



Sisson Project:

Baseline Ambient Air Quality Technical Report

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1.0 INTRODUCTION

This document is the Baseline Ambient Air Quality Technical Report prepared by Stantec Consulting Ltd. (Stantec) as background information for the Environmental Impact Assessment (EIA) of the Sisson Project (the Project), proposed by Northcliff Resources Ltd. (Northcliff).

The Project consists of a conventional open pit tungsten and molybdenum mine, an ore processing plant, and associated facilities and infrastructure located on provincial Crown land approximately 10 kilometres (km) southwest of the community of Napadogan, New Brunswick and approximately 60 km directly northwest of the city of Fredericton (see Figure 1.1 for a map of the Project area).

1.1 PURPOSE OF THIS TECHNICAL REPORT

The purpose of this Baseline Ambient Air Quality Technical Report is to describe the baseline conditions with respect to ambient air quality in Central New Brunswick generally, and in the vicinity of the Project specifically. The Atmospheric Environment has been identified as a valued environmental component (VEC) for the EIA of the Project due to its intrinsic importance to the health and well-being of humans, wildlife, vegetation, and other biota. Air quality is a key component of the Atmospheric Environment in this regard. Ambient air quality simply refers to air quality in its background condition. Thus, this Technical Report characterizes the existing ambient air quality in the area near the Sisson Project and provides background information for the EIA of the Project.

The available data from the existing provincial monitoring network were collected and reviewed. Previous data collected in support of the Sisson Project (*e.g.*, meteorological data and dustfall data (Rescan™ 2010)) were also reviewed. Very little ambient air quality monitoring had been done previously in the area near the Project. Following an identification of gaps in available ambient air quality information for the Project area, a work plan (Stantec 2011a) was developed to fill these data gaps and collect ambient air quality data representative of the Sisson Project site.

To supplement the available ambient air quality information, a baseline ambient air quality monitoring program was developed to collect ambient air quality data near the Project site. Based on the Project Description for the Sisson Project submitted to the Canadian Environmental Assessment Agency in April 2011 (Stantec 2011b) and knowledge of the Project that existed at that time, prior to the inception of the ambient air quality monitoring work, the air contaminants of potential concern likely to be released in substantive quantities during the operation of the Project were selected for baseline ambient air quality monitoring. An ambient air quality monitoring station was established at Napadogan to collect ambient air quality data for total suspended particulate (TSP), selected trace metals, particulate matter less than 2.5 microns (PM_{2.5}), sulphur dioxide (SO₂), and nitrogen dioxide (NO₂). Baseline ambient air quality monitoring was carried out at this location for a six-month period, between August 2011 and February 2012.

The recent trends, maximum concentrations and comparisons with provincial or national ambient air quality objectives were identified to further describe the baseline ambient air quality in New Brunswick, Central New Brunswick, and near the Project.

1.2 SPATIAL BOUNDARIES

The spatial boundaries for the characterization of the existing conditions for ambient air quality are based on the following terms.

The **Project Development Area (PDA)** is the most basic and immediate area of the Project. The PDA is limited to the area of physical disturbance associated with the construction and operation of the Project. For this Project, the PDA consists of an area of approximately 1,200 hectares (ha) that includes the area of physical disturbance associated with the open pit, processing facility, storage areas, and tailings storage facility (TSF). The PDA also includes access roads and a transmission line, the specific area of which will be determined and assessed in the EIA Report.

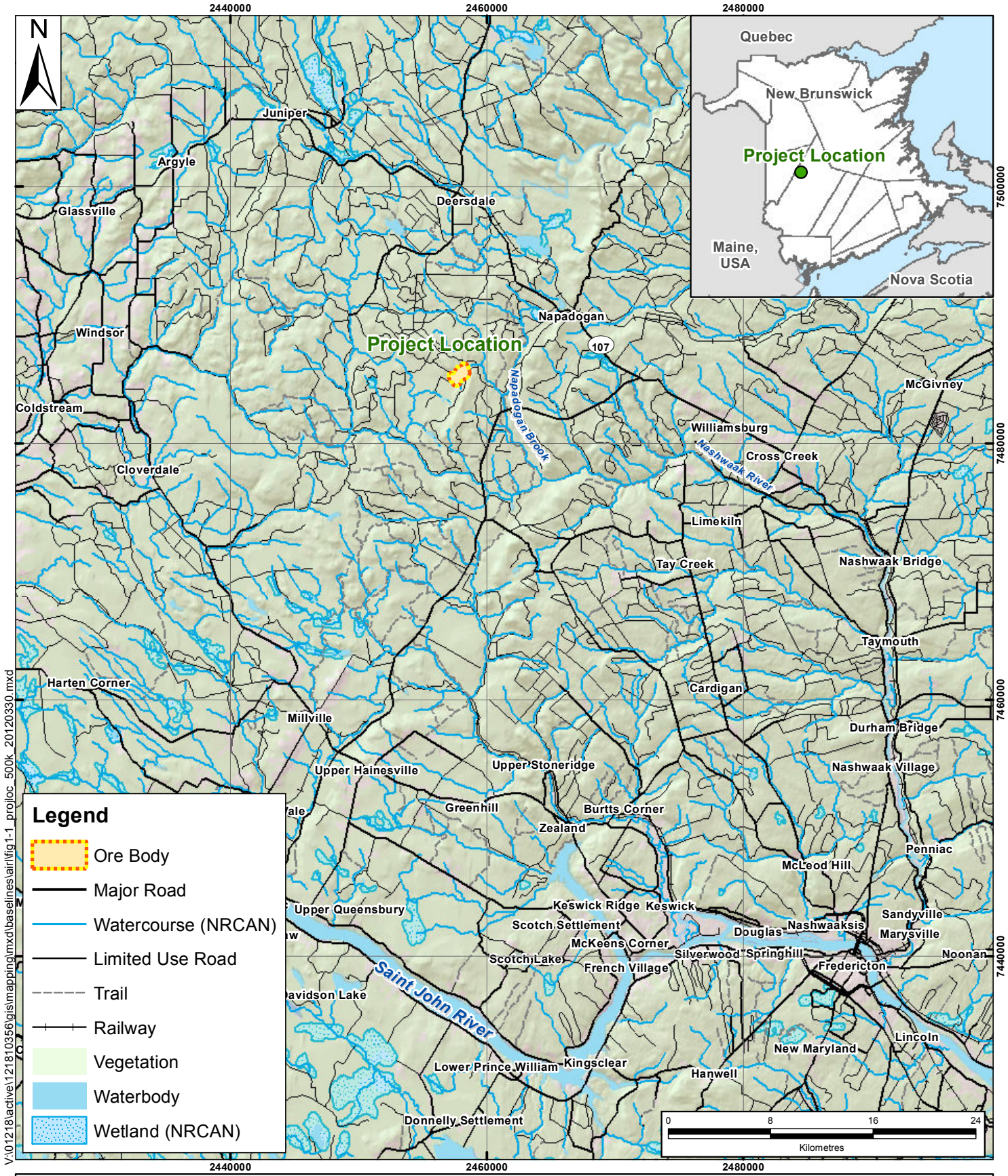
The **Study Area** for this Technical Report includes a 10 km by 10 km area centered on the PDA. It is selected to include the nearest residential receptors to the Project and so that, at its boundary, the Project-related air contaminant levels would be expected to be at or near the existing background concentrations. The Study Area corresponds to the Local Assessment Area (LAA) as defined in the Final Terms of Reference for the Sisson EIA (Stantec 2012).

1.3 ORGANIZATION OF THIS TECHNICAL REPORT

The remainder of this Technical Report is presented in four sections, as follows.


- Section 2.0 provides overview of the Atmospheric Environment in New Brunswick generally and in the Study Area specifically, including a summary of existing knowledge on climatology, meteorology, and ambient air quality from published literature, as well as an identification of data gaps.
- Section 3.0 describes the 2011-2012 ambient air quality monitoring program conducted for the Project, including the monitoring methodology, site selection, monitoring results, and quality assurance/quality control (QA/QC) procedures implemented to ensure the integrity of the monitoring results.
- Section 4.0 provides an overall summary of the report.
- Section 5.0 provides references consulted in the preparation of this report.

Supporting information for the report is provided in the appendices.



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NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC PROJECT AND SHOULD NOT BE USED FOR OTHER PURPOSES.

<p>Project Location Sisson Project: Baseline Ambient Air Quality Technical Report Napadogan, N.B.</p>		Scale:	Project No.:	Data Sources:	Fig. No.:	 <p>Stantec</p>
		1:400,000	121810356	SNB NRCAN, ESRI	1.1	
Client:	Northcliff Resources Ltd.	Date: (dd/mm/yyyy)	Dwn. By:	Appd. By:		
		30/03/2012	JAB	DLM		

2.0 OVERVIEW OF THE ATMOSPHERIC ENVIRONMENT IN THE STUDY AREA

2.1 NEW BRUNSWICK

2.1.1 Climatology

The Climate of New Brunswick can be generally characterized as continental in the central and northern regions of the province, with more of a moderated climate in the southern and eastern regions of the province due to influence from the Atlantic Ocean.

In the winter months, cold arctic air frequently flows across New Brunswick and most significant winter storms typically originate from the northeastern United States or the Gulf of Mexico. The winters are generally characterized as cold with significant snow falls. However, short mild spells often occur throughout the winter when the flow of arctic air from the north breaks down, often resulting in several freeze thaw cycles, which are more prevalent in southern areas.

In summer, the air mass is generally warm with occasions of hot, humid air from the Gulf of Mexico, specifically in areas away from the influence of the ocean. In coastal areas, moist air from the Atlantic Ocean can produce frequent mild spells in winter and cooler moderated weather in the summer (Environment Canada 2000).

Further, topography has a limited influence on the climate in New Brunswick, except for some localized effects in some locations due to areas of terrain relief or air flow along river valleys.

2.1.2 Ambient Air Quality

The New Brunswick Department of Environment and Local Government (NBDELG, formerly the New Brunswick Department of Environment (NBENV)), in cooperation with Environment Canada and a number of industrial partners, operates a network of ambient air quality monitoring stations in various regions of the province. The results of such monitoring are documented annually in the publication by the NBENV entitled “New Brunswick Air Quality Monitoring Results”, the most recent of which is available for the 2009 calendar year (NBENV 2011).

Ambient air quality in New Brunswick can generally be characterized as good most of the time, with few exceedances of the provincial ambient air quality objectives or Canada-wide Standards. Based on the most recently available data from the NBDELG, compliance with the ambient air quality objectives is greater than 98% for the contaminants measured at the monitoring sites in the provincial network in 2009 (NBENV 2011). Additionally, a gradual improvement in air quality has been observed in the province in recent years when compared to historical levels, with 2009 having the highest levels of compliance with the provincial objectives on record.

2.1.2.1 Ambient Air Quality Objectives, Standards and Criteria for Comparison with Measured Data

The measured concentrations of the air contaminants are compared with NBDELG Air Quality Objectives, the Canadian Council of Ministers the Environment (CCME) Canada-wide Standard for PM_{2.5}, and Ontario Ministry of the Environment (OMOE) 24-hour ambient air quality criteria, as applicable. The OMOE criteria were used for comparison with the measured concentrations where ambient air quality objectives or standards from the province of New Brunswick were not available.

The objectives, standards and criteria used for the results comparison are provided in Table 2.1.

Table 2.1 Summary of Ambient Air Quality Objectives, Standards and Criteria

Compound	Averaging Period	New Brunswick (NBDELG) Maximum Permissible Ground-Level Concentration of Contaminant (µg/m ³)*	Other Ambient Air Quality Standards or Criteria (µg/m ³)
Total Suspended Particulate Matter (TSP)	24-hour Annual	120 70 (geometric mean)	-- --
Particulate Matter Less than 2.5 microns (PM _{2.5})	24-hour	--	30 ¹
Sulphur Dioxide (SO ₂)	1-hour	900	--
	24-hour	300	--
	Annual	60	--
Nitrogen Oxides (NO _x) as Nitrogen Dioxide (NO ₂)	1-hour	400	--
	24-hour	200	--
	Annual	100	--
Antimony (Sb)	24-hour	--	25 ²
Arsenic (As)	24-hour	--	0.3 ²
Barium (Ba)	24-hour	--	10 ²
Beryllium (Be)	24-hour	--	0.01 ²
Cadmium (Cd)	24-hour	--	0.025 ²
Chromium (Cr)	24-hour	--	1.5 ²
Cobalt (Co)	24-hour	--	0.1 ²
Copper (Cu)	24-hour	--	50 ²
Lead (Pb)	24-hour	--	0.5 ²
Manganese (Mn)	24-hour	--	2.5 ²
Mercury (Hg)	24-hour	--	2 ²
Molybdenum (Mo)	24-hour	--	120 ²
Nickel (Ni)	24-hour	--	2 ²
Selenium (Se)	24-hour	--	10 ²
Vanadium (V)	24-hour	--	2 ²
Zinc (Zn)	24-hour	--	120 ²
Notes:			
-- No standard or objective available.			

Source: * Schedule B, New Brunswick *Air Quality Regulation* 97-133 under the *Clean Air Act*.

¹ CCME (2000), Canada-wide Standards for Particulate Matter (Based on 98th percentile of 3 year rolling average); and

² OMOE (2008), Ontario Ministry of Environment Ambient Air Quality Criteria.

2.2 CENTRAL NEW BRUNSWICK

2.2.1 Climate

The climate normals from 1971-2001 for the Fredericton Airport weather station are provided in Table 2.2 (Environment Canada 2012). The Fredericton Airport weather data are considered to be an accurate representation of average weather conditions in Central and Southwestern New Brunswick. A brief description of the climate normals for the Fredericton Airport as reported by Environment Canada (2012) is provided in the following text.

During the winter, the air mass is cold and unaltered with a January daily mean temperature of -9.8°C. In the summer, the air mass is predominantly warm continental with a July daily mean temperature of 19.3°C. The extreme maximum and minimum temperatures recorded are 37.2°C and -37.2°C, recorded during August and February, respectively.

The average annual precipitation is 1,143.3 mm, of which 77.5% is in the form of rain. Extremes in daily precipitation occur in August and September and are in the range of 124.0 mm to 148.6 mm.

The average annual wind speed reported at the Fredericton Airport weather station is approximately 12.4 km/h. The maximum wind speeds occur in March with average speeds of 14.6 km/h and the minimum speeds occur in August at an average of 10.0 km/h. The average monthly wind speeds are higher in the winter than in the summer. The prevailing winds are from the south or southwest in summer and from the west or northwest in winter. Maximum hourly wind speeds, averaged from 1971 to 2000 for each month, range from 48 km/h and 80 km/h, while maximum gusts for the same period range from 93 km/h to 132 km/h. Occurrences of extreme winds are uncommon at Fredericton, as over the last three decades there has been an average of 2.3 and 0.3 days per year with winds \geq 52 km/h and 63 km/h, respectively (Environment Canada 2012).

Meteorological stations operated by Environment Canada are also located not too far from the Project site (e.g., Juniper and the CFB Gagetown Airport).

A wind rose plot for the Fredericton airport is provided in Figure 2.1. The wind direction is reported as the direction from which the wind blows, and is measured at a height of 10 m above grade. The relative length of a particular wind vector indicates the frequency of winds occurring from that direction and the various colours used for each vector are indicative of the range of wind speeds.

Winds at the Fredericton Airport are frequently from the south, west, northwest and southwest directions. Winds from the north and northeast directions are also dominant. The most dominant direction occurs from the south. The highest wind speeds occur from the northwest and northeasterly directions, with the lowest wind speeds occurring most frequently from the south and southwesterly directions.

Table 2.2 Climate Normals – Fredericton Airport (1971-2001)

Station Location - Lat.: 45°52'N, Long.: 66°32'W, Elev.: 20.7 m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature													
Daily Mean (°C)	-9.8	-8.2	-2.4	4.3	11.1	16.2	19.3	18.4	13.1	7	1.1	-6.3	5.3
Daily Maximum (°C)	-4	-2.3	3	9.7	17.5	22.8	25.6	24.7	19.5	12.8	5.6	-1.1	11.2
Daily Minimum (°C)	-15.5	-14.1	-7.8	-1.1	4.7	9.6	13	12.1	6.7	1.2	-3.5	-11.4	-0.5
Extreme Daily Maximum (°C)	14.1	18.6	22.2	30.3	35.2	35.3	36.7	37.2	33.9	27.8	21.1	15.9	--
Date (yyyy/dd)	1983/11	1994/20	1962/30	1990/27	1977/23	2001/27	1952/15	1975/02	2001/09	1968/16	1956/01	2000/17	--
Extreme Daily Minimum (°C)	-35.6	-37.2	-28.9	-15.1	-6.7	-0.6	1.7	1.3	-3.9	-8.9	-20.2	-33.8	--
Date (yyyy/dd)	1971/19	1962/02	1982/01	1995/05	1951/18	1971/06	1962/03	1978/28	1971/27	1959/22	1996/30	1989/30	--
Precipitation													
Rainfall (mm)	46.2	32.2	48.1	64.1	94.2	88.6	87.1	89.8	94.5	96	85.5	59.4	885.5
Snowfall (cm)	70.2	50.6	54.4	22.5	1.5	0	0	0	0	1.5	18.5	57.3	276.5
Precipitation (mm)	109.6	79.2	102.7	87.4	95.9	88.6	87.1	89.8	94.5	97.7	103.2	107.8	1143.3
Extreme Daily Precipitation (mm)	70.7	51.8	58.8	58.7	83.8	69.9	69.1	148.6	124	60.2	81	81.3	--
Date (yyyy/dd)	2000/04	1970/04	1984/14	1954/17	1961/27	1954/27	1970/11	1989/05	1999/22	1976/09	1960/01	1967/04	--
Other													
Daytime Relative Humidity (%)	62.2	56.6	56.3	53.4	52	54.1	55.5	55.9	58	58.6	64.7	66.8	57.8
Mean Wind Speed (km/h)	12.7	13	14.6	14.3	13.6	12	10.8	10	10.9	11.8	12.4	12.6	12.4
Most Frequent Wind Direction	W	W	W	W	S	S	S	S	S	S	W	W	S
Extreme Wind Gust Speed (km/h)	119	121	105	100	97	132	105	93	105	117	116	103	--
Date (yyyy/dd)	1962/27	1976/02	1959/23	1977/03	1961/28	1971/30	1974/03	1991/02	1960/13	1963/29	1963/30	1968/05	--
Note: Bold denotes an all-time record.													

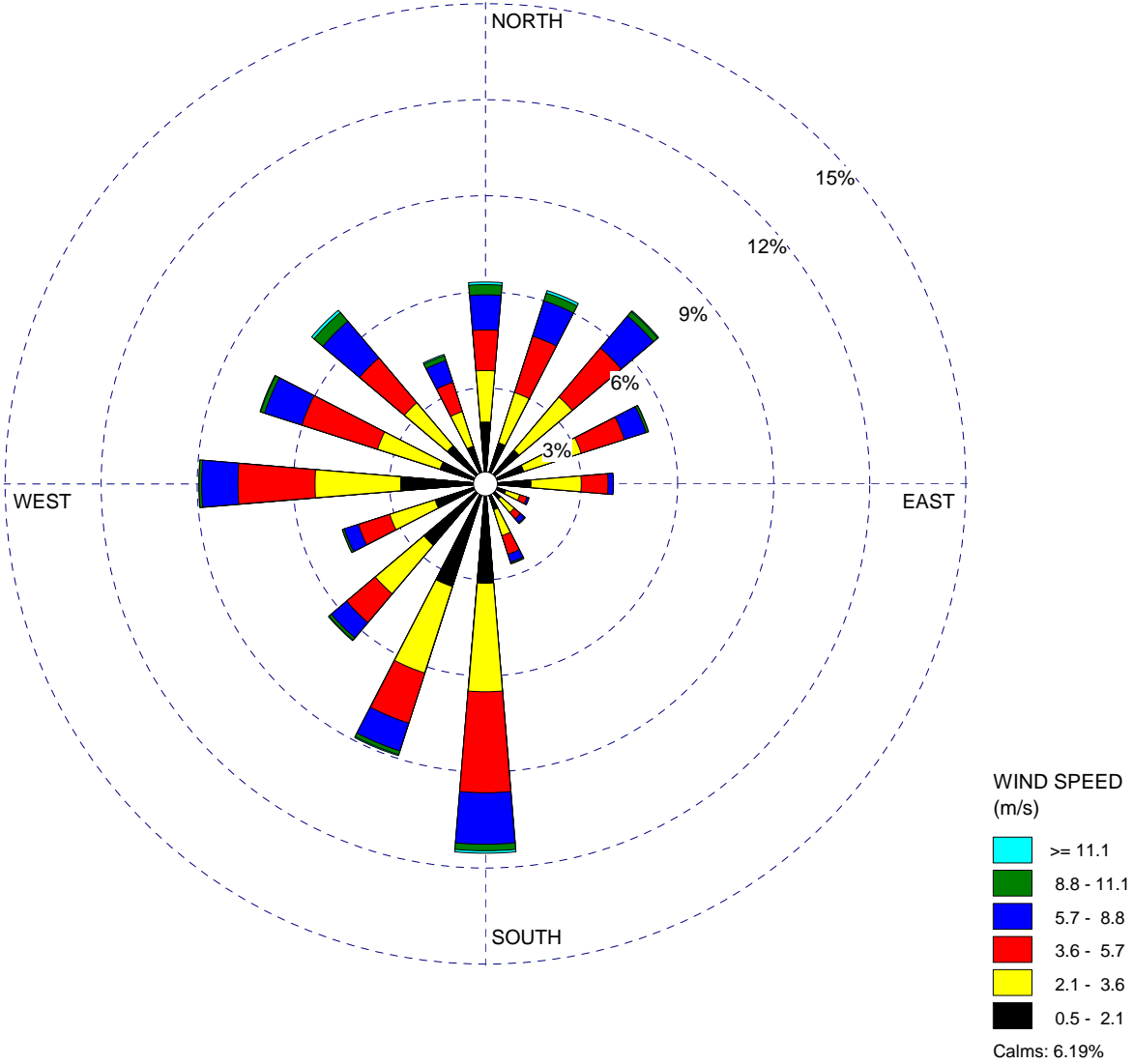
Source: Environment Canada Climate Normals 1971-2000 (Environment Canada 2012).

WIND ROSE PLOT:

Figure 2.1 - Winds at the Fredericton Airport: Jan 2007 - Mar 2012

DISPLAY:

**Wind Speed
Direction (blowing from)**



COMMENTS:

DATA PERIOD:

**2007 2008 2009 2010 2011
2012
Jan 1 - Dec 31
00:00 - 23:00**

COMPANY NAME:

MODELER:



Stantec

CALM WINDS:

6.19%

TOTAL COUNT:

44884 hrs.

AVG. WIND SPEED:

3.60 m/s

DATE:

3/29/2012

PROJECT NO.:

121810356

2.2.2 Ambient Air Quality

The available ambient air quality data from the existing provincial monitoring network were reviewed and analyzed. The analysis was conducted to help further describe the baseline ambient air quality in Central New Brunswick.

Data summaries from the annual air quality reports released by the NBDELG were used in the analysis (NBENV 2010; NBENV 2011). The data was acquired from the most recently available annual reports for 2008 and 2009. The most recent of these reports is entitled “New Brunswick Air Quality Monitoring Results: Report for 2009” (NBENV 2011). Data from the stations nearest to the Project were reviewed, specifically the ambient air quality monitoring stations at Fredericton and Nackawic. The monitoring results for TSP, PM_{2.5}, SO₂ and NO₂ concentrations were the focus of the data review. Recent trends, maximum concentrations and comparisons with provincial or national ambient air quality objectives were identified.

The highest observed 1-hour and 24-hour average air contaminant concentrations for each month of 2008 and 2009 at each monitoring station are presented in the tables below. The presentation of the highest observed monthly values is the format used in the NBDELG Air Quality reports. Percentile and annual average concentration data are also presented, where available.

2.2.2.1 Nackawic Monitoring Station

The Nackawic monitoring station is operated by AV Nackawic Inc. as a condition of its Approval to Operate issued under the New Brunswick Air Quality Regulation (GNB 1997). The station is located on Caverhill Road in Nackawic. TSP (also sometimes referred to as total particulate matter or PM) and SO₂ concentrations are measured at the Nackawic monitoring station.

The highest observed 24-hour average ground-level concentration of TSP by month for 2008 and 2009 (*i.e.*, the most recent years for which data are available), as measured by the NBDELG ambient air quality monitoring network at Nackawic, are provided in Table 2.3.

Table 2.3 Highest Observed 24-hour Average Ground-Level Concentrations of TSP by Month – Nackawic

Month	Highest Observed 24-hour Average Ground-Level Concentration of TSP during Month ($\mu\text{g}/\text{m}^3$)		NBDELG Maximum Permissible 24-hour Ground-Level Concentration of TSP ($\mu\text{g}/\text{m}^3$)
	2008	2009	
January	23	20	120
February	20	18	
March	15	15	
April	30	18	
May	28	25	
June	28	20	
July	32	25	
August	25	32	
September	23	20	
October	20	15	
November	15	22	
December	20	20	

Note: Values in **bold** indicate a measured concentration in excess of the applicable objective, standard, or criterion.

The highest observed 1-hour average ground-level concentration of SO₂ by month for 2008 and 2009, as measured by the NBDELG ambient air quality monitoring network at Nackawic, are provided in Table 2.4.

Table 2.4 Highest Observed 1-hour Average Ground-Level Concentrations of SO₂ by Month – Nackawic

Month	Highest Observed 1-hour Average Ground-Level Concentration of SO ₂ during Month (µg/m ³)		NBDELG Maximum Permissible 1-hour Ground-level Concentration of SO ₂ (µg/m ³)
	2008	2009	
January	71	77	900
February	98	42	
March	257	71	
April	48	24	
May	61	87	
June	143	124	
July	64	40	
August	34	24	
September	48	34	
October	71	50	
November	42	85	
December	77	64	

Note: Values in **bold** indicate a measured concentration in excess of the applicable objective, standard, or criterion.

2.2.2.2 Fredericton Monitoring Station

The Fredericton monitoring station is operated by NBDELG and is located on Aberdeen Street in downtown Fredericton. Ground-level concentrations of PM_{2.5}, NO₂, and ozone (O₃) are monitored at the Fredericton station. Ozone is not discussed here.

The highest observed 1-hour average ground-level concentration of NO₂ by month for 2008 and 2009, as measured by the NBDELG ambient air quality monitoring network at Fredericton, are provided in Table 2.5.

Table 2.5 Highest Observed 1-hour Average Ground-Level Concentrations of NO₂ by Month – Fredericton

Month	Highest Observed 1-hour Average Ground-Level Concentration of NO ₂ during Month (µg/m ³)		NBDELG Maximum Permissible 1-hour Ground-level Concentration of NO ₂ (µg/m ³)
	2008	2009	
January	90	66	400
February	77	68	
March	90	73	
April	85	64	
May	38	36	
June	23	81	
July	17	94	
August	30	24	
September	38	38	
October	38	51	
November	62	56	
December	51	53	

Note: Values in **bold** indicate a measured concentration in excess of the applicable objective, standard, or criterion.

The annual average NO₂ concentrations measured at the NBDELG operated Fredericton station for 2005 to 2009 are provided in Table 2.6.

Table 2.6 Annual Average NO₂ Concentrations – Fredericton

Year	Annual Average Ground-Level Concentration of NO ₂ (µg/m ³)	NBDELG Maximum Permissible Annual Average Ground-Level Concentration of NO ₂ (µg/m ³)
2005	4.0	100
2006	3.0	
2007	3.0	
2008	3.0	
2009	4.0	

Note: Values in **bold** indicate a measured concentration in excess of the applicable objective, standard, or criterion.

The 24-hour average PM_{2.5} 98th percentile concentrations for the period of 2005 to 2009 at the Fredericton monitoring station are provided in Table 2.7.

Table 2.7 24-hour Average PM_{2.5} 98th Percentiles – Fredericton

Year	24-hour Average 98 th Percentile Concentration of PM _{2.5} (µg/m ³)	Canada-wide Standard for PM _{2.5} (µg/m ³ , 98 th percentile, 3-year rolling average)
2005	16.0	-
2006	15.5	
2007	16.0	
2008	16.0	
2009	16.0	
3-year Rolling Average		
2005-2007	15.8	30
2006-2008	15.8	
2007-2009	16.0	

Note: Values in **bold** indicate a measured concentration in excess of the applicable objective, standard, or criterion.

2.2.2.3 Discussion

The measured air contaminant concentrations at both Fredericton and Nackawic were well below the applicable objectives and standards for 2008 and 2009. The concentrations of the contaminants measured at both sites were generally consistent from year to year and in some cases the concentrations have decreased from historical values. However, some elevated 1-hour and 24-hour maximum concentrations were still measured on occasion, though within regulatory standards.

It is important to note that these ambient monitoring stations are located in urban (Fredericton) and industrial (Nackawic) areas, respectively. Thus, the measured concentrations are likely to be higher at these two monitoring sites than at the Sisson Project site, due to the nearby sources of air contaminant emissions (e.g., vehicle traffic and large industrial sources) in these areas, compared to the Sisson Project site which is rural and for which influencing sources of emissions on air quality are not present. This is demonstrated when comparing NBDELG data with the baseline results from the Napadogan monitoring site, discussed in Section 3 below. Generally, the measured concentrations at the Napadogan site are much lower than the concentrations measured at Fredericton and Nackawic.

2.3 STUDY AREA

2.3.1 Meteorology

A meteorological station has been in operation at the Sisson Project site since 2007, the location of which is shown in Figure 2.2. The parameters measured at the Sisson meteorological station include temperature, pressure, relative humidity, wind speed and direction, precipitation, solar radiation and snow depth. Due to uncertainties in the quality of the wind data recorded at the Sisson station over the period of 2007 to the end of 2010, the wind data from spring 2011 to winter 2012 will be the focus of the discussion presented herein. Treatment of the other meteorological parameters over the 2007-2011 period is discussed in the Sisson Project 2011 Hydrometeorological Report (Knight Piésold 2012).

A wind rose plot for the Sisson meteorological station is provided in Figure 2.3. Again, the wind direction is reported as the direction from which the wind blows, and is measured at a height of 10 m above grade.

At the Sisson site, winds from the southwest direction are the most dominant. Winds also prevail from the northeast and northwest directions, although not as frequently. The highest wind speeds occur most frequently from the northeast and northwest directions, with the lowest wind speeds most frequently occurring from the southwest direction.

A direct comparison of data from the on-site meteorological station and the Fredericton Airport is not strictly applicable because of the high variability in wind speed and direction that can occur at different sites, as localized effects, such as terrain, can greatly influence surface winds. Further, the distance (approximately 60 km) between the sites can also result in variability in the wind speeds and direction.

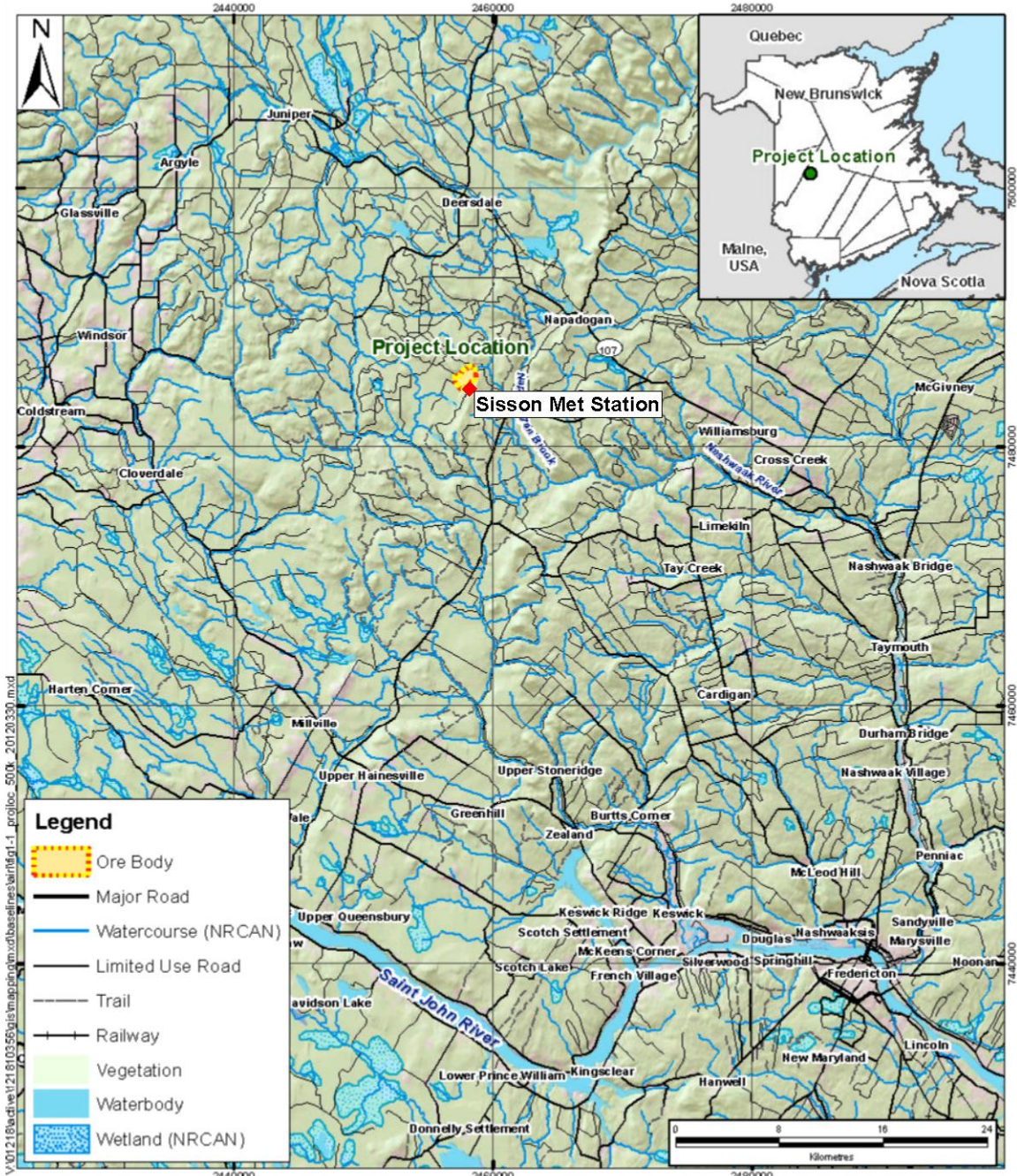
A summary of other meteorological data for the Sisson Project site is provided in Table 2.8. The data presented in Table 2.8 are from the Sisson Project 2011 Hydrometeorological Report (Knight Piésold 2012).

Table 2.8 Summary of Meteorological Data – Sisson Project Site

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Temperature* (°C)	-11.8	-10.3	-4.4	2.2	9.4	13.9	16.6	15.6	11.2	5.3	-0.3	-7.8	3.3
Maximum Temperature* (°C)	-8.4	-5.4	-1.2	5.4	12.1	16.4	20.0	17.3	14.9	7.9	5.3	-2.3	6.8
Minimum Temperature* (°C)	-16.6	-15.1	-7.3	-0.6	7.2	11.3	13.9	13.0	8.3	3.0	-3.6	-16.1	-0.2
Average Relative Humidity (%)#	82	82	67	71	71	78	79	81	80	81	78	86	78
Total Precipitation* (mm)	115	83	107	96	111	113	127	122	119	117	116	123	1,350
Notes:													
°C Degrees Celsius.													
mm Millimetres.													
* Estimated long-term values (Knight Piésold 2012).													
# Sisson climate station, 2007-2011 (Knight Piésold 2012).													

Figure 2.2

Location of the Sisson Project
Meteorological Station
Operated by Northcliff



Stantec

One Team. Infinite Solutions.

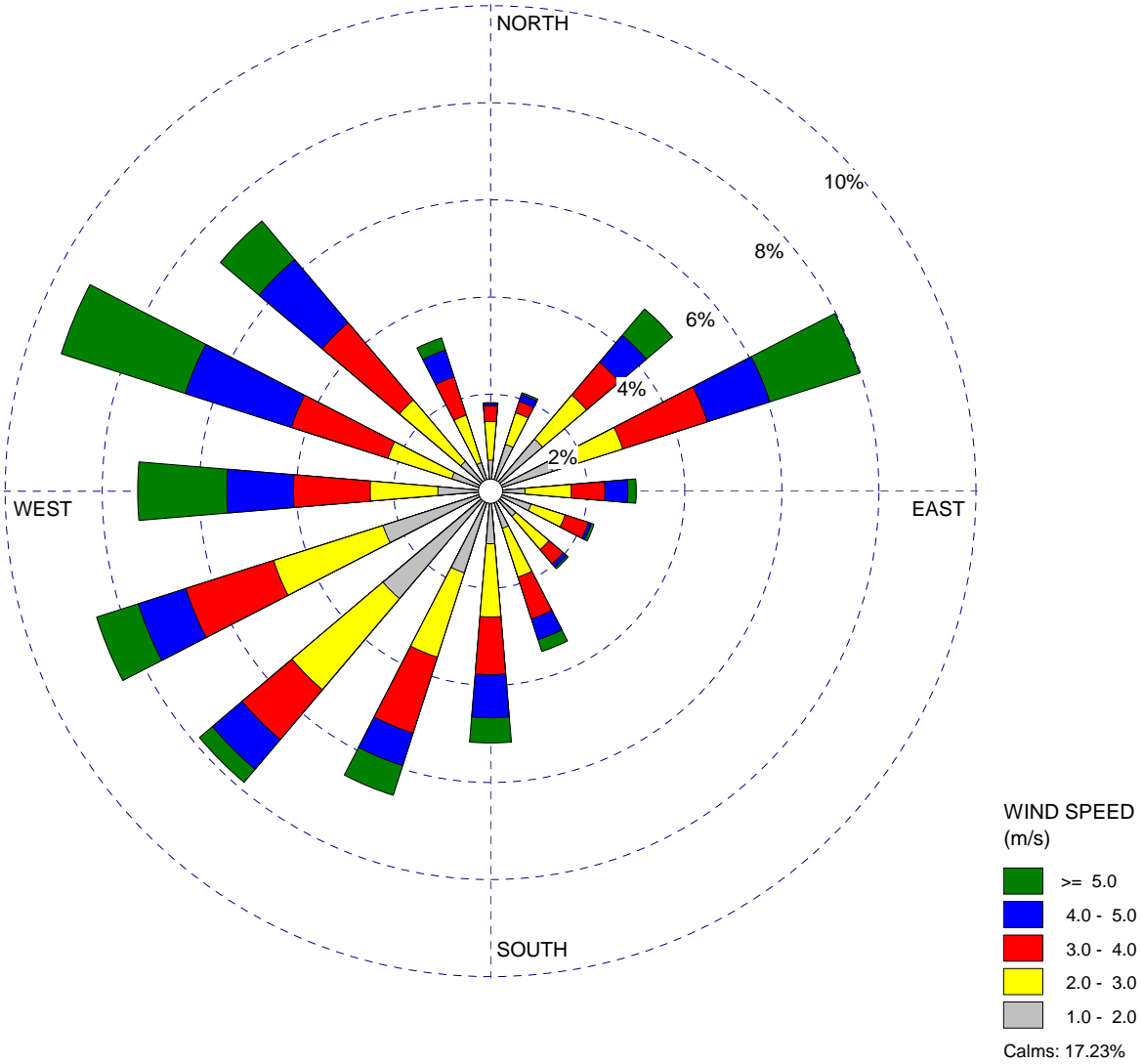
PROJECT 121810356

WIND ROSE PLOT:

Figure 2.3 - Winds at the Sisson Meteorological Station: 2011 - 2012

DISPLAY:

**Wind Speed
Direction (blowing from)**



COMMENTS:

DATA PERIOD:

**2011-2012
Jan 1 - Dec 31
00:00 - 23:00**

COMPANY NAME:

MODELER:



Stantec

CALM WINDS:

17.23%

TOTAL COUNT:

9706 hrs.

AVG. WIND SPEED:

2.66 m/s

DATE:

7/20/2012

PROJECT NO.:

121810356

2.3.2 Ambient Air Quality

In 2008 and 2009, Rescan™ carried out dustfall monitoring at various locations in and around the Sisson Project site to characterize ambient particulate matter deposition loadings. Rescan™ did not collect ambient TSP data through high volume sampling, data on combustion gases, or any other ambient air quality information.

The dustfall monitoring was conducted through 2008 and 2009 at five locations in and around the Sisson Project site, including one at the meteorological station. Total dustfall mass per unit area was determined. The dustfall samples were also analyzed for inorganic compounds such as sulphates and nitrates, and various trace metals, including lead, arsenic, and mercury (Rescan™ 2010). Dustfall and/or deposition sampling is not typically required by NBDELG, nor is there any provincial air quality standard available for dustfall for comparison with the monitoring results. As well, dustfall data is not particularly useful for establishing the baseline ambient air quality since the smaller particles that remain entrained in the ambient air are typically of more concern with respect to air quality. Thus, the dustfall data were not considered for this baseline air quality report.

No other ambient air quality data are known to be available for the Study Area.

2.4 IDENTIFIED GAPS IN DATA

Several gaps were identified in the existing baseline air quality data for the Study Area, based on the review conducted. As noted above, ambient air quality data from the provincial monitoring network and dustfall data (collected by Rescan™) were reviewed. Meteorological data from Environment Canada operated weather stations nearest to the Project site were also reviewed.

The data gaps identified are specifically related to ambient air quality data within the Study Area, with respect to air contaminants expected to be released in substantive quantities from the construction and operation of the Project. The data gaps identified are as follows:

- concentrations TSP in ambient air within the Study Area;
- concentrations of trace metals in the ambient air within the Study Area;
- concentrations of PM_{2.5} in the ambient air within the Study Area; and
- concentrations of combustion gases, specifically SO₂ and NO₂, in the ambient air within the Study Area.

Therefore, based on these identified gaps, Stantec developed a work plan to collect baseline ambient air quality monitoring data for the Project (Stantec 2011a).

3.0 2011-2012 AMBIENT AIR QUALITY MONITORING PROGRAM IN THE STUDY AREA

The monitoring program that was undertaken by Stantec on behalf of Northcliff to collect ambient air quality data in the Study Area is described in this section.

3.1 METHODOLOGY

The methodology employed in the development of the ambient air quality monitoring program in the Study Area is described below. The sampling methodologies used in the ambient air quality monitoring program are described in documents published by the United States Environmental Protection Agency (USEPA 1999a; 1999b; 1999c; 2012) and Environment Canada (Environment Canada 2004) and are accepted by regulatory agencies across Canada, including New Brunswick.

The NBENV was consulted prior to commencement of the sampling. The proposed location and methodologies were reviewed and discussed during a meeting between Stantec and the NBENV on July 13, 2011. The monitoring location in Napadogan and sampling methodologies were considered acceptable by the NBENV (Murray, D. Personal communication, July 13, 2011).

3.1.1 Site Selection

3.1.1.1 Site Selection Criteria

Siting of an ambient air quality monitoring station is generally based on Environment Canada (Environment Canada 2004) and Canadian Council of Ministers of the Environment (CCME 2011) site selection guidelines. It is generally specified in the guidelines that the site selection should consider the following:

- the monitoring station(s) should be located in residential or commercial locales where outdoor activities typically exist, to represent the ground-level concentrations of contaminants to which that people might normally be exposed;
- they should be generally located in open flat area(s) and away from nearby buildings, trees and vegetation and/or other obstructions; and
- appropriate distances should be maintained between the monitoring station and heavy industrial activity, major arterial traffic routes, and other major primary particulate or combustion gas emission sources.

These guidelines were considered in the selection of the monitoring site for the Sisson Project, and every effort was made to follow the guidelines.

3.1.1.2 Description of Monitoring Station and Location

The ambient air quality monitoring location selected for the Sisson Project was at a residence located at 29 Second Street in Napadogan, NB. The coordinates of the monitoring site are 46.41°N and 66.93°W, and the approximate geographic location is shown in Figure 3.1.

Napadogan was selected as the location for the baseline ambient air quality monitoring since it is the nearest residential area to the Project (approximately 10 km northeast of the proposed Project site).

The Napadogan site is located in the nearest residential area to the Project in a cleared, flat area, primarily free of obstructions in the immediate vicinity of the site. However, since the community of Napadogan is small geographically, the monitoring site was located in somewhat close proximity to air contaminant emissions sources (such as vehicle traffic on Route 107 and the Napadogan sawmill). It is also important to note that the Napadogan site is generally downwind of the Project site for the most dominant wind directions.

Stantec personnel set up the ambient monitoring equipment in Napadogan on August 12, 2011. Through discussion with NBENV, and given the rural and undeveloped nature of the Study Area, it was determined that a single ambient air quality monitoring station would be sufficient to characterize baseline conditions for ambient air quality in the Study Area, and that this monitoring station would consist of the following:

- monitoring for total suspended particulate (TSP) using a high-volume (hi-vol) sampler for a 24-hour period per week, with subsequent laboratory analysis of the collected particulate matter for trace metals contents;
- monitoring of particulate matter less than 2.5 microns (PM_{2.5}) using a hi-vol sampler equipped with PM_{2.5} sample inlet for a 24-hour period once per week; and
- passive sampling of sulphur dioxide (SO₂) and nitrogen dioxide (NO₂) concentrations using all-season passive samplers to collect a time-integrated SO₂ and NO₂ concentration over a 7-day period.

The hi-vol samplers and passive samplers were located in two areas cleared of vegetation on either side of the driveway between the residence at 29 Second Street and Route 107. Photos of the monitoring site are provided in Figures 3.2 and 3.3, with additional photos taken during the site visits provided in Appendix B. The monitoring location was directly across Route 107 from the Napadogan sawmill, approximately 150 m to the southwest of the sawmill and 20 m southwest of Route 107. Though guidance would generally suggest that monitoring stations should be located away from potential influencing sources of emissions such as industrial sources, the very sparse population of the area and the specific needs for monitoring (e.g., availability of electrical power, site security), the siting of the monitoring station of this location was considered to be the best possible location.

The ambient air quality monitoring was carried out over a six month period from August 12, 2011 to February 22, 2012. This period was selected for the monitoring in order to cover a portion of the summer, fall, and winter months. During the sampling period, Stantec personnel conducted weekly visits to the ambient monitoring site to collect the samples and check the equipment. During the visits, anecdotal observations for odour and activities happening near the monitoring site were noted and documented on field sheets.

Stantec personnel dismantled and recovered the ambient monitoring equipment from the monitoring site in Napadogan during the final visit on February 22, 2012.

3.1.2 Monitoring Methods

3.1.2.1 Particulate Matter

Monitoring was conducted following the sampling protocols outlined in Environment Canada's "National Air Pollution Surveillance Network Quality Assurance and Quality Control Guidelines", (Environment Canada 2004). The particulate matter samples (including trace metals and PM_{2.5}) were collected on a weekly basis, rather than every six days (as per the National Air Pollution Surveillance (NAPS) network schedule), to coincide with the weekly collection of the passive samples of combustion gases and allow for efficient trips to the site by Stantec personnel (Stantec 2011c; 2011d).

Figure 3.1

Ambient Air Quality Monitoring Location

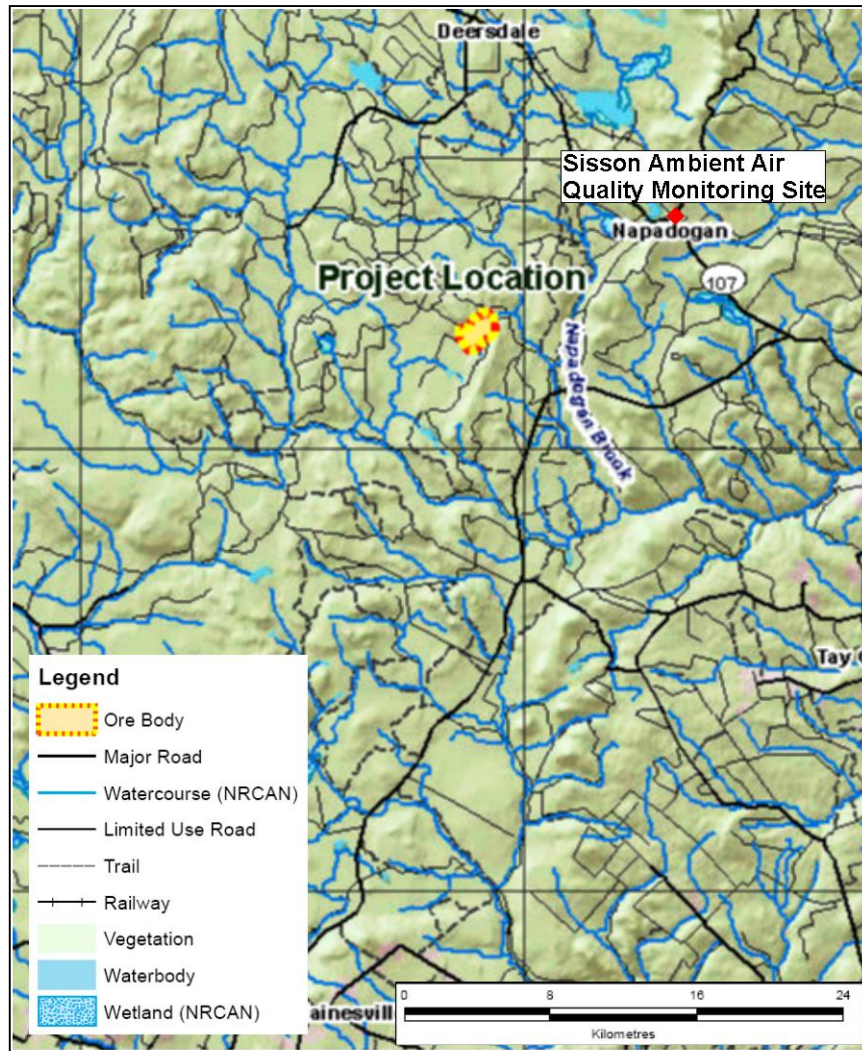




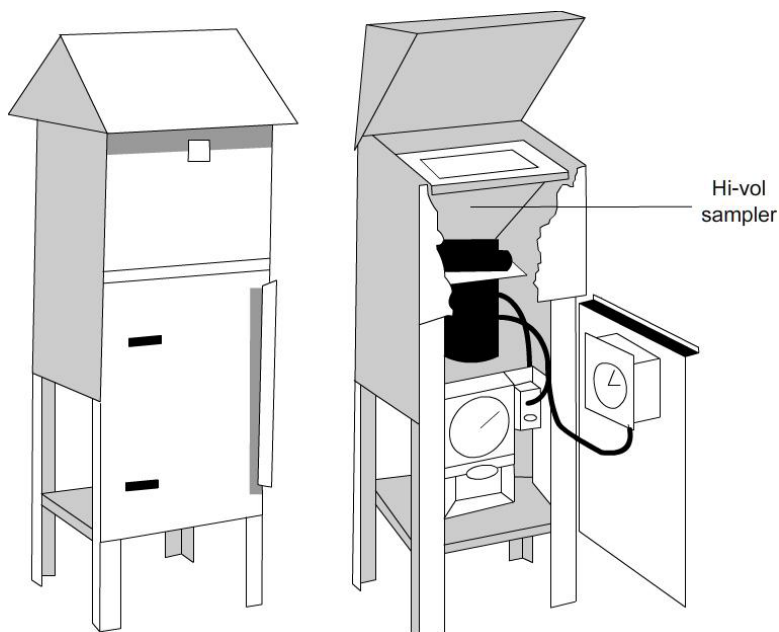
Figure 3.2 Hi-Vol Samplers Monitoring Location – 29 Second Street, Napadogan, NB



Figure 3.3 Passive Samplers Monitoring Location – 29 Second Street, Napadogan, NB

3.1.2.1.1 Total Suspended Particulate (TSP)

The ambient concentrations of TSP in ambient air were measured according to the USEPA Method IO-2 (USEPA 1999a), using a high-volume (hi-vol) sampler (Figure 3.4). The total suspended particulate matter samples were collected on pre-weighed quartz filters installed on the hi-vol. A pump was used to draw ambient air through the instrument over a continuous 24-hour period, and any suspended particulate matter in the ambient air was collected on the filter. The samples were collected over one 24-hour period per week, after which the volume of air drawn was recorded. The filters were then manually recovered and sent to the lab to be post-weighed. The concentration of TSP was then calculated from the mass of the material collected on the filter and the total volume of air through the sampler during the period. The laboratory analysis was performed by Maxxam Analytics according to USEPA Method IO-3.1 (USEPA 1999b) "Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air – Selection, Preparation and Extraction of Filter Material".



Source: USEPA (2012).

Figure 3.4 TSP Hi-Vol Sampler

3.1.2.1.2 Trace Metals in TSP

The material captured on the filter for the TSP samples was also analyzed by Maxxam Analytics for specific metals using Inductively Coupled Plasma/Mass Spectrometry (ICP/MS) according to USEPA Method IO-3.5, "Determination of Metals in Ambient Particulate Matter Using Inductively Coupled Plasma/Mass Spectrometry (ICP/MS)" (USEPA 1999c). Trace metals concentrations were calculated by dividing the mass of a specific trace metal collected by the total volume of air sampled.

The specific trace metals analyzed in the particulate samples were as follows.

- Aluminum (Al);
- Chromium (Cr);
- Nickel (Ni);
- Thallium (Tl);
- Antimony (Sb);
- Cobalt (Co);
- Phosphorus (P);
- Tin (Sn);
- Arsenic (As);
- Copper (Cu);
- Potassium (K);
- Titanium (Ti);
- Barium (Ba);
- Iron (Fe);
- Selenium (Se);
- Tungsten (W);
- Beryllium (Be);
- Lead (Pb);
- Silicon (Si);
- Uranium (U);
- Bismuth (Bi);
- Magnesium (Mg);
- Silver (Ag);
- Vanadium (V);
- Boron (B);
- Manganese (Mn);
- Sodium (Na);
- Zinc (Zn);
- Cadmium (Cd);
- Total Mercury (Hg);
- Strontium (Sr);
- Zirconium (Zr);
- Calcium (Ca);
- Molybdenum (Mo);
- Sulphur (S).

3.1.2.1.3 Particulate Matter Less Than 2.5 Microns

Ambient concentrations of particulate matter with particles having a diameter of 2.5 microns (μm) or less ($\text{PM}_{2.5}$) were also measured using a hi-vol sampler (Figure 3.5). This sampler was similar to that used for TSP, but with a selective size inlet to separate and measure the 2.5 μm fraction. Ambient air entered the hi-vol sampler through an opening in the weather proof hood. The air flowed into a stilling chamber and through a screen that was designed to prevent the entry of insects and large sized airborne debris. An oil-wetted collection surface, which trapped particles larger than 2.5 microns in diameter, was employed to remove the larger particles in the air sample. The $\text{PM}_{2.5}$ particles present in the ambient air that was drawn through the sampler were collected on a pre-weighed quartz filter. The samples were collected over one 24-hour period per week, after which the filters were recovered and sent to the lab to be post-weighed to determine the mass of $\text{PM}_{2.5}$ collected. The total volume of ambient air passing through the filter over the 24-hour period was measured and recorded. The $\text{PM}_{2.5}$ concentration was then calculated from the mass of the material collected on the filter and the total volume of air through the sampler during the period. The laboratory analysis was performed by Maxxam Analytics according to USEPA Method IO-3.1 (USEPA 1999b), "Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air – Selection, Preparation and Extraction of Filter Material".



Source: Tisch Environmental (2007).

Figure 3.5 PM_{2.5} Hi-Vol Selective Size Inlet Sampling Head

3.1.2.2 Combustion Gases (Sulphur Dioxide and Nitrogen Dioxide)

The ambient concentrations of sulphur dioxide (SO₂) and nitrogen dioxide (NO₂) were measured using all-season passive samplers (Figure 3.6) according to Maxxam Analytics reference methods for passive sampling (Maxxam 2011a and 2011b). Each passive sample was collected over a seven-day period, where the media in the sampling device passively absorbs SO₂ and NO₂ present in the ambient air. At the end of each weekly sampling period, the passive samplers were recovered and sent to the lab to determine the SO₂ and NO₂ concentrations (time-integrated concentrations over a seven-day period). Meteorological data were also needed to calculate the concentrations. Data for average temperature, relative humidity and wind speed for each weekly sampling period were obtained from the Sisson meteorological station and the Environment Canada meteorological station located at the CFB Gagetown Airport. The data were provided to the lab for the analyses. It is noted that meteorological data was obtained from the Gagetown Airport since recent hourly data from the Fredericton Airport station was not available from the Environment Canada website. The Gagetown Airport station is located at CFB Gagetown, approximately 5 km to the east of the Fredericton Airport station.



Figure 3.6 **Passive Sampler**

3.1.3 **Laboratory Analysis**

The laboratory analyses were performed by an independent analytical laboratory, Maxxam Analytics Inc. in accordance with the methods described in previous sections. The gravimetric and trace metals analyses were carried out by the Maxxam Analytics laboratory in Mississauga, Ontario. The SO₂ and NO₂ passive sample analyses were carried out by the Maxxam Analytics laboratory in Edmonton, Alberta.

Maxxam Analytics is accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL) to the standards of the Standards Council of Canada (SCC).

3.1.4 **Quality Assurance and Quality Control**

The quality assurance and quality control procedures that were implemented to ensure the integrity of the monitoring data are described below.

3.1.4.1 **Calibrations**

Calibrations of the equipment used in the baseline ambient air quality monitoring program were conducted in accordance with accepted protocols and manufacturer specifications. Both the hi-vol samplers for TSP and PM_{2.5} were calibrated on three occasions during the sampling program: when first installed; after the first three months of operation; and at the end of the sampling program.

The calibrations were carried out using a variable resistance calibration kit provided with the samplers from the manufacturer. The variable resistance calibration kit allows for the simulation of various filter loading conditions. The hi-vol samplers control the air flow using electronic mass flow controllers in conjunction with a continuous flow recorder. To calibrate the hi-vol samplers, the variable orifice is positioned over the filter plate using a mounting bracket. A manometer measuring pressure differences across the orifice is connected to the pressure tap on the side of the variable orifice on one side, and open to the atmosphere on the other. With the hi-vol sampler operating, the orifice is adjusted to produce five different flow readings on the continuous flow recorder. The five manometer readings, along with their corresponding flow from the continuous recorder, are entered into a sampler calibration data sheet supplied by the manufacturer.

The orifice manometer readings are converted into the actual air flow they represent for each of the five points and are corrected to the meteorological conditions present during calibration. This corrected flow recorder reading is used with the manometer reading to calculate a correlation coefficient using the least squares regression method to confirm a linear relationship. This linear plot verifies that the air flow being recorded by continuous flow recorder on the hi-vol sampler is consistent with the actual flow measured by the change in pressure on the monometer. Further information on the calibration procedures and results thereof can be provided upon request to Stantec.

3.1.4.2 Data Management and Processing

3.1.4.2.1 High-Volume Sampler Data (TSP, PM_{2.5}, and Trace Metals)

Elapsed time, continuous flow recorder charts, and meteorological conditions for each sampling event were recorded and stored. All samples were submitted to Maxxam Analytics (Mississauga, Ontario) for gravimetric analysis (for both TSP and PM_{2.5}) and trace metals analysis (for TSP samples only). The results were received as spreadsheet and .pdf files directly from the laboratory. Rigorous chain of custody protocols and associated documentation were implemented throughout the sampling program to ensure quality data. Results (including detection limits) were saved in spreadsheet format for subsequent data processing.

Elapsed time, continuous flow values, meteorological information, and calibration data are used to convert the collected weight of particulate during each sampling event (as provided by the laboratory through gravimetric analysis of the filter media) to actual ground-level concentrations over a 24-hour period (as reported in micrograms of particulate matter per cubic metre of air, or $\mu\text{g}/\text{m}^3$) corrected to the actual volume of air sampled per event. The data are stored as monthly spreadsheet files.

3.1.4.2.2 Passive Sampler Data (SO₂ and NO₂)

The elapsed time and meteorological conditions for each weekly sampling event were logged and stored. The passive samples were submitted to Maxxam Analytics (Edmonton, Alberta) for analysis using the appropriate chain of custody form and subsequent results were received as .pdf files directly from the laboratory. Results (including detection limits and method blanks) were saved in spreadsheet format for subsequent data processing.

Laboratory reports include actual ground-level concentrations over a seven-day period (as $\mu\text{g}/\text{m}^3$) for individual parameters. The data are stored as monthly spreadsheet files.

3.1.4.2.3 Sample Handling Procedures

The hi-vol filters and passive samples were submitted to Maxxam Analytics every four weeks throughout the monitoring period. The samples were submitted for analysis using the appropriate chain of custody forms from each Maxxam lab. The particulate matter filters were sent to Maxxam Analytics in Mississauga, Ontario and the passive SO₂/NO₂ samples were sent to Maxxam Analytics in Edmonton, Alberta. The passive samples were kept refrigerated/on ice prior to receipt at the lab. Sample handling and chain-of-custody procedures were strictly adhered to throughout the monitoring program.

3.1.4.3 Quality Control of Sampling Results

The integrated results for samples collected from the passive and high-volume monitoring are received by e-mail from Maxxam Analytics. The results are transmitted in the format of spreadsheet file tables and .pdf reports. These laboratory spreadsheets are filed in monthly folders for later use. In preparation for the reports, the laboratory spreadsheets are reformatted and edited into a template spreadsheet for the raw report tables. Report tables are created from the raw report table spreadsheet.

3.2 RESULTS

3.2.1 Baseline Ambient Air Quality Monitoring

The results of the baseline ambient air quality monitoring at Napadogan are presented in this section.

3.2.1.1 Total Suspended Particulate

The TSP concentrations measured at Napadogan are presented in Table 3.1.

Table 3.1 Measured 24-Hour Average Ground-Level Concentrations of TSP

Sample ID	Collection Date	24-hour Average Ground-Level Concentration of TSP ($\mu\text{g}/\text{m}^3$)	NBDELG Maximum Permissible Ground-level Concentration ($\mu\text{g}/\text{m}^3$)
TSP-1	August 15, 2011	25.0	120
TSP-2	August 21, 2011	35.3	
TSP-3	August 28, 2011	18.5	
TSP-4	September 4, 2011	28.4	
TSP-5	September 11, 2011	12.8	
TSP-6	September 18, 2011	11.1	
TSP-7	September 25, 2011	16.5	
TSP-8	October 2, 2011	9.2	
TSP-9	October 9, 2011	20.5	
TSP-10	October 16, 2011	7.6	
TSP-11	October 23, 2011	8.0	
TSP-12	October 30, 2011	3.8	
TSP-13	November 6, 2011	6.0	
TSP-14	November 13, 2011	10.4	
TSP-15	November 20, 2011	9.0	
TSP-16	November 29, 2011	5.5	
TSP-17	December 6, 2011	6.3	
TSP-18	December 13, 2011	7.6	

Table 3.1 Measured 24-Hour Average Ground-Level Concentrations of TSP

Sample ID	Collection Date	24-hour Average Ground-Level Concentration of TSP ($\mu\text{g}/\text{m}^3$)	NBDELG Maximum Permissible Ground-level Concentration ($\mu\text{g}/\text{m}^3$)
TSP-19	December 20, 2011	8.7	
TSP-20	January 10, 2012	3.8	
TSP-21	January 17, 2012	8.8	
TSP-22	January 24, 2012	3.7	
TSP-23	January 31, 2012	8.8	
TSP-24	February 7, 2012	4.4	
TSP-25	February 14, 2012	6.2	
TSP-26	February 21, 2012	7.1	
Notes:			
Values in bold indicate a measured concentration in excess of the applicable objective, standard, or criterion.			
< not detected in sample, detection limit reported.			

The percentile values for TSP at Napadogan are provided in Table 3.2.

Table 3.2 Percentile Values – 24-Hour TSP Concentrations

Value	24-Hour Average Ground-Level Concentration of TSP ($\mu\text{g}/\text{m}^3$)	NBDELG Maximum Permissible Ground-level Concentration ($\mu\text{g}/\text{m}^3$)
Maximum	35.3	120
99 th Percentile	33.5	
98 th Percentile	31.8	
95 th Percentile	27.5	
90 th Percentile	22.8	
Median	8.7	
Average	11.3	
Minimum	3.7	
Standard Deviation	8.1	

The highest observed TSP ground-level concentrations measured at Napadogan during each of the months during which monitoring was conducted are presented in Table 3.3. These highest observed monthly values are presented for comparison purposes with the NBDELG monthly maximum data presented above (Section 2.2).

Table 3.3 Highest Observed 24-hour Average Ground-Level Concentrations by Month – TSP

Month	Highest Observed 24-hour Average Ground-level Concentration of TSP during Month ($\mu\text{g}/\text{m}^3$)	NBDELG Maximum Permissible Ground-level Concentration ($\mu\text{g}/\text{m}^3$)
August 2011	35.3	120
September 2011	28.4	
October 2011	20.5	
November 2011	10.4	
December 2011	8.7	
January 2012	8.8	
February 2012	7.1	
Note: Values in bold indicate a measured concentration in excess of the applicable objective, standard, or criterion.		

3.2.1.2 Trace Metals

The highest observed ground-level concentrations of trace metals during the monitoring period at Napadogan are provided in Table 3.4.

Table 3.4 Highest Observed 24-hour Average Ground-Level Concentrations during Monitoring Period– Trace Metals in TSP

Metal	Highest Observed 24-hour Average Ground-level Concentration of Selected Trace Metal during Period of Aug 2011 - Feb 2012 ($\mu\text{g}/\text{m}^3$)	Ontario Ministry of Environment (OMOE) Ambient Air Quality Criteria ($\mu\text{g}/\text{m}^3$)
Aluminum (Al)	0.34	-
Antimony (Sb)	4.2E-03	25
Arsenic (As)	2.5E-03	0.3
Barium (Ba)	3.4E-03	10
Beryllium (Be)	4.2E-04	0.01
Bismuth (Bi)	2.5E-03	-
Boron (B)	2.5E-03	-
Cadmium (Cd)	8.3E-04	0.025
Calcium (Ca)	0.12	-
Chromium (Cr)	1.2E-03	1.5
Cobalt (Co)	8.3E-04	0.1
Copper (Cu)	0.28	50
Iron (Fe)	0.63	-
Lead (Pb)	4.2E-03	0.5
Magnesium (Mg)	0.16	-
Manganese (Mn)	0.02	2.5
Total Mercury (Hg)	9.2E-06	2
Molybdenum (Mo)	1.3E-03	120
Nickel (Ni)	1.7E-03	2
Phosphorus (P)	0.06	-
Potassium (K)	0.16	-
Selenium (Se)	4.2E-03	10
Silicon (Si)	0.10	-
Silver (Ag)	8.3E-04	-
Sodium (Na)	0.35	-
Strontium (Sr)	6.2E-04	-
Sulphur (S)	1.36	-
Thallium (Tl)	4.2E-03	-
Tin (Sn)	4.2E-03	-
Titanium (Ti)	0.02	-
Tungsten (W)	<1.5E-03	-
Uranium (U)	0.03	-
Vanadium (V)	1.6E-03	2
Zinc (Zn)	0.06	120
Zirconium (Zr)	6.7E-04	-

Notes:
Values in **bold** indicate a measured concentration in excess of the applicable objective, standard, or criterion.
< not detected in sample, detection limit reported.

3.2.1.3 Particulate Matter Less than 2.5 Microns

The PM_{2.5} concentrations measured at Napadogan are provided in Table 3.5.

Table 3.5 Measured 24-Hour Average Ground-Level Concentrations of PM_{2.5}

Sample ID	Collection Date	24-hour Average Ground-Level Concentration of PM _{2.5} (µg/m ³)	CCME Canada-wide Standard (µg/m ³ , 98 th percentile, 3-year rolling average)
PM _{2.5} -1	August 13, 2011	<1.9	
PM _{2.5} -2	August 19, 2011	NA*	
PM _{2.5} -3	August 26, 2011	6.8	
PM _{2.5} -4	September 4, 2011	8.1	
PM _{2.5} -5	September 9, 2011	7.9	
PM _{2.5} -6	September 16, 2011	2.1	
PM _{2.5} -7	September 23, 2011	5.0	
PM _{2.5} -8	September 30, 2011	2.9	
PM _{2.5} -9	October 7, 2011	2.8	
PM _{2.5} -10	October 14, 2011	<2.0	
PM _{2.5} -11	October 21, 2011	3.9	
PM _{2.5} -12	October 28, 2011	2.7	
PM _{2.5} -13	November 4, 2011	4.3	
PM _{2.5} -14	November 11, 2011	<1.9	
PM _{2.5} -15	November 18, 2011	1.8	
PM _{2.5} -16	November 27, 2011	3.7	
PM _{2.5} -17	December 4, 2011	4.2	
PM _{2.5} -18	December 8, 2011	3.2	
PM _{2.5} -19	December 18, 2011	2.3	
PM _{2.5} -20	January 8, 2012	3.0	
PM _{2.5} -21	January 15, 2012	1.5	
PM _{2.5} -22	January 22, 2012	2.7	
PM _{2.5} -23	January 29, 2012	3.0	
PM _{2.5} -24	February 5, 2012	5.1	
PM _{2.5} -25	February 12, 2012	2.6	
PM _{2.5} -26	February 19, 2012	2.9	

30

Notes:
 Values in **bold** indicate a measured concentration in excess of the applicable objective, standard, or criterion.
 < not detected in sample, detection limit reported.
 NA* filter damaged, results not available.

The percentile values for PM_{2.5} at Napadogan are provided in Table 3.6.

Table 3.6 Percentile Values – 24-Hour PM_{2.5} Average Ground-Level Concentrations

Value	24-Hour Average Ground-Level Concentration of PM _{2.5} (µg/m ³)	CCME Canada-wide Standard (µg/m ³ , 98 th percentile, 3-year rolling average)
Maximum	8.1	30
99 th Percentile	8.1	
98 th Percentile	8.0	
95 th Percentile	7.7	
90 th Percentile	6.1	
Median	2.9	
Average	3.5	
Minimum	1.5	
Standard Deviation	1.8	

The highest observed 24-hour ground-level concentrations of PM_{2.5} by month as measured at Napadogan are provided in Table 3.7.

Table 3.7 Highest Observed 24-hour Average Ground-Level Concentrations by Month – PM_{2.5}

Month	Highest Observed 24-hour Average Ground-level Concentration of PM _{2.5} during Month (µg/m ³)	CCME Canada-wide Standard (µg/m ³)
August 2011	6.8	30
September 2011	8.1	
October 2011	3.9	
November 2011	4.3	
December 2011	4.2	
January 2012	3.8	
February 2012	5.1	
Note: Values in bold indicate a measured concentration in excess of the applicable objective, standard, or criterion.		

3.2.1.4 Combustion Gases

The SO₂ and NO₂ weekly concentrations measured at Napadogan are presented in Table 3.8. Although no ambient objectives exist for weekly average concentrations of SO₂ and NO₂, the NBDELG Maximum Permissible Annual Average Ground-level concentrations are provided in Table 3.8 to serve as a conservative comparison with the measured concentrations.

Table 3.8 Weekly Average Ground-Level Concentrations – SO₂ and NO₂

Sample ID	Collection Period		Weekly Average Sulphur Dioxide Ground-Level Concentration (µg/m ³)	NBDELG Maximum Permissible Sulphur Dioxide Annual Average Ground-Level Concentration (µg/m ³)	Weekly Average Nitrogen Dioxide Ground-Level Concentration (µg/m ³)	NBDELG Maximum Permissible Nitrogen Dioxide Annual Average Ground-Level Concentration (µg/m ³)
	Start Date	Finish Date				
SO ₂ /NO ₂ -1	August 12, 2011	August 18, 2011	<1.0	60	1.5	100
SO ₂ /NO ₂ -2	August 18, 2011	August 25, 2011	<1.0		<0.8	
SO ₂ /NO ₂ -3	August 25, 2011	September 1, 2011	<1.0		0.8	
SO ₂ /NO ₂ -4	September 1, 2011	September 7, 2011	<1.0		0.9	
SO ₂ /NO ₂ -5	September 7, 2011	September 13, 2011	<1.3		<0.9	
SO ₂ /NO ₂ -6	September 13, 2011	September 22, 2011	0.8		<0.6	
SO ₂ /NO ₂ -7	September 22, 2011	September 29, 2011	<1.0		<0.8	
SO ₂ /NO ₂ -8	September 29, 2011	October 6, 2011	<1.0		<0.8	
SO ₂ /NO ₂ -9	October 6, 2011	October 13, 2011	<1.0		1.3	
SO ₂ /NO ₂ -10	October 13, 2011	October 20, 2011	<1.0		1.1	
SO ₂ /NO ₂ -11	October 20, 2011	October 27, 2011	<1.0		2.1	
SO ₂ /NO ₂ -12	October 27, 2011	November 3, 2011	<1.0		1.9	
SO ₂ /NO ₂ -13	November 3, 2011	November 10, 2011	<1.0		2.4	
SO ₂ /NO ₂ -14	November 10, 2011	November 17, 2011	<1.0		3.4	
SO ₂ /NO ₂ -15	November 17, 2011	November 24, 2011	1.6		3.0	
SO ₂ /NO ₂ -16	November 24, 2011	December 1, 2011	<1.0		1.9	
SO ₂ /NO ₂ -17	December 1, 2011	December 8, 2011	<1.0		<0.8	
SO ₂ /NO ₂ -18	December 8, 2011	December 14, 2011	<1.0		2.1	
SO ₂ /NO ₂ -19	December 14, 2011	December 21, 2011	<1.0		2.8	
SO ₂ /NO ₂ -20	January 5, 2012	January 12, 2012	<1.0		3.0	
SO ₂ /NO ₂ -21	January 12, 2012	January 19, 2012	1.3		2.6	
SO ₂ /NO ₂ -22	January 19, 2012	January 26, 2012	1.6		4.7	
SO ₂ /NO ₂ -23	January 26, 2012	February 2, 2012	1.3		1.1	
SO ₂ /NO ₂ -24	February 2, 2012	February 9, 2012	1.0		1.9	
SO ₂ /NO ₂ -25	February 12, 2012	February 15, 2012	1.0		4.7	
SO ₂ /NO ₂ -26	February 15, 2012	February 22, 2012	<1.0		3.0	

Notes:
 Values in **bold** indicate a measured concentration in excess of the applicable objective, standard, or criterion.
 < not detected in sample, detection limit reported.

The percentile values for the weekly SO₂ and NO₂ concentrations are provided in Table 3.9.

Table 3.9 Percentile Values – Weekly Average SO₂ and NO₂ Concentrations

Value	Weekly Average Sulphur Dioxide Ground-Level Concentration (µg/m ³)	NBDELG Maximum Permissible Sulphur Dioxide Annual Average Ground-Level Concentration (µg/m ³)	Weekly Average Nitrogen Dioxide Ground-Level Concentration (µg/m ³)	NBDELG Maximum Permissible Nitrogen Dioxide Annual Average Ground-Level Concentration (µg/m ³)
Maximum	1.6	60	4.7	100
99 th Percentile	1.6		4.7	
98 th Percentile	1.6		4.7	
95 th Percentile	1.5		4.4	
90 th Percentile	1.3		3.2	
Median	1.0		1.9	
Average	1.1		2.0	
Minimum	<0.8		<0.6	
Standard Deviation	0.2		1.2	
Notes: Values in bold indicate a measured concentration in excess of the applicable objective, standard, or criterion. < not detected in sample, detection limit reported.				

The highest observed weekly ground-level concentrations of SO₂ and NO₂ by month as measured at Napadogan are presented in Table 3.10. These are presented for comparison purposes with the NBDELG monthly maximum data presented above (Section 2.2), where applicable.

Table 3.10 Highest Observed Weekly Average Ground-Level Concentrations By Month – SO₂ and NO₂

Month	Highest Observed Weekly Average Sulphur Dioxide Ground-Level Concentration during Month (µg/m ³)	NBDELG Maximum Permissible Sulphur Dioxide Annual Average Ground-Level Concentration (µg/m ³)	Highest Observed Weekly Average Nitrogen Dioxide Ground-Level Concentration during Month (µg/m ³)	NBDELG Maximum Permissible Nitrogen Dioxide Annual Average Ground-Level Concentration (µg/m ³)
August 2011	<1.0	60	1.5	100
September 2011	1.3		0.9	
October 2011	<1.0		2.1	
November 2011	1.6		3.4	
December 2011	<1.0		2.8	
January 2012	1.6		4.7	
February 2012	1.0		4.7	
Notes: Values in bold indicate a measured concentration in excess of the applicable objective, standard, or criterion. < not detected in sample, detection limit reported.				

3.2.1.5 Discussion

The measured 24-hour average concentrations of TSP and PM_{2.5} were well below the NBDELG Objective and CCME Canada-wide Standard, respectively. The highest concentrations were measured in August and September 2011. However, it is noted that for the first five weeks of monitoring there was road construction on Route 107 through Napadogan. For this time period the road surface was gravel, with ongoing intermittent construction activities. The road was re-surfaced with chip seal by September 12, 2011. Since the construction activities near the monitoring site generate some airborne dust, this is likely the cause for the higher concentrations of particulate matter measured during those months (August and September 2011).

The measured trace metals concentrations at Napadogan were well below the respective OMOE Ambient Air Quality Criteria, where they exist. Also, for many of the trace metals, the measured concentrations were below the detection limit.

Since SO₂ and NO₂ measured concentrations (passive samples) are weekly averages, the measured values are not compared directly with any objectives, guidelines or criteria as no such weekly values exist for SO₂ or NO₂—that stated, all measured values for SO₂ and NO₂ were very low and near the detection limit of the monitoring method and instruments. Though a direct comparison of weekly averages to an annual average ground-level concentration is not appropriate, if one were to compare the weekly average monitoring results to the annual average maximum ground-level concentration for each parameter as prescribed by the *New Brunswick Air Quality Regulation* (GNB 1997), the measured values would be less than 1/50th of the standard in most cases, indicating very low background values for these parameters. This is expected given the rural nature of the Study Area and the lack of nearby influencing point sources of emissions as well as the general lack of influence of long-range transport of air pollutants into Central New Brunswick from other regions. The highest concentrations of NO₂ were measured in the late fall and winter months. This is likely a result of wood combustion used for heat at nearby residences in the colder months. The highest SO₂ concentrations measured at Napadogan were close to and only slightly higher than the detection limit. Also for several of the weekly sample periods, the measured concentrations of SO₂ and NO₂ were below the detection limit.

Based on the baseline ambient air quality monitoring results, air quality in the Napadogan area near the Sisson site is representative of that found in a rural, sparsely populated area, with essentially no substantive sources of air contaminant emissions nearby.

The raw and calculated ambient air quality data are provided in Appendix A.

3.2.2 Odour

Sensory observations of odour were made by Stantec staff during each visit to the ambient monitoring site at Napadogan. During the period of the monitoring, no objectionable odours were detected by Stantec personnel during the visits to the Sisson monitoring site. During the winter months of the monitoring program, an occasional weak wood burning odour was detected at the site, presumably originating from nearby homes using wood for heat on colder days. However, these odours were weak and not objectionable.

4.0 SUMMARY

This Baseline Ambient Air Quality Technical Report was prepared as background information for the Environmental Impact Assessment (EIA) for the Sisson Project (the Project). The purpose of this report was to describe the baseline conditions with respect to ambient air quality in Central New Brunswick generally, and in the vicinity of the Project specifically.

The Atmospheric Environment has been identified as a valued environmental component (VEC) for the EIA of the Project due to its intrinsic importance to the health and well-being of humans, wildlife, vegetation, and other biota. Air quality is a key component of the Atmospheric environment in this regard. This report is focused on evaluating the Atmospheric Environment near the Project in two key areas: the Project Development Area (PDA) and the surrounding Study Area. The PDA was defined as the area of physical disturbance associated with the construction and operation of the Project. The Study Area was defined to include a 10 km by 10 km area centered on the PDA, and was selected to include the nearest residential receptors to the Project and so that, at its boundary, the Project related air contaminants would be expected to be at or near the existing background concentrations. This Technical Report presented the background data reviewed from published literature and field studies conducted and resulting data collected within the Study Area.

The available data from the existing provincial ambient air quality monitoring network were collected and reviewed. Previous data collected in support of the Sisson Project (e.g., meteorological data and dustfall data (Rescan™ 2010)) were also reviewed.

The available ambient air quality data from the existing provincial monitoring network (more specifically, data from the provincial monitoring stations nearest to the Project site) were reviewed in detail. The recent trends, maximum concentrations and comparisons with provincial or national ambient air quality objectives were identified to further describe the baseline ambient air quality in Central New Brunswick. Ambient air quality stations at Nackawic and Fredericton were determined to be closest to the Project site and ambient air quality data from these stations were reviewed. The air contaminant concentrations most recently measured at both locations were well below the applicable objectives and standards.

Following an identification of gaps in available ambient air quality information for the Project area, a work plan (Stantec 2011a) was developed to fill these data gaps and collect ambient air quality data representative of the Sisson Project site. Based on the identified data gaps, field studies were conceived and carried out in summer/fall 2011 and winter 2012.

Ambient air quality monitoring was conducted for a 26-week (6-month) period from August 12, 2011 to February 22, 2012 at Napadogan, New Brunswick. The monitoring was conducted using accepted methodologies in order to characterize the existing ambient air quality in the area near the Sisson Project and to provide background information for the EIA of the Project.

As determined by the ambient air quality monitoring data collected at Napadogan for this Project, the measured concentrations of air contaminants at the Napadogan site are well below the respective objectives, guidelines or standards, where they exist. For many of the air contaminants, the measured ambient concentrations were below the detection limit.

During the period of the monitoring, no objectionable odours were detected by Stantec personnel during the visits to the ambient air quality monitoring site in Napadogan.

Based on the results of the baseline ambient air quality monitoring conducted at Napadogan and review of ambient air quality data from the NBDELG ambient air quality monitoring network, air quality in the Napadogan area near the Sisson site is representative of that found in a rural, sparsely populated area, with essentially no substantive sources of air contaminant emissions nearby.

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Appendix A

List of Acronyms and Units

LIST OF ACRONYMS AND UNITS

Acronym/Unit	Definition
≥	greater than or equal to
<	less than
°	degrees
°C	degree Celsius
µg	microgram (1E-06 g)
µm	micrometre or micron (1E-06 m)
CAEAL	Canadian Association of Environmental Analytical Laboratories
CCME	Canadian Council of Ministers of the Environment
cm	centimetre
<i>e.g.</i> ,	for example
EIA/EA	environmental impact assessment/environmental assessment
GNB	Government of New Brunswick
ha	hectare
h	hour
<i>i.e.</i> ,	that is
km	kilometre (1,000 m)
kPa	kilopascals
LAA	Local Assessment Area
m	metre
m/s	metres per second
mm	millimetre

Acronym/Unit	Definition
mm/h	millimetres per hour
NAPS	National Air Pollution Surveillance
NBDELG	New Brunswick Department of Environment and Local Government (formerly New Brunswick Department of Environment, or NBENV)
NBENV	New Brunswick Department of Environment
NO ₂	nitrogen dioxide
OMOE	Ontario Ministry of the Environment
PDA	Project Development Area
PM _{2.5}	particulate matter less than 2.5 microns
QA/QC	quality assurance/quality control
SO ₂	sulphur dioxide
SCC	Standards Council of Canada
TSF	tailings storage facility
TSP	total suspended particulate
USEPA	United States Environmental Protection Agency
VEC	valued environmental component
W/m ²	Watts per square metre

Appendix B

Raw and Calculated Data

Ambient Air Quality Results - Week 1-4

Sisson Project
121810356 Task 400.110.102
Results Summary

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Particulate Matter Results

Filter ID	Start Time	Stop Time	Measured Concentration (ug/m3)	NBENV Objective/ CCME CWS for PM2.5 (ug/m3)
TSP				
TSP-1	8/15/11 12:00 AM	8/16/11 12:00 AM	25.0	120
TSP-2	8/21/11 12:00 AM	8/22/11 12:00 AM	35.3	
TSP-3	8/28/11 12:00 AM	8/29/11 12:00 AM	18.5	
TSP-4	9/4/11 12:00 AM	9/5/11 12:00 AM	28.4	
PM2.5				
PM2.5-1	8/13/11 12:00 AM	8/14/11 12:00 AM	1.90	30
PM2.5-2	8/19/11 12:00 AM	8/20/11 12:00 AM	NA*	
PM2.5-3	8/26/11 12:00 AM	8/27/11 12:00 AM	6.84	
PM2.5-4	9/4/11 12:00 AM	9/5/11 12:00 AM	8.11	

*sample damaged due to equipment operational issues, measurement not available for this sample

Metals Results

Metals	Measured Concentration (ug/m3)				OMOE 24 hr Criteria (ug/m3)
	TSP/Metals-1	TSP/Metals-2	TSP/Metals-3	TSP/Metals-4	
Aluminum (Al)	7.5E-02	0.34	8.3E-02	0.16	-
Antimony (Sb)	4.2E-03	4.1E-03	4.1E-03	4.1E-03	25
Arsenic (As)	2.5E-03	2.5E-03	2.4E-03	2.5E-03	0.3
Barium (Ba)	3.0E-03	3.4E-03	1.4E-03	2.7E-03	10
Beryllium (Be)	4.2E-04	4.1E-04	4.1E-04	4.1E-04	0.01
Bismuth (Bi)	2.5E-03	2.5E-03	2.4E-03	2.5E-03	-
Boron (B)	2.5E-03	2.5E-03	2.4E-03	2.5E-03	-
Cadmium (Cd)	8.3E-04	8.3E-04	8.2E-04	8.2E-04	0.025
Calcium (Ca)	9.3E-02	0.12	6.0E-02	9.3E-02	-
Chromium (Cr)	1.0E-03	9.9E-04	1.0E-03	9.0E-04	1.5
Cobalt (Co)	8.3E-04	8.3E-04	8.2E-04	8.2E-04	0.1
Copper (Cu)	8.3E-02	0.19	0.14	0.16	50
Iron (Fe)	0.29	0.63	0.23	0.33	-
Lead (Pb)	2.5E-03	2.2E-03	1.2E-03	1.5E-03	0.5
Magnesium (Mg)	5.6E-02	0.16	8.2E-02	0.11	-
Manganese (Mn)	1.4E-02	2.2E-02	7.7E-03	1.1E-02	2.5
Molybdenum (Mo)	1.3E-03	1.2E-03	1.2E-03	1.2E-03	120
Nickel (Ni)	1.3E-03	1.7E-03	1.2E-03	1.2E-03	2
Phosphorus (P)	3.8E-02	5.6E-02	5.2E-02	5.3E-02	-
Potassium (K)	0.15	0.16	0.12	0.13	-
Selenium (Se)	4.2E-03	4.1E-03	4.1E-03	4.1E-03	10
Silicon (Si)	9.3E-02	9.8E-02	7.0E-02	7.0E-02	-
Silver (Ag)	8.3E-04	8.3E-04	8.2E-04	8.2E-04	-
Sodium (Na)	0.23	0.20	0.35	0.20	-
Strontium (Sr)	5.0E-04	6.2E-04	4.9E-04	5.7E-04	-
Sulphur (S)	0.73	1.36	0.35	0.92	-
Thallium (Tl)	4.2E-03	4.1E-03	4.1E-03	4.1E-03	-
Tin (Sn)	4.2E-03	4.1E-03	4.1E-03	4.1E-03	-
Titanium (Ti)	3.3E-03	1.8E-02	3.4E-03	6.4E-03	-
Uranium (U)	2.1E-02	2.1E-02	2.9E-02	2.1E-02	-
Vanadium (V)	8.3E-04	1.6E-03	8.2E-04	8.2E-04	2
Zinc (Zn)	5.6E-02	3.5E-02	2.2E-02	2.3E-02	120
Zirconium (Zr)	6.7E-04	4.1E-04	4.1E-04	4.1E-04	-

OMOE 2008. Ontario Ministry of the Environment Ambient Air Quality Criteria. February 2008. Available online at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079182.pdf .

SO2/NO2 Passive Sample Results

Sample ID	Start Time	Stop Time	Weekly Average Measured Concentration (ug/m3)
Sulphur Dioxide (SO2)			
SO2-1	8/12/2011 12:30	8/18/2011 13:30	1.05
SO2-2	8/18/2011 13:30	8/25/2011 13:30	1.05
SO2-3	8/25/2011 13:30	9/1/2011 15:16	1.05
SO2-4	9/1/2011 15:16	9/7/2011 15:43	1.05
Nitrogen Dioxide (NO2)			
NO2-1	8/12/2011 12:30	8/18/2011 13:30	1.51
NO2-2	8/18/2011 13:30	8/25/2011 13:30	0.75
NO2-3	8/25/2011 13:30	9/1/2011 15:16	0.75
NO2-4	9/1/2011 15:16	9/7/2011 15:43	0.94

not detected in sample, detection limit reported

Calculations - Sisson Hi-Vols
 Napadogan Site
 121810356
 Task 400.110.102

yellow highlight indicates compound was not detected in sample, and detection limit is reported
 oil splatter on filter - bad sample

Sampling ID	TSP-1	PM2.5-1	TSP-2	PM2.5-2	TSP-3	PM2.5-3	TSP-4	PM2.5-4
Sampling Date	15-Aug-11	13-Aug-11	21-Aug-11	19-Aug-11	28-Aug-11	26-Aug-11	4-Sep-11	2-Sep-11
Average Ambient Temperature (Celcius)	18.7	18.6	20.7	20.6	17.7	19.4	19.0	15.2
Average Ambient Pressure (kpa)	101.15	101.29	100.99	100.96	101.03	100.84	101.11	102.05
Average Actual Flow Rate on Chart Recorder (cfm)	48	51	49	43	49	48	49	49
Average Actual Flow Rate with Calibration Correction (m ³ /min)	1.63	1.79	1.66	1.46	1.67	1.66	1.66	1.73
Average Standard Flow Rate (sm ³ /min)	1.66	1.83	1.68	1.48	1.70	1.69	1.69	1.80
Sampling Time (min)	1440	1440	1440	1440	1440	1440	1440	1440
Total Standard Sample Volume (sm ³)	2397	2630	2413	2127	2452	2427	2438	2589
Mass Particulate Collected on Filter (mg)	60.0	5.0	85.1	1760	45.3	16.6	69.2	21.0
Particulate Concentration (ug/sm ³)	25.0	1.9	35.3	827.3	18.5	6.8	28.4	8.1
Metals - mass collected on filter (ug)								
Aluminum (Al)	180		831		203		379	
Antimony (Sb)	10		10		10		10	
Arsenic (As)	6		6		6		6	
Barium (Ba)	7.1		8.2		3.4		6.5	
Beryllium (Be)	1		1		1		1	
Bismuth (Bi)	6		6		6		6	
Boron (B)	6		6		6		6	
Cadmium (Cd)	2		2		2		2	
Calcium (Ca)	224		288		147		226	
Chromium (Cr)	2.5		2.4		2.5		2.2	
Cobalt (Co)	2		2		2		2	
Copper (Cu)	200		454		333		389	
Iron (Fe)	705		1530		553		811	
Lead (Pb)	6.0		5.4		3		3.7	
Magnesium (Mg)	135		396		200		264	
Manganese (Mn)	33.9		53.3		18.9		27.4	
Molybdenum (Mo)	3		3		3		3	
Nickel (Ni)	3.1		4.2		3		3	
Phosphorus (P)	91		134		127		129	
Potassium (K)	354		378		299		326	
Selenium (Se)	10		10		10		10	
Silicon (Si)	224		236		172		171	
Silver (Ag)	2		2		2		2	
Sodium (Na)	552		480		860		483	
Strontium (Sr)	1.2		1.5		1.2		1.4	
Sulphur (S)	1750		3280		850		2250	
Thallium (Tl)	10		10		10		10	
Tin (Sn)	10		10		10		10	
Titanium (Ti)	8.0		42.3		8.4		15.6	
Uranium (U)	50		50		71		50	
Vanadium (V)	2		3.8		2		2	
Zinc (Zn)	135		83.9		53.4		56.3	
Zirconium (Zr)	1.6		1		1		1	
Metals Concentrations (ug/m3)								
Aluminum (Al)	7.5E-02		0.34		8.3E-02		0.16	
Antimony (Sb)	4.2E-03		4.1E-03		4.1E-03		4.1E-03	
Arsenic (As)	2.5E-03		2.5E-03		2.4E-03		2.5E-03	
Barium (Ba)	3.0E-03		3.4E-03		1.4E-03		2.7E-03	
Beryllium (Be)	4.2E-04		4.1E-04		4.1E-04		4.1E-04	
Bismuth (Bi)	2.5E-03		2.5E-03		2.4E-03		2.5E-03	
Boron (B)	2.5E-03		2.5E-03		2.4E-03		2.5E-03	
Cadmium (Cd)	8.3E-04		8.3E-04		8.2E-04		8.2E-04	
Calcium (Ca)	9.3E-02		0.12		6.0E-02		9.3E-02	
Chromium (Cr)	1.0E-03		9.9E-04		1.0E-03		9.0E-04	
Cobalt (Co)	8.3E-04		8.3E-04		8.2E-04		8.2E-04	
Copper (Cu)	8.3E-02		0.19		0.14		0.16	
Iron (Fe)	0.29		0.63		0.23		0.33	
Lead (Pb)	2.5E-03		2.2E-03		1.2E-03		1.5E-03	
Magnesium (Mg)	5.6E-02		0.16		8.2E-02		0.11	
Manganese (Mn)	1.4E-02		2.2E-02		7.7E-03		1.1E-02	
Molybdenum (Mo)	1.3E-03		1.2E-03		1.2E-03		1.2E-03	
Nickel (Ni)	1.3E-03		1.7E-03		1.2E-03		1.2E-03	
Phosphorus (P)	3.8E-02		5.6E-02		5.2E-02		5.3E-02	
Potassium (K)	0.15		0.16		0.12		0.13	
Selenium (Se)	4.2E-03		4.1E-03		4.1E-03		4.1E-03	
Silicon (Si)	9.3E-02		9.8E-02		7.0E-02		7.0E-02	
Silver (Ag)	8.3E-04		8.3E-04		8.2E-04		8.2E-04	
Sodium (Na)	0.23		0.20		0.35		0.20	
Strontium (Sr)	5.0E-04		6.2E-04		4.9E-04		5.7E-04	
Sulphur (S)	0.73		1.36		0.35		0.92	
Thallium (Tl)	4.2E-03		4.1E-03		4.1E-03		4.1E-03	
Tin (Sn)	4.2E-03		4.1E-03		4.1E-03		4.1E-03	
Titanium (Ti)	3.3E-03		1.8E-02		3.4E-03		6.4E-03	
Uranium (U)	2.1E-02		2.1E-02		2.9E-02		2.1E-02	
Vanadium (V)	8.3E-04		1.6E-03		8.2E-04		8.2E-04	
Zinc (Zn)	5.6E-02		3.5E-02		2.2E-02		2.3E-02	
Zirconium (Zr)	6.7E-04		4.1E-04		4.1E-04		4.1E-04	

Sampling Schedule

Particulate Samples

Filter ID	Start Time	Stop Time	Sample Duration (hrs)
TSP			
TSP-1	8/15/2011 0:00	8/16/2011 0:00	24
TSP-2	8/21/2011 0:00	8/22/2011 0:00	24
TSP-3	8/28/2011 0:00	8/29/2011 0:00	24
TSP-4	9/4/2011 0:00	9/5/2011 0:00	24
PM2.5			
PM2.5-1	8/13/2011 0:00	8/14/2011 0:00	24
PM2.5-2	8/19/2011 0:00	8/20/2011 0:00	24
PM2.5-3	8/26/2011 0:00	8/27/2011 0:00	24
PM2.5-4	9/4/2011 0:00	9/5/2011 0:00	24

SO2/NO2 Passive Samples

Sample ID	Sample Period	
	Start Time	Stop Time
SO2/NO2 - 1	8/12/2011 12:30	8/18/2011 13:30
SO2/NO2 - 2	8/18/2011 13:30	8/25/2011 13:30
SO2/NO2 - 3	8/25/2011 13:30	9/1/2011 15:16
SO2/NO2 - 4	9/1/2011 15:16	9/7/2011 15:43

Daily Average Weather Data

Filter ID	Start Time	Stop Time	Average Temp ('C)	Average Pressure (kPa)
TSP				
TSP-1	8/15/2011 0:00	8/16/2011 0:00	18.7	101.2
TSP-2	8/21/2011 0:00	8/22/2011 0:00	20.7	101.0
TSP-3	8/28/2011 0:00	8/29/2011 0:00	17.7	101.0
TSP-4	9/4/2011 0:00	9/5/2011 0:00	19.0	101.1
PM2.5				
PM2.5-1	8/13/2011 0:00	8/14/2011 0:00	18.6	101.3
PM2.5-2	8/19/2011 0:00	8/20/2011 0:00	20.6	101.0
PM2.5-3	8/26/2011 0:00	8/27/2011 0:00	19.4	100.8
PM2.5-4	9/2/2011 0:00	9/3/2011 0:00	15.2	102.0

Hi-vol Flow Chart Readings

Filter ID	Start Time	Stop Time	Average Chart Flow Rate (CFM)
TSP			
TSP-1	8/15/2011 0:00	8/16/2011 0:00	48
TSP-2	8/21/2011 0:00	8/22/2011 0:00	49
TSP-3	8/28/2011 0:00	8/29/2011 0:00	49
TSP-4	9/4/2011 0:00	9/5/2011 0:00	49
PM2.5			
PM2.5-1	8/13/2011 0:00	8/14/2011 0:00	51
PM2.5-2	8/19/2011 0:00	8/20/2011 0:00	43
PM2.5-3	8/26/2011 0:00	8/27/2011 0:00	48
PM2.5-4	9/4/2011 0:00	9/5/2011 0:00	49

Ambient Air Quality Results - Week 5-8

Sisson Project

121810356 Task 400.110.102

Results Summary

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Particulate Matter Results

Filter ID	Start Time	Stop Time	Measured Concentration (ug/m3)	NBENV Objective/ CCME CWS for PM2.5 (ug/m3)
TSP				
TSP-5	9/11/11 12:00 AM	9/12/11 12:00 AM	12.8	120
TSP-6	9/18/11 12:00 AM	9/19/11 12:00 AM	11.1	
TSP-7	9/25/11 12:00 AM	9/26/11 12:00 AM	16.5	
TSP-8	10/2/11 12:00 AM	10/3/11 12:00 AM	9.2	
PM2.5				
PM2.5-5	9/9/11 12:00 AM	9/10/11 12:00 AM	7.9	30
PM2.5-6	9/16/11 12:00 AM	9/17/11 12:00 AM	2.1	
PM2.5-7	9/23/11 12:00 AM	9/24/11 12:00 AM	5.0	
PM2.5-8	9/30/11 12:00 AM	10/1/11 12:00 AM	2.9	

*sample damaged due to equipment operational issues, measurement not available for this sample

Metals Results

Metals	Measured Concentration (ug/m3)				OMOE 24 hr Criteria (ug/m3)
	TSP/Metals-5	TSP/Metals-6	TSP/Metals-7	TSP/Metals-8	
Arsenic (As)	2.3E-03	2.2E-03	2.5E-03	2.3E-03	0.3
Cadmium (Cd)	7.6E-04	7.5E-04	8.2E-04	7.7E-04	0.025
Chromium (Cr)	9.2E-04	1.2E-03	8.2E-04	8.4E-04	1.5
Cobalt (Co)	7.6E-04	7.5E-04	8.2E-04	7.7E-04	0.1
Copper (Cu)	0.19	0.14	0.16	0.16	50
Iron (Fe)	0.11	0.17	0.09	0.06	-
Lead (Pb)	1.1E-03	1.1E-03	1.2E-03	1.2E-03	0.5
Manganese (Mn)	6.0E-03	6.3E-03	7.2E-03	3.3E-03	2.5
Nickel (Ni)	1.1E-03	1.1E-03	1.2E-03	1.2E-03	2
Selenium (Se)	3.8E-03	3.7E-03	4.1E-03	3.8E-03	10
Sulphur (S)	0.09	0.15	0.44	0.14	-
Vanadium (V)	7.6E-04	7.5E-04	8.2E-04	7.7E-04	2
Zinc (Zn)	0.01	0.01	0.01	6.6E-03	120

OMOE 2008. Ontario Ministry of the Environment Ambient Air Quality Criteria. February 2008. Available online at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079182.pdf .

SO2/NO2 Passive Sample Results

Sample ID	Start Time	Stop Time	Weekly Average Measured Concentration (ug/m3)
Sulphur Dioxide (SO2)			
SO2-5	9/7/2011 15:43	9/13/2011 17:00	1.31
SO2-6	9/13/2011 17:00	9/22/2011 14:00	0.79
SO2-7	9/22/2011 14:00	9/29/2011 9:55	1.05
SO2-8	9/29/2011 9:55	10/6/2011 14:50	1.05
Nitrogen Dioxide (NO2)			
NO2-5	9/7/2011 15:43	9/13/2011 17:00	0.94
NO2-6	9/13/2011 17:00	9/22/2011 14:00	0.56
NO2-7	9/22/2011 14:00	9/29/2011 9:55	0.75
NO2-8	9/29/2011 9:55	10/6/2011 14:50	0.75

Calculations - Sisson Hi-Vols
 Napadogan Site
 121810356
 Task 400.110.102

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Sampling ID	TSP-5	PM2.5-5	TSP-6	PM2.5-6	TSP-7	PM2.5-7	TSP-8	PM2.5-8
Sampling Date	11-Sep-11	9-Sep-11	18-Sep-11	16-Sep-11	25-Sep-11	23-Sep-11	2-Oct-11	30-Sep-11
Average Ambient Temperature (Celcius)	9.8	15.8	8.7	8.2	19.3	18.0	9.1	16.2
Average Ambient Pressure (kpa)	101.45	100.70	102.88	100.17	101.50	101.98	101.00	100.25
Average Actual Flow Rate on Chart Recorder (cfm)	50	49	50	50	49	48	50	48
Average Actual Flow Rate with Calibration Correction (m ³ /min)	1.72	1.71	1.73	1.77	1.66	1.68	1.72	1.67
Average Standard Flow Rate (sm ³ /min)	1.82	1.76	1.86	1.86	1.70	1.73	1.81	1.70
Sampling Time (min)	1440	1440	1440	1440	1440	1440	1440	1440
Total Standard Sample Volume (sm ³)	2615	2529	2684	2675	2448	2488	2607	2446
Mass Particulate Collected on Filter (mg)	33.5	19.9	29.8	5.7	40.5	12.4	24.1	7.0
Particulate Concentration (ug/sm³)	12.8	7.9	11.1	2.1	16.5	5.0	9.2	2.9
Metals - mass collected on filter (ug)								
Arsenic (As)	6.0		6.0		6.0		6.0	
Cadmium (Cd)	2.0		2.0		2.0		2.0	
Chromium (Cr)	2.4		3.2		2.0		2.2	
Cobalt (Co)	2.0		2.0		2.0		2.0	
Copper (Cu)	509.0		387.0		398.0		413.0	
Iron (Fe)	287.0		450.0		231.0		167.0	
Lead (Pb)	3.0		3.0		3.0		3.0	
Manganese (Mn)	15.7		16.8		17.6		8.6	
Nickel (Ni)	3.0		3.0		3.0		3.0	
Selenium (Se)	10.0		10.0		10.0		10.0	
Sulphur (S)	248.0		409.0		1080.0		378.0	
Vanadium (V)	2.0		2.0		2.0		2.0	
Zinc (Zn)	35.9		30.2		33.2		17.2	
Metals Concentrations (ug/m3)								
Arsenic (As)	2.3E-03		2.2E-03		2.5E-03		2.3E-03	
Cadmium (Cd)	7.6E-04		7.5E-04		8.2E-04		7.7E-04	
Chromium (Cr)	9.2E-04		1.2E-03		8.2E-04		8.4E-04	
Cobalt (Co)	7.6E-04		7.5E-04		8.2E-04		7.7E-04	
Copper (Cu)	0.19		0.14		0.16		0.16	
Iron (Fe)	0.11		0.17		0.09		0.06	
Lead (Pb)	1.1E-03		1.1E-03		1.2E-03		1.2E-03	
Manganese (Mn)	0.01		0.01		0.01		3.3E-03	
Nickel (Ni)	1.1E-03		1.1E-03		1.2E-03		1.2E-03	
Selenium (Se)	3.8E-03		3.7E-03		4.1E-03		3.8E-03	
Sulphur (S)	0.09		0.15		0.44		0.14	
Vanadium (V)	7.6E-04		7.5E-04		8.2E-04		7.7E-04	
Zinc (Zn)	0.01		0.01		0.01		0.01	

Sampling Schedule

Particulate Samples

Filter ID	Start Time	Stop Time	Sample Duration (hrs)
TSP			
TSP-5	9/11/2011 0:00	9/12/2011 0:00	24
TSP-6	9/18/2011 0:00	9/19/2011 0:00	24
TSP-7	9/25/2011 0:00	9/26/2011 0:00	24
TSP-8	10/2/2011 0:00	10/3/2011 0:00	24
PM2.5			
PM2.5-5	9/9/2011 0:00	9/10/2011 0:00	24
PM2.5-6	9/16/2011 0:00	9/17/2011 0:00	24
PM2.5-7	9/23/2011 0:00	9/24/2011 0:00	24
PM2.5-8	9/30/2011 0:00	10/1/2011 0:00	24

SO2/NO2 Passive Samples

Sample ID	Sample Period	
	Start Time	Stop Time
SO2/NO2 - 5	9/7/2011 15:43	9/13/2011 17:00
SO2/NO2 - 6	9/13/2011 17:00	9/22/2011 14:00
SO2/NO2 - 7	9/22/2011 14:00	9/29/2011 9:55
SO2/NO2 - 8	9/29/2011 9:55	10/6/2011 14:50

Daily Average Weather Data

Filter ID	Start Time	Stop Time	Average Temp (°C)	Average Pressure (kPa)
TSP				
TSP-5	9/11/2011 0:00	9/12/2011 0:00	9.8	101.5
TSP-6	9/18/2011 0:00	9/19/2011 0:00	8.7	102.9
TSP-7	9/25/2011 0:00	9/26/2011 0:00	19.3	101.5
TSP-8	10/2/2011 0:00	10/3/2011 0:00	9.1	101.0
PM2.5				
PM2.5-5	9/9/2011 0:00	9/10/2011 0:00	15.8	100.7
PM2.5-6	9/16/2011 0:00	9/17/2011 0:00	8.2	100.2
PM2.5-7	9/23/2011 0:00	9/24/2011 0:00	18.0	102.0
PM2.5-8	9/30/2011 0:00	10/1/2011 0:00	16.2	100.3

Hi-vol Flow Chart Readings

Filter ID	Start Time	Stop Time	Average Chart Flow Rate (CFM)
TSP			
TSP-5	9/11/2011 0:00	9/12/2011 0:00	50
TSP-6	9/18/2011 0:00	9/19/2011 0:00	50
TSP-7	9/25/2011 0:00	9/26/2011 0:00	49
TSP-8	10/2/2011 0:00	10/3/2011 0:00	50
PM2.5			
PM2.5-5	9/9/2011 0:00	9/10/2011 0:00	49
PM2.5-6	9/16/2011 0:00	9/17/2011 0:00	50
PM2.5-7	9/23/2011 0:00	9/24/2011 0:00	48
PM2.5-8	9/30/2011 0:00	10/1/2011 0:00	48

Ambient Air Quality Results - Week 9-12

Sisson Project

121810356 Task 400.110.102

Results Summary

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Particulate Matter Results

Filter ID	Start Time	Stop Time	Measured Concentration (ug/m3)	NBENV Objective/ CCME CWS for PM2.5 (ug/m3)
TSP				
TSP-9	10/9/11 12:00 AM	10/10/11 12:00 AM	20.5	120
TSP-10	10/16/11 12:00 AM	10/17/11 12:00 AM	7.6	
TSP-11	10/23/11 12:00 AM	10/24/11 12:00 AM	8.0	
TSP-12	10/30/11 12:00 AM	10/31/11 12:00 AM	3.8	
PM2.5				
PM2.5-9	10/7/11 12:00 AM	10/8/11 12:00 AM	2.8	30
PM2.5-10	10/14/11 12:00 AM	10/15/11 12:00 AM	2.0	
PM2.5-11	10/21/11 12:00 AM	10/22/11 12:00 AM	3.9	
PM2.5-12	10/28/11 12:00 AM	10/29/11 12:00 AM	2.7	

*sample damaged due to equipment operational issues, measurement not available for this sample

Metals Results

Metals	Measured Concentration (ug/m3)				OMOE 24 hr Criteria (ug/m3)
	TSP/Metals-9	TSP/Metals-10	TSP/Metals-11	TSP/Metals-12	
Arsenic (As)	2.5E-03	2.3E-03	2.3E-03	2.2E-03	0.3
Cadmium (Cd)	8.2E-04	7.8E-04	7.7E-04	7.3E-04	0.025
Chromium (Cr)	1.0E-03	7.8E-04	9.3E-04	7.3E-04	1.5
Cobalt (Co)	8.2E-04	7.8E-04	7.7E-04	7.3E-04	0.1
Copper (Cu)	0.18	0.17	0.21	0.24	50
Iron (Fe)	0.20	0.03	0.06	0.04	-
Lead (Pb)	4.2E-03	1.6E-03	1.4E-03	1.4E-03	0.5
Manganese (Mn)	9.8E-03	2.3E-03	6.4E-03	2.9E-03	2.5
Nickel (Ni)	1.2E-03	1.2E-03	1.2E-03	1.1E-03	2
Selenium (Se)	4.1E-03	3.9E-03	3.9E-03	3.7E-03	10
Sulphur (S)	1.18	0.31	0.18	0.10	-
Vanadium (V)	8.2E-04	7.8E-04	9.6E-04	7.3E-04	2
Zinc (Zn)	0.02	0.02	0.01	8.0E-03	120

OMOE 2008. Ontario Ministry of the Environment Ambient Air Quality Criteria. February 2008. Available online at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079182.pdf.

SO2/NO2 Passive Sample Results

Sample ID	Start Time	Stop Time	Weekly Average Measured Concentration (ug/m3)
Sulphur Dioxide (SO2)			
SO2-9	10/6/2011 14:50	10/13/2011 14:35	1.05
SO2-10	10/13/2011 14:35	10/20/2011 15:20	1.05
SO2-11	10/20/2011 15:20	10/27/2011 15:00	1.05
SO2-12	10/27/2011 15:00	11/3/2011 13:10	1.05
Nitrogen Dioxide (NO2)			
NO2-9	10/6/2011 14:50	10/13/2011 14:35	1.32
NO2-10	10/13/2011 14:35	10/20/2011 15:20	1.13
NO2-11	10/20/2011 15:20	10/27/2011 15:00	2.07
NO2-12	10/27/2011 15:00	11/3/2011 13:10	1.88

Calculations - Sisson Hi-Vols
 Napadogan Site
 121810356
 Task 400.110.102

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Sampling ID	TSP-9	PM2.5-9	TSP-10	PM2.5-10	TSP-11	PM2.5-11	TSP-12	PM2.5-12
Sampling Date								
Average Ambient Temperature (Celcius)	20.3	1.1	8.3	13.2	7.7	10.3	0.1	0.2
Average Ambient Pressure (kpa)	101.62	102.21	99.78	102.12	101.36	100.70	100.87	100.81
Average Actual Flow Rate on Chart Recorder (cfm)	49	50	50	48	49	49	50	50
Average Actual Flow Rate with Calibration Correction (m ³ /min)	1.66	1.82	1.71	1.69	1.69	1.73	1.74	1.81
Average Standard Flow Rate (sm ³ /min)	1.69	2.00	1.79	1.78	1.80	1.81	1.89	1.96
Sampling Time (min)	1440	1440	1440	1440	1440	1440	1440	1440
Total Standard Sample Volume (sm ³)	2440	2874	2572	2560	2592	2605	2728	2827
Mass Particulate Collected on Filter (mg)	50.1	8.0	19.5	5	20.8	10.2	10.4	7.6
Particulate Concentration (ug/sm³)	20.5	2.8	7.6	2.0	8.0	3.9	3.8	2.7
Metals - mass collected on filter (ug)								
Arsenic (As)	6.0		6.0		6.0		6.0	
Cadmium (Cd)	2.0		2.0		2.0		2.0	
Chromium (Cr)	2.5		2.0		2.4		2.0	
Cobalt (Co)	2.0		2.0		2.0		2.0	
Copper (Cu)	448.0		432.0		536.0		644.0	
Iron (Fe)	488.0		87.0		164.0		115.0	
Lead (Pb)	10.3		4.1		3.6		3.8	
Manganese (Mn)	23.9		6.0		16.7		7.8	
Nickel (Ni)	3.0		3.0		3.0		3.0	
Selenium (Se)	10.0		10.0		10.0		10.0	
Sulphur (S)	2870.0		789.0		467.0		267.0	
Vanadium (V)	2.0		2.0		2.5		2.0	
Zinc (Zn)	47.4		49.5		33.9		21.9	
Metals Concentrations (ug/m3)								
Arsenic (As)	2.5E-03		2.3E-03		2.3E-03		2.2E-03	
Cadmium (Cd)	8.2E-04		7.8E-04		7.7E-04		7.3E-04	
Chromium (Cr)	1.0E-03		7.8E-04		9.3E-04		7.3E-04	
Cobalt (Co)	8.2E-04		7.8E-04		7.7E-04		7.3E-04	
Copper (Cu)	0.18		0.17		0.21		0.24	
Iron (Fe)	0.20		0.03		0.06		0.04	
Lead (Pb)	4.2E-03		1.6E-03		1.4E-03		1.4E-03	
Manganese (Mn)	0.01		0.00		0.01		2.9E-03	
Nickel (Ni)	1.2E-03		1.2E-03		1.2E-03		1.1E-03	
Selenium (Se)	4.1E-03		3.9E-03		3.9E-03		3.7E-03	
Sulphur (S)	1.18		0.31		0.18		0.10	
Vanadium (V)	8.2E-04		7.8E-04		9.6E-04		7.3E-04	
Zinc (Zn)	0.02		0.02		0.01		0.01	

Sampling Schedule

Particulate Samples

Filter ID	Start Time	Stop Time	Sample Duration (hrs)
TSP			
TSP-9	10/9/2011 0:00	10/10/2011 0:00	24
TSP-10	10/16/2011 0:00	10/17/2011 0:00	24
TSP-11	10/23/2011 0:00	10/24/2011 0:00	24
TSP-12	10/30/2011 0:00	10/31/2011 0:00	24
PM2.5			
PM2.5-9	10/7/2011 0:00	10/8/2011 0:00	24
PM2.5-10	10/14/2011 0:00	10/15/2011 0:00	24
PM2.5-11	10/21/2011 0:00	10/22/2011 0:00	24
PM2.5-12	10/28/2011 0:00	10/29/2011 0:00	24

SO2/NO2 Passive Samples

Sample ID	Sample Period	
	Start Time	Stop Time
SO2/NO2 - 9	10/6/2011 14:50	10/13/2011 14:35
SO2/NO2 - 10	10/13/2011 14:35	10/20/2011 15:20
SO2/NO2 - 11	10/20/2011 15:20	10/27/2011 15:00
SO2/NO2 - 12	10/27/2011 15:00	11/3/2011 13:10

Daily Average Weather Data

Filter ID	Start Time	Stop Time	Average Temp ('C)	Average Pressure (kPa)
TSP				
TSP-9	10/9/11 0:00	10/10/11 0:00	20.3	101.6
TSP-10	10/16/11 0:00	10/17/11 0:00	8.3	99.8
TSP-11	10/23/11 0:00	10/24/11 0:00	7.7	101.4
TSP-12	10/30/11 0:00	10/31/11 0:00	0.1	100.9
PM2.5				
PM2.5-9	10/7/11 0:00	10/8/11 0:00	1.1	102.2
PM2.5-10	10/14/11 0:00	10/15/11 0:00	13.2	102.1
PM2.5-11	10/21/11 0:00	10/22/11 0:00	10.3	100.7
PM2.5-12	10/28/11 0:00	10/29/11 0:00	0.2	100.8

Hi-vol Flow Chart Readings

Filter ID	Start Time	Stop Time	Average Chart Flow Rate (CFM)
TSP			
TSP-9	10/9/2011 0:00	10/10/2011 0:00	49
TSP-10	10/16/2011 0:00	10/17/2011 0:00	50
TSP-11	10/23/2011 0:00	10/24/2011 0:00	49
TSP-12	10/30/2011 0:00	10/31/2011 0:00	50
PM2.5			
PM2.5-9	10/7/2011 0:00	10/8/2011 0:00	50
PM2.5-10	10/14/2011 0:00	10/15/2011 0:00	48
PM2.5-11	10/21/2011 0:00	10/22/2011 0:00	49
PM2.5-12	10/28/2011 0:00	10/29/2011 0:00	50

Ambient Air Quality Results - Week 13-16

Sisson Project

121810356 Task 400.110.102

Results Summary

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Particulate Matter Results

Filter ID	Start Time	Stop Time	Measured Concentration (ug/m3)	NBENV Objective/ CCME CWS for PM2.5 (ug/m3)
TSP				
TSP-13	Nov 6/2011 0:00	Nov 7/2011 0:00	6.0	120
TSP-14	Nov 13/2011 0:00	Nov 14/2011 0:00	10.4	
TSP-15	Nov 20/2011 0:00	Nov 21/2011 0:00	9.0	
TSP-16	Nov 29/2011 0:00	Nov 30/2011 0:00	5.5	
PM2.5				
PM2.5-13	Nov 4/2011 0:00	Nov 10/2011 12:25	4.3	30
PM2.5-14	Nov 11/2011 0:00	Nov 12/2011 0:00	1.9	
PM2.5-15	Nov 18/2011 0:00	Nov 19/2011 0:00	1.8	
PM2.5-16	Nov 27/2011 0:00	Nov 28/2011 0:00	3.7	

*sample damaged due to equipment operational issues, measurement not available for this sample

Metals Results

Metals	Measured Concentration (ug/m3)				OMOE 24 hr Criteria (ug/m3)
	TSP/Metals-13 6-Nov-11	TSP/Metals-14 13-Nov-11	TSP/Metals-15 20-Nov-11	TSP/Metals-16 29-Nov-11	
Arsenic (As)	2.2E-03	2.0E-03	2.0E-03	1.9E-03	0.3
Cadmium (Cd)	7.3E-04	6.6E-04	6.8E-04	6.5E-04	0.025
Chromium (Cr)	7.3E-04	6.6E-04	6.8E-04	6.5E-04	1.5
Cobalt (Co)	7.3E-04	6.6E-04	6.8E-04	6.5E-04	0.1
Copper (Cu)	0.15	0.21	0.19	0.16	50
Iron (Fe)	0.06	0.12	0.08	0.06	-
Lead (Pb)	1.2E-03	2.3E-03	2.9E-03	9.7E-04	0.5
Manganese (Mn)	4.2E-03	6.9E-03	4.4E-03	5.8E-03	2.5
Nickel (Ni)	1.1E-03	1.0E-03	1.1E-03	9.7E-04	2
Selenium (Se)	3.6E-03	3.3E-03	3.4E-03	3.2E-03	10
Sulphur (S)	0.12	0.57	0.39	0.18	-
Vanadium (V)	7.3E-04	6.6E-04	7.8E-04	6.5E-04	2
Zinc (Zn)	8.1E-03	0.01	0.01	0.01	120

OMOE 2008. Ontario Ministry of the Environment Ambient Air Quality Criteria. February 2008. Available online at:

http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079182.pdf

SO2/NO2 Passive Sample Results

Sample ID	Start Time	Stop Time	Weekly Average Measured Concentration (ug/m3)
Sulphur Dioxide (SO2)			
SO2-13	Nov 3/2011 13:11	Nov 10/2011 12:46	1.05
SO2-14	Nov 10/2011 12:46	Nov 17/2011 11:45	1.05
SO2-15	Nov 17/2011 11:45	Nov 24/2011 13:35	1.57
SO2-16	Nov 24/2011 13:35	Dec 1/2011 15:46	1.05
Nitrogen Dioxide (NO2)			
NO2-13	Nov 3/2011 13:11	Nov 10/2011 12:46	2.45
NO2-14	Nov 10/2011 12:46	Nov 17/2011 11:45	3.39
NO2-15	Nov 17/2011 11:45	Nov 24/2011 13:35	3.01
NO2-16	Nov 24/2011 13:35	Dec 1/2011 15:46	1.88

Calculations - Sisson Hi-Vols
 Napadogan Site
 121810356
 Task 400.110.102

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Sampling ID	TSP-13	PM2.5-13	TSP-14	PM2.5-14	TSP-15	PM2.5-15	TSP-16	PM2.5-16
Sampling Date	6-Nov-11	4-Nov-11	13-Nov-11	11-Nov-11	20-Nov-11	18-Nov-11	29-Nov-11	27-Nov-11
Average Ambient Temperature (Celcius)	2.1	4.4	4.4	7.9	2.3	-2.2	1.0	-1.0
Average Ambient Pressure (kpa)	102.12	101.71	101.36	100.33	100.91	100.90	101.71	102.30
Average Actual Flow Rate on Chart Recorder (cfm)	46	50	51	49	50	51	51	52
Average Actual Flow Rate with Calibration Correction (m ³ /min)	1.74	1.76	1.95	1.70	1.91	1.82	1.97	1.86
Average Standard Flow Rate (sm ³ /min)	1.90	1.90	2.09	1.79	2.06	1.99	2.15	2.06
Sampling Time (min)	1440	9360	1440	1440	1440	1440	1440	1440
Total Standard Sample Volume (sm ³)	2742	17797	3015	2573	2962	2866	3091	2968
Mass Particulate Collected on Filter (mg)	16.4	76.2	31.3	5	26.7	5.3	16.9	10.9
Particulate Concentration (ug/sm ³)	6.0	4.3	10.4	1.9	9.0	1.8	5.5	3.7
Metals - mass collected on filter (ug)								
Arsenic (As)	6		6		6		6	
Cadmium (Cd)	2		2		2		2	
Chromium (Cr)	2		2		2		2.0	
Cobalt (Co)	2		2		2		2	
Copper (Cu)	422		627		563		488	
Iron (Fe)	163		374		228		177	
Lead (Pb)	3.2		6.8		8.7		3	
Manganese (Mn)	11.6		20.7		12.9		17.8	
Nickel (Ni)	3		3		3.3		3	
Selenium (Se)	10		10		10		10	
Sulphur (S)	325		1720		1170		568	
Vanadium (V)	2		2		2.3		2	
Zinc (Zn)	22.1		42.6		40.5		31.7	
Metals Concentrations (ug/m3)								
Arsenic (As)	2.2E-03		2.0E-03		2.0E-03		1.9E-03	
Cadmium (Cd)	7.3E-04		6.6E-04		6.8E-04		6.5E-04	
Chromium (Cr)	7.3E-04		6.6E-04		6.8E-04		6.5E-04	
Cobalt (Co)	7.3E-04		6.6E-04		6.8E-04		6.5E-04	
Copper (Cu)	0.15		0.21		0.19		0.16	
Iron (Fe)	0.06		0.12		0.08		0.06	
Lead (Pb)	1.2E-03		2.3E-03		2.9E-03		9.7E-04	
Manganese (Mn)	4.2E-03		6.9E-03		4.4E-03		5.8E-03	
Nickel (Ni)	1.1E-03		1.0E-03		1.1E-03		9.7E-04	
Selenium (Se)	3.6E-03		3.3E-03		3.4E-03		3.2E-03	
Sulphur (S)	0.12		0.57		0.39		0.18	
Vanadium (V)	7.3E-04		6.6E-04		7.8E-04		6.5E-04	
Zinc (Zn)	8.1E-03		0.01		0.01		0.01	

Sampling Schedule

Particulate Samples

Filter ID	Start Time	Stop Time	Sample Duration (hrs)
TSP			
TSP-13	Nov 6/2011 0:00	Nov 7/2011 0:00	24
TSP-14	Nov 13/2011 0:00	Nov 14/2011 0:00	24
TSP-15	Nov 20/2011 0:00	Nov 21/2011 0:00	24
TSP-16	Nov 29/2011 0:00	Nov 30/2011 0:00	24
PM2.5			
PM2.5-13	Nov 4/2011 0:00	Nov 10/2011 12:25	156
PM2.5-14	Nov 11/2011 0:00	Nov 12/2011 0:00	24
PM2.5-15	Nov 18/2011 0:00	Nov 19/2011 0:00	24
PM2.5-16	Nov 27/2011 0:00	Nov 28/2011 0:00	24

SO2/NO2 Passive Samples

Sample ID	Sample Period	
	Start Time	Stop Time
SO2/NO2 - 13	Nov 3/2011 13:11	Nov 10/2011 12:46
SO2/NO2 - 14	Nov 10/2011 12:46	Nov 17/2011 11:45
SO2/NO2 - 15	Nov 17/2011 11:45	Nov 24/2011 13:35
SO2/NO2 - 16	Nov 24/2011 13:35	Dec 1/2011 15:46

Daily Average Weather Data

Filter ID	Start Time	Stop Time	Average Temp ('C)	Average Pressure (kPa)
TSP				
TSP-13	11/6/11 0:00	11/7/11 0:00	2.1	102.1
TSP-14	11/13/11 0:00	11/14/11 0:00	4.4	101.4
TSP-15	11/20/11 0:00	11/21/11 0:00	2.3	100.9
TSP-16	11/29/11 0:00	11/30/11 0:00	1.0	101.7
PM2.5				
PM2.5-13	11/4/11 0:00	11/10/11 12:25	4.4	101.7
PM2.5-14	11/11/11 0:00	11/12/11 0:00	7.9	100.3
PM2.5-15	11/18/11 0:00	11/19/11 0:00	-2.2	100.9
PM2.5-16	11/27/11 0:00	11/28/11 0:00	-1.0	102.3

Hi-vol Flow Chart Readings

Filter ID	Start Time	Stop Time	Average Chart Flow Rate (CFM)
TSP			
TSP-13	Nov 6/2011 0:00	Nov 7/2011 0:00	46
TSP-14	Nov 13/2011 0:00	Nov 14/2011 0:00	51
TSP-15	Nov 20/2011 0:00	Nov 21/2011 0:00	50
TSP-16	Nov 29/2011 0:00	Nov 30/2011 0:00	51
PM2.5			
PM2.5-13	Nov 4/2011 0:00	Nov 10/2011 12:25	50
PM2.5-14	Nov 11/2011 0:00	Nov 12/2011 0:00	49
PM2.5-15	Nov 18/2011 0:00	Nov 19/2011 0:00	51
PM2.5-16	Nov 27/2011 0:00	Nov 28/2011 0:00	52

Ambient Air Quality Results - Week 17-20

Sisson Project
121810356 Task 400.110.102
Results Summary

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Particulate Matter Results

Filter ID	Start Time	Stop Time	Measured Concentration (ug/m3)	NBENV Objective/ CCME CWS for PM2.5 (ug/m3)
TSP				
TSP-17	Dec 6/2011 0:00	Dec 7/2011 0:00	6.3	120
TSP-18	Dec 13/2011 0:00	Dec 14/2011 0:00	7.6	
TSP-19	Dec 20/2011 0:00	Dec 21/2011 0:00	8.7	
TSP-20	Jan 10/2012 0:00	Jan 11/2012 0:00	3.8	
PM2.5				
PM2.5-17	Dec 4/2011 0:00	Dec 5/2011 0:00	4.2	30
PM2.5-18	Dec 8/2011 0:00	Dec 9/2011 0:00	3.2	
PM2.5-19	Dec 18/2011 0:00	Dec 19/2011 0:00	2.3	
PM2.5-20	Jan 8/2012 0:00	Jan 9/2012 0:00	3.0	

*sample damaged due to equipment operational issues, measurement not available for this sample

Metals Results

Metals	Measured Concentration (ug/m3)				OMOE 24 hr Criteria (ug/m3)
	TSP/Metals-17 6-Dec-11	TSP/Metals-18 13-Dec-11	TSP/Metals-19 20-Dec-11	TSP/Metals-20 10-Jan-12	
Arsenic (As)	2.0E-03	1.9E-03	1.9E-03	2.0E-03	0.3
Cadmium (Cd)	6.8E-04	6.4E-04	6.3E-04	6.8E-04	0.025
Chromium (Cr)	6.8E-04	7.0E-04	8.5E-04	6.8E-04	1.5
Cobalt (Co)	6.8E-04	6.4E-04	6.3E-04	6.8E-04	0.1
Copper (Cu)	0.20	0.28	0.22	0.10	50
Iron (Fe)	0.07	0.05	0.14	0.05	-
Lead (Pb)	1.6E-03	2.4E-03	1.6E-03	1.5E-03	0.5
Manganese (Mn)	6.2E-03	4.3E-03	4.1E-03	5.0E-03	2.5
Nickel (Ni)	1.0E-03	9.5E-04	9.5E-04	1.0E-03	2
Selenium (Se)	3.4E-03	3.2E-03	3.2E-03	3.4E-03	10
Sulphur (S)	0.43	0.42	0.27	0.16	-
Vanadium (V)	6.8E-04	6.4E-04	6.3E-04	6.8E-04	2
Zinc (Zn)	9.7E-03	0.02	0.02	8.3E-03	120

OMOE 2008. Ontario Ministry of the Environment Ambient Air Quality Criteria. February 2008. Available online at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079182.pdf.

SO2/NO2 Passive Sample Results

Sample ID	Start Time	Stop Time	Weekly Average Measured Concentration (ug/m3)
Sulphur Dioxide (SO2)			
SO2-17	Dec 1/2011 15:46	Dec 8/2011 12:10	1.05
SO2-18	Dec 8/2011 12:10	Dec 14/2011 15:10	1.05
SO2-19	Dec 14/2011 15:10	Dec 21/2011 13:00	1.05
SO2-20	Jan 5/2012 13:30	Jan 12/2012 10:45	1.05
Nitrogen Dioxide (NO2)			
NO2-17	Dec 1/2011 15:46	Dec 8/2011 12:10	0.75
NO2-18	Dec 8/2011 12:10	Dec 14/2011 15:10	2.07
NO2-19	Dec 14/2011 15:10	Dec 21/2011 13:00	2.82
NO2-20	Jan 5/2012 13:30	Jan 12/2012 10:45	3.01

Calculations - Sisson Hi-Vols
 Napadogan Site
 121810356
 Task 400.110.102

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Sampling ID	TSP-17	PM2.5-17	TSP-18	PM2.5-18	TSP-19	PM2.5-19	TSP-20	PM2.5-20
Sampling Date	6-Nov-11	4-Nov-11	13-Nov-11	11-Nov-11	20-Nov-11	18-Nov-11	29-Nov-11	27-Nov-11
Average Ambient Temperature (Celcius)	3.7	-0.6	-5.4	-1.4	-5.7	-11.0	-3.8	-3.8
Average Ambient Pressure (kpa)	101.38	102.69	100.43	100.40	100.76	101.72	100.16	100.89
Average Actual Flow Rate on Chart Recorder (cfm)	50	51	51	52	51	53	49	51
Average Actual Flow Rate with Calibration Correction (m ³ /min)	1.91	1.83	1.98	1.85	1.98	1.93	1.88	1.82
Average Standard Flow Rate (sm ³ /min)	2.06	2.03	2.18	2.01	2.20	2.21	2.06	2.01
Sampling Time (min)	1440	1440	1440	1440	1440	1440	1440	1440
Total Standard Sample Volume (sm ³)	2959	2918	3145	2890	3167	3179	2962	2891
Mass Particulate Collected on Filter (mg)	18.6	12.2	24.0	9.2	27.4	7.2	11.4	8.7
Particulate Concentration (ug/sm³)	6.3	4.2	7.6	3.2	8.7	2.3	3.8	3.0
Metals - mass collected on filter (ug)								
Arsenic (As)	6		6		6		6	
Cadmium (Cd)	2		2		2		2	
Chromium (Cr)	2		2.2		2.7		2	
Cobalt (Co)	2		2		2		2	
Copper (Cu)	598		872		685		290	
Iron (Fe)	218		144		454		148	
Lead (Pb)	4.7		7.4		5.0		4.5	
Manganese (Mn)	18.4		13.5		13.1		14.8	
Nickel (Ni)	3		3		3		3	
Selenium (Se)	10		10		10		10	
Sulphur (S)	1260		1320		852		472	
Vanadium (V)	2		2		2		2	
Zinc (Zn)	28.7		56.0		62.2		24.6	
Metals Concentrations (ug/m3)								
Arsenic (As)	2.0E-03		1.9E-03		1.9E-03		2.0E-03	
Cadmium (Cd)	6.8E-04		6.4E-04		6.3E-04		6.8E-04	
Chromium (Cr)	6.8E-04		7.0E-04		8.5E-04		6.8E-04	
Cobalt (Co)	6.8E-04		6.4E-04		6.3E-04		6.8E-04	
Copper (Cu)	0.20		0.28		0.22		0.10	
Iron (Fe)	0.07		0.05		0.14		0.05	
Lead (Pb)	1.6E-03		2.4E-03		1.6E-03		1.5E-03	
Manganese (Mn)	6.2E-03		4.3E-03		4.1E-03		5.0E-03	
Nickel (Ni)	1.0E-03		9.5E-04		9.5E-04		1.0E-03	
Selenium (Se)	3.4E-03		3.2E-03		3.2E-03		3.4E-03	
Sulphur (S)	0.43		0.42		0.27		0.159336051	
Vanadium (V)	6.8E-04		6.4E-04		6.3E-04		6.8E-04	
Zinc (Zn)	9.7E-03		0.02		0.02		8.3E-03	

Sampling Schedule

Particulate Samples

Filter ID	Start Time	Stop Time	Sample Duration (hrs)
TSP			
TSP-17	Dec 6/2011 0:00	Dec 7/2011 0:00	24
TSP-18	Dec 13/2011 0:00	Dec 14/2011 0:00	24
TSP-19	Dec 20/2011 0:00	Dec 21/2011 0:00	24
TSP-20	Jan 10/2012 0:00	Jan 11/2012 0:00	24
PM2.5			
PM2.5-17	Dec 4/2011 0:00	Dec 5/2011 0:00	24
PM2.5-18	Dec 8/2011 0:00	Dec 9/2011 0:00	24
PM2.5-19	Dec 18/2011 0:00	Dec 19/2011 0:00	24
PM2.5-20	Jan 8/2012 0:00	Jan 9/2012 0:00	24

SO2/NO2 Passive Samples

Sample ID	Sample Period	
	Start Time	Stop Time
SO2/NO2 - 17	Dec 1/2011 15:46	Dec 8/2011 12:10
SO2/NO2 - 18	Dec 8/2011 12:10	Dec 14/2011 15:10
SO2/NO2 - 19	Dec 14/2011 15:10	Dec 21/2011 13:00
SO2/NO2 - 20	Jan 5/2012 13:30	Jan 12/2012 10:45

Daily Average Weather Data

Filter ID	Start Time	Stop Time	Average Temp ('C)	Average Pressure (kPa)
TSP				
TSP-17	12/6/11 0:00	12/7/11 0:00	3.7	101.4
TSP-18	12/13/11 0:00	12/14/11 0:00	-5.4	100.4
TSP-19	12/20/11 0:00	12/21/11 0:00	-5.7	100.8
TSP-20	1/10/12 0:00	1/11/12 0:00	-3.8	100.2
PM2.5				
PM2.5-17	12/4/11 0:00	12/5/11 0:00	-0.6	102.7
PM2.5-18	12/8/11 0:00	12/9/11 0:00	-1.4	100.4
PM2.5-19	12/18/11 0:00	12/19/11 0:00	-11.0	101.7
PM2.5-20	1/8/12 0:00	1/9/12 0:00	-3.8	100.9

Hi-vol Flow Chart Readings

Filter ID	Start Time	Stop Time	Average Chart Flow Rate (CFM)
TSP			
TSP-17	Dec 6/2011 0:00	Dec 7/2011 0:00	50
TSP-18	Dec 13/2011 0:00	Dec 14/2011 0:00	51
TSP-19	Dec 20/2011 0:00	Dec 21/2011 0:00	51
TSP-20	Jan 10/2012 0:00	Jan 11/2012 0:00	49
PM2.5			
PM2.5-17	Dec 4/2011 0:00	Dec 5/2011 0:00	51
PM2.5-18	Dec 8/2011 0:00	Dec 9/2011 0:00	52
PM2.5-19	Dec 18/2011 0:00	Dec 19/2011 0:00	53
PM2.5-20	Jan 8/2012 0:00	Jan 9/2012 0:00	51

Ambient Air Quality Results - Week 21-24

Sisson Project
121810356 Task 400.110.102
Results Summary

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Particulate Matter Results

Filter ID	Start Time	Stop Time	Measured Concentration (ug/m3)	NBENV Objective/CCME CWS for PM2.5 (ug/m3)
TSP				
TSP-21	Jan 17/2012 0:00	Jan 18/2012 0:00	8.8	120
TSP-22	Jan 24/2012 0:00	Jan 25/2012 0:00	3.7	
TSP-23	Jan 31/2012 0:00	Feb 1/2012 0:00	8.8	
TSP-24	Feb 7/2012 0:00	Feb 8/2012 0:00	4.4	
PM2.5				
PM2.5-21	Jan 15/2012 0:00	Jan 16/2012 0:00	1.5	30
PM2.5-22	Jan 22/2012 0:00	Jan 23/2012 0:00	2.7	
PM2.5-23	Jan 29/2012 0:00	Jan 30/2012 0:00	3.0	
PM2.5-24	Feb 5/2012 0:00	Feb 6/2012 0:00	5.1	

*sample damaged due to equipment operational issues, measurement not available for this sample

Metals Results

Metals	Measured Concentration (ug/m3)				OMOE 24 hr Criteria (ug/m3)
	TSP/Metals-21 17-Jan-12	TSP/Metals-22 24-Jan-12	TSP/Metals-23 31-Jan-12	TSP/Metals-24 7-Feb-12	
Arsenic (As)	2.0E-03	2.0E-03	1.8E-03	2.0E-03	0.3
Cadmium (Cd)	6.6E-04	6.8E-04	6.0E-04	6.5E-04	0.025
Chromium (Cr)	1.1E-03	6.8E-04	6.0E-04	6.5E-04	1.5
Cobalt (Co)	6.6E-04	6.8E-04	6.0E-04	6.5E-04	0.1
Copper (Cu)	0.27	0.27	0.20	0.27	50
Iron (Fe)	0.08	0.02	0.16	0.04	-
Lead (Pb)	4.1E-03	2.2E-03	9.1E-04	9.8E-04	0.5
Manganese (Mn)	7.8E-03	6.3E-03	5.8E-03	2.6E-03	2.5
Total Mercury (Hg)	6.6E-06	6.8E-06	6.0E-06	6.5E-06	2
Nickel (Ni)	9.8E-04	1.0E-03	9.1E-04	9.8E-04	2
Selenium (Se)	3.3E-03	3.4E-03	3.0E-03	3.3E-03	10
Sulphur (S)	0.44	0.23	0.15	0.18	-
Tungsten (W)	1.5E-03	1.5E-03	1.4E-03	1.5E-03	-
Vanadium (V)	6.6E-04	6.8E-04	6.0E-04	6.5E-04	2
Zinc (Zn)	2.4E-02	0.01	0.01	5.5E-03	120

OMOE 2008. Ontario Ministry of the Environment Ambient Air Quality Criteria. February 2008. Available online at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079182.pdf.

SO2/NO2 Passive Sample Results

Sample ID	Start Time	Stop Time	Weekly Average Measured Concentration (ug/m3)
Sulphur Dioxide (SO2)			
SO2-21	Jan 12/2012 10:45	Jan 19/2012 14:25	1.31
SO2-22	Jan 19/2012 14:25	Jan 26/2012 13:30	1.57
SO2-23	Jan 26/2012 13:30	Feb 2/2012 13:40	1.31
SO2-24	Feb 2/2012 13:40	Feb 9/2012 14:19	1.05
Nitrogen Dioxide (NO2)			
NO2-21	Jan 12/2012 10:45	Jan 19/2012 14:25	2.63
NO2-22	Jan 19/2012 14:25	Jan 26/2012 13:30	4.71
NO2-23	Jan 26/2012 13:30	Feb 2/2012 13:40	1.13
NO2-24	Feb 2/2012 13:40	Feb 9/2012 14:19	1.88

Calculations - Sisson Hi-Vols
 Napadogan Site
 121810356
 Task 400.110.102

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Sampling ID	TSP-21	PM2.5-21	TSP-22	PM2.5-22	TSP-23	PM2.5-23	TSP-24	PM2.5-24
Sampling Date	17-Jan-12	15-Jan-12	24-Jan-12	22-Jan-12	31-Jan-12	29-Jan-12	7-Feb-12	5-Feb-12
Average Ambient Temperature (Celcius)	-5.5	-19.7	3.0	-17.5	-14.3	-3.5	-5.9	-14.2
Average Ambient Pressure (kpa)	100.79	101.26	102.49	102.60	101.73	100.42	100.74	101.12
Average Actual Flow Rate on Chart Recorder (cfm)	53	55	52	54	54	53	53	54
Average Actual Flow Rate with Calibration Correction (m ³ /min)	1.91	2.02	1.86	1.99	1.99	1.87	1.91	1.96
Average Standard Flow Rate (sm ³ /min)	2.12	2.38	2.03	2.35	2.30	2.05	2.12	2.25
Sampling Time (min)	1440	1440	1440	1440	1440	1440	1440	1440
Total Standard Sample Volume (sm ³)	3051	3428	2927	3386	3315	2957	3056	3246
Mass Particulate Collected on Filter (mg)	26.7	5.1	10.9	9	29.2	9.0	13.3	16.6
Particulate Concentration (µg/sm³)	8.8	1.5	3.7	2.7	8.8	3.0	4.4	5.1
Metals - mass collected on filter (µg)								
Arsenic (As)	6		6		6		6	
Cadmium (Cd)	2		2		2		2	
Chromium (Cr)	3.4		2		2		2	
Cobalt (Co)	2		2		2		2	
Copper (Cu)	822		792		663		840	
Iron (Fe)	249		60		537		124	
Lead (Pb)	12.4		6.5		3		3	
Manganese (Mn)	23.8		18.3		19.1		7.9	
Total Mercury (Hg)	0.02		0.02		0.02		0.02	
Nickel (Ni)	3		3		3		3	
Selenium (Se)	10		10		10		10	
Sulphur (S)	1340		683		488		538	
Tungsten (W)	4.5		4.5		4.5		4.5	
Vanadium (V)	2		2		2		2	
Zinc (Zn)	72.8		21.9		19.6		16.7	
Metals Concentrations (µg/m3)								
Arsenic (As)	2.0E-03		2.0E-03		1.8E-03		2.0E-03	
Cadmium (Cd)	6.6E-04		6.8E-04		6.0E-04		6.5E-04	
Chromium (Cr)	1.1E-03		6.8E-04		6.0E-04		6.5E-04	
Cobalt (Co)	6.6E-04		6.8E-04		6.0E-04		6.5E-04	
Copper (Cu)	0.27		0.27		0.20		0.27	
Iron (Fe)	0.08		0.02		0.16		0.04	
Lead (Pb)	4.1E-03		2.2E-03		9.1E-04		9.8E-04	
Manganese (Mn)	7.8E-03		6.3E-03		5.8E-03		2.6E-03	
Total Mercury (Hg)	6.6E-06		6.8E-06		6.0E-06		6.5E-06	
Nickel (Ni)	9.8E-04		1.0E-03		9.1E-04		9.8E-04	
Selenium (Se)	3.3E-03		3.4E-03		3.0E-03		3.3E-03	
Sulphur (S)	0.44		0.23		0.15		0.18	
Tungsten (W)	1.5E-03		1.5E-03		1.4E-03		1.5E-03	
Vanadium (V)	6.6E-04		6.8E-04		6.0E-04		6.5E-04	
Zinc (Zn)	2.4E-02		0.01		0.01		5.5E-03	

Sampling Schedule

Particulate Samples

Filter ID	Start Time	Stop Time	Sample Duration (hrs)
TSP			
TSP-21	Jan 17/2012 0:00	Jan 18/2012 0:00	24
TSP-22	Jan 24/2012 0:00	Jan 25/2012 0:00	24
TSP-23	Jan 31/2012 0:00	Feb 1/2012 0:00	24
TSP-24	Feb 7/2012 0:00	Feb 8/2012 0:00	24
PM2.5			
PM2.5-21	Jan 15/2012 0:00	Jan 16/2012 0:00	24
PM2.5-22	Jan 22/2012 0:00	Jan 23/2012 0:00	24
PM2.5-23	Jan 29/2012 0:00	Jan 30/2012 0:00	24
PM2.5-24	Feb 5/2012 0:00	Feb 6/2012 0:00	24

SO2/NO2 Passive Samples

Sample ID	Sample Period	
	Start Time	Stop Time
SO2/NO2 - 21	Jan 12/2012 10:45	Jan 19/2012 14:25
SO2/NO2 - 22	Jan 19/2012 14:25	Jan 26/2012 13:30
SO2/NO2 - 23	Jan 26/2012 13:30	Feb 2/2012 13:40
SO2/NO2 - 24	Feb 2/2012 13:40	Feb 9/2012 14:19

Hi-vol Flow Chart Readings

Filter ID	Start Time	Stop Time	Average Chart Flow Rate (CFM)
TSP			
TSP-21	Jan 17/2012 0:00	Jan 18/2012 0:00	53
TSP-22	Jan 24/2012 0:00	Jan 25/2012 0:00	52
TSP-23	Jan 31/2012 0:00	Feb 1/2012 0:00	54
TSP-24	Feb 7/2012 0:00	Feb 8/2012 0:00	53
PM2.5			
PM2.5-21	Jan 15/2012 0:00	Jan 16/2012 0:00	55
PM2.5-22	Jan 22/2012 0:00	Jan 23/2012 0:00	54
PM2.5-23	Jan 29/2012 0:00	Jan 30/2012 0:00	53
PM2.5-24	Feb 5/2012 0:00	Feb 6/2012 0:00	54

Ambient Air Quality Results - Week 25-26

Sisson Project

121810356 Task 400.110.102

Results Summary

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Particulate Matter Results

Filter ID	Start Time	Stop Time	Measured Concentration (ug/m3)	NBENV Objective/ CCME CWS for PM2.5 (ug/m3)
TSP				
TSP-25	Feb 14/2012 0:00	Feb 15/2012 0:00	6.2	120
TSP-26	Feb 21/2012 0:00	Feb 22/2012 0:00	7.1	
PM2.5				
PM2.5-25	Feb 12/2012 0:00	Feb 13/2012 0:00	2.6	30
PM2.5-26	Feb 19/2012 0:00	Feb 20/2012 0:00	2.9	

*sample damaged due to equipment operational issues, measurement not available for this sample

Metals Results

Metals	Measured Concentration (ug/m3)		OMOE 24 hr Criteria (ug/m3)
	TSP/Metals-25 14-Feb-12	TSP/Metals-26 21-Feb-12	
Arsenic (As)	1.8E-03	2.0E-03	0.3
Cadmium (Cd)	6.1E-04	6.6E-04	0.025
Chromium (Cr)	6.1E-04	6.6E-04	1.5
Cobalt (Co)	6.1E-04	6.6E-04	0.1
Copper (Cu)	0.26	0.21	50
Iron (Fe)	0.04	0.17	-
Lead (Pb)	1.2E-03	9.9E-04	0.5
Manganese (Mn)	2.3E-03	4.9E-03	2.5
Total Mercury (Hg)	9.2E-06	6.6E-06	2
Nickel (Ni)	9.2E-04	9.9E-04	2
Selenium (Se)	3.1E-03	3.3E-03	10
Sulphur (S)	0.16	0.19	-
Tungsten (W)	1.4E-03	1.5E-03	-
Vanadium (V)	6.1E-04	6.6E-04	2
Zinc (Zn)	5.5E-03	4.7E-03	120

OMOE 2008. Ontario Ministry of the Environment Ambient Air Quality Criteria. February 2008. Available online at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079182.pdf.

SO2/NO2 Passive Sample Results

Sample ID	Start Time	Stop Time	Weekly Average Measured Concentration (ug/m3)
Sulphur Dioxide (SO2)			
SO2-25	Feb 12/2012 14:19	Feb 15/2012 13:00	1.05
SO2-26	Feb 15/2012 13:00	Feb 22/2012 12:00	1.05
Nitrogen Dioxide (NO2)			
NO2-25	Feb 12/2012 14:19	Feb 15/2012 13:00	4.71
NO2-26	Feb 15/2012 13:00	Feb 22/2012 12:00	3.01

Calculations - Sisson Hi-Vols
 Napadogan Site
 121810356
 Task 400.110.102

yellow highlight indicates compound was not detected in sample, and detection limit is reported

Sampling ID	TSP-25	PM2.5-25	TSP-26	PM2.5-26
Sampling Date	14-Feb-12	12-Feb-12	21-Feb-12	19-Feb-12
Average Ambient Temperature (Celcius)	-12.9	-13.2	-6.7	-3.8
Average Ambient Pressure (kpa)	101.24	99.08	101.45	100.40
Average Actual Flow Rate on Chart Recorder (cfm)	54	54	52	51
Average Actual Flow Rate with Calibration Correction (m ³ /min)	1.98	1.94	1.89	1.80
Average Standard Flow Rate (sm ³ /min)	2.27	2.17	2.11	1.97
Sampling Time (min)	1440	1440	1440	1440
Total Standard Sample Volume (sm ³)	3265	3126	3043	2840
Mass Particulate Collected on Filter (mg)	20.4	8.0	21.5	8.2
Particulate Concentration (µg/sm³)	6.2	2.6	7.1	2.9
Metals - mass collected on filter (ug)				
Arsenic (As)	6		6	
Cadmium (Cd)	2		2	
Chromium (Cr)	2		2	
Cobalt (Co)	2		2	
Copper (Cu)	861		648	
Iron (Fe)	139		527	
Lead (Pb)	3.8		3	
Manganese (Mn)	7.5		14.9	
Total Mercury (Hg)	0.03		0.02	
Nickel (Ni)	3		3	
Selenium (Se)	10		10	
Sulphur (S)	507		584	
Tungsten (W)	4.5		4.5	
Vanadium (V)	2		2	
Zinc (Zn)	18		14.3	
Metals Concentrations (ug/m3)				
Arsenic (As)	1.8E-03		2.0E-03	
Cadmium (Cd)	6.1E-04		6.6E-04	
Chromium (Cr)	6.1E-04		6.6E-04	
Cobalt (Co)	6.1E-04		6.6E-04	
Copper (Cu)	0.26		0.21	
Iron (Fe)	0.04		0.17	
Lead (Pb)	1.2E-03		9.9E-04	
Manganese (Mn)	2.3E-03		4.9E-03	
Total Mercury (Hg)	9.2E-06		6.6E-06	
Nickel (Ni)	9.2E-04		9.9E-04	
Selenium (Se)	3.1E-03		3.3E-03	
Sulphur (S)	0.16		0.19	
Tungsten (W)	1.4E-03		1.5E-03	
Vanadium (V)	6.1E-04		6.6E-04	
Zinc (Zn)	5.5E-03		4.7E-03	

Sampling Schedule

Particulate Samples

Filter ID	Start Time	Stop Time	Sample Duration (hrs)
TSP			
TSP-25	Feb 14/2012 0:00	Feb 15/2012 0:00	24
TSP-26	Feb 21/2012 0:00	Feb 22/2012 0:00	24
PM2.5			
PM2.5-25	Feb 12/2012 0:00	Feb 13/2012 0:00	24
PM2.5-26	Feb 19/2012 0:00	Feb 20/2012 0:00	24

SO2/NO2 Passive Samples

Sample ID	Sample Period	
	Start Time	Stop Time
SO2/NO2 - 25	Feb 12/2012 14:19	Feb 15/2012 13:00
SO2/NO2 - 26	Feb 15/2012 13:00	Feb 22/2012 12:00

Daily Average Weather Data

Filter ID	Start Time	Stop Time	Average Temp (°C)	Average Pressure (kPa)
TSP				
TSP-25	2/14/12 0:00	2/15/12 0:00	-12.9	101.2
TSP-26	2/21/12 0:00	2/22/12 0:00	-6.7	101.5
PM2.5				
PM2.5-25	2/12/12 0:00	2/13/12 0:00	-13.2	99.1
PM2.5-26	2/19/12 0:00	2/20/12 0:00	-3.8	100.4

Hi-vol Flow Chart Readings

Filter ID	Start Time	Stop Time	Average Chart Flow Rate (CFM)
TSP			
TSP-25	Feb 14/2012 0:00	Feb 15/2012 0:00	54
TSP-26	Feb 21/2012 0:00	Feb 22/2012 0:00	52
PM2.5			
PM2.5-25	Feb 12/2012 0:00	Feb 13/2012 0:00	54
PM2.5-26	Feb 19/2012 0:00	Feb 20/2012 0:00	51

SO2 and NO2 Passive Samples - Average Weather Data

Sample ID	Sample Period		Average Wind Speed (m/s)	Average Temperature (°C)	Average Relative Humidity (%)
	Start Time	Stop Time			
Week 1-4					
SO2/NO2 - 1	Aug 12/2011 12:30	Aug 18/2011 13:30	1.91	17.9	82.7
SO2/NO2 - 2	Aug 18/2011 13:30	Aug 25/2011 13:30	2.55	18.1	81.0
SO2/NO2 - 3	Aug 25/2011 13:30	Sep 1/2011 15:16	2.67	16.4	83.1
SO2/NO2 - 4	Sep 1/2011 15:16	Sep 7/2011 15:43	2.04	15.9	86.4
Week 5-8					
SO2/NO2 - 1	Sep 7/2011 15:43	Sep 13/2011 17:00	2.62	13.5	79.4
SO2/NO2 - 2	Sep 13/2011 17:00	Sep 22/2011 14:00	2.16	11.2	83.1
SO2/NO2 - 3	Sep 22/2011 14:00	Sep 29/2011 9:55	2.21	15.8	81.3
SO2/NO2 - 4	Sep 29/2011 9:55	Oct 6/2011 14:50	3.66	10.0	86.6
Week 9-12					
SO2/NO2 - 1	Oct 6/2011 14:50	Oct 13/2011 14:35	2.73	9.86	66.3
SO2/NO2 - 2	Oct 13/2011 14:35	Oct 20/2011 15:20	3.26	9.40	86.0
SO2/NO2 - 3	Oct 20/2011 15:20	Oct 27/2011 15:00	2.58	6.57	84.6
SO2/NO2 - 4	Oct 27/2011 15:00	Nov 3/2011 13:10	2.51	0.91	79.2
Week 13-16					
SO2/NO2 - 1	Nov 3/2011 13:11	Nov 10/2011 12:46	2.86	4.68	65.1
SO2/NO2 - 2	Nov 10/2011 12:46	Nov 17/2011 11:45	3.03	6.20	85.0
SO2/NO2 - 3	Nov 17/2011 11:45	Nov 24/2011 13:35	2.70	-3.23	74.6
SO2/NO2 - 4	Nov 24/2011 13:35	Dec 1/2011 15:46	2.98	2.76	89.0
Week 17-20					
SO2/NO2 - 1	Dec 1/2011 15:46	Dec 8/2011 12:10	2.15	-0.09	88.9
SO2/NO2 - 2	Dec 8/2011 12:10	Dec 14/2011 15:10	1.97	-8.45	81.5
SO2/NO2 - 3	Dec 14/2011 15:10	Dec 21/2011 13:00	3.24	-4.59	72.9
SO2/NO2 - 4	Jan 5/2012 13:30	Jan 12/2012 10:45	1.93	-7.78	71.5
Week 21-26					
SO2/NO2 - 1	Jan 12/2012 10:45	Jan 19/2012 14:25	3.87	-12.1	76.4
SO2/NO2 - 2	Jan 19/2012 14:25	Jan 26/2012 13:30	3.12	-9.02	81.8
SO2/NO2 - 3	Jan 26/2012 13:30	Feb 2/2012 13:40	3.33	-8.58	78.2
SO2/NO2 - 4	Feb 2/2012 13:40	Feb 9/2012 14:19	3.09	-9.85	71.5
SO2/NO2 - 5	Feb 12/2012 14:19	Feb 15/2012 13:00	3.34	-8.85	67.8
SO2/NO2 - 6	Feb 15/2012 13:00	Feb 22/2012 12:00	3.07	-3.29	73.3

Met station is approximately 10 km Southwest of the ambient monitoring location

Week 17-20 and week 25 and 26 data obtained from EC station approximately 60 km SSE

Appendix C

Napadogan Monitoring Site Photos



**Photo 1 Ambient Air Quality Monitoring Site –
Hi-Vols – Summer/Fall**



**Photo 2 Ambient Air Quality Monitoring Site –
Hi-Vols – Summer/Fall 2**



**Photo 3 Ambient Air Quality Monitoring Site –
Passive Sampler – Summer/Fall**



**Photo 4 Ambient Air Quality Monitoring Site –
Passive Sampler – Summer/Fall 2**

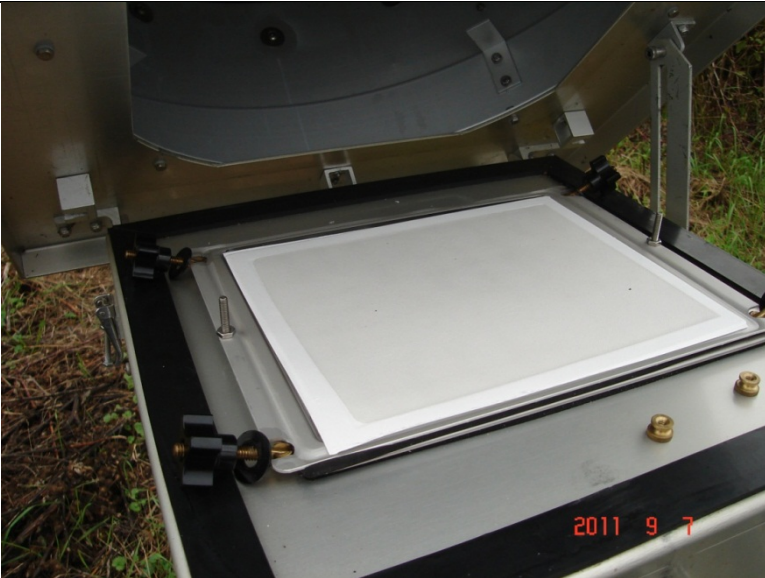


Photo 5 PM_{2.5} Filter



Photo 6 TSP/Metals Filter

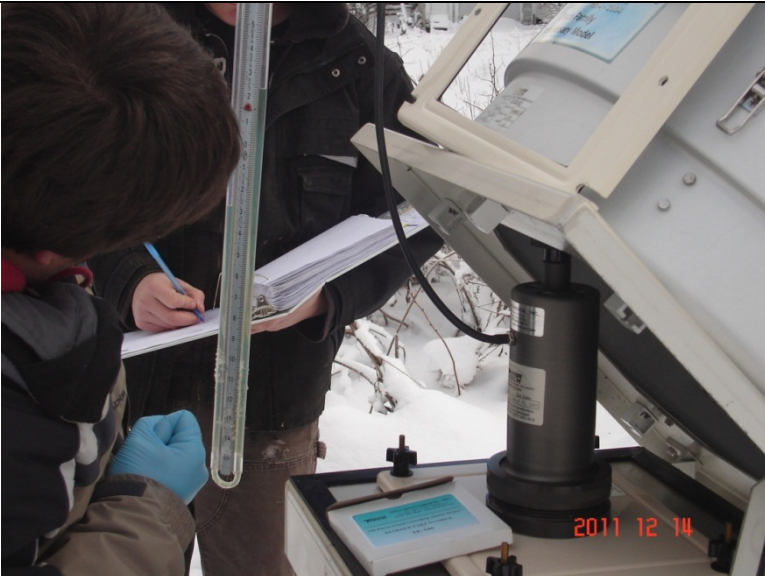


Photo 7 PM_{2.5} Hi-Vol Calibration



Photo 8 TSP Hi-Vol Calibration



Photo 9 Ambient Air Quality Monitoring Site –
Hi-Vols – Winter



Photo 10 Ambient Air Quality Monitoring Site –
Passive Sampler – Winter