Appendix V4-2B

Doris North Gold Mine Project: Air Quality Compliance Report Q1 and Q2, 2010

MAC RESOURCES

Hope Bay Mining Ltd.

DORIS NORTH GOLD MINE PROJECT
Air Quality Compliance Report
Q1 and Q2, 2010

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November 2010

DORIS NORTH GOLD MINE PROJECT

AIR QUALITY COMPLIANCE REPORT Q1 AND Q2, 2010

November 2010
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Prepared for:

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The Gold Company

Hope Bay Mining Ltd.

Prepared by:

Rescan™
Engineers and Scientists

Rescan™ Environmental Services Ltd.
Vancouver, British Columbia

Executive Summary

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Executive Summary

The following atmospheric monitoring requirements are outlined in the Doris North Gold Mine Project Certificate (NIRB No. 003, issued September 15, 2006):

1. Section 4.0. Item 8. Newmont will fund and install a weather station at the mine site to collect atmospheric data, including air temperature and precipitation. The design and location of this station shall be developed in consultation with Environment Canada officials.
2. Section 4.0. Item 30. Newmont will install and fund an atmospheric monitoring station. This station and its location shall be developed in consultation with Environment Canada and Health Canada air quality officials and focus on particulates of concern generated at the mine site. The results of air-quality monitoring are to be reported every six months to NIRB through the Monitoring Officer, and from there to all of the parties.
3. Commentary: NIRB expects that Canada Wide Standards for Dioxins and Furans and the Canada Wide Standards for Mercury will apply and should be followed including stack testing of incinerators.

This report is intended to meet the requirements outlined in bullet two above for the first six months of 2010. Separate reports will be submitted for the remaining bullets.

In order to comply with Item 30 in Section 4.0 of the Project Certificate, Hope Bay Mining Limited (HBML) along with Rescan Environmental Services (Rescan) conducted the following activities in Q1 and Q2 2010:

- Collected measurements of particulates of concern, including suspended particulate matter (by the use of two Partisol samplers which measured PM_{10}, $PM_{2.5}$ and TSP) and dustfall (seven dustfall monitoring stations); and
- Collected measurements of ambient air quality, including sulphur dioxide, nitrogen dioxide, and ozone (SO_2, NO_2 and O_3; by the use of two Passive Air Monitoring Systems (PASS)).

In addition to the existing program, two new dustfall collectors were installed in early summer 2010 to observe baseline dustfall concentrations in the south end of the belt.

The samples collected for particulate matter (PM_{10}, $PM_{2.5}$ and TSP), dustfall and SO_2, NO_2 and O_3 were analyzed at an accredited laboratory. All parameters were compared with the Nunavut Environmental Guideline for Air Quality Sulphur Dioxide and Suspended Particulates, and the National Ambient Air Quality Objectives (NAAQOs) established under the Canadian Environmental Protection Act (CEPA). The 2010 Q1 and Q2 air quality monitoring results indicated that there were no exceedances for any of the monitored parameters, and results were indicative of background concentrations associated with undeveloped areas.

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DORIS NORTH GOLD MINE PROJECT
AIR QUALITY COMPLIANCE REPORT Q1 AND Q2, 2010

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Glossary and Abbreviations

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Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

Air Quality Standards	Objectives for maximum concentrations of criteria air contaminants in the atmosphere developed to ensure long-tern protection of public health and the environment.
Ambient Air Quality	The outdoor air quality at a particular site.
ASTM	American Society for Testing and Materials.
BCMoE	British Columbia Ministry of Environment.
Criteria Air Contaminants	Contaminants for which environmental regulatory agencies have established ambient air concentration limits.
Fugitive Dust	Particulate matter, often sand or mineral dust, released to the atmosphere by mechanical disruption of soil or by wind scouring.
Inhalable particulate matter (PM_{10})	PM_{10} particles are airborne particles that have a diameter of 10 µm or less and are thus a subset of total suspended particulate. The majority of PM_{10} particles are from fugitive dust sources. PM_{10} can enter the respiratory system and have been linked to health problems.
Oxides of Nitrogen (NO_x)	NO_x gas primarily consists of nitrogen oxide (NO) and nitrogen dioxide (NO_2). The gases are emitted with exhaust from combustion engines and products from blasting operations. NO_x can be converted to nitric acid in the atmosphere and thus contribute to acid deposition.
Ozone (O_3)	A colourless, odourless reactive gas naturally found in the earth's stratosphere, where it absorbs the ultraviolet component of incoming solar radiation that could be harmful to life on earth. It is also found near earth's surface where pollutants emitted from human activities react in the presence of sunlight to form ozone. How sunny weather and stagnant conditions favour ozone formulation. The principal pollutants involved in these reactions are NO_x, volatile organic carbon (VOC) and carbon monoxide (CO).
Respirable particulate matter ($PM_{2.5}$)	$PM_{2.5}$ particles are a subset of PM_{10} and are defined as particles with a diameter less than 2.5 µm. These particles are small enough to enter deep into the respiratory system. The majority of PM emitted in diesel engine exhaust is $PM_{2.5}$.
Sulphur Dioxide (SO_2)	Fossil fuel contains a small amount of organic compounds. During fuel combustion, the sulphur is oxidized and emitted as SO_2 gas with the engine exhaust. In the atmosphere, SO_2 can further oxidize to sulphate particles, which contribute to acid deposition.
TSP	Total suspended particulates (TSP) are solid matter or liquid droplets from smoke, dust, fuel ash, or condensing vapours that can be suspended in the air.
USEPA	United States Environmental Protection Agency. The USEPA has promulgated a variety of guidelines, objectives, emission factors, air dispersion modelling procedures and statutes for the protection of ambient air quality.

1. Introduction

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1. Introduction

The following atmospheric monitoring requirements are outlined in the Doris North Gold Mine Project Certificate (NIRB No. 003, issued September 15, 2006):

1. Section 4.0. Item 8. Newmont will fund and install a weather station at the mine site to collect atmospheric data, including air temperature and precipitation. The design and location of this station shall be developed in consultation with Environment Canada (EC) officials.
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- Collected measurements of ambient air quality, including sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and ozone (O_3, by the use of two Passive Air Monitoring Systems (PASS)).

As required in the Project Certificate, the locations for the instruments used to measure the above parameters along with the monitoring objectives were reviewed with Mr. Dave Fox (Air Protection Management Analyst North, Environment Canada, Yellowknife).

Chapter 2 of this report provides the results from the particulate matter (both suspended particulate matter and dustfall) measurements, and Chapter 3 of this report provides the results from the passive ambient air quality samplers for SO_2, NO_2 and O_3. Chapter 4 provides a brief discussion of the results.

2. Particulate Matter

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2. Particulate Matter

Particulate matter is a criteria air quality contaminant (CAC) associated with mining and mineral processing operations. It is generated by mobile equipment, crushing, blasting, bulk handling and storage and other associated mineral processing and construction activities. As part of the ambient air quality compliance monitoring program, particulate matter was monitored in Q1 and Q2 2010 at various locations for the concentration of suspended particulate matter and dustfall.

2.1 SUSPENDED PARTICULATE MATTER

Suspended particulate matter (SPM) in ambient air generally is a complex, multi-phase system of all airborne solid and low vapour pressure liquid particles having aerodynamic particle sizes from 0.01 to 100 µm in diameter and larger. SPM concentrations in ambient air were monitored using two Partisol samplers located on the butte near the Doris camp. The site selection, methods and results are presented below.

2.1.1 Site Selection

As with any type of ambient air monitoring study, the validity of conclusions depends on representativeness of the sample data. Therefore, the sampling location and the siting of the ambient air samplers are important.

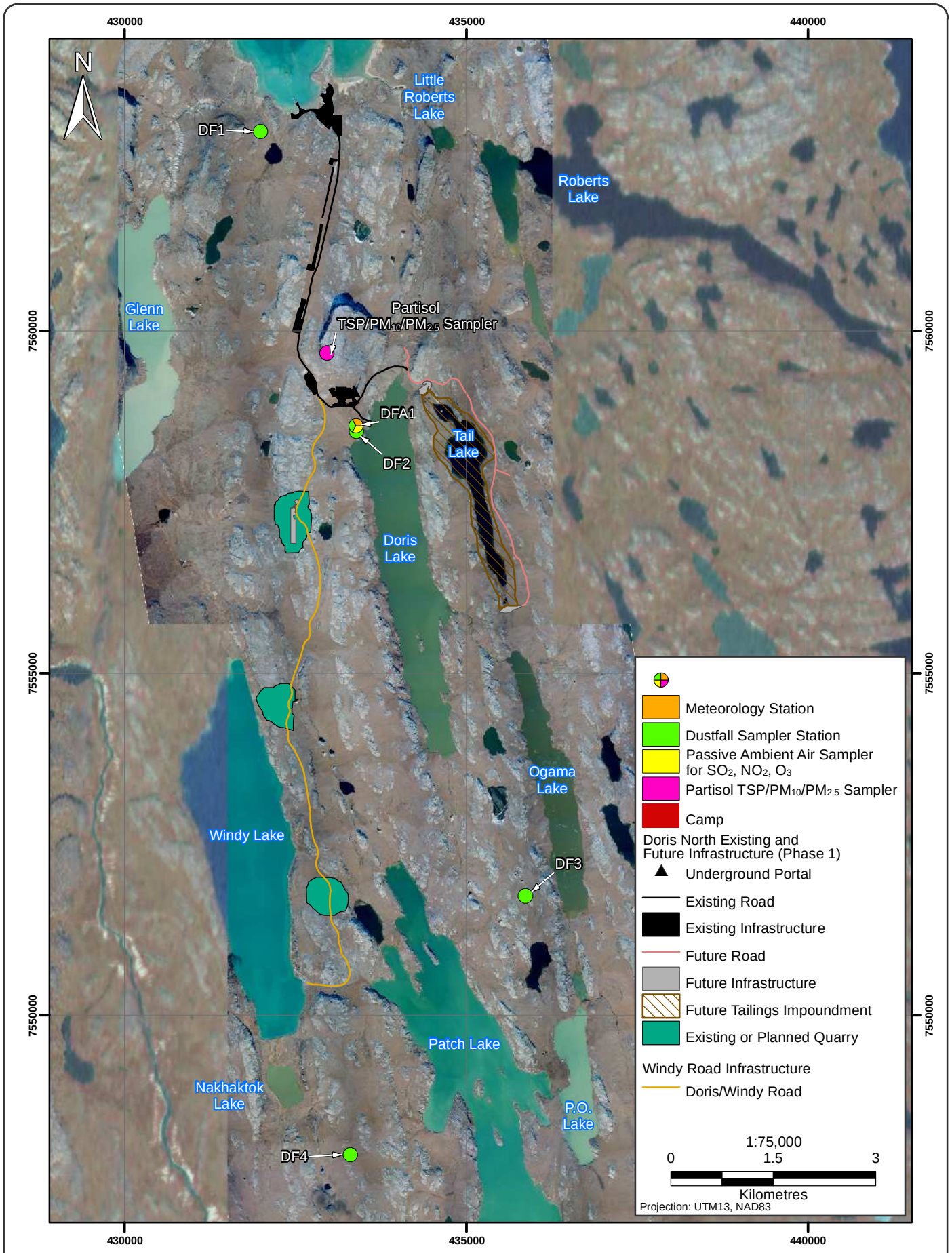
Nunavut does not have established siting requirements for ambient air samplers. Therefore, the siting criteria from the British Columbia Ministry of Environment (BC MoE 2009) and the US EPA methods (US EPA 2009 and US EPA 1999) were used.

Additional factors, not specified in standard site selection criteria, were also considered. Due to the very cold climate the Partisol samplers were installed inside a temperature controlled shelter. As a result the sample schedule interruptions potentially caused by cold weather, wet conditions and excess humidity (filter conditioning), air leaks and pump malfunctioning were minimized. The Partisol air sampler location is free from obstructions and nearby pollutant sources that may cause interference in suspended particulate monitoring (Figure 2-1.1 and Plates 2-1.1 and 2.1-2).

2.1.2 Monitoring Method

Suspended particulate matter is being monitored by the Partisol ambient air samplers in three forms; TSP, PM_{10} and $PM_{2.5}$. The Partisol plus model 2025 ambient air sampler monitors TSP and the Partisol Sequential Dichotomous Model 2025D ambient air sampler monitors PM_{10} and $PM_{2.5}$ simultaneously (Plate 2.1-3). The Partisol instruments are widely used in Canada for compliance monitoring programs and are recognized as reference equivalent methods by the US EPA (US EPA 2009).

The Partisol ambient air samplers draw a particulate-laden ambient air stream through a size-selective inlet, and then through a 47 mm diameter filter. A built-in pump provides the vacuum required to pull the air flow through the sample filter and a volume flow controller monitors and automatically adjusts the flow rate (Figure 2.1-2). The filters, approved for use with the Partisol ambient air samplers, were the Pallflex TX40H120-WW teflon coated fibre glass type. The Partisol air sampler filters are pre and post weighted at a laboratory that is accredited by the Canadian Association for Laboratory Accreditation (CALA).



Ambient Air Quality Monitoring Stations for Suspended Particulate Matter (TSP, PM_{10}, $PM_{2.5}$), Dustfall and Gases (SO_2, NO_2, O_3)

Figure 2.1-1a

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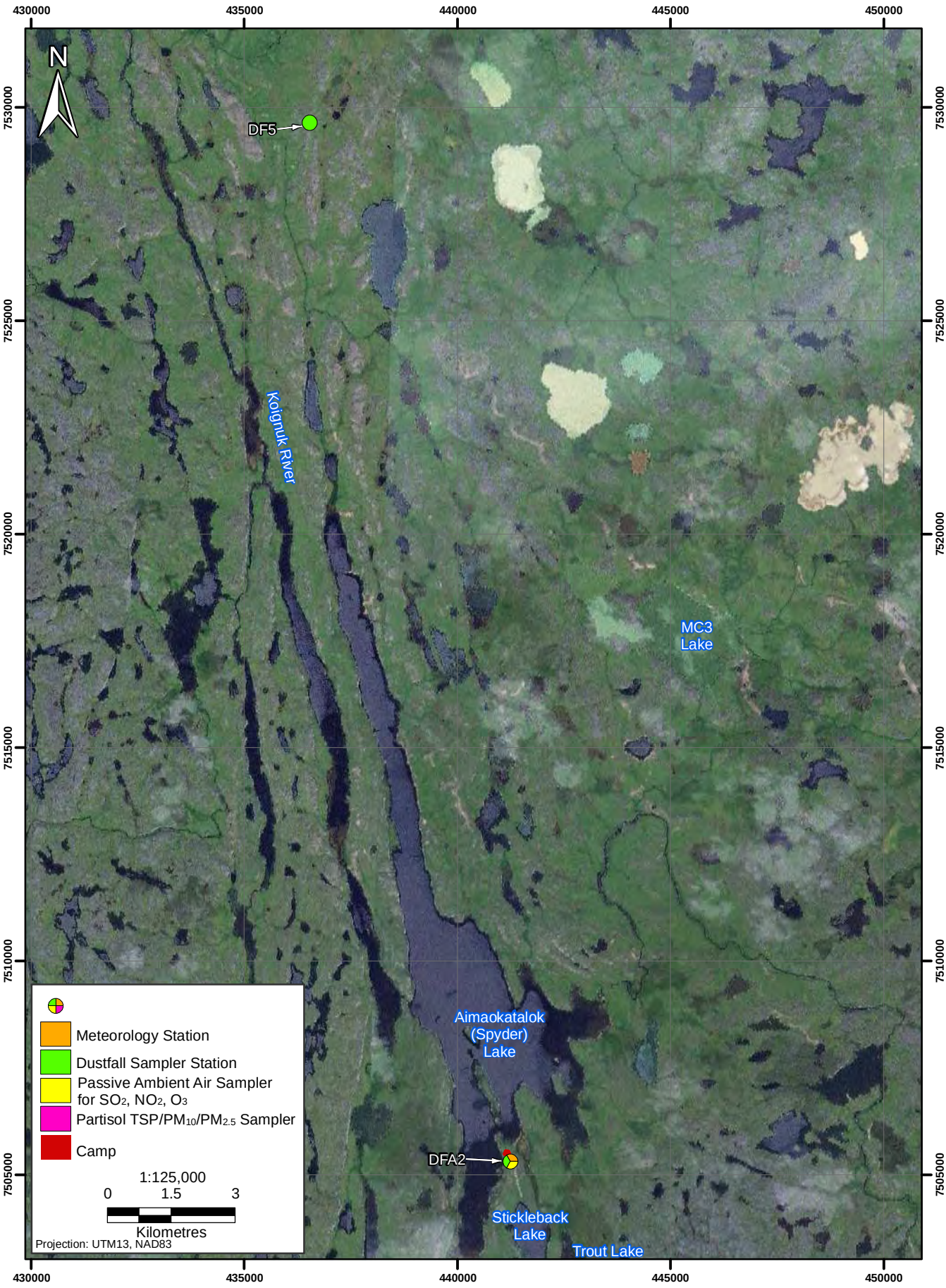

Ambient Air Quality Monitoring Stations for Suspended Particulate Matter (TSP, PM_{10}, $PM_{2.5}$), Dustfall and Gases (SO_2, NO_2, O_3)

Figure 2.1-1b

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Plate 2.1-1. The Partisol ambient air samplers are located at the top of a butte that is approximately 660 m north of the Doris camp. Doris Lake is shown in the background of this photograph.

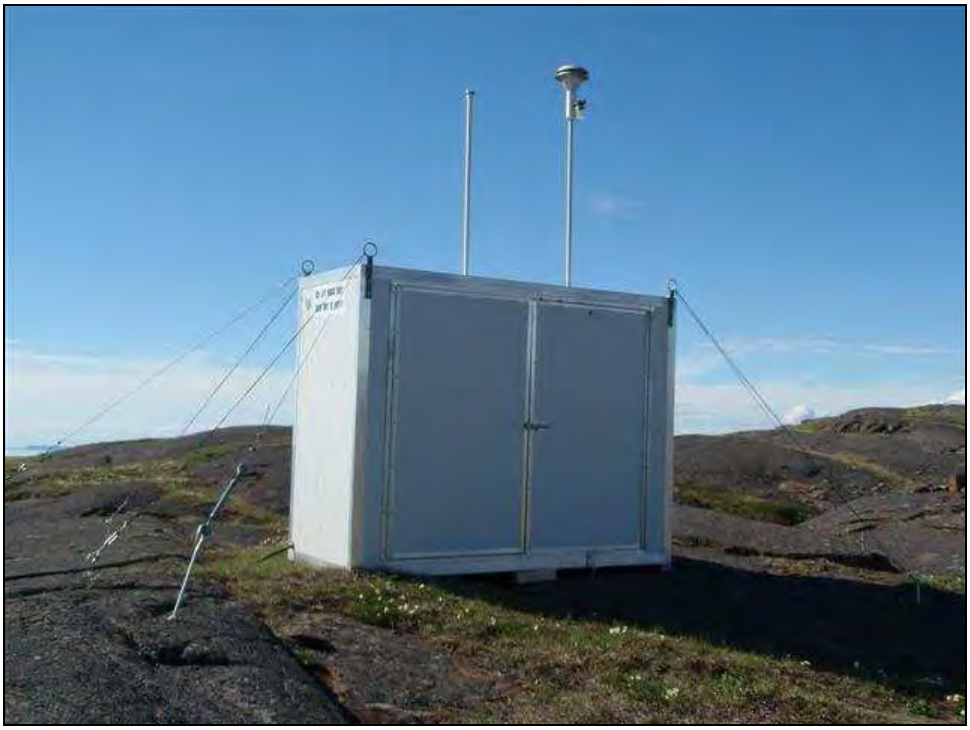
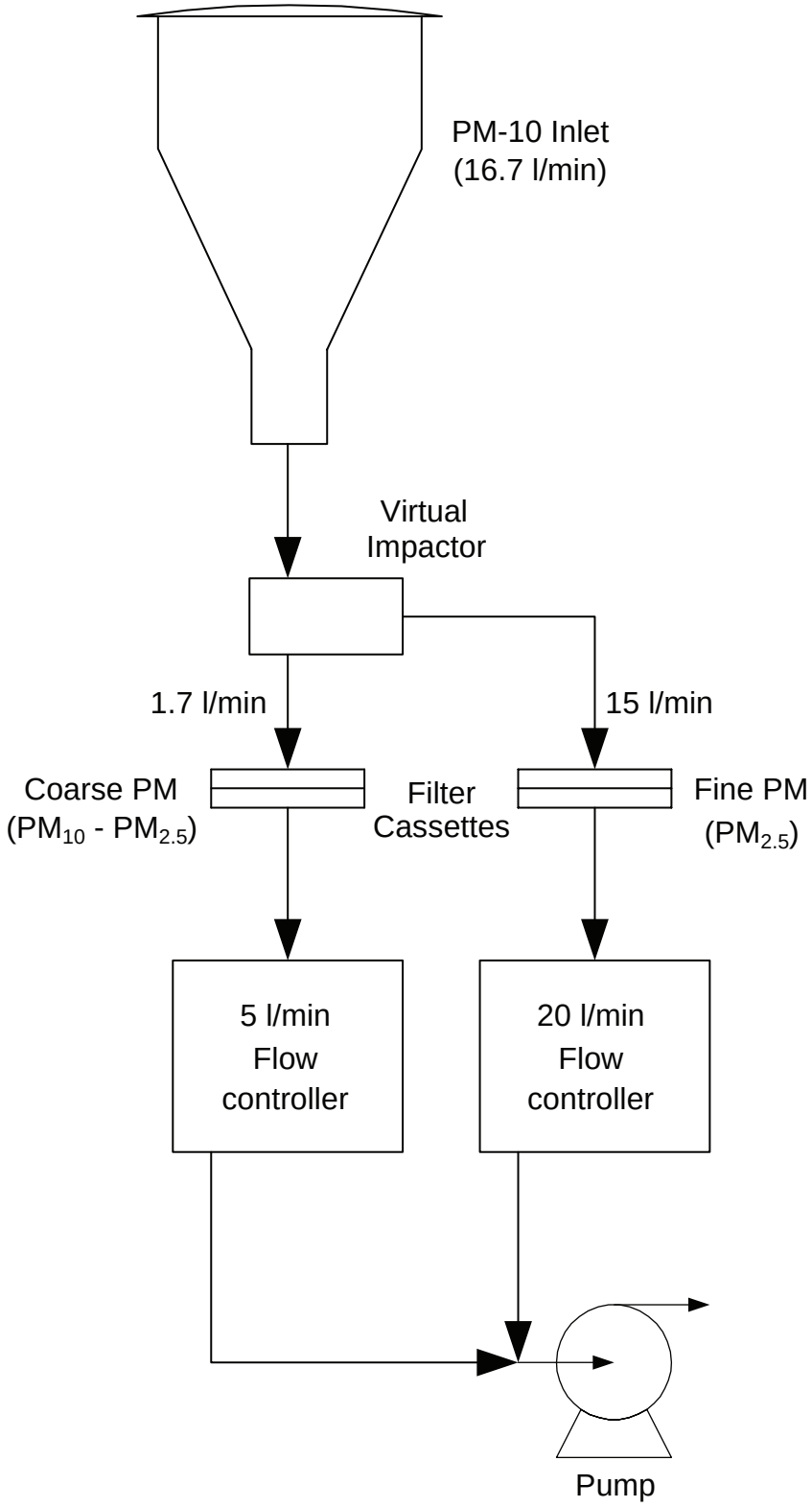


Plate 2.1-2. Temperature controlled shelter housing the Partisol ambient air samplers, early July 2010.



Source: Thermo Fisher Scientific, 2007

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Simplified Diagram for the Partisol Sequential Dichotomous Model 2025D Ambient Air Sampler

Figure 2.1-2

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Plate 2.1-3. Inside the temperature controlled shelter the Partisol sampler for TSP is shown on the left and the PM_{10}/$PM_{2.5}$ sampler is on right.

The filter exchange is performed using pneumatic pressure from the sample pump, and does not involve any special electromechanical components, belts or motors. New filter cassettes from the supply magazine (left) are pushed up and rightward to the sampling position, while the previous cassette is moved to the storage magazine (right, Plate 2.1-4). The supply and storage magazines are covered to seal off the filter cassettes thereby protecting them from environmental interferences during sampling operations.

The Partisol Plus 2025 TSP sampler (the instrument on left at Plate 2.1-3) monitors only TSP therefore, the instrument does not split the incoming ambient air and all sampling air goes through one filter.

The Partisol ambient air samplers at the Doris project are programmed to follow Environment Canada's National Air Pollution Surveillance (NAPS) schedule. The NAPS program requires 24-hour sampling every six days for particulate matter monitoring.

2.1.3 Results and Comparison

The following are results from the ambient air quality sampling program for suspended particulate matter monitored from January to June 2010. Table 2.1-1 summarizes the results from the Partisol 2025 Dichotomous sampler which provides ambient PM_{10} and $PM_{2.5}$ concentrations. The PM_{10} and $PM_{2.5}$ concentrations are representative of baseline conditions in an undisturbed remote area. There are no ambient air quality standards in Nunavut for PM_{10} and $PM_{2.5}$ therefore the Northwest Territories and Canada-Wide Standards were used to compare $PM_{2.5}$ and the British Columbia and Ontario standards for PM_{10}. The Canada-Wide Standards were created by the Canadian Council for Ministers of the Environment (CCME 2000). The PM_{10} and $PM_{2.5}$ concentrations from this reporting period were low compare to the guidelines (Table 2.1.1). The trends can be seen in Figure 2.1-3.

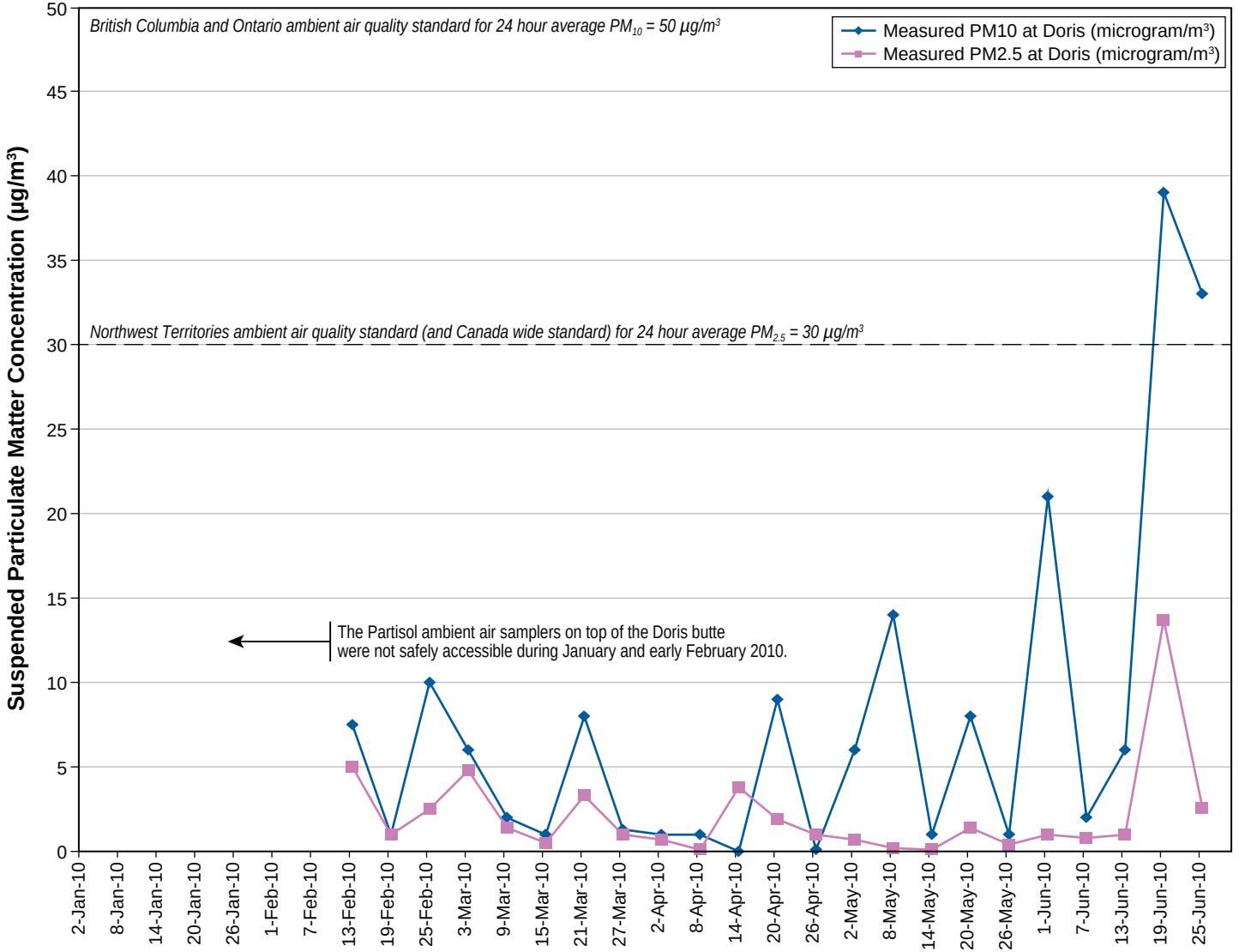

Figure 2.1-3

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PM_{10} and $PM_{2.5}$ Concentrations in Q1 and Q2 2010

Figure 2.1-3

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Plate 2.1-4. The Partisol air sampler filters are contained in a magazine on the left side of the unit. The filters laden with suspended particulate matter are contained in a magazine on the right side of the unit (PM_{10} at front and $PM_{2.5}$ at rear).

Table 2.1-1. PM_{10} and $PM_{2.5}$ Results Summary

Day	Sample Date	Measured PM_{10} at Doris (microgram/m^3)	Measured $PM_{2.5}$ at Doris (microgram/m^3)
Saturday	2-Jan-2010	n/a	n/a
Friday	8-Jan-2010	n/a	n/a
Thursday	14-Jan-2010	n/a	n/a
Wednesday	20-Jan-2010	n/a	n/a
Tuesday	26-Jan-2010	n/a	n/a
Monday	1-Feb-2010	n/a	n/a
Sunday	7-Feb-2010	n/a	n/a
Saturday	13-Feb-2010	7.5	5
Friday	19-Feb-2010	1	1
Thursday	25-Feb-2010	10	2.5
Wednesday	3-Mar-2010	6	4.8
Tuesday	9-Mar-2010	2	1.4
Monday	15-Mar-2010	1	0.5
Sunday	21-Mar-2010	8	3.3
Saturday	27-Mar-2010	1.3	1

(continued)

Table 2.1-1. PM_{10} and $PM_{2.5}$ Results Summary (completed)

Day	Sample Date	Measured PM_{10} at Doris (microgram/m^3)	Measured $PM_{2.5}$ at Doris (microgram/m^3)
Friday	2-Apr-2010	1	0.7
Thursday	8-Apr-2010	1	0.1
Wednesday	14-Apr-2010	invalid	3.8
Tuesday	20-Apr-2010	9	1.9
Monday	26-Apr-2010	0.1	1
Sunday	2-May-2010	6	0.7
Saturday	8-May-2010	14	0.2
Friday	14-May-2010	1	0.1
Thursday	20-May-2010	8	1.4
Wednesday	26-May-2010	1	0.4
Tuesday	1-Jun-2010	21	1
Monday	7-Jun-2010	2	0.8
Sunday	13-Jun-2010	6	1
Saturday	19-Jun-2010	39	13.7
Friday	25-Jun-2010	33	2.6
Guidelines *		**50**	**30**
Average		**8.1**	**2.1**

** National Ambient Air Quality Objectives for Particulate Matter (Health Canada 1998)*
n/a= not available because the Partisol ambient air samplers on top of the Doris butte were not safely accessible during January and early February 2010.

Table 2.1-2 summarizes the results from the Partisol Plus 2025 sampler which monitors TSP concentrations. None of the 24 hour TSP concentrations exceeded the Health Canada - National Ambient Air Quality Objective (NAAQO) or the Nunavut Environmental Guideline for Air Quality (Nunavut 2002) of 120 $\mu g/m^3$.

Table 2.1-2. Total Suspended Particulate (TSP) Results Summary

	Sample Date	Measured TSP at Doris ($\mu g/m^3$)
Saturday	2-Jan-2010	n/a
Friday	8-Jan-2010	n/a
Thursday	14-Jan-2010	n/a
Wednesday	20-Jan-2010	n/a
Tuesday	26-Jan-2010	n/a
Monday	1-Feb-2010	n/a
Sunday	7-Feb-2010	n/a
Saturday	13-Feb-2010	2.5
Friday	19-Feb-2010	1.7
Thursday	25-Feb-2010	6.8

(continued)

Table 2.1-2. Total Suspended Particulate (TSP) Results Summary (completed)

	Sample Date	Measured TSP at Doris (μg/m^3)
Wednesday	3-Mar-2010	7.3
Tuesday	9-Mar-2010	2.4
Monday	15-Mar-2010	4.5
Sunday	21-Mar-2010	3.7
Saturday	27-Mar-2010	1.3
Friday	2-Apr-2010	1.5
Thursday	8-Apr-2010	0.5
Wednesday	14-Apr-2010	10.9
Tuesday	20-Apr-2010	1.4
Monday	26-Apr-2010	0.2
Sunday	2-May-2010	2.9
Saturday	8-May-2010	4.1
Friday	14-May-2010	1.1
Thursday	20-May-2010	2.5
Wednesday	26-May-2010	1.1
Tuesday	1-Jun-2010	0.4
Monday	7-Jun-2010	0.9
Sunday	13-Jun-2010	1.5
Saturday	19-Jun-2010	13.9
Friday	25-Jun-2010	2.3
TSP Objective		**120 ***
TSP Average		**3.3**

** 24-hr limit specified in Canadian Ambient Air Quality Objective and the Nunavut Environmental Guideline for Air Quality.*
n/a= not available because the Partisol ambient air samplers on top of the Doris butte were not safely accessible during January and early February 2010.

Overall, the 24-hour suspended particulate matter concentrations were low. The nearest NAPS suspended particulate matter monitoring station to the Project is Yellowknife, NWT station, and the PM_{10} and $PM_{2.5}$ annual averages were 6 and 3 μg/m^3 in 2006, respectively. The only suspended particulate matter monitoring station operated by NAPS in Nunavut is located in Iqaluit and this station monitors PM_{10}. The annual average at Iqualit station for PM_{10} was 14 μg/m^3 in 2006. During the first six months of 2010, average PM_{10} and $PM_{2.5}$ concentrations at the Doris North project site were similar to NAPS Yellowknife station and PM_{10} was lower than at NAPS Iqualit station.

TSP concentrations at the Project site were lower than PM_{10} and $PM_{2.5}$ which is inaccurate because PM_{10} and $PM_{2.5}$ are subsets of TSP; therefore, the TSP concentration should be equal or higher than PM_{10} concentration. A leak test and a flow audit were performed during the periodical site visit, and the cause of these low TSP concentrations is currently being investigated and any problems with equipment or sampling procedures will be alleviated once identified. TSP concentrations are not monitored by NAPS in this region therefore there is no regional data to compare with.

2.2 DUSTFALL

The purpose of the dustfall monitoring program is to quantify the amount of dust deposition near the Project site and compare the results to the available criteria and standards.

In addition to the original five dustfall monitoring stations, in June 2010 two new dustfall stations were established in the south end of the belt. Two dustfall stations, collocated with meteorological stations, use an Alberta Environment sampling method (Alberta AMD 1989), and the remaining five stations use the ASTM 2004 method.

2.2.1 Site Selection

The two dustfall monitoring stations, which use the Alberta Environment method, are collocated at the Doris North and Boston automated meteorological stations. The remaining five dustfall stations followed the ASTM 2004 site selection recommendations. Three dustfall stations are located in the central and south portions of the belt (Figure 2.1-1a and 2.1-1b). Dominant wind directions as well as present and potential future project activities were considered during the site selection process. There are no obstructions or local sources of air pollutants near the new stations. In addition, the relatively flat topography allows for the collection of representative data (Figure 2.1-1a and 2.1-1b). The dustfall monitoring stations are in open areas that are free of structures higher than 1 m within a 20 m radius of the collection container.

2.2.2 Monitoring Method

Dustfall (settleable particulate matter) was monitored at the five dustfall monitoring stations by using the ASTM D1739-98 sampling method (ASTM 2004). The dustfall monitoring stations collect particles small enough to pass through a 1 mm screen and large enough to settle by virtue of their weight.

This method requires containers of a standard size and shape, which are sealed in a laboratory. The containers were installed on a 2 m pole, surrounded by a windscreen and were each exposed to the atmosphere for about 30 days. All dustfall results were prorated by the laboratory to a 30-day average, so that they could be compared with standards. Monthly samples were sent to the laboratory for analysis of total, soluble and insoluble particulate matter. The stations which use the ASTM method (DF1-DF5) have two dustfall collectors at each station. One of the containers is analyzed in the laboratory for particulates (total, soluble and insoluble) and anions (sulphate, nitrate, chloride, and ammonia) and the other for total metals and various cations. Because algae are an interference for dustfall measurements the deionized water in the dustfall containers also contains algaecide. The windscreen around the sample container improves the dustfall collection efficiency and bird spikes are used to minimize contaminants from bird faeces (Plate 2.2-1).

The two dustfall stations, which are collocated with Doris and Boston meteorological stations, were operated in accordance to the Alberta Environment sampling method (Alberta AMD 1989). Each station consisted of one dustfall collector. Monthly samples were sent to the laboratory for analysis of total dustfall and total fixed dustfall. Total dustfall is defined as the amount of material left after evaporation of a sample of dustfall and its subsequent drying. Total fixed dustfall is the residue that is left after ignition of the total dustfall sample (Alberta AMD 1989).

Plate 2.2-1. Dustfall monitoring station (DF4) near the Doris project site. For locations using the ASTM (2004) method two sample containers are required to provide a sufficient volume of sample for the various parameters (e.g. particulate, anions, cations, total metals). Locations using the Alberta Environment (AMD 1989) method only require one collector.

2.2.3 Results and Comparison

The dustfall results are summarized in Tables 2.2-1 and 2.2-2. During Q1 and Q2 2010 one batch of dustfall samples was collected at the stations that followed the ASTM method (DF1 to DF5). During Q1 and Q2, seven batches of dustfall samples were collected at the Doris station using the Alberta Environment sampling method and four batches of samples were collected at the Boston station. Table 2.2-3 summarizes the dustfall limits in various jurisdictions. There is no consistency in dustfall limits among various authorities and jurisdictions. Overall, the Doris project dustfall results were lower than any of the limits listed in Table 2.2-3. This was expected and indicates typical baseline levels for an undisturbed area. The dustfall results for the Alberta Environment method are summarized in Figure 2.2-1.

Table 2.2-1. Dustfall Results using the ASTM Method (mg/dm^2/day) for July 2010

Dustfall	DF1	DF2	DF3	DF4	DF5
Total	0.44	0.19	0.15	0.2	<0.10
Total Insoluble	0.25	<0.10	<0.10	<0.10	<0.10
Total Soluble	0.2	0.15	<0.10	0.16	<0.10

Note: < 0.10 = Less than the detection limit of 0.10 mg/dm^2/ day

Table 2.2-2. Dustfall Results using the Alberta Environment Method (mg/dm^2/day)

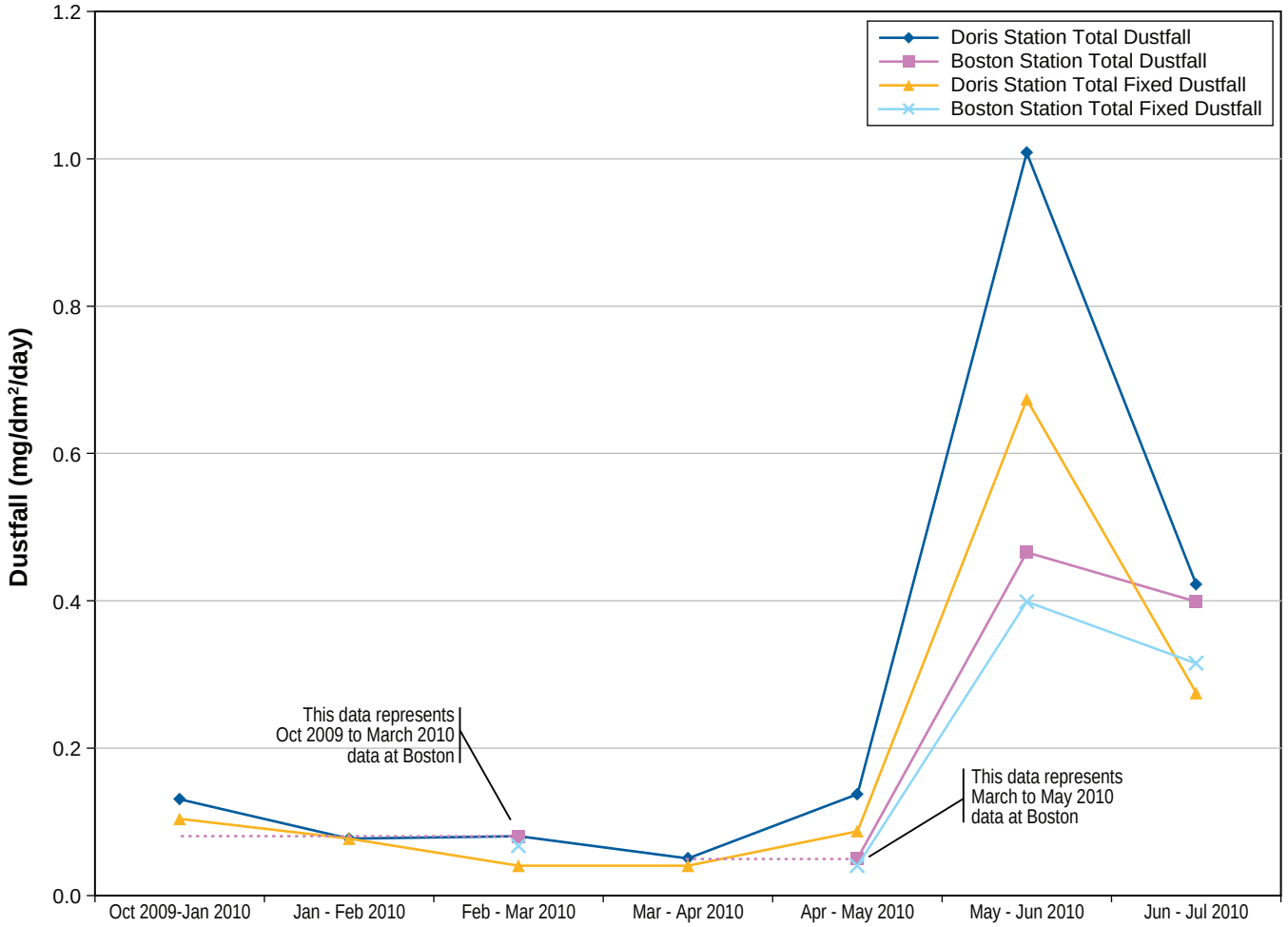
Doris Station	Oct 22, 2009 - Jan 14, 2010[1]	Jan 14 - Feb 12, 2010	Feb 12 - Mar 1, 2010	Mar 1 - Apr 3, 2010	Apr 3 - May 16, 2010	May 16 - Jun 2, 2010	Jun 2 - Jul 7, 2010
Doris Total Dustfall	0.131	0.077	0.080	0.133	0.137	1.008	0.422
Doris Total Fixed Dustfall	0.104	0.077	0.040	0.090	0.087	0.673	0.275
Boston Station			**Oct 22, 2009 - Mar 21, 2010[2]**		**Mar 21 - May 17, 2010[3]**	**May 17 - Jun 10, 2010**	**Jun 10 - Jul 1, 2010**
Boston Total Dustfall			0.080		0.050	0.466	0.399
Boston Total Fixed Dustfall			0.067		0.040	0.399	0.315

Notes: 1. The Doris station was not accessible between October 2009 and January 2010.
2. The Boston station was not accessible from October 2009 to March 2010 therefore the first sampling of 2010 consists of 5-month data. The Boston station was not accessible during April 2010.
3. The Boston station was not accessible in April 2010 therefore the second sampling at Boston consists of 2-month data.

Table 2.2-3. Dustfall Limits in Several Jurisdictions

Jurisdiction		Dustfall Criterion Level (mg/m^2/day)	Comments	Dustfall Criterion Level (mg/dm^2/day)
Alberta	Residential and recreational areas	175	averaged over 30 days	1.75
	Commercial and industrial areas	525	averaged over 30 days	5.25
Ontario		230	averaged over 30 days	2.3
Saskatchewan		667	averaged over 30 days	6.67
British Columbia Pollution Control Objective (BC MOE 1979)		170 to 290		1.7 to 2.9

The concentration of total metals in the dustfall samples was also analyzed and the laboratory results are summarized in Appendix III. Most of the metal concentrations were below the detection limits and the detectable metal concentrations were very low and for all intents and purposes would be considered negligible. There are no specific criteria for metal concentrations in settleable particulate matter. However, there are workplace or occupational air quality standards (e.g., industrial hygiene) for metals that are of concern with respect to human health. The metals that are a concern for human health are cadmium, lead and arsenic and the concentrations in the collected dustfall samples were negligible or below the detection limit.



Note: The Doris station was not accessible on a monthly basis between October 2009 and January 2010.
The Boston station was not accessible on a monthly basis between October 2009 and March 2010 and during April 2010.

Figure 2.2-1

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Doris North Project Dustfall Concentrations

Figure 2.2-1

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3. Ambient Air Quality Monitoring by Passive Samplers

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3. Ambient Air Quality Monitoring by Passive Samplers

The passive ambient air quality samplers obtained monthly average concentrations for criteria air contaminants at the Project site. The Passive ambient air samplers were attached to with the Boston and Doris automated meteorological station towers and monitored SO_2, NO_2 and O_3 (Figure 2.2-1).

3.1 SITE SELECTION

The samplers (Plate 3.1-1) were placed in environmentally safe locations where they would not be affected by weather or damaged by wildlife. They were placed far from obstructions and there were no nearby roadways that could influence measurements. One sampler was located near the Doris meteorological station (Figure 2.2-1) and the other was located near the Boston meteorological station.

Plate 3.1-1. The white circular device shown in this photo is the passive air sampling system on the Boston automated meteorological station.

3.2 MONITORING METHOD

Passive air sampling is a diffusive method which monitors gas or vapour pollutants from the atmosphere at a rate controlled by a physical process, such as diffusion through a static air layer or permeation through a membrane. The passive method does not involve the active movement of the air through the sampler; therefore no electric air moving pump is required. The number of days of contact between the ambient air and the permeation membrane is important. The local meteorological conditions are also used in the calculations. The meteorological parameters that are used in the PASS calculations are air temperature, wind speed and relative humidity.

The passive air monitoring sampling system (PASS) provides low detection limits, is very easy to install and does not require power. The passive sampler is kept under a rain shelter (Plate 3.2-1) on a tripod beside the Doris meteorological station. The other PASS monitoring site is located at the Boston meteorological station. Duplicate PASS samplers are collected at the Boston station for quality assurance and control purposes.

Plate 3.2-1. Passive air samplers under a rain shelter.

3.3 RESULTS AND COMPARISON

Monthly PASS samples were sent to Maxxam Analytical Laboratory for analysis. The PASS results and air quality guidelines are summarized in Table 3.3-1 and Table 3.3-2, respectively. The original laboratory reports are in Appendix II. The trends are presented in Figures 3.3-1 to 3.3-3.

The PASS results are expressed as monthly average concentrations; however Health Canada's National Ambient Air Quality Objectives (NAAQO) and the Nunavut Environmental Guideline for Air Quality only use averaging periods of 1-hour, 24-hour and 1-year. Therefore, the PASS results cannot be directly compared with the Canadian and Nunavut ambient air quality objectives or guidelines. After a full year of data has been collected the 1 year average SO_2, NO_2 and O_3 averages will be compared to the annual ambient air quality guidelines. This comparison will be done in the final 2010 air quality compliance report.

Overall, monthly concentrations of SO_2 and NO_2 were lower than guidelines and monthly O_3 concentrations were consistent and similar to levels estimated by Health Canada (1999) for areas that are not impacted by anthropogenic pollution. Based on Health Canada's guideline, reasonable estimates of background ozone for areas of Canada relatively unimpacted by anthropogenic pollution are:

- Daily 1 hr. Maximum (May - Sept.) 35 to 48 ppb (69 to 94 $\mu g/m^3$); and
- Monthly 1 hr. Average (May - Sept.) 25 to 40 ppb (49 to 78 $\mu g/m^3$).

As a result, the passive ambient air quality results are representative of baseline concentrations in an undisturbed area.

Table 3.3-1. Passive Ambient Air Quality Monitoring Results[1]

Doris Station	Units	Jan-2010	Feb-2010	Mar-2010	Apr-2010	May-2010	Jun-2010	Average
SO_2	$\mu g/m^3$	5.0	0.5	0.1	0.1	0.3	0.3	1.0
	ppb	1.9	0.2	0.05	0.05	0.1	0.1	0.4
NO_2	$\mu g/m^3$	9.6	4.7	1.5	1.3	0.1	0.9	3.0
	ppb	5.1	2.5	0.8	0.7	0.05	0.5	1.6
O_3	$\mu g/m^3$	62.1	51.5	69.8	71.9	69.8	52.3	62.9
	ppb	31.7	26.3	35.6	36.7	35.6	26.7	32.1
Boston Station[2]	**Units**			**Oct 2009-Mar 2010 [3]**	**Apr-2010**	**May-2010**	**Jun-2010**	**Average**
SO_2	$\mu g/m^3$			0.3	0.1	0.3	0.4	0.3
	ppb			0.1	0.05	0.1	0.15	0.1
NO_2	$\mu g/m^3$			0.1	0.1	0.1	3.4	0.9
	ppb			0.05	0.05	0.05	1.8	0.5
O_3	$\mu g/m^3$			54.1	68.5	61.3	52.1	59.0
	ppb			27.6	35.0	31.3	26.6	30.1

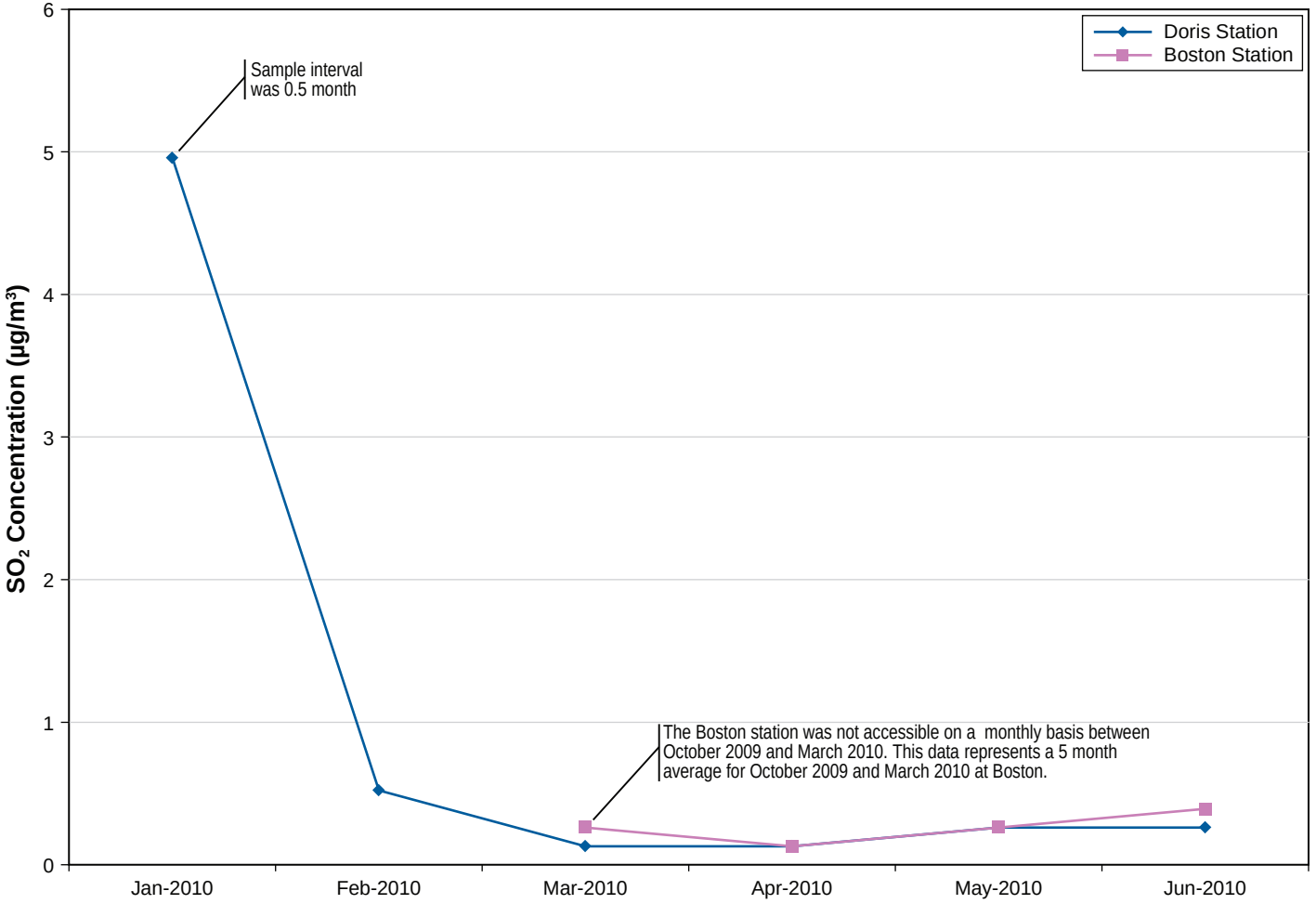
Detection limits are (0.1 ppb) (0.26 ug/m³) for SO_2, 0.1 ppb (0.188 ug/m³) for NO_2 and 0.1 ppb (0.196 ug/m³) for O_3.
1 = If the samples below detection limit (lower than 0.1 ppb) the concentration was assumed as half of the detection limit (0.05 ppb) in the table and/or in the average calculations.
2 = The average of two duplicate samples are presented.
3 = The Boston station was inaccessible between October 2009 and March 2010 therefore a 5 month average is presented.

Table 3.3-2. Ambient Air Quality Guidelines for SO_2, NO_2 and O_3

	Unit	Annual	Daily	1-Hour
SO_2 *	$\mu g/m^3$	30	150	450
NO_2 **	$\mu g/m^3$	100	200	400
O_3 **	$\mu g/m^3$	30	50	160

** Nunavut Environmental Guideline for Air Quality and National Ambient Air Quality Objectives (NAAQOs) maximum desirable level.*
*** National Ambient Air Quality Objectives (NAAQOs) maximum acceptable level established and reviewed based on recommendations under the Canadian Environmental Protection Act (CEPA)*

Although direct comparisons cannot be made between the monthly PASS results and the NAAQO and Nunavut air quality guidelines due to the different averaging periods, the concentrations of SO_2, NO_2 and O_3 during Q1 and Q2 2010 were typically low and representative of an undisturbed area.



Note: The Nunavut Environmental Guideline for Air Quality for annual average SO_2 concentrations is 30 µg/m³.

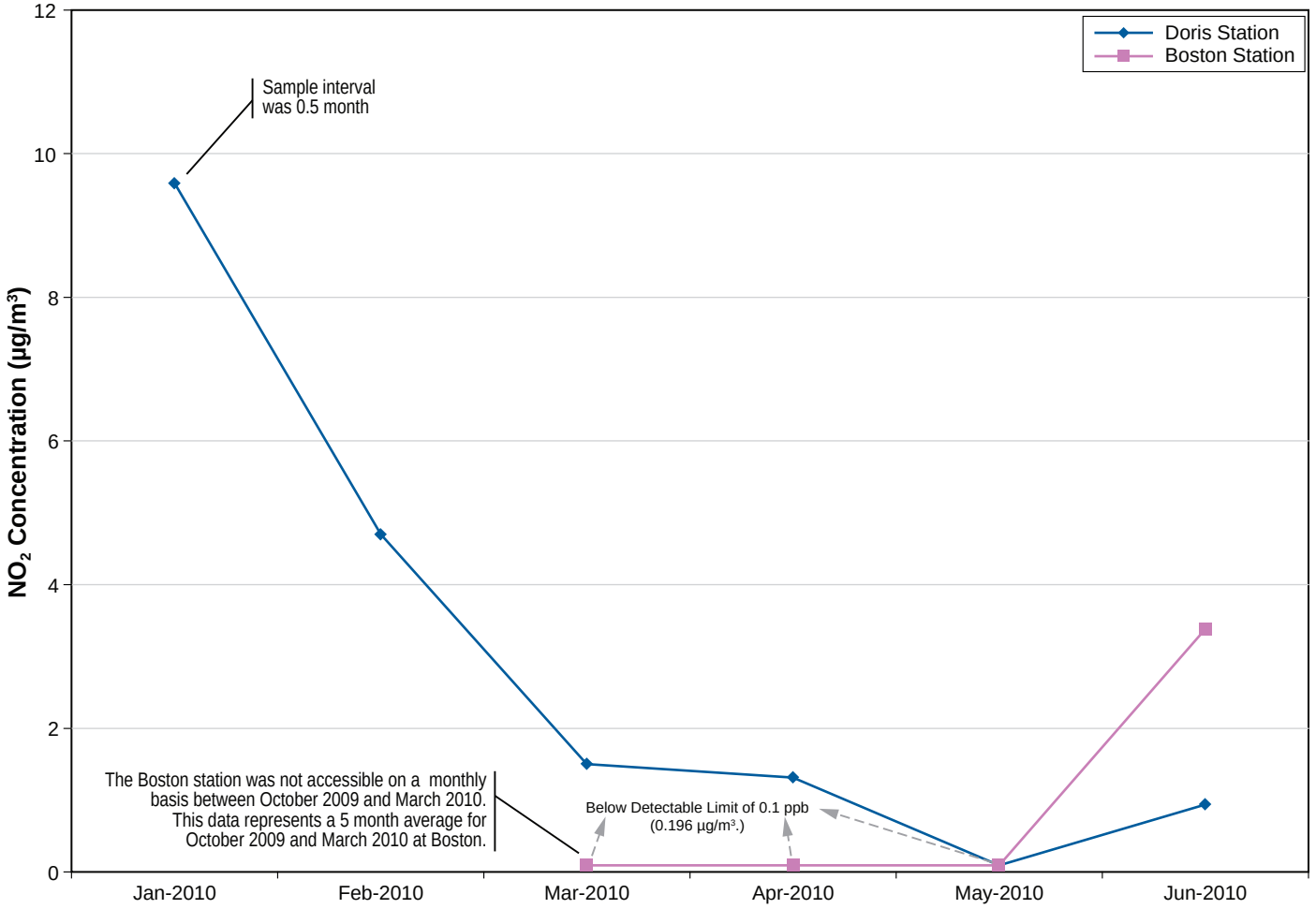
Figure 3.3-1

NEWMONT NORTH AMERICA

Doris North Project SO_2 Concentrations from the Passive Air Samplers

Figure 3.3-1

Rescan Engineers & Scientists



Note: The National Ambient Air Quality Objective for Canada for annual average NO_2 concentrations is 100 µg/m³ (maximum acceptable).

Figure 3.3-2

NEWMONT NORTH AMERICA

Doris North Project NO_2 Concentrations from the Passive Air Samplers

Figure 3.3-2

Rescan™ Engineers & Scientists

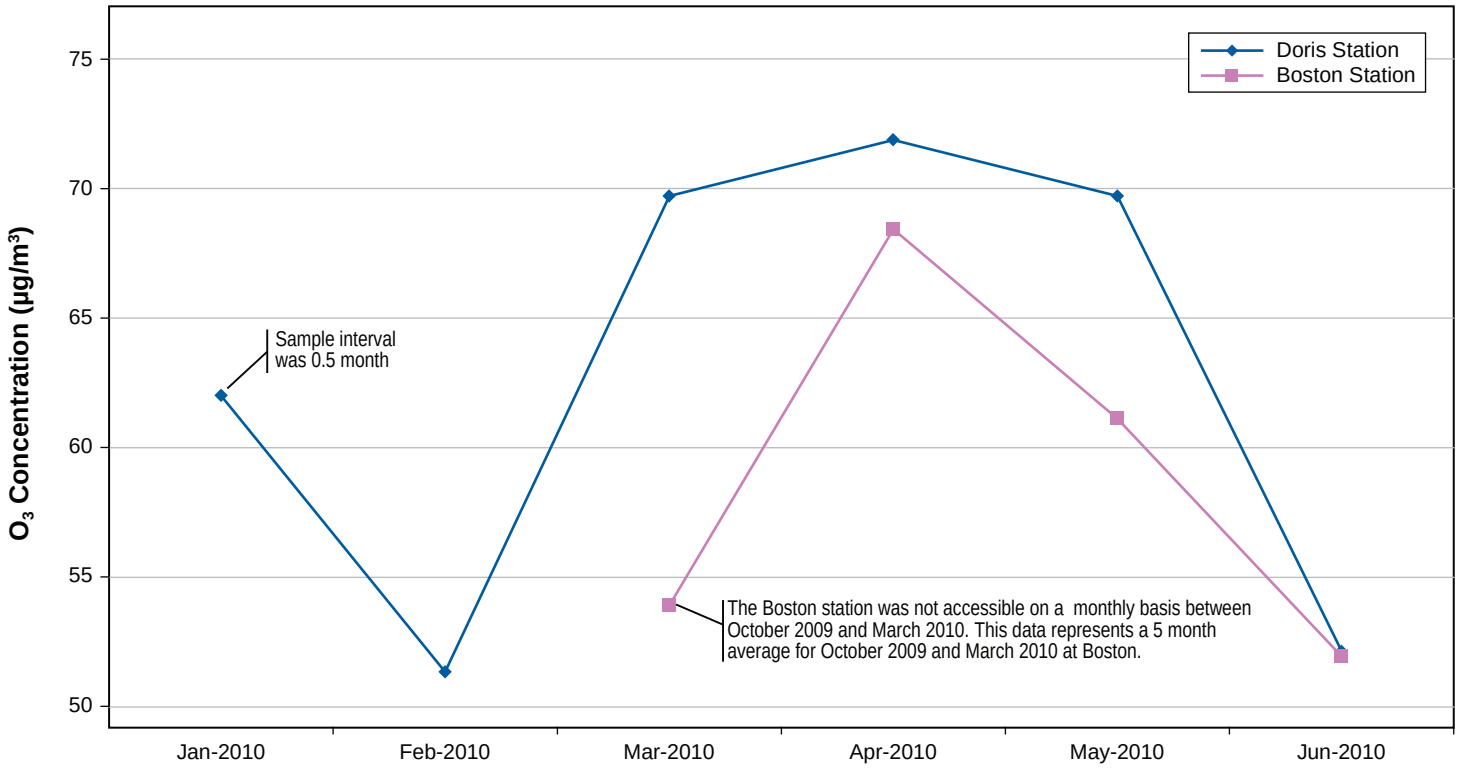


Figure 3.3-3

NEWMONT NORTH AMERICA

Doris North Project O_3 Concentrations from the Passive Air Samplers

Figure 3.3-3

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4. Results and Discussion

4. Results and Discussion

The ambient air quality monitoring program at the Doris North Project site was continued during the first six months of 2010. The program was improved by adding two dustfall stations to monitor baseline settleable particulate matter (dustfall) concentrations in the central and south portions of the belt. The previously installed passive ambient air monitoring and dustfall stations and the two Partisol ambient air quality samplers continued monitoring throughout the reporting period.

The Partisol ambient air quality samplers and program follows the Environment Canada – National Air Pollutant Surveillance (NAPS) schedule and allows for collection of a 24-hr sample every six days for each parameter (TSP, PM_{10} and $PM_{2.5}$). The PM_{10} and $PM_{2.5}$ concentrations at the Doris site were low and typical of background concentrations for remote undisturbed areas in Canada. They were also lower than the Health Canada – National Ambient Air Quality Objectives, Canada-Wide Standards and Nunavut Environmental Guidelines for Air Quality. The total suspended particulate matter concentrations at the Doris site were lower than expected; therefore, a leak test and a flow audit were performed. The sampler passed the leak test and flow audit and additional diagnostic tests are being used to determine why the results are lower than expected.

There were seven dustfall stations that were actively monitoring in the first six months of 2010. Three dustfall stations were located near the Doris site and two were located in the central and south part of the belt. All were operated according to the ASTM 1739-98 sampling method (reapproved in 2004). The other two dustfall stations located at Doris and Boston meteorological stations followed the 1985 Alberta Air Monitoring Directive Method. Dustfall results from all months and stations were below criteria from various jurisdictions. The maximum recorded dustfall concentration of 1.0 $mg/dm^2/day$ (July 2010 at Doris meteorological station) was below the Alberta (5.25 $mg/dm^2/day$) and British Columbia (1.7 to 2.3 $mg/dm^2/day$) limits (no criteria are available for Nunavut and Northwest Territories).

The passive ambient air quality monitoring program included monthly sampling for SO_2, NO_2 and O_3. The maximum observed concentrations were 5.0, 9.6 and 71.9 $\mu g/m^3$ for SO_2, NO_2 and O_3 respectively. The background concentrations were representative of a remote undisturbed area. Because of different averaging periods the PASS results (monthly average) cannot be directly compared with the Nunavut Environmental Guideline for Air Quality or Health Canada's National Ambient Air Quality Objectives – NAAQO (annual, 24-hour and 1-hour averages). Monthly average ozone concentrations at the Doris site were in the general range of background concentrations (49 to 78 $\mu g/m^3$) estimated by Health Canada (1999) for areas not effected by anthropogenic sources. SO_2 and NO_2 concentrations were lower than the National and Territorial objectives.

The ambient air quality monitoring program at the Doris site will continue with the sampling of TSP, PM_{10} and $PM_{2.5}$, monthly dustfall monitoring and passive air sampling for SO_2, NO_2 and O_3. The Boston station with Alberta Dustfall monitoring method and passive samplers will continue if winter conditions permit access to this site. Results from Q3 and Q4 of 2010 will be included in the annual 2010 report.

References

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Appendix 1

Suspended Particulate Matter Results (TSP, PM_{10} and $PM_{2.5}$) from the Partisol Ambient Air Samplers

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Maxxam Analytics

Your Project #: 1009-002-02

Attention: DAN JARRATT
RESCAN ENVIRONMENTAL SERVICES LTD.
SIXTH FLOOR
1111 WEST HASTINGS STREET
VANCOUVER, BC
CANADA V6E 2J3

Report Date: 2010/02/16

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B004921
Received: 2010/02/01, 08:41

Sample Matrix: Air
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
NO2 Passive Analysis (1)	1	2010/02/04	2010/02/16	EINDSOP-00148	Tang Passive NO2 in
O3 Passive Analysis (1)	1	2010/02/03	2010/02/16	EINDSOP-00197	EPA 300 R2.1
SO2 Passive Analysis (1)	1	2010/02/02	2010/02/16	EINDSOP-00149	Tang Passive SO2 in

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The detection limit is based on a 30 day sampling period.

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Levi Manchak
17 Feb 2010 08:28:41 -07:00

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Phone# (780) 378-8500

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Total cover pages: 1

Maxxam Analytics

Maxxam Job #: B004921
Report Date: 2010/02/16

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02

Sampler Initials: JT

RESULTS OF CHEMICAL ANALYSES OF AIR

Maxxam ID		S61296		
Sampling Date		2009/10/22		
	Units	**09DORIS-010**	**RDL**	**QC Batch**
Passive Monitoring				
Calculated NO2	ppb	0.2	0.1	3724113
Calculated O3	ppb	40.9	0.1	3720878
Calculated SO2	ppb	0.1	0.1	3719476

RDL = Reportable Detection Limit

Maxxam Analytics

Maxxam Job #: B004921
Report Date: 2010/02/16

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02

Sampler Initials: JT

General Comments

Exposure Dates: 2009/10/22 - 2010/01/14

Results relate only to the items tested.

Maxxam Analytics

RESCAN ENVIRONMENTAL SERVICES LTD.
Attention: DAN JARRATT
Client Project #: 1009-002-02
P.O. #:
Site Reference:

Quality Assurance Report

Maxxam Job Number: PB004921

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3719476 DF4	Calibration Check	Calculated SO2	2010/02/02		100	%	95 - 105
	Spiked Blank	Calculated SO2	2010/02/02		97	%	N/A
	Method Blank	Calculated SO2	2010/02/02	<0.1		ppb	
3720878 OZ	Calibration Check	Calculated O3	2010/02/03		101	%	91 - 107
	Spiked Blank	Calculated O3	2010/02/03		96	%	N/A
	Method Blank	Calculated O3	2010/02/03	<0.1		ppb	
3724113 DF4	Calibration Check	Calculated NO2	2010/02/04		97	%	76 - 118
	Spiked Blank	Calculated NO2	2010/02/04		104	%	N/A
	Method Blank	Calculated NO2	2010/02/04	<0.1		ppb	

Calibration Check: A calibration standard analyzed at different times to evaluate on-going calibration accuracy.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Analytics

Validation Signature Page

Maxxam Job #: B004921

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

LINDA LIN, Supervisor, Centre for Passive Sampling Technology

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Your Project #: 1009-002-02
Site: HOPE BAY (BOSTON/DORRIS)

Attention: DAN JARRATT
RESCAN ENVIRONMENTAL SERVICES LTD.
SIXTH FLOOR
1111 WEST HASTINGS STREET
VANCOUVER, BC
CANADA V6E 2J3

Report Date: 2010/02/24

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B009095
Received: 2010/02/18, 13:40

Sample Matrix: Air
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
NO2 Passive Analysis (1)	1	2010/02/23	2010/02/24	EINDSOP-00148	Tang Passive NO2 in
O3 Passive Analysis (1)	1	2010/02/20	2010/02/20	EINDSOP-00197	EPA 300 R2.1
SO2 Passive Analysis (1)	1	2010/02/21	2010/02/24	EINDSOP-00149	Tang Passive SO2 in

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The detection limit is based on a 30 day sampling period.

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Levi Manchak
24 Feb 2010 13:44:33 -07:00

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LEVI MANCHAK,
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Phone# (780) 378-8500

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Maxxam Analytics

Maxxam Job #: B009095
Report Date: 2010/02/24

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02
Site Reference: HOPE BAY (BOSTON/DORRIS)
Sampler Initials: JT

RESULTS OF CHEMICAL ANALYSES OF AIR

Maxxam ID		S86094		
Sampling Date		2010/01/14		
	Units	**10DORIS-001**	**RDL**	**QC Batch**
Passive Monitoring				
Calculated NO2	ppb	5.1	0.1	3764128
Calculated O3	ppb	31.7	0.1	3759736
Calculated SO2	ppb	1.9	0.1	3759864

RDL = Reportable Detection Limit

Maxxam Analytics

Maxxam Job #: B009095
Report Date: 2010/02/24

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02
Site Reference: HOPE BAY (BOSTON/DORRIS)
Sampler Initials: JT

General Comments

Sample Exposure Dates: 2010/01/14 - 2010/02/12

Results relate only to the items tested.

Maxxam Analytics

RESCAN ENVIRONMENTAL SERVICES LTD.
Attention: DAN JARRATT
Client Project #: 1009-002-02
P.O. #:
Site Reference: HOPE BAY (BOSTON/DORRIS)

Quality Assurance Report

Maxxam Job Number: PB009095

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3759736 OZ	Calibration Check	Calculated O3	2010/02/20		97	%	91 - 107
	Spiked Blank	Calculated O3	2010/02/20		102	%	N/A
	Method Blank	Calculated O3	2010/02/20	<0.1		ppb	
3759864 OZ	Calibration Check	Calculated SO2	2010/02/21		101	%	95 - 105
	Spiked Blank	Calculated SO2	2010/02/21		100	%	N/A
	Method Blank	Calculated SO2	2010/02/21	<0.1		ppb	
3764128 OZ	Calibration Check	Calculated NO2	2010/02/23		99	%	76 - 118
	Spiked Blank	Calculated NO2	2010/02/23		100	%	N/A
	Method Blank	Calculated NO2	2010/02/23	<0.1		ppb	

Calibration Check: A calibration standard analyzed at different times to evaluate on-going calibration accuracy.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Analytics

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Maxxam Job #: B009095

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LINDA LIN, Supervisor, Centre for Passive Sampling Technology

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Your Project #: 1009-002-02
Site: HOPE BAY (BOSTON/DORIS)

Attention: DAN JARRATT
RESCAN ENVIRONMENTAL SERVICES LTD.
SIXTH FLOOR
1111 WEST HASTINGS STREET
VANCOUVER, BC
CANADA V6E 2J3

Report Date: 2010/03/24

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B015112
Received: 2010/03/16, 10:54

Sample Matrix: Air
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
NO2 Passive Analysis (1)	1	2010/03/23	2010/03/24	EINDSOP-00148	Tang Passive NO2 in
O3 Passive Analysis (1)	1	2010/03/24	2010/03/24	EINDSOP-00197	EPA 300 R2.1
SO2 Passive Analysis (1)	1	2010/03/19	2010/03/24	EINDSOP-00149	Tang Passive SO2 in

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The detection limit is based on a 30 day sampling period.

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Levi Manchak
24 Mar 2010 15:34:23 -06:00

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Email:
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Maxxam Job #: B015112
Report Date: 2010/03/24

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02
Site Reference: HOPE BAY (BOSTON/DORIS)
Sampler Initials: JT

RESULTS OF CHEMICAL ANALYSES OF AIR

Maxxam ID		T22248		
Sampling Date		2010/02/11		
	Units	**10DORIS-002**	**RDL**	**QC Batch**
Passive Monitoring				
Calculated NO2	ppb	2.5	0.1	3832690
Calculated O3	ppb	26.3	0.1	3837340
Calculated SO2	ppb	0.2	0.1	3824807

RDL = Reportable Detection Limit

General Comments

Meteorological data from Cambridge Bay, NT station utilized.

Results relate only to the items tested.

Maxxam Analytics

RESCAN ENVIRONMENTAL SERVICES LTD.
Attention: DAN JARRATT
Client Project #: 1009-002-02
P.O. #:
Site Reference: HOPE BAY (BOSTON/DORIS)

Quality Assurance Report

Maxxam Job Number: PB015112

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3824807 DF4	Calibration Check	Calculated SO2	2010/03/19		98	%	95 - 105
	Spiked Blank	Calculated SO2	2010/03/19		100	%	N/A
	Method Blank	Calculated SO2	2010/03/19	<0.1		ppb	
3832690 DF4	Calibration Check	Calculated NO2	2010/03/23		102	%	76 - 118
	Spiked Blank	Calculated NO2	2010/03/23		101	%	N/A
	Method Blank	Calculated NO2	2010/03/23	<0.1		ppb	
3837340 OZ	Calibration Check	Calculated O3	2010/03/24		100	%	91 - 107
	Spiked Blank	Calculated O3	2010/03/24		102	%	N/A
	Method Blank	Calculated O3	2010/03/24	<0.1		ppb	

Calibration Check: A calibration standard analyzed at different times to evaluate on-going calibration accuracy.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

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Site: HOPE BAY (BOSTON/DORIS)

Attention: DAN JARRATT
RESCAN ENVIRONMENTAL SERVICES LTD.
SIXTH FLOOR
1111 WEST HASTINGS STREET
VANCOUVER, BC
CANADA V6E 2J3

Report Date: 2010/05/05

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B026701
Received: 2010/04/28, 09:39

Sample Matrix: Air
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
NO2 Passive Analysis (1)	3	2010/05/05	2010/05/05	EINDSOP-00148	Tang Passive NO2 in
O3 Passive Analysis (1)	3	2010/05/05	2010/05/05	EINDSOP-00197	EPA 300 R2.1
SO2 Passive Analysis (1)	3	2010/04/29	2010/05/05	EINDSOP-00149	Tang Passive SO2 in

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The detection limit is based on a 30 day sampling period.

Encryption Key

Levi Manchak
05 May 2010 14:36:28 -06:00

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Total cover pages: 1

Maxxam Analytics

Maxxam Job #: B026701
Report Date: 2010/05/05

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02
Site Reference: HOPE BAY (BOSTON/DORIS)
Sampler Initials: JT

RESULTS OF CHEMICAL ANALYSES OF AIR

Maxxam ID		T82500	T82502	T82503		
Sampling Date		2010/03/01 14:00	2009/10/22 12:00	2009/10/22 12:00		
	Units	**10DORIS-003**	**09BOSTON-010**	**09BOSTON-010 DUP**	**RDL**	**QC Batch**
Passive Monitoring						
Calculated NO2	ppb	0.8	<0.1	<0.1	0.1	3931920
Calculated O3	ppb	35.6	29.9	25.3	0.1	3932278
Calculated SO2	ppb	<0.1	0.1	0.1	0.1	3921887

RDL = Reportable Detection Limit

Maxxam Analytics

Maxxam Job #: B026701
Report Date: 2010/05/05

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02
Site Reference: HOPE BAY (BOSTON/DORIS)
Sampler Initials: JT

General Comments

Doris Sample Dates: 2010/03/01 - 204/04/03
Boston Sample Dates: 2009/10/22 - 2010/03/21

Results relate only to the items tested.

Maxxam Analytics

RESCAN ENVIRONMENTAL SERVICES LTD.
Attention: DAN JARRATT
Client Project #: 1009-002-02
P.O. #:
Site Reference: HOPE BAY (BOSTON/DORIS)

Quality Assurance Report

Maxxam Job Number: PB026701

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3921887 DF4	Calibration Check	Calculated SO2	2010/04/29		99	%	95 - 105
	Spiked Blank	Calculated SO2	2010/04/29		98	%	N/A
	Method Blank	Calculated SO2	2010/04/29	<0.1		ppb	
3931920 DF4	Calibration Check	Calculated NO2	2010/05/05		101	%	76 - 118
	Spiked Blank	Calculated NO2	2010/05/05		98	%	N/A
	Method Blank	Calculated NO2	2010/05/05	<0.1		ppb	
3932278 OZ	Calibration Check	Calculated O3	2010/05/05		98	%	91 - 107
	Spiked Blank	Calculated O3	2010/05/05		100	%	N/A
	Method Blank	Calculated O3	2010/05/05	<0.1		ppb	

Calibration Check: A calibration standard analyzed at different times to evaluate on-going calibration accuracy.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Analytics

Validation Signature Page

Maxxam Job #: B026701

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

LINDA LIN, Supervisor, Centre for Passive Sampling Technology

---

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics

Your Project #: 1009-002-02
Site: HOPE BAY (BOSTON/DORIS)

Attention: DAN JARRATT
RESCAN ENVIRONMENTAL SERVICES LTD.
SIXTH FLOOR
1111 WEST HASTINGS STREET
VANCOUVER, BC
CANADA V6E 2J3

Report Date: 2010/08/18

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B065899
Received: 2010/08/04, 08:53

Sample Matrix: Air
Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Determination of Dustfall	6	2010/08/12	2010/08/12	EINDSOP-00180	AMD 32020
Determination of Dustfall-mg/cm2/30 days	6	2010/08/12	2010/08/12		see departement
Exposure (Number of days)	6	2010/08/12	2010/08/12		see department
NO2 Passive Analysis (1)	9	2010/08/10	2010/08/18	EINDSOP-00148	Tang Passive NO2 in
O3 Passive Analysis (1)	9	2010/08/11	2010/08/18	EINDSOP-00197	EPA 300 R2.1
SO2 Passive Analysis (1)	9	2010/08/09	2010/08/18	EINDSOP-00149	Tang Passive SO2 in

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The detection limit is based on a 30 day sampling period.

Encryption Key

Levi Manchak
18 Aug 2010 08:36:20 -06:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

LEVI MANCHAK,
Email:
Phone# (780) 378-8500

==========

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Total cover pages: 1

Maxxam Analytics

Maxxam Job #: B065899
Report Date: 2010/08/18

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02
Site Reference: HOPE BAY (BOSTON/DORIS)
Sampler Initials: JT

RESULTS OF CHEMICAL ANALYSES OF AIR

Maxxam ID		V92056		V92089		V92090	V92091		
Sampling Date		2010/04/03		2010/05/16		2010/06/02	2010/03/21		
	Units	**10DORIS-004**	**RDL**	**10DORIS-005**	**RDL**	**10DORIS-006**	**10BOSTON-003**	**RDL**	**QC Batch**
Industrial									
Exposure	days	43	1	17	1	35	57	1	4175872
Dustfall Determination									
Total Dustfall	mg	5	1	14	3	12	2	1	4173361
Total Dustfall (30 day)	mg/cm2/30day	0.041	0.001	0.301	0.003	0.126	0.015	0.001	4173362
Total Fixed Dustfall	mg	3	1	9	3	8	2	1	4173361
Total Fixed Dustfall (30 day)	mg/cm2/30day	0.026	0.001	0.201	0.003	0.082	0.012	0.001	4173362
Passive Monitoring									
Calculated NO2	ppb	0.7	0.1	<0.1	0.1	0.5	<0.1	0.1	4166901
Calculated O3	ppb	36.7	0.1	35.6	0.1	26.7	34.6	0.1	4172168
Calculated SO2	ppb	<0.1	0.1	0.1	0.1	0.1	DAMAGED	0.1	4162847

RDL = Reportable Detection Limit

Maxxam ID		V92092		V92184		V92185		
Sampling Date		2010/03/21		2010/05/17		2010/06/10		
	Units	**10BOSTON-003DUP**	**RDL**	**10BOSTON-005**	**RDL**	**10BOSTON-006**	**RDL**	**QC Batch**
Industrial								
Exposure	days		1	24	1	21	1	4175872
Dustfall Determination								
Total Dustfall	mg		1	9	2	11	1	4173361
Total Dustfall (30 day)	mg/cm2/30day		0.001	0.139	0.002	0.199	0.001	4173362
Total Fixed Dustfall	mg		1	8	2	5	1	4173361
Total Fixed Dustfall (30 day)	mg/cm2/30day		0.001	0.119	0.002	0.094	0.001	4173362
Passive Monitoring								
Calculated NO2	ppb	<0.1	0.1	<0.1	0.1	1.6	0.1	4166901
Calculated O3	ppb	35.3	0.1	33.0	0.1	25.7	0.1	4172168
Calculated SO2	ppb	<0.1	0.1	0.1	0.1	0.1	0.1	4162847

RDL = Reportable Detection Limit

Maxxam Analytics

Maxxam Job #: B065899
Report Date: 2010/08/18

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02
Site Reference: HOPE BAY (BOSTON/DORIS)
Sampler Initials: JT

RESULTS OF CHEMICAL ANALYSES OF AIR

Maxxam ID		V92249	V92250		
Sampling Date		2010/05/17	2010/06/10		
	Units	**10BOSTON-005 (DUP)**	**10BOSTON-006 (DUP)**	**RDL**	**QC Batch**
Passive Monitoring					
Calculated NO2	ppb	<0.1	1.9	0.1	4166901
Calculated O3	ppb	29.5	25.7	0.1	4172168
Calculated SO2	ppb	0.1	0.2	0.1	4162847

RDL = Reportable Detection Limit

Maxxam Analytics

Maxxam Job #: B065899
Report Date: 2010/08/18

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-002-02
Site Reference: HOPE BAY (BOSTON/DORIS)
Sampler Initials: JT

General Comments

Sample Exposure Dates are as follows:
10Doris004: 2010/04/03 - 2010/05/16
10Doris005: 2010/05/16 - 2010/06/02
10Doris006: 2010/06/02 - 2010/07/07

10Boston002: 2010/03/02 - 2010/05/17
10Boston003: 2010/03/02 - 2010/05/17
10Boston005: 2010/05/17 - 2010/06/10
10Boston006: 2010/06/10 - 2010/07/01
10Boston005 (DUP): 2010/05/17 - 2010/06/10
10Boston006 (DUP): 2010/06/10 - 2010/07/01

Sample: V92091 was returned to the lab missing barrier. - DF

Results relate only to the items tested.

Maxxam Analytics

RESCAN ENVIRONMENTAL SERVICES LTD.
Attention: DAN JARRATT
Client Project #: 1009-002-02
P.O. #:
Site Reference: HOPE BAY (BOSTON/DORIS)

Quality Assurance Report

Maxxam Job Number: PB065899

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4162847 DF4	Calibration Check	Calculated SO2	2010/08/09		100	%	95 - 105
	Spiked Blank	Calculated SO2	2010/08/09		103	%	N/A
	Method Blank	Calculated SO2	2010/08/09	<0.1		ppb	
4166901 DF4	Calibration Check	Calculated NO2	2010/08/10		99	%	76 - 118
	Spiked Blank	Calculated NO2	2010/08/10		96	%	N/A
	Method Blank	Calculated NO2	2010/08/10	<0.1		ppb	
4172168 OZ	Calibration Check	Calculated O3	2010/08/12		102	%	91 - 107
	Spiked Blank	Calculated O3	2010/08/12		99	%	N/A
	Method Blank	Calculated O3	2010/08/12	<0.1		ppb	
4173361 OZ	Calibration Check	Total Dustfall	2010/08/12		102	%	N/A
	Method Blank	Total Dustfall	2010/08/12	<1		mg	
		Total Fixed Dustfall	2010/08/12	<1		mg	
	RPD [V92056-01]	Total Dustfall	2010/08/12	NC		%	N/A
		Total Fixed Dustfall	2010/08/12	NC		%	N/A

N/A = Not Applicable
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Calibration Check: A calibration standard analyzed at different times to evaluate on-going calibration accuracy.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Maxxam Analytics

Validation Signature Page

Maxxam Job #: B065899

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

LINDA LIN, Supervisor, Centre for Passive Sampling Technology

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Appendix 2

Passive Ambient Air Quality Results

Rescan™
Engineers and Scientists

Maxxam Analytics

Your Project #: 1009-C02-02
Site: HOPE BAY, NUNAVUT - BASELINE

Attention: DAN JARRATT
RESCAN ENVIRONMENTAL SERVICES LTD.
SIXTH FLOOR
1111 WEST HASTINGS STREET
VANCOUVER, BC
CANADA V6E 2J3

Report Date: 2010/07/29

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B058541
Received: 2010/07/16, 15:42

Sample Matrix: Filter
Samples Received: 34

Analyses	Quantity	Date Extracted	Date Analyzed	LaboratoryMethod	AnalyticalMethod
MassDetermination(ug/filter)	34	N/A	2010/07/29	EINDSOP-00151	EPA2.12Monitoring
MassDetermination(ug/m³) (1)	33	N/A	2010/07/29	EINDSOP-00151	EPA2.12Monitoring
Volume	33	N/A	2010/07/29	N/A	seedepartement

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) As per method, results are blank subtracted.

Encryption Key

Levi Manchak
29 Jul 2010 15:42:06 -06:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

LEVI MANCHAK,
Email:
Phone#(780)378-8500

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Total cover pages: 1

Maxxam Analytics

Maxxam Job #: B058541
Report Date: 2010/07/29

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-C02-02
Site Reference: HOPE BAY, NUNAVUT - BASELINE

RESULTS OF CHEMICAL ANALYSES OF FILTER

MaxxamID		V50474		V79267	V79268	V79269	V79270	V79271		
SamplingDate		2010/05/14		2010/05/20	2010/05/26	2010/06/01	2010/06/07	2010/06/13		
	Units	**TSP: 13270**	**QC Batch**	**TSP: 15479**	**TSP: 089982**	**TSP: 090584**	**TSP: 027324**	**TSP: 054431**	**RDL**	**QC Batch**
.										
Volume	m3	25.30	4141150	25.30	25.30	25.40	25.30	25.40	0.01	4141151
PM2.5/10										
ParticulateMatter	ug/m3	1.1	4141149	2.5	1.1	0.4	0.9	1.5	0.1	4141149
ParticulateMatter	ug/filter	29	4141147	63	28	11	24	37	3	4141147

RDL = Reportable Detection Limit

MaxxamID		V79272	V79273	V79274	V79275	V79276	V79277		
SamplingDate		2010/06/19	2010/06/25	2010/07/01	2010/07/07	2010/07/13	2010/05/14		
	Units	**TSP: 098266**	**TSP: 091292**	**TSP: 091297**	**TSP: 058034**	**TSP: 089946**	**PM2.5: 20700**	**RDL**	**QC Batch**
.									
Volume	m3	25.30	25.40	25.30	25.30	25.30	22.80	0.01	4141151
PM2.5/10									
ParticulateMatter	ug/m3	13.9	2.3	1.3	2.0	2.4	<0.1	0.1	4141149
ParticulateMatter	ug/filter	352	59	32	50	61	<3	3	4141147

RDL = Reportable Detection Limit

MaxxamID		V79278	V79279	V79280	V79281	V79282	V79283		
SamplingDate		2010/05/20	2010/05/26	2010/06/01	2010/06/07	2010/06/13	2010/06/19		
	Units	**PM2.5: 13293**	**PM2.5: 076152**	**PM2.5: 090549**	**PM2.5: 14316**	**PM2.5: 084094**	**PM2.5: 20606**	**RDL**	**QC Batch**
.									
Volume	m3	22.80	22.70	22.80	22.80	22.80	22.80	0.01	4141151
PM2.5/10									
ParticulateMatter	ug/m3	1.4	0.4	1.0	0.8	1.0	13.7	0.1	4141149
ParticulateMatter	ug/filter	32	8	22	19	23	312	3	4141147

RDL = Reportable Detection Limit

Maxxam Analytics

Maxxam Job #: B058541
Report Date: 2010/07/29

RESCAN ENVIRONMENTAL SERVICES LTD.
Client Project #: 1009-C02-02
Site Reference: HOPE BAY, NUNAVUT - BASELINE

RESULTS OF CHEMICAL ANALYSES OF FILTER

MaxxamID		V79284	V79285	V79286		V79287		V79288		
SamplingDate		2010/06/25	2010/07/01	2010/07/07		2010/07/13		2010/05/14		
	Units	**PM2.5: 15072**	**PM2.5: 14087**	**PM2.5: 20636**	**QC Batch**	**PM2.5: 46850**	**RDL**	**PM10: 27802**	**RDL**	**QC Batch**
.										
Volume	m3	22.70	22.80	22.80	4141151	22.80	0.01	2.50	0.01	4141150
PM2.5/10										
ParticulateMatter	ug/m3	2.6	0.6	3.2	4141149	3.3	0.1	<1	1	4141148
ParticulateMatter	ug/filter	59	14	73	4141147	75	3	<3	3	4141146
RDL = Reportable Detection Limit										

MaxxamID		V79289	V79290	V79291	V79292	V79293	V79294		
SamplingDate		2010/05/20	2010/05/26	2010/06/01	2010/06/07	2010/06/13	2010/06/19		
	Units	**PM10: 24945**	**PM10: 098000**	**PM10: 076204**	**PM10: 053122**	**PM10: 058030**	**PM10: 076324**	**RDL**	**QC Batch**
.									
Volume	m3	2.50	2.50	2.50	2.50	2.50	2.50	0.01	4141150
PM2.5/10									
ParticulateMatter	ug/m3	8	<1	12	2	6	39	1	4141148
ParticulateMatter	ug/filter	19	<3	31	5	14	98	3	4141146
RDL = Reportable Detection Limit									

MaxxamID		V79295	V79318	V79320	V79321	V79322		
SamplingDate		2010/06/25	2010/07/01	2010/07/07	2010/07/13			
	Units	**PM10: 027820**	**PM10: 20619**	**PM10: 083499**	**PM10: 090554**	**BLANK**	**RDL**	**QC Batch**
.								
Volume	m3	2.50	2.50	2.50	2.50		0.01	4141150
PM2.5/10								
ParticulateMatter	ug/m3	33	6	37	23		1	4141148
ParticulateMatter	ug/filter	82	16	92	57	6	3	4141146
RDL = Reportable Detection Limit								

General Comments

Results relate only to the items tested.

Maxxam Analytics

RESCAN ENVIRONMENTAL SERVICES LTD.
Attention: DAN JARRATT
Client Project #: 1009-C02-02
P.O. #:
Site Reference: HOPE BAY, NUNAVUT - BASELINE

Quality Assurance Report

Maxxam Job Number: PB058541

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4141146	LL	CalibrationCheck	ParticulateMatter	2010/07/29		100	%	N/A
4141147	LL	CalibrationCheck	ParticulateMatter	2010/07/29		100	%	N/A

Calibration Check: A calibration standard analyzed at different times to evaluate on-going calibration accuracy.

Maxxam Analytics

Validation Signature Page

Maxxam Job #: B058541

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

DARREN FUNNELL,

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Appendix 3

Dustfall Analysis Results

Rescan™
Engineers and Scientists

Certificate of Analysis

RESCAN ENVIRONMENTAL SERVICES
ATTN: DAN JARRATT
SIXTH FLOOR
1111 WEST HASTINGS STREET
VANCOUVER BC V6E 2J3

Report Date: 23-AUG-10 12:41 (MT)
Version: FINAL

Lab Work Order #: L917373 **Date Received:** 06-AUG-10

Project P.O. #: NOT SUBMITTED
Job Reference: 100-002-02
Legal Site Desc:
CofC Numbers: 10-044439

Other Information:

Comments:

Amber Springer
Account Manager