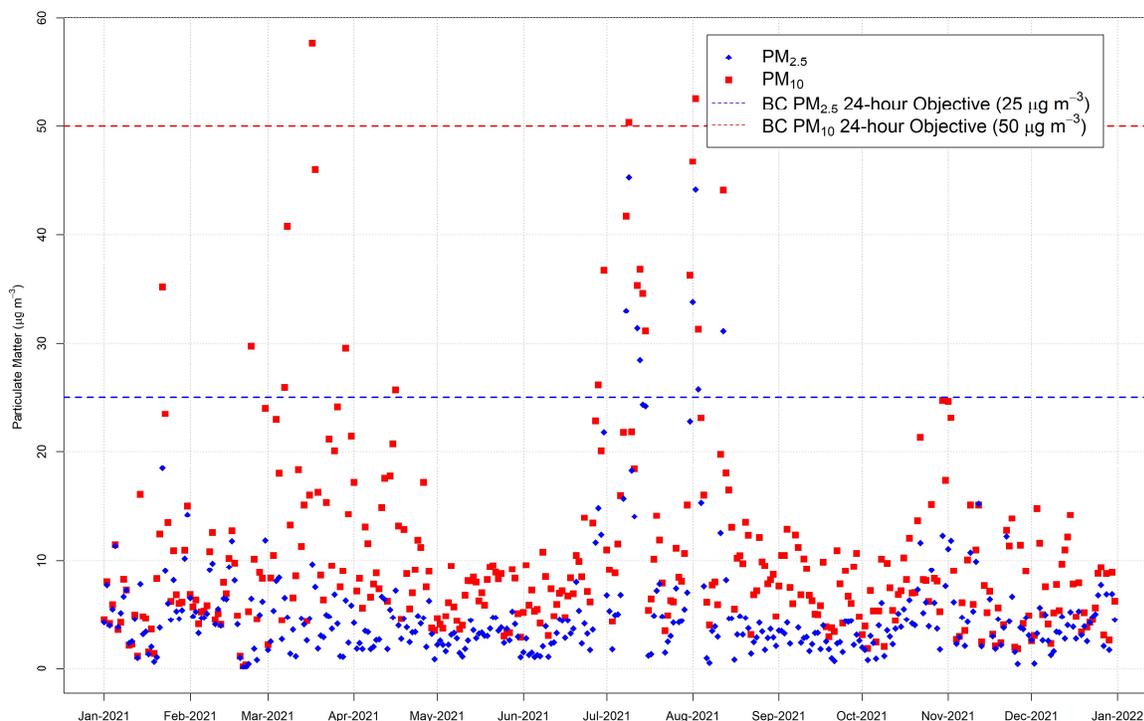


Figure 3-6: Daily average PM_{2.5} and PM₁₀ measurements from Station 12 – Hudson’s Hope for 2021 (in µg/m³). The target AAQO’s are plotted as broken lines. The annual daily 98th percentile PM_{2.5} concentration of 25.5 µg/m³ was greater than the AAQO (25 µg/m³) so all PM_{2.5} events were exceedances.

An email alerting system operated for the duration of 2021 to immediately notify BC Hydro staff and its contractors about any excursions of the AAQOs taking place so they could work to identify the source and mitigate its associated effects if it was found to be related to their operations. As of December 31, 2021, the distribution list for the alerting system included 122 individuals representing 25 firms, including BC Hydro and contractor environment, health and safety, and construction management personnel, and the Project’s Independent Environmental Monitor (EDI Environmental Dynamics Inc.). The alerting system sends notifications of events when concentrations near or above AAQO’s are being recorded by the analyzers.

Table 3-4 lists the alert events for 2021 at the five monitoring stations. Note that some of these events persisted over more than one day and had multiple daily excursions and exceedances within the time period (i.e., start and end dates).



Table 3-4: Summary of PM alert events at Site C in 2021.

Start Date	End Date	Station	Contaminant	Excursion /Exceedance	Total Excursions or Exceedances During Event
2021-02-28	2021-03-01	Stn 12: Hudson's Hope	PM _{2.5}	No ⁽¹⁾	-
2021-03-11	2021-03-12	Stn 7B/C North Camp	PM ₁₀	No ⁽¹⁾	-
2021-03-15	2021-03-16	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	1
2021-03-17	2021-03-19	Stn 12: Hudson's Hope	PM ₁₀	Exceedance	1
2021-03-30	2021-03-31	Stn 7B/C: North Camp	PM ₁₀	Exceedance	1
2021-04-13	2021-04-13	Stn 7B/C: North Camp	PM ₁₀	No ⁽¹⁾	-
2021-04-15	2021-04-17	Stn 7B/C: North Camp	PM ₁₀	Exceedance	1
2021-04-16	2021-04-18	Stn 9: Fort St. John 85th Ave	PM ₁₀	No ⁽¹⁾	-
2021-04-17	2021-04-17	Stn 8: Fort St. John Old Fort	PM ₁₀	No ⁽¹⁾	-
2021-04-20	2021-04-20	Stn 7B/C: North Camp	PM ₁₀	No ⁽¹⁾	-
2021-05-06	2021-05-07	Stn 7B/C: North Camp	PM ₁₀	No ⁽¹⁾	-
2021-05-22	2021-05-22	Stn 7B/C: North Camp	PM ₁₀	No ⁽¹⁾	-
2021-05-30	2021-06-04	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	3
2021-06-19	2021-06-20	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	2
2021-06-27	2021-07-01	Stn 7B/C: North Camp	PM ₁₀	Exceedance	4
2021-06-28	2021-07-01	Stn 7B/C: North Camp	PM _{2.5}	Excursion	3
2021-06-28	2021-07-01	Stn 9: Fort St. John 85th Ave	PM _{2.5}	Excursion	2
2021-06-30	2021-07-01	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	1
2021-07-01	2021-07-01	Stn 8: Fort St. John Old Fort	PM _{2.5}	No ⁽¹⁾	-
2021-07-07	2021-07-15	Stn 7B/C: North Camp	PM ₁₀	Exceedance	4
2021-07-07	2021-07-15	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	3
2021-07-08	2021-07-15	Stn 9: Fort St. John 85th Ave	PM _{2.5}	Excursion	1
2021-07-08	2021-07-14	Stn 1: Peace Valley Attachie Flat Upper Terrace	PM _{2.5}	Excursion	2
2021-07-08	2021-07-16	Stn 12: Hudson's Hope	PM _{2.5}	Exceedance	4
2021-07-08	2021-07-14	Stn 1: Peace Valley Attachie Flat Upper Terrace	PM ₁₀	No ⁽¹⁾	-
2021-07-08	2021-07-16	Stn 7B/C: North Camp	PM _{2.5}	No ⁽¹⁾	-
2021-07-09	2021-07-14	Stn 12: Hudson's Hope	PM ₁₀	Exceedance	1
2021-07-13	2021-07-14	Stn 8: Fort St. John Old Fort	PM _{2.5}	No ⁽¹⁾	-
2021-07-20	2021-07-21	Stn 9: Fort St. John 85th Ave	PM _{2.5}	No ⁽¹⁾	-
2021-07-31	2021-08-03	Stn 7B/C: North Camp	PM ₁₀	Excursion	3
2021-08-01	2021-08-06	Stn 7B/C: North Camp	PM _{2.5}	Excursion	2
2021-08-01	2021-08-04	Stn 1: Peace Valley Attachie Flat Upper Terrace	PM _{2.5}	Excursion	2
2021-08-01	2021-08-04	Stn 12: Hudson's Hope	PM _{2.5}	Exceedance	3
2021-08-01	2021-08-03	Stn 8: Fort St. John Old Fort	PM _{2.5}	Excursion	2
2021-08-01	2021-08-04	Stn 9: Fort St. John 85th Ave	PM _{2.5}	Excursion	3



Start Date	End Date	Station	Contaminant	Excursion /Exceedance	Total Excursions or Exceedances During Event
2021-08-01	2021-08-03	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	1
2021-08-01	2021-08-21	Stn 8: Fort St. John Old Fort	PM ₁₀	No ⁽¹⁾	-
2021-08-01	2021-08-03	Stn 12: Hudson's Hope	PM ₁₀	Exceedance	1
2021-08-02	2021-08-03	Stn 1: Peace Valley Attachie Flat Upper Terrace	PM ₁₀	Exceedance	1
2021-08-12	2021-08-13	Stn 12: Hudson's Hope	PM _{2.5}	Exceedance	1
2021-08-29	2021-08-30	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	1
2021-09-03	2021-09-04	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	1
2021-09-24	2021-09-25	Stn 9: Fort St. John 85th Ave	PM ₁₀	No ⁽¹⁾	-
2021-10-01	2021-10-03	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	2
2021-10-02	2021-10-03	Stn 7B/C: North Camp	PM ₁₀	Exceedance	1
2021-10-12	2021-10-14	Stn 9: Fort St. John 85th Ave	PM ₁₀	Exceedance	1
2021-10-31	2021-11-03	Stn 7B/C: North Camp	PM ₁₀	Exceedance	2
2021-12-11	2021-12-13	Stn 1: Peace Valley Attachie Flat Upper Terrace	PM _{2.5}	No ⁽¹⁾	-

NOTES: Events highlighted yellow and red indicate that there was a regional Air Quality Advisory in place or Smokey Skies Bulletin released by ENV at these times, respectively.

(1) 'No' indicates a measurement of 90% of the AAQO was recorded, but levels did not exceed the AAQO.

The PM_{2.5} and PM₁₀ excursions/exceedances recorded between June 30th through August 3rd coincided with time periods when the ENV issued Smokey Skies bulletins due to forest fires and this was the major factor in elevated PM levels. Earlier in the year (April 17-18) ENV issued an Air Quality Advisory and this time period overlapped with PM₁₀ alerts recorded at stations with higher residential populations and industrial activity (3 events recorded April 15 to 18). These advisories provide important regional context for the air quality exceedances recorded by stations in the Site C monitoring network. Events recorded at only one station such as at the main Project dam construction site, Station 7C (Fort St. John North Camp C) are more likely to originate from a local PM emission source(s) from the Project, while one emission source like a wildfire could potentially be detected at many stations.

Open burning of piles of vegetation cleared in the footprint of the future Site C reservoir occurred in 2021 and are summarized in Table 3-5.

Table 3-5: 2021 Open Burn Pile Summary

Location	2021 Burn Piles
Forestry Clearing	1008
Highway	46
TOTAL	1054

All ignition events were based on custom venting forecasts which were used to inform brush burning events. A Qualified Environmental Professional (QEP) sent out advance notification for every ignition event to the stakeholder



list included as Appendix A in the Smoke Management Plan (Rev. 5, BC Hydro 2021). Notices were also included in publications (e.g., notifications to First Nations, biweekly construction bulletins, etc.) distributed by the BC Hydro public relations team.

3.3 Gaseous Criteria Air Contaminants

Table 3-6 gives an overview of the completeness of the datasets for gaseous criteria air contaminants (CO, NO₂ and SO₂) measured at Station 7C (Fort St. John North Camp C) and Station 12 (Hudson's Hope), as well as the number of any excursions and/or exceedances above the provincial AAQOs (ENV 2021) and a comparison of the annual averages with the provincial AAQOs.

For CO, a value is an exceedance once it is greater than the provincial Pollution Control Objectives (PCOs); whereas, for NO₂ and SO₂, there is only an exceedance if the 98th and 97th percentile of daily 1-hour maxima in the year is greater than their AAQOs, respectively. If this condition has not been met, values above the respective AAQOs do not constitute exceedances and are classified only as excursions.

Table 3-6: Summary of gaseous criteria air contaminant results for 2021 at Station 7C (Fort St. John North Camp C) and Station 12 (Hudson's Hope) (in µg/m³).

	Station 7C Fort St. John North Camp C				Station 12 Hudson's Hope	
	NO ₂	SO ₂	CO	CO (8-hr Rolling Average)	NO ₂	SO ₂
Percentage data complete	98.9	99.5	96.8	95.6	99.7	99.7
1-hour AAQO	113	183	14,300	NA ⁽¹⁾	113	183
8-hour AAQO	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	5,500	NA ⁽¹⁾	NA ⁽¹⁾
AAQO/PCO Exceedances / Excursions ⁽²⁾	0	0	0	0	0	0
Annual AAQO	32	13	NA ⁽¹⁾	NA ⁽¹⁾	32	13
Annual Average	7.6	0.7	156	156	4.2	0.9
97 th percentile of Daily 1-Hour Maximum	NA ⁽¹⁾	10.6	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	2.6
98 th percentile of Daily 1-Hour Maximum	50.1	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	40.5	NA ⁽¹⁾

NOTES: (1) NA is used where the quantity in question is not applicable to the measurement.
 (2) The term excursion is used here for NO₂ and SO₂ when the daily 1-hour maximum is greater than their respective AAQO but without satisfying the 98th or 97th percentile condition for achievement.

No excursions of the 1-hour SO₂ and 1-hour NO₂ AAQOs were observed in 2021 at either Station 7C (Fort St. John North Camp C) or Station 12 (Hudson's Hope). There were also no observed exceedances of the 1-hour and 8-hour rolling average PCOs for CO in 2020 at Station 7C (Fort St. John North Camp C). The annual average NO₂ and SO₂ concentrations were well below their respective annual AAQOs.

Figure 3-7 through Figure 3-9 show the daily 1-hour maximum concentrations of NO₂ and SO₂, as well as the 1-hour and 8-hour rolling average CO concentrations, respectively at Station 7C (Fort St. John North Camp C). Figure 3-10



and Figure 3-11 show the daily 1-hour maximum concentrations of NO₂ and SO₂, at Station 12 (Hudson's Hope), respectively.

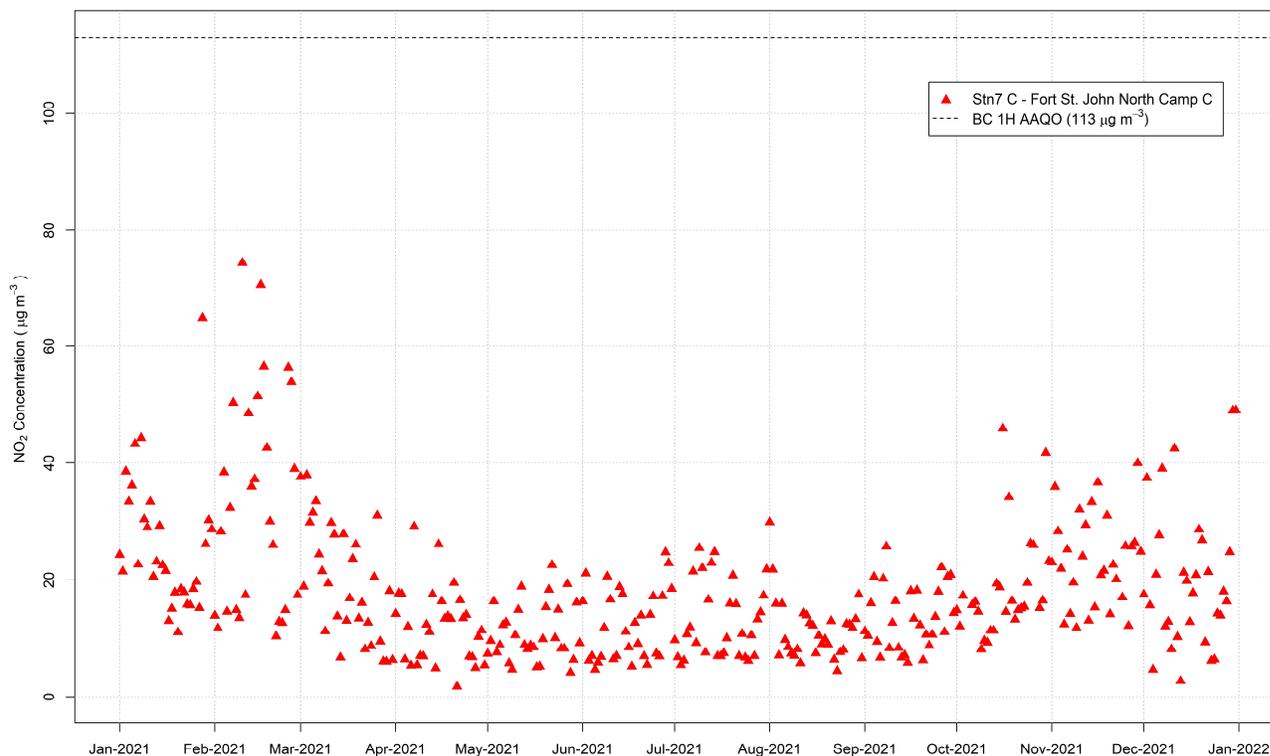


Figure 3-7: Daily 1-hour maximum NO₂ concentrations from Station 7C - Fort St. John North Camp C for 2021 (in µg/m³).

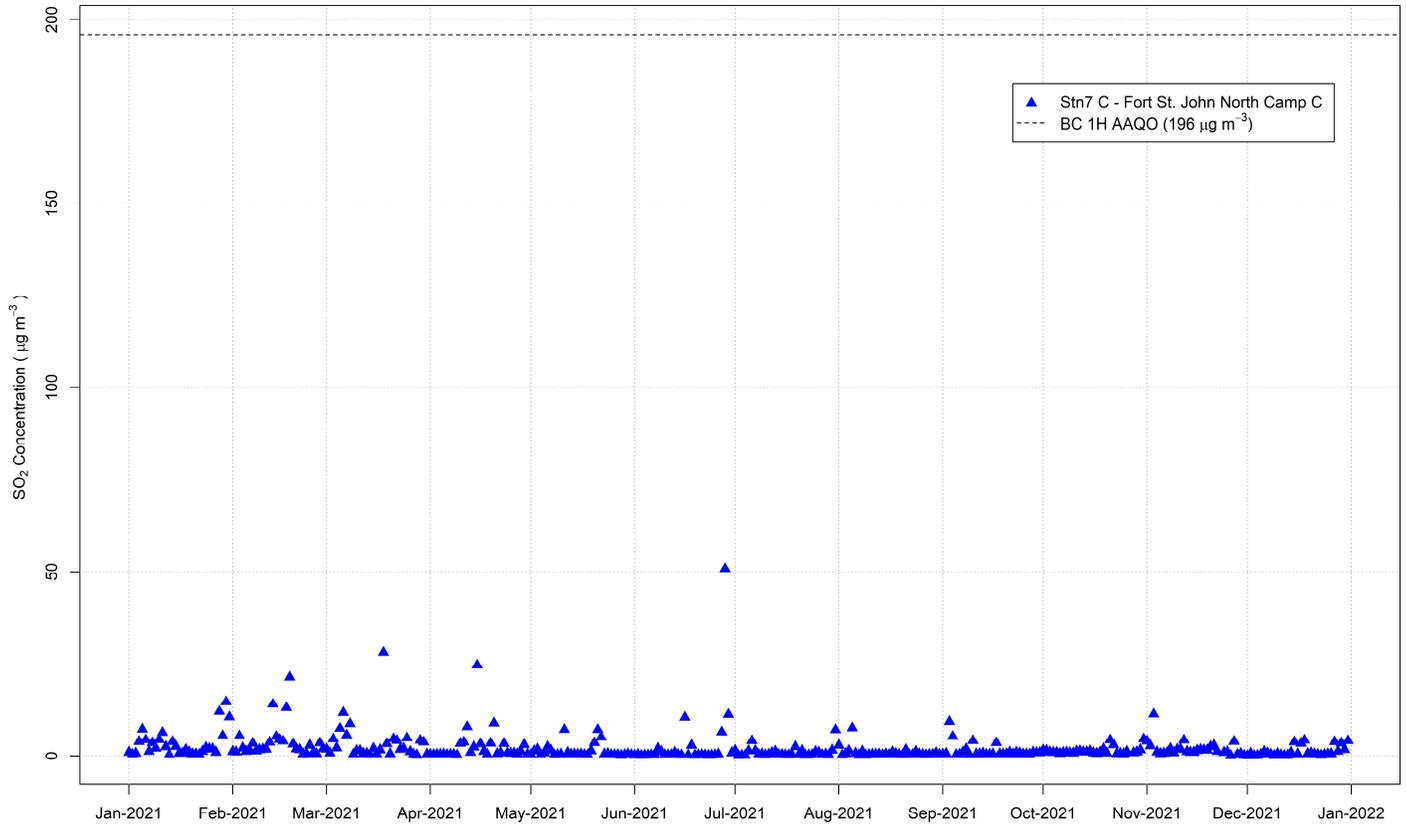


Figure 3-8: Daily 1-hour maximum SO₂ concentrations from Station 7C - Fort St. John North Camp C for 2021 (in µg/m³).

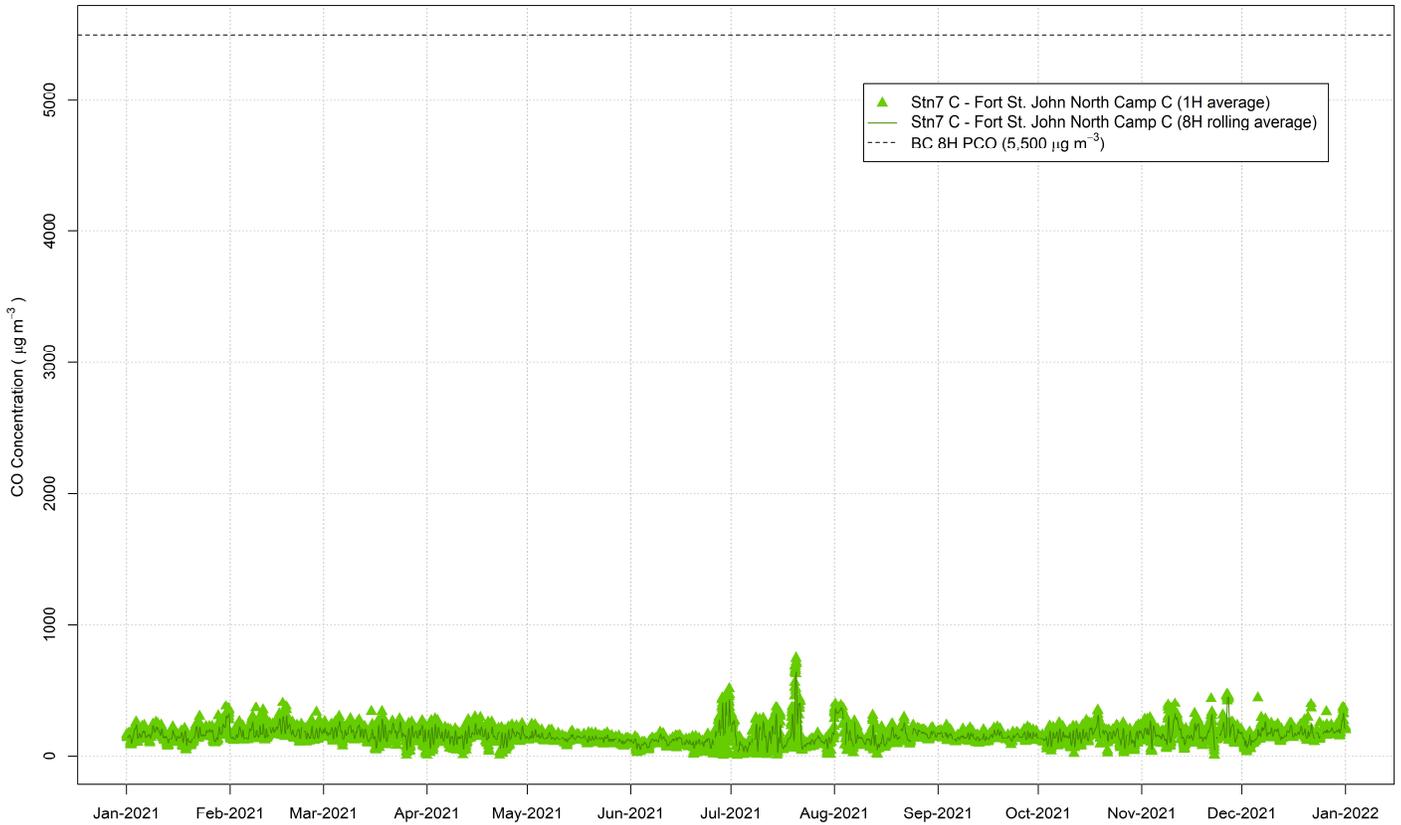


Figure 3-9: 1-hour (green) and 8-hour rolling average (black line) CO concentrations from Station 7C - Fort St. John North Camp C for 2021 (in $\mu\text{g/m}^3$).

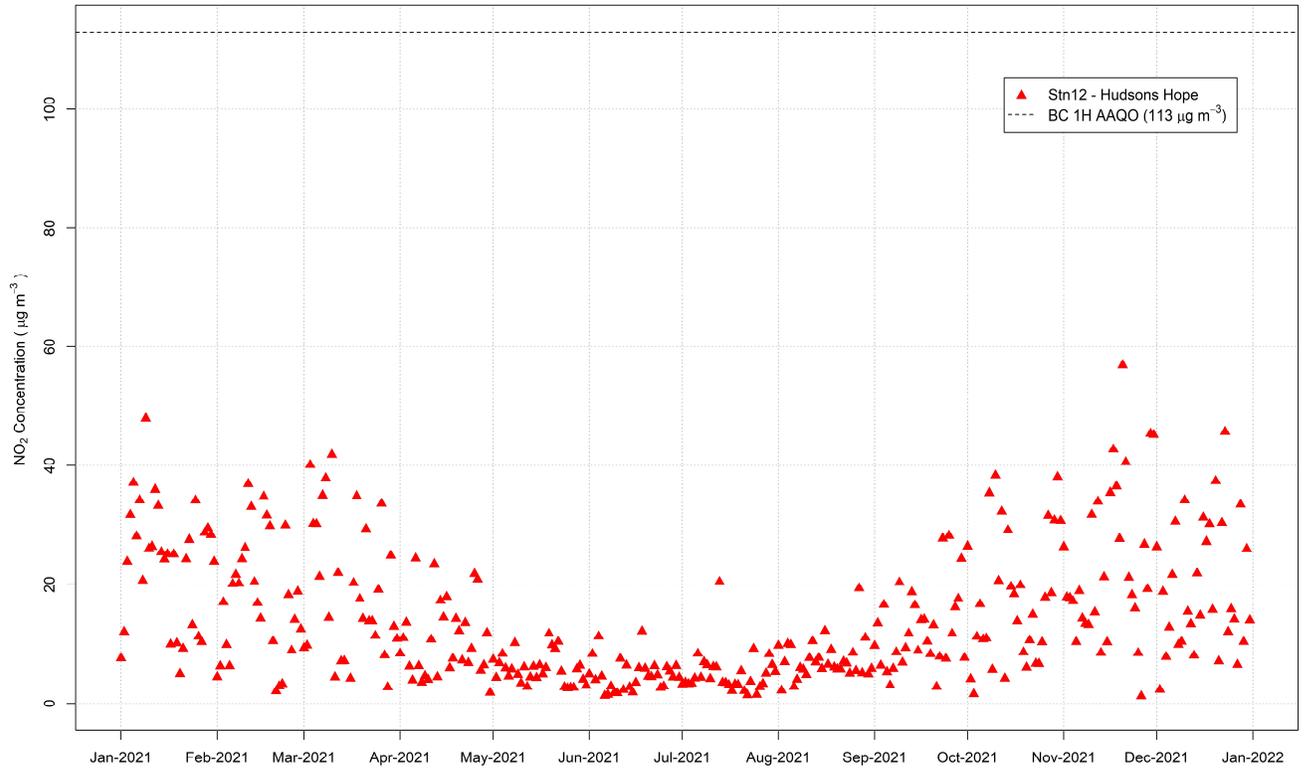


Figure 3-10: Daily 1-hour maximum NO₂ concentrations from Station 12 - Hudson's Hope for 2021 (in µg/m³).

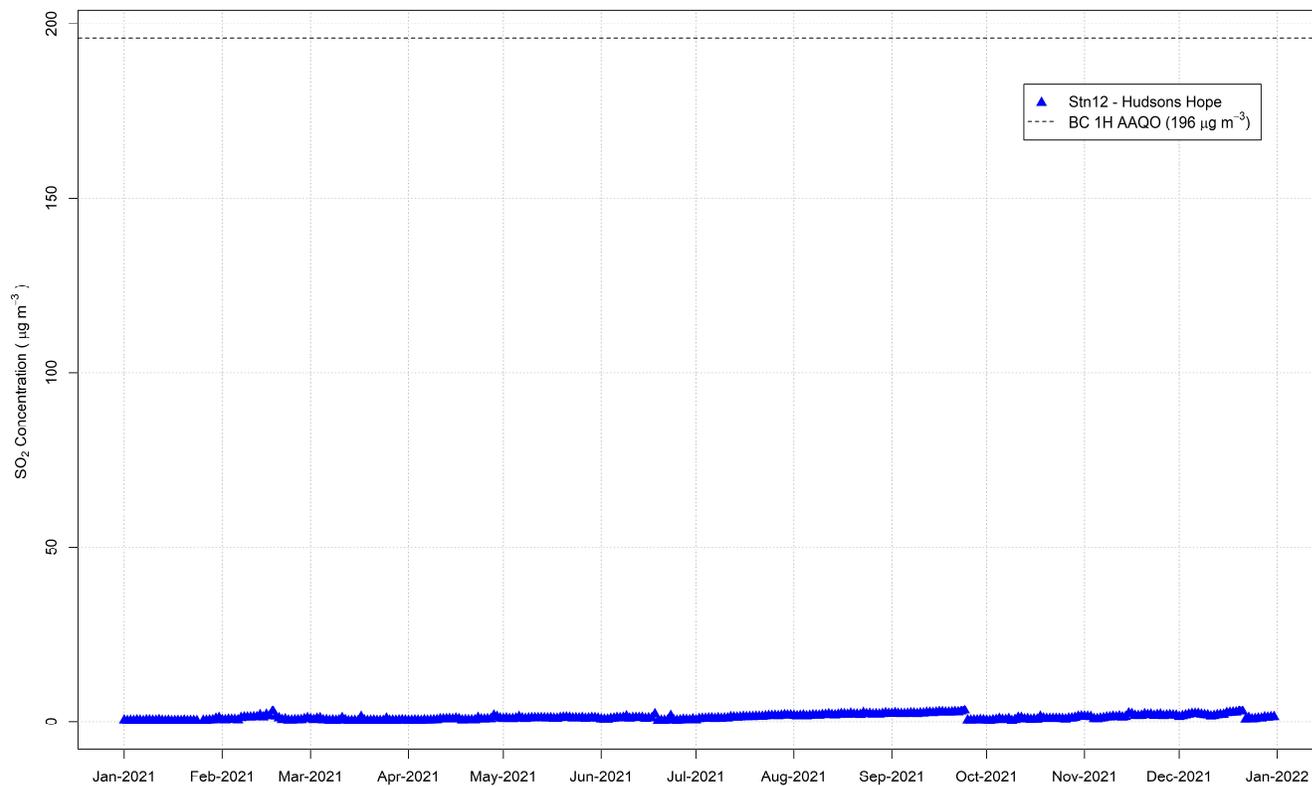


Figure 3-11: Daily 1-hour maximum SO₂ concentrations from Station 12 - Hudson's Hope for 2021 (in µg/m³).



3.4 Air Quality Reporting

Condition 12.3.3 of the FDS requires that BC Hydro produce a plan that includes procedures to enable the appropriate authorities to alert sensitive receptor groups and Reservoir Area Indigenous Groups in case of any measured exceedances of the AAQO's and to address those exceedances. Following Section 5.0 of BC Hydro's Air Quality Monitoring Program (included as Appendix A of the CEMP; BC Hydro 2022), BC Hydro has developed a MOU with ENV to allow access to all air quality readings monitored by BC Hydro. The MOU includes an agreement for BC Hydro to share collected data, with the understanding that ENV will regularly audit the monitoring stations (see Section 3.4.1).

According to the MOU, ENV will be responsible for reporting the information publicly on the Ministry's near real-time air quality data portal¹. This data portal is currently active and available to all interested parties to view current and historical air quality data from BC Hydro's air quality monitoring stations. Based on these measurements and other monitoring in the region, ENV and Northern Health are able to issue air quality advisories as they deem appropriate. In addition, quality assured data are provided annually to ENV prior to the subsequent Provincial Clean Air Day, in accordance with the MOU. Throughout 2021, also in accordance with the MOU, measurements from the Site C monitoring network were shared regularly (monthly) with the Pacific Climate Impacts Consortium (PCIC).² PCIC is a regional climate service centre at the University of Victoria that provides practical information on the physical impacts of climate variability and change in the Pacific and Yukon Region of Canada.

The BC Hydro ambient network has been operated at a high standard that is consistent with provincial and national technical standards per guidance documents. The real-time readings are being shared with external users to inform decision-making for health alerts and climate issues and with internal Project contractors, and BC Hydro managers and decision makers to minimise emissions and comply with the AAQO's. External audits are discussed in the following section and have indicated that the data quality is high and meets expectations. BC Hydro concludes that the ambient monitoring program is a success and is very useful to all parties seeking reliable, timely and accessible information that has been verified to the highest applicable technical standards.

3.4.1 Monitoring Station Audits

During 2021 the ENV conducted equipment performance audits on all five ambient air quality monitoring stations on March 15-16th, June 22-23rd and October 25-26th in accordance with the MOU. The results of these audits are presented in Table 3-7. Pass rates for the three audits in 2021 were 93% (13 of 14 analyzers) in March, 100% (all analyzers) in June and 93% (13 of 14 analyzers) in October.

In March, the Station 12 (Hudson's Hope) NO_x analyzer failed on the low span point, likely due to poor station temperature control during the audit calibration. The failed unit was re-calibrated, and care is now taken to avoid calibration checks while staff are moving in and out of the station which can allow room temperature drift. In June, the Station 8 (Fort St John - Old Fort) PM_{2.5} analyzer had been recently installed after annual maintenance and was still settling and so was not audited. In October, the Station 7C (Fort St John North Camp) PM_{2.5} analyzer failed the foil calibration audit. The root cause of this failure is uncertain as prior foil calibrations indicated the system was

¹ <https://envistaweb.env.gov.bc.ca/> Data is available by searching in the reporting tool under purpose = BC HYDRO

² <https://www.pacificclimate.org/>



working well. It is possible that the foil calibration kit was contaminated or that accumulated dust in the enclosure's air conditioning unit got knocked into the foil chamber during the audit. The foil calibration test was repeated multiple times, and an adjustment of 5% was accepted. The corrective action implemented was to return the foils for calibration certification and carefully clean around the beta chamber. Quarterly foil checks will continue as previously, since they have proven to be sufficient.

Table 3-7: Summary of ENV audit results for 2021.

Station	Parameter	Audit Date		
		Mar 15-16th 2021	Jun 22-23rd 2021	Oct 25-26th 2021
Station 1 (Attachie Flat Upper Terrace)	PM _{2.5}	Pass	Pass	Pass
	PM ₁₀	Pass	Pass	Pass
Station 7C (Fort St. John North Camp C)	PM _{2.5}	Pass	Pass	Fail
	PM ₁₀	Pass	Pass	Pass
	NO _x	Pass	Pass	Pass
	SO ₂	Pass	Pass	Pass
Station 8 (Old Fort)	PM _{2.5}	Pass	No Audit	Pass
	PM ₁₀	Pass	Pass	Pass
Station 9 (85th Avenue)	PM _{2.5}	Pass	Pass	Pass
	PM ₁₀	Pass	Pass	Pass
Station 12 (Hudson's Hope)	PM _{2.5}	Pass	Pass	Pass
	PM ₁₀	Pass	Pass	Pass
	NO _x	Fail	Pass	Pass
	SO ₂	Pass	Pass	Pass



4 CONCLUSIONS

Data quality was high in 2021 and the completed amount of valid data exceeded 93% for the 1-hour readings and exceeded 91% for the 24-hour averages. The vast majority of the measured ambient concentrations in 2021 were well below their respective AAQO. Year 2021 included a hot and dry summer that featured several wildfires that can be related to the elevated PM readings as discussed below. No exceedances of the 1-hour or annual AAQO's for sulphur dioxide (SO₂) and nitrogen dioxide (NO₂), or 1-hour and 8-hour Pollution Control Objectives (PCO's) 's for carbon monoxide (CO) were observed in 2021 at the two stations where these parameters are being measured, specifically, Station 7C (Fort St. John North Camp C) and Station 12 (Hudson's Hope).

For particulate matter, elevated levels of PM_{2.5} and PM₁₀ were not uncommon in 2021 due to the extensive forest fire season. Relative to the BC AAQO, there were twenty-six exceedances of the 24-hour target of 50 µg/m³. The majority of the 24-hour PM₁₀ exceedances outside of the fire season were observed at Station 7C (Fort St. John North Camp C), Station 9 (85th Avenue), and Station 12 (Hudson's Hope). After careful consideration of weather conditions, these can likely be attributed to dam construction activities. An alerting system is in place to immediately notify BC Hydro and its contractors about excursions of the AAQOs taking place so they can work to identify the activities onsite that may be responsible for the emissions and implement mitigation measures or change activities to reduce those emissions.

For PM_{2.5} measurements in 2021, there were 17 excursions recorded where elevated levels occurred and alerts were issued; however, most of the calculated 98th percentile values were below the BC AAQO of 25 µg/m³. Eight exceedances of the AAQO were recorded at the Hudson's Hope Station. The PM_{2.5} alert at Station 8 (Fort St-John Old Fort) in February 2021 was the result of local burning not related to Site C activities. During April 2021 regionally elevated PM₁₀ values exacerbated conditions in Fort St John causing alerts to be triggered. During the months of July and August in 2021, there were extensive wildfires in British Columbia and these events were detected at all of the network's PM₁₀ and PM_{2.5} units and triggered over 20 alerts. It is also likely that the PM_{2.5} alert from Station 7C (Fort St. John North Camp C) and Station 9 (85th Avenue) were caused by the regional forest fires, as there was no local burning occurring. The PM_{2.5} alert event at Station 12 (Hudson's Hope) on August 12th, 2021 was likely the result of a local wildfire near the Williston Lake area.

During 2021 the BC ENV conducted equipment performance audits on all five ambient air quality monitoring stations on March 15-16, June 22-23 and October 25-26 in accordance with the BC Hydro Memorandum of Understanding. The results of these audits were excellent and indicated pass rates for the three audits were 93% (13 of 14 analyzers) in March, 100% (all analyzers) in June, and 93% (13 of 14 analyzers) in October.



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RWDI Air Inc. (2019). Site C Climate and Air Quality Monitoring Annual Report 2018. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2020). Site C Climate and Air Quality Monitoring Annual Report 2019. Prepared for BC Hydro Power and Authority. Vancouver, BC.

RWDI Air Inc. (2021) Site C Climate and Air Quality Monitoring Annual Report 2020. Prepared for BC Hydro Power and Authority. Vancouver, BC.

APPENDIX A

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2021 COMPLIANCE SUMMARY



Table A- 1: Summary of AQMP Conditions and Year 2021 Compliance Summary

Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
EAC Condition 57	The EAC Holder must develop an Air Quality Management Plan and Smoke Management Plan	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan and B (Air Quality Monitoring Plan)	Completed February 4, 2016	Construction Environmental Monitoring Plan
	The Air Quality Management Plan and Smoke Management Plan must include at least the following to describe how the EAC Holder:			
	<ul style="list-style-type: none"> Identify places of high use by Indigenous Groups for traditional purposes and develop mitigation measures if adverse effects are predicted at those locations. 	Ground truthing activities are conducted per the Aboriginal Plant Use Mitigation Plan, Cultural Resources Mitigation Plan, and Heritage Resources Management Plan.	<ul style="list-style-type: none"> BC Hydro has initiated ground truthing programs with the purpose of engaging with Indigenous land users, including registered trapline holders, to verify and accurately locate Indigenous land use information, and to identify concerns related to specific features, or sites that may be affected by the Project. BC Hydro has provided funding to Indigenous groups for ground truthing through Consultation and Capacity Funding Agreements. During this reporting period, ground truthing was undertaken by Blueberry River, Doig River, and 	<p>To date, ground truthing has identified areas of Indigenous use along the transmission line right-of-way, Cache Creek / Bear Flats, and Halfway River / Attachie Flats, and other areas.</p> <p>Confidential ground truthing reports that summarize the ground truthing activities identify times when these areas may be used.</p> <p>Setback distances and ignition criteria described in the Smoke Management Plan (Sections 4.4 and 5.0, respectively) would apply in these areas.</p> <p>Indigenous groups will be notified of planned debris burning through the activities and tools described in section 5.0 of the Aboriginal Group Communications Plan (Appendix D of the CEMP).</p> <p>BC Hydro continues to consult with Indigenous groups regarding construction plans, and has sent invitation letters in April and September 2017; January, June, and August 2018; June and August 2019; May 2020; and August 2021 highlighting areas where construction is planned in order that Indigenous groups could ground truth</p>



Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
			Halfway River First Nation.	areas of traditional significance prior to construction.
	<ul style="list-style-type: none"> Measures to manage emissions and dust from all Project activities. 	Construction Environmental Management Plan Section 4.1	Completed February 4, 2016, and ongoing	Section 4.1 provides mitigation measures to be completed to manage emissions and dust.
	<ul style="list-style-type: none"> Measures to manage Project effects on air quality associated with concrete production at concrete batch plants. 	Construction Environmental Management Plan Section 4.1	Completed February 4, 2016, and ongoing	Section 4.1 provides mitigation measures to be taken to manage air quality effects associated with concrete batch plant operations
	<ul style="list-style-type: none"> Control Project-related smoke by following the most current BC Ministry of Environment Open Burning Smoke Control Regulation. 	Construction Environmental Management Plan Appendix A	Ongoing	Section 4.1 and Appendix A of the CEMP refer to the requirement to control Project-related smoke in accordance with the BC Ministry of Environment and Climate Change's Open Burning Smoke Control Regulation. BC Hydro audits compliance with this requirement by reviewing contractor EPPs and conducting environmental audits during construction to verify implementation of EPPs.
	<ul style="list-style-type: none"> Measures to retain vegetative barriers, or install temporary barriers, where practical. 	Construction Environmental Management Plan Section 4.1	Ongoing	Section 4.1 identifies this commitment.
	<ul style="list-style-type: none"> Procedures to provide MOE with data collected during monitoring so that they can notify sensitive populations if air quality thresholds are exceeded. 	Construction Environmental Management Plan Appendix B Section 5.0	Ongoing	BC Hydro has entered into an agreement with the BC Ministry of Environment and Climate Change (ENV) to make all air quality measurements available in near real-time. All operational air quality stations are accessed hourly by the BC ENV.
	The EAC Holder must monitor air quality associated with shoreline protection works at Hudson's Hope during the construction period and for the first two years of operations.	Construction Environmental Management Plan Appendix B Section 4.0	Ongoing	Shoreline protection works at Hudson's Hope began in 2020 and will continue through 2022. An air quality monitoring station was installed in October 2020, monitoring will continue during construction and for the first 2 years of Site C operations.



Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
	The EAC Holder must provide these draft Air Quality Management Plan and Smoke Management Plan to MOE, City of Fort St. John, District of Hudson’s Hope, Peace River Regional District, District of Taylor, District of Hudson’s Hope, District of Chetwynd and Indigenous Groups for review a minimum of 90 days prior to the commencement of construction activities.	Draft Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendix A (Smoke Management Plan) and Appendix B (Air Quality Monitoring Program)	Completed	The draft CEMP was submitted for review and comment on October 17, 2014.
	The EAC Holder must file the final Air Quality Management Plan and Smoke Management Plan with EAO, MOE, City of Fort St. John, District of Hudson’s Hope, Peace River Regional District, District of Taylor, District of Chetwynd and Indigenous Groups a minimum of 30 days prior to the commencement of construction activities.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendix A (Smoke Management Plan) and Appendix B (Air Quality Monitoring Program)	Completed	The final (Revision 1) of the CEMP was provided to regulatory agencies, governments and Indigenous Groups on June 5, 2015. The CEMP continues to be updated as required, with the most recent version, Revision 9, dated January 17, 2022, was accessible to regulators, government agencies, Indigenous Groups and the public via the Site C Clean Energy Project website at: https://www.sitecproject.com/document-library/environmental-management . https://www.sitecproject.com/sites/default/files/construction-environmental-management-plan-CEMP-rev-9_0.pdf



Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
	The EAC Holder must develop, implement and adhere to the final Air Quality Management Plan and Smoke Management Plan, and any amendments, to the satisfaction of EAO.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan and B (Air Quality Monitoring Plan)	Ongoing	<p>2020 Air Quality Management Plan Annual Report</p> <p>BC Hydro audits contractor compliance with implementation of relevant requirements of the Air Quality Management Plan through:</p> <ul style="list-style-type: none"> • reviewing Environmental Protection Plans (EPPs) submitted by the contractors and, • conducting environmental audits during construction to verify that requirements of the Plan are being considered and implemented as required <p>BC Hydro will continue to issue Field Advice Memos to its contractors to address any issues of non-compliance.</p>
EAC Condition 59	The EAC Holder must outline measures including relocation of affected home-owners, as deemed appropriate in consultation with affected home-owners, to address serious levels of noise or changes in air quality during construction of the Project. The measures would be included in the appropriate plans.	Construction Environmental Management Plan Section 4.11 (Noise and Vibration Management) and Appendix B (Air Quality Monitoring Plan)	Consultation with affected homeowners or Northern Health/BC Ministry of Environment to occur if necessary	A noise and air quality complaint response process has been developed and is being implemented. Key steps in the process include proactive noise mitigation, complaint response, monitoring/notification as required, and additional mitigation if warranted.



Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
FDS Condition 12.1	The Proponent shall ensure that Designated Project construction is undertaken in a manner that protects the health of Indigenous peoples, by ensuring that exceedances of federal and provincial ambient air quality objectives are avoided or minimized and by managing the potential effects of smoke and dustfall.		Ongoing	<p>Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan and B (Air Quality Monitoring Plan)</p> <p>BC Hydro audits contractor compliance with implementation of relevant requirements of the Air Quality Management Plan through:</p> <ul style="list-style-type: none"> • reviewing Environmental Protection Plans (EPPs) submitted by the contractors and, • conducting environmental audits during construction to verify that requirements of the Plan are being considered and implemented as required <p>BC Hydro will continue to issue Field Advice Memos to its contractors to address any issues of non-compliance.</p>
FDS Condition 12.2	The Proponent shall develop, in consultation with Reservoir Area Indigenous groups, an air quality management plan to ensure exceedances of those ambient air quality objectives due to Designated Project construction are avoided or minimized at human receptor sites located outside the Project Activity Zone.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan and B (Air Quality Monitoring Plan)	Completed February 4, 2016	Construction Environmental Management Plan



Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
FDS Condition 12.3	The plan shall include:			
FDS Condition 12.3.1	<ul style="list-style-type: none"> measures to avoid or minimize exceedances of federal and provincial ambient air quality objectives for Total Suspended Particulates (TSP), Particulate Matter (PM_{2.5}, PM₁₀), Carbon Monoxide (CO), Nitrogen Dioxide (NO₂) and Sulphur Dioxide (SO₂); 	Construction Environmental Management Plan Section 4.1	Completed February 4, 2016	Construction Environmental Management Plan
FDS Condition 12.3.2	<ul style="list-style-type: none"> measures to minimize or manage the potential effects of smoke and dustfall; 	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan)	Completed February 4, 2016	Construction Environmental Management Plan
FDS Condition 12.3.3	<ul style="list-style-type: none"> procedures to enable the appropriate authorities to alert sensitive receptor groups and Reservoir Area Indigenous groups in cases of exceedance of air quality standards and to address those exceedances; and 	Construction Environmental Management Plan Appendix B Section 5.0	Ongoing	BC Hydro has entered into an agreement with the BC ENV to make all air quality data available in near real-time. All operational air quality stations are accessed hourly by the BC ENV.
FDS Condition 12.3.4	<ul style="list-style-type: none"> procedures to monitor air quality effects at locations used by Indigenous groups and to develop mitigation measures if adverse effects are predicted at those locations. 	Construction Environmental Management Plan Appendix B	Completed July 8, 2016	Air quality monitors measuring PM ₁₀ and PM _{2.5} were installed at three locations before construction began. A fourth station at the construction site measuring PM ₁₀ , PM _{2.5} , SO ₂ , NO _x and CO was installed July 7, 2016, and a fifth station at Hudson's Hope measuring PM ₁₀ , PM _{2.5} , SO ₂ , and NO _x was installed as of October 1, 2020.

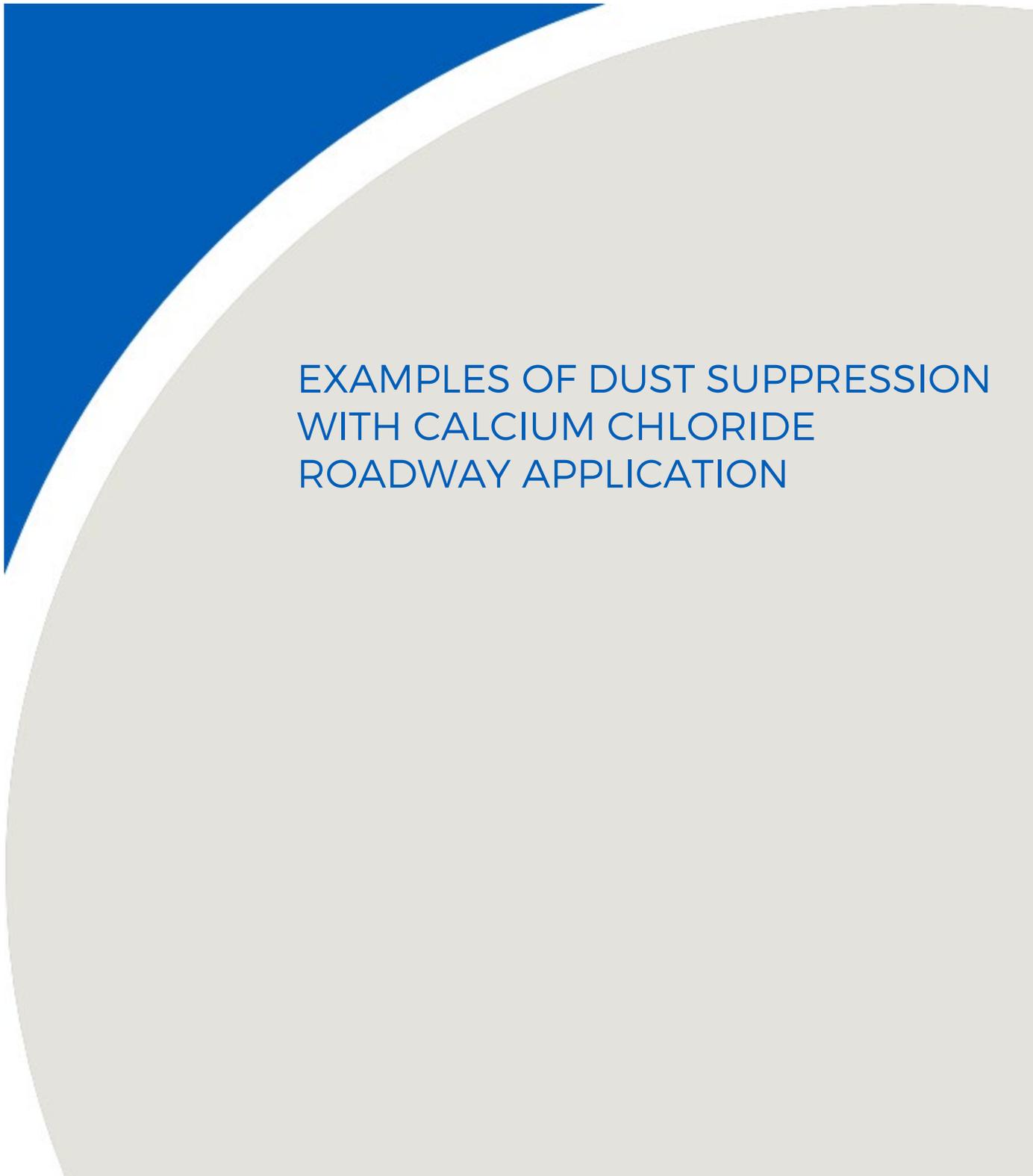


Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
FDS Condition 12.4	The Proponent shall submit to the Agency and Reservoir Area Indigenous groups a draft copy of the plan for review 90 days prior to initiating construction.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendix A (Smoke Management Plan)	Completed	The draft CEMP was submitted for review and comment on October 17, 2014.
FDS Condition 12.5	The Proponent shall submit to the Agency the final plan a minimum of 30 days prior to initiating construction. When submitting the final plan, the Proponent shall provide to the Agency an analysis that demonstrates how it has appropriately considered the input, views or information received from Reservoir Area Indigenous groups.	Construction Environmental Management Plan Section 4.1 (Air Quality Management Plan) and Appendices A (Smoke Management Plan)	Completed	The final Construction Environmental Management Plan, along with the Consideration Tracking Table was submitted on June 5, 2015.
FDS Condition 12.6	The Proponent shall implement the plan and provide to the Agency an analysis and summary of the implementation of the plan, as well as any amendments made to the plan in response to the results, on an annual basis during construction and the first year of operation.	Air Quality Management Plan 2015	5th Annual Report to CEAA included in this document.	Air Quality Management Plan 2015. <ul style="list-style-type: none"> • 1st Annual Report to CEAA submitted July 2016. • Second Annual Report submitted March 21, 2017 and revised June 14, 2017. • Third Annual Report was submitted March 29, 2018 • 4th Annual Report submitted April 1, 2019. • 5th Annual Report submitted March 31, 2020. • 6th Annual Report submitted March 31, 2021. • 7th Annual Report included in this document.

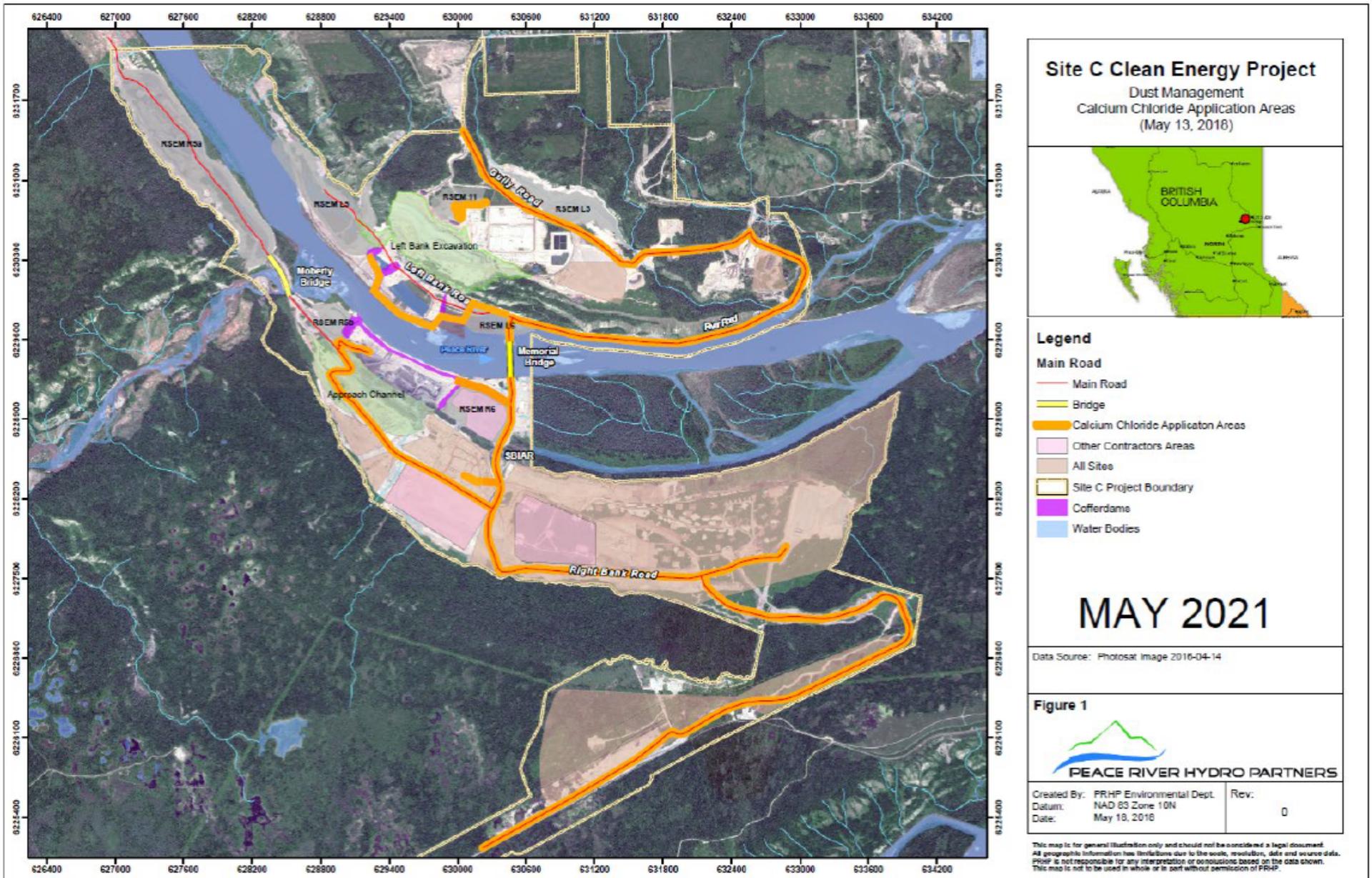


Condition	Condition Description	Plan Reference	Status	Evidence/Deliverables
FDS Condition 12.7	The Proponent shall provide a copy of the same version of its annual reporting on ambient air quality as provided to the Agency and in the same timeframe to Reservoir Area Indigenous groups and the Métis Nation British Columbia.	Air Quality Management Plan 2015	5th Annual Report to CEAA included in this document.	Air Quality Management Plan 2015. <ul style="list-style-type: none"> • 1st Annual Report to CEAA submitted July 2016. • Second Annual Report submitted March 21, 2017 and revised June 14, 2017. • Third Annual Report submitted March 29, 2018 • 4th Annual Report submitted April 1, 2019. • 5th Annual Report submitted March 31, 2020. • 6th Annual Report submitted March 31, 2021. • 7th Annual Report included in this document.

APPENDIX B

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EXAMPLES OF DUST SUPPRESSION WITH CALCIUM CHLORIDE ROADWAY APPLICATION



As provided by Peace River Hydro Partners in memos dated:
 May 12, 2021
 May 13, 2021
 July 22, 2021
 July 25, 2021
 July 27, 2021

Calcium chloride application -
Roadways within the 85th Avenue till conveyor corridor
As provided by Peace River Hydro Partners on May 14, 2021

