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:

- consideration of 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;
- identification of information and data sources used in the assessment;
- identification and rationale for selection of criteria and indicators for air quality;
- establishment of temporal and spatial boundaries for the assessment of effects on these criteria;
- description of the existing environment to gain an understanding of baseline conditions for these criteria;
- identification and screening of effect pathways that could link Project activities to changes in these criteria;
- characterization of predicted net effects (after mitigation) of the Project on criteria (if required);
- assessment and determination of significance of cumulative effects from the Project and previous, existing and reasonably foreseeable developments (RFDs) on criteria (if required);
- assessment of uncertainty in the effects predictions, indicating how uncertainties are addressed; and
- identification of proposed monitoring or follow-up to confirm predictions and address uncertainty.

As outlined in Section 5, the assessment is structured around three assessment cases:

- Base Case;
- Project Case; and
- Cumulative Effects Case.

9.1 Input from Consultation and Engagement

Concerns regarding dust and air emissions from construction activities were raised during consultation and engagement for the Project. This issue has been considered and addressed in this section of the Environmental Assessment Report. A detailed consultation and engagement record is provided in Appendices 2-III and 2-IX.

9.2 Information Sources

Information for the air quality baseline was collected from review of the Ministry of the Environment and Climate Change (MOECC) and Environment and Climate Change Canada (ECCC) National Air Pollution Surveillance Network (NAPS) database (ECCC 2016). 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. For the purposes of the Environmental Assessment, 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, Assessment Endpoints, 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).

Assessment endpoints represent the key properties of a criterion that should be protected (Section 5.1). The assessment endpoint for the air quality criterion is concentrations of criteria air contaminants (CACs) and particulate matter (PM) from the Project that are within ambient provincial and federal air quality criteria and standards.

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

- **Ambient concentrations of SPM:** SPM collectively describes airborne particles or aerosols less than 44 µm in size (MOECC 2012). SPM is commonly known as dust and results in reduced visibility.
- **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).
- **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).
- **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).
- **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).

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, assessment endpoint, and indicators selected for the assessment of Project effects on air quality, and the rationale for their selection, are provided in Table 9-1.

Table 9-1: Air Quality Criterion, Indicators, and Assessment Endpoint

Criterion	Rationale	Indicators	Assessment Endpoint
Air quality	■ Sensitivity of human health to air quality ■ Sensitivity of the environment (soils, plants, animals) to air quality	■ Ambient concentrations of SPM ■ Ambient concentrations of PM_{10} and $PM_{2.5}$ ■ Ambient concentrations of CO ■ Ambient concentrations of NO_2 ■ Ambient concentrations of SO_2	Concentrations of CACs and PM from the Project that are within ambient provincial and federal air quality criteria and standards

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 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/m³)	24-hour	120	N/A	N/A	120	120
	Annual	60	N/A	60	70	70
PM_{10} (µg/m³)	24-hour	50	N/A	N/A	N/A	50
$PM_{2.5}$ (µg/m³)	24-hour	25[(d)]	28/27	N/A	N/A	27
	Annual	N/A	10/8.8	N/A	N/A	8.8
NO_2 (µg/m³)	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/m³)	1-hour	600	183.4[(e)]	450	900	900
	24-hour	275	N/A	150	300	300
	Annual	55	13.1[(f)]	30	60	60
CO (µg/m³)	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 70ppb and converted to µg/m³ using a reference temperature of 25°C and pressure of 1 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.

CAAQSs = Canadian Ambient Air Quality Standards; NAAQOs = National Ambient Air Quality Objectives; N/A = no guideline available; µg/m³ = micrograms per cubic metre; SO_2 = sulphur dioxide; NO_2 = nitrogen dioxide; O_3 = ozone; CO = carbon monoxide; SPM = suspended particulate matter <44 µm; PM = particulate matter.

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 Spatial Boundaries

Spatial boundaries for the assessment are provided in Table 9-3.

Table 9-3: Air Quality Spatial Boundaries

Spatial Boundaries	Area (ha)	Description	Rationale
Project footprint	5,005 ha	The Project footprint is the preferred route ROW, laydown yards, storage yards, construction camps, temporary construction easements, and new access roads	Designed to capture the potential direct effects of the physical 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 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; ROW = right-of-way; RSA = Regional Study Area.

9.5 Description of the Existing Environment (Base Case)

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 review 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. 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	2003-2013	n/a	n/a	2003-2013	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 $PM_{2.5}$, measurements 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 below the pending CAAQS of 8.8 µg/m³ (2020 phase-in date).

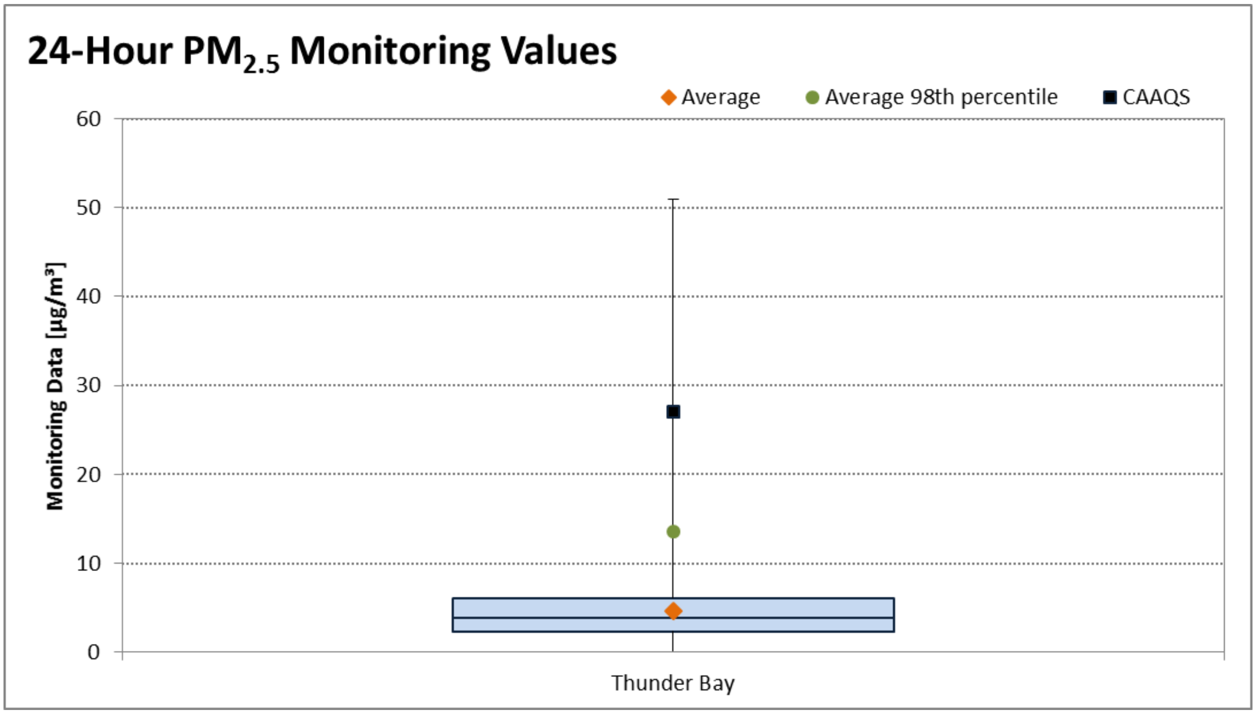


Figure 9-1: Monitored Fine Particulate Matter ($PM_{2.5}$) from the Thunder Bay Monitoring Station

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.

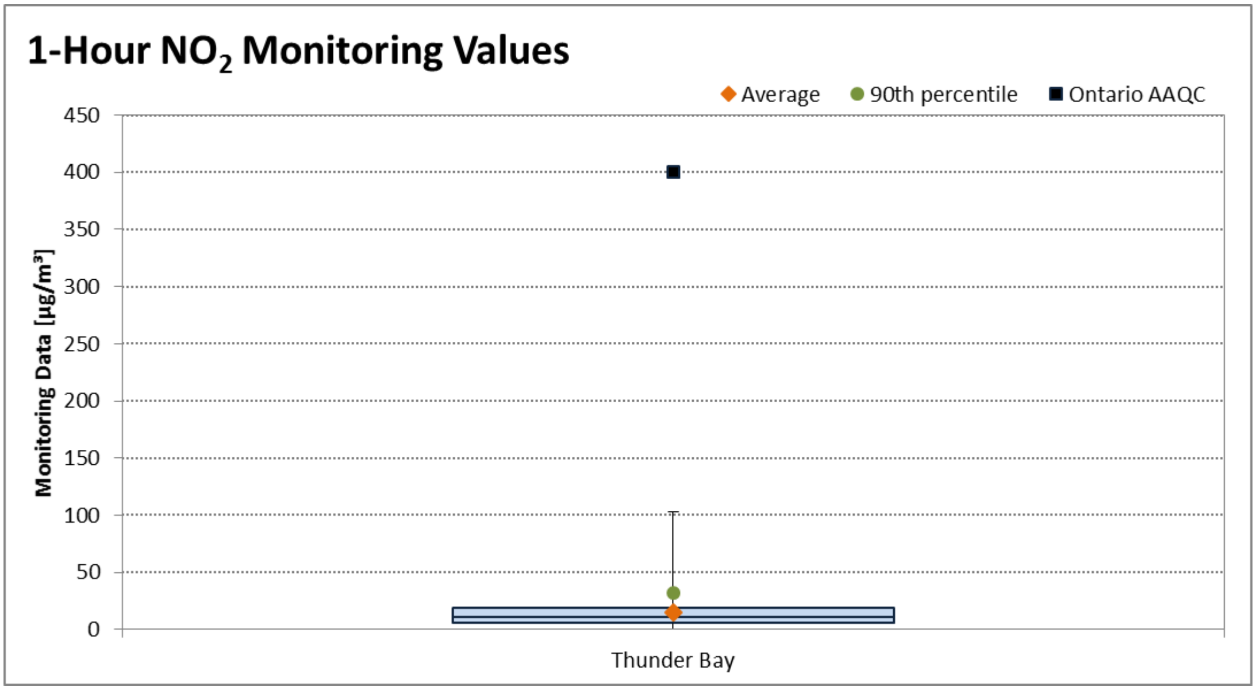
9.5.2.3 Concentrations of Sulphur Dioxide

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 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.



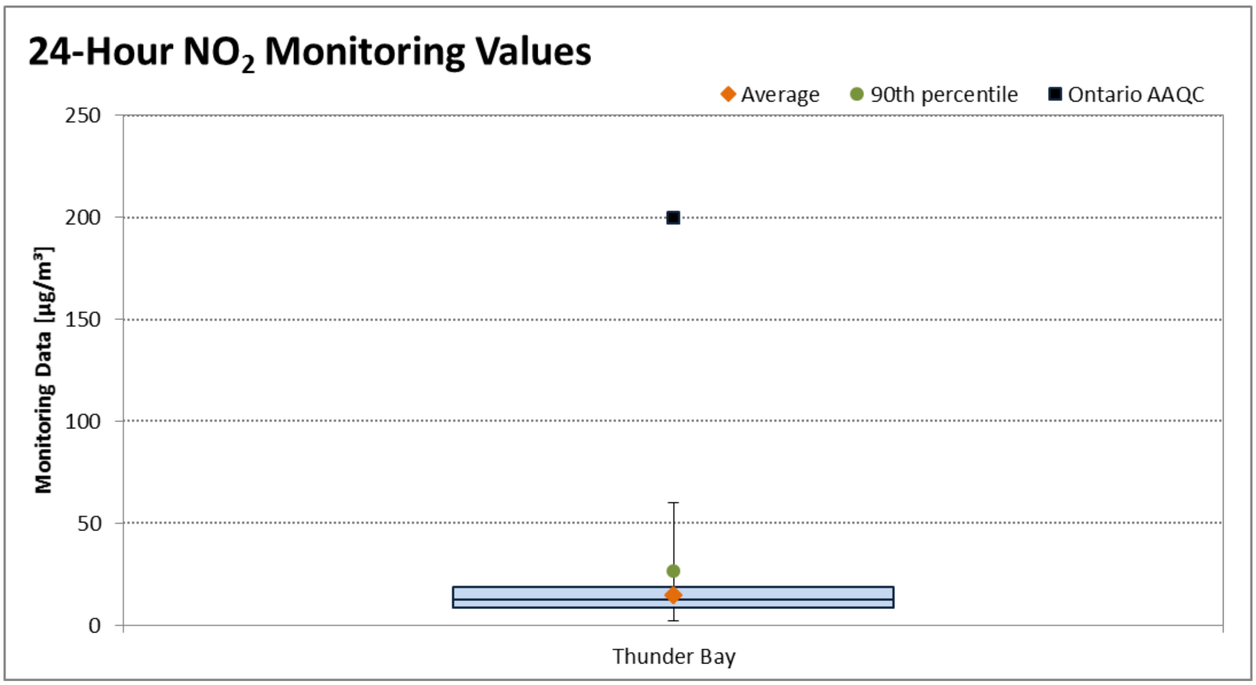


Figure 9-2: Monitored Nitrogen Dioxide (NO_2) from the Thunder Bay Monitoring Station

9.5.2.5 Summary of Existing Environment (Base Case)

A summary of the available background air quality concentrations for indicator compounds is provided in Table 9-5. 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.

Table 9-5: Air Quality Background Concentrations

Indicator Compound	Averaging Period	Background Concentration (µg/m³)	Project Criteria (µg/m³)	% of Project Criteria (%)
SPM	24-hour	35.7	120	30
	Annual	18.4	70	26
PM_{10}	24-hour	17.8	50	36
$PM_{2.5}$	24-hour	8.9	27	33
	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	900	2
	24-hour	13.1	300	4
	Annual	5.2	60	9
CO	1-hour	520	36,200	1
	8-hour	460	15,700	3

Note:

1-hour, 8-hour, and 24-hour values are based on 90^{th} 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 98^{th} percentile of the 24-hour observations.

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.

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.

9.6 Project-Environment Interactions and Pathway Analysis

The linkages between Project components and activities and potential effects to air quality are identified and assessed through a pathway analysis (Section 5.4).

Potential pathways for effects on air quality are presented in Table 9-6. Classification of effects pathways to air quality are also presented in Table 9-6, and detailed descriptions are provided in the subsequent sections.

Table 9-6: Potential Effect Pathways for Effects to Air Quality

Project Component or Activity	Effect Pathway	Pathway Duration	Mitigation	Pathway Type
Project activities during the construction phase, including: ■ land clearing activities; ■ material handling and hauling; ■ vehicular exhaust; and, ■ reclamation of temporary access roads and staging areas.	CAC and fugitive dust emissions from construction activities can result in changes in ambient concentrations	Temporary, with effects limited to construction	**Construction Phase:** ■ Where reasonable and practicable, vehicles and equipment will be turned off when not in use, unless weather and/or safety conditions dictate the need for them to remain turned on and in a safe operating condition. ■ The Contractor will keep equipment well-maintained. ■ Burning of slash will be subject to agreements with landowners, and to permits and approvals by appropriate regulatory agency (Table 1-1). ■ Dust control practices (e.g., wetting with water) may be implemented on access roads near residential areas or other areas as advised by the Environmental Inspector(s), where required. ■ Minimize dust-generating activities, as practicable and where required, during periods of high wind to limit dust emissions and spread. ■ Use multi-passenger vehicles to transport workers to site when practicable. ■ Where residences are confirmed within 100 m of construction, administrative controls will be undertaken to minimize simultaneous construction activities within a 5 km radius, where practicable. ■ Handheld portable monitors will be used by the Environmental monitors 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 air quality criteria, the construction scheduling will be reviewed and amended to the extent feasible.	Secondary

CAC = criteria air contaminants.

9.6.1 Pathway Screening

9.6.1.1 No Pathway

No "no pathways" are predicted for net effects to air quality. Subsequently, there is no further discussion of no pathways.

9.6.1.2 Secondary Pathways

In some cases both a Project component or activity (i.e., source) and an effect pathway may exist, but the Project is assessed as resulting in a minor environmental change with a negligible net effect on air quality relative to baseline values, resulting in a predicted secondary pathway. A negligible net effect is an effect where there is a small measurable change that is expected to be within the range of baseline or guideline values, and is not expected to result in a change on the assessment endpoint. This pathway, described in the following bullet, was assessed as secondary and was not carried through to the net effects assessment.

- **CAC and fugitive dust emissions from construction activities can result in changes in ambient concentrations.**

The potential sources of air and fugitive dust emissions are from equipment and activities associated with construction of the Project. Specifically, construction activities have the potential to temporarily affect local air quality in the immediate vicinity 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 stretch along the preferred route. Corresponding equipment data for these activities provided by the Project construction team were used in combination with published emission factors to prepare emission rate estimates for a representative, approximately 5 km stretch 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. A summary of the equipment data and emission factor references used for each source of emissions is provided in Table 9-7. Mitigation measures (Table 9-6) were assumed to be implemented and were incorporated into the fugitive dust and material handling calculations. Vehicle exhaust emissions were conservatively prepared, assuming vehicles comply with US 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 10 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.

The data in Table 9-7 were used to prepare emission estimates for the representative, approximately 5 km segment of Project construction. A copy of the detailed emission calculations is provided in Appendix 1-III, Attachment MNRF-AQ-18.

Table 9-7: Data used for Emission Calculations

Emission Source	Equipment/Activity Data used in Emission Rate Calculations	Emission Factor used in Emission Rate Calculations	Additional Comments
■ Land clearing activities ■ Material handling and hauling activities including extraction, dozing, and grading ■ Reclamation of temporary access roads and staging areas	■ Equipment type and quantity ■ Equipment capacity ■ Vehicle speed	AP-42 Chapter 11.9 *Western Surface Coal Mining* (US EPA 1998)	No additional comments
Vehicular exhausts	■ Equipment type and quantity ■ Vehicle engine size ■ Equipment hours of operation	Crank case emission standards from *Exhaust and Crankcase Emission Factors from Nonroad Engine Modelling Compression-Ignition* (US EPA 2010)	US EPA emission standards are not available for PM_{10} and $PM_{2.5}$; therefore, it was assumed that SPM emissions consist of PM_{10}, and that $PM_{2.5}$ emissions are 97% of PM_{10} emissions, as is typical for particulate matter that is emitted from vehicular exhausts
Fugitive dust from vehicles travelling on unpaved roads	■ Equipment type and quantity ■ Equipment weight ■ Vehicle kilometres travelled	AP-42 Chapter 13.2.2 *Unpaved Roads* (US EPA 2006)	No additional comments

$PM_{2.5}$ = particulate matter less than 2.5 microns; PM_{10} = particulate matter less than 10 microns; SPM = suspended particulate matter; US EPA = United States Environmental Protection Agency.

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 200 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 50% was assumed.

A summary of the total emission rates (estimated construction emissions including mitigation for fugitive dust) for each indicator compound is provided in Table 9-8.

Table 9-8: 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	1.06	0.80	0.31	2.17
PM_{10}	0.30	0.21	0.31	0.81
$PM_{2.5}$	0.03	0.08	0.31	0.42
NO_x as NO_2	0	0	5.27	5.27
SO_2	0	0	0.01	0.01
CO	0	0	5.63	5.63

Note: Individual data values presented in this table are rounded to 2 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.

A screening assessment was completed using the emission rates presented in Table 9-8 and the US EPA SCREEN3 dispersion model to predict air quality concentrations at approximately 100 m intervals from the centreline of the preferred route right-of-way (ROW) to the outer boundary of the air quality LSA. SCREEN3 is a single source Gaussian plume model that calculates maximum ground level concentrations from point, area, flare, and volume sources. It is used as a screening model in Ontario to estimate short-term calculations of concentrations for stationary sources (MOECC 2008). Emission rates were modelled as a single volume source on 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.

Results were calculated based on a 1-hour averaging period and converted to 8-hour and 24-hour averaging periods using conversion factors (MOECC 2008). 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 results is provided in Table 9-9.

Table 9-9: Predicted Air Quality Concentrations at Increasing Distance from the Preferred Route Centreline in the Air Quality Local Study Area

Indicator Compound	Averaging Period	Relevant Project Criteria	Distance from Preferred Route Centreline (m)							
			100	200	300	400	500	1,000	1,500	2,000
SPM (µg/m^3)	24-hour	120	60.55	39.50	28.51	21.93	17.57	8.52	5.36	3.78
	Annual	70	11.61	7.57	5.46	4.20	3.37	1.63	1.03	0.73
PM_{10} (µg/m^3)	24-hour	50	22.74	14.83	10.71	8.24	6.60	3.20	2.01	1.42
$PM_{2.5}$ (µg/m^3)	24-hour	27	11.82	7.71	5.56	4.28	3.43	1.66	1.05	0.74
	Annual	8.8	2.27	1.48	1.07	0.82	0.66	0.32	0.20	0.14
NO_2 (µg/m^3)	1-hour	400	358.19	233.66	168.64	129.72	103.96	50.38	31.68	22.3
	24-hour	200	147.11	95.97	69.26	53.28	42.70	20.69	13.01	9.19
	Annual	100	28.20	18.39	13.28	10.21	8.18	3.97	2.49	1.76
SO_2 (µg/m^3)	1-hour	900	0.71	0.46	0.33	0.26	0.21	0.10	0.06	0.04
	24-hour	300	0.29	0.19	0.14	0.11	0.08	0.04	0.03	0.02
	Annual	60	0.06	0.04	0.03	0.02	0.02	0.01	<0.01	<0.01
CO (µg/m^3)	1-hour	36,200	382.38	249.45	180.03	138.48	110.98	53.78	33.82	23.89
	8-hour	15,700	213.61	139.35	100.57	77.36	62.00	30.04	18.89	13.35

CO = carbon monoxide; 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.

The screening assessment indicates that predicted concentrations from Project activities of indicator compounds are below the relevant Project criteria (i.e., the lowest applicable criteria) within approximately 100 m of the preferred route centreline. Predicted concentrations from Project activities were added to background data, where available, and are summarized in Table 9-10. Predicted concentrations from Project activities in combination with background air quality are below the relevant criteria within approximately 100 m of the preferred route centreline after effective implementation of mitigation.

Table 9-10: Predicted Air Quality Concentrations (Including Background) at Increasing Distance from Preferred Route Centreline in the Air Quality Local Study Area

Indicator Compound	Averaging Period	Relevant Project Criteria	Distance from Preferred Route Centreline (m)							
			100	200	300	400	500	1,000	1,500	2,000
SPM (μg/m^3)	24-hour	120	96.25	75.20	64.21	57.63	53.27	44.22	41.06	39.48
	Annual	70	30.01	25.97	23.86	22.60	21.77	20.03	19.43	19.13
PM_{10} (μg/m^3)	24-hour	50	40.54	32.63	28.51	26.04	24.40	21.00	19.81	19.22
$PM_{2.5}$ (μg/m^3)	24-hour	27	16.42	12.31	10.16	8.88	8.03	6.26	5.65	5.34
	Annual	8.8	6.87	6.08	5.67	5.42	5.26	4.92	4.80	4.74
NO_2 (μg/m^3)	1-hour	400	390.19	265.66	200.64	161.72	135.96	82.38	63.68	54.38
	24-hour	200	173.51	122.37	95.66	79.68	69.1	47.09	39.41	35.59
	Annual	100	43	33.19	28.08	25.01	22.98	18.77	17.29	16.56
SO_2 (μg/m^3)	1-hour	900	16.41	16.16	16.03	15.96	15.91	15.8	15.76	15.74
	24-hour	300	13.39	13.29	13.24	13.21	13.18	13.14	13.13	13.12
	Annual	60	5.26	5.24	5.23	5.22	5.22	5.21	5.21	5.21
CO (μg/m^3)	1-hour	36,200	902.38	769.45	700.03	658.48	630.98	573.78	553.82	543.89
	8-hour	15,700	673.61	599.35	560.57	537.36	522	490.04	478.89	473.35

CO = carbon monoxide; 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 centreline.

As part of the noise assessment (Section 11), a series of potential air and noise sensitive receptors were identified using Ministry of Natural Resources and Forestry (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. The number of existing potential PORs, within given distances to the Project footprint in the air quality LSA, is summarized in Table 9-11. Therefore, it is possible these existing structures are PORs representative of the existing air quality sensitive land uses and if required, will need to be verified through additional investigations, which may include ground-truthing.

Table 9-11: 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	209
50 to 100 m	205
100 to 250 m	971
250 to 500 m	1,166
500 to 1000 m	2,418
1000 to 1500 m	1,536
Total	**6,505**

a) The Project footprint is the preferred route right-of-way, construction camps, laydown areas, 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).

Approximately 6,505 potential PORs were identified within the LSA. Of these 6,505 potential PORs, the results of the conservative secondary pathway assessment indicate that 6,091 can be screened out as having negligible net effects from air quality. As noted in the previous sections, due to the absence of a detailed construction schedule, conservative assumptions were used to develop a "worst case scenario" that was used 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.

Of the remaining 414 potential PORs that are within 100m of the Project footprint, sufficient information is not available at this time to complete a primary pathway assessment; these potential PORs need to be verified for the air quality assessment and additional details regarding the construction schedule is required. It is reasonable to assume that if this information was available then the primary assessment would show that the effects of the project are not significant. The reason for this is because in reality, it is very unlikely that all construction activities would occur within such a short spread of construction as it is typical practice to stagger these activities. For example, access road construction cannot commence before the land has been cleared and are therefore very unlikely to occur on the same day within close proximity of a potential POR as for efficiency a longer area of the Project will be cleared. The detailed construction schedule, once complete, will provide further clarification on activity location. Where residences are confirmed within 100 m of construction, administrative controls will be undertaken to minimize simultaneous construction activities within a 5 km radius, where practicable. Additionally, as part of the Environmental Protection Plan (EPP) a construction monitoring plan will be implemented at confirmed residences located within 100 m of construction. Handheld portable monitors will be used by the Environmental monitors 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 as possible. This monitoring plan will be incorporated into the EPP, prior to construction of the project.

Negligible net effects of the Project are predicted on ambient concentrations of SPM, ambient concentrations of PM_{10} and $PM_{2.5}$, ambient concentrations of carbon monoxide, ambient concentrations of nitrogen dioxide, and ambient concentrations of sulphur dioxide given the screening-level results and effective implementation of the mitigation measures identified in Table 9-6. There is no potential for an effect on the air quality assessment endpoint (i.e., concentrations of CACs and particulate matter from the Project are within ambient provincial and federal air quality criteria and standards).

9.6.1.3 Primary Pathways

No primary effect pathways were identified for air quality. Subsequently, there is no further assessment or characterization of net effects, including determination of significance (Section 5.4.3).

9.7 Project Effects Assessment (Project Case)

No primary effect pathways were identified for air quality as a result of the Project (refer to Section 9.6.1). No further assessment or characterization of net effects, including determination of significance, is required.

9.8 Cumulative Effects Assessment (Cumulative Effects Case)

No primary effect pathways were identified for air quality as a result of the Project (refer to Section 9.6.1). Consequently, the air quality criterion is not carried forward for assessment of cumulative effects. Predicted air quality concentrations from construction activities associated with the Project return to baseline levels within approximately 1,500 m of the Project centreline for each assessed indicator compound. Given the rural location of the Project, it is unlikely that another construction project will occur within 1.5 km of the Project at the same time as that section is being constructed.

9.9 Prediction Confidence in the Assessment

The confidence in the effects assessment for air quality is high, considering that the mitigation described in the EPP (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 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.

9.10 Follow-Up, Inspection, and Monitoring Programs

No follow-up or inspection programs will be required for air quality for receptors greater than 100 m from the project centreline. Where residences are confirmed within 100 m of construction, administrative controls will be undertaken to minimize simultaneous construction activities within a 5 km radius, where practicable. Additionally, as part of the EPP a construction monitoring plan will be implemented at confirmed residences located within 100 m of construction. Handheld portable monitors will be used by the Environmental monitors 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, the construction scheduling will be reviewed and amended as possible. This monitoring plan will be incorporated into the EPP, prior to construction of the Project.

9.11 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 (Section 12);
- Wildlife and Wildlife Habitat (Section 14); and
- Human Health (Section 21).