9. AIR QUALITY

This section describes and summarizes an assessment of the effects of the East-West Tie Transmission Project (the Project) on air quality. The assessment follows the general approach and concepts described in Section 5. The main steps in the assessment include:

- considering input from Indigenous communities, government representatives and agencies, other communities, property owners, and people or groups interested in the Project during the ongoing consultation and engagement process (Section 9.1);
- identifying information and data sources used in the assessment (Section 9.2);
- identifying and rationale for selection of criteria and indicators for air quality (Section 9.3);
- establishing temporal boundaries (i.e., construction and operation phases) and study areas (i.e., Project footprint and local study area) for the assessment of effects on air quality (Section 9.4);
- describing the existing environment (i.e., baseline characterization) and identifying environmentally sensitive features specific to each criterion (Section 9.5);
- identifying potential Project-environment interactions (Section 9.6);
- undertaking the net effects assessment (Section 9.7):
  - identifying potential environmental effects;
  - identifying mitigation measures;
  - predicting the net effects; and
  - characterizing the net effects (i.e., after mitigation) of the Project on environmental criteria (Section 9.8).
- assessing the significance of the net effects (Section 9.9);
- conducting a cumulative effects assessment of the net effects in combination with other past, present, or reasonably foreseeable developments (RFDs) and activities and assessing significance, if applicable (Section 9.10);
- determining the degree of certainty in the net effects prediction and associated assessment of significance (Section 9.11); and
- identifying follow-up, inspection, and monitoring programs that will be completed during and after construction (Section 9.12).

9.1 Input from Consultation and Engagement

Consultation and engagement for the Project included Indigenous communities, regulatory agencies, property owners, interest holders, Crown interests and the general public. Consultation activities are described in Section 2 of the amended EA Report. The draft and final EA Reports were each subject to a public review and comment period. Comments received on the draft EA Report, responses and change log are provided in Appendix 1-III. Comments received on the final EA Report and responses are provided in Appendix 1-IV. The following concerns related to air quality were raised during consultation and engagement and from comments received on the draft and final EA Reports:

- Red Sky Métis Independent Nation expressed concerns about the potential for dust to result from the Project. This concern is addressed in Section 9.7.1.4 through the implementation of dust control measures.
- Multiple Indigenous communities requested information about Project monitoring programs and requested that community members be involved in monitoring programs. Any specific monitoring opportunities would be discussed directly with the communities through existing relationship frameworks.
- Specific comments made by Ministry of Environment and Climate Change (MOECC) regarding criteria selection for the Air Quality report were considered and incorporated throughout Section 9 (this section).
- MOECC, Ministry of Natural Resources and Forestry (MNRF), and Métis Nation of Ontario (MNO) expressed concern that many responses to comments on the draft EA Report were provided in Appendix 1-III of the final EA Report and not integrated into the body of the final EA Report. Suggested changes acknowledged in responses to comments on the draft EA Report but not incorporated into the final EA Report have been incorporated into the amended EA Report where appropriate.
- MOECC, MNRF and Indigenous communities expressed concern with the pathway screening methodology employed in the draft and final EA Reports. The EA methods have been revised and feedback has been incorporated. The terms "effect pathway" and "assessment endpoint" were removed from the amended EA Report. This revision is reflected throughout this section of the amended EA Report.
- MOECC, MNRF and Indigenous communities expressed concerns about the use of the pathway screening method excluding some potential Project effects from being carried forward to the net effects assessment. All potential Project effects are considered in the net effects assessment and a net effects assessment table was added as Table 9-21 in this section.

Specific responses to concerns expressed by Indigenous communities are also included in Section 2.2.5 of the amended Environmental Assessment (EA) Report and a detailed public and Indigenous consultation and engagement record is provided in Appendices 2-III and 2-IX, respectively.

9.2 Information Sources

Information for the characterization of air quality conditions and the assessment of Project effects was collected from a review of the following sources:

- MOECC and Environment and Climate Change Canada (ECCC) National Air Pollution Surveillance Network (NAPS) database (ECCC 2016); and
- MNRF Land Information Ontario (LIO) datasets and spatial datasets.

The review of these data allowed characterization of baseline air quality conditions in the air quality Local Study Area (LSA; Section 9.4.2). Field studies were not completed to characterize the existing air quality in the Project footprint or air quality LSA because there were sufficient data available from existing data sources.

Thunder Bay Monitoring Station is located approximately 12 kilometres (km) from the closest section of the Project footprint. Data were used from this station where available. The majority of the Project footprint is located in an area with less local and background emission sources than the Thunder Bay monitoring station. Assuming background air quality concentrations at the Thunder Bay Monitoring Station apply to the Project is a conservative estimate. Northern Ontario does not typically have air quality issues as much of the landscape is natural and undisturbed. For the purposes of the amended EA report, sufficient information was deemed to be available from the reference listed above to assess the potential effects of the Project on air quality.

9.3 Criteria and Indicators

Criteria are components of the environment that are considered to have economic, social, biological, conservation, aesthetic, or ethical value (Section 5.1). Clean air is important to Canadians, and both the environment (soils, plants, animals) and human health are sensitive to air quality. Ambient air quality criteria have been established by the provincial and federal governments in recognition of this and protection against adverse effects on health or the environment (MOECC 2012).

Indicators represent attributes of the environment that can be used to characterize changes to criteria in a meaningful way. The indicators for air quality are Criteria Air Contaminants (CACs) and PM (suspended particulate matter [SPM], PM_{10}, and $PM_{2.5}$) or collectively, the indicator compounds, and are defined as follows:

- **Predicted ambient concentrations of SPM:** SPM collectively describes airborne particles or aerosols less than 44 micrometers (µm) in size (MOECC 2012). SPM is commonly known as dust and results in reduced visibility. Predicted concentrations are calculated through quantitative modelling and used to measure potential effects through comparison to federal and provincial criteria. Concentrations are measured in micrograms per cubic meter ($\mu g/m^3$).
- **Predicted ambient concentrations of PM (PM_{10} and $PM_{2.5}$):** PM_{10} is airborne particles nominally smaller than 10 µm in diameter and $PM_{2.5}$ is airborne particles nominally smaller than 2.5 µm in diameter. Emissions of PM_{10} can result in local nuisance effects. Emissions of $PM_{2.5}$ can penetrate deep into the respiratory system and cause health effects (MOECC 2015). Predicted concentrations are calculated through quantitative modelling and used to measure potential effects through comparison to federal and provincial criteria. Concentrations are measured in $\mu g/m^3$.
- **Predicted ambient concentrations of carbon monoxide (CO):** CO is a colourless, odourless, tasteless gas, and at high concentrations can cause adverse health effects. It is produced primarily from the incomplete combustion of fossil fuels, as well as natural sources (MOECC 2015). Predicted concentrations are calculated through quantitative modelling and used to measure potential effects through comparison to federal and provincial criteria. Concentrations are measured in $\mu g/m^3$.
- **Predicted ambient concentrations of nitrogen dioxide (NO_2):** The presence of NO_2 in the atmosphere has known health (e.g., lung irritation) and environmental (e.g., acid precipitation and ground-level ozone formation) effects (MOECC 2015). Predicted concentrations are calculated through quantitative modelling and used to measure potential effects through comparison to federal and provincial criteria. Concentrations are measured in $\mu g/m^3$.
- **Predicted ambient concentrations of sulphur dioxide (SO_2):** The presence of SO_2 in the atmosphere has known health (e.g., lung irritation) and environmental (e.g., acid precipitation) effects (MOECC 2015). Predicted concentrations are calculated through quantitative modelling and used to measure potential effects through comparison to federal and provincial criteria. Concentrations are measured in $\mu g/m^3$.

The CAC above are focused on the concentrations in the environment of those compounds that are anticipated to be emitted as a result of the Project, for which relevant air quality criteria exist, and that are generally accepted as indicative of changing air quality. The criterion and indicators selected for the assessment of Project effects on air quality, the measurement of potential effects for the indictors, data sources used, and the rationale for their selection, are provided in Table 9-1.

Table 9-1: Air Quality Criterion and Indicators

Criterion	Indicators	Measurement of Potential Effects	Data Sources(s)	Rationale
Air quality	Predicted ambient concentrations of SPM	Predicted concentrations are calculated through quantitative modelling and used to measure potential effects through comparison to federal and provincial criteria.	■ Ambient Air Quality Criteria (MOECC 2012); ■ National Ambient Air Quality Objectives (Canadian Council for Ministers of the Environment, 1999); and ■ Canadian Ambient Air Quality Standards (Government of Canada, 2015).	■ Sensitivity of human health to air quality; and ■ Sensitivity of the environment (soils, plants, animals) to air quality.
	Predicted ambient concentrations of PM_{10} and $PM_{2.5}$			
	Predicted ambient concentrations of CO			
	Predicted ambient concentrations of NO_2			
	Predicted ambient concentrations of SO_2			

CAC = criteria air contaminants; CO = carbon monoxide; NO_2 = nitrogen dioxide; PM = particulate matter; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SO_2 = sulphur dioxide; SPM = suspended particulate matter.

The MOECC has issued guidelines related to ambient air concentrations that are summarized in *Ontario's Ambient Air Quality Criteria* (MOECC 2012). These guidelines represent indications of good air quality based on protection against adverse effects on health or the environment. The guidelines are not regulatory enforceable limits (MOECC 2012).

There are two sets of federal objectives and standards: the National Ambient Air Quality Objectives (NAAQOs) and the Canadian Ambient Air Quality Standards (CAAQSs; formerly the National Ambient Air Quality Standards). The NAAQOs are benchmarks that can be used to facilitate air quality management on a regional scale, and provide goals for outdoor air quality that protect public health, the environment, or aesthetic properties of the environment (CCME 1999). The federal government has established the following levels of NAAQOs (Health Canada 1994):

- The maximum desirable level defines the long-term goal for air quality and provides a basis for an anti-degradation policy for unpolluted parts of the country and for the continuing development of control technology.
- The maximum acceptable level is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort, and well-being.

In 2010, the Canadian Council of Ministers of the Environment (CCME) agreed to move forward with a new collaborative air quality management system that included the development of CAAQSs, designed to better protect human health. The CAAQSs were developed under the *Canadian Environmental Protection Act, 1999*, and include standards for $PM_{2.5}$, which is not addressed by the National Ambient Air Quality Standards. There are two standards for $PM_{2.5}$. The first standard came into effect in 2015 and will be superseded by a more stringent standard in 2020 (Government of Canada 2013).

None of the air quality criteria, objectives, or standards described above are regulatory limits. Their purpose is to serve as an indicator of good air quality and as a comparison benchmark for monitoring data. Monitoring data in Canada periodically exceed these criteria, objectives, and standards at different locations. This does not result in an immediate effect on human health, but serves as guidance for identifying areas where air quality could potentially be improved.

A summary of provincial and federal criteria, objectives, and standards applicable to the Project are listed in Table 9-2. The most stringent of the applicable criteria, objective, or standard was selected for each of the indicator compounds to establish a conservative limit for the effects of the Project on air quality. These limits are described as Project criteria in Table 9-2. Some of the NAAQOs phase out in 2020, to be replaced by more stringent standards. As construction of the Project is anticipated to occur into 2020, pre-2020 limits were not considered for selection as Project criteria. The different averaging periods in Table 9-2 represent the different periods of concern over which the health, environmental, or aesthetic effects are usually measured in the relevant criteria, objective, or standard.

Table 9-2: Available Provincial and Federal Air Quality Criteria, Objectives, and Standards for the Indicator Compounds (μg/m³)

Indicator Compounds	Averaging Period	Ontario Ambient Air Quality Criteria[(a)]	CAAQSs[(b)]	NAAQOs[(c)]		Selected Criteria, Objectives, and Standards for the Project
				Maximum Desirable	Maximum Acceptable	
SPM (μg/m^3)	24-hour	120	n/a	n/a	120	120
	Annual	60	n/a	60	70	60
PM_{10} (μg/m^3)	24-hour	50	n/a	n/a	n/a	50
$PM_{2.5}$ (μg/m^3)	24-hour	25[(d)]	28/27	n/a	n/a	25
	Annual	n/a	10/8.8	n/a	n/a	8.8
NO_2 (μg/m^3)	1-hour	400	n/a	n/a	400	400
	24-hour	200	n/a	n/a	200	200
	Annual	n/a	n/a	60	100	100
SO_2 (μg/m^3)	1-hour	600	183.4[(e)]	450	900	183.4
	24-hour	275	n/a	150	300	275
	Annual	55	13.1[(f)]	30	60	13.1
CO (μg/m^3)	1-hour	36,200	n/a	15,000	35,000	35,000
	8-hour	15,700	n/a	6,000	15,000	15,000

a) MOECC (2012).

b) CAAQS published in Canada Gazette Volume 147, No. 21 - May 25, 2013 (Government of Canada 2013). The standards will be phased in in 2015 and 2020, with both numbers shown in the table. The larger (first) value represents the CAAQS for 2015.

c) CCME (1999).

d) Compliance with the Ontario ambient air quality criteria for $PM_{2.5}$ is based on the 98th percentile of the annual monitored data averaged over three years of measurements.

e) CAAQS for SO_2 provided as 70 parts per billion (ppb) and converted to μg/m³ using a reference temperature of 25°C and pressure of 1 atmosphere (atm).

f) CAAQS for SO_2 provided as 5ppb and converted to μg/m³ using a reference temperature of 25°C and pressure of 1 atm.

CAAQS = Canadian Ambient Air Quality Standards; CO = carbon monoxide; μg/m^3 = micrograms per cubic meter; NAAQOs = National Ambient Air Quality Objectives; n/a = no guideline available; NO_2 = nitrogen dioxide; O_3 = ozone; SPM = suspended particulate matter <44 μm; PM = particulate matter; SO_2 = sulphur dioxide.

9.4 Assessment Boundaries

9.4.1 Temporal Boundaries

The Project is planned to occur during two phases (Section 5.2.1):

- **construction phase:** the period from the start of construction to the start of operation (approximately two years); and
- **operation phase:** encompasses operation and maintenance activities throughout the life of the Project, which is anticipated to be indefinite.

The assessment of Project effects on air quality considers effects that occur during the construction phase as emissions are considered to be largest during this phase of the Project. These periods are sufficient to capture the effects of the Project.

9.4.2 Study Areas

Study areas for the assessment are provided in Table 9-3.

Table 9-3: Air Quality Study Areas

Study Area	Area (hectares [ha])	Description	Rationale
Project footprint	3,490	The Project footprint is the preferred route ROW, laydown yards, storage yards, construction camps, construction easements, and new access roads	Designed to capture the potential direct effects of the footprint of the Project
Air quality LSA	Representative 5-km-long, 4-km-wide area (2,000 ha)	A representative, approximately 5-km segment of the preferred route ROW. Emissions within the segment were predicted to a distance of approximately 2 km on either side of the preferred route ROW. This approximately 5-km-long, 4-km-wide area is the air quality LSA.	■ A 5 km length was selected as this is the typical estimated length of the Project over which construction activities may occur simultaneously and within close proximity to one another. ■ A separate air quality RSA is not necessary because the air quality LSA is large enough to encompass predicted changes in air quality

LSA = Local Study Area; ha = hectare; km = kilometre; ROW = right-of-way; RSA = Regional Study Area.

9.5 Description of the Existing Environment

This section provides a summary of the existing environment for air quality as determined through desktop review.

9.5.1 Baseline Data Collection Methods

A desktop study was completed to identify baseline conditions in the air quality LSA. Background air quality in the air quality LSA has been described by considering regional concentrations based on publicly available monitoring data. The background air quality represents the existing conditions of air quality before the construction and operation of the Project. Sources of emissions include vehicles on roadways, long-range transboundary air pollution such as industrial sources in the United States, and small regional sources such as local industry. Available air quality data sources were reviewed and relevant information assembled to provide a general understanding of air quality conditions in the air quality LSA.

In Ontario, regional air quality is monitored through a network of air quality monitoring stations operated by the MOECC and ECCC's NAPS. The air quality monitoring stations are owned and operated by the MOECC but are also part of the larger NAPS network and adhere to the operating principles of the network. These stations are operated under strict quality assurance and quality control procedures (ECCC 2016). Existing air quality was characterized using background air concentrations from the closest monitoring data source in the vicinity of the Project. For this assessment, data from 2009 to 2013 were used, which is the most recent five-year period for which data are quality assured by ECCC.

The station identified as being most relevant to the Project is located at 421 James Street South in the City of Thunder Bay (Thunder Bay Monitoring Station). This air monitoring station is located in central Thunder Bay, close to industrial sources. This station is approximately 12 km away from the nearest part of the Project footprint (Lakehead Transformer Station [TS]). The majority of the Project footprint is located in an area with less local and background emission sources than that present/recorded at the Thunder Bay Monitoring Station. Assuming background air quality concentrations at the Thunder Bay Monitoring Station apply to the Project is a conservative estimate. There are no other active monitoring stations within 100 km of the Project for which sufficient data were available. Details for the Thunder Bay Monitoring Station are provided in Table 9-4.

Table 9-4: Ambient Air Quality Monitoring Parameters

Monitoring Station Name	NAPS Station ID	Indicator Compounds						Distance from Project
		SPM	PM_{10}	$PM_{2.5}$	CO	SO_2	NO_2	
Thunder Bay	60809	n/a	n/a	2003 to 2013	n/a	n/a	2003 to 2013	Approximately 12 km southwest from Lakehead TS

CO = carbon monoxide; n/a = not applicable; station not used for obtaining compound data; NAPS = National Air Pollution Surveillance Network; NO_2 = nitrogen dioxide; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SO_2 = sulphur dioxide; SPM = suspended particulate matter; TS = transformer station.

9.5.2 Baseline Conditions

The 90th percentile of the 1-hour, 8-hour, and 24-hour measurements are typically used to represent the background air quality value when conducting an effects assessment as this value is exceeded only 10% of the time. Air quality is not a normally distributed data set; therefore, using the maximum would be overly conservative. The industry common practice is to use the 90th percentile as the background concentration to avoid the influence of outlier data. The annual average concentration is used for annual background levels. (AESRD 2013). The MOECC does not provide specific guidance for this; therefore, guidance from another Canadian jurisdiction was used.

9.5.2.1 Concentrations of Particulate Matter

Particulate emissions occur from anthropogenic sources, such as agricultural, industrial, and transportation sources, as well as natural sources. PM is classified based on its aerodynamic particle size, primarily due to the different health effects that can be associated with the particles of different diameters. In addition, larger particles (i.e., SPM) can result in nuisance effects, such as soiling or reduced visibility. In Ontario, particulate emissions have been demonstrating a steady decline since 2003 (MOECC 2015).

For 24-hour $PM_{2.5}$, air quality measurements recorded at Thunder Bay Station meet the pending CAAQS values of 27 µg/m³ (2020 phase-in date). As shown in Figure 9-1, the annual average $PM_{2.5}$ values are also below the pending CAAQS of 8.8 µg/m³ (2020 phase-in date).

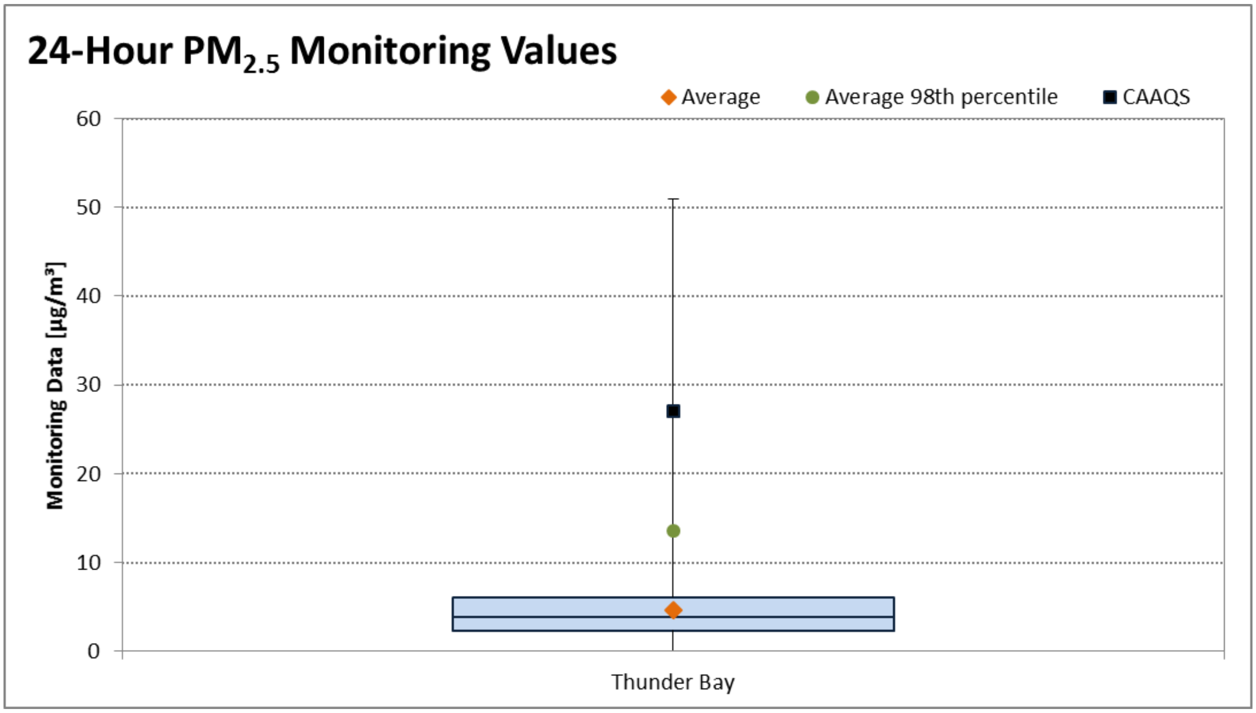


Figure 9-1: Monitored Fine Particulate Matter ($PM_{2.5}$) from the Thunder Bay Monitoring Station

No local monitoring data were available for SPM and PM_{10}. However, an estimate of the background SPM and PM_{10} concentrations can be determined from available $PM_{2.5}$ monitoring data. Fine particulate matter (i.e., $PM_{2.5}$) is a subset of PM_{10}, and PM_{10} is a subset of SPM. Therefore, it is reasonable to assume that the ambient concentrations of SPM will be greater than corresponding PM_{10} levels, and PM_{10} concentrations will be greater than the corresponding levels of $PM_{2.5}$. The overall levels of typical background $PM_{2.5}$ in Canada were found to be about 50% of the PM_{10} concentrations and about 25% of the SPM concentrations (Brook et al. 2011). By applying this ratio, background SPM and PM_{10} concentrations were estimated for the region. Derived SPM and PM_{10} values are below the relevant Ontario ambient air quality criteria and NAAQOs.

9.5.2.2 Concentrations of Carbon Monoxide

Carbon monoxide is produced primarily from the incomplete combustion of fossil fuels and from natural sources (MOECC 2015). No local monitoring data were available for carbon monoxide. There are no monitoring stations within 1,000 km of the Project that monitor carbon monoxide. A recent assessment of air quality in Ontario for the year 2014 provides a provincial level assessment of carbon monoxide. There were no recorded exceedances of the provincial carbon monoxide criteria in Ontario during 2014, and concentrations are shown to be decreasing, year-on-year, across the province (MOECC 2015). Provincial average data from the 2014 observations were used to define background carbon monoxide concentrations in the absence of locally monitored data.

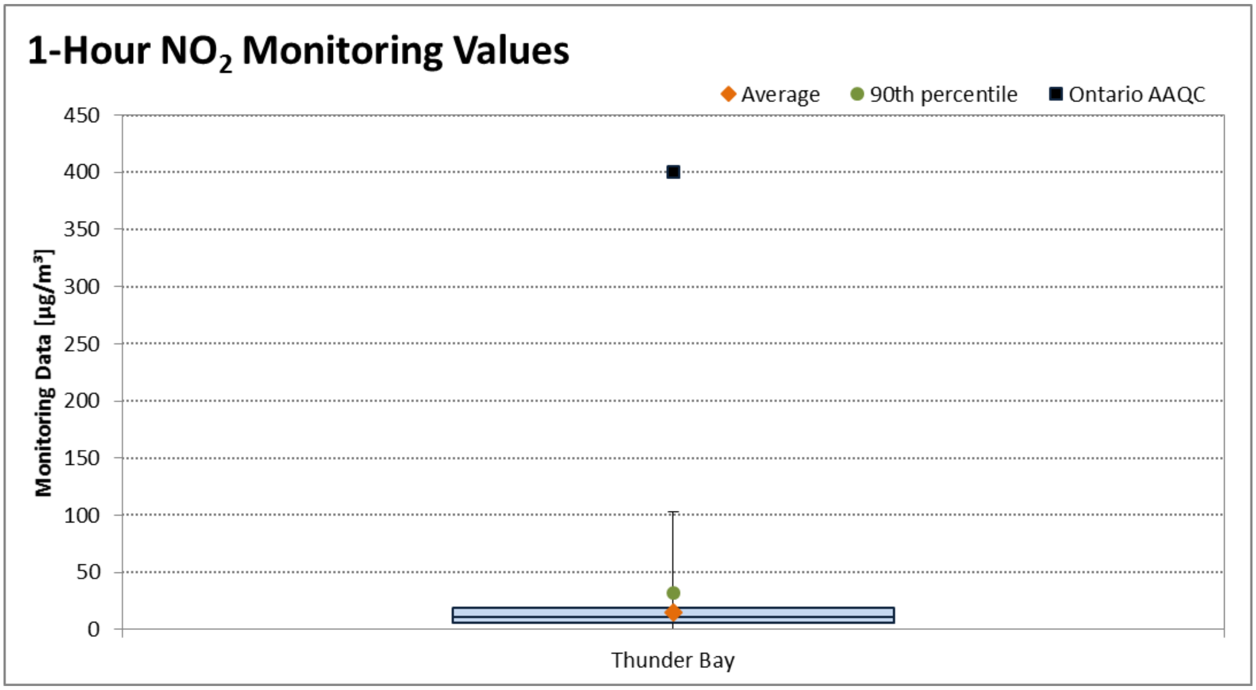
9.5.2.3 Concentrations of Sulphur Dioxide

Sulphur dioxide is produced primarily from utilities and industrial sources, such as smelting (MOECC 2015). There are no monitoring stations within 500 km of the Project that monitor sulphur dioxide. A recent assessment of air quality in Ontario for the year 2014 provided a provincial level assessment of sulphur dioxide. There were no recorded exceedances of the annual or 24-hour provincial sulphur dioxide criteria in Ontario during 2014. There was one exceedance of the 1-hour criteria in the City of Greater Sudbury during 2014. The City of Greater Sudbury features several smelters. The Project is in an area with fewer local sources of sulphur dioxide emissions and a lower background source influence; therefore, the City of Greater Sudbury is not representative of background air quality for the Project. Additionally, sulphur dioxide concentrations are shown to be decreasing, year-on-year, across the province (MOECC 2015). Provincial average data for the year 2014 were used to define background sulphur dioxide concentrations in the absence of locally monitored data.

9.5.2.4 Concentrations of Nitrogen Dioxide

Nitrogen oxides (NO_X) are emitted in two primary forms: nitric oxide (NO) and nitrogen dioxide (NO_2). Nitric oxide reacts with ozone in the atmosphere to create nitrogen dioxide. The primary source of nitrogen oxides in the region is the combustion of fossil fuels. Emissions of nitrogen oxides result from the operation of stationary equipment such as incinerators, boilers, and generators, as well as the operation of mobile sources such as vehicles, haul trucks, and other equipment.

The presence of nitrogen dioxide in the atmosphere has known environmental effects (e.g., acid precipitation, ground-level ozone formation) (MOECC 2015). As a result, regulatory guideline levels are based on nitrogen dioxide emissions and concentrations. Emissions of nitrogen dioxide in Ontario have shown a steady decline from 2004 (MOECC 2015). As shown in Figure 9-2, the monitoring data assessed show that no exceedances of the 1-hour or 24-hour AAQC for nitrogen dioxide were recorded at the Thunder Bay Monitoring Station.



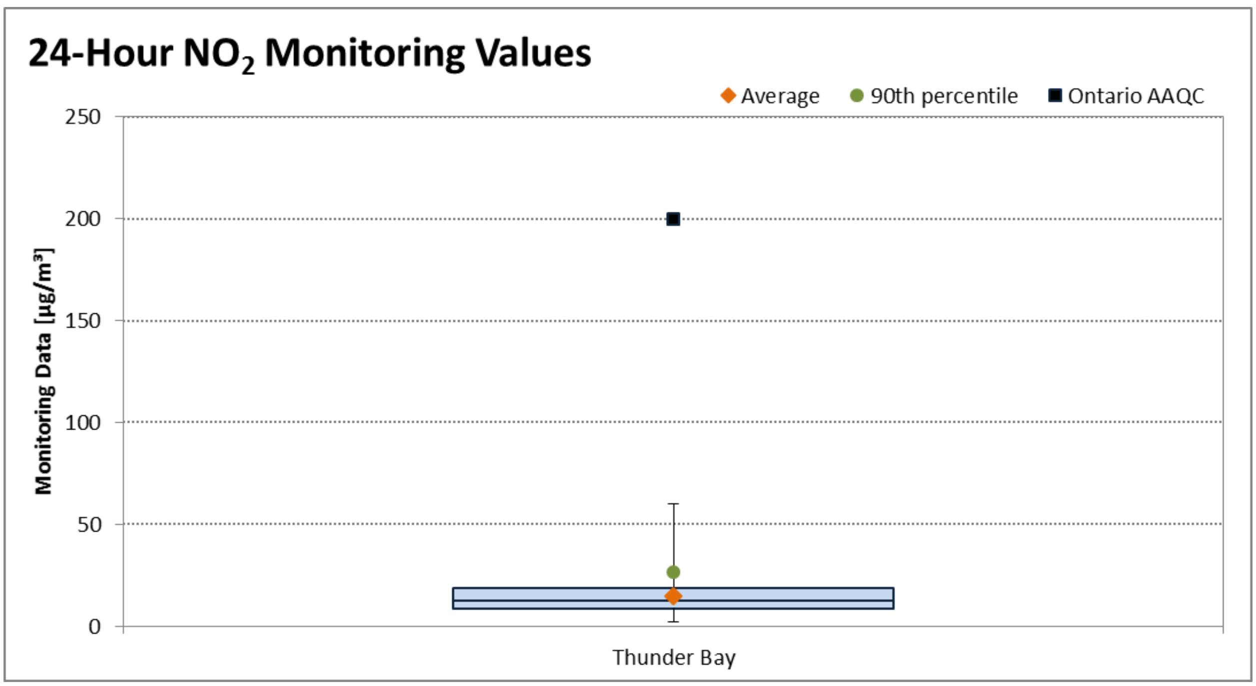


Figure 9-2: Monitored Nitrogen Dioxide (NO_2) from the Thunder Bay Monitoring Station

9.5.2.5 Summary of Baseline Conditions

A summary of the available background air quality concentrations for indicator compounds is provided in Table 9-5 and was used to help describe background air quality in the air quality LSA. Overall, the monitoring data indicate that background air quality surrounding the Project is below the relevant provincial and federal ambient air quality guidelines, criteria, and standards for all indicator compounds.

Table 9-5: Air Quality Background Concentrations used to Represent Conditions in the Local Study Area

Indicator Compound	Averaging Period[(a)]	Background Concentration (µg/m³)[(b)]	Project Criteria (µg/m³)	% of Project Criteria (%)
SPM[(c)]	24-hour	35.7	120	30
	Annual	18.4	60	31
PM_{10}[(c)]	24-hour	17.8	50	36
$PM_{2.5}$	24-hour	8.9	25	36
	Annual	4.6	8.8	52
NO_X (expressed as NO_2)	1-hour	32.0	400	8
	24-hour	26.4	200	13
	Annual	14.8	100	15
SO_2	1-hour	15.7	183.4	9
	24-hour	13.1	275	5
	Annual	5.2	13.1	40
CO	1-hour	520	35,000	1
	8-hour	460	15,000	3

a) 1-hour, 8-hour, and 24-hour values are based on 90th percentile, while annual values are averaged over the five annual values available in the period. The 24-hour $PM_{2.5}$ is calculated according the requirements of the standard, which uses the three-year rolling average of the 98th percentile of the 24-hour observations.

b) Data are taken from the Thunder Bay Monitoring Station, where data are available. Where data are not available, the regional average for Ontario was used.

c) SPM and PM_{10} concentrations are derived from $PM_{2.5}$ monitored data

CO = carbon monoxide; NO_2 = nitrogen dioxide; NO_X = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SPM = suspended particulate matter; SO_2 = sulphur dioxide; µg/m³ = micrograms per cubic metre; % = percent.

9.6 Potential Project-Environment Interactions

Potential Project-environment interactions were identified through a review of the Project Description and existing environmental conditions. The linkages between Project components and activities and potential effects to air quality are identified in Table 9-6.

Table 9-6: Project-Environment Interactions for Air Quality

Criteria	Indicator	Project Phase		Description of Potential Project-Environment Interaction (Potential Effect)
		Construction (includes access road and ROW preparation, installation, and reclamation activities)	Operation (includes operation and maintenance activities)	
Air quality	■ Predicted ambient concentrations of SPM; ■ Predicted ambient concentrations of PM_{10} and $PM_{2.5}$; ■ Predicted ambient concentrations of CO; ■ Predicted ambient concentrations of NO_2; and ■ Predicted ambient concentrations of SO_2.	✓	-	Increase in ambient concentrations from CAC and fugitive dust emissions

CAC = criteria air contaminants; ✓ = A potential Project-environment interaction could result in an environmental or socio-economic effect; --= No plausible interaction was identified.

9.7 Potential Effects, Mitigation and Net Effects

This section presents the potential effects, appropriate mitigation measures, and predicted net Project effects for air quality.

9.7.1 Predicted Ambient Concentrations of SPM, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2

9.7.1.1 Increase in Ambient Concentrations from Criteria Air Contaminants and Fugitive Dust Emissions

9.7.1.1.1 Potential Effects

Potential effects to air quality are calculated through atmospheric dispersion modelling. The inputs to the atmospheric dispersion modelling include estimations of potential emissions released as a result of Project activities. Equipment and activities associated with construction of the Project are potential sources of air and fugitive dust emissions and can result in a change to ambient concentrations. Specifically, construction activities have the potential to temporarily affect local air quality in the immediate vicinity of the Project. The assessment of Project effects on air quality considers effects that occur during the construction stage as emissions are considered to be largest during this stage of the Project.

Emissions from construction are primarily composed of fugitive dust and combustion products from the movement and operation of construction equipment and vehicles. Potential effects associated with construction are anticipated to be minimal due to their short duration and intermittent frequency. A screening assessment was completed to assess potential short-term impacts on local air quality.

The activities associated with construction of the Project include the following:

- flagging and clearing;
- access road improvements;
- staking;
- geotechnical investigations;
- foundation installation;
- tower erection;
- stringing; and
- reclamation.

These activities will be sequentially staggered and, therefore, it is not reasonable to include all construction activities in the modelled scenario. Upon review of the construction plan for the Project, it was assumed that as a worst case, flagging and clearing, access road construction, staking, geotechnical investigations, and foundation installation could occur at the same time within an approximately 5-km-long section along the preferred route ROW. This is a very conservative approach as the preliminary construction schedule identifies that the transmission line will be constructed in six different segments, each approximately 60 km in length, with staggered start dates working sequentially from east to west across the preferred route ROW, with some exceptions. There is only minor overlap in time between activities on the same segment. As a result, the equipment list used to calculate air quality emissions is likely to be split between all segments, covering a much larger area than 5 km. Attributing all equipment to 5 km of one segment at one time provides a very conservative, worst case analysis.

In addition to the activities described above, the Project will also include some slash burning of wood waste and incineration of waste generated at camp sites. These activities will not occur at the same time or location. In addition, the camp waste incineration will be approved for use through an Environmental Compliance Approval. These activities are not expected have greater emissions of the indicator compounds than the construction activities detailed above and were therefore not included in the assessed scenario.

Corresponding equipment data for each activity provided by the Project construction team were used with published emission factors to prepare emission rate estimates for a representative, approximately 5 km section of construction activities. Published emission factors were taken from the United States Environmental Protection Agency (US EPA) database. This is an MOECC approved data source and industry standard, given that Ontario does not publish emission factors to the same level of detail.

The data in Table 9-7 were used to prepare emission estimates for the representative, approximately 5 km section of Project construction.

Table 9-7: Emission Sources by Activity Type

Activity Type	Equipment	Emission Sources
Flagging and clearing	■ Pickups; ■ All-terrain Vehicle; ■ Feller; ■ Skidder; and ■ Processor.	■ Land clearing and material handling; ■ Vehicular emissions; and ■ Fugitive dust from vehicles travelling on unpaved roads.
Access Road Construction	■ Pickups; ■ Dump Trucks; ■ Dozers; ■ Excavators; ■ Feller; ■ Skidder; ■ Processor; and ■ Flatbed.	■ Land clearing and material handling; ■ Vehicular emissions; and ■ Fugitive dust from vehicles travelling on unpaved roads.
Staking	■ Pickups; and ■ All-terrain Vehicle.	■ Vehicular emissions; and ■ Fugitive dust from vehicles travelling on unpaved roads.
Geotechnical Investigations	n/a	n/a
Foundation Installation	■ Pickups; ■ All-terrain Vehicle; ■ Flatbed; ■ Backhoe; and ■ Forklift.	■ Material handling; ■ Vehicular emissions; and ■ Fugitive dust from vehicles travelling on unpaved roads.

n/a = no anticipated air quality emission sources for this activity

Mitigation measures (Table 9-19) were assumed to be implemented and were incorporated into the fugitive dust and material handling calculations, where possible. Mitigation measures planned to further reduce the effects of air emissions associated with the Project include practices to control dust and other air emissions (e.g., maintenance of vehicles and equipment, wetting areas). In areas where there are residences or sensitive receptors located within approximately 100 m of the Project footprint, emphasis will be placed on comprehensive implementation of mitigation measures, in particular dust suppression activities such as watering and dust suppressants. Fugitive dust controls on unpaved roads and material handling activities range from a 10% to 90% control (Western Governors' Association 2006). In this assessment, a conservative mid-range control efficiency of 65% was assumed.

Land Clearing and Material Handling

Land clearing and material handling activities include the use of excavators, dozers, graders, and dump trucks to extract and move material. Emissions from these activities include fugitive dust from material movements.

Emission Calculation – Grading

An equation from U.S. EPA AP-42 Chapter 11.9 "*Western Surface Coal Mining*" (US EPA 1998) was used to calculate the emission factors associated with grading activities. The equation for SPM, PM_{10} and $PM_{2.5}$ are as follows:

$$EF_{SPM} = 0.0034 \times S^{2.5}$$

$$EF_{PM10} = EF_{PM15} \times 0.6$$

$$EF_{PM2.5} = EF_{SPM} \times 0.031$$

where: EF_{xxx} = particulate emission factor (kg/VKT)
S = speed of grader (km/hr)

The following equation was used to determine the emission rates for SPM, PM_{10} and $PM_{2.5}$ from grading using the emission factor equation above.

$$ER_{GR} = EF_{xxx} \times VKT \times \frac{1{,}000\ g}{1\ kg} \times \frac{1\ hr}{3600\ seconds} \times \frac{H}{24\ hr} \times (1 - C)$$

where: ER_{GR}= emission rate from grading (g/s)
EF_{xxx} =particulate emission factor (kg/VKT)
VKT = vehicle kilometres travelled/day
H = hours per day grading is occurring (hr)
C=Control efficiency (%)

Emission Calculation – Bulldozing

An equation from U.S. EPA AP-42 Chapter 11.9 "*Western Surface Coal Mining*" (US EPA 1998) was used to calculate the emission factors associated with bulldozing activities. The equation for SPM, PM_{10} and $PM_{2.5}$ are as follows:

$$EF_{SPM} = \frac{2.6 \times s^{1.2}}{M^{1.3}}$$

$$EF_{PM10} = EF_{PM15} \times 0.75$$

$$EF_{PM2.5} = EF_{SPM} \times 0.105$$

where: EF_{xxx} = particulate emission factor (kg/hour)
s = silt content (%)
M= material moisture content (%)

The following equation was used to determine the emission rates for SPM, PM_{10} and $PM_{2.5}$ from bulldozing using the emission factor equation above.

$$ER_{BZ} = EF_{xxx} \times \frac{1{,}000\ g}{1\ kg} \times \frac{1\ hr}{3600\ seconds} \times \frac{H}{24\ hr} \times (1 - C)$$

where: ER_{BZ}= emission rate from bulldozing (g/s)
EF_{xxx} =particulate emission factor (kg/hour)
H = hours per day grading is occurring (hr)
C=Control Efficiency (%)

Emission Calculation – Material Handling

A primary source of fugitive dust in construction is the result of transfer of materials to/from stockpiles. The emission factors will vary depending on the moisture content of the material being moved.

The emissions from material handing include SPM, PM_{10} and $PM_{2.5}$. To quantify emissions from these activities, an equation in U.S. EPA AP-42 Chapter 13.2.4 "*Aggregate Handling and Storage Piles*" (US EPA 2006) was used to calculate the fugitive dust emission factors associated with material handling activities. The equation is as follows:

$$EF_{MH} = k \times 0.0016 \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

where: EF_{MH} = particulate emission factor (kg/Mg),
k = particle size multiplier for particle size range (refer to Table 9-8),
U = Wind speed (m/s), and
M =moisture content *of* material (percent) (%)

Table 9-8: Particle Size Multipliers – Material Handling

Size Range	Particle Size Multiplier (k)
$PM_{2.5}$	0.053
PM_{10}	0.35
SPM	0.74

k = particle size multiplier for particle size range.

The following equation was used to determine the emission rates for SPM, PM_{10} and $PM_{2.5}$ from material handling using the emission factor equation above.

$$ER_{MH} = EF_{MH} \times DT \times \frac{1{,}000, g}{1\ kg} \times \frac{1\ day}{24\ hour} \times \frac{1\ hr}{3600\ seconds} \times (1 - C)$$

where: ER_{MH} *= emission rate (g/s)*
DT = daily throughput (Mg/day)
EF_{MH} *= emission factor (kg/Mg)*
C=Control Efficiency (%)

Emission rates for land clearing and material handling were calculated using the inputs in Table 9-9.

Table 9-9: Land Clearing and Material Handling Emission Calculation Inputs

Emission Activity	Input/Emission Factor	Notation	Value	Notes
Grading	Grader Vehicle Speed [km/h]	*S*	5	None
	VKT/day	*VKT/day*	100	Four graders cover 25 VKT/day each
	Hours per day grading is occurring	*H*	10	Typical length of a construction day
	Dust Suppressant Control Efficiency (%)	*C*	65%	Mid-range of typical dust control efficiencies
Bulldozing	Silt content (%)	*s*	8.5%	Typical silt content of construction site (AP 42, section 13.2.2)
	Hours per day grading is occurring	*H*	10	Typical length of a construction day
	Dust Suppressant Control Efficiency (%)	*C*	65%	Mid-range of typical dust control efficiencies
Material Handling	Moisture Content	*M*	3.4%	Typical moisture content of exposed ground (AP 42, section 13.2.4)
	Wind Speed, [m/s]	*U*	2.64	Environment and Climate Change Canada Climate Normal for Wawa
	Material Hauling	*DT*	1,200 tonnes per day	600 tonnes per day with two drops
	Dust Suppressant Control Efficiency (%)	*C*	65%	Mid-range of typical dust control efficiencies

C = dust suppressant control efficiency; DT = material hauling; M = moisture content; s = silt content; H = hours per day grading is occurring; m/s = meters per second; % = percent; VKT/day = vehicle kilometres travelled per day.

Vehicular Emissions

Vehicle engine emission rates for all off-road vehicles (i.e., the mobile fleet) were derived using the emission standards for off-road engines outlined in the *Canadian Off-Road Compression Engine Emission Regulation SOR/2005-32,* promulgated under the *Canadian Environmental Protection Act* (CEPA; ECCC 1999). This regulation aligns engine certification values to those of U.S. EPA Tier 2, Tier 3 and Tier 4 standards. Vehicle exhaust emissions were conservatively prepared, assuming vehicles comply with U.S. EPA Tier 3 emission standards. Tier 3 emission standards are the minimum emission standards that vehicle exhausts are required to meet in Ontario on equipment purchased after 2010. New equipment is typically designed to meet more stringent Tier 4 emission standards that can be less than 10% of Tier 3 emission standards. Vehicles were assumed to be operating for ten hours, 365 days per year. This is a conservative assumption as construction of an approximately 5 km stretch of the Project is anticipated to take substantially less than one year.

Tier 3 emission standards are provided for nitrogen oxides (NO_X), carbon monoxide (CO), total suspended particulate matter (SPM). Within these limits all SPM is in the form of PM_{10}, and $PM_{2.5}$ emissions are 97% of PM_{10} emissions.

The following equation was used to determine the emission rates for non-road vehicles exhaust:

$$ER = EF \times Engine\ Horsepower\ Rating \times V \times LF \times \frac{Hours\ of\ Operation}{24\ hr} \times \frac{1\ hr}{3600\ seconds}$$

where: ER = emission rate (g/s)
V = number of vehicles
EF = emission factor (g/hp-hr)
LF = load factor

Load factors were derived from published literature for the respective vehicle categories.

For SO_2, emissions were calculated based on fuel consumption rates for each specific equipment type. The sulphur content of fuel was assumed to be 15 parts per million, and is based on the Sulphur in Diesel Fuel Regulations SOR/2002-254, dated June 2012, promulgated under CEPA (CEPA 1999). The following equation was used to determine the SO_2 emission factor:

$$ER = Fuel\ Density \times Sulphur\ Content \times \frac{MM\ SO_2}{MM\ Sulphur}$$

where: MM = molar mass (g/mol)

Inputs used (i.e., horsepower, number and load factors) to calculate the emissions from the construction fleet engine exhaust are outlined in Table 9-10.

Table 9-10: Off-road Vehicles Exhaust Emission Rate Calculation Parameters

Equipment	Estimated Number of Vehicles	Engine Size [hp]	Load Factor	Estimated Daily Operating Hours per Vehicle(a)
Pickup	50	365	0.5	2
ATV	53	50	0.5	2
Grader	4	179	0.64	10
Dump	8	717	0.41	2
Dozer1	3	363	0.75	10
Dozer2	4	139	0.75	10
Excavator	10	417	0.53	4
Feller	5	203	0.7	10
Skidder	5	250	0.7	10
Processer	5	303	4	4
Flatbed	10	455	0.5	10
Backhoe	2	127	0.48	10
Forklift	20	172.86	0.3	2
Mulcher	8	275	0.59	10

a) Within a 5 km stretch of construction activities along the ROW.
hp = horsepower.

Fugitive Dust from Vehicles Travelling on Unpaved Roads

Emissions from unpaved roads occur as the result of the entrainment of dust from the road as a result of vehicle traffic. Particles are lifted from the surface and entrained. The turbulent wake behind the vehicle continues to act on the road after the vehicle has passed.

The predictive emission equation in U.S. EPA AP-42 Chapter 13.2.2 "*Unpaved Roads*" (November 2006) was used to calculate the emissions of SPM, PM_{10} and $PM_{2.5}$ from unpaved roadways. The equation applicable to vehicles travelling on unpaved surfaces at industrial sites (Equation 1a) was used, and is as follows:

$$EF = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b} \times \frac{(365-p)}{365}$$

where: EF = emission factor (lb/VMT)
k = particle size multiplier (lb/VMT) (refer to Table 9-11)
s = surface silt content (%)
W = mean vehicle weight (tons)
a = empirical constant (refer to Table 9-11)
b = empirical constant (refer to Table 9-11)
p= number of days with precipitation per year
1 lb/VMT = 281.9 g/VKT

This emission factor is then multiplied by the number of vehicles travelling the roadway and the length of the roadway (denoted as VKT) to derive a SPM emission rate. Due to the high variability from site to site, it is recommended that site specific values be determined. For example, a 1% change in silt content will result in a 34% reduction in the lbs/VMT. Particle size constants for fugitive dust from the unpaved roads equation are presented in Table 9-11.

Table 9-11: Particle Size Constants for Fugitive Dust from Unpaved Roads Equation

Size Range	k (lb/VMT)	a	b
$PM_{2.5}$	0.15	0.9	0.45
PM_{10}	1.5	0.9	0.45
SPM	4.9	0.7	0.45

k = particle size multiplier; lb/VMT = pounds per vehicle mile travelled; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SPM = suspended particulate matter.

In addition, the effect of routine watering to control emissions was applied. Unpaved road dust emissions were calculated without an adjustment for natural mitigation.

The emission rate calculation for unpaved roads was as follows:

$$ER = EF \times VKT/day \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3600\ s} \times C$$

where: EF = emission factor in g/VKT
VKT/day = vehicle kilometre travelled per day
C= Control Efficiency (%)

The inputs used to calculate the fugitive dust emissions from the trucks travelling on the access roads are outlined in Table 9-12. The required information to calculate the VKTs/day and the fugitive dust emissions from the unpaved roads are presented in Table 9-13.

Table 9-12: Unpaved Road Dust Emission Rate Calculation Parameter

Emission Activity	Input/Emission Factor	Notation	Value	Notes
Unpaved Road Dust	Silt content [%]	*s*	8.5%	Typical silt content of construction site (AP 42, Section 13.2.2)
	Annual days with precipitation	*p*	169.8	Climate normal for Wawa
	Dust Suppressant Control Efficiency (%)	*C*	65%	Mid-range of typical dust control efficiencies
	Mean Vehicle Weight	*W*	9.16	Mean vehicle weight in tonnes, averaged by VKT

C = control efficiency; p = annual days with precipitation; % = percent; s = silt content; VKT = vehicle kilometres travelled; W = mean vehicle weight.

Table 9-13: Off-road Vehicles Fugitive Dust Emission Rate Calculation Parameters

Equipment	Assumed Weight (tonnes)	Maximum VKT/day[(a)]
Pickup	1.8	100
ATV	0.3	106
Excavator	52.4	10
Dump	101.1	8
Feller	13.9	5
Skidder	20.9	5
Processer	33.7	5
Flatbed	12.1	20
Backhoe	17.9	2
Forklift	14.4	20
Mulcher	24.4	8

a) Within a 5 km stretch of construction activities

VKT/day = vehicle kilometres travelled per day.

A summary of the total emission rates (estimated construction emissions including mitigation for fugitive dust) for each indicator compound is provided in Table 9-14.

Table 9-14: Total Construction Emission Rates for Representative 5-kilometre Segment of Project Construction

Indicator Compound	Emission Rates by Source			Total Emission Rate over Representative 5-km Segment (g/s)
	Unpaved Road Dust (g/s)	Material Handling Activities (g/s)	Vehicle Exhaust (g/s)	
SPM	1.12	0.36	0.13	1.61
PM_{10}	0.32	0.10	0.13	0.55
$PM_{2.5}$	0.03	0.03	0.13	0.19
NO_x as NO_2	0	0	2.69	2.69
SO_2	0	0	0.01	0.01
CO	0	0	3.44	3.44

Note: Individual data values presented in this table are rounded to two decimal places. The totals were calculated using exact data values.

CO = carbon monoxide; NO_2 = nitrogen dioxide; NO_X = nitric oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SO_2 = sulphur dioxide; SPM = suspended particulate matter; g/s = grams per second.

The screening assessment was completed using the emission rates presented in Table 9-14 and the US EPA AERMOD dispersion model to predict air quality concentrations at approximately 100 metre (m) intervals from the centreline of the preferred route right-of-way (ROW) to the outer boundary of the air quality LSA. AERMOD is a steady state Gaussian plume model that is currently the US EPAs regulatory air dispersion model. It calculates maximum ground level concentrations from point, area, flare, and volume sources. It is used for compliance assessments in Ontario to estimate concentrations from stationary sources and is considered a Tier 3 or advanced model by the MOECC (MOECC 2017). A summary of the reliability criteria for AERMOD is provided in Table 9-15.

Table 9-15: Reliability Summary for the AERMOD Dispersion Model

Model Name	Developer	Use in Assessment	Development	Calibration	Validation	Uncertainty and Sensitivity
AERMOD (Version 14134)	United States Environmental Protection Agency	Predict air quality concentrations	■ AERMOD was developed to replace the long-standing ISC model as the model recommended by the U.S. EPA. ■ AERMOD is based on Gaussian plume dispersion theory (US EPA 2004 that has been used for more than 30 years. ■ The application of specific algorithms has been updated to reflect current understanding of dispersion theory (US EPA 2004).	Five years of meteorological data were used in the modelling. The meteorological dataset selected was the MOECC regional dataset for Northern Ontario. Due to the varying land use categories along the construction length, the “crops” dataset was used for conservatism as it results in the highest predicted concentration.	■ AERMOD has been adopted by the US EPA as its preferred and recommended dispersion model (US EPA 2005). ■ Prior to adoption, the US EPA completed a rigorous review of the model performance (U.S. EPA 2003, 2005).	■ AERMOD is based on known theory, and proven to reliably produce repeatable results. ■ Uncertainty associated with emissions is managed by making conservative assumptions. ■ Model predictions are sensitive to fluctuations in the meteorology, which can be managed by using a five-year data set. ■ Five years of data should include the full range of possible meteorological conditions.

MOECC = Ministry of the Environment and Climate Change; U.S. EPA = United States Environmental Protection Agency.

Emission rates were modelled as a series of adjacent volume sources located along the centreline representing the emission sources operating at once in the same volume of air. This is a conservative representation of construction activities, likely to result in an overestimate of predicted concentrations as the activities are assumed to be stationary instead of mobile. This is appropriate for the screening level approach used for the assessment. During construction, emission sources will be spread out across the width of the ROW and the maximum ground level concentrations resulting from each activity will not occur in the same location.

Predicted concentrations of each indicator compound were calculated based on one hour and 24-hour averaging periods. Annual results were also calculated for comparison to annual air quality criteria. This is a conservative comparison as the construction period for an approximately 5 km segment of the transmission line is anticipated to require much less than one year. A summary of predicted concentrations is provided in Table 9-16.

Table 9-16: Predicted Air Quality Concentrations from Project Activities Only at Increasing Distance from the Edge of the Preferred Route Right-of-Way in the Air Quality Local Study Area

Indicator Compound	Averaging Period	Relevant Project Criteria	Distance from Preferred Route ROW Boundary (m)							
			100	200	300	400	500	1,000	1,500	2,000
SPM (µg/m^3)	24-hour	120	77.60	51.34	38.97	31.30	26.31	23.30	20.99	19.15
	Annual	60	18.32	11.97	9.05	7.32	6.16	5.31	4.67	4.17
PM_{10} (µg/m^3)	24-hour	50	26.36	17.44	13.24	10.63	8.94	7.91	7.13	6.50
$PM_{2.5}$ (µg/m^3)	24-hour	25	9.28	6.14	4.66	3.74	3.15	2.79	2.51	2.29
	Annual	8.8	2.19	1.43	1.08	0.88	0.74	0.64	0.56	0.50
NO_2 (µg/m^3)	1-hour	400	364.10	232.01	173.36	140.81	117.73	101.18	87.27	78.42
	24-hour	200	129.53	85.71	65.04	52.25	43.91	38.89	35.03	31.96
	Annual	100	30.58	19.98	15.10	12.22	10.27	8.87	7.80	6.95
SO_2 (µg/m^3)	1-hour	183.4	0.78	0.50	0.37	0.30	0.25	0.22	0.19	0.17
	24-hour	275	0.28	0.18	0.14	0.11	0.09	0.08	0.08	0.07
	Annual	13.1	0.07	0.04	0.03	0.03	0.02	0.02	0.02	0.01
CO (µg/m^3)	1-hour	35,000	464.47	295.97	221.15	179.63	150.18	129.07	111.33	100.03
	8-hour	15,000	259.47	165.34	123.54	100.35	83.90	72.11	62.19	55.88

CO = carbon monoxide; m = meter; µg/m^3 = micrograms per cubic meter; NO_2 = nitrogen dioxide; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; ROW = right-of-way; SO_2 = sulphur dioxide; SPM = suspended particulate matter.

The screening assessment indicates that predicted concentrations of indicator compounds from Project construction activities are below the relevant Project criteria (i.e., the lowest applicable criteria) within approximately 100 m of the preferred route ROW. Predicted concentrations from Project construction activities were added to background data, where available, and are summarized in Table 9-17. Predicted concentrations from Project activities in combination with background air quality are below the relevant criteria within approximately 100 m of the preferred route ROW after effective implementation of mitigation.

Table 9-17: Predicted Air Quality Concentrations (including background) at Increasing Distance from the Edge of the Preferred Route Right-of-Way in the Air Quality Local Study Area

Indicator Compound	Averaging Period	Relevant Project Criteria	Distance from Preferred Route ROW (m)							
			100	200	300	400	500	1,000	1,500	2,000
SPM (µg/m^3)	24-hour	120	113.30	87.04	74.67	67.00	62.01	59.00	56.69	54.85
	Annual	60	36.72	30.37	27.45	25.72	24.56	23.71	23.07	22.57
PM_{10} (µg/m^3)	24-hour	50	44.16	35.24	31.04	28.43	26.74	25.71	24.93	24.30
$PM_{2.5}$ (µg/m^3)	24-hour	25	18.18	15.04	13.56	12.64	12.05	11.69	11.41	11.19
	Annual	8.8	6.79	6.03	5.68	5.48	5.34	5.24	5.16	5.10
NO_2 (µg/m^3)	1-hour	400	396.10	264.01	205.36	172.81	149.73	133.18	119.27	110.42
	24-hour	200	155.93	112.11	91.44	78.65	70.31	65.29	61.43	58.36
	Annual	100	45.38	34.78	29.90	27.02	25.07	23.67	22.60	21.75
SO_2 (µg/m^3)	1-hour	183.4	16.48	16.20	16.07	16.00	15.95	15.92	15.89	15.87
	24-hour	275	13.38	13.28	13.24	13.21	13.19	13.18	13.18	13.17
	Annual	13.1	5.27	5.24	5.23	5.23	5.22	5.22	5.22	5.21
CO (µg/m^3)	1-hour	35,000	984.47	815.97	741.15	699.63	670.18	649.07	631.33	620.03
	8-hour	15,000	719.47	625.34	583.54	560.35	543.90	532.11	522.19	515.88

CO = carbon monoxide; m = meter; µg/m^3 = micrograms per cubic meter; NO_2 = nitrogen dioxide; $PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SO_2 = sulphur dioxide; SPM = suspended particulate matter.

Construction activities associated with the Project have the potential to temporarily affect local air quality in the immediate vicinity of the Project. Potential effects associated with construction are anticipated to be minimal due to their short and intermittent duration. As a result, construction emissions are unlikely to have a long-term effect on local air quality.

A conservative screening assessment was completed to assess potential effects on air quality. In Ontario, there are no applicable regulatory limits for air quality emissions from construction activities. Therefore, predicted concentrations were assessed against the Project indicators that provide an indicator of good air quality. The results of the screening assessment indicate that predicted concentrations from Project activities and predicted concentrations from Project activities in combination with background air quality for indicator compounds are below the relevant regulatory criteria within approximately 100 m of the preferred route centreline for assessed averaging periods. Predicted concentrations decrease by as much as 50% an additional approximately 200 m from the preferred route ROW.

As part of the noise assessment (Section 11), a series of potential air and noise sensitive receptors were identified using MNRF Land Information Ontario (LIO) datasets and spatial datasets. The MNRF LIO spatial dataset identifies existing structures that include but are not limited to dwellings, garages, sheds and barns. The MNRF LIO spatial data set identifies existing structures, and these structures have been conservatively considered as "potential" Points of Reception (PORs), but it is anticipated that a number of these structures will not qualify as sensitive receptors. Therefore, it is possible these existing structures are PORs representative of the existing air quality sensitive land uses and if required, may need to be verified through ground-truthing. The number of existing potential PORs, within given distances to the Project footprint in the air quality LSA, is summarized in Table 9-18.

Table 9-18: Summary of Structure Distance to the Boundary of the Project Footprint[a]

Distances	Number of Potential PORs[c]
In Project footprint[b]	-
0 to 50 m	25
50 to 100 m	53
100 to 250 m	222
250 to 500 m	535
500 to 1000 m	1,452
1000 to 1500 m	2,028
Total	**4,315**

a) The Project footprint is the preferred route right-of-way, construction camps, laydown yards, staging yards and access roads.
b) Structures in the Project footprint will be purchased and no longer assessed.
c) Structures as defined in Ministry of Natural Resources and Forestry Land Information Ontario layer “Building_As_Symbol” (MNRF 2016).
- = not applicable; m = meter; POR = Point of Reception.

The potential receptors identified include cabins, structures along existing roads, tourism establishments, places of spiritual importance and residential areas. Locations where receptors are crossed by the Project footprint include features such as driveways.

As noted in the previous sections, the preliminary nature of the construction schedule required conservative assumptions to be used to develop a worst-case scenario for dispersion modelling purposes in the secondary assessment. The conservative construction schedule assumed that the construction activities of flagging and clearing, access road construction, staking, geotechnical investigations, and foundation installation could occur on the same day, at the same location. The preliminary construction schedule identifies that construction of the transmission line will occur in six different segments, each approximately 60 km in length, with construction occurring at up to all six segments, consecutively. Additionally, activities on each segment will be staggered sequentially. This means that the equipment assessed will be spread out over a much greater distance in reality with many activities not occurring simultaneously.

9.7.1.1.2 Mitigation

Mitigation measures planned to reduce the effects of air emissions associated with the Project include measures to control dust and other air emissions (e.g., wind erosion control, maintenance of vehicles and equipment, coordination of worker transportation, spray dust control solution that holds moisture for a long period of time minimizing the generation of fugitive dust and compliance with regulatory approvals and permits). In areas where there are residences or sensitive receptors (e.g., hospitals, elderly centers, healthcare facilities) located within approximately 100 m of the Project footprint, emphasis will be placed on comprehensive implementation of mitigation measures, in particular dust suppression activities such as watering and dust suppressants. Fugitive dust controls on unpaved roads and material handling activities range from a 10% to 90% control (Western Governors’ Association 2006). In this assessment, a conservative mid-range control efficiency of 65% was assumed.

NextBridge will identify and confirm the potential receptors within 100 m of construction activities prior to construction of each segment. If the receptor is confirmed to be an occupied residence and the construction activities are anticipated to be negligible sources of fugitive dust and tailpipe emissions (e.g., surveying and flagging, geotechnical investigations, conductor stringing and tensioning, decommissioning of temporary infrastructures, and clean up and reclamation) then no further action is required. However, construction activities that may trigger the need for monitoring include site access development, material hauling, transmission foundation and anchor construction, transmission structure assembly and erection. If these activities are being undertaken within 100 m of the confirmed occupied residence, NextBridge will assess the construction schedule, environmental conditions, and season and evaluate the need for monitoring. Monitoring will be undertaken when emission generating activities have the potential to impact the receptor. Handheld portable monitors will be used by a qualified person within approximately 10 m of confirmed residences to provide real-time concentrations that can be compared to ambient air quality criteria. If the monitoring indicates potential for an exceedance of the ambient air quality criteria, the construction scheduling will be reviewed and amended to the extent practicable.

These mitigation measures are expected to minimize potential effect associated with air emissions. Mitigation measures are summarized in Table 9-19. The effectiveness of mitigation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.

9.7.1.1.3 Net Effects

There is a predicted net effect after implementation of the mitigation described above (Section 9.7.1.2) and in Table 9-19. Ambient concentrations of all indicator compounds will increase as a result of construction activities and therefore, this effect (increase in ambient concentrations from CAC and fugitive dust emissions) is carried forward to the net effects characterization (Section 9.8).

9.7.2 Summary of Potential Effects, Mitigation and Net Effects

A summary of the potential effects assessment is provided in Table 9-19, which is based on the previous assessment discussion and the implementation of mitigation measures identified above and further supplemented in the table below.

Table 9-19: Summary of Potential Effects, Mitigation and Predicted Net Effects for Air Quality

Criteria	Indicator	Project Component or Activity	Potential Effect	Mitigation	Inspection and Monitoring Details	Net Effect
Air quality	■ Ambient concentrations of SPM; ■ Ambient concentrations of PM_{10} and $PM_{2.5}$; ■ Ambient concentrations of CO; ■ Ambient concentrations of NO_2; and ■ Ambient concentrations of SO_2.	Project activities during the construction phase, including: ■ site access development, site preparation and soil salvage (e.g., clearing and grubbing); ■ material handling and hauling; ■ vehicular exhaust; ■ construction of temporary workspaces; ■ decommissioning of temporary access roads and workspaces; and ■ clean-up and reclamation.	Increase in ambient concentrations from CAC and fugitive dust emissions	**Construction Phase**: Air Quality/Emission Mitigation ■ Turn off vehicles and equipment when not in use and minimize idling, unless weather and/or safety conditions dictate the need for them to remain turned on and in a safe operating condition. ■ Noise abatement, emission and pollution control equipment on machinery should be in place, properly maintained and in good working order. ■ Keep equipment well-maintained. ■ Burning of slash will be in accordance with regulatory approvals and permits and subject to agreements with landowners, SFL holders (e.g., overlapping agreements). ■ Implement dust control measures (e.g., spray dust control solution that holds moisture for a long period of time causing dust to settle) as advised by the Environmental Inspector. ■ To minimize drifting soils and loss of topsoil in areas prone to wind or water erosion stabilize the disturbed area as soon as practicable by: ▪ spreading wood chips or straw crimping (weed-free straw); sowing a fast growing ground cover (e.g., cereal crop); ▪ installing erosion control blankets; or ▪ walking down tree and shrub debris over exposed soils (rollback). ■ Retain compatible vegetation (e.g., below 2 m in height) where practicable on areas prone to wind erosion, steep slopes, drainage ways or next to a water body. ■ Tackify, cover, seed, apply water or pack the topsoil stockpiles and windrows with approved equipment, if soils prone to wind erosion ■ Use multi passenger vehicles to transport workers to site when practicable. ■ Where occupied residences are confirmed within 100 m of construction, schedule activities within 5 km radius in a manner that reduces the number of construction activities occurring at the same time.	**Construction Phase:** ■ The Owner will appoint qualified Environmental Inspector(s) to guide implementation, monitor and report on the effectiveness of the construction procedures and mitigation measures for minimizing potential impacts. ■ Identify and confirm the potential receptors within 100 m of construction activities prior to construction of each segment. If the receptor is confirmed to be an occupied residence, implement the following measures: ▪ If the construction activities are anticipated to be negligible sources of fugitive dust and tailpipe emissions (e.g., surveying and flagging, geotechnical investigations, conductor stringing and tensioning, decommissioning of temporary infrastructures, and clean up and reclamation) then no further action is required. ▪ Construction activities that may trigger the need for monitoring include site access development, material hauling, transmission foundation and anchor construction, transmission structure assembly and erection. If these activities are being undertaken within 100 m of the confirmed occupied residence, the Owner will assess the construction schedule, environmental conditions, and season and evaluate the need for monitoring. ▪ Monitoring will be undertaken when emission generating activities have the potential to impact the receptor. Handheld portable monitors will be used by a qualified person within approximately 10 m of confirmed occupied residences to provide real-time concentrations that can be compared to ambient air quality criteria.	Net effect – Increase in ambient concentrations from CAC and fugitive dust emissions

CAC = criteria air contaminants; CO = carbon monoxide; km = kilometre; m = meter; PM_{10} = particulate matter less than 10 microns; $PM_{2.5}$ = particulate matter less than 2.5 microns; NO_2 = nitrogen dioxide; SPM = suspended particulate matter; SO_2 = sulphur dioxide.

9.8 Net Effects Characterization

9.8.1 Approach

The effects assessment approach followed the general process described in Section 5.5 (methods section). Net effects are described using the factors of significance in Table 5-5. Effect levels are defined for the magnitude effects characteristic for air quality in Table 9-20.

Table 9-20: Magnitude Effect Levels for Air Quality

Indicator / Net Effect	Effects Level Definition			
	Negligible	Low	Moderate	High
Predicted Ambient Concentration of SPM, PM_{10}, $PM_{2.5}$, CO, NO_2 and SO_2	Maximum predicted concentration (including background) is less than 10% of Project Criteria	Maximum predicted concentration (including background) is between 10% and 50% of Project Criteria	Maximum predicted concentration (including background) is between 50% and 100% of Project Criteria	Maximum predicted concentration (including background) is greater than 100% of Project Criteria

CO = carbon monoxide; % = percent; PM_{10} = particulate matter less than 10 microns; $PM_{2.5}$ = particulate matter less than 2.5 microns; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; SPM = suspended particulate matter.

9.8.2 Results

Net effects are described after the implementation of effective mitigation and summarized according to direction, magnitude, geographic extent, duration/irreversibility, frequency/timing, and likelihood of the effect occurring following the methods described in Section 5.5.4. Effective implementation of mitigation summarized in Table 9-19, Section 9.7, and the Construction Environmental Protection Plan (CEPP; refer to Appendix 4-II), which were not incorporated into the emission calculations, is expected to reduce the magnitude and duration of net effects on air quality.

9.8.2.1 Ambient Concentrations of SPM, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2

9.8.2.1.1 Change to Ambient Concentrations from Criteria Air Contaminants and Fugitive Dust Emissions

Construction activities associated with the Project have the potential to temporarily affect local air quality in the immediate vicinity of the Project. Net effects associated with construction are anticipated to be minimal due to their short duration and intermittent frequency. Additionally, as the majority of construction activities are anticipated to take place during winter months, this will add additional natural mitigation measures that were not accounted for in the emission calculations (Section 9.7.1.1). As a result, construction emissions are unlikely to have a long-term effect on local air quality.

The magnitude of the effect was assessed as moderate to high within 100 m of the Project footprint as predicted concentrations from air quality modelling may be greater than Project Criteria, which are typically used as an indicator of good air quality, however, receptors located within this distance will be verified in advance of construction and administrative controls will be undertaken to minimize simultaneous construction within a 5 km radius. The magnitude of the effect at receptors located greater than a 100-m distance from the Project footprint was assessed as moderate to low as the predicted ambient concentrations of all indicators beyond this distance are less than the Project Criteria. The predicted increase in concentrations of the indicator compounds was considered to be local, as the magnitude of the net effect is reduced to low within approximately 500 m of the ROW. The net effect was also characterized as short-term and reversible as the net effect only occurs during construction and once construction is completed in an area, the emission sources will be removed and predicted ambient concentrations will return to baseline conditions. The net effect was predicted to be intermittent as not all equipment and activities will be occurring simultaneously at the same location and are expected to be sequentially staggered. The net effect was assessed as possible based on mitigation and conservatism in the assessment.

9.8.3 Summary of Net Effects Characterization

A summary of the characterization of net effects of the Project on air quality is provided in Table 9-21.

Table 9-21: Characterization of Predicted Net Effects for Air Quality

Criteria	Indicator	Net effect	Direct/ Indirect	Direction	Factors of Significance				
					Magnitude	Geographic Extent	Duration/ Irreversibility	Frequency	Likelihood of Occurrence
Air quality	■ Ambient concentrations of SPM; ■ Ambient concentrations of PM_{10} and $PM_{2.5}$; ■ Ambient concentrations of CO; ■ Ambient concentrations of NO_2; and ■ Ambient concentrations of SO_2.	Change to ambient concentrations from CAC and fugitive dust emissions	Direct	Negative	Moderate to high[(a)]	Local – LSA	Short-term – reversible	Infrequent	Possible

a) The assessed magnitude is high within 100 m of the Project footprint but decreases to moderate beyond 100 m of the ROW.

CAC = criteria air contaminants; CO = carbon monoxide; LSA = local study area; PM_{10} = particulate matter less than 10 microns; $PM_{2.5}$ = particulate matter less than 2.5 microns; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; SPM = suspended particulate matter.

9.9 Assessing Significance

The assessment of significance of net effects from the Project on air quality followed the general process described in Section 5.6 and was informed by the interaction between the factors of significance, with magnitude, duration and geographic extent being the most important factors. Implementation of proven mitigation is expected to reduce the duration and magnitude of potential adverse effects on air quality. Consideration is also given to concerns of interested agencies, groups and individuals raised during consultation and engagement and through review comments on the draft and final EA reports.

The factors considered in the assessment of significance of net effects on air quality are outlined in Table 9-22. The predicted net effect to air quality would be considered to be significant if the net effect were assessed as high magnitude, long-term, permanent duration and high likelihood at any geographic extent and any likelihood. The effect, if significant, would be measurable and predicted to result in a frequent and likely change to air concentrations above the indicators of good air quality. The net effect would be considered not significant if the effect were determined to be temporary, low extent, infrequent and unlikely to cause permanent changes to ambient air quality.

Implementation of proven mitigation in Table 9-19, discussed in Section 9.7, and in the CEPP (refer to Appendix 4-II) is expected to avoid or reduce the duration, magnitude, and extent of the net effect on air quality. The magnitude of the effect at receptors located greater than a 100-m distance from the ROW was assessed as moderate to low within the air quality LSA. Effects at all locations were assessed as direct, and local. The net effect was anticipated to be reversible over the short-term.

The predicted net effect on air quality is not anticipated to result in a concentration of the indicator compound above levels considered to representative of good air quality. Therefore, the predicted net effect on air quality was assessed as not significant.

Table 9-22: Factors Considered in the Assessment of Significance of Net Effects on Air Quality

Criteria	Indicators	Significance	Magnitude	Duration	Extent	Frequency	Likelihood	Context / Sustainability
Air Quality impact	■ Predicted ambient concentrations of SPM; ■ Predicted ambient concentrations of PM_{10} and $PM_{2.5}$; ■ Predicted ambient concentrations of CO; ■ Predicted ambient concentrations of NO_2; and ■ Predicted ambient concentrations of SO_2.	Significant	High or Moderate	Any Duration	Regional or beyond regional	Any frequency	Definite or Probable	Effects to the criterion would likely result in regional concentrations of the indicator compound above levels considered to representative of good air quality.
			High	Any Duration	Local	Continuous	Definite or Probable	
		Not significant	High or Moderate	Short-term	Local	Infrequent or frequent	Possible or Unlikely	Effects to the criterion would not likely result in concentrations of the indicator compound above levels considered to representative of good air quality.
			Low or Moderate	Any	Any	Any frequency	Any	

CO = carbon monoxide; PM_{10} = particulate matter less than 10 microns; $PM_{2.5}$ = particulate matter less than 2.5 microns; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; SPM = suspended particulate matter.

9.10 Cumulative Effects Assessment

In addition to assessing the net environmental effects of the Project itself, the assessment also evaluates the significance of the net and cumulative effects from the Project that overlap temporally and spatially with effects from all other past, present and reasonably foreseeable development and activities (Section 5.7).

Importantly, not all net effects from the Project on air quality may require an assessment of cumulative effects. The factors used to determine if a net effect should be carried forward for further analysis in the cumulative effects assessment are outlined in Section 5.7. Based on these factors, the magnitude of the net effect for air quality was predicted to be moderate to high for receptors within 100 m of the Project footprint; however, the likelihood of occurrence of the effect is considered possible (the effect may occur but is not likely) based on mitigation and conservatism in the assessment. Net effects assessed as 'unlikely' and 'possible' were not considered to likely contribute to cumulative effects, and are not carried forward to the cumulative effects assessment (refer to Section 5.7). Considered with the limited geographic extent of the net effect, short duration, intermittent frequency and the evaluated likelihood of occurrence, this effect is not expected to have potential to act cumulatively. Therefore, a cumulative effects assessment was not completed for this net effect.

9.11 Prediction Confidence in the Assessment

The confidence in the effects assessment for air quality is high, considering that the mitigation described in the CEPP (refer to Appendix 4-II) is based on accepted and proven best management practices that are well understood and have been applied to transmission line projects throughout North America. Uncertainty in the assessment has been further reduced by making conservative assumptions in the calculation and modelling methodologies used in the screening assessment, implementation of known effective mitigation and monitoring measures, and available adaptive management measures to address unforeseen circumstances should they arise.

For the calculations, it was assumed that specific equipment was operating at the same time, in the same representative, approximately 5-km segment of the ROW. Additionally, for fugitive dust and material handling, a smaller mitigation factor was selected to increase conservatism. For this reason, it is highly unlikely that the emission estimates for the Project are underestimated. Emission rates were modelled using a single volume source to represent possible sources. This is conservative as the emissions sources would likely be more spread out along the length of the ROW. As well, with this approach, it is assumed that the maximum concentrations from each activity would occur in the same location, which is unlikely given that the activities will likely be more spread out. The results of the assessment are unlikely to underestimate the effects of the Project on air quality in the air quality LSA given the conservative approach of the assessment described above.

Uncertainty in the assessment has been further reduced by planning adaptive management measures to address unforeseen circumstances should they arise.

9.12 Follow-up, Inspection, and Monitoring Programs

The objectives of follow-up, inspection, and monitoring programs include:

- evaluating the effectiveness of mitigation and reclamation, and modifying or enhancing measures as necessary through adaptive management;
- identifying unanticipated potentially adverse effects, including possible accidents and malfunctions; and
- contributing to continual improvement.

Monitoring activities are described in the CEPP (refer to Appendix 4-II). A summary of the monitoring activities relevant to the protection of the air quality during construction and post-construction are described below:

- NextBridge will employ the services of qualified Environmental Inspector(s) to guide implementation, monitor and report on the effectiveness of the construction procedures and mitigation measures for minimizing potential impacts; and
- If the construction activities such as site access development, material hauling, transmission foundation and anchor construction, transmission structure assembly and erection are being undertaken within 100 m of the confirmed occupied residence, NextBridge will assess the construction schedule, environmental conditions, and season and evaluate the need for monitoring. Monitoring will be undertaken when these emission generating activities have the potential to impact the receptor. Handheld portable monitors will be used by a qualified person within approximately 10 m of confirmed occupied residences to provide real-time concentrations that can be compared to ambient air quality criteria.

9.13 Information Passed on to Other Components

Results of the air quality assessment were reviewed and incorporated into the following components of the Environmental Assessment:

- Vegetation and Wetlands (refer to Section 12);
- Wildlife and Wildlife Habitat (refer to Section 14);
- Indigenous Current Use of Lands and Resources for Traditional Purposes (refer to Section 17);
- Socio-Economic Environment (refer to Section 18);
- Non-Traditional Land and Resource Use (refer to Section 19); and
- Human Health (refer to Section 21).