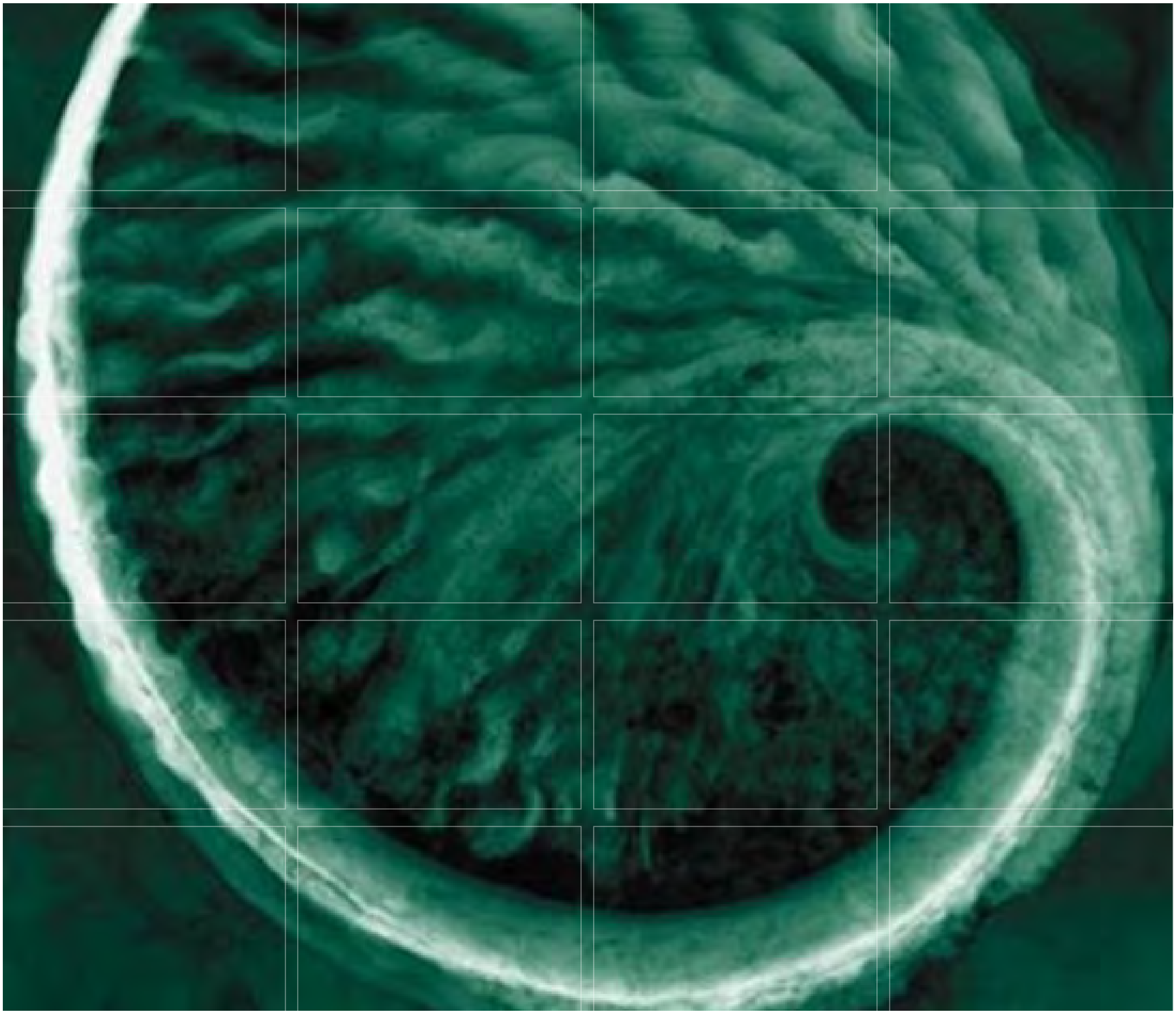

*Prepared for:*

Rio Tinto
DOMINION DIAMOND CORPORATION
Diavik Diamond Mine

DIAVIK DIAMOND MINE

# 2014-2015 Environmental Air Quality Monitoring Report

April 2016

*The world's leading sustainability consultancy*

ERM

**Diavik Diamond Mines (2012) Inc.**

# DIAVIK DIAMOND MINE

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**April 2016**

Project #0207514-0009

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# EXECUTIVE SUMMARY

Diavik Diamond Mines (2012) Inc. has been collecting and reporting air quality related data since initial site construction in 2001. In June of 2013 Diavik Diamond Mines submitted an Environmental Air Quality Monitoring Plan to the Environmental Monitoring Advisory Board. The components of the Environmental Air Quality Monitoring Plan include total suspended particulate monitoring, dustfall monitoring, snow core program, National Pollutant Release Inventory reporting, and greenhouse gas reporting. This report presents an updated Environmental Air Quality Monitoring Report for the period of 2014 to 2015.

Total suspended particulate concentrations were measured at two stations, the Communications Building and A154 Dike Stations, in 2014 and 2015. The 2014 annual TSP arithmetic means measured at the Communications Building and A154 Dike Stations were 14.5 µg/m$^3$ and 8.7 µg/m$^3$, respectively. Both were less than the Government of the Northwest Territories Department of Environment and Natural Resources annual arithmetic mean standard of 60 µg/m$^3$ and there were no daily exceedances of the 24 hour average standard of 120 µg/m$^3$. The 2015 annual arithmetic means measured at the Communications Building and A154 Dike Stations were 13.6 µg/m$^3$ and 2.3 µg/m$^3$, respectively. Both were less than the annual arithmetic mean standard of 60 µg/m$^3$. At the Communications Building Station, total suspended particulate concentration was greater than the 24 hour Average (120 µg/m$^3$) on one (1) occasion (day). These results are consistent with the prediction from the 2012 dispersion model which predicted two (2) 24 hour exceedances per year. In 2015 at the A154 Dike Station, total suspended solid did not exceed the 24 hour Average (120 µg/m$^3$) or the annual arithmetic mean (60 µg/m$^3$).

In 2014 and 2015, dustfall was monitored at 12 dustfall gauges and 27 snow survey stations located at varying distances around the Project. Annual dustfall measured at each of the 12 dustfall gauges ranged from 24.3 to 582 mg/dm$^2$/y. The annualized dustfall rates estimated from the snow survey sites ranged from 9.3 to 1,013 mg/dm$^2$/y. Dustfall rates generally decreased, as expected, with distance from the Project with the lowest dustfall rate recorded at station Control 1 (5,655 m from the Project) and areas that were predominantly downwind of the Project received more dustfall than upwind areas.

Snow water chemistry was also measured at 19 of the snow survey stations and compared to EQC as indicated in the Project Water Licence (W2007L2-0003) as approved by the WLWB. All 2014 and 2015 snow water chemistry sample concentrations were less than their associated reference levels as specified by the "maximum concentration of any grab sample" specified in Water Licence W2007L2-0003 except for aluminum, chromium, nickel, and zinc from the 2015 SS3-6 snow core.

Of the criteria air contaminants, the observed carbon monoxide, sulphur oxide, nitrogen oxide and volatile organic compounds levels remained similar between 2014 and 2015. These constituents are primarily derived from the combustion of diesel fuel. Diesel consumption increased in 2015 compared to 2014 and hence there was a minor increase in carbon monoxide, sulphur oxide, nitrogen oxide and volatile organic compounds. Total particulate matter, 10-micron particulate matter and 2.5-micron particulate matter levels in 2015 increased from 2014. A21 Construction including crushing, material handling, and road dust contributed to higher fugitive dust emissions in 2015.

Greenhouse gas emissions increased between 2014 and 2015 by 4.2%. Greenhouse gas emissions at the Project are primarily derived from the combustion of diesel fuel. Increased diesel consumption in 2015 compared to 2014 is due to increased mobile equipment usage for A21 Construction. In 2015, the Project's 9.2 megawatt wind farm (consisting of four turbines) saved 5.2 million litres of diesel fuel needed for power, thereby reducing the Project's greenhouse gas emissions by 14,404 tonnes (7.7% of total greenhouse gas emissions in 2015).

# ACKNOWLEDGEMENTS

This report was prepared for Diavik Diamond Mines (2012) Inc. (DDMI) by ERM Consultants Canada Ltd. (ERM). Fieldwork and on site sample analyses were completed by DDMI and other sample analyses were completed by Maxxam Analytics (Maxxam). Data analyses and reporting were completed by Philip Porter (P.Eng.) and reviewed by Daniel Casanova (B.Sc., EP) and Tonia Robb (Ph.D.). The project was managed by Benjamin Beall (Ph.D.) and Marc Wen (M.Sc.) was the partner in charge.

# DIAVIK DIAMOND MINE

# 2014-2015 Environmental Air Quality Monitoring Report

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# 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.

| | |
|---|---|
| **AEMP** | Aquatic Effects Monitoring Program |
| **BC** | British Columbia |
| **BC MOE** | British Columbia Ministry of Environment |
| **CAC** | Criteria Air Contaminants |
| **$CH_4$** | Methane |
| **$CO_2e$** | Carbon Dioxide Equivalent |
| **CO** | Carbon Monoxide |
| **cm** | Centimetre |
| **DDMI** | Diavik Diamond Mines (2012) Inc. |
| **$dm^2$** | Square decimetre |
| **Dustfall** | Dust deposition |
| **EA** | Environmental Agreement |
| **ECCC** | Environment and Climate Change Canada |
| **EAQMP** | Environmental Air Quality Monitoring Plan |
| **EMAB** | Environmental Monitoring Advisory Board |
| **EMS** | Environmental Management System |
| **ENR** | Department of Environment and Natural Resources |
| **EQC** | Effluent Quality Criteria |
| **ERM** | ERM Consultants Canada Ltd. |
| **GHG** | Greenhouse Gas |
| **GWP** | Global Warming Potential |
| **hr** | Hour |

| | |
|---|---|
| **L** | Litre |
| **m** | Metre |
| **Maxxam** | Maxxam Analytics |
| **mg** | Milligram |
| **$NH_3$** | Ammonia |
| **$NO_2$** | Nitrogen Dioxide |
| **NPRI** | National Pollutant Release Inventory |
| **$NO_x$** | Oxides of Nitrogen |
| **$O_3$** | Ozone |
| **$PM_{2.5}$** | Particulate Matter ≤ 2.5 µg |
| **$PM_{10}$** | Particulate Matter ≤ 10 µg |
| **QA/QC** | Quality Assurance and Quality Control |
| **SOP** | Standard Operating Procedure |
| **$SO_x$** | Oxides of Sulphur |
| **$SO_2$** | Sulphur Dioxide |
| **TPM** | Total Particulate Matter |
| **TSP** | Total Suspended Particulate |
| **the Project** | Diavik Diamond Mine |
| **WLWB** | Wek’èezhìi Land and Water Board |
| **VOCs** | Volatile Organic Compounds |
| **µg** | Microgram |

# 1. INTRODUCTION

Diavik Diamond Mines (2012) Inc. (DDMI) has been collecting and reporting air quality related data since initial site construction in 2001. In June of 2013 DDMI submitted an Environmental Air Quality Monitoring Plan (EAQMP) to the Environmental Monitoring Advisory Board (EMAB). The EAQMP was developed to address Article 7.2 (a) of the Environmental Agreement (EA) (Diavik 2000). The EAQMP and its results are not part of a Regulatory Instrument but are subject to review by EMAB and the Parties identified under EA Article 7.5.

The purpose of this report is to provide a summary of the 2015 air quality monitoring and emissions data in relation to the Diavik Diamond Mine's (hereafter referred to as the Project) operational activities. This *2015 Environmental Air Quality Monitoring Report* summarizes air quality observations from the following programs conducted at the Project:

- Total Suspended Particulate (TSP) Continuous Monitors;
- Dustfall Monitoring as part of the Aquatic Effects Monitoring Program (AEMP);
- Snow Core Program as part of the AEMP;
- Emission Monitoring and Reporting to the Environment and Climate Change Canada (ECCC) National Pollutant Release Inventory (NPRI); and
- Greenhouse Gas (GHG) Monitoring and Reporting to ECCC.

In 2015, the primary sources of fugitive dust were associated with unpaved roads, airstrip usage and construction activities at A21 kimberlite pipe. The A21 kimberlite pipe is located just south of Diavik's existing mining operations. A21 development required rockfill dike construction to encircle the ore body located just offshore of existing mining operations at Lac de Gras (Rio Tinto 2014). The A21 development construction involved re-mining, hauling and crushing of 3,362,383 tonnes of waste rock from the North Country rock pile. To supress fugitive dust generation, roads were watered during the summer as needed and EK35 was applied to the airport apron (tarmac) and helipad during the spring months.

Project production rate was steady throughout the year and all mining occurred underground. Fugitive dust generation is expected to be greatest during snow-free periods where and when there is site activity. It was expected that the highest fugitive dust generation and resulting dustfall occurred in areas closest to the Project footprint including A21 and the country rock pile between May and September.

The 2015 predominant wind directions were largely omnidirectional with a higher frequency from the southeast and lower frequency from the southwest. The expectation is that airborne material will be deposited primarily north and south of the Project. Fugitive dust generation is expected to be highest during snow-free periods in proximity to site activities. Therefore, it is expected that the greatest fugitive dust generation and resulting dustfall occurred in areas closest to the Project footprint between April and September.

# 2. CONTINUOUS TOTAL SUSPENDED PARTICULATE MONITORING

## 2.1 BACKGROUND

Total suspended particulate (TSP) consists of small airborne particles such as dust, smoke, ash and pollen with aerodynamic diameters of typically less than 100 microns (µm). TSP is a concern for human health and welfare, as well as for animals and plants due to effects on breathing and respiratory systems, damage to lung tissue, cancer and premature death. TSP that settles out of the air onto surfaces is called dust deposition or dustfall. Ambient TSP monitoring in strategic locations can provide monitoring information to assist in understanding, tracking and responding to potential dust deposition concerns.

In 2012 an updated air dispersion modelling assessment was undertaken for the entire the Project (Golder 2012). The modelling results indicated that:

- Annual TSP concentrations are predicted to be lower than the Government of the Northwest Territories Guidelines for Ambient Air Quality Guidelines (2002) for receptors located in the vicinity of the Project. For two days per year, 24 hr concentrations of TSP are predicted to exceed the air quality criteria; and
- Maximum TSP deposition rates (dustfall) are predicted to be higher on the Project site (222.2 mg/dm$^2$/y) than off-site (4.1 mg/dm$^2$/y) and generally greater than predicted in the earlier model. For example 100 mg/dm$^2$/y was originally predicted adjacent to A154 pit (Cirrus Consultants 1998).

Two TSP monitors were installed at the Project in April 2013. The locations of the monitors were selected based on proximity to the Project boundary, with careful consideration of the TSP results from the updated air dispersion modelling assessment and in consideration of the availability of power (Diavik 2013).

## 2.2 METHODS

### 2.2.1 Monitoring Locations

TSP monitoring is undertaken at two locations—one sampler is near the A154 Dike (along the south-east corner of the A154 pit) and the second sampler is within the Communications Building (CB) adjacent to the accommodations complex (Figure 2.1-1). The location of the A154 Dike monitor and the site near the CB was selected based on the proximity to the boundary of the Project footprint and the results of the updated air dispersion modelling assessment and power requirements. The approximate locations of the DDMI TSP stations are presented in Table 2.2-1 below and Figure 2.1-1 shows the location of the two TSP Monitors.

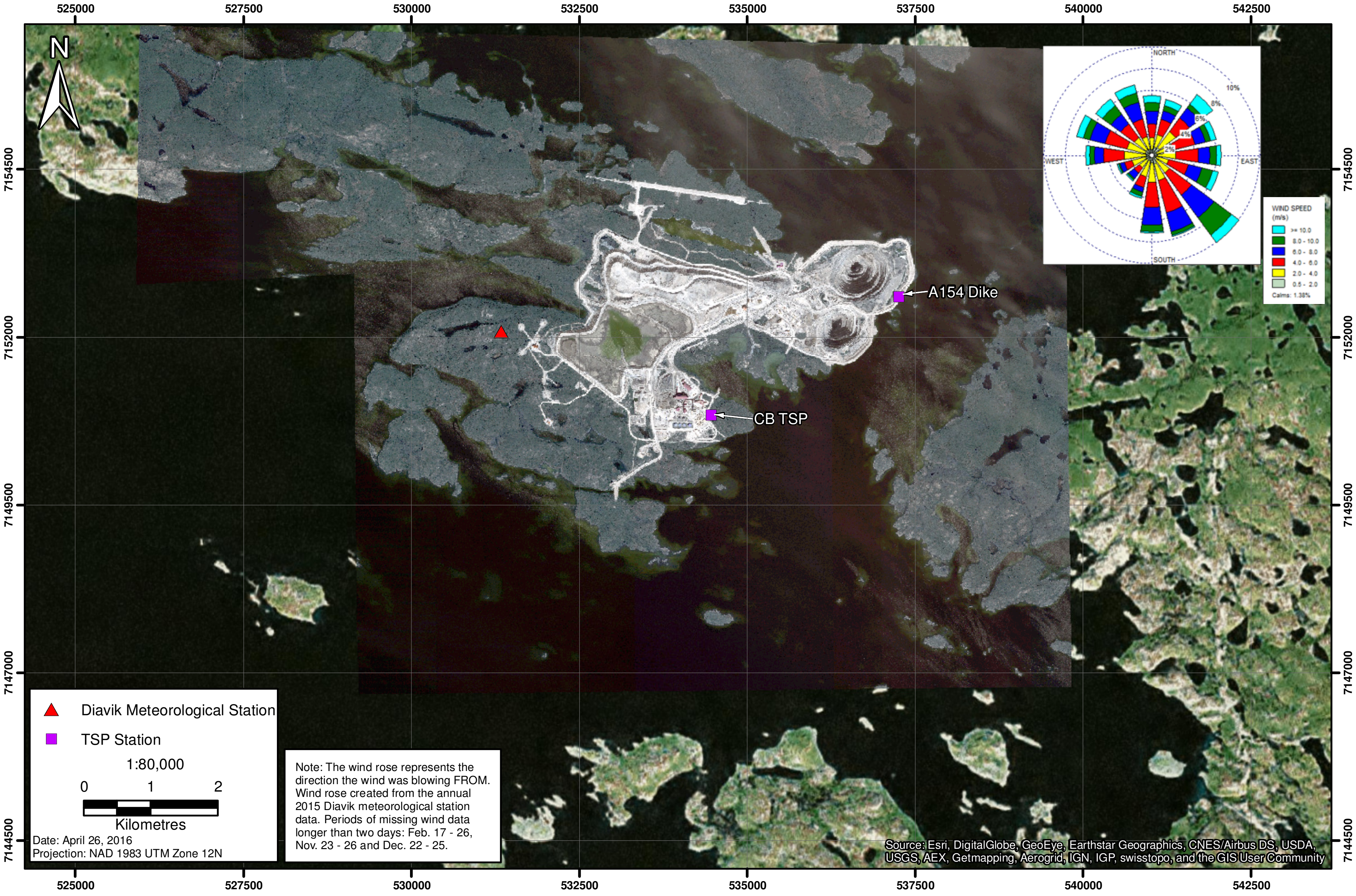
**Table 2.2-1. DDMI TSP Stations UTM Coordinates[1]**

| Station | Zone | Metres East | Metres North |
|---|---|---|---|
| CB | 12W | 534,460 | 7,150,847 |
| A154 Dike | 12W | 537,258 | 7,152,609 |

[1] *World Geodetic System 1984 (WGS-84)*

# Figure 2.1-1

# TSP Monitoring Locations



Date: April 26, 2016
Projection: NAD 1983 UTM Zone 12N

Note: The wind rose represents the direction the wind was blowing FROM. Wind rose created from the annual 2015 Diavik meteorological station data. Periods of missing wind data longer than two days: Feb. 17 - 26, Nov. 23 - 26 and Dec. 22 - 25.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

### 2.2.2 Recording TSP

Quality assurance and quality control (QA/QC) procedures that applied to TSP monitoring included the following:

- Adherence to the DDMI TSP Monitoring Standard Operating Procedure (SOP);
- Incorporation of the DDMI TSP into the DDMI Environmental Management System; and
- Review of monitoring data and retention of calibration and maintenance records as outlined in Section 2.2.3 below.

TSP monitoring is undertaken using the SHARP 5014i monitor that uses beta attenuation monitoring technology. Ambient air is drawn through a subsonic orifice at a controlled flow rate; continuous mass measurements are conducted and hourly mass concentrations are calculated and stored in the iSeries platform data logging system. The sampling equipment is contained within a climate-controlled shelter to minimize data loss during extreme weather conditions.

The monitoring of TSP concentrations is continuous and hourly concentrations are recorded. TSP monitoring is conducted continuously for one year on an annual basis.

Where applicable, observations were adjusted by ERM, as required, using the methodology in the *Alberta Air Monitoring Directive Chapter 6: Ambient Data Quality* (Alberta Environment and Sustainable Resource Development 2014). This included below zero adjustments for TSP concentrations; however, no baseline adjustments were performed because zero and span calibration reports were not completed in 2014 or 2015.

### 2.2.3 Analysis

Annual 24 hr TSP concentration graphs were generated for each of the monitoring locations and the average annual TSP concentration calculated. The 24 hr data was examined for trends and compared with predicted concentrations.

Periods of seasonal or event driven elevated concentrations were compared with known site activities to assist with identification of dominant sources or seasonal factors. The results of this analysis are presented in this report and will be used to update and modify the dust management SOPs incorporated in the Environmental Management System (EMS) if necessary.

Analysis also included a comparison of the observed particulate concentrations at the communications building to that observed at the A154 Dike. The readings at the communications building are expected to consistently be slightly greater than those at the A154 Dike due the communication building's proximity road dust emissions, diesel combustion sources (boilers and power house), the processing plant and the run of mine ore stockpiles. However, occasional events in the region (e.g., a dust storm transporting airborne particulate) could result in greater measured particulate concentrations at the A154 Dike when compared to the communications building.

## 2.3 RESULTS

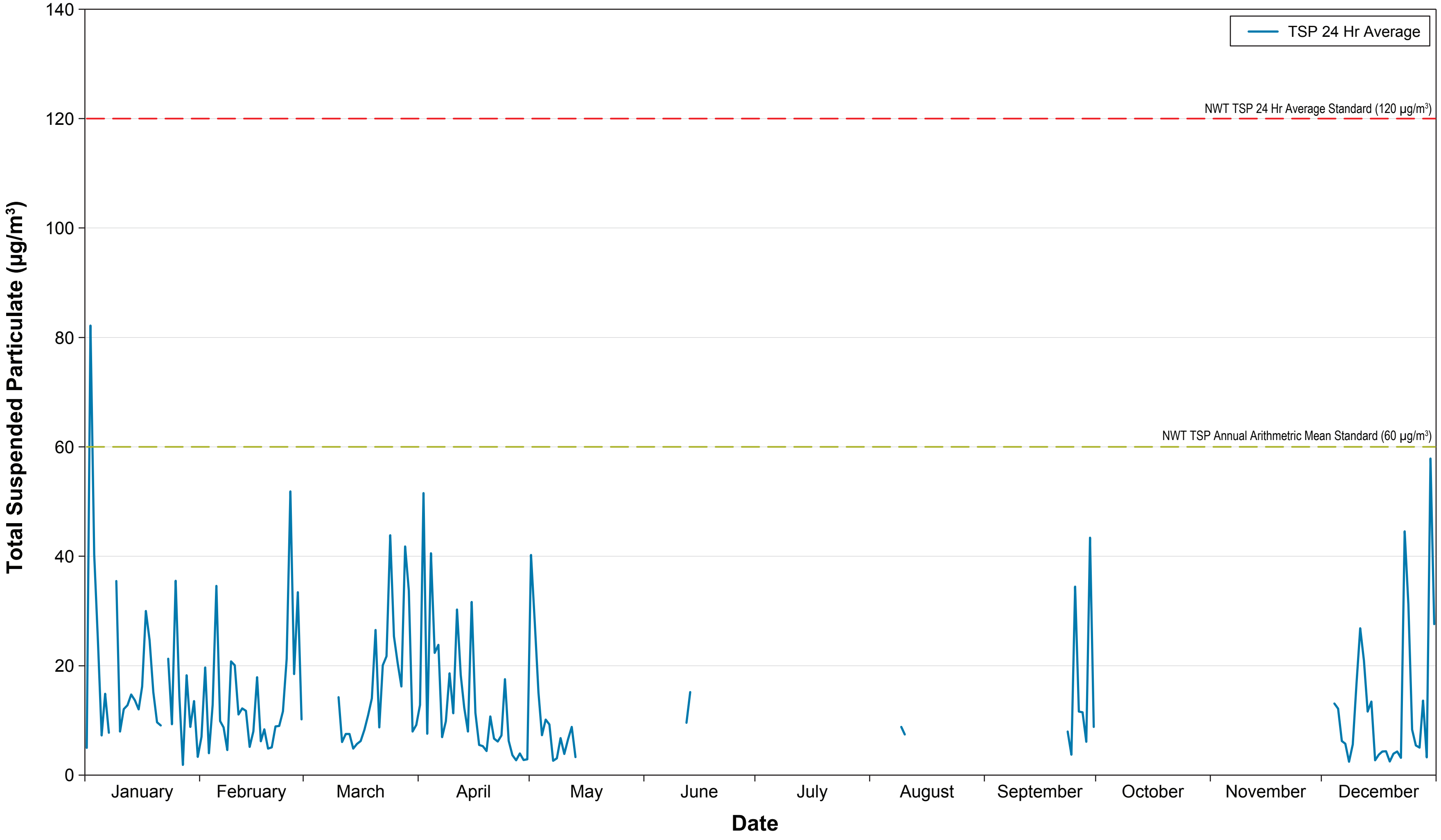
TSP results were compared to the Government of the Northwest Territories Department of Environment and Natural Resources (ENR) Guideline for Ambient Air Quality Standards in the Northwest Territories (GNWT 2011). ENR uses two standards for TSP:

- 24 hr Average: 120 μg/m$^3$; and
- Annual Arithmetic Mean: 60 μg/m$^3$.

Figures 2.3-1 to 2.3-4 below show the 2014 and 2015 24 hr average TSP concentrations for both monitoring stations compared to the GNWT 2011 Standards. Table 2.3-1 summarizes the TSP results for both years.

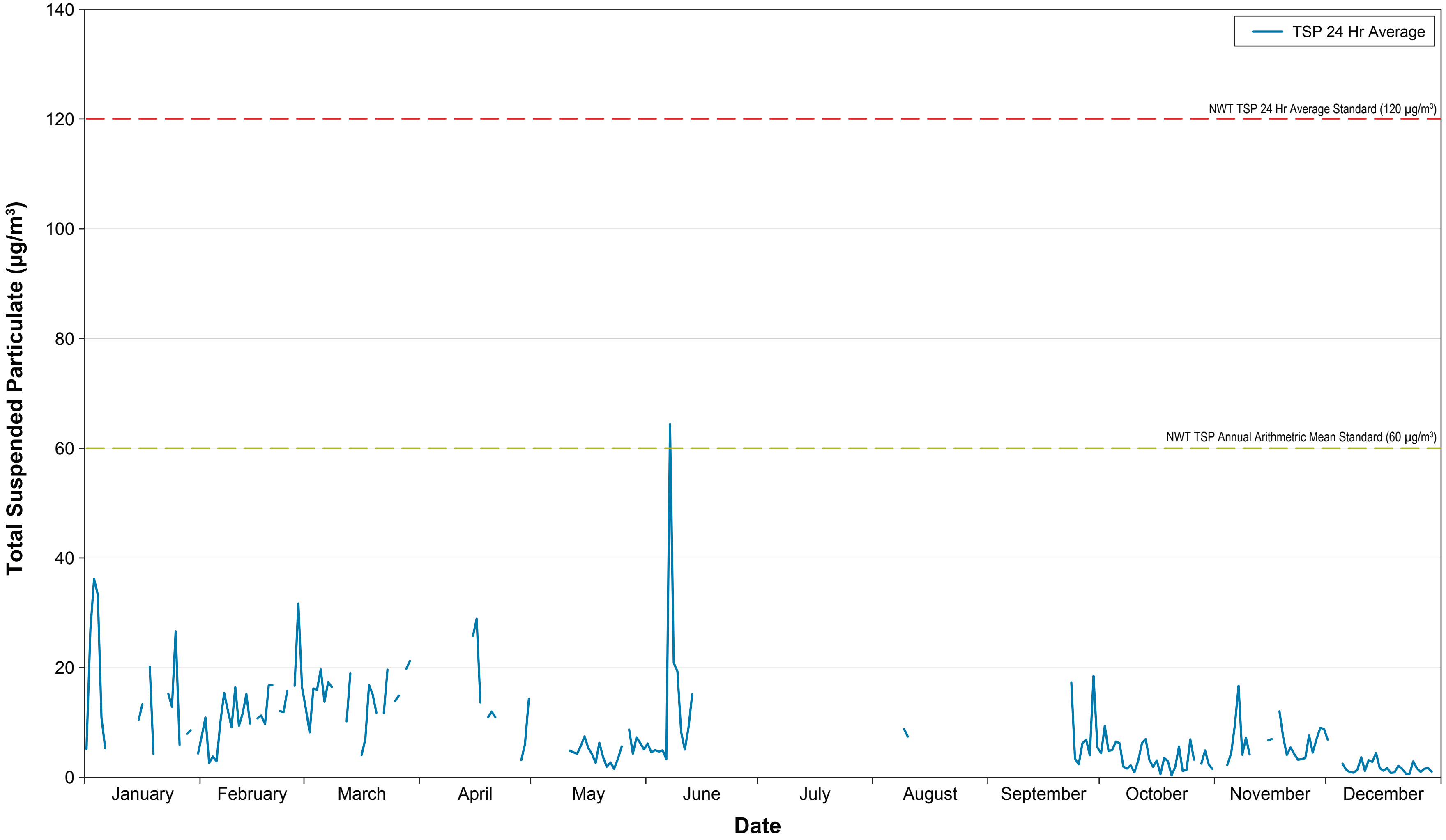
# Figure 2.3-1

## 2014 Daily Mean TSP Readings - Communications Building



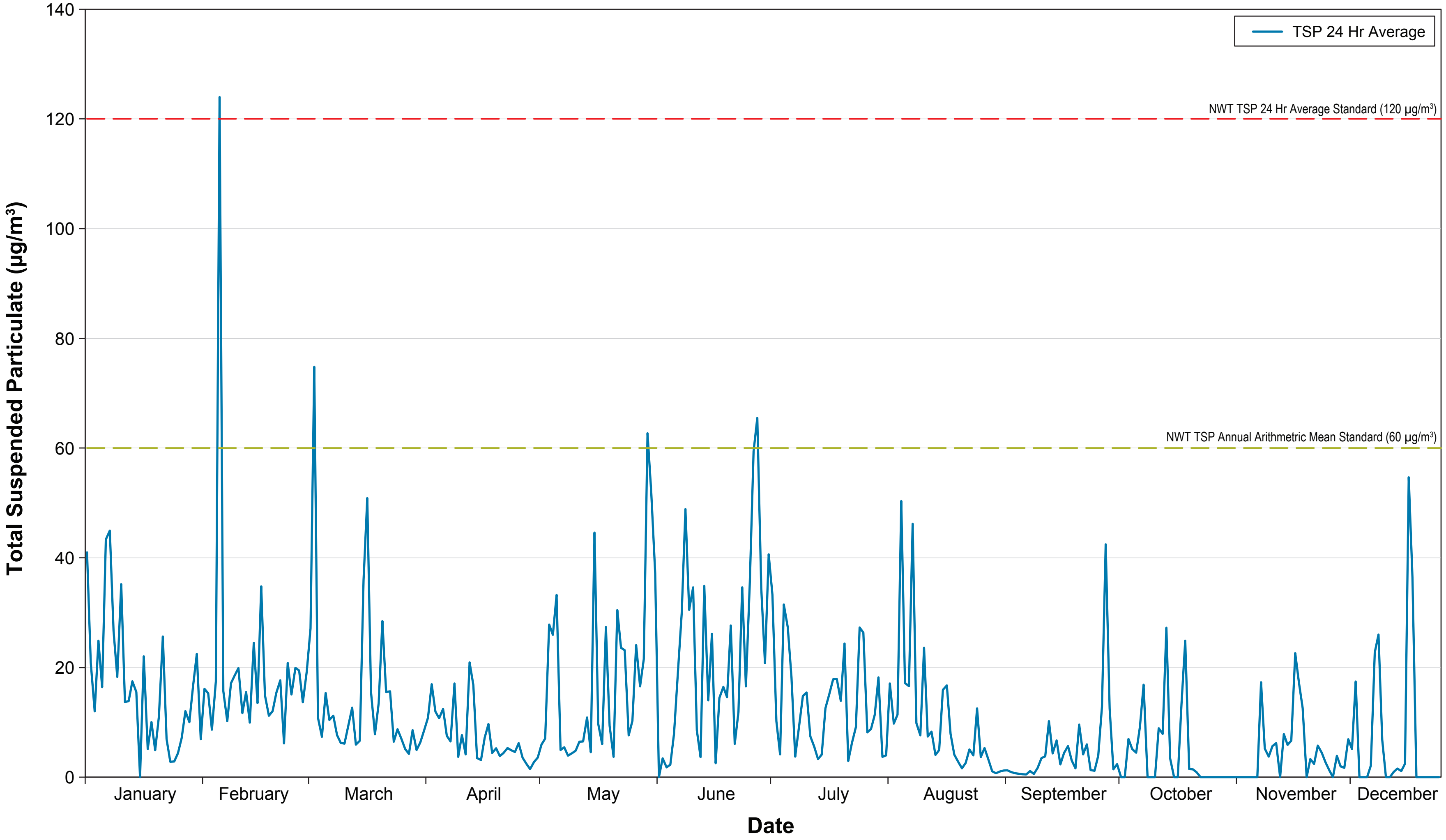
# Figure 2.3-2

# 2014 Daily Mean TSP Readings - A154 Dike



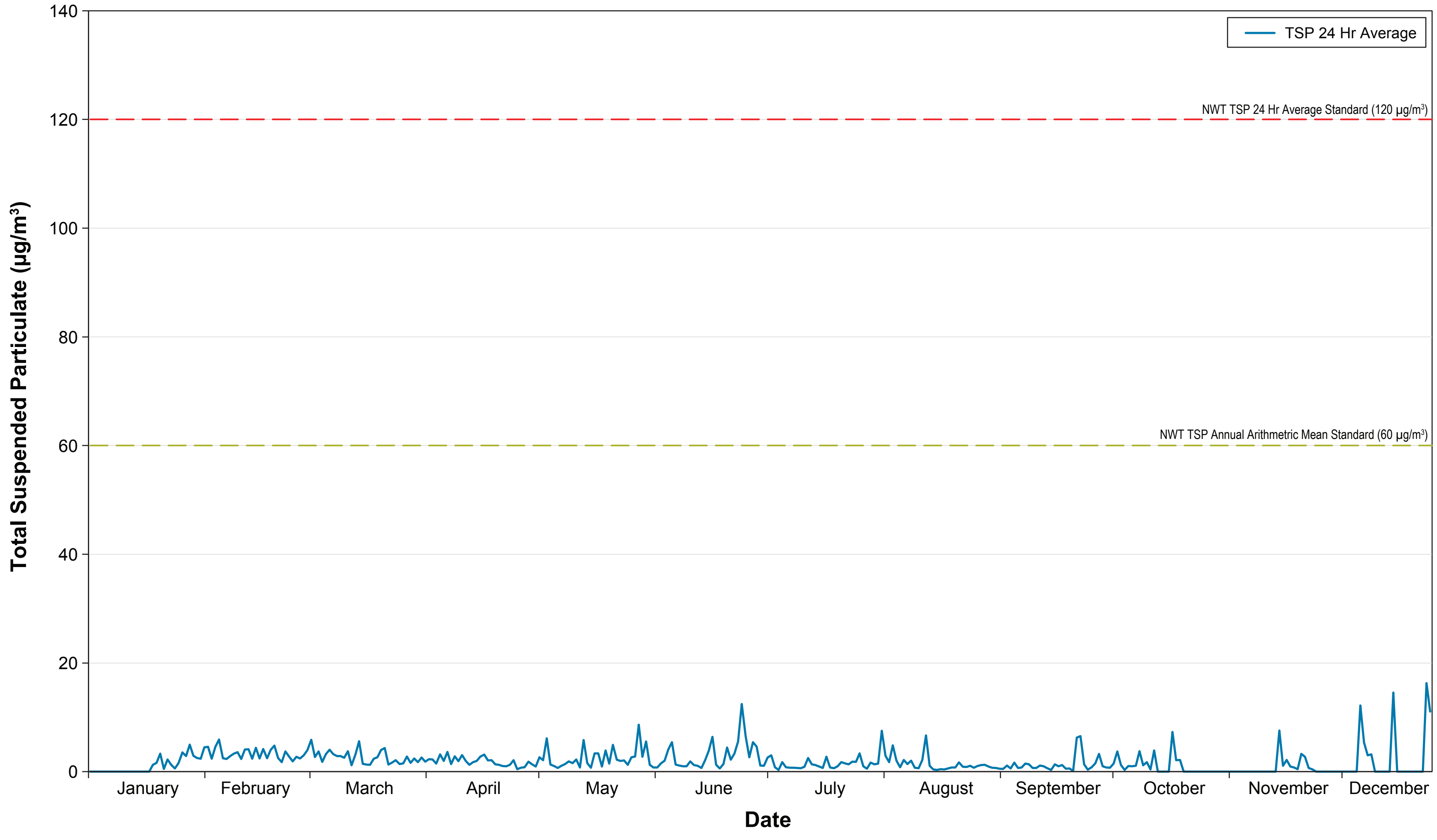
# Figure 2.3-3

## 2015 Daily Mean TSP Readings – Communications Building



# Figure 2.3-4

# 2015 Daily Mean TSP Readings – A154 Dike



### Table 2.3-1. 2014 and 2015 TSP Results, Diavik Diamond Mine

| Year | Station | TSP Concentration (µg/m³) Annual Mean | Max. Daily Mean | Min. Daily Mean | No. of Daily TSP Exceedances (>120 µg/m³) | No. of Days with Data Used[1] |
|---|---|---|---|---|---|---|
| 2014 | Communications Building | 14.5 | 82.2 | 1.9 | 0 | 162 (44%) |
| 2014 | A154 Dike | 8.7 | 64.4 | 0.3 | 0 | 202 (55%) |
| 2015 | Communications Building | 13.6 | 124 | 0.5 | 1 | 318 (87%) |
| 2015 | A154 Dike | 2.3 | 16.3 | 0.1 | 0 | 293 (80%) |

[1] *Number of days with 18 or more hours of hourly data (75%)*

In 2014, the annual mean TSP concentration was 14.5 µg/m³ at the CB Station and 8.7 µg/m³ at the A154 Dike Station. The annual mean TSP at both stations was lower than the annual mean TSP standard of 60 µg/m³ and there were no exceedances of the 24 hr mean TSP standard of 120 µg/m³. There were 162 and 202 days in 2014 with sufficient hourly TSP data to calculate daily mean TSP values for the CB and A154 Dike Stations, respectively. Insufficient data were available to make robust seasonal comparisons as the majority of missing data occurred during the summer at both stations.

In 2015 at the CB Station, TSP was greater (124 µg/m³) than the 24 hr mean standard (120 µg/m³) on one (1) occasion (February 5, 2015); however, the overall annual mean (13.6 µg/m³) was lower than the annual mean standard (60 µg/m³) in 2015. These results are consistent with the prediction from the 2012 dispersion model which predicted two (2) 24 hr exceedances per year.

Greater TSP concentrations were observed in the winter months (13.4 µg/m³ average from October to March) than in the summer months (12.9 µg/m³ from June to September) at the CB Station; however, the difference between the two seasons was minimal suggesting seasonal factors did not play a major factor in the observed TSP. Instead TSP concentrations were more likely influenced by construction and operations activities. Additionally, dust suppression activities may have impacted the observed TSP during the summer months. A154 Dike Station TSP observations also reflected a minor seasonal effect: 3.1 µg/m³ average from October to March and 1.8 µg/m³ from June to September.

In 2015 at the A154 Dike Station, TSP did not exceed the 24 hr Average (120 µg/m³) or the annual arithmetic mean (60 µg/m³).

Both the CB Station and the A154 Dike Station had data gaps in 2015. The CB Station and the A154 Dike Station did not record data 13% and 20% of the time in 2015, respectively. There were 48 days in 2015 in which the A154 Dike Station did not record TSP concentrations including the following periods due to sensor malfunctions:

- January 1st to January 17th, 2015 (17 days);
- October 25th to November 19th, 2015 (26 days); and
- November 30th to December 10th, 2015 (12 days).

Values on these days were not included in the annual arithmetic mean calculation. The CB Station did not experience long periods of no results recorded like the A154 Dike Station did in 2015.

# 3. DUSTFALL MONITORING

Community interest in the possible effects of dust deposition on wildlife and aquatic environments are the basis for the focus of DDMI's EAQMP on TSP. Dustfall is the total fraction that deposits on vegetation, snow and water and it is the total fraction that is monitored in the dust gauges and snow cores.

In accordance with the EA and requirements associated with the Aquatic Effects Monitoring Program (AEMP), a dust monitoring program was initiated in 2001. The program was designed to achieve the following objectives:

- Determine dust deposition (dustfall) rates at various distances from the Project footprint; and
- Determine the chemical characteristics of dustfall that may be deposited onto and subsequently into, Lac de Gras as a result of mining activities, in support of the AEMP.

In 2014 and 2015, dustfall monitoring included three components, with sampling conducted at varying distances around the Project from 25 to 5,655 metres (m) away from infrastructure:

1. Dustfall gauges (10 monitoring and 2 control locations);
2. Dustfall from snow surveys (24 monitoring and 3 control locations); and
3. Snow water chemistry from snow surveys (16 monitoring and 3 control locations).

Additional information, data and figures can be found in the *2014 Diavik Dust Deposition Report* (ERM 2015) and the *2015 Diavik Dust Deposition Report* (ERM 2016a; Appendix A).

## 3.1 DUSTFALL GAUGES

Dustfall gauges were placed at 12 stations (including two control stations) around the Project at distances ranging from approximately 25 to 5,655 m from mining operations (Table 3.1-1 and Figure 3.1-1). Each gauge collected dustfall year-round, with samples being collected for analysis every three months. The average total sampling period for the 12 locations was 367 from 2014-2015 and 387 days from 2015-2016.

Dustfall gauges consisted of a hollow brass cylinder (52 centimetres (cm) length, 12.5 cm inner diameter) housed in a Nipher snow gauge (Plate 3.1-1). The cylinder collected dustfall, while the Nipher snow gauge reduced air turbulence around the gauge to increase dustfall catch efficiency. The cylinder was exchanged with an empty, clean cylinder at the end of each sampling period and the content of the cylinder that was retrieved was processed in the DDMI environment laboratory to determine the mass of collected dustfall. This processing involved filtration, drying and weighing of samples as specified in the standard operating procedures (SOPs) ENVR-508-0112 and ENVI-403-0112 (Appendix A).

*Plate 3.1-1. Dustfall gauge during sample collection. The dustfall gauge consisted of a hollow brass cylinder (centre) housed inside a Nipher snow gauge (right).*

## Table 3.1-1. Dustfall Gauges and Snow Survey Sampling Locations, Diavik Diamond Mine, 2014 and 2015

| Transect Line | Station ID | Sampling Dates | | Total Sample Exposure Duration (Days) | | UTM Coordinates[1] | | Approx. Distance from Mining Operations (m) | Surface Description | Snow Water Chemistry Sampled[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2014 | 2015 | 2014 | 2015 | Easting (m) | Northing (m) | | | |
| *Dustfall Gauges* | | | | | | | | | | |
| | Dust 1 | Mar. 21, Jun. 3, Sep. 15, Dec. 7 | Mar. 8, Jul. 5, Sep. 17, Jan. 1 | 368 | 391 | 533964 | 7154321 | 75 | Land | n/a |
| | Dust 2A | Mar. 21, Jun. 2, Sep. 15, Dec. 7 | Mar. 7, Jul. 5, Sep. 15, Jan. 1 | 366 | 390 | 535678 | 7151339 | 435 | Land | n/a |
| | Dust 3 | Mar. 21, Jun. 3, Sep. 15, Dec. 7 | Mar. 7, Jul. 5, Sep. 17, Jan. 1 | 366 | 391 | 535024 | 7151872 | 30 | Land | n/a |
| | Dust 4 | Mar. 22, Jun. 3, Sep. 15, Dec. 7 | Mar. 9, Jul. 5, Sep. 17, Jan. 1 | 368 | 391 | 531397 | 7152127 | 200 | Land | n/a |
| | Dust 5 | Mar. 21, Jun. 2, Sep. 14, Dec. 7 | Mar. 9 Jul. 5, Sep. 14, Jan. 1 | 368 | 368 | 535696 | 7155138 | 1,195 | Land | n/a |
| | Dust 6 | Mar. 22, Jun. 3, Sep. 13, Dec. 7 | Mar. 7, Jul. 5, Sep. 17, Jan. 1 | 366 | 391 | 537502 | 7152934 | 25 | Land | n/a |
| | Dust 7 | Mar. 21, Jun. 2, Sep. 14, Dec. 7 | Mar. 7, Jul. 5, Sep. 15, Jan. 1 | 368 | 390 | 536819 | 7150510 | 1,155 | Land | n/a |
| | Dust 8 | Mar. 21, Jun. 2, Sep. 14, Dec. 7 | Mar. 9, Jul. 5, Sep. 14, Jan. 1 | 366 | 368 | 531401 | 7154146 | 1,220 | Land | n/a |
| | Dust 9 | Mar. 21, Jun. 2, Sep. 13, Dec. 7 | Mar. 7, Jul. 5, Sep. 15, Jan. 1 | 368 | 390 | 541204 | 7152154 | 3,810 | Land | n/a |
| | Dust 10 | Mar. 22, Jun. 2, Sep. 13, Dec. 7 | Mar. 9, Jul. 5, Sep. 15, Jan. 1 | 368 | 390 | 532908 | 7148924 | 670 | Land | n/a |
| | Dust C1 | Mar. 22, Jun. 2, Sep. 13, Dec. 7 | Mar. 9, Jul. 5, Sep. 15, Jan. 1 | 368 | 390 | 534979 | 7144270 | 5,655 | Land | n/a |
| | Dust C2 | Mar. 22, Jun. 2, Sep. 14, Dec. 7 | Mar. 9, Jul. 5, Sep. 14, Jan. 1 | 366 | 390 | 528714 | 7153276 | 3,075 | Land | n/a |

### Table 3.1-1. Dustfall Gauges and Snow Survey Sampling Locations, Diavik Diamond Mine, 2014 and 2015 (continued)

| Transect Line | Station ID | Sampling Dates | | Total Sample Exposure Duration (Days) | | UTM Coordinates[1] | | Approx. Distance from Mining Operations (m) | Surface Description | Snow Water Chemistry Sampled[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2014 | 2015 | 2014 | 2015 | Easting (m) | Northing (m) | | | |
| *Snow Surveys* | | | | | | | | | | |
| 1 | SS1-1 | Apr. 8 | Apr. 2 | 201 | 184 | 533911 | 7154288 | 30 | Land | |
| | SS1-2 | Apr. 8 | Apr. 2 | 201 | 184 | 533924 | 7154367 | 115 | Land | |
| | SS1-3[3] | Apr. 8 | Apr. 2 | 201 | 184 | 533966 | 7154517 | 275 | Land | |
| | SS1-4 | Apr. 8 | Apr. 2 | 201 | 158 | 534485 | 7155094 | 920 | Ice | ✓ |
| | SS1-5[4] | May 11 | Apr. 2 | 189 | 158 | 535099 | 7156279 | 115 | Ice | ✓ |
| 2 | SS2-1[5] | May 11 | Apr. 14 | 189 | 170 | 537553 | 7153473 | 180 | Ice | ✓ |
| | SS2-2[5] | May 11 | Apr. 14 | 189 | 170 | 537829 | 7153476 | 445 | Ice | ✓ |
| | SS2-3[5] | May 11 | Apr. 14 | 189 | 170 | 538484 | 7153939 | 1,220 | Ice | ✓ |
| | SS2-4 | May 11 | Mar. 31 | 189 | 156 | 539151 | 7154685 | 2,180 | Ice | ✓ |
| 3 | SS3-4 | May 11 | Apr. 5 | 189 | 161 | 536585 | 7151002 | 615 | Ice | ✓ |
| | SS3-5 | May 11 | Apr. 5 | 189 | 161 | 537623 | 7150817 | 1,325 | Ice | ✓ |
| | SS3-6 | May 11 | Apr. 5 | 189 | 161 | 536305 | 7151564 | 60 | Ice | ✓ |
| | SS3-7[4] | May 11 | Apr. 5 | 189 | 161 | 536344 | 7151366 | 250 | Ice | ✓ |
| | SS3-8 | May 11 | Apr. 5 | 189 | 161 | 536688 | 7150810 | 830 | Ice | ✓ |
| 4 | SS4-1 | Apr. 19 | Apr. 8 | 212 | 190 | 531491 | 7152211 | 100 | Land | |
| | SS4-2 | Apr. 19 | Apr. 8 | 212 | 190 | 531356 | 7152261 | 245 | Land | |
| | SS4-3 | Apr. 19 | Apr. 8 | 212 | 190 | 531331 | 7152434 | 350 | Land | |
| | SS4-4[3] | May 12 | Apr. 8 | 190 | 164 | 531141 | 7153167 | 1,065 | Ice | ✓ |
| | SS4-5[4,5] | May 12 | Apr. 8 | 190 | 164 | 531405 | 7154116 | 1,220 | Ice | ✓ |

## Table 3.1-1. Dustfall Gauges and Snow Survey Sampling Locations, Diavik Diamond Mine, 2014 and 2015 (completed)

| Transect Line | Station ID | Sampling Dates | | Total Sample Exposure Duration (Days) | | UTM Coordinates[1] | | Approx. Distance from Mining Operations (m) | Surface Description | Snow Water Chemistry Sampled[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2014 | 2015 | 2014 | 2015 | Easting (m) | Northing (m) | | | |
| 5 | SS5-1[3,6] | Apr. 19 | Apr. 10 | 212 | 192 | 533150 | 7148925 | 665 | Land | |
| | SS5-2 | May 12 | Apr. 10 | 212 | 192 | 533150 | 7148875 | 710 | Land | |
| | SS5-3 | May 12 | Apr. 10 | 190 | 166 | 533150 | 7148700 | 885 | Ice | ✓ |
| | SS5-4 | May 12 | Apr. 10 | 190 | 166 | 533150 | 7147950 | 1,635 | Ice | ✓ |
| | SS5-5 | May 12 | Apr. 10 | 190 | 166 | 533150 | 7146950 | 2,635 | Ice | ✓ |
| Control 1 | | May 12 | Apr. 10 | 235 | 192 | 534983 | 7144271 | 5,655 | Land | ✓[7] |
| Control 2 | | May 12 | Apr. 8 | 235 | 190 | 528714 | 7153281 | 3,075 | Land | ✓[7] |
| Control 3 | | May 11 | Apr. 5 | 234 | 187 | 538650 | 7148750 | 3,570 | Land | ✓[7] |

[1] *UTM Zone 12W, NAD83*

[2] *n/a = not applicable, blank cell = no snow water chemistry sample and ✓= snow water chemistry sample collected.*

[3] *Duplicate sample collected in 2014 for snow water chemistry.*

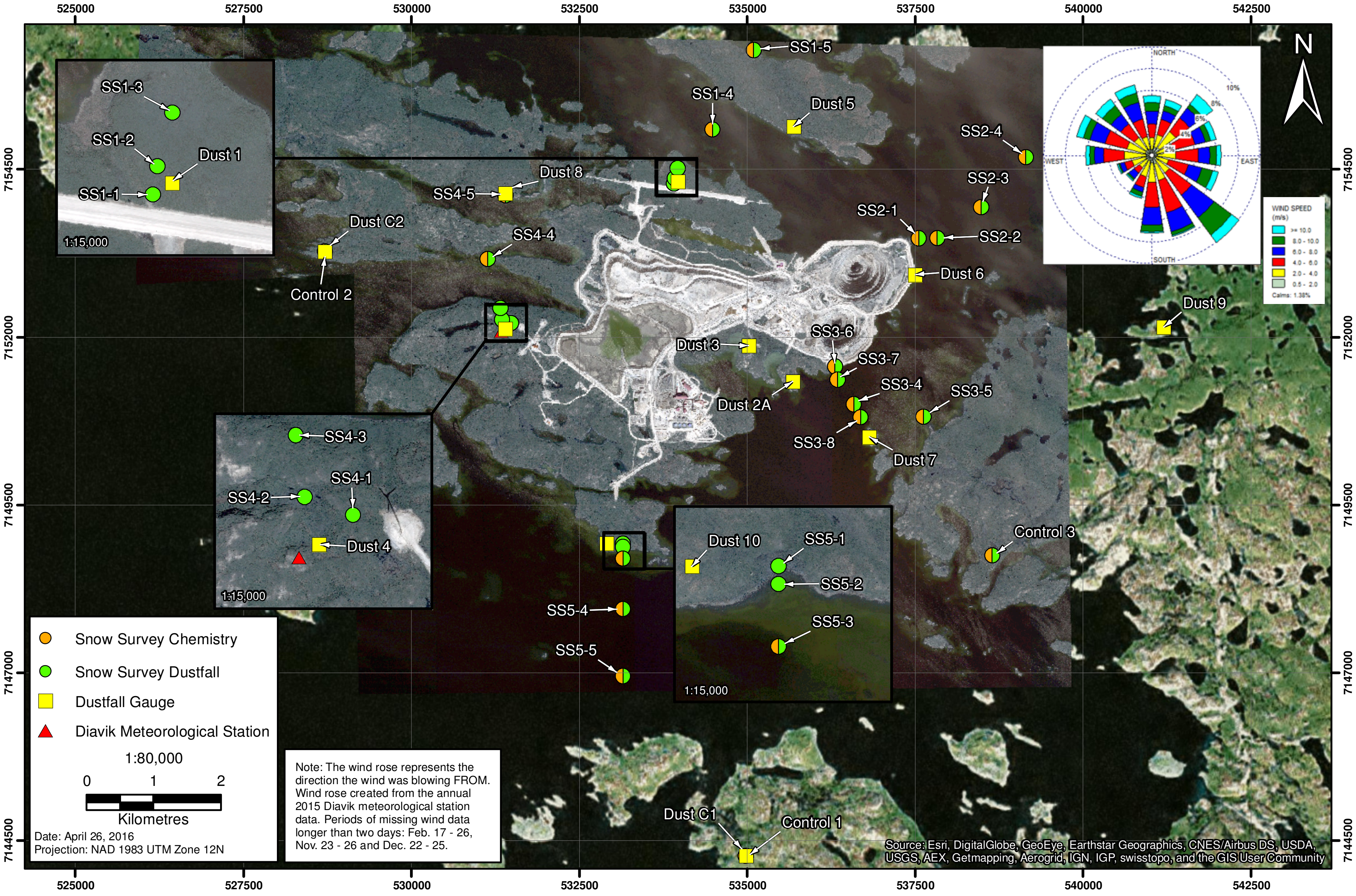
[4] *Duplicate sample collected in 2015 for snow water chemistry.*

[5] *Blank sample collected in 2014 for snow water chemistry.*

[6] *Blank sample collected in 2015 for snow water chemistry.*

[7] *Snow water chemistry was sampled over ice, adjacent to the on-land control station, see Appendix A for further details.*

# Figure 3.1-1
## Dustfall Gauge and Snow Survey Locations, Diavik Diamond Mine, 2015



Date: April 26, 2016
Projection: NAD 1983 UTM Zone 12N

Note: The wind rose represents the direction the wind was blowing FROM. Wind rose created from the annual 2015 Diavik meteorological station data. Periods of missing wind data longer than two days: Feb. 17 - 26, Nov. 23 - 26 and Dec. 22 - 25.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Once the mass of collected dustfall at a station was measured, the mean daily dustfall rate over the collection period was calculated as:

$$D = \frac{M}{A * T} \qquad \text{[Equation 3.1-1]}$$

where

$D$ = mean daily dustfall rate (mg/dm$^2$/d) during time period $T$
$M$ = mass of dustfall collected (mg) during time period $T$
$A$ = surface area of dustfall gauge collection cylinder orifice (dm$^2$; approximately 1.227 dm$^2$)
$T$ = number of days of dustfall collection (d)

Estimated dustfall rates were compared to British Columbia Ministry of Environment (BC MOE) dustfall objectives for the mining, smelting and related industries (Table 3.1-2; BC MOE 2016). The dustfall objectives ranges from 1.7 to 2.9 milligram per square decimetre per day (mg/dm$^2$/d), averaged over 30 days. The 1.7 mg/dm$^2$/d objective is often considered to be applicable at sensitive locations whereas the 2.9 mg/dm$^2$/d objective is applicable to areas where it can be shown that unacceptably deleterious changes will not follow. Snow water chemistry data were compared to effluent quality criteria (EQC) as indicated in the Project Water Licence (W2007L2-0003) as approved by the WLWB.

**Table 3.1-2. Dustfall and Snow Water Chemistry Reference Values**

| Parameter | Value | Unit | Comment | Source |
|---|---|---|---|---|
| Dustfall Rate | 1.7 – 2.9<br>(621 – 1,059) | mg/dm$^2$/d<br>(mg/dm$^2$/y) | Objective for the mining, smelting and related industries | BC MOE (2016) |
| Aluminum-Total | 3,000 | µg/L | Max. grab sample concentration | W2007L2-0003 |
| Ammonia-N | 12,000 | µg/L | Max. grab sample concentration | W2007L2-0003 |
| Arsenic-Total | 100 | µg/L | Max. grab sample concentration | W2007L2-0003 |
| Cadmium-Total | 3 | µg/L | Max. grab sample concentration | W2007L2-0003 |
| Chromium-Total | 40 | µg/L | Max. grab sample concentration | W2007L2-0003 |
| Copper-Total | 40 | µg/L | Max. grab sample concentration | W2007L2-0003 |
| Lead-Total | 20 | µg/L | Max. grab sample concentration | W2007L2-0003 |
| Nickel-Total | 100 | µg/L | Max. grab sample concentration | W2007L2-0003 |
| Nitrite-N | 2,000 | µg/L | Max. grab sample concentration | W2007L2-0003 |
| Zinc-Total | 20 | µg/L | Max. grab sample concentration | W2007L2-0003 |

## 3.2 DUSTFALL SNOW SURVEYS

Dustfall was assessed as part of the snow surveys completed at 27 stations (including three control stations), along five transects around the Project (Table 3.1-1; Figure 3.3-1). Across stations, the distance from mining operations ranged from approximately 30 to 5,655 m. The average exposure periods were 200 and 171 days in 2014 and 2015, respectively. The start dates correspond to the first snowfall for land stations (September 19, 2013 and September 30, 2014) and shortly after ice freeze up, once ice conditions were safe for work, for ice stations (November 3, 2013 and October 26, 2014).

At each snow survey station, a snow corer was used to drill into the snow pack to retrieve a cylindrical snow core (6.1 cm inner diameter; Plate 3.2-1). Cores were extracted at each station and composited in the field to obtain a representative snow sample for the station. A minimum of three snow cores were collected at each (land and ice) snow sampling station, as outlined in the SOP ENVR-512-0213. Composited samples were bagged and brought to the DDMI environment laboratory for processing as specified in SOP ENVR-512-0213 and ENVI-403-0112 (see Appendix F). Processing of snow cores required filtration, drying and weighing. For QA/QC, duplicate samples were collected at the stations indicated in Table 3-1-1.

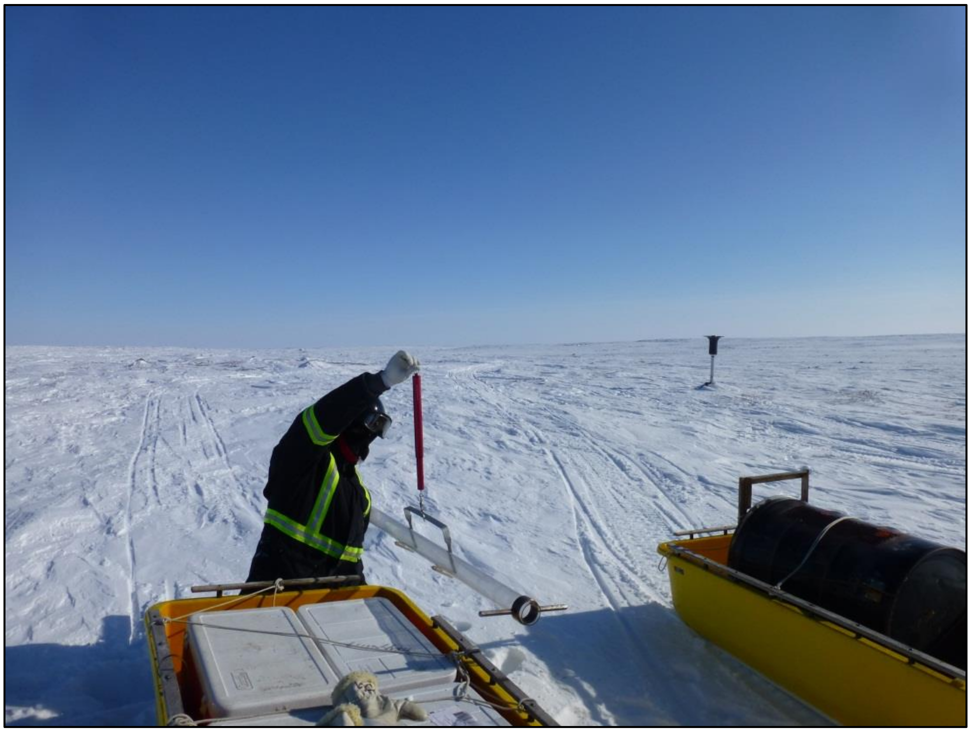


*Plate 3.2-1. Snow core sample being weighed, with dustfall gauge in background.*

Mean daily dustfall rate (mg/dm$^2$/d) was calculated for the collection period using Equation 3.1-1, with surface area ($A$) equal to the surface area of the snow corer tube orifice (0.2922 dm$^2$) multiplied by the number of snow cores used for the composited sample at the station. The mean annual dustfall rate (mg/dm$^2$/y) was estimated by multiplying the mean daily dustfall rate by 365 days.

Dustfall rates were compared to the BC dustfall objective for the mining, smelting and related industries (Table 3.1-2).

## 3.3 SNOW WATER CHEMISTRY

Snow water chemistry analysis was performed on snow cores extracted from 19 of the snow survey locations (including three control locations; Table 3.1-1; Figure 3.3-1). These locations included the 16 snow survey dustfall stations that were located on ice, as well as samples taken on ice adjacent to the three control stations. Across stations, the distance from mining operations ranged from approximately 60 to 5,655 m. The average exposure periods were 200 and 171 days in 2014 and 2015, respectively. At each station located over water, cores were collected for chemistry analysis immediately after the dustfall snow cores were extracted.

Snow water chemistry cores were extracted using a snow corer in accordance with the dustfall snow survey core extraction. A minimum of three cores at each site were extracted and composited to obtain the required 3 litres (L) of snow water for the laboratory chemical analysis (see Appendix F). Snow cores were then processed and prepared for shipment to Maxxam where the chemical analysis was performed. For QA/QC purposes, duplicate samples and blanks were collected at the stations indicated in Table 3.1-1. Snow water chemistry sampling methodology is detailed in the *2014 Diavik Dust Deposition Report* (ERM 2015) and the *2015 Diavik Dust Deposition Report* (ERM 2016a; Appendix A).

EQC, including "maximum average concentration" and "maximum concentration of any grab sample," are stipulated in DDMI's Water Licence (W2007L2-0003) for aluminium, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite and zinc (Table 3.1-2). Snow water chemistry results for these variables were compared to the "maximum concentration of any grab sample." These results are also presented as part of DDMI's AEMP report.

## 3.4 RESULTS

Dustfall and snow water chemistry results were grouped into zones based on their relative distance from the Project footprint (Table 3.4-1). Although station groupings into zones were first established at the outset of the program, these groupings were re-established in 2013 using satellite imagery of the site.

The primary sources of fugitive dust were associated with unpaved road and airstrip usage in 2014 and 2015, with the addition of construction activities at A21 in 2015. To supress dust generation, roads were watered during the summer as needed and EK35 was applied to the airport apron (tarmac) and helipad during the spring months. Construction for the A21 development started in 2015, which involved re-mining, hauling and crushing of 3,362,383 tonnes of waste rock from the North Country rock pile. Project production rate was steady throughout the year and all mining occurred underground. Fugitive dust generation is expected to be greatest during snow-free periods where and when there is site activity. It was expected that the highest fugitive dust generation and resulting dustfall occurred in areas closest to the Project footprint such as near A21 and the country rock pile between May and September.

The predominant winds in 2014 were from the east, south, and southeast, with sporadic strong winds from the north. The 2015 predominant wind directions were largely omnidirectional with a higher frequency from the southeast and lower frequency from the southwest. The expectation is that airborne material will be deposited primarily west, north, northwest, and south of the Project as seen in Figure 3.3-1.

Results from the dustfall gauges, dustfall snow surveys and the snow water chemistry analysis are presented below.

### 3.4.1 Dustfall Gauges

Total dustfall collected from each dustfall gauge throughout the year is summarized in Table 3.4-1. The following tables and figures are included in the *2014 Diavik Dust Deposition Report* (ERM 2015) and the *2015 Diavik Dust Deposition Report* (ERM 2016a; Appendix A):

- Total dustfall observed at each station for each sampling period;
- Annual dustfall for each station at its location relative to the Project;
- Historical records of annual dustfall for each station;
- A comparison of dustfall versus distance from the Project footprint; and
- Boxplots summarizing the dustfall magnitude distribution measured in each year.

Detailed information on the 2014 and 2015 measurements and calculations for each station are included in the annual dust deposition reports (ERM 2015; ERM 2016a, Appendix A).

In general, dustfall decreased with increasing distance from the Project (Table 3.4-1; ERM 2015, ERM 2016a, Appendix A). The greatest estimated dustfall rate measured using gauges occurred at the closest station (within 30 m) to the Project, Dust 3 (479 mg/dm²/y in 2014 and 582 mg/dm²/y in 2015). Station Dust 3 is downwind of the footprint. The second highest dustfall rate in 2014 was observed at Dust 6 (429 mg/dm²/y), which is approximately 25 m from the project. The second highest estimated dustfall rate in 2015 was observed at Dust 7 (458 mg/dm²/y), which is over 1 kilometre from the Project. The lowest dustfall rates were measured at the two control stations and at: Dust C1 (105 and 98 mg/dm²/y in 2014 and 2015, respectively) in the 5,655 m zone, Dust C2 (61 and 112 mg/dm²/y in 2014 and 2015, respectively) in the 3,075 m zone and Dust 9 (89 and 88 mg/dm²/y in 2014 and 2015, respectively) in the 3,810 m zone (Table 3.4-1; ERM 2015; ERM 2016a, Appendix A). In 2015, dustfall measured near the airstrip at Dust 1 (391 mg/dm²/y) was below the mean (467 mg/dm²/y) in the 0 - 100 m zone.

With the exception of stations Dust 3 and Dust 7, observed annual dustfall rates estimated from dustfall gauges in 2014 and 2015 were less than historical dustfall rate estimates. At stations Dust 3 and Dust 7, 2015 dustfall rates were within the range of historical values. Dustfall rates were generally greater in 2015 than in 2013 and 2014; however, are within the range of dustfall rates recorded for the Project (ERM 2015; ERM 2016a, Appendix A).

The annualized dustfall rates estimated from gauges at each station were less than the BC objective for the mining industry (621 – 1,059 mg/dm²/y). There are currently no standards or objectives for the Northwest Territories; however, the BC objective is generally used as a standard for comparison at other mines in the region.

**Table 3.4-1. Dustfall Results, Diavik Diamond Mine, 2014 and 2015**

| Zone (m) | Year | Dustfall (mg/dm²/y) | |
|---|---|---|---|
| | | Median | Mean |
| 0 - 100 | 2014 | 337 | 321 |
| | 2015 | 378 | 467 |
| 101 - 250 | 2014 | 140 | 166 |
| | 2015 | 96 | 145 |
| 251 - 1,000 | 2014 | 131 | 135 |
| | 2015 | 160 | 222 |
| 1,001 - 2,500 | 2014 | 88 | 126 |
| | 2015 | 85 | 125 |
| Control | 2014 | 61 | 55 |
| | 2015 | 92 | 71 |

Dust gauges recorded greater amounts of residue in the spring and summer months (March to July) than in the fall and winter months (September to January). For example, Station Dust 3 gauge recorded 386.7 mg of residue in July which was deployed for 120 days compared to 81 mg of residue recorded in January which was deployed for 106 days. Similar trends were observed for all other gauges. As expected, fugitive dust generation was the greatest during snow-free periods where and when there is site activity. The highest fugitive dust generation and resulting dustfall occurred in areas closest to the Project footprint such as near A21 and the country rock pile between May and September.

The 2012 modelling predicted maximum dustfall deposition rates are to be higher on the Project site (222.2 mg/dm$^2$/y) than off-site (4.1 mg/dm$^2$/y) and generally greater than originally predicted in 1998. For example, 100 mg/dm$^2$/y was originally predicted adjacent to A154 pit (Cirrus Consultants 1998). Dustfall measured in 2014 and 2015 exceeded the modelled predictions in the immediate vicinity of the mine infrastructure, as well as dustfall rates for off-site areas. However, the 2015 dustfall results were expected to be greater than the modelled predictions for operations because of construction activities simultaneously occurring during operations activities.

### 3.4.2 Dustfall Snow Surveys

Annual dustfall rates estimated from each snow survey station in 2014 and 2015 are included in the annual rates presented in Table 3.4-1. Historical records of annual dustfall rates for each station, the relationships between annual dustfall rates and distance from the Project footprint, boxplots summarizing dustfall rates measured in each year are presented in the annual dust deposition reports (ERM 2015; ERM 2016, Appendix A) . Duplicate samples were collected at stations indicated in Table 3.4-1 for QA/QC purposes and are discussed in the annual dust deposition reports (ERM 2015; ERM 2016a, Appendix A).

Annualized dustfall rates estimated from snow survey data ranged from 4 to 337 mg/dm$^2$/y in 2014 and 9.3 to 1,013 mg/dm$^2$/y in 2015 (ERM 2015; ERM 2016a, Appendix A). In general, dustfall rates decreased with increasing distance from the Project, with the lowest dustfall rate recorded at station Control 1 in both 2014 and 2015. Dustfall rates at stations Dust 3, SS1-2, Dust 2A, Dust 7, and SS3-5 (2014), and SS1-3, Dust 7, SS3-6, SS3-7, SS3-4, SS3-8 and SS3-5 (2015) were greater than the upper limit of the 95% confidence interval for their respective zones. The distribution of higher dustfall measurements at these stations suggested higher dustfall rates south, southeast, north, and northwest of the Project (ERM 2015; ERM 2016a, Appendix A).

Comparisons of mean and maximum values suggest that dustfall rates were generally higher in 2015 than in 2013 and 2014 (ERM 2016a; Appendix A).

Annualized dustfall rates measured at each station during the 2014 and 2015 snow surveys were less than the BC objective for the mining industry (621 – 1,059 mg/dm$^2$/y).

### 3.4.3 Snow Chemistry

All analytical results for snow water chemistry are included in the *2014 Diavik Dust Deposition Report* (ERM 2015) and the *2015 Diavik Dust Deposition Report* (ERM 2016a; Appendix A). Results of QA/QC samples are also discussed in the annual dust deposition reports.

All 2014 samples had analyte concentrations less than reference levels as specified by the "maximum concentration of any grab sample" specified in Water Licence W2007L2-0003. 2015 sample concentrations were also less than their associated reference levels with the exception of station SS3-6 located in the 0 – 100 m zone (Table 3.4-2). Station SS3-6 observed aluminum, chromium, nickel, and zinc concentrations were greater than the respective reference levels. Station SS3-6 is 60 m from the Project (second closest sample location) and had the highest residue mass per filter (391.7 mg) of any of the snow core samples.

**Table 3.4-2. Snow Water Chemistry Results, Diavik Diamond Mine, 2014 and 2015**

| Zone (m) | Year | Maximum Snow Water Chemistry Results (µg/L) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Aluminum | Ammonia | Arsenic | Cadmium | Chromium | Copper | Lead | Nickel | Nitrite | Phosphorus | Zinc |
| 0 - 100 | 2014 | 410 | 49 | 0.21 | 0.01 | 6.3 | 1.6 | 0.78 | 18 | 4.8 | 43 | 7.4 |
| | 2015 | *4,260* | 190 | 0.8 | 0.08 | *53* | 8.5 | 6.6 | *130* | 5.4 | 290 | *29* |
| 101 - 250 | 2014 | 780 | 120 | 0.35 | 0.02 | 13 | 3.9 | 1.3 | 37 | 5.3 | 90 | 11 |
| | 2015 | 600 | 78 | 0.3 | 0.02 | 8.1 | 1.9 | 0.8 | 18 | 4.7 | 66 | 7.3 |
| 251 - 1,000 | 2014 | 1,260 | 170 | 0.42 | 0.02 | 32 | 4.1 | 1.9 | 97 | 7.3 | 160 | 12 |
| | 2015 | 3,000 | 150 | 0.5 | 0.05 | 37 | 6.5 | 5.5 | 85 | 8.2 | 120 | 22 |
| 1,001 - 2,500 | 2014 | 430 | 95 | 0.32 | 0.01 | 8.4 | 1.6 | 0.92 | 24 | 4.5 | 42 | 7.2 |
| | 2015 | 1,740 | 120 | 0.4 | 0.1 | 22 | 3.1 | 1.9 | 46 | 6.3 | 64 | 13 |
| Control | 2014 | 450 | 110 | 0.24 | 0.01 | 6.8 | 2.5 | 0.94 | 20 | 6.4 | 83 | 6.6 |
| | 2015 | 2,230 | 54 | 0.3 | 0.1 | 32 | 3.4 | 2.3 | 63 | 2.5 | 19 | 15 |

*Note: Values in bold greater than applicable EQG.*

In general, average concentrations of snow water chemistry variables of interest decreased with increasing distance from the Project (ERM 2015; ERM 2016a, Appendix A). However, high and variable concentrations were observed in 2015 for aluminum, chromium, and nickel at Station SS3-8, located in the 251 to 1,000 zone, and SS4-4, located in the 1,001 to 2,500 zone. Station SS3-8 also had among the highest concentrations observed in 2014. Select metal concentrations at these two locations were more than double the concentrations recorded at the other sites, including samples collected in the 101 to 250 zone. Station SS3-8 is located to the southeast and SS4-4 is located northwest of the Project (Figure 3.1-1).

# 4. NATIONAL POLLUTANT RELEASE INVENTORY

## 4.1 PROGRAM OVERVIEW

According to ECCC, air issues such as smog and acid rain result from the presence of, and interactions between, a group of pollutants known as Criteria Air Contaminants (CAC) and some related pollutants. CAC, in particular, refer to a group of pollutants that include:

- Sulphur Oxides ($SO_x$);
- Nitrogen Oxides ($NO_x$);
- Particulate Matter (PM);
- Volatile Organic Compounds (VOC);
- Carbon Monoxide (CO); and
- Ammonia ($NH_3$).

In addition, Ground-level Ozone ($O_3$) and Secondary Particulate Matter are often referred to among the CAC because both ground-level ozone and secondary particulate matter are by-products of chemical reactions between the CAC (ECCC 2013).

CAC are produced from a number of sources, including burning of fossil fuels and it is because of these shared sources that CAC are grouped together.

While there is no regulatory requirement or standard for pollutant release in the Northwest Territories, the National Pollutant Release Inventory (NPRI) is a legislated, publicly accessible inventory used to track the amount of pollutant releases (to air, water and land), disposals and transfers for recycling. The program is administered by ECCC and is a requirement of the Canadian Environmental Protect Act (CEPA) 1999 for owners or operators of facilities that exceed 20,000 employee hours per year and that meet the NPRI reporting requirements published in the Canada Gazette, Part I (ECCC 2016a). NPRI reports containing emissions of CACs are to be submitted prior to June 1 each year to ECCC.

NPRI substance emissions were derived using emission factor calculations provided by Environment Canada NPRI Toolkit (NPRI 2016). Operational values such as fuel usage and mobile equipment hours were recorded at the Project throughout the year and weather conditions from the Project (onsite) weather station are used to calculate NPRI values.

## 4.2 RESULTS

Table 4.2-1 compares 2014 NPRI results against the 2015 NPRI results for the Project. NPRI reports for previous years (2001 – 2014) are available on the NPRI website (ECCC 2016d). NPRI results for the previous year are typically released by ECCC in April, 22 months following submission on June 1 of each year. (e.g., 2014 data was reported by June 1 2015 is released by Environment Canada in April of 2016).

**Table 4.2-1. NPRI Results, Diavik Diamond Mine, 2014 and 2015**

| CACs | Reporting Threshold (Tonnes) | 2014 (Tonnes) | 2015 (Tonnes) |
|---|---|---|---|
| Carbon Monoxide (CO) | 20 | 588 | 590 |
| Sulphur Dioxide ($SO_2$) | 20 | 0.7 | 0.8 |
| Oxides of Nitrogen (expressed as $NO_2$) ($NO_x$) | 20 | 2,214 | 2,221 |
| Volatile Organic Compounds (VOCs) | 10 | 56 | 57 |
| Total Particulate Matter (TPM) | 20 | 512 | 778 |
| Particulate Matter ≤ 10 µm ($PM_{10}$) | 0.5 | 172 | 294 |
| Particulate Matter ≤ 2.5 µm ($PM_{2.5}$) | 0.3 | 47 | 65 |

CO, $SO_x$, $NO_x$ and VOC levels increased modestly between 2014 and 2015 (Table 4.2-1). These constituents are primarily derived from the combustion of diesel fuel. Diesel consumption increased slightly in 2015 compared to 2014 and hence there was a minor increase in CO, $SO_x$, $NO_x$ and VOC's.

TPM, $PM_{10}$ and $PM_{2.5}$ levels in 2015 were greater when compared to 2014 (Table 4.2-1). The increase in dust-related variables is likely related to A21 construction activities, including crushing, material handling and road dust fugitive dust emissions.

# 5. GREENHOUSE GAS REPORTING

## 5.1 PROGRAM OVERVIEW

While there is no territorial regulatory requirement or standard for GHG release in the Northwest Territories, the Greenhouse Gas Emissions Reporting Program (GHGRP) is Canada's legislated, publicly accessible inventory of facility-reported GHG data and information. The program is administered by ECCC and is a requirement of the CEPA 1999 for owners or operators of facilities that emit the equivalent of 50,000 tonnes or more of GHGs in carbon dioxide equivalent units ($CO_2e$), per year. GHG reports are to be submitted prior to June 1 each year.

GHG emissions were derived by using emission factor calculations provided by Environment Canada for Metal Mining (ECCC 2004). Operational values such as fuel usage and mobile equipment hours were recorded at the Project throughout the year.

## 5.2 RESULTS

Table 5.2-1 below compares 2014 and 2015 GHG results for the Project. GHG reports for previous years (2001 – 2012) are available on the GHG website (ECCC 2016c). GHG results for the previous year are typically released by Environment Canada in April, 22 months following submission on June 1 of each year (e.g., 2014 data was reported by June 1, 2015 will be released by Environment Canada in April of 2016). However, 2013 and 2014 are currently not available for viewing on the ECCC GHG Inventory website.

Three GHG are calculated at the Project; $CO_2$, methane ($CH_4$) and nitrogen dioxide ($N_2O$). To calculate $CO_2e$, Global Warming Potentials (GWP) are used to convert $CH_4$ and $N_2O$ to $CO_2e$. The 2015 $CH_4$ and $N_2O$ GWPs are 25 and 298, respectively (ECCC 2016b).

**Table 5.2-1. GHG Equivalents for the Diavik Diamond Mine, 2014 and 2015**

| Constituent | 2014 (Tonnes) | 2015 (Tonnes) |
|---|---|---|
| $CO_2e$ | 179,476 | 186,942 |

The $CO_2e$ increased between 2014 and 2015 at the Project (Table 5.2-1). GHG emissions at the Project are primarily derived from the combustion of diesel fuel. Increased diesel consumption in 2015 compared to 2014 is due to increased mobile equipment usage for A21 Construction.

In 2015, the Project's 9.2 megawatt wind farm (consisting of four turbines; Plate 5.2-1) saved 5.2 million litres of diesel fuel needed for power, thereby reducing the Project's $CO_2e$ by 14,404 tonnes (7.7% of total GHG emissions). In 2015, the wind farm generated 20.8 gigawatt hours of energy or enough wind energy to power the Project's underground mine. Since start-up in 2012, the estimated diesel fuel savings has totalled 14.8 million litres and has prevented 41,771 tonnes of $CO_2e$ from being emitted to the atmosphere.

*Plate 5.2-1. The Diavik 9.2 megawatt wind farm. The wind farm consists of four wind turbines. (Diavik 2015)*

# 6. SUMMARY

Total suspended particulate concentrations were measured at two stations, the Communications Building and A154 Dike Stations, in 2014 and 2015. The 2014 annual TSP arithmetic means measured at the Communications Building and A154 Dike Stations were 14.5 µg/m$^3$ and 8.7 µg/m$^3$, respectively. Both were less than the Government of the Northwest Territories Department of Environment and Natural Resources annual arithmetic mean standard of 60 µg/m$^3$ and there were no daily exceedances of the 24 hour average standard of 120 µg/m$^3$. The 2015 annual arithmetic means measured at the Communications Building and A154 Dike Stations were 13.6 µg/m$^3$ and 2.3 µg/m$^3$, respectively. Both were less than the annual arithmetic mean standard of 60 µg/m$^3$. At the Communications Building Station, total suspended particulate concentration was greater than the 24 hour Average (120 µg/m$^3$) on one (1) occasion (day). These results are consistent with the prediction from the 2012 dispersion model which predicted two (2) 24 hour exceedances per year. In 2015 at the A154 Dike Station, total suspended solid did not exceed the 24 hour Average (120 µg/m$^3$) or the annual arithmetic mean (60 µg/m$^3$).

In 2015, dustfall was monitored at 12 dustfall gauges and 27 snow survey stations located at varying distances around the Project. Snow water chemistry was also measured at 19 of the snow survey stations and compared to EQC as indicated in the Project Water Licence (W2007L2-0003) as approved by the WLWB.

Median dustfall observed in 2015 was similar to that observed in 2014 and also decreased with distance from the Project. Annual dustfall measured at each of the 12 dustfall gauges ranged from 88 to 582 mg/dm$^2$/y. The annualized dustfall rates in 2014 and 2015 ranged from 9.3 to 1,013 mg/dm$^2$/y. Because dustfall gauges continuously collect dust throughout the year and the snow surveys are only representative of dustfall accumulated over the snow cover period, the reported annual dustfall results from the dustfall gauges are expected to provide a better estimate of annual dustfall compared to snow survey results for similar geographic areas. However, results obtained from both methods showed similar patterns.

Dustfall levels were generally higher in 2015 than in 2014. However, 2014 and 2015 dustfall levels are within the range of historical data collected for the Project. Annualized dustfall estimated from each snow survey station in 2014 and 2015 was less than some historical dustfall estimates. Comparisons of mean and maximum values suggest that dustfall rates were generally higher in 2015 than in 2013 and 2014. Overall, as expected, dustfall rates generally decreased with distance from the Project with the lowest dustfall rate recorded at station Control 1 (5,655 m from the Project) and areas that were predominantly downwind of the Project received more dustfall than upwind areas. Although there are no dustfall standards for the Northwest Territories, 2015 dustfall rates were less than the 1.7 to 2.9 mg/dm$^2$/d (621 to 1,059 mg/dm$^2$/y) BC MOE dustfall objective for the mining, smelting and related industries (BC MOE 2016).

Snow water chemistry analytes of interest included those variables with effluent quality criteria (EQC; i.e., aluminum, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite and zinc) or a load limit (i.e., phosphorous) specified in the Type "A" Water Licence (W2007L2-0003). All 2014 and 2015 sample concentrations were less than their associated reference levels as specified by the "maximum concentration of any grab sample" with the exception of the results from the 2015 SS3-6 snow core. At Station SS3-6 in 2015, aluminum, chromium, nickel, and zinc concentrations were greater than the respective reference levels. SS3-6 is 60 m from the Project (second closest sample location) and had the highest residue mass per filter (391.7 mg) of any of the snow core samples. Median concentrations of arsenic, chromium, and nickel have increased in recent years, while concentrations of copper, lead, and zinc decreased in recent years. Other analytes of interest have shown no obvious pattern. Typically, concentrations decreased with distance from the Project; however, high concentrations of certain variables of interest were recorded at Station SS3-8, located in the 251 - 1000 zone, and Station SS4-4, located in the 1001 - 2500 zone. Concentrations at these two locations were more than double the concentrations recorded at the other sites, including samples collected in the 0 - 100 zone. Station SS3-8 is located to the southeast and SS404 is located northwest of the Project.

Of the COCs, the observed CO, $SO_x$, $NO_x$, and VOC levels increased modestly between 2014 and 2015. These constituents are primarily derived from the combustion of diesel fuel. Diesel consumption increased in 2015 compared to 2014 and hence there was a minor increase in CO, $SO_x$, $NO_x$, and VOC's. TPM, $PM_{10}$, and $PM_{2.5}$ levels in 2015 increased from 2014. A21 Construction including crushing, material handling and road dust contributed to higher fugitive dust emissions in 2015. No new substances were reported (i.e., exceeded NPRI thresholds) in 2015 compared to 2014.

$CO_2e$ increased between 2014 and 2015 by 4.2%. GHG emissions at the Project are primarily derived from the combustion of diesel fuel. Increased diesel consumption in 2015 compared to 2014 is due to increased mobile equipment usage for A21 Construction. In 2015, the Project's 9.2 megawatt wind farm (consisting of four turbines) saved 5.2 million litres of diesel fuel needed for power, thereby reducing the Project's $CO_2e$ by 14,404 tonnes (7.7% of total GHG emissions). In 2015, the wind farm generated 20.8 gigawatt hours of energy or enough wind energy to power the Project's underground mine. Since start-up in 2012, the estimated diesel fuel savings has totalled 14.8 million litres and has prevented 41,771 tonnes of $CO_2e$ from being emitted to the atmosphere.

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Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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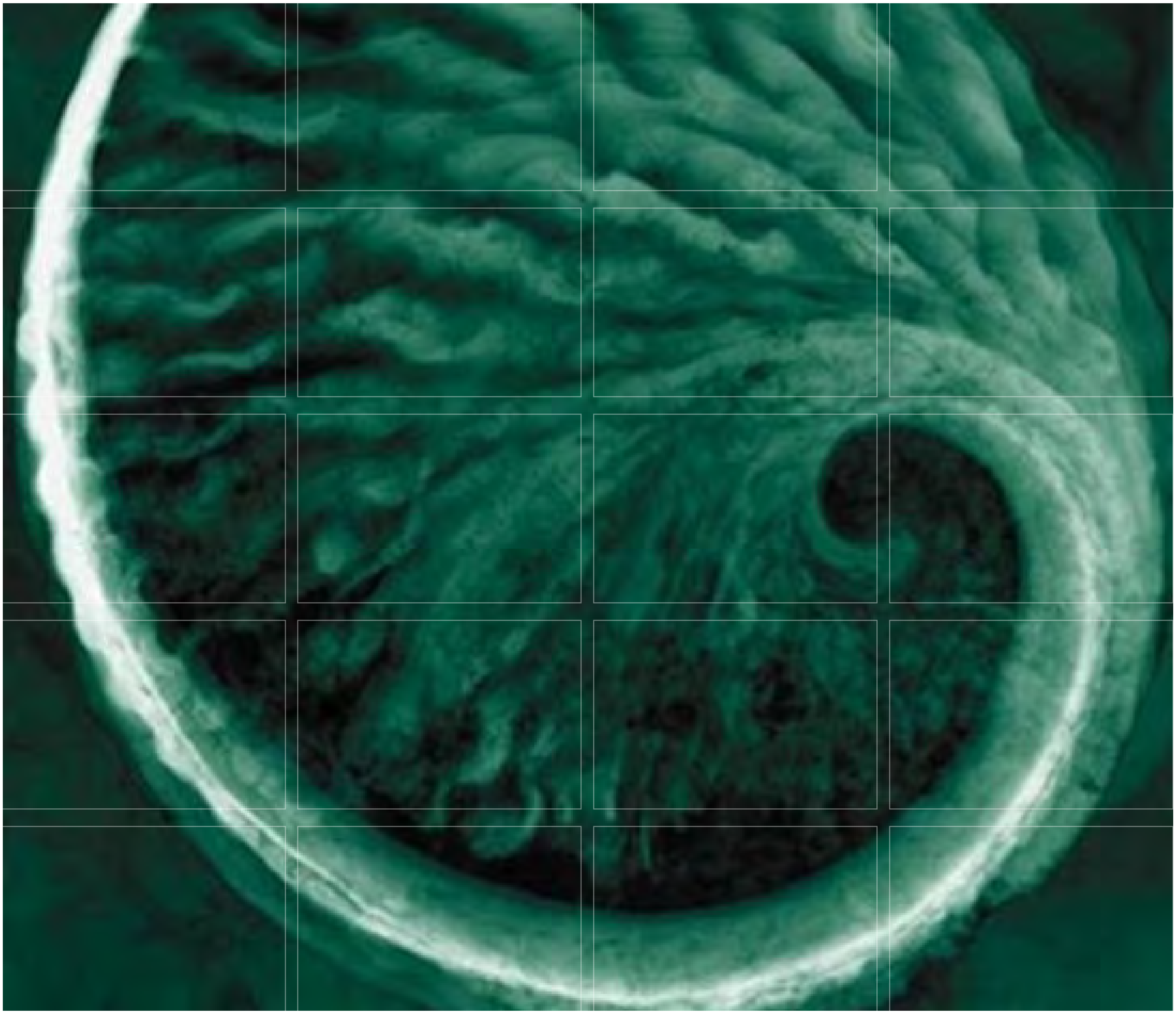
# *Appendix A*

## *2015 Diavik Dust Deposition Report*



*Prepared for:*

DOMINION
DIAMOND
CORPORATION

Rio Tinto

Diavik Diamond Mine

# DIAVIK DIAMOND MINE

# 2015 Dust Desposition Report

March 2016

*The world's leading sustainability consultancy*

ERM

**Diavik Diamond Mines (2012) Inc.**

# DIAVIK DIAMOND MINE
# 2015 Dust Deposition Report

**March 2016**

Project #0207514-0008

Citation:
ERM. 2016. *Diavik Diamond Mine: 2015 Dust Deposition Report*. Prepared for Diavik Diamond Mines (2012) Inc. by ERM Consultants Canada Ltd.: Yellowknife, Northwest Territories.

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# EXECUTIVE SUMMARY

Potential air and water quality concerns associated with airborne fugitive dust, which may result from Diavik Diamond Mine (the "Project") mining activities, were identified in the Diavik Diamond Mine Environmental Assessment (DDMI 1998). In accordance with the Environmental Assessment and requirements associated with the Aquatic Effects Monitoring Program (AEMP), a dust monitoring program was initiated in 2001. The program was designed to achieve the following objectives:

- Determine dust deposition (dustfall) rates at various distances from the mine project footprint; and
- Determine the chemical characteristics of dustfall that may be deposited onto, and subsequently into, Lac de Gras as a result of mining activities, in support of the AEMP.

In 2015, dustfall monitoring included three components, with sampling conducted at varying distances around the mine from 25 to 5,655 metres (m) away from infrastructure:

1. Dustfall gauges (10 monitoring and 2 control locations).
2. Dustfall from snow surveys (24 monitoring and 3 control locations).
3. Snow water chemistry from snow surveys (16 monitoring and 3 control locations).

A general reduction trend in dust levels was observed prior to 2015 for several years; however, dustfall rates were generally higher in 2015 than in 2014. Overall, as expected, dustfall rates decreased with distance from the Project, and areas that were predominantly downwind of the Project received more dustfall than upwind areas.

Median dustfall estimated in 2015 was similar results in 2014 and also decreased with distance from the Project. Annual dustfall estimated from each of the 12 dustfall gauges ranged from 88 to 582 mg/dm$^2$/y. The annualized dustfall rates estimated from the 2015 snow survey data ranged from 9.3 to 1,013 mg/dm$^2$/y. Although there are no dustfall standards for the Northwest Territories, 2015 dustfall rates were less than the 1.7 to 2.9 mg/dm$^2$/d (621 to 1,059 mg/dm$^2$/y) British Columbia Ministry of Environment dustfall objective for the mining, smelting, and related industries (BC MOE 2016).

Snow water chemistry analytes of interest included those variables with effluent quality criteria (EQC; i.e., aluminum, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite, and zinc) or a load limit (i.e., phosphorous) specified in the Type "A" Water Licence (W2015L2-0001, formerly W2007L2-0003). All 2015 sample concentrations were less than their associated reference levels as specified by the "maximum concentration of any grab sample" specified in Water Licence W2015L2-0001 except some of the results from the SS3-6 snow core. SS3-6 aluminum, chromium, nickel and zinc concentrations were greater than the respective reference levels. SS3-6 is 60 m from the Project (second closest sample location) and had the highest residue mass per filter (391.7 mg) of any of the snow core samples. Concentrations of arsenic, chromium, and nickel have increased in recent years, while concentrations of copper, lead and zinc decreased in recent years. Typically, concentrations decreased with distance from the Project; however, high concentrations of certain variables of interest were

recorded at Station SS3-8, located in the 251-1,000 m zone and station SS4-4, located in the 1,001-2,500 m zone. Concentrations for metals such as aluminum and nickel at these two locations were more than double the concentrations recorded at the other sites, including samples collected in the 0-100 m zone. SS3-8 is located to the southeast and SS4-4 is located northwest of the Project. However, concentrations of all variables were less than their corresponding effluent quality criteria (EQC).

# ACKNOWLEDGEMENTS

This report was prepared for Diavik Diamond Mines (2012) Inc. (DDMI) by ERM Consultants Canada Ltd. (ERM). Fieldwork and on site sample analyses were completed by DDMI, and other sample analyses were completed by Maxxam Analytics. Data analyses and reporting were completed by Philip Porter (P.Eng.) and reviewed by Daniel Casanova (B.Sc.). The report was also reviewed by Benjamin Beall (Ph.D.). The project was managed by Benjamin Beall and Marc Wen (M.Sc.) was the partner in charge.

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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.

| | |
|---|---|
| **AEMP** | Aquatic Effects Monitoring Program |
| **BC** | British Columbia |
| **BC MOE** | British Columbia Ministry of Environment |
| **cm** | Centimetre |
| **d** | Day |
| **DDMI** | Diavik Diamond Mines (2012) Inc. |
| **$dm^2$** | Square decimetre |
| **Dustfall** | Dust deposition |
| **EQC** | Effluent Quality Criteria |
| **ERM** | ERM Consultants Canada Ltd. |
| **IQR** | Interquartile range, IQR = Q3 - Q1 |
| **L** | Litre |
| **m** | Metre |
| **mg** | Milligram |
| **$Q_1$** | First quartile |
| **$Q_3$** | Third quartile |
| **QA/QC** | Quality Assurance and Quality Control |
| **RPD** | Relative Percent Difference |
| **SOP** | Standard Operating Procedure |
| **the Project** | Diavik Diamond Mine |
| **WLWB** | Wek’èezhìi Land and Water Board |
| **y** | Year |
| **µg** | Microgram |

# 1. INTRODUCTION

Potential air and water quality concerns associated with airborne fugitive dust, which may result from Diavik Diamond Mine (the "Project") mining activities, were identified in the Diavik Diamond Mine Environmental Assessment (DDMI 1998). In accordance with the Environmental Assessment and requirements associated with the Aquatic Effects Monitoring Program (AEMP), a dust monitoring program was initiated in 2001. The program was designed to achieve the following objectives:

- Determine dust deposition (dustfall) rates at various distances from the mine project footprint; and
- Determine the chemical characteristics of dustfall that may be deposited onto, and subsequently into, Lac de Gras as a result of mining activities, in support of the AEMP.

Since 2001, the dustfall monitoring program has gone through various changes, including an increase in the number of sampling locations, the relocation of some sampling stations, and improvements to the dustfall sampling methodology. A description of annual changes is provided in Appendix A.

Historical dustfall monitoring results have been presented each year in the *Diavik Diamond Mine Dust Deposition* reports from 2001 to 2014 (DDMI 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015).

# 2. METHODOLOGY

The 2015 dustfall monitoring program incorporated three monitoring components, with sampling completed at varying distances around the mine along five transects, including three control locations (Table 2-1, Figure 2-1):

1. Dustfall gauges (10 monitoring and 2 control locations).
2. Dustfall from snow surveys (24 monitoring and 3 control locations).
3. Snow water chemistry from snow surveys (16 monitoring and 3 control locations).

## 2.1 DUSTFALL GAUGES

Dustfall gauges were placed at 12 stations (including two control stations) around the Project at distances ranging from approximately 25 to 5,655 metres (m) from mining operations (Table 2-1). Each gauge collected dustfall year-round, with samples were collected every three months. The average total sampling period for the 12 locations was 387 days.

Dustfall gauges consisted of a hollow brass cylinder (52 centimetres (cm) length, 12.5 cm inner diameter) housed in a Nipher snow gauge (Plate 2.1-1). The cylinder collected dustfall, while the Nipher snow gauge reduced air turbulence around the gauge to increase dustfall catch efficiency. The cylinder was exchanged with an empty, clean cylinder at the end of each sampling period, and the content of the cylinder that was retrieved was processed in the Diavik Diamond Mines (2012) Inc. (DDMI) environment lab to determine the mass of collected dustfall. This processing involved filtration, drying, and weighing of samples as specified in the standard operating procedures (SOPs) ENVR-508-0112 and ENVI-403-0112 (see Appendix E).

Once the mass of collected dustfall at a station was measured, the mean daily dustfall rate over the collection period was calculated as:

$$D = \frac{M}{A * T} \qquad \text{[Equation 2.1-1]}$$

where

$D$ = mean daily dustfall rate (mg/dm$^2$/d) during time period $T$
$M$ = mass of dustfall collected (mg) during time period $T$
$A$ = surface area of dustfall gauge collection cylinder orifice (dm$^2$; approximately 1.227 dm$^2$)
$T$ = number of days of dustfall collection (d)

The mean daily dustfall rate (mg/dm$^2$/d) was then multiplied by 365 days to estimate the mean annual dustfall rate (mg/dm$^2$/y).

## Table 2-1. Dustfall and Snow Water Chemistry Sampling Locations, Diavik Diamond Mine, 2015

| Transect Line | Station ID | 2015 Sampling Dates | Total Sample Exposure Duration (days) | UTM Coordinates[1] | | Approx. Distance from Mining Operations (m) | Surface Description | Snow Water Chemistry Sampled[2] |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting (m) | Northing (m) | | | |
| *Dustfall Gauges* | | | | | | | | |
| | Dust 1 | Mar. 8, Jul. 5, Sep. 17, Jan. 1 | 391 | 533964 | 7154321 | 75 | Land | n/a |
| | Dust 2A | Mar. 7, Jul. 5, Sep. 15, Jan. 1 | 390 | 535678 | 7151339 | 435 | Land | n/a |
| | Dust 3 | Mar. 7, Jul. 5, Sep. 17, Jan. 1 | 391 | 535024 | 7151872 | 30 | Land | n/a |
| | Dust 4 | Mar. 9, Jul. 5, Sep. 17, Jan. 1 | 391 | 531397 | 7152127 | 200 | Land | n/a |
| | Dust 5 | Mar. 9 Jul. 5, Sep. 14, Jan. 1 | 368 | 535696 | 7155138 | 1,195 | Land | n/a |
| | Dust 6 | Mar. 7, Jul. 5, Sep. 17, Jan. 1 | 391 | 537502 | 7152934 | 25 | Land | n/a |
| | Dust 7 | Mar. 7, Jul. 5, Sep. 15, Jan. 1 | 390 | 536819 | 7150510 | 1,155 | Land | n/a |
| | Dust 8 | Mar. 9, Jul. 5, Sep. 14, Jan. 1 | 368 | 531401 | 7154146 | 1,220 | Land | n/a |
| | Dust 9 | Mar. 7, Jul. 5, Sep. 15, Jan. 1 | 390 | 541204 | 7152154 | 3,810 | Land | n/a |
| | Dust 10 | Mar. 9, Jul. 5, Sep. 15, Jan. 1 | 390 | 532908 | 7148924 | 670 | Land | n/a |
| | Dust C1 | Mar. 9, Jul. 5, Sep. 15, Jan. 1 | 390 | 534979 | 7144270 | 5,655 | Land | n/a |
| | Dust C2 | Mar. 9, Jul. 5, Sep. 14, Jan. 1 | 390 | 528714 | 7153276 | 3,075 | Land | n/a |
| *Snow Surveys* | | | | | | | | |
| 1 | SS1-1 | Apr. 2 | 184 | 533911 | 7154288 | 30 | Land | |
| | SS1-2 | Apr. 2 | 184 | 533924 | 7154367 | 115 | Land | |
| | SS1-3 | Apr. 2 | 184 | 533966 | 7154517 | 275 | Land | |
| | SS1-4 | Apr. 2 | 158 | 534485 | 7155094 | 920 | Ice | ✓ |
| | SS1-5-4[3] | Apr. 2 | 158 | 535099 | 7156279 | 115 | Ice | ✓ |
| | SS1-5-5[3] | Apr. 2 | 158 | 535099 | 7156279 | 2,180 | Ice | ✓ |
| 2 | SS2-1[4] | Apr. 14 | 170 | 537553 | 7153473 | 180 | Ice | ✓ |
| | SS2-2[4] | Apr. 14 | 170 | 537829 | 7153476 | 445 | Ice | ✓ |
| | SS2-3[4] | Apr. 14 | 170 | 538484 | 7153939 | 1,220 | Ice | ✓ |
| | SS2-4 | Mar. 31 | 156 | 539151 | 7154685 | 2,180 | Ice | ✓ |

*(continued)*

**Table 2-1. Dustfall and Snow Water Chemistry Sampling Locations, Diavik Diamond Mine, 2015 (completed)**

| Transect Line | Station ID | 2015 Sampling Dates | Total Sample Exposure Duration (days) | UTM Coordinates[1] | | Approx. Distance from Mining Operations (m) | Surface Description | Snow Water Chemistry Sampled[2] |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting (m) | Northing (m) | | | |
| *Snow Surveys (cont'd)* | | | | | | | | |
| 3 | SS3-4 | Apr. 5 | 161 | 536585 | 7151002 | 615 | Ice | ✓ |
| | SS3-5 | Apr. 5 | 161 | 537623 | 7150817 | 1,325 | Ice | ✓ |
| | SS3-6 | Apr. 5 | 161 | 536305 | 7151564 | 60 | Ice | ✓ |
| | SS3-7-4[3] | Apr. 5 | 161 | 536344 | 7151366 | 250 | Ice | ✓ |
| | SS3-7-5[3] | Apr. 5 | 161 | 536344 | 7151366 | 250 | Ice | ✓ |
| | SS3-8 | Apr. 5 | 161 | 536688 | 7150810 | 830 | Ice | ✓ |
| 4 | SS4-1 | Apr. 8 | 190 | 531491 | 7152211 | 100 | Land | |
| | SS4-2 | Apr. 8 | 190 | 531356 | 7152261 | 245 | Land | |
| | SS4-3 | Apr. 8 | 190 | 531331 | 7152434 | 350 | Land | |
| | SS4-4 | Apr. 8 | 164 | 531141 | 7153167 | 1,065 | Ice | ✓ |
| | SS4-5-4[3] | Apr. 8 | 164 | 531405 | 7154116 | 1,220 | Ice | ✓ |
| | SS4-5-5[3] | Apr. 8 | 164 | 531405 | 7154116 | 1,220 | Ice | ✓ |
| 5 | SS5-1 | Apr. 10 | 192 | 533150 | 7148925 | 665 | Land | |
| | SS5-1 EBW[4] | Apr. 10 | 192 | 533150 | 7148925 | 665 | Land | |
| | SS5-2 | Apr. 10 | 192 | 533150 | 7148875 | 710 | Land | |
| | SS5-3 | Apr. 10 | 166 | 533150 | 7148700 | 885 | Ice | ✓ |
| | SS5-4 | Apr. 10 | 166 | 533150 | 7147950 | 1,635 | Ice | ✓ |
| | SS5-5 | Apr. 10 | 166 | 533150 | 7146950 | 2,635 | Ice | ✓ |
| | Control 1 | Apr. 10 | 192 | 534983 | 7144271 | 5,655 | Land | ✓[5] |
| | Control 2 | Apr. 8 | 190 | 528714 | 7153281 | 3,075 | Land | ✓[5] |
| | Control 3 | Apr. 5 | 187 | 538650 | 7148750 | 3,570 | Land | ✓[5] |

[1] *UTM Zone 12W, NAD83*

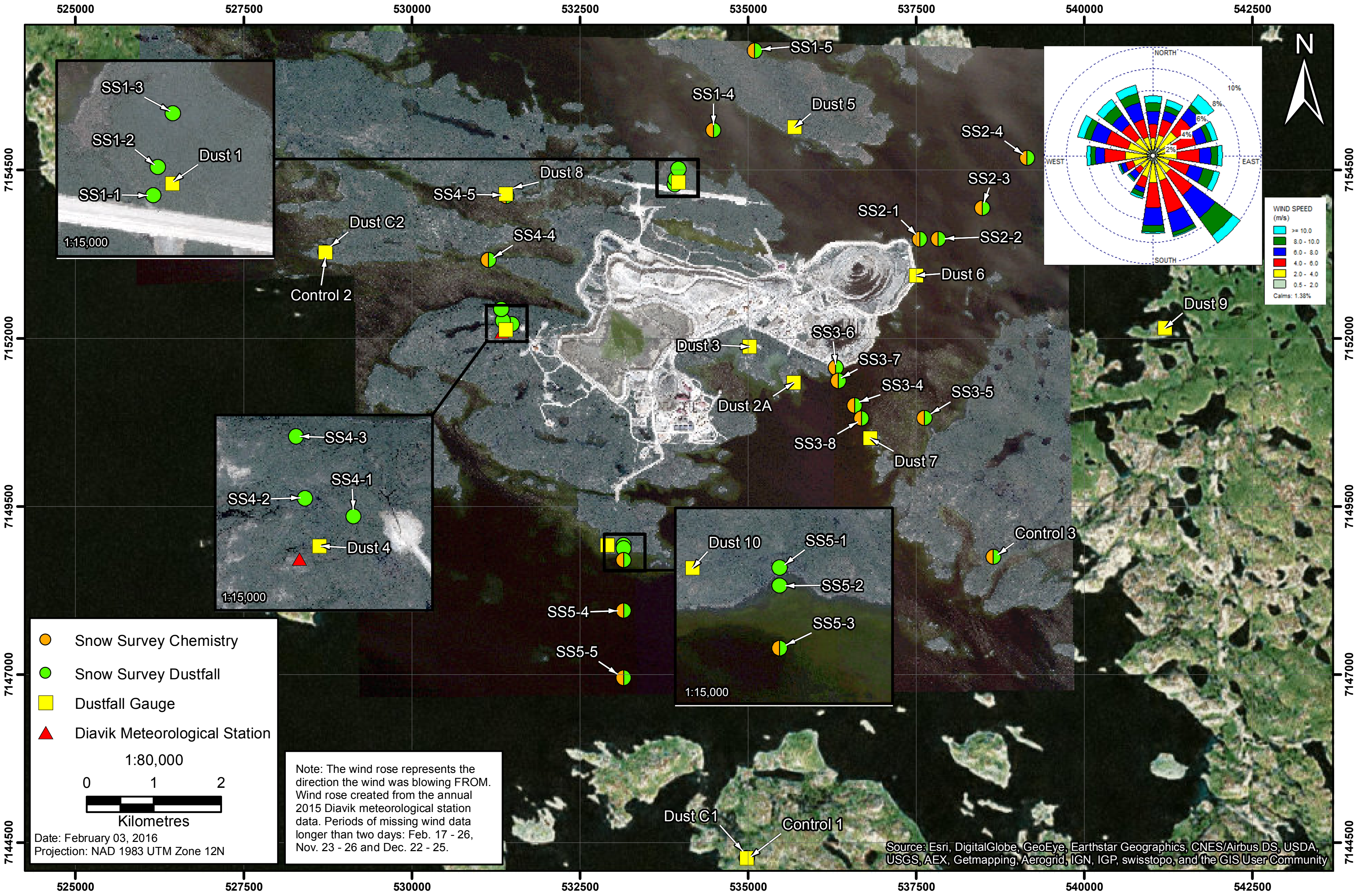
[2] *n/a = not applicable.*

[3] *Duplicate sample taken for snow water chemistry.*

[4] *Blank sample taken for snow water chemistry.*

[5] *Snow water chemistry was sampled over ice, adjacent to the on-land control station, see Section 2.3 for further details.*

# Figure 2-1
# Dustfall Gauge and Snow Survey Locations, Diavik Diamond Mine, 2015



Date: February 03, 2016
Projection: NAD 1983 UTM Zone 12N

Note: The wind rose represents the direction the wind was blowing FROM. Wind rose created from the annual 2015 Diavik meteorological station data. Periods of missing wind data longer than two days: Feb. 17 - 26, Nov. 23 - 26 and Dec. 22 - 25.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

*Plate 2.1-1. Dustfall gauge during sample collection. The dustfall gauge consisted of a hollow brass cylinder (centre) housed inside a Nipher snow gauge (right).*

Estimated dustfall rates were compared to British Columbia Ministry of Environment (BC MOE) dustfall objectives for the mining, smelting and related industries (Table 2.1-1; BC MOE 2016). The dustfall objectives ranges from 1.7 to 2.9 milligram per square decimetre per day ($mg/dm^2/d$), averaged over 30 days. The 1.7 $mg/dm^2/d$ objective is often considered to be applicable at sensitive locations whereas the 2.9 $mg/dm^2/d$ objective is applicable to areas where it can be shown that unacceptably deleterious changes will not follow. Both values are presented throughout this report. Snow water chemistry data were compared to effluent quality criteria (EQC) set out in Wek'èezhìi Land and Water Board (WLWB) Water Licence W2015L2-0001 (formerly W2007L2-0003).

## Table 2.1-1. Dustfall and Snow Water Chemistry Reference Values

| Parameter | Value | Unit | Comment | Source |
|---|---|---|---|---|
| Dustfall Rate | 1.7–2.9<br>(621–1,059) | $mg/dm^2/d$<br>($mg/dm^2/y$) | Objective for the mining, smelting, and related industries | BC MOE (2016) |
| Aluminum-Total | 3,000 | µg/L | Max. grab sample concentration | W2015L2-0001 |
| Ammonia-N | 12,000 | µg/L | Max. grab sample concentration | W2015L2-0001 |
| Arsenic-Total | 100 | µg/L | Max. grab sample concentration | W2015L2-0001 |
| Cadmium-Total | 3 | µg/L | Max. grab sample concentration | W2015L2-0001 |
| Chromium-Total | 40 | µg/L | Max. grab sample concentration | W2015L2-0001 |
| Copper-Total | 40 | µg/L | Max. grab sample concentration | W2015L2-0001 |
| Lead-Total | 20 | µg/L | Max. grab sample concentration | W2015L2-0001 |
| Nickel-Total | 100 | µg/L | Max. grab sample concentration | W2015L2-0001 |
| Nitrite-N | 2,000 | µg/L | Max. grab sample concentration | W2015L2-0001 |
| Zinc-Total | 20 | µg/L | Max. grab sample concentration | W2015L2-0001 |

## 2.2 DUSTFALL SNOW SURVEYS

Dustfall snow surveys were performed at 27 stations (including three control stations), along five transects around the Project (Table 2-1 and Figure 2-1). Across stations, the distance from mining operations ranged from approximately 30 to 5,655 m and the average total sampling period in 2015 was 171 days. The start dates correspond to the first snowfall for land stations (September 30, 2014), and shortly after ice freeze up for ice stations (October 26, 2014).

At each snow survey station, a snow corer was used to drill into the snow pack to retrieve a cylindrical snow core (6.1 cm inner diameter; Plate 2.2-1). Cores were extracted at each station and composited in the field to ensure a representative snow sample was obtained for the station. A minimum of three snow cores were collected at each (land and ice) of the snow sampling stations, as outlined in the SOP ENVR-512-0213. Composited samples were bagged and brought to the DDMI environment lab for processing as specified in SOP ENVR-512-0213 and ENVI-403-0112 (see Appendix F). Processing of snow cores involved filtration, drying and weighing. For quality assurance and control, duplicate samples were collected at stations SS1-5, SS3-7 and SS4-5.

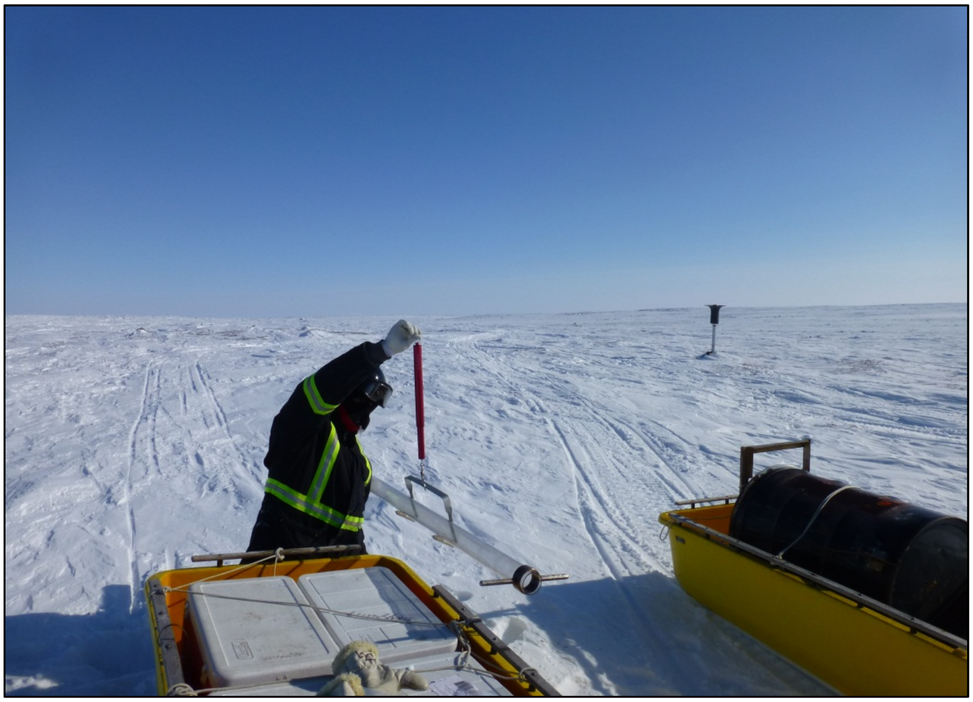


*Plate 2.2-1. Snow core sample being weighed, with dustfall gauge in background.*

Mean daily dustfall rate (mg/dm$^2$/d) was then calculated over the collection period using Equation 2.1-1, with surface area (*A*) equal to the surface area of the snow corer tube orifice (0.2922 dm$^2$) multiplied by the number of snow cores used for the composited sample at the station. The mean annual dustfall rate (mg/dm$^2$/y) was estimated by multiplying the mean daily dustfall rate by 365 days.

Dustfall rates were compared to the BC dustfall objective for the mining, smelting and related industries (Table 2.1-1), for comparison purposes only.

## 2.3 SNOW WATER CHEMISTRY

Snow water chemistry analysis was performed on snow cores extracted from 19 locations (including three control locations; Table 2-1 and Figure 2-1). These locations included the 16 dustfall snow survey stations that were located on ice, as well as samples taken on ice adjacent to the three control stations. Across stations, the distance from mining operations ranged from approximately 60 to 5,655 m and the average total sampling period in 2015 was 171 days. At each station located over water, cores were collected for chemistry analysis immediately after the dustfall snow cores were extracted.

Snow water chemistry cores were extracted using a snow corer in accordance with the dustfall snow survey core extraction. A minimum of three cores at each site were extracted and composited to obtain the necessary 3 litres (L) of snow water required for the laboratory chemical analysis as required (see Appendix F). Snow cores were then processed and prepared for shipment to Maxxam where the chemical analysis was performed. For quality assurance and control purposes, duplicate samples were collected at stations SS1-5, SS3-7 and SS4-5, and a blank sample was collected at station SS2-2. Snow water chemistry sampling methodology is detailed in SOP ENVR-512-0213 (see Appendix F).

EQC, including "maximum average concentration" and "maximum concentration of any grab sample," are stipulated in DDMI's Water Licence (W2015L2-0001) for aluminium, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite, and zinc (Table 2.1-1). Snow water chemistry results for these variables were compared to the "maximum concentration of any grab sample." These results are also presented as part of DDMI's Aquatic Effects Monitoring Program (AEMP) report.

# 3. RESULTS

Dustfall and snow water chemistry results were grouped into zones based on their relative distance from the mine footprint (see Table 3.1-1). Although station groupings into zones were first established at the outset of the program, these groupings were re-established in 2013 using satellite imagery of the site.

In 2015, the primary sources of fugitive dust were associated with unpaved road and airstrip usage and construction activities at A21. Another source of fugitive dust is truck traffic along the ice road to the Project. However, the consistency in dust deposition rates near the ice road alignment between winter and summer indicated that the contributions of dust from the ice road were modest relative to other sources. To supress dust generation, roads were watered during the summer as needed, and EK35 was applied to the airport apron (tarmac) and helipad during the spring. Also, in 2015, construction for the A21 development commenced which involved re-mining, hauling and crushing of 3,362,383 tonnes of waste rock from the North Country rock pile. Mine production rate was steady throughout the year, and all mining occurred underground. Fugitive dust generation is expected to be greatest during snow-free periods where and when there is site activity. It was expected that the highest fugitive dust generation and resulting dustfall occurred in areas closest to the mine footprint such as near A21 and the country rock pile between May and September.

The 2015 predominant wind directions at the site were from the south and southeast, and there are also strong winds from the northeast and northwest. The expectation is that airborne material will be deposited primarily north and south of the mine as seen in Figure 3.1-1.

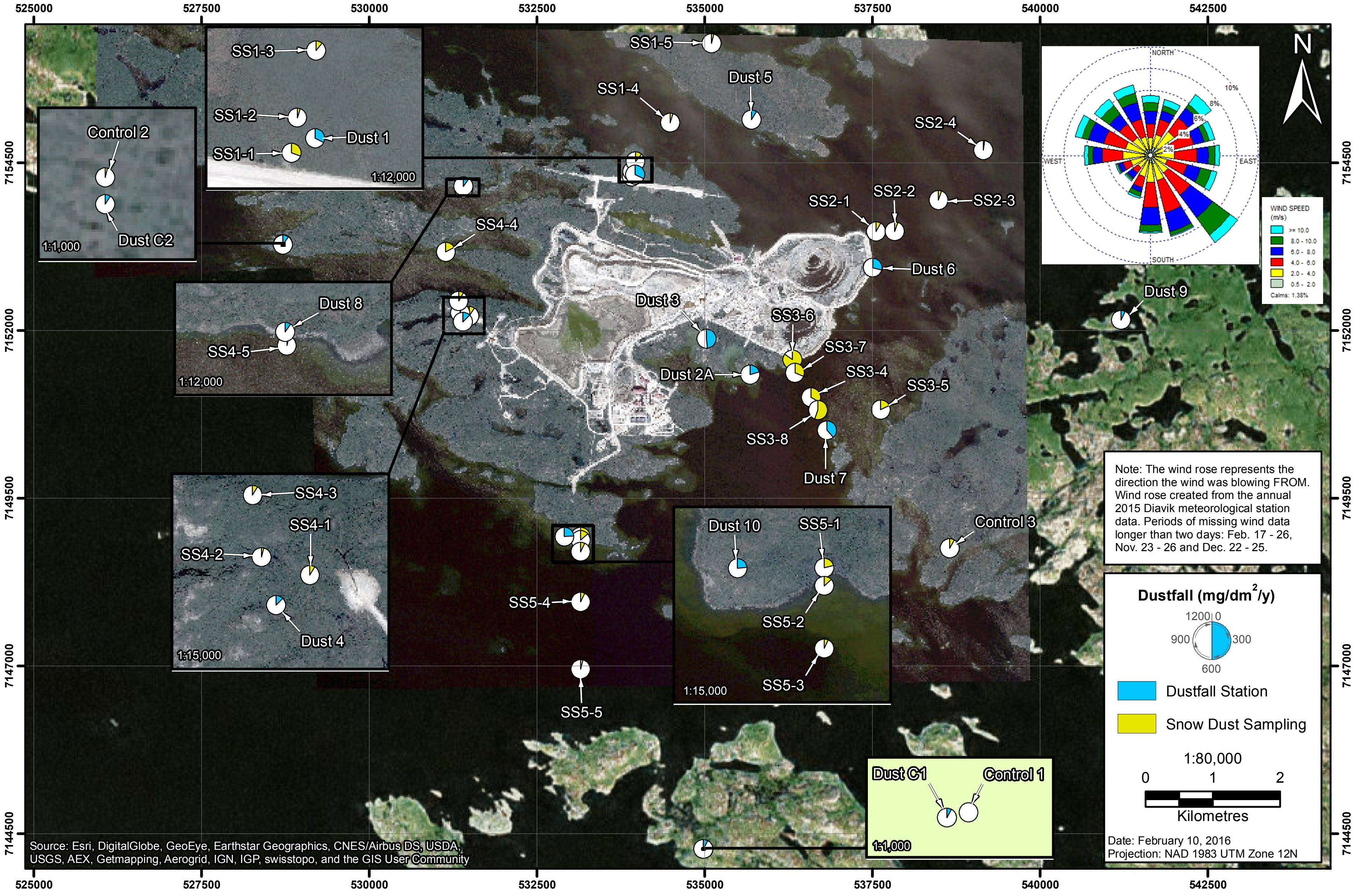
Results from the dustfall gauges, dustfall snow surveys and the snow water chemistry analysis are presented below.

## 3.1 DUSTFALL GAUGES

Total dustfall collected from each dustfall gauge throughout the year is summarized in Table 3.1-1; annual 2015 dustfall for each station at its location relative to the Project is presented in Figure 3.1-1; the historical records of annual dustfall for each station are presented in Figures 3.1-2 and 3.1-3. A comparison of 2015 dustfall versus distance from the mine footprint is presented in Figure 3.1-4. Boxplots summarizing the dustfall magnitude distribution measured in each year are presented in Figure 3.1-5. Detailed information on 2015 measurements and calculations for each station are included in Appendix B.

In general, dustfall decreased with increasing distance from the Project (Table 3.1-1 and Figure 3.1-1 to 3.1-4). The greatest estimated dustfall rate measured using gauges occurred at the closest station (within 30 m) to the Project, Dust 3 (582 mg/dm$^2$/y). Dust 3 is downwind of the footprint. The second highest estimated dustfall rate measured using gauges occurred at Dust 7 (458 mg/dm$^2$/y) which is over 1 kilometre from the Project. The lowest dustfall rates were measured at the two control stations and at: Dust C1 (98 mg/dm$^2$/y), Dust C2 (112 mg/dm$^2$/y) and Dust 9 (88 mg/dm$^2$/y; Table 3.1-1; Figures 3.1-3 and 3.1-4).

# Figure 3.1-1
## Dustfall Results, Diavik Diamond Mine, 2015



Note: The wind rose represents the direction the wind was blowing FROM. Wind rose created from the annual 2015 Diavik meteorological station data. Periods of missing wind data longer than two days: Feb. 17 - 26, Nov. 23 - 26 and Dec. 22 - 25.

**Dustfall (mg/dm$^2$/y)**

1200 0 300 600 900

🟦 Dustfall Station

🟨 Snow Dust Sampling

1:80,000

0 1 2 Kilometres

Date: February 10, 2016
Projection: NAD 1983 UTM Zone 12N

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

**Table 3.1-1. Dustfall and Snow Water Chemistry Results, Diavik Diamond Mine, 2015**

|  |  |  |  | Snow Water Chemistry (µg/L) |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Zone** | **Station** | **Approx. Distance from 2015 Project Footprint (m)** | **Dustfall ($mg/dm^2/y$) (621–1,059)** | **Aluminum (3,000)** | **Ammonia (12,000)** | **Arsenic (100)** | **Cadmium (3)** | **Chromium (40)** | **Copper (40)** | **Lead (20)** | **Nickel (100)** | **Nitrite (2,000)** | **Phosphorous (n/a)** | **Zinc (20)** |
| 0-100 m | Dust 1 | 75 | 391 | - | - | - | - | - | - | - | - | - | - | - |
|  | Dust 3 | 30 | 582 | - | - | - | - | - | - | - | - | - | - | - |
|  | Dust 6 | 25 | 346 | - | - | - | - | - | - | - | - | - | - | - |
|  | SS1-1 | 30 | 366 | - | - | - | - | - | - | - | - | - | - | - |
|  | SS3-6 | 60 | 1,013 | 4260 | 190 | 0.8 | 0.08 | 53 | 8.5 | 7.6 | 127 | 5.4 | 293 | 29 |
|  | SS4-1 | 100 | 106 | - | - | - | - | - | - | - | - | - | - | - |
|  | **Mean (SD)** |  | **467 (307)** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** |
|  | **95% Confidence Interval on Mean (Lower – Upper Limit)** |  | **323<br>(145 – 790)** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** |
|  | **Median** |  | **378** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** | **n/a** |
| 101-250 m | Dust 4 | 200 | 148 | - | - | - | - | - | - | - | - | - | - | - |
|  | SS1-2 | 115 | 56 | - | - | - | - | - | - | - | - | - | - | - |
|  | SS2-1 | 180 | 96 | 599 | 78 | 0.3 | 0.02 | 8.1 | 1.9 | 0.8 | 13.9 | 3.6 | 28 | 7.3 |
|  | SS3-7 | 250 | 379 | 588.5 | 77.5 | 0.1 | 0.01 | 6.7 | 1.4 | 0.8 | 18 | 4.7 | 65.7 | 5.6 |
|  | SS4-2 | 245 | 45 | - | - | - | - | - | - | - | - | - | - | - |
|  | **Mean (SD)** |  | **145 (137)** | **593.8 (7.4)** | **77.8 (0.4)** | **0.2 (0.1)** | **0.01 (0)** | **7.4 (1)** | **1.6 (0.3)** | **0.8 (0.03)** | **16 (2.9)** | **4.2 (0.8)** | **46.8 (26.6)** | **6.4 (1.2)** |
|  | **95% Confidence Interval on Mean (Lower – Upper Limit)** |  | **170<br>(0.0 - 315)** | **66.7<br>(527 - 660.5)** | **3.2<br>(74.6 - 80.9)** | **0.94<br>(0 - 1.1)** | **0.02<br>(0 - 0.03)** | **8.8<br>(0 - 16.1)** | **0.3<br>(0 - 4.7)** | **0.3<br>(0.5 - 1.1)** | **26<br>(0 - 42)** | **7<br>(0 - 11.1)** | **239.2<br>(0 - 286)** | **10.6<br>(0 - 17)** |
|  | **Median** |  | **96** | **593.8** | **77.8** | **0.2** | **0.01** | **7.4** | **1.6** | **0.8** | **16** | **4.2** | **46.8** | **6.4** |
| 251-1,000 m | Dust 10 | 670 | 282 | - | - | - | - | - | - | - | - | - | - | - |
|  | Dust 2A | 435 | 246 | - | - | - | - | - | - | - | - | - | - | - |
|  | SS1-3 | 275 | 132 | - | - | - | - | - | - | - | - | - | - | - |
|  | SS1-4 | 920 | 55 | 135 | 45 | 0.1 | *0.01* | 1 | 0.3 | 0.3 | 2.3 | 2.4 | 15.6 | 2.3 |
|  | SS2-2 | 445 | 65 | 377 | 94 | *0.2* | *0.01* | *4.6* | *0.9* | *0.5* | 9.8 | 4 | *26.6* | 3.6 |
|  | SS3-4 | 615 | 396 | 633 | 90 | 0.2 | 0.02 | 6.1 | 2 | 1.1 | 15.7 | 7.7 | 121 | 7.8 |
|  | SS3-8 | 830 | 670 | 3000 | 150 | 0.5 | 0.05 | 36.7 | 6.5 | 5.5 | 85.4 | 8.2 | 93 | 21.6 |
|  | SS4-3 | 350 | 98 | - | - | - | - | - | - | - | - | - | - | - |
|  | SS5-1 | 665 | 253 | - | - | - | - | - | - | - | - | - | - | - |
|  | SS5-2 | 710 | 160 | - | - | - | - | - | - | - | - | - | - | - |
|  | SS5-3 | 885 | 82 | 210 | 54 | 0.08 | 0.01 | 2.7 | 0.6 | 0.4 | 8.1 | 2 | 35.5 | 3.5 |
|  | **Mean (SD)** |  | **222 (183)** | **871.0 (1,205.4)** | **86.6 (41.5)** | **0.2 (0.2)** | **0.02 (0.02)** | **10.2 (14.9)** | **2 (2.6)** | **1.5 (2.2)** | **24.3 (34.5)** | **4.9 (2.9)** | **58.3 (46.1)** | **7.8 (8)** |
|  | **95% Confidence Interval on Mean (Lower – Upper Limit)** |  | **123<br>(99 - 345)** | **1,496.7<br>(0 – 2,367.7)** | **51.5<br>(35.1 – 138.1)** | **0.2<br>(0.01 – 0.4)** | **0.02<br>(0 – 0.04)** | **18.5<br>(0 – 28.8)** | **3.2<br>(0 – 5.2)** | **2.8<br>(0 – 4.3)** | **42.9<br>(0 – 67.1)** | **3.6<br>(1.2 – 8.5)** | **57.2<br>(1.2 – 115.5)** | **10<br>(0 – 17.7)** |
|  | **Median** |  | **160** | **377.0** | **90.0** | **0.2** | **0.01** | **4.6** | **0.9** | **0.5** | **9.8** | **4** | **35.5** | **3.6** |

*(continued)*

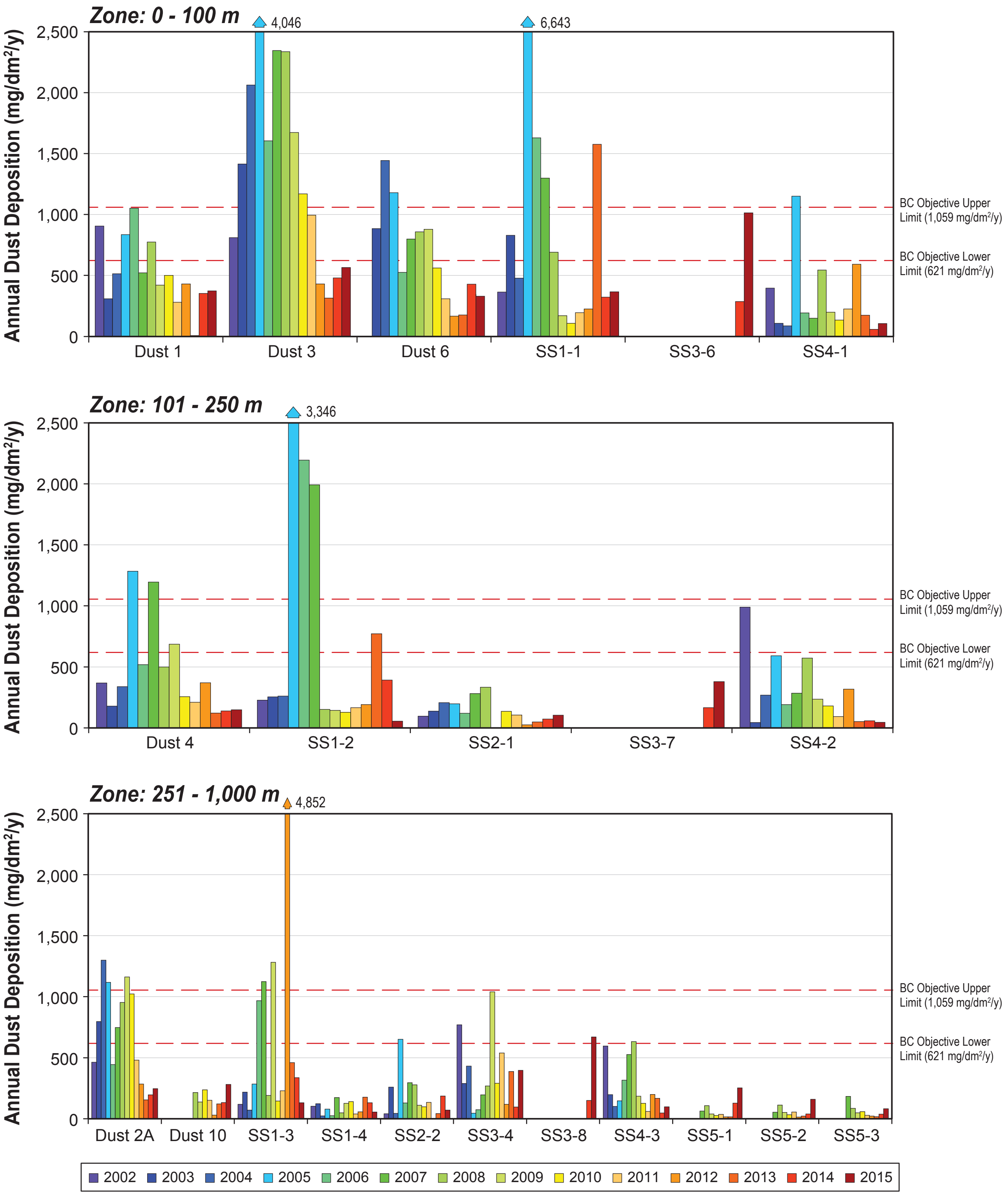
**Table 3.1-1. Dustfall and Snow Water Chemistry Results, Diavik Diamond Mine, 2015 (completed)**

| | | | | Snow Water Chemistry (µg/L)[bc] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Zone** | **Station** | **Approx. Distance from 2015 Project Footprint (m)** | **Dustfall ($mg/dm^2/y$) (621–1,059)** | **Aluminum (3,000)** | **Ammonia (12,000)** | **Arsenic (100)** | **Cadmium (3)** | **Chromium (40)** | **Copper (40)** | **Lead (20)** | **Nickel (100)** | **Nitrite (2,000)** | **Phosphorous (n/a)** | **Zinc (20)** |
| 1,001-2,500 m | Dust 5 | 1,195 | 103 | - | - | - | - | - | - | - | - | - | - | - |
| | Dust 7 | 1,155 | 458 | - | - | - | - | - | - | - | - | - | - | - |
| | Dust 8 | 1,220 | 121 | - | - | - | - | - | - | - | - | - | - | - |
| | Dust 9 | 3,810 | 88 | - | - | - | - | - | - | - | - | - | - | - |
| | SS1-5 | 2,180 | 50 | 96.2 | 35 | 0.08 | 0.01 | 0.7 | 0.2 | 0.2 | 1.7 | 3.7 | 10.4 | 2.2 |
| | SS2-3 | 1,220 | 62 | 52.5 | 30 | 0.05 | 0.01 | 0.7 | 0.7 | 0.1 | 1.3 | 2.7 | 11.1 | 1.7 |
| | SS2-4 | 2,180 | 27 | 418 | 68 | 0.4 | 0.01 | 4.4 | 1.3 | 0.7 | 5.1 | *2* | 13.1 | 3.6 |
| | SS3-5 | 1,325 | 218 | 551 | 120 | 0.2 | 0.01 | 5.2 | 1.3 | 1 | 13.8 | 6.3 | 49.1 | 5.7 |
| | SS4-4 | 1,065 | 202 | 1740 | 68 | 0.4 | 0.07 | 21.5 | 3.1 | 1.9 | 45.6 | 2.4 | 64.2 | 12.5 |
| | SS4-5 | 1,220 | 43 | 826 | 73 | 0.2 | 0.02 | 11.9 | 1.7 | 1 | 21 | *2* | 23.4 | 10.1 |
| | SS5-4 | 1,635 | 83 | 124 | 30 | 0.08 | 0.01 | 2.3 | 0.5 | 0.2 | 7.4 | *2* | 19.3 | 3.6 |
| | SS5-5 | 2,635 | 45 | 455 | 19 | 0.1 | 0.01 | 6.4 | 0.8 | 0.6 | 12.9 | *2* | 9 | 4.2 |
| | **Mean (SD)** | | **125 (121)** | **532.8 (554.4)** | **55.4 (33.4)** | **0.2 (0.1)** | **0.02 (0.02)** | **6.6 (7)** | **1.2 (0.9)** | **0.7 (0.6)** | **13.6 (14.6)** | **2.9 (1.5)** | **25.0 (20.6)** | **5.4 (3.9)** |
| | **95% Confidence Interval on Mean (Lower – Upper Limit)** | | **77 (48- 202)** | **463.5 (69.4 – 996.3)** | **28 (27.4 – 83.3)** | **0.1 (0.07 – 0.3)** | **0.02 (0 – 0.04)** | **5.8 (0.8 – 12.5)** | **0.8 (0.4 – 2)** | **0.5 (0.2 – 1.2)** | **12.2 (1.4 – 25.8)** | **1.3 (1.6 – 4.1)** | **17.2 (7.8 – 42.1)** | **3.2 (2.2 – 8.7)** |
| | **Median** | | **85** | **436.5** | **51.5** | **0.1** | **0.01** | **4.8** | **1** | **0.7** | **10.2** | **2.2** | **16.2** | **3.9** |
| Control | Dust C1 | 5,655 | 98 | - | - | - | - | - | - | - | - | - | - | - |
| | Dust C2 | 3,075 | 112 | - | - | - | - | - | - | - | - | - | - | - |
| | CONTROL 1 | 5,655 | 9.3 | 151 | 28 | 0.06 | 0.01 | 1.8 | 0.4 | 0.3 | 2.1 | 2.2 | 4.6 | 2.4 |
| | CONTROL 2 | 3,075 | 44 | 226 | 40 | 0.07 | 0.08 | 4.4 | 0.8 | 0.6 | 7.2 | *2* | 11.6 | 5.6 |
| | CONTROL 3 | 3,570 | 92 | 2230 | 54 | 0.35 | 0.03 | 32.4 | 3.4 | 2.3 | 63.4 | 2.5 | 19.3 | 14.8 |
| | **Mean (SD)** | | **71 (43)** | **869.0 (1,179.3)** | **40.7 (13)** | **0.2 (0.2)** | **0.04 (0.03)** | **12.9 (17)** | **1.5 (1.6)** | **1.1 (1.1)** | **24.2 (34)** | **2.2 (0.3)** | **11.8 (7.4)** | **7.6 (6.4)** |
| | **95% Confidence Interval on Mean (Lower – Upper Limit)** | | **53 (18-124)** | **2,929.4 (0 – 3,798.4)** | **32.3 (8.3 – 73)** | **0.4 (0 – 0.6)** | **0.08 (0 – 0.1)** | **42.2 (0 – 55)** | **4.1 (0 - 5.6)** | **2.8 (0 – 3.8)** | **84.5 (0 – 108.7)** | **0.6 (1.6 – 2.9)** | **18.3 (0 – 30.1)** | **16 (0 -23.6)** |
| | **Median** | | **92** | **226.0** | **40** | **0.07** | **0.03** | **4.4** | **0.8** | **0.6** | **7.2** | **2.2** | **11.6** | **5.6** |
| **Reference Levels[a]** | | | **621 – 1,059** | **3,000** | **12,000** | **100** | **3.0** | **40** | **40.0** | **20.0** | **100** | **2,000.0** | **n/a** | **20.0** |

*Notes:*
*Dash (-) = not available (snow water chemistry not sampled)*
*n/a = not applicable*
*For measurements that were less than the detection limit, the detection limit was used for calculations and are shown as italicized in the table.*
*[a] BC MOE (2016) for dustfall and Water Licence W2015L2-0001 for snow water chemistry. See Table 2.1-1 for reference level descriptions.*

# Figure 3.1-2

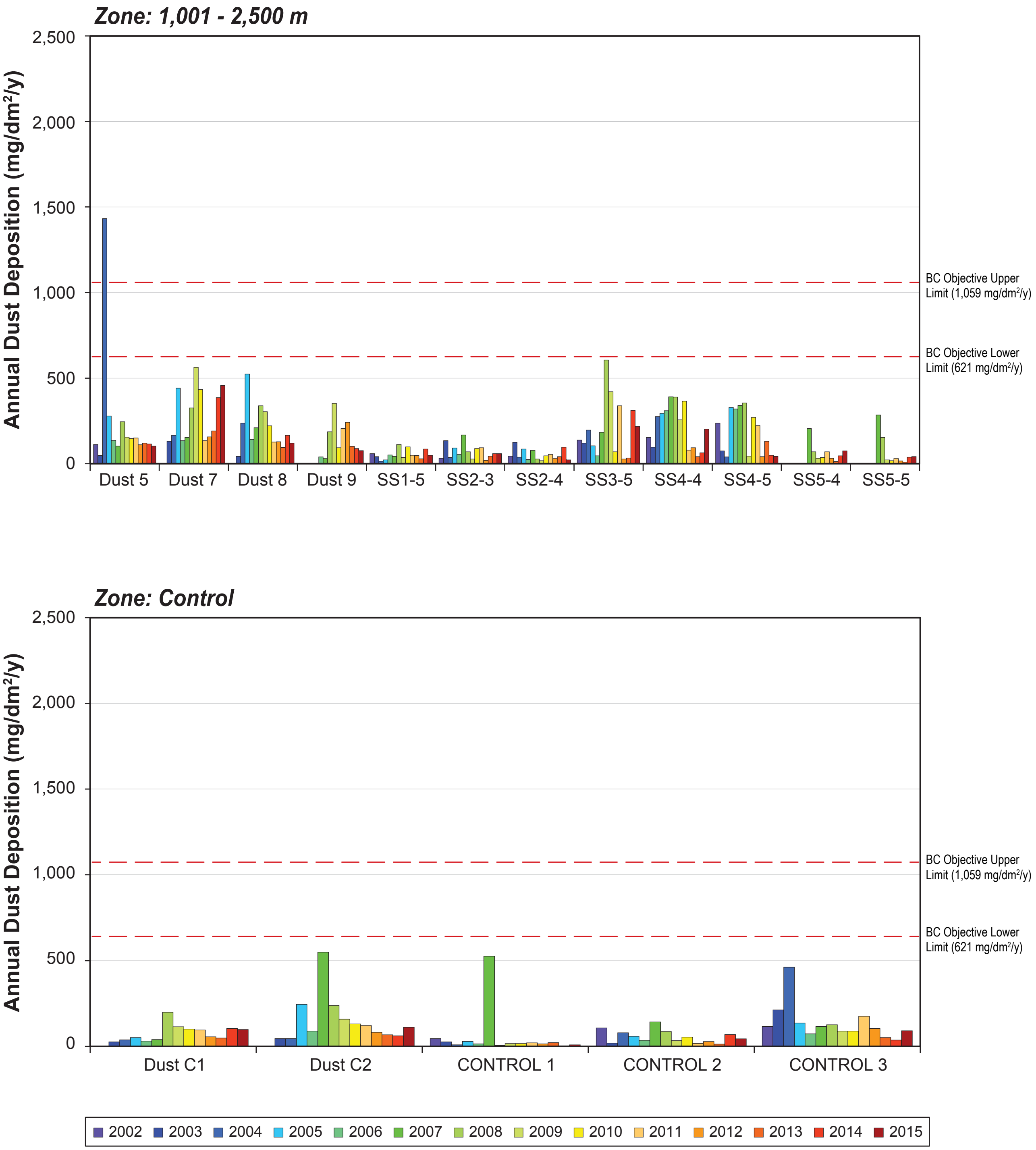
## Calculated Annual Dust Deposition Rates at Dustfall Gauges and Snow Survey Locations up to 1,000 m from the Project Footprint, Diavik Diamond Mine, 2002 to 2015



Notes: *BC Objective Source: BC MOE (2016).*
*Annual deposition was calculated using the methodology described in Section 2.*
*See Table 2-1 for actual 2015 sample exposure times.*
*Station locations have been grouped into zones based on their distance from the 2015 Project footprint. Some stations have historically been grouped in different zones based on their distance from the Project footprint when they were first established (see Section 3 for further details).*

## Figure 3.1-3

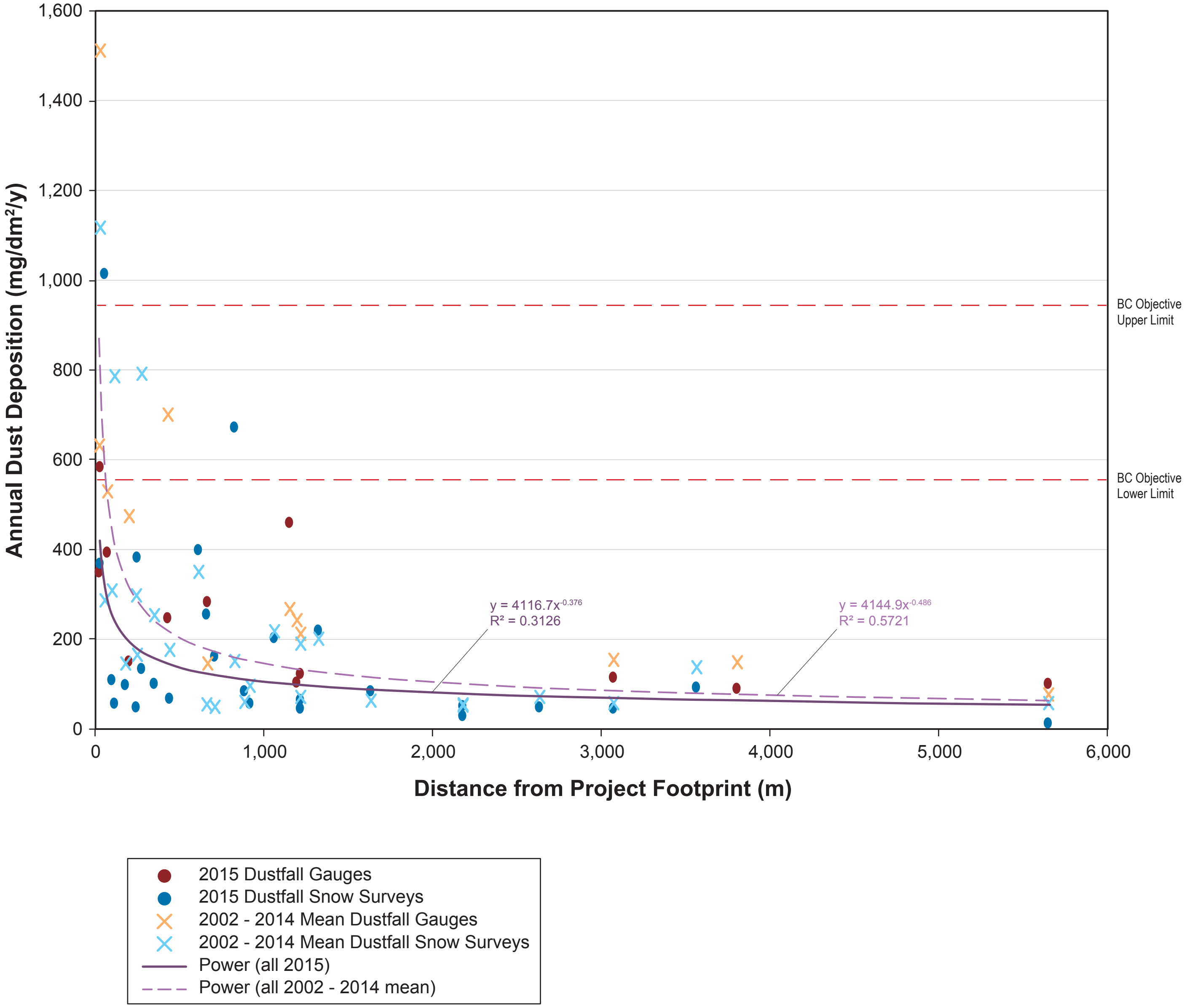
## Calculated Annual Dust Deposition Rates at Dustfall Gauges and Snow Survey Locations greater than 1,000 m from the Project Footprint, Diavik Diamond Mine, 2002 to 2015



Notes: *BC Objective Source: BC MOE (2016).*
*Annual deposition was calculated using the methodology described in Section 2.*
*See Table 2-1 for actual 2015 sample exposure times.*
*Station locations have been grouped into zones based on their distance from the 2015 Project footprint. Some stations have historically been grouped in different zones based on their distance from the Project footprint when they were first established (see Section 3 for further details).*

## Figure 3.1-4

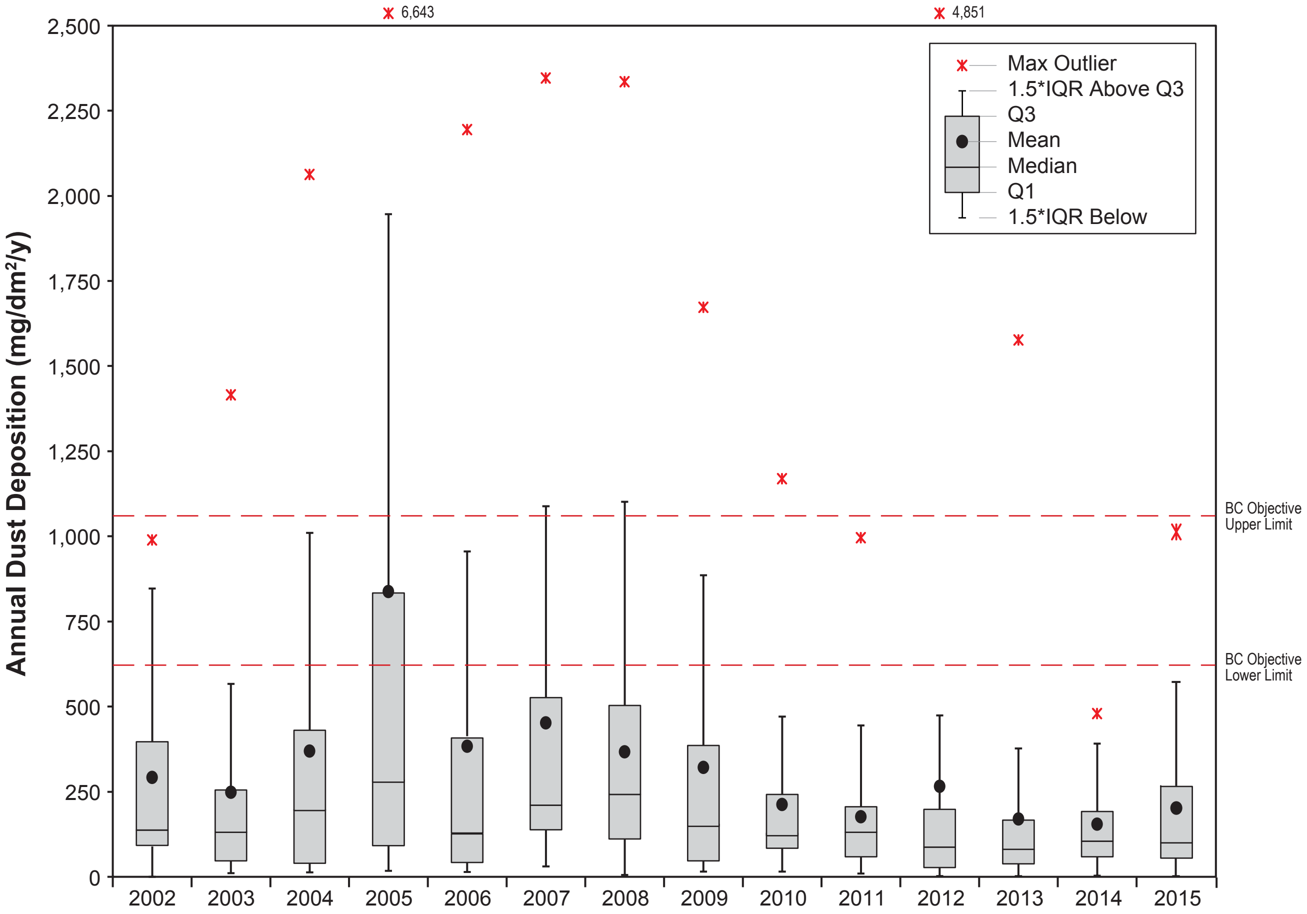
## Dust Deposition Versus Distance from Project Footprint, Diavik Diamond Mine, 2015



*Notes: BC Objective Source: BC MOE (2016)*
*Annual deposition is calculated using the methodology described in Section 2.*
*See Table 2-1 for actual 2015 sample exposure times.*

# Figure 3.1-5

# Dust Deposition Box Plot, Diavik Diamond Mine, 2002 to 2015



*Notes: BC Objective Source: BC MOE (2016)*
*Annual deposition is calculated using the methodology described in Section 2.*
*See Table 2-1 for actual 2015 sample exposure times.*

With the exception of Dust 3 and Dust 7, dustfall rates estimated from dustfall gauges in 2015 were less than historical dustfall rate estimates (Figures 3.1-2 to 3.1-4). At Dust 3 and Dust 7, 2015 dustfall rates were within the range of historical values (Figure 3.1-3). Comparisons of mean and maximum dustfall values suggest that dustfall rates were generally higher in 2015 than in 2013 and 2014; however, are within the range of dustfall rates recorded for the Project (Figure 3.1-4 and 3.1-5).

The annualized dustfall rates estimated from gauges at each station were less than the BC objective for the mining industry (621–1,059 mg/dm$^2$/y; Figures 3.1-2 to 3.1-4). This objective was used for comparison purposes only: there are currently no standards or objectives for the Northwest Territories; however, the BC objective is generally used as a standard for comparison at other mines in the region.

## 3.2 DUSTFALL SNOW SURVEYS

Annual dustfall rates estimated from each snow survey station in 2015 are summarized in Table 3.1-1. Historical records of annual dustfall rates for each station are presented in Figures 3.1-2 and 3.1-3. The relationships between annual dustfall rates and distance from the mine footprint are shown in Figures 3.1-1 and 3.1-4. Boxplots summarizing dustfall rates measured in each year are presented in Figure 3.1-5. 2015 snow survey field datasheets and laboratory results are included in Appendix B. Duplicate samples were collected at stations SS1-5, SS3-7 and SS4-5 for QA/QC purposes and are discussed in Section 3.4.

Annualized dustfall rates estimated from 2015 snow survey data ranged from 9.3 to 1,013 mg/dm$^2$/y (Table 3.1-1; Figures 3.1-2 and 3.1-3). In general, dustfall rates decreased with increasing distance from the Project, with the lowest dustfall rate recorded at station Control 1 (Table 3.1-1; Figures 3.1-4). Mean dustfall rates estimated using both dustfall gauges and snow surveys within the 0–100, 101-250, 251–1,000, 1,001–2,500 and Control zones were 467, 145, 222, 125 and 71 mg/dm$^2$/y, respectively (Table 3.1-1). Dustfall rates at stations Dust 7, SS3-6, SS3-7, SS3-4, SS3-8 and SS3-5 were greater than the upper limit of the 95% confidence interval for their respective zones in 2015. These high dustfall rates, compared to the overall distribution of dustfall rates within each zone, indicated that higher dustfall rates were observed southeast and northwest of the Project (Table 3.1-1).

Annualized dustfall estimated from each snow survey station in 2015 was less than some historical dustfall estimates (Figures 3.1-2 and 3.1-3). Comparisons of mean and maximum values suggest that dustfall rates were generally higher in 2015 than in 2013 and 2014 (Figures 3.1-4 and 3.1-5).

Annualized dustfall rates measured at each station during the 2015 snow survey were less than the BC objective for the mining industry (621–1,059 mg/dm$^2$/y). This objective was used for comparison purposes only: there are currently no standards or objectives for the Northwest Territories; however, the BC objective is generally used as a standard for comparison at other mines in the region.

## 3.3 SNOW WATER CHEMISTRY

A summary of the snow water chemistry results for each variable of interest (i.e., variables for which EQC exist and phosphorous) is provided below. The full suite of analytical results for snow water chemistry is included in Appendix D. For QA/QC purposes, duplicate samples were collected at stations SS1-5, SS3-7 and SS4-5, and an equipment blank sample was collected at station SS2-2. Results of QA/QC samples are discussed in Section 3.4.

All 2015 sample concentrations were less than their associated reference levels as specified by the "maximum concentration of any grab sample" specified in Water Licence W2015L2-0001 except some of the results from the SS3-6 snow core. SS3-6 aluminum, chromium, nickel and zinc concentrations were greater than the respective reference levels. SS3-6 is 60 m from the Project (second closest sample location) and had the highest residue mass per filter (391.7 mg) of any of the snow core samples.

In general, average concentrations of snow water chemistry variables of interest decreased with increasing distance from the Project (Figure 3.3-1 to Figure 3.3-4). However, high variable concentrations such as for aluminum, chromium and nickel were recorded at Station SS3-8, located in the 251-1000 zone, and SS4-4, located in the 1001-2500 zone. Select metal concentrations at these two locations were more than double the concentrations recorded at the other sites, including samples taken in the 101-250 zone. SS3-8 is located to the southeast and SS4-4 is located northwest of the Project (Figure 2-1). It should be noted that the 0-100 zone has one (1) sampling location; therefore, no median was reported and are not included in Figures 3.3-1 to 3.3-4.

### 3.3.1 Aluminum

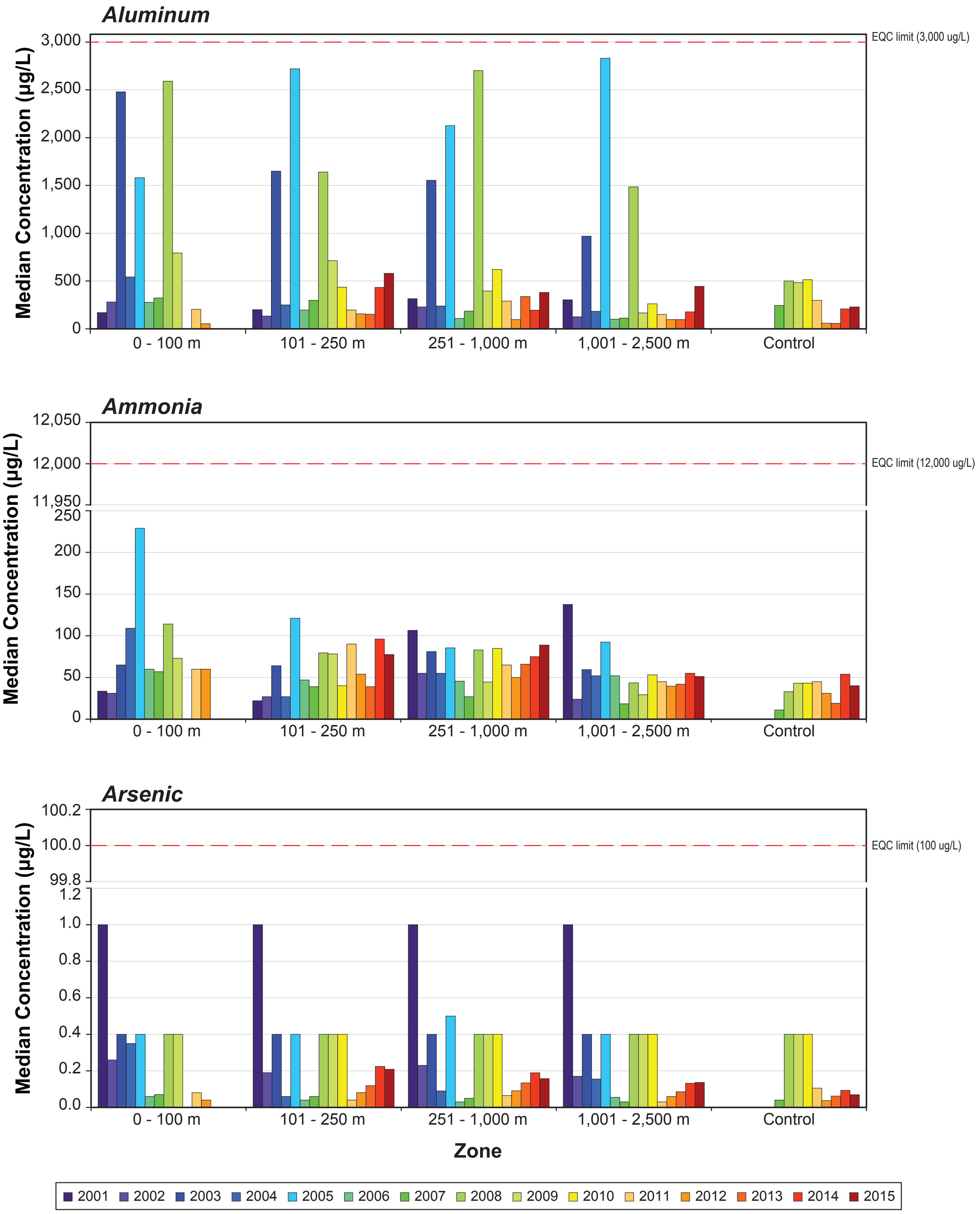
Aluminum concentrations measured in 2015 ranged from 52.5 µg/L at station SS2-3 in the 1,001-2,500 m zone to 4,260 µg/L at station SS3-6 in the 0–100 m zone (Table 3.1-1). Median 2015 aluminum concentrations were greatest in the 101-250 m zone and decreased with distance from mine (Figure 3.3-1). Compared to previous years, the 2015 median concentration in each zone was relatively high (Figure 3.3-1). There was one concentration that was greater than the reference value the 3,000 µg/L EQC specified in the Water Licence at SS3-6 and one grab sample was 3,000 µg/L at SS3-8 which was equal to the EQC (Table 3.1-1; Figure 3.3-1). There were generally high concentrations of aluminum observed in grab samples in 2015 compared to 2013 and 2014; however, were within the range of historical concentrations.

### 3.3.2 Ammonia

Ammonia concentrations measured in 2015 ranged from 19 µg/L at station SS5-5 in the 1,001-2,500 m zone to 190 µg/L at station SS3-6 in the 0–100 m zone (Table 3.1-1). Median 2015 ammonia concentrations were greatest in the 251-1,000 m zone and were similar for all distance ranges (Figure 3.3-1). The 2015 median concentration in each zone was less than in 2014 except for the 251-1,000 m zone (Figure 3.3-1). All measurements were well less than the value of 12,000 µg/L specified in the Water Licence for grab sample concentrations.

# Figure 3.3-1

## Snow Water Chemistry Results: Aluminum, Ammonia and Arsenic, 2001 to 2015



*Note: Max grab sample concentrations: Aluminium 3,000 µg/L, Ammonia 12,000 µg/L, Arsenic 100 µg/L.*

### 3.3.3 Arsenic

Arsenic concentrations measured in 2015 ranged from 0.05 µg/L at station SS2-3 in the 1,001-2,500 m zone to 0.8 µg/L at station SS3-6 in the 0–100 m zone (Table 3.1-1). Median 2015 arsenic concentrations were greatest in the 101-250 m zone and were similar for all distance ranges (Figure 3.3-1). The 2015 median concentration in each zone was similar to 2014 median concentrations (Figure 3.3-1). All measurements were well less than the value of 100 µg/L specified in the Water Licence for grab sample concentrations.

### 3.3.4 Cadmium

Cadmium concentrations measured in 2015 ranged from 0.01 µg/L at station SS1-4 in the 251-1,000 m zone to 0.08 µg/L at station CONTROL 2 (3,075 m) (Table 3.1-1). Median 2015 cadmium concentrations were greatest in the control zone and were similar for all distance ranges (Figure 3.3-2). The 2015 median concentration in each zone was similar to 2014 median concentrations (Figure 3.3-2). All measurements were well less than the value of 3 µg/L specified in the Water Licence for grab sample concentrations.

### 3.3.5 Chromium

Chromium concentrations measured in 2015 ranged from 0.7 µg/L at station SS2-3 in the 1,001-2,500 m zone to 53 µg/L at station SS3-6 in the 0–100 m zone (Table 3.1-1). Median 2015 chromium concentrations were greatest in the 101-250 m zone (Figure 3.3-2). The 2015 median concentration in each zone were greater than 2014 median concentrations (Figure 3.3-2). SS3-6 in the 0–100 m zone was greater than the reference value of 40 µg/L specified in the Water Licence for grab sample concentrations. All other concentrations were below this value.

### 3.3.6 Copper

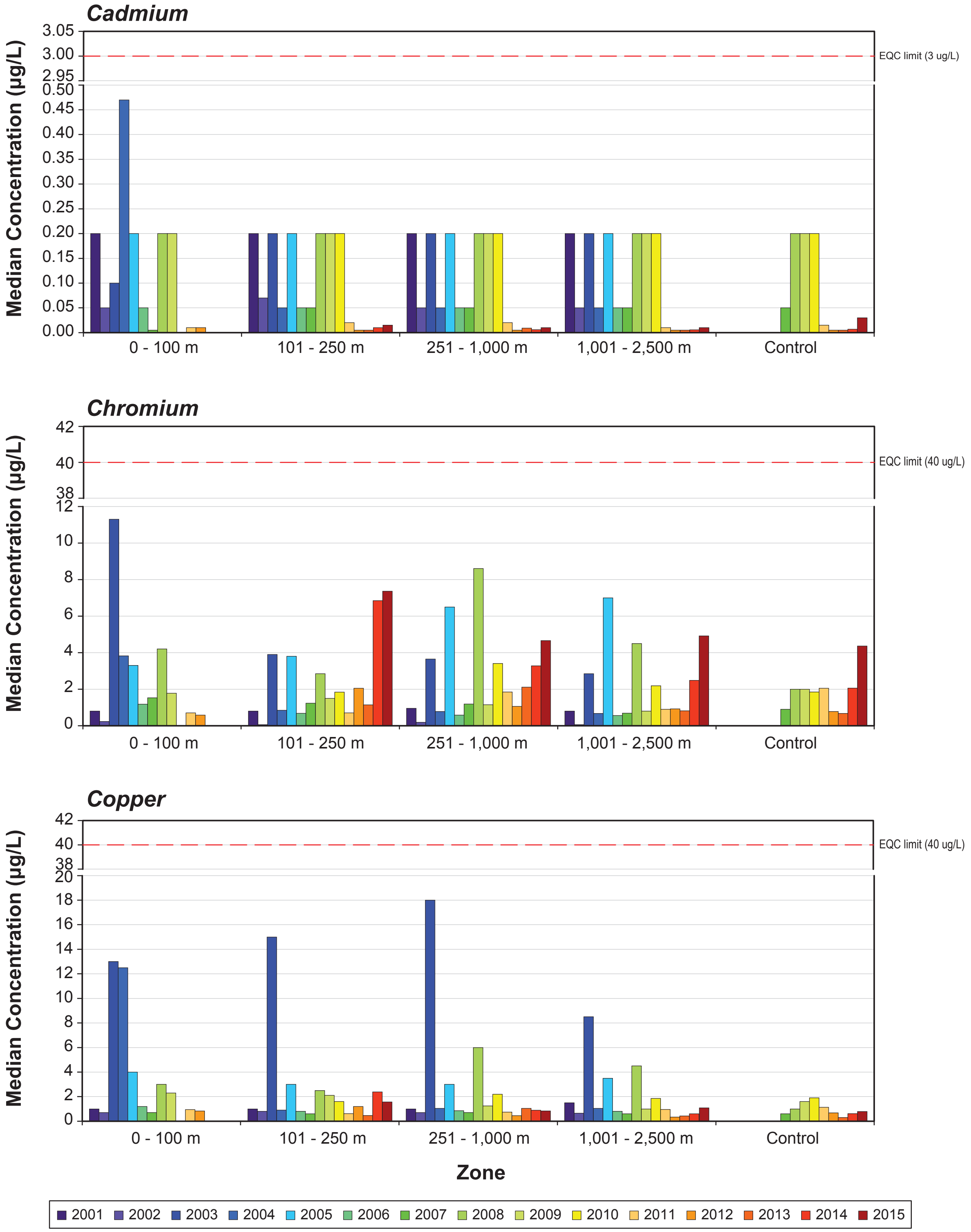
Copper concentrations measured in 2015 ranged from 0.2 µg/L at station SS1-5 in the 1,001-2,500 m zone to 8.5 µg/L at station SS3-6 in the 0–100 m zone (Table 3.1-1). Median 2015 copper concentrations were generally similar across all distance zones, with the greatest median concentrations in the 101-250 m zone (Figure 3.3-2). Modest inter-annual variations in copper concentrations were observed between 2014 and 2015 except the 101-250 m zone, which was much lower in 2015 (Figure 3.3-2). All measurements were well less than the value of 40 µg/L specified in the Water Licence for grab sample concentrations.

### 3.3.7 Lead

Lead concentrations measured in 2015 ranged from 0.1 µg/L at station SS2-3 in the 1,001-2,500 m zone to 6.7 µg/L at station SS3-6 in the 0–100 m zone (Table 3.1-1). Median 2015 lead concentrations were greatest in the 101-250 m zone and were similar for all distance ranges (Figure 3.3-3). The 2015 median concentration in each zone was similar to 2014 median concentrations except the Control and 1,001-2,500 zones which were roughly twice the 2014 respective values (Figure 3.3-3). All measurements were well less than the value of 20 µg/L specified in the Water Licence for grab sample concentrations.

# Figure 3.3-2

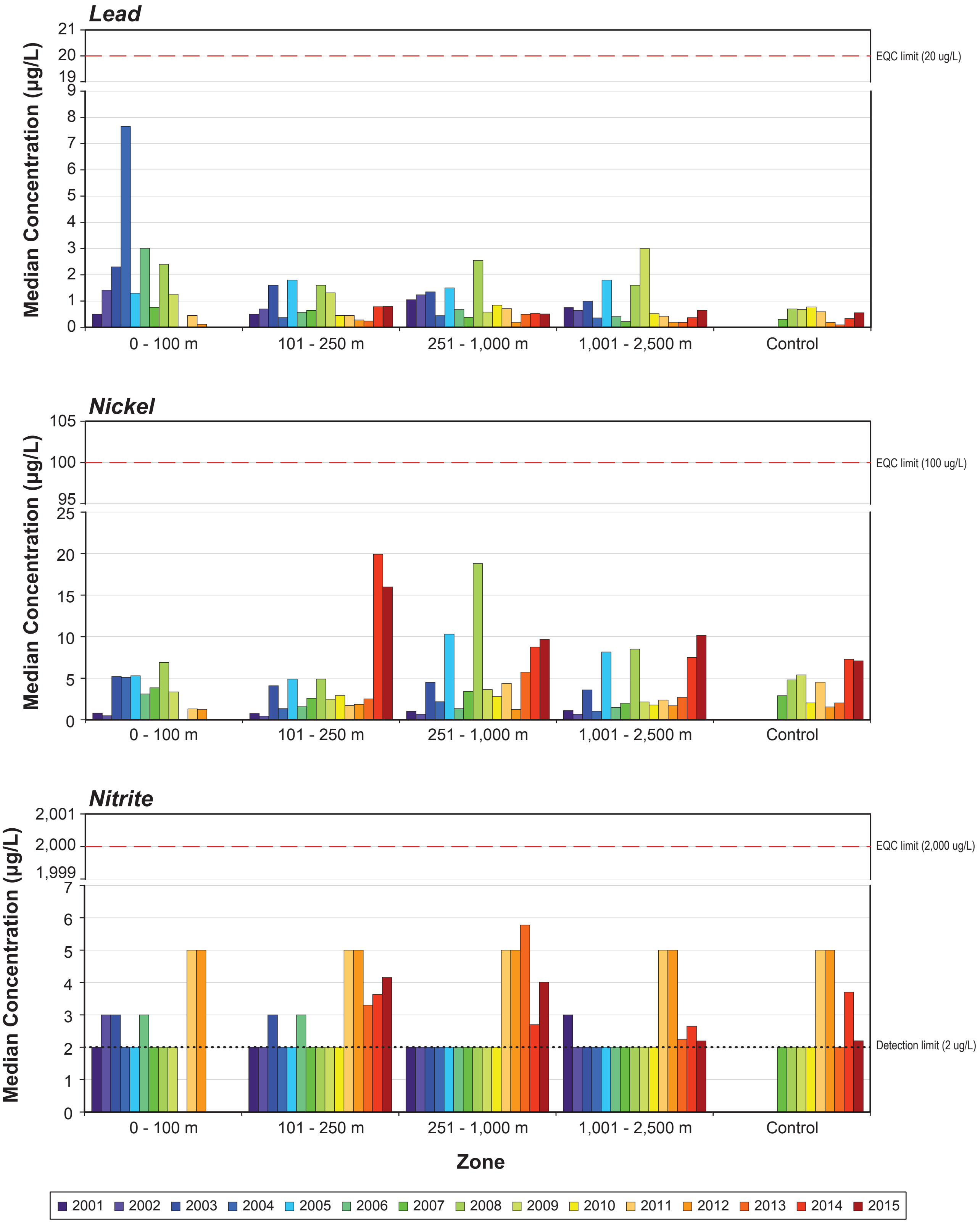
# Snow Water Chemistry Results: Cadmium, Chromium and Copper, 2001 to 2015



*Note: Max grab sample concentrations: Cadmium 3 µg/L, Chromium 40 µg/L, Copper 40 µg/L.*

## Figure 3.3-3

## Snow Water Chemistry Results: Lead, Nickel and Nitrite, 2001 to 2015



*Note: Max grab sample concentrations: Lead 20 µg/L, Nickel 100 µg/L, Nitrite 2,000 µg/L.*

### 3.3.8 Nickel

Nickel concentrations measured in 2015 ranged from 1.3 µg/L at station SS2-3 in the 1,001-2,500 m zone to 127 µg/L at station SS3-6 in the 0–100 m zone (Table 3.1-1). Median 2015 nickel concentrations were greatest in the 101-250 m zone and were similar across all other distance ranges (Figure 3.3-3). The 2015 median concentration in each zone was similar to 2014 median concentrations (Figure 3.3-3). SS3-6 in the 0–100 m zone was greater than the reference value of 100 µg/L specified in the Water Licence for grab sample concentrations. All other concentrations were below this value.

### 3.3.9 Nitrite

Nitrite concentrations measured in 2015 ranged from 2 µg/L at stations SS2-4, SS4-5, SS5-4 and SS-5 in the 1,001-2,500 m zone and SS5-3 in the 251-1,000 m zone to 8.2 µg/L at station SS3-8 in the 251-1,000 m zone (Table 3.1-1). Median 2015 nitrite concentrations were greatest (4.2 µg/L) in the 101-250 m zone and ranged from 2.2 to 4 µg/L in the other zones (Figure 3.1-3). The 2015 median concentration in each zone was similar to 2014 median concentrations (Figure 3.3-3). All measurements were well less than the value of 2,000 µg/L specified in the Water Licence for grab sample concentrations.

### 3.3.10 Phosphorous

Phosphorous concentrations measured in 2015 ranged from 4.6 µg/L at CONTROL 1 (5,655 m) to 293 µg/L at station SS3-6 in the 0–100 m zone (Table 3.1-1). Median 2015 phosphorus concentrations were greatest (46.8 µg/L) in the 101-250 m zone and were ranged from 11.6 to 35.5 µg/L in the other zones (Figure 3.3-4). The 2015 median concentration in each zone was similar to 2014 median concentrations except the Control zone which was much lower in 2015 (Figure 3.3-4). Although the Water Licence has a load limit for phosphorous, there is no EQC specified in the licence.

### 3.3.11 Zinc

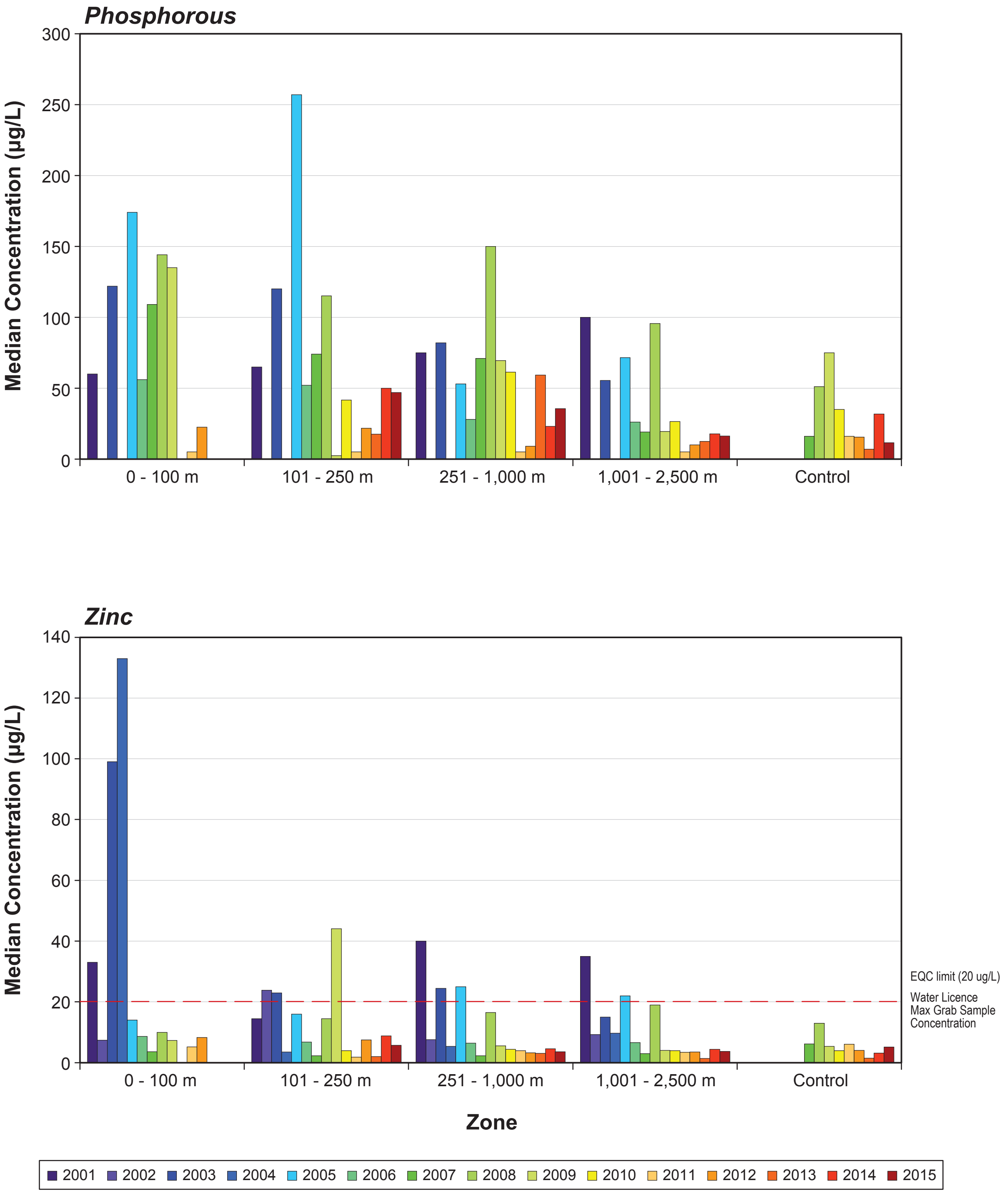
Zinc concentrations measured in 2015 ranged from 1.7 µg/L at station SS2-3 in the 1,001-2,500 m zone to 29 µg/L at station SS3-6 in the 0–100 m zone (Table 3.1-1). Median 2015 zinc concentrations were greatest in the 101-250 m zone and were similar for all distance ranges (Figure 3.3-4). The 2015 median concentration in each zone was less than 2014 median concentrations except the Control zone which was greater in 2015 (Figure 3.3-4). SS3-6 in the 0–100 m zone was greater than the reference value of 20 µg/L specified in the Water Licence for grab sample concentrations. All other concentrations were below this value.

## 3.4 QUALITY ASSURANCE AND CONTROL

Dustfall gauge, dustfall snow survey and snow water chemistry sampling and analysis were conducted by experienced technicians following SOPs ENVR-508-0112, ENVR-512-0213 and ENVI-403-0112 to ensure proper field sampling and laboratory analysis. As part of SOP ENVR-512-0213, duplicate and blank samples were taken for some snow survey and snow water chemistry sample sites (Table 2-1). The results from these samples are summarized in Table 3.4-1.

**Figure 3.3-4**

# Snow Water Chemistry Results: Phosphorus and Zinc, 2001 to 2015



*Note: Max grab sample concentrations: Zinc 20 µg/L, Phosphorous n/a.*

**Table 3.4-1. Sample Duplicates and Blanks**

| Parameter | Relative Percent Difference [a] (%) | | | SS5-1 Blank Sample (µg/L) | Percent Below Non-blank SS5-1 Sample (%) |
|---|---|---|---|---|---|
| | SS1-5 | SS3-7 | SS4-5 | | |
| Dustfall | 36 | 7 | n/a | n/a | n/a |
| Aluminum | 37 | 37 | 14 | 1.73 | 100 |
| Ammonia | n/a | 6 | 22 | *8.20* | 91 |
| Arsenic | 36 | 12 | 18 | *0.02* | 92 |
| Cadmium | —[b] | — | — | *0.01* | 50 |
| Chromium | 37 | 47 | 15 | *0.05* | 99 |
| Copper | — | 41 | 16 | *0.05* | 94 |
| Lead | 46 | 38 | 18 | *0.01* | 99 |
| Nickel | 23 | 42 | 10 | 0.03 | 100 |
| Nitrite | n/a | — | — | *2.20* | 45 |
| Phosphorous | n/a | 3 | 3 | *2.00* | 84 |
| Zinc | 32 | 33 | 30 | 0.73 | 80 |

*Notes:*

*n/a = not applicable*

*For measurements that were less than the detection limit, the detection limit was used for calculations and are shown as italicized in the table.*

[a] *Relative difference between duplicates, with respect to their mean: RPD = 100 × |rep1 − rep2| / [(rep1 + rep2)/2]*

[b] *Relative percent difference was calculated for parameters with observations more than 5× the analytical detection limit.*

The relative percent difference (RPD) of duplicate samples from a site represents the amount of variation between duplicates. According to the Project AEMP, the data quality objective for duplicate water quality samples is a RPD of 20% when concentrations are ≥5 times the DL (AEMP 2014). Of the calculated RPD values, 14 of 26 RPD values were greater than 20%, and 4 of 26 RPD values were greater than 40%. Duplicate samples from sites SS1-5 and SS3-7 had generally higher RPD values than the duplicate sample from SS4-5, which indicated that within-site variability was not correlated with distance from the mine. The concentrations of all parameters in the blank processed at station SS5-1 were much less than those from the non-blank sample, suggesting the data were of good quality. The majority of the parameters analyzed in the blank sample were below analytical detection limits, which would be expected for an uncontaminated blank.

# 4. SUMMARY

In 2015, dustfall was monitored at 12 dustfall gauges and 27 snow survey stations located at varying distances around the mine. Snow water chemistry was also measured at 19 of the snow survey stations and compared to EQC set out in the WLWB Water Licence W2015L2-0001 (formerly W2007L2-0003).

Median dustfall estimated in 2015 was similar results in 2014 and also decreased with distance from the Project. Annual dustfall measured at each of the 12 dustfall gauges ranged from 88 to 582 mg/dm$^2$/y. The annualized dustfall rates estimated from the 2015 snow survey sites ranged from 9.3 to 1,013 mg/dm$^2$/y. Because dustfall gauges continuously collect dust throughout the year, and the snow surveys are only representative of dustfall accumulated over the snow cover period, the reported annual dustfall results from the dustfall gauges are expected to provide a better estimate of annual dustfall compared to snow survey results for similar geographic areas. However, results obtained from both methods showed similar patterns.

Dustfall levels were generally higher in 2015 than in 2014; however, are within the range of historical data collected for the Project. Annualized dustfall estimated from each snow survey station in 2015 was less than some historical dustfall estimates. Comparisons of mean and maximum values suggest that dustfall rates were generally higher in 2015 than in 2013 and 2014. Overall, as expected, dustfall rates generally decreased with distance from the Project with the lowest dustfall rate recorded at station Control 1 (5,655 m from the Project), and areas that were predominantly downwind of the Project received more dustfall than upwind areas. Although there are no dustfall standards for the Northwest Territories, 2015 dustfall rates were less than the 1.7 to 2.9 mg/dm$^2$/d (621 to 1,059 mg/dm$^2$/y) BC MOE dustfall objective for the mining, smelting, and related industries (BC MOE 2016). Mean dustfall rates estimated using both dustfall gauges and snow surveys within the 0–100 m, 101–250 m, 251-1,000 m, 1,001–2,500 m and Control zones were 467, 145, 222, 125 and 71 mg/dm$^2$/y, respectively.

Snow water chemistry analytes of interest included those variables with effluent quality criteria (EQC; i.e., aluminum, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, nitrite, and zinc) or a load limit (i.e., phosphorous) specified in the Type "A" Water Licence (W2015L2-0001). All 2015 sample concentrations were less than their associated reference levels as specified by the "maximum concentration of any grab sample" specified in Water Licence W2015L2-0001except some of the results from the SS3-6 snow core. SS3-6 aluminum, chromium, nickel and zinc concentrations were greater than the respective reference levels. SS3-6 is 60 m from the Project (second closest sample location) and had the highest residue mass per filter (391.7 mg) of any of the snow core samples. Median concentrations of arsenic, chromium, and nickel have increased in recent years, while concentrations of copper, lead and zinc decreased in recent years. Other analytes of interest have shown no obvious pattern. Typically, concentrations decreased with distance from the Project; however, high concentrations of certain variables of interest were recorded at Station SS3-8, located in the 251-1000 zone and station SS4-4, located in the 1001-2500 zone. Concentrations at these two locations were more than double the concentrations recorded at the other sites, including samples collected in the 0-100 zone. SS3-8 is located to the southeast and SS404 is located northwest of the Project. However, concentrations of all variables were less than their corresponding EQC.

# REFERENCES

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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# *Appendix A*

## *Annual Changes to Dustfall Program*

# APPENDIX A. ANNUAL CHANGES TO DUSTFALL PROGRAM

## 2001

The 2001 dust monitoring program was based entirely upon snow survey samples collected along four radial transects emanating from the project footprint outward to a distance of approximately 1,000 meters. All sample locations were analyzed for dust deposition, while only those locations on Lac de Gras were analyzed for snow water chemistry.

## 2002

DDMI amended the dust monitoring program, in response to recommendations made by the Mackenzie Valley Land and Water Board, to include two snow survey control locations. In addition, five dust gauges (passive dust collectors) were deployed, one along each of the snow survey transects and one at a control location, in efforts to enhance the monitoring program.

## 2003

In response to further recommendations, the dust monitoring program was modified. All four snow survey transects were extended in length to a distance of approximately 2,000 meters from the project footprint. An additional five dust gauges, including a second control, were deployed.

## 2004

Increased construction activity necessitated further changes to the dust monitoring program. One dust gauge (Dust 02) was removed from its location to accommodate project footprint expansion, and subsequently relocated and redeployed (Dust 2A).

## 2005

Dust deposition monitoring was carried out with no modifications to either the snow survey or the dust gauge portion of the program.

## 2006

An additional dust gauge was deployed bringing the total to eleven (including two controls). Testing of Mini-Vol portable air samplers were conducted to determine feasibility of incorporation into the dust monitoring program. Preliminary findings proved the inclusion of the Mini-Vol samplers would be impractical.

## 2007

The snow survey portion of the program was amended with an additional snow survey transect being incorporated bringing the total number of transects to five. As well, snow water chemistry samples were collected adjacent to the pre-existing control locations as background references.

Two additional dust gauges (temporary) were deployed adjacent to two pre-existing dust gauges. The intent of the temporary gauges was to compare results from the same location when sample collection frequency is altered.

DDMI initiated contact with Environment Canada and Golder Associates with regards to remodeling dust deposition with the intent of revising predictions made in the 1998 environmental effects report.

In light of dust deposition monitoring results from previous years, several control measures were adopted to reduce dust generation on site, including the utilization of EK-35 (suppressant) on the airport apron, taxiway and helipad, and fitting a second 830E haul truck with tank for haul road watering.

## 2008

All of the dust gauges were modified to accommodate the replacement of the polyacrylic dust gauge inserts with brass Nipher gauge inserts, to minimize loss associated with damage during the collection and handling of the dust gauges.

An additional dust gauge was added to the program bringing the total to twelve permanently deployed (including two control), and two temporary (reference) dust gauges.

Three snow survey sample points were not sampled as they had become overtaken by construction activity and expansion of the project footprint.

Additional preparations for dust deposition modelling were completed including data collection, identification of point source inputs, selection of a modelling program and inputs (with regulator input) and discussion of cumulative effects.

## 2009

The two temporary dust gauges deployed in 2007 were decommissioned. All twelve permanent gauges were collected quarterly. An error in collection/deployment resulted in "No Data" being collected for Dust 03 between July 11 and September.

Snow survey sampling was conducted in April. An error in collection/analysis resulted in the Dust Deposition sample for SS2-1 being compromised; as such "No Dust Deposition Data" was available for this location.

## 2010

All twelve permanent dust gauges were collected quarterly during 2010. Overall, there was a reduction of observed dustfall deposition from 2009 to 2010, with the exception of Dust 1 and Dust 10.

Snow survey sampling was conducted throughout the month of April. An error in collection/ processing resulted in two missing stations for the water quality analysis. SS2-1 field results were collected; however, the sample was compromised during processing in the lab. An error also resulted with the collection of SS5-2; data collection for water quality analysis was missed in the field. No data for these two stations resulted in Zone 1 having no data for the various water chemistry results and SS5-2 was not represented in Zone 3 data for 2010.

## 2011

All twelve permanent dust gauges were collected quarterly during 2011. During collection and repair to Station Dust 5 in September, the sample was compromised and therefore not processed, which resulted in data loss.

Snow survey sampling was conducted throughout the month of April. Due to an internal error shipping samples, water quality samples for stations SS1-4, SS1-5, SS2-1, SS2-2, SS2-3, SS2-4, and SSC-3 arrived at the Maxxam laboratory past the recommended holding time.

## 2012

All twelve permanent dust gauges were collected quarterly during 2012. During collection in June repairs were conducted on Station Dust 9 as it was found on its side, the sample was compromised, which resulted in data loss. Overall in 2012, 8 of the 12 dust gauges reported lower deposition rates compared to 2011.

Snow survey sampling was conducted on April 30 and on May 4 and 5.

## 2013

All twelve permanent dust gauges were collected quarterly during 2013. Station Dust 5 was dismantled upon arrival in September and the sample was compromised, which resulted in data loss for that quarter.

Snow survey sampling was conducted at 24 locations from April 26 to 28.

## 2014

All twelve permanent dust gauges were collected quarterly during 2014.

Snow survey sampling was conducted at 24 locations from April 7 to May 12. Three additional sites, SS3-6, SS3-7, SS3-8, were installed.

## 2015

No changes were made to the dustfall program in 2015.

All twelve permanent dust gauges were collected quarterly during 2015.

Snow survey sampling was conducted at 24 locations from March 31 to April 10.

# *Appendix B*

## *Dustfall Gauge Analytic Results*

## Appendix B. Dustfall Gauge Analytic Results

| Sample Date | Dust Gauge ID | Filter # | Weight of Filter (mg) | Filter + Residue (mg) | Weight of Residue (mg) | Cumulative (filters, mg) | Dust Deposition (mg/dm$^2$) | Days Deployed | Dust Deposition (mg/dm$^2$/d) | Dust Deposition (mg/dm$^2$/y) |
|---|---|---|---|---|---|---|---|---|---|---|
| 06-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 8-Mar-15 | Dust 1 | 1 | 120.9 | 206.7 | 85.8 | 85.8 | 69.95 | 92.00 | n/a | n/a |
| 5-Jul-15 | Dust 1 | 1 | 126.7 | 366.2 | 239.5 | 239.5 | 195.26 | 119.00 | n/a | n/a |
| 5-Jul-15 | Dust 1 | 2 | 119.1 | 123 | 3.9 | 3.9 | 3.18 | 0.00 | n/a | n/a |
| 17-Sep-15 | Dust 1 | 1 | 129.5 | 160.2 | 30.7 | 30.7 | 25.03 | 74.00 | n/a | n/a |
| 17-Sep-15 | Dust 1 | 2 | 130 | 137.5 | 7.5 | 7.5 | 6.11 | 0.00 | n/a | n/a |
| 17-Sep-15 | Dust 1 | 3 | 119 | 166.5 | 47.5 | 47.5 | 38.73 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust 1 | 1 | 130.1 | 228.5 | 98.4 | 98.4 | 80.22 | 106.00 | n/a | n/a |
| | | | | | **TOTALS** | **513.3** | **418.49** | **391.00** | **1.07** | **390.7** |
| 07-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 7-Mar-15 | Dust 2A | 1 | 119.3 | 228.5 | 109.2 | 109.2 | 89.03 | 90.00 | n/a | n/a |
| 5-Jul-15 | Dust 2A | 1 | 125.7 | 288.4 | 162.7 | 162.7 | 132.65 | 120.00 | n/a | n/a |
| 15-Sep-15 | Dust 2A | 1 | 124.7 | 130.6 | 5.9 | 5.9 | 4.81 | 72.00 | n/a | n/a |
| 15-Sep-15 | Dust 2A | 2 | 124.2 | 129 | 4.8 | 4.8 | 3.91 | 0.00 | n/a | n/a |
| 15-Sep-15 | Dust 2A | 3 | 124.1 | 128.9 | 4.8 | 4.8 | 3.91 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust 2A | 1 | 126.2 | 161.8 | 35.6 | 35.6 | 29.02 | 108.00 | n/a | n/a |
| | | | | | **TOTALS** | **323** | **263.34** | **390.00** | **0.68** | **246.5** |
| 06-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 7-Mar-15 | Dust 3 | 1 | 117.5 | 344 | 226.5 | 226.5 | 184.66 | 91.00 | n/a | n/a |
| 5-Jul-15 | Dust 3 | 1 | 118.8 | 505.6 | 386.8 | 386.8 | 315.35 | 120.00 | n/a | n/a |
| 5-Jul-15 | Dust 3 | 2 | 120.1 | 123.4 | 3.3 | 3.3 | 2.69 | 0.00 | n/a | n/a |
| 17-Sep-15 | Dust 3 | 1 | 119.6 | 139.7 | 20.1 | 20.1 | 16.39 | 74.00 | n/a | n/a |
| 17-Sep-15 | Dust 3 | 2 | 129.8 | 177.3 | 47.5 | 47.5 | 38.73 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust 3 | 1 | 120 | 201 | 81 | 81 | 66.04 | 106.00 | n/a | n/a |
| | | | | | **TOTALS** | **765.2** | **623.86** | **391.00** | **1.60** | **582.4** |

## Appendix B. Dustfall Gauge Analytic Results

| Sample Date | Dust Gauge ID | Filter # | Weight of Filter (mg) | Filter + Residue (mg) | Weight of Residue (mg) | Cumulative (filters, mg) | Dust Deposition (mg/dm$^2$) | Days Deployed | Dust Deposition (mg/dm$^2$/d) | Dust Deposition (mg/dm$^2$/y) |
|---|---|---|---|---|---|---|---|---|---|---|
| 06-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 9-Mar-15 | Dust 4 | 1 | 121.8 | 182.3 | 60.5 | 60.5 | 49.32 | 93.00 | n/a | n/a |
| 5-Jul-15 | Dust 4 | 1 | 125.8 | 197 | 71.2 | 71.2 | 58.05 | 118.00 | n/a | n/a |
| 17-Sep-15 | Dust 4 | 1 | 119.5 | 133.3 | 13.8 | 13.8 | 11.25 | 74.00 | n/a | n/a |
| 1-Jan-16 | Dust 4 | 1 | 121.4 | 170.5 | 49.1 | 49.1 | 40.03 | 106.00 | n/a | n/a |
| | | | | | **TOTALS** | **194.6** | **158.65** | **391.00** | **0.41** | **148.1** |
| 29-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 9-Mar-15 | Dust 5 | 1 | 118.3 | 139 | 20.7 | 20.7 | 16.88 | 70.00 | n/a | n/a |
| 5-Jul-15 | Dust 5 | 1 | 117.2 | 187.7 | 70.5 | 70.5 | 57.48 | 118.00 | n/a | n/a |
| 14-Sep-15 | Dust 5 | 1 | 125.5 | 131.1 | 5.6 | 5.6 | 4.57 | 71.00 | n/a | n/a |
| 14-Sep-15 | Dust 5 | 2 | 119 | 126.3 | 7.3 | 7.3 | 5.95 | 0.00 | n/a | n/a |
| 14-Sep-15 | Dust 5 | 3 | 120.1 | 125.9 | 5.8 | 5.8 | 4.73 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust 5 | 1 | 116.6 | 133.8 | 17.2 | 17.2 | 14.02 | 109.00 | n/a | n/a |
| | | | | | **TOTALS** | **127.1** | **103.62** | **368.00** | **0.28** | **102.8** |
| 06-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 7-Mar-15 | Dust 6 | 1 | 118.8 | 272.6 | 153.8 | 153.8 | 125.39 | 91.00 | n/a | n/a |
| 5-Jul-15 | Dust 6 | 1 | 112.7 | 320.3 | 207.6 | 207.6 | 169.25 | 120.00 | n/a | n/a |
| 5-Jul-15 | Dust 6 | 2 | 112.5 | 115 | 2.5 | 2.5 | 2.04 | 0.00 | n/a | n/a |
| 17-Sep-15 | Dust 6 | 1 | 127.2 | 130.8 | 3.6 | 3.6 | 2.94 | 74.00 | n/a | n/a |
| 17-Sep-15 | Dust 6 | 2 | 118.2 | 121.5 | 3.3 | 3.3 | 2.69 | 0.00 | n/a | n/a |
| 17-Sep-15 | Dust 6 | 3 | 124.7 | 128.9 | 4.2 | 4.2 | 3.42 | 0.00 | n/a | n/a |
| 17-Sep-15 | Dust 6 | 4 | 119.6 | 139.3 | 19.7 | 19.7 | 16.06 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust 6 | 1 | 131.2 | 191.3 | 60.1 | 60.1 | 49.00 | 106.00 | n/a | n/a |
| | | | | | **TOTALS** | **454.8** | **370.79** | **391.00** | **0.95** | **346.1** |

## Appendix B.  Dustfall Gauge Analytic Results

| Sample Date | Dust Gauge ID | Filter # | Weight of Filter (mg) | Filter + Residue (mg) | Weight of Residue (mg) | Cumulative (filters, mg) | Dust Deposition (mg/dm$^2$) | Days Deployed | Dust Deposition (mg/dm$^2$/d) | Dust Deposition (mg/dm$^2$/y) |
|---|---|---|---|---|---|---|---|---|---|---|
| 07-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 7-Mar-15 | Dust 7 | 1 | 119.2 | 320.3 | 201.1 | 201.1 | 163.95 | 90.00 | n/a | n/a |
| 5-Jul-15 | Dust 7 | 1 | 113.8 | 452.2 | 338.4 | 338.4 | 275.89 | 120.00 | n/a | n/a |
| 15-Sep-15 | Dust 7 | 1 | 120.7 | 123.4 | 2.7 | 2.7 | 2.20 | 72.00 | n/a | n/a |
| 15-Sep-15 | Dust 7 | 2 | 123.4 | 133.7 | 10.3 | 10.3 | 8.40 | 0.00 | n/a | n/a |
| 15-Sep-15 | Dust 7 | 3 | 115.5 | 118.7 | 3.2 | 3.2 | 2.61 | 0.00 | n/a | n/a |
| 15-Sep-15 | Dust 7 | 4 | 107.8 | 117.8 | 10 | 10 | 8.15 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust 7 | 1 | 119.5 | 153.5 | 34 | 34 | 27.72 | 108.00 | n/a | n/a |
| | | | | | **TOTALS** | **599.7** | **488.93** | **390.00** | **1.25** | **457.6** |
| 29-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 9-Mar-15 | Dust 8 | 1 | 117.4 | 148.2 | 30.8 | 30.8 | 25.11 | 70.00 | n/a | n/a |
| 5-Jul-15 | Dust 8 | 1 | 114.2 | 179.4 | 65.2 | 65.2 | 53.16 | 118.00 | n/a | n/a |
| 14-Sep-15 | Dust 8 | 1 | 127.2 | 128.1 | 0.9 | 0.9 | 0.73 | 71.00 | n/a | n/a |
| 14-Sep-15 | Dust 8 | 2 | 122.2 | 127 | 4.8 | 4.8 | 3.91 | 0.00 | n/a | n/a |
| 14-Sep-15 | Dust 8 | 3 | 132.2 | 139.1 | 6.9 | 6.9 | 5.63 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust 8 | 1 | 120.5 | 161.7 | 41.2 | 41.2 | 33.59 | 109.00 | n/a | n/a |
| | | | | | **TOTALS** | **149.8** | **122.13** | **368.00** | **0.33** | **121.1** |
| 07-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 7-Mar-15 | Dust 9 | 1 | 119 | 154.6 | 35.6 | 35.6 | 29.02 | 90.00 | n/a | n/a |
| 5-Jul-15 | Dust 9 | 1 | 121.1 | 125.9 | 4.8 | 4.8 | 3.91 | 120.00 | n/a | n/a |
| 5-Jul-15 | Dust 9 | 2 | 120.1 | 153.1 | 33 | 33 | 26.90 | 0.00 | n/a | n/a |
| 5-Jul-15 | Dust 9 | 3 | 114.4 | 114.8 | 0.4 | 0.4 | 0.33 | 0.00 | n/a | n/a |
| 15-Sep-15 | Dust 9 | 1 | 120.5 | 128.5 | 8 | 8 | 6.52 | 72.00 | n/a | n/a |
| 15-Sep-15 | Dust 9 | 2 | 122.1 | 124.8 | 2.7 | 2.7 | 2.20 | 0.00 | n/a | n/a |
| 15-Sep-15 | Dust 9 | 3 | 111.2 | 115.1 | 3.9 | 3.9 | 3.18 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust 9 | 1 | 124 | 151.4 | 27.4 | 27.4 | 22.34 | 108.00 | n/a | n/a |
| | | | | | **TOTALS** | **115.8** | **94.41** | **390.00** | **0.24** | **88.4** |

## Appendix B.  Dustfall Gauge Analytic Results

| Sample Date | Dust Gauge ID | Filter # | Weight of Filter (mg) | Filter + Residue (mg) | Weight of Residue (mg) | Cumulative (filters, mg) | Dust Deposition (mg/dm²) | Days Deployed | Dust Deposition (mg/dm²/d) | Dust Deposition (mg/dm²/y) |
|---|---|---|---|---|---|---|---|---|---|---|
| 07-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 9-Mar-15 | Dust 10 | 1 | 118.2 | 161.2 | 43 | 43 | 35.06 | 92.00 | n/a | n/a |
| 5-Jul-15 | Dust 10 | 1 | 126.3 | 298 | 171.7 | 171.7 | 139.98 | 118.00 | n/a | n/a |
| 15-Sep-15 | Dust 10 | 1 | 121.7 | 127.6 | 5.9 | 5.9 | 4.81 | 72.00 | n/a | n/a |
| 15-Sep-15 | Dust 10 | 2 | 120.6 | 126.2 | 5.6 | 5.6 | 4.57 | 0.00 | n/a | n/a |
| 15-Sep-15 | Dust 10 | 3 | 126.8 | 133.1 | 6.3 | 6.3 | 5.14 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust 10 | 1 | 123 | 260.4 | 137.4 | 137.4 | 112.02 | 108.00 | n/a | n/a |
| | | | | | **TOTALS** | **369.9** | **301.57** | **390.00** | **0.77** | **282.2** |
| 07-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 9-Mar-15 | Dust C1 | 1 | 120.6 | 156 | 35.4 | 35.4 | 28.86 | 92.00 | n/a | n/a |
| 5-Jul-15 | Dust C1 | 1 | 118.4 | 151.5 | 33.1 | 33.1 | 26.99 | 118.00 | n/a | n/a |
| 15-Sep-15 | Dust C1 | 1 | 120.2 | 141.8 | 21.6 | 21.6 | 17.61 | 72.00 | n/a | n/a |
| 15-Sep-15 | Dust C1 | 2 | 122.2 | 145.1 | 22.9 | 22.9 | 18.67 | 0.00 | n/a | n/a |
| 15-Sep-15 | Dust C1 | 3 | 124.4 | 132 | 7.6 | 7.6 | 6.20 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust C1 | 1 | 125.1 | 133.5 | 8.4 | 8.4 | 6.85 | 108.00 | n/a | n/a |
| | | | | | **TOTALS** | **129** | **105.17** | **390.00** | **0.27** | **98.4** |
| 07-Dec-14 | Initial Deployment Date | | | | | | | | | |
| 9-Mar-15 | Dust C2 | 1 | 117.7 | 204.9 | 87.2 | 87.2 | 71.09 | 92.00 | n/a | n/a |
| 5-Jul-15 | Dust C2 | 1 | 122.9 | 158.8 | 35.9 | 35.9 | 29.27 | 118.00 | n/a | n/a |
| 14-Sep-15 | Dust C2 | 1 | 119.9 | 121.2 | 1.3 | 1.3 | 1.06 | 71.00 | n/a | n/a |
| 14-Sep-15 | Dust C2 | 2 | 126.2 | 129.6 | 3.4 | 3.4 | 2.77 | 0.00 | n/a | n/a |
| 14-Sep-15 | Dust C2 | 3 | 124.6 | 127.1 | 2.5 | 2.5 | 2.04 | 0.00 | n/a | n/a |
| 1-Jan-16 | Dust C2 | 1 | 125.9 | 142.3 | 16.4 | 16.4 | 13.37 | 109.00 | n/a | n/a |
| | | | | | **TOTALS** | **146.7** | **119.60** | **390.00** | **0.31** | **111.9** |

# *Appendix C*

## *Dustfall Snow Survey Field Sheets and Analytic Results*

Rio Tinto

# Dust Gauge Collection Field Sheet

| | | | |
|---|---|---|---|
| **Area:** | 8000 | **No:** | ENVI-178-0312 |
| **Effective Date:** | 26-Mar-2012 | **Revision:** | R0 |
| **Task:** | Dust Gauge Collection Field Sheet | **By:** | Dianne Dul |
| | | **Page:** | 1 of 2 |

**GENERAL**

**LOCATION NAME:** Dust 1 **DATE (dd-mmm-yyyy):** 2015-Dec-31 **TIME (24:00):** 14:50

**SAMPLED BY:** JG/SS **TYPE OF SAMPLE:** [✓ Dust] **Other**________

**GPS COORDINATES (UTM):** ________ **E** ________ **N (Zone)** ________

**DESCRIPTION:** ________

CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -13 °C **Wind Direction:** W **Wind Speed (knots):** 11

**Precipitation:** rain / mist / snow / [✓ N/A] **Cloud Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100]

**Snow Cover:** 0%, 10%, [✓ 25%], 50%, 75%, 100% **Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** 2015-Sept-17

**Total Volume of Water After Melting :** 760 (mL)

| **Filter #** | **Weight of Filter** | **Filter + Residue** | **Residue Weight** | **Comments** |
|---|---|---|---|---|
| 1 | 130.1 | 228.5 | 98.4 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

Rio Tinto

# Dust Gauge Collection Field Sheet

| | | | |
|---|---|---|---|
| | | **No:** | ENVI-178-0312 |
| **Area:** | 8000 | **Revision:** | R0 |
| **Effective Date:** | 26-Mar-2012 | **By:** | Dianne Dul |
| **Task:** | Dust Gauge Collection Field Sheet | | |
| | | **Page:** | 1 of 2 |

## GENERAL

**LOCATION NAME:** DUST 2A

**DATE (dd-mmm-yyyy):** 2016-Jan-02

**TIME (24:00):** ________

**SAMPLED BY:** JG/SS

**TYPE OF SAMPLE:** [✓ Dust]

**Other** ________

**GPS COORDINATES (UTM):** ________ **E** ________ **N (Zone)** ________

**DESCRIPTION:** ________

## CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -8 °C

**Wind Direction:** NE

**Wind Speed (knots):** 15

**Precipitation:** rain / mist / snow / [✓ N/A]

**Cloud Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100]

**Snow Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100%]

**Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** 2015-Sept 15

**Total Volume of Water After Melting :** 850 (mL)

| **Filter #** | **Weight of Filter** | **Filter + Residue** | **Residue Weight** | **Comments** |
|---|---|---|---|---|
| 1 | 126.2 | 161.8 | 35.6 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

Rio Tinto

# Dust Gauge Collection Field Sheet

| | | | |
|---|---|---|---|
| | | **No:** | ENVI-178-0312 |
| **Area:** | 8000 | **Revision:** | R0 |
| **Effective Date:** | 26-Mar-2012 | **By:** | Dianne Dul |
| **Task:** | Dust Gauge Collection Field Sheet | | |
| | | **Page:** | 1 of 2 |

GENERAL

LOCATION NAME: DUST 3

DATE (dd-mmm-yyyy): 2015-Jan-02

TIME (24:00): ____

SAMPLED BY: JG/SS

TYPE OF SAMPLE: [✓ Dust]

Other ____

GPS COORDINATES (UTM): ____ E ____ N (Zone) ____

DESCRIPTION: ____

CLIMATE CONDITIONS (if sampling outside)

Air Temp: -8 °C

Wind Direction: NE

Wind Speed (knots): 15

Precipitation: rain / mist / snow / [✓ N/A]

Cloud Cover: 0%, 10%, 25%, 50%, 75%, [✓ 100]

Snow Cover: 0%, 10%, 25%, 50%, 75%, [✓ 100%]

Dust in area: Visible, [✓ Not Visible]

COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)

Date Sample Collected was Deployed 2015-Sept-17

Total Volume of Water After Melting: 900 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 120 | 201.0 | 81.0 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| Totals | | | | |

Rio Tinto

## Dust Gauge Collection Field Sheet

| | | | |
|---|---|---|---|
| **Area:** | 8000 | **No:** | ENVI-178-0312 |
| **Effective Date:** | 26-Mar-2012 | **Revision:** | R0 |
| **Task:** | Dust Gauge Collection Field Sheet | **By:** | Dianne Dul |
| | | **Page:** | 1 of 2 |

**GENERAL**

**LOCATION NAME:** DUST 4

**DATE (dd-mmm-yyyy):** 2016-Jan-01

**TIME (24:00):**

**SAMPLED BY:** JG/SS

**TYPE OF SAMPLE:** [✓ Dust]

**Other**

**GPS COORDINATES (UTM):** ____ **E** ____ **N (Zone)**

**DESCRIPTION:**

CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -13 °C

**Wind Direction:** W

**Wind Speed (knots):** 11

**Precipitation:** rain / mist / snow / [✓ N/A]

**Cloud Cover:** 0%, 10%, 25%, 50%, 75%, 100

**Snow Cover:** 0%, 10%, 25%, 50%, 75%, 100%

**Dust in area:** Visible, Not Visible

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** 2015-Sept-17

**Total Volume of Water After Melting :** 950 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 121.4 | 170.5 | 49.1 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| Totals | | | | |

Rio Tinto

## Dust Gauge Collection Field Sheet

**No:** ENVI-178-0312
**Area:** 8000
**Revision:** R0
**Effective Date:** 26-Mar-2012
**By:** Dianne Dul
**Task:** Dust Gauge Collection Field Sheet
**Page:** 1 of 2

**GENERAL**

**LOCATION NAME:** DUST 5 **DATE (dd-mmm-yyyy):** 2016-Jan-01 **TIME (24:00):**
**SAMPLED BY:** JG/SS **TYPE OF SAMPLE:** [✓ Dust] **Other**
**GPS COORDINATES (UTM):** E N (Zone)
**DESCRIPTION:**

CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -9 °C **Wind Direction:** Calm **Wind Speed (knots):** Calm
**Precipitation:** rain / mist / snow / [✓ N/A] **Cloud Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100]
**Snow Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100%] **Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** 2015-Sept-14

**Total Volume of Water After Melting :** 675 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 116.6 | 133.8 | 17.2 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

# Dust Gauge Collection Field Sheet

**No:** ENVI-178-0312
**Revision:** R0
**By:** Dianne Dul

**Area:** 8000
**Effective Date:** 26-Mar-2012
**Task:** Dust Gauge Collection Field Sheet

**Page:** 1 of 2

**GENERAL**

**LOCATION NAME:** DUST 6
**DATE (dd-mmm-yyyy):** 2015-Dec-31
**TIME (24:00):** 14:35
**SAMPLED BY:** JG/SS
**TYPE OF SAMPLE:** [✓ Dust]
**Other**
**GPS COORDINATES (UTM):** E N (Zone)
**DESCRIPTION:**

CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -13 °C
**Wind Direction:** W
**Wind Speed (knots):** 11
**Precipitation:** rain / mist / snow / [✓ N/A]
**Cloud Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100]
**Snow Cover:** 0%, 10%, [✓ 25%], 50%, 75%, 100%
**Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** ~~2015 Sept 17~~
2015-Sept-17

**Total Volume of Water After Melting :** 730 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 131.2 | 191.3 | 60.1 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

## Dust Gauge Collection Field Sheet

| | | | |
|---|---|---|---|
| | | **No:** | ENVI-178-0312 |
| **Area:** | 8000 | **Revision:** | R0 |
| **Effective Date:** | 26-Mar-2012 | **By:** | Dianne Dul |
| **Task:** | Dust Gauge Collection Field Sheet | | |
| | | **Page:** | 1 of 2 |

**GENERAL**

LOCATION NAME: DUST 7

DATE (dd-mmm-yyyy): 2016-Jan-01

TIME (24:00):

SAMPLED BY: JG/SS

TYPE OF SAMPLE: [✓ Dust]

Other

GPS COORDINATES (UTM): E N (Zone)

DESCRIPTION:

CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -8 °C

**Wind Direction:** NE

**Wind Speed (knots):** 15

**Precipitation:** rain / mist / snow / [✓ N/A]

**Cloud Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100]

**Snow Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100%]

**Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

Date Sample Collected was Deployed 2015-Sept-15

Total Volume of Water After Melting : 900 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 119.5 | 153.5 | 34.0 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

Rio Tinto

## Dust Gauge Collection Field Sheet

| | | | |
|---|---|---|---|
| | | **No:** | ENVI-178-0312 |
| **Area:** | 8000 | **Revision:** | R0 |
| **Effective Date:** | 26-Mar-2012 | **By:** | Dianne Dul |
| **Task:** | Dust Gauge Collection Field Sheet | | |
| | | **Page:** | 1 of 2 |

**GENERAL**

**LOCATION NAME:** DUST 8 **DATE (dd-mmm-yyyy):** 2016-Jan-02 **TIME (24:00):**

**SAMPLED BY:** JG/SS **TYPE OF SAMPLE:** [✓ Dust] **Other**

**GPS COORDINATES (UTM):** **E** **N (Zone)**

**DESCRIPTION:**

CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -8 °C **Wind Direction:** NE **Wind Speed (knots):** 15

**Precipitation:** rain / mist / snow / [✓ N/A] **Cloud Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100]

**Snow Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100%] **Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** 2015-Sept-14

**Total Volume of Water After Melting :** 900 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 120.5 | 161.7 | 41.2 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

# Dust Gauge Collection Field Sheet

**No:** ENVI-178-0312
**Area:** 8000
**Revision:** R0
**Effective Date:** 26-Mar-2012
**By:** Dianne Dul
**Task:** Dust Gauge Collection Field Sheet
**Page:** 1 **of** 2

**GENERAL**

**LOCATION NAME:** DUST 9
**DATE (dd-mmm-yyyy):** 2016-Jan-02
**TIME (24:00):** ____
**SAMPLED BY:** JG / SS
**TYPE OF SAMPLE:** [✓ Dust]
**Other** ____
**GPS COORDINATES (UTM):** ____ **E** ____ **N (Zone)** ____
**DESCRIPTION:** ____

CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -8 °C
**Wind Direction:** NE
**Wind Speed (knots):** 15
**Precipitation:** rain / mist / snow / [✓ N/A]
**Cloud Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100]
**Snow Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100%]
**Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** 2015-Sept-15

**Total Volume of Water After Melting :** 620 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 124.0 | 151.4 | 27.4 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

RioTinto

# Dust Gauge Collection Field Sheet

| | | | |
|---|---|---|---|
| | | **No:** | ENVI-178-0312 |
| **Area:** | 8000 | **Revision:** | R0 |
| **Effective Date:** | 26-Mar-2012 | **By:** | Dianne Dul |
| **Task:** | Dust Gauge Collection Field Sheet | | |
| | | **Page:** | 1 of 2 |

## GENERAL

**LOCATION NAME:** DUST 10 **DATE (dd-mmm-yyyy):** 2016 Jan-01 **TIME (24:00):** ____

**SAMPLED BY:** JG/SS **TYPE OF SAMPLE:** [✓ Dust] **Other** ____

**GPS COORDINATES (UTM):** ____ **E** ____ **N (Zone)** ____

**DESCRIPTION:** ____

## CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -9 °C **Wind Direction:** Calm **Wind Speed (knots):** Calm

**Precipitation:** rain / mist / snow / [✓ N/A] **Cloud Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100]

**Snow Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100%] **Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** ~~940~~ 2015-Sept-15

**Total Volume of Water After Melting :** 940 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 123.0 | 260.4 | 137.4 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

Rio Tinto

# Dust Gauge Collection Field Sheet

**Area:** 8000
**Effective Date:** 26-Mar-2012
**Task:** Dust Gauge Collection Field Sheet

**No:** ENVI-178-0312
**Revision:** R0
**By:** Dianne Dul
**Page:** 1 **of** 2

**GENERAL**

**LOCATION NAME:** DUST C1
**DATE (dd-mmm-yyyy):** 2016-Jan-01
**TIME (24:00):**
**SAMPLED BY:** JG/SS
**TYPE OF SAMPLE:** [✓ Dust]
**Other**
**GPS COORDINATES (UTM):** E N (Zone)
**DESCRIPTION:**

CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -9 °C
**Wind Direction:** Calm
**Wind Speed (knots):** Calm
**Precipitation:** rain / mist / snow / [✓ N/A]
**Cloud Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100]
**Snow Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100%]
**Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** 2015-Sept-15

**Total Volume of Water After Melting :** 860 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 125.1 | 133.5 | 8.4 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

# Dust Gauge Collection Field Sheet

**No:** ENVI-178-0312
**Revision:** R0
**By:** Dianne Dul
**Area:** 8000
**Effective Date:** 26-Mar-2012
**Task:** Dust Gauge Collection Field Sheet
**Page:** 1 of 2

**GENERAL**

**LOCATION NAME:** DUST C2
**DATE (dd-mmm-yyyy):** 2018-Jan-01
**TIME (24:00):**
**SAMPLED BY:** JG/SS
**TYPE OF SAMPLE:** [✓ Dust]
**Other**
**GPS COORDINATES (UTM):** ____ **E** ____ **N (Zone)** ____
**DESCRIPTION:**

CLIMATE CONDITIONS (if sampling outside)

**Air Temp:** -13 °C
**Wind Direction:** W
**Wind Speed (knots):** 11
**Precipitation:** rain / mist / snow / [✓ N/A]
**Cloud Cover:** 0%, 10%, 25%, 50%, 75%, 100
**Snow Cover:** 0%, 10%, 25%, 50%, 75%, [✓ 100%]
**Dust in area:** Visible, [✓ Not Visible]

**COLLECTION COMMENTS: (i.e. damage to station, bugs - twigs in sample, hole in vestibule, etc.)**

**Date Sample Collected was Deployed** 2015-Sppt-14

**Total Volume of Water After Melting :** 900 (mL)

| Filter # | Weight of Filter | Filter + Residue | Residue Weight | Comments |
|---|---|---|---|---|
| 1 | 125.9 | 142.3 | 16.4 | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| **Totals** | | | | |

# *Appendix D*

*Snow Water Chemistry Analytic Results*

Your P.O. #: K30524
Your Project #: SNP-A
PO # K30524
Your C.O.C. #: 08444639

**Attention:DDMI Environment**

DIAVIK DIAMOND MINES INC.
P.O. BOX 2498
300-5201 - 50th AVE.
YELLOWKNIFE, NT
CANADA X1A 2P8

**Report Date: 2015/04/28**
Report #: R1858731
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B531392**
**Received: 2015/04/18, 10:45**

Sample Matrix: Water
# Samples Received: 6

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Acidity pH 4.5 & pH 8.3 (as CaCO3) | 6 | N/A | 2015/04/20 | BBY6SOP-00037 | SM 22 2310 B m |
| Alkalinity - Water | 6 | 2015/04/20 | 2015/04/20 | BBY6SOP-00026 | SM 22 2320 B m |
| Chloride by Automated Colourimetry | 6 | N/A | 2015/04/20 | BBY6SOP-00011 | SM 22 4500-Cl- G m |
| Conductance - water | 6 | N/A | 2015/04/20 | BBY6SOP-00026 | SM 22 2510 B m |
| Fluoride - Mining Clients | 6 | N/A | 2015/04/20 | BBY6SOP-00048 | SM 22 4500-F C m |
| Hardness Total (calculated as CaCO3) | 6 | N/A | 2015/04/23 | BBY7SOP-00002 | EPA 6020a R1 m |
| Mercury (Total-LowLevel) by CVAF | 6 | 2015/04/22 | 2015/04/23 | BBY7SOP-00015 | BCMOE BCLM Oct2013 m |
| Na, K, Ca, Mg, S by CRC ICPMS (total) | 6 | N/A | 2015/04/23 | BBY7SOP-00002 | EPA 6020A R1 m |
| Elements by ICPMS Low Level (total) | 6 | N/A | 2015/04/22 | BBY7SOP-00002 | EPA 6020A |
| Nitrogen (Total) | 6 | 2015/04/20 | 2015/04/21 | BBY6SOP-00016 | SM 22 4500-N C m |
| Ammonia-N (Preserved) | 6 | N/A | 2015/04/22 | BBY6SOP-00009 | SM 22 4500-NH3- G m |
| Nitrate+Nitrite (N) (low level) | 6 | N/A | 2015/04/18 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrite (N) (low level) | 6 | N/A | 2015/04/18 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrogen - Nitrate (as N) | 6 | N/A | 2015/04/18 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| pH Water (1) | 6 | N/A | 2015/04/20 | BBY6SOP-00026 | SM 22 4500-H+ B m |
| Orthophosphate by Konelab (low level) | 6 | N/A | 2015/04/20 | BBY6SOP-00013 | SM 22 4500-P E m |
| Sulphate by Automated Colourimetry | 6 | N/A | 2015/04/20 | BBY6SOP-00017 | SM 22 4500-SO42- E m |
| Total Dissolved Solids - Low Level | 6 | N/A | 2015/04/23 | BBY6SOP-00033 | SM 22 2540 C m |
| TKN (Calc. TN, N/N) total | 6 | N/A | 2015/04/22 | BBY WI-00033 | Calculation |
| Phosphorus-P (LL Tot, dissolved) - UF/UP | 6 | 2015/04/21 | 2015/04/21 | BBY6SOP-00013 | SM 22 4500-P E m |
| Total Phosphorus | 6 | N/A | 2015/04/21 | BBY6SOP-00013 | SM 22 4500-P E m |
| Total Suspended Solids-Low Level | 3 | 2015/04/20 | 2015/04/21 | BBY6SOP-00034 | SM 22 2540 D |
| Total Suspended Solids-Low Level | 3 | 2015/04/21 | 2015/04/22 | BBY6SOP-00034 | SM 22 2540 D |
| Turbidity | 6 | N/A | 2015/04/24 | BBY6SOP-00027 | SM 22 2130 B m |

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Your P.O. #: K30524
Your Project #: SNP-A
PO # K30524
Your C.O.C. #: 08444639

**Attention:DDMI Environment**

DIAVIK DIAMOND MINES INC.
P.O. BOX 2498
300-5201 - 50th AVE.
YELLOWKNIFE, NT
CANADA X1A 2P8

**Report Date: 2015/04/28**
Report #: R1858731
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B531392**
**Received: 2015/04/18, 10:45**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Tabitha Rudkin, AScT, Burnaby Project Manager
Email: TRudkin@maxxam.ca
Phone# (604)638-2639
====================================================================
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.

## RESULTS OF CHEMICAL ANALYSES OF WATER

| **Maxxam ID** | | MB8307 | MB8308 | | MB8309 | MB8310 | | MB8311 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/10 | 2015/04/10 | | 2015/04/05 | 2015/04/05 | | 2015/04/05 | | |
| **COC Number** | | 08444639 | 08444639 | | 08444639 | 08444639 | | 08444639 | | |
| | **Units** | **SS5-3** | **SS5-4** | **QC Batch** | **SS3-4** | **SS3-5** | **QC Batch** | **SS3-7-4** | **RDL** | **QC Batch** |
| **Misc. Inorganics** | | | | | | | | | | |
| Acidity (pH 4.5) | mg/L | <0.50 | <0.50 | 7871286 | <0.50 | <0.50 | 7871286 | <0.50 | 0.50 | 7871286 |
| Acidity (pH 8.3) | mg/L | <0.50 | <0.50 | 7871286 | <0.50 | <0.50 | 7871286 | <0.50 | 0.50 | 7871286 |
| Fluoride (F) | mg/L | 0.011 | <0.010 | 7870414 | <0.010 | 0.011 | 7870414 | <0.010 | 0.010 | 7870414 |
| **Calculated Parameters** | | | | | | | | | | |
| Total Hardness (CaCO3) | mg/L | 5.71 | 4.89 | 7869264 | 16.8 | 14.9 | 7869264 | 19.6 | 0.50 | 7869264 |
| Nitrate (N) | mg/L | 0.0879 | 0.0716 | 7869267 | 0.112 | 0.109 | 7869267 | 0.0800 | 0.0020 | 7869267 |
| **Misc. Inorganics** | | | | | | | | | | |
| Alkalinity (Total as CaCO3) | mg/L | 1.01 | 0.83 | 7871308 | 6.64 | 6.25 | 7871308 | 4.89 | 0.50 | 7871308 |
| Alkalinity (PP as CaCO3) | mg/L | <0.50 | <0.50 | 7871308 | <0.50 | <0.50 | 7871308 | <0.50 | 0.50 | 7871308 |
| Bicarbonate (HCO3) | mg/L | 1.23 | 1.01 | 7871308 | 8.10 | 7.63 | 7871308 | 5.97 | 0.50 | 7871308 |
| Carbonate (CO3) | mg/L | <0.50 | <0.50 | 7871308 | <0.50 | <0.50 | 7871308 | <0.50 | 0.50 | 7871308 |
| Hydroxide (OH) | mg/L | <0.50 | <0.50 | 7871308 | <0.50 | <0.50 | 7871308 | <0.50 | 0.50 | 7871308 |
| **Anions** | | | | | | | | | | |
| Orthophosphate (P) | mg/L | 0.0063 (1) | 0.0052 (1) | 7871334 | 0.0050 (1) | 0.0055 (1) | 7871334 | 0.0036 (1) | 0.0010 | 7871334 |
| Dissolved Sulphate (SO4) | mg/L | <0.50 | <0.50 | 7871054 | 0.77 | 0.71 | 7871054 | 0.57 | 0.50 | 7871054 |
| Dissolved Chloride (Cl) | mg/L | <0.50 | <0.50 | 7871050 | 0.66 | <0.50 | 7871050 | <0.50 | 0.50 | 7871050 |
| **Nutrients** | | | | | | | | | | |
| Total Ammonia (N) | mg/L | 0.054 | 0.030 | 7878426 | 0.090 | 0.12 | 7878426 | 0.075 | 0.0050 | 7878426 |
| Dissolved Phosphorus (P) | mg/L | 0.0177 (1) | 0.0113 (1) | 7873711 | 0.0521 (1) | 0.0296 (1) | 7873711 | 0.0386 (1) | 0.0020 | 7873711 |
| Total Total Kjeldahl Nitrogen (Calc) | mg/L | 0.069 | 0.040 | 7869268 | 0.119 | 0.142 | 7869268 | 0.090 | 0.020 | 7869268 |
| Nitrate plus Nitrite (N) | mg/L | 0.0879 (1) | 0.0716 (1) | 7869335 | 0.120 (1) | 0.116 (1) | 7869335 | 0.0851 (1) | 0.0020 | 7869335 |
| Nitrite (N) | mg/L | <0.0020 (1) | <0.0020 (1) | 7869336 | 0.0077 (1) | 0.0063 (1) | 7869336 | 0.0051 (1) | 0.0020 | 7869336 |
| Total Nitrogen (N) | mg/L | 0.157 | 0.112 | 7871414 | 0.239 | 0.257 | 7871414 | 0.175 | 0.020 | 7871414 |
| Total Phosphorus (P) | mg/L | 0.0355 | 0.0193 | 7873796 | 0.121 | 0.0491 | 7873754 | 0.0647 | 0.0020 | 7873796 |
| **Physical Properties** | | | | | | | | | | |
| Conductivity | uS/cm | 5.6 | 5.3 | 7871309 | 17.6 | 16.8 | 7871309 | 13.7 | 1.0 | 7871309 |
| pH | pH | 6.03 | 5.91 | 7871310 | 7.16 | 6.98 | 7871310 | 6.86 | N/A | 7871310 |
| **Physical Properties** | | | | | | | | | | |
| Total Suspended Solids | mg/L | 22.8 (1) | 11.7 (1) | 7869980 | 82.5 (1) | 107 (1) | 7872406 | 43.9 (1) | 1.0 | 7872406 |
| Total Dissolved Solids | mg/L | 5.2 (1) | 3.2 (1) | 7869204 | 14.0 (1) | 9.0 (1) | 7869204 | 8.5 (1) | 1.0 | 7869204 |
| Turbidity | NTU | 5.60 (1) | 2.83 (1) | 7877321 | 17.4 (1) | 12.7 (1) | 7877321 | 10.5 (1) | 0.10 | 7877321 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Sample arrived to laboratory past recommended hold time.

## RESULTS OF CHEMICAL ANALYSES OF WATER

| **Maxxam ID** | | MB8312 | | |
|---|---|---|---|---|
| **Sampling Date** | | 2015/04/05 | | |
| **COC Number** | | 08444639 | | |
| | **Units** | **SS3-7-5** | **RDL** | **QC Batch** |
| **Misc. Inorganics** | | | | |
| Acidity (pH 4.5) | mg/L | <0.50 | 0.50 | 7871286 |
| Acidity (pH 8.3) | mg/L | <0.50 | 0.50 | 7871286 |
| Fluoride (F) | mg/L | <0.010 | 0.010 | 7870414 |
| **Calculated Parameters** | | | | |
| Total Hardness (CaCO3) | mg/L | 13.7 | 0.50 | 7869264 |
| Nitrate (N) | mg/L | 0.0891 | 0.0020 | 7869267 |
| **Misc. Inorganics** | | | | |
| Alkalinity (Total as CaCO3) | mg/L | 4.55 | 0.50 | 7871308 |
| Alkalinity (PP as CaCO3) | mg/L | <0.50 | 0.50 | 7871308 |
| Bicarbonate (HCO3) | mg/L | 5.55 | 0.50 | 7871308 |
| Carbonate (CO3) | mg/L | <0.50 | 0.50 | 7871308 |
| Hydroxide (OH) | mg/L | <0.50 | 0.50 | 7871308 |
| **Anions** | | | | |
| Orthophosphate (P) | mg/L | 0.0031 (1) | 0.0010 | 7871334 |
| Dissolved Sulphate (SO4) | mg/L | 0.63 | 0.50 | 7871054 |
| Dissolved Chloride (Cl) | mg/L | 0.72 | 0.50 | 7871050 |
| **Nutrients** | | | | |
| Total Ammonia (N) | mg/L | 0.080 | 0.0050 | 7878426 |
| Dissolved Phosphorus (P) | mg/L | 0.0242 (1) | 0.0020 | 7873711 |
| Total Total Kjeldahl Nitrogen (Calc) | mg/L | 0.098 | 0.020 | 7869268 |
| Nitrate plus Nitrite (N) | mg/L | 0.0934 (1) | 0.0020 | 7869335 |
| Nitrite (N) | mg/L | 0.0043 (1) | 0.0020 | 7869336 |
| Total Nitrogen (N) | mg/L | 0.191 | 0.020 | 7871414 |
| Total Phosphorus (P) | mg/L | 0.0666 | 0.0020 | 7873754 |
| **Physical Properties** | | | | |
| Conductivity | uS/cm | 13.1 | 1.0 | 7871309 |
| pH | pH | 6.82 | N/A | 7871310 |
| **Physical Properties** | | | | |
| Total Suspended Solids | mg/L | 18.9 (1) | 1.0 | 7869980 |
| Total Dissolved Solids | mg/L | 7.0 (1) | 1.0 | 7869204 |
| Turbidity | NTU | 9.67 (1) | 0.10 | 7877321 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Sample arrived to laboratory past recommended hold time.

## MERCURY BY COLD VAPOR (WATER)

| **Maxxam ID** | | MB8307 | MB8308 | MB8309 | MB8310 | MB8311 | MB8312 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/10 | 2015/04/10 | 2015/04/05 | 2015/04/05 | 2015/04/05 | 2015/04/05 | | |
| **COC Number** | | 08444639 | 08444639 | 08444639 | 08444639 | 08444639 | 08444639 | | |
| | **Units** | **SS5-3** | **SS5-4** | **SS3-4** | **SS3-5** | **SS3-7-4** | **SS3-7-5** | **RDL** | **QC Batch** |
| **Elements** | | | | | | | | | |
| Total Mercury (Hg) | ug/L | 0.0022 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | 0.0020 | 7877792 |
| RDL = Reportable Detection Limit | | | | | | | | | |

## ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

| **Maxxam ID** | | MB8307 | MB8308 | MB8309 | MB8310 | MB8311 | MB8312 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/10 | 2015/04/10 | 2015/04/05 | 2015/04/05 | 2015/04/05 | 2015/04/05 | | |
| **COC Number** | | 08444639 | 08444639 | 08444639 | 08444639 | 08444639 | 08444639 | | |
| | **Units** | **SS5-3** | **SS5-4** | **SS3-4** | **SS3-5** | **SS3-7-4** | **SS3-7-5** | **RDL** | **QC Batch** |
| **Total Metals by ICPMS** | | | | | | | | | |
| Total Aluminum (Al) | ug/L | 210 | 124 | 633 | 551 | 696 | 481 | 0.20 | 7872610 |
| Total Antimony (Sb) | ug/L | 0.023 | <0.020 | 0.038 | 0.029 | <0.020 | <0.020 | 0.020 | 7872610 |
| Total Arsenic (As) | ug/L | 0.078 | 0.079 | 0.158 | 0.172 | 0.137 | 0.122 | 0.020 | 7872610 |
| Total Barium (Ba) | ug/L | 10.0 | 8.43 | 22.0 | 20.6 | 24.5 | 20.2 | 0.020 | 7872610 |
| Total Beryllium (Be) | ug/L | <0.010 | <0.010 | 0.024 | 0.019 | 0.026 | 0.016 | 0.010 | 7872610 |
| Total Bismuth (Bi) | ug/L | 0.0612 | 0.0222 | 0.279 | 0.205 | 0.191 | 0.131 | 0.0050 | 7872610 |
| Total Boron (B) | ug/L | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | 5.0 | 7872610 |
| Total Cadmium (Cd) | ug/L | 0.0062 | 0.0068 | 0.0160 | 0.0120 | 0.0167 | 0.0100 | 0.0050 | 7872610 |
| Total Chromium (Cr) | ug/L | 2.66 | 2.30 | 6.05 | 5.24 | 8.25 | 5.11 | 0.050 | 7872610 |
| Total Cobalt (Co) | ug/L | 0.518 | 0.436 | 1.06 | 0.924 | 1.37 | 0.888 | 0.0050 | 7872610 |
| Total Copper (Cu) | ug/L | 0.594 | 0.513 | 1.95 | 1.28 | 1.68 | 1.11 | 0.050 | 7872610 |
| Total Iron (Fe) | ug/L | 465 | 279 | 1170 | 980 | 1460 | 921 | 1.0 | 7872610 |
| Total Lead (Pb) | ug/L | 0.417 | 0.193 | 1.06 | 0.979 | 0.983 | 0.666 | 0.0050 | 7872610 |
| Total Lithium (Li) | ug/L | 0.58 | 0.51 | 2.90 | 1.70 | 2.37 | 1.81 | 0.50 | 7872610 |
| Total Manganese (Mn) | ug/L | 8.90 | 6.85 | 24.1 | 20.1 | 29.1 | 18.2 | 0.050 | 7872610 |
| Total Molybdenum (Mo) | ug/L | 0.067 | 0.092 | 0.291 | 0.153 | 0.266 | 0.269 | 0.050 | 7872610 |
| Total Nickel (Ni) | ug/L | 8.13 | 7.40 | 15.7 | 13.8 | 21.8 | 14.2 | 0.020 | 7872610 |
| Total Selenium (Se) | ug/L | <0.040 | <0.040 | <0.040 | <0.040 | <0.040 | <0.040 | 0.040 | 7872610 |
| Total Silicon (Si) | ug/L | 599 | 426 | 1450 | 1520 | 1820 | 1290 | 50 | 7872610 |
| Total Silver (Ag) | ug/L | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.0050 | 7872610 |
| Total Strontium (Sr) | ug/L | 4.24 | 4.51 | 12.7 | 11.5 | 11.3 | 10.0 | 0.050 | 7872610 |
| Total Thallium (Tl) | ug/L | 0.0045 | 0.0021 | 0.0114 | 0.0118 | 0.0133 | 0.0104 | 0.0020 | 7872610 |
| Total Tin (Sn) | ug/L | 0.014 | <0.010 | 0.029 | 0.022 | 0.029 | 0.020 | 0.010 | 7872610 |
| Total Titanium (Ti) | ug/L | 18.6 | 11.7 | 38.5 | 43.8 | 53.4 | 36.9 | 0.50 | 7872610 |
| Total Uranium (U) | ug/L | 0.443 | 0.152 | 1.84 | 1.32 | 1.49 | 1.08 | 0.0020 | 7872610 |
| Total Vanadium (V) | ug/L | 0.59 | 0.53 | 1.48 | 1.46 | 2.00 | 1.43 | 0.10 | 7872610 |
| Total Zinc (Zn) | ug/L | 3.46 | 3.60 | 7.83 | 5.74 | 6.52 | 4.68 | 0.10 | 7872610 |
| Total Zirconium (Zr) | ug/L | 0.074 | 0.057 | 0.184 | 0.189 | 0.184 | 0.139 | 0.050 | 7872610 |
| Total Calcium (Ca) | mg/L | 0.481 | 0.389 | 3.00 | 2.71 | 2.31 | 2.02 | 0.010 | 7869265 |
| Total Magnesium (Mg) | mg/L | 1.10 | 0.952 | 2.26 | 1.98 | 3.35 | 2.10 | 0.010 | 7869265 |
| Total Potassium (K) | mg/L | 0.194 | 0.186 | 0.504 | 0.404 | 0.521 | 0.419 | 0.010 | 7869265 |
| Total Sodium (Na) | mg/L | 0.283 | 0.438 | 0.295 | 0.186 | 0.182 | 0.165 | 0.010 | 7869265 |
| Total Sulphur (S) | mg/L | <0.10 | 0.19 | 0.23 | 0.23 | 0.20 | 0.18 | 0.10 | 7869265 |

RDL = Reportable Detection Limit

## GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

| | |
|---|---|
| Package 1 | 3.0°C |

**Results relate only to the items tested.**

Maxxam Job #: B531392
Report Date: 2015/04/28

# QUALITY ASSURANCE REPORT

DIAVIK DIAMOND MINES INC.
Client Project #: SNP-A
Your P.O. #: K30524
Sampler Initials: DB

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | Units | Value (%) | QC Limits |
| 7869204 | Total Dissolved Solids | 2015/04/23 | 100 | 80 - 120 | 102 | 80 - 120 | <1.0 | mg/L | 2.4 (1) | 20 |
| 7869335 | Nitrate plus Nitrite (N) | 2015/04/18 | | | 104 | 80 - 120 | <0.0020 | mg/L | | |
| 7869336 | Nitrite (N) | 2015/04/18 | | | 103 | 80 - 120 | <0.0020 | mg/L | | |
| 7869980 | Total Suspended Solids | 2015/04/21 | | | 99 | 80 - 120 | <1.0 | mg/L | | |
| 7870414 | Fluoride (F) | 2015/04/20 | 96 | 80 - 120 | 94 | 80 - 120 | <0.010 | mg/L | NC | 20 |
| 7871050 | Dissolved Chloride (Cl) | 2015/04/20 | NC | 80 - 120 | 100 | 80 - 120 | <0.50 | mg/L | 0.35 | 20 |
| 7871054 | Dissolved Sulphate (SO4) | 2015/04/20 | NC | 80 - 120 | 94 | 80 - 120 | <0.50 | mg/L | 2.4 | 20 |
| 7871286 | Acidity (pH 4.5) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871286 | Acidity (pH 8.3) | 2015/04/20 | | | 101 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871308 | Alkalinity (PP as CaCO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871308 | Alkalinity (Total as CaCO3) | 2015/04/20 | 102 | 80 - 120 | 97 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871308 | Bicarbonate (HCO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871308 | Carbonate (CO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871308 | Hydroxide (OH) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871309 | Conductivity | 2015/04/20 | | | 100 | 80 - 120 | <1.0 | uS/cm | NC | 20 |
| 7871310 | pH | 2015/04/20 | | | 101 | 97 - 103 | | | 5.3 | N/A |
| 7871334 | Orthophosphate (P) | 2015/04/20 | 119 | 80 - 120 | 92 | 80 - 120 | <0.0010 | mg/L | NC | 20 |
| 7871414 | Total Nitrogen (N) | 2015/04/21 | NC | 80 - 120 | 97 | 80 - 120 | <0.020 | mg/L | 1.3 | 20 |
| 7872406 | Total Suspended Solids | 2015/04/22 | | | 106 | 80 - 120 | <1.0 | mg/L | | |
| 7872610 | Total Aluminum (Al) | 2015/04/22 | NC | 80 - 120 | 104 | 80 - 120 | <0.20 | ug/L | 0.66 | 20 |
| 7872610 | Total Antimony (Sb) | 2015/04/22 | 100 | 80 - 120 | 100 | 80 - 120 | <0.020 | ug/L | 0.81 | 20 |
| 7872610 | Total Arsenic (As) | 2015/04/22 | 105 | 80 - 120 | 103 | 80 - 120 | <0.020 | ug/L | 0.0097 | 20 |
| 7872610 | Total Barium (Ba) | 2015/04/22 | NC | 80 - 120 | 105 | 80 - 120 | <0.020 | ug/L | 0.98 | 20 |
| 7872610 | Total Beryllium (Be) | 2015/04/22 | 96 | 80 - 120 | 94 | 80 - 120 | <0.010 | ug/L | NC | 20 |
| 7872610 | Total Bismuth (Bi) | 2015/04/22 | 90 | 80 - 120 | 96 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7872610 | Total Boron (B) | 2015/04/22 | | | | | <5.0 | ug/L | 2.9 | 20 |
| 7872610 | Total Cadmium (Cd) | 2015/04/22 | 96 | 80 - 120 | 102 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7872610 | Total Chromium (Cr) | 2015/04/22 | 96 | 80 - 120 | 100 | 80 - 120 | <0.050 | ug/L | 1.9 | 20 |
| 7872610 | Total Cobalt (Co) | 2015/04/22 | 93 | 80 - 120 | 100 | 80 - 120 | <0.0050 | ug/L | 5.6 | 20 |
| 7872610 | Total Copper (Cu) | 2015/04/22 | 91 | 80 - 120 | 102 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| 7872610 | Total Iron (Fe) | 2015/04/22 | 99 | 80 - 120 | 107 | 80 - 120 | <1.0 | ug/L | NC | 20 |

## QUALITY ASSURANCE REPORT(CONT'D)

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | Units | Value (%) | QC Limits |
| 7872610 | Total Lead (Pb) | 2015/04/22 | 95 | 80 - 120 | 98 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7872610 | Total Lithium (Li) | 2015/04/22 | NC | 80 - 120 | 103 | 80 - 120 | <0.50 | ug/L | 3.9 | 20 |
| 7872610 | Total Manganese (Mn) | 2015/04/22 | NC | 80 - 120 | 99 | 80 - 120 | <0.050 | ug/L | 1.7 | 20 |
| 7872610 | Total Molybdenum (Mo) | 2015/04/22 | NC | 80 - 120 | 98 | 80 - 120 | <0.050 | ug/L | 0.98 | 20 |
| 7872610 | Total Nickel (Ni) | 2015/04/22 | 95 | 80 - 120 | 101 | 80 - 120 | <0.020 | ug/L | 0.60 | 20 |
| 7872610 | Total Selenium (Se) | 2015/04/22 | 98 | 80 - 120 | 98 | 80 - 120 | <0.040 | ug/L | NC | 20 |
| 7872610 | Total Silicon (Si) | 2015/04/22 | | | | | <50 | ug/L | 3.8 | 20 |
| 7872610 | Total Silver (Ag) | 2015/04/22 | 95 | 80 - 120 | 88 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7872610 | Total Strontium (Sr) | 2015/04/22 | NC | 80 - 120 | 97 | 80 - 120 | <0.050 | ug/L | 1.9 | 20 |
| 7872610 | Total Thallium (Tl) | 2015/04/22 | 81 | 80 - 120 | 95 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| 7872610 | Total Tin (Sn) | 2015/04/22 | 95 | 80 - 120 | 98 | 80 - 120 | <0.010 | ug/L | NC | 20 |
| 7872610 | Total Titanium (Ti) | 2015/04/22 | 98 | 80 - 120 | 103 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 7872610 | Total Uranium (U) | 2015/04/22 | 102 | 80 - 120 | 100 | 80 - 120 | <0.0020 | ug/L | 1.2 | 20 |
| 7872610 | Total Vanadium (V) | 2015/04/22 | 101 | 80 - 120 | 105 | 80 - 120 | <0.10 | ug/L | 0.48 | 20 |
| 7872610 | Total Zinc (Zn) | 2015/04/22 | 91 | 80 - 120 | 103 | 80 - 120 | <0.10 | ug/L | NC | 20 |
| 7872610 | Total Zirconium (Zr) | 2015/04/22 | | | | | <0.050 | ug/L | NC | 20 |
| 7873711 | Dissolved Phosphorus (P) | 2015/04/21 | 103 | 80 - 120 | 104 | 80 - 120 | <0.0020 | mg/L | NC | 20 |
| 7873754 | Total Phosphorus (P) | 2015/04/21 | 106 | 80 - 120 | 95 | 80 - 120 | <0.0020 | mg/L | 0.62 | 20 |
| 7873796 | Total Phosphorus (P) | 2015/04/21 | 101 | 80 - 120 | 109 | 80 - 120 | <0.0020 | mg/L | 7.3 | 20 |
| 7877321 | Turbidity | 2015/04/24 | | | 99 | 80 - 120 | <0.10 | NTU | 7.1 | 20 |
| 7877792 | Total Mercury (Hg) | 2015/04/23 | 91 | 80 - 120 | 92 | 80 - 120 | <0.0020 | ug/L | NC | 20 |

## QUALITY ASSURANCE REPORT(CONT'D)

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch** | **Parameter** | **Date** | **% Recovery** | **QC Limits** | **% Recovery** | **QC Limits** | **Value** | **Units** | **Value (%)** | **QC Limits** |
| 7878426 | Total Ammonia (N) | 2015/04/22 | 98 | 80 - 120 | 94 | 80 - 120 | <0.0050 | mg/L | 0.028 | 20 |

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Sample analysed past recommended hold time.

# VALIDATION SIGNATURE PAGE

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

Rob Reinert, Data Validation Coordinator

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B531392

Date Shipped: 2015-Apr-16

04/480

Results Received:

Shipping Memo: 70658

Maxxam Job #:

08344639

RioTinto

## Diavik Diamond Mines Inc. - Chain of Custody

Diavik Diamond Mines Inc.
P.O.Box 2498
5007-50 Ave
Yellowknife NT
X1A 2P8

| Contact Information - Sample Inquiry | |
|---|---|
| DDMI ENVIRONMENT | |
| DDMLENVIRONMENT@RIOTINTO.COM | |
| Site Env. Supervisor | Sean Sinclair / Darcy Bourassa @ 867-669-6500 ext 5403 |

| REPORT TO | REPORT DISTRIBUTION | |
|---|---|---|
| DDMI ENVIRONMENT | Electronic PDF | ✓ |
| DDMLENVIRONMENT@RIOTINTO.COM | Electronic Excel | ✓ |
| REFERENCE LAB ID # MAXXAM | Hard Copy | |

| SERVICE REQUESTED | | INVOICE TO |
|---|---|---|
| Regular (Default) | ✓ | DDMI ACCOUNTS PAYABLE |
| Priority (50% Surcharge) | | DDMLAP@RIOTINTO.COM |
| Emergency (100% Surcharge) | | Reference PO # K30524 (Maxxam 2015) |

SAMPLE INFORMATION / ANALYSIS REQUESTED

| Identification | | Project | Collected By | Date | Type | Routine Parameters: (pH, EC, Acidity, Alkalinity, Fl, K, Cl, SO4, PO4, NO2, NO3, Dissolved Phosphorus, TDS) | Nutrients: (Ammonia, Total Phosphorus, TKN) PRESERVED | TOC (Total Organic Carbon) - analysis to be taken from the 120mL Nutrients bottle | DOC (Dissolved Organic Carbon) UNFILTERED & UNPRESERVED | Total Metals Low Level +Sb,Se PRESERVED | Total Mercury PRESERVED | Dissolved Metals Low Level + Sb,Se UNFILTERED & UNPRESERVED | Dissolved Mercury - UNFILTERED & UNPRESERVED | Oil & Grease and Mineral Oil & Grease PRESERVED | Biochemical Oxygen Demand (BoD) | BTEX -F1 (3 x 40 mL pre-preserved) | F2 - F4 (250 mL Amber pre-preserved) | Fecal Coliforms (2 bottles pre-preserved) | | TSS, Turb, pH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS5-3 | MB8307 | SNP-A | DB/DD | 2015-Apr-10 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS5-4 | MB8308 | SNP-A | DD/DB | 2015-Apr-10 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS3-4 | MB8309 | SNP-A | JG/SS | 2015-Apr-05 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS3-5 | MB8310 | SNP-A | JG/DD | 2015-Apr-05 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS3-7-4 | MB8311 | SNP-A | JG/DB | 2015-Apr-05 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS3-7-5 | MB8312 | SNP-A | JG/DB | 2015-Apr-05 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |

B531392

| SAMPLE CONDITION (Shipped) | | | SPECIAL INSTRUCTIONS | SAMPLE CONDITION (Received) | | |
|---|---|---|---|---|---|---|
| TEMP°C | FROZEN | | 30 Bottles Total Keep Cool Do Not Freeze | TEMP°C | FROZEN | |
| 5.0 | COLD | ✓ | | 6, 7, 7 | COLD | |
| | AMBIENT | | | | AMBIENT | |

| RELINQUISHED BY: | DATE / TIME: | RECEIVED BY: | DATE / TIME: |
|---|---|---|---|
| KG | 2015-Apr-16 | Jenna Walter | 20150417 1009 |

Doc # ENVI-140-0112 R0

Report Uploaded to MP5: Relinquished: GIONA CHANGIKWA 20150417 10:24

Data Checked for Breaches:

ice/seal present
MARILOU TRUANT
apr 18/15
2, 4, 3
10:45
CSU ✓

Your P.O. #: K30524
Your Project #: SNP-A
PO # K30524
Your C.O.C. #: 08344578

**Attention:DDMI Environment**

DIAVIK DIAMOND MINES INC.
P.O. BOX 2498
300-5201 - 50th AVE.
YELLOWKNIFE, NT
CANADA X1A 2P8

**Report Date: 2015/04/28**
Report #: R1858782
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B531394**
**Received: 2015/04/18, 10:45**

Sample Matrix: Water
# Samples Received: 5

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Acidity pH 4.5 & pH 8.3 (as CaCO3) | 5 | N/A | 2015/04/20 | BBY6SOP-00037 | SM 22 2310 B m |
| Alkalinity - Water | 5 | 2015/04/20 | 2015/04/20 | BBY6SOP-00026 | SM 22 2320 B m |
| Chloride by Automated Colourimetry | 5 | N/A | 2015/04/20 | BBY6SOP-00011 | SM 22 4500-Cl- G m |
| Conductance - water | 5 | N/A | 2015/04/20 | BBY6SOP-00026 | SM 22 2510 B m |
| Fluoride - Mining Clients | 5 | N/A | 2015/04/20 | BBY6SOP-00048 | SM 22 4500-F C m |
| Hardness Total (calculated as CaCO3) | 5 | N/A | 2015/04/23 | BBY7SOP-00002 | EPA 6020a R1 m |
| Mercury (Total-LowLevel) by CVAF | 5 | 2015/04/22 | 2015/04/23 | BBY7SOP-00015 | BCMOE BCLM Oct2013 m |
| Na, K, Ca, Mg, S by CRC ICPMS (total) | 5 | N/A | 2015/04/23 | BBY7SOP-00002 | EPA 6020A R1 m |
| Elements by ICPMS Low Level (total) | 5 | N/A | 2015/04/22 | BBY7SOP-00002 | EPA 6020A |
| Nitrogen (Total) | 5 | 2015/04/20 | 2015/04/21 | BBY6SOP-00016 | SM 22 4500-N C m |
| Ammonia-N (Preserved) | 5 | N/A | 2015/04/22 | BBY6SOP-00009 | SM 22 4500-NH3- G m |
| Nitrate+Nitrite (N) (low level) | 5 | N/A | 2015/04/18 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrite (N) (low level) | 5 | N/A | 2015/04/18 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrogen - Nitrate (as N) | 5 | N/A | 2015/04/18 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| pH Water (1) | 5 | N/A | 2015/04/20 | BBY6SOP-00026 | SM 22 4500-H+ B m |
| Orthophosphate by Konelab (low level) | 5 | N/A | 2015/04/20 | BBY6SOP-00013 | SM 22 4500-P E m |
| Sulphate by Automated Colourimetry | 5 | N/A | 2015/04/20 | BBY6SOP-00017 | SM 22 4500-SO42- E m |
| Total Dissolved Solids - Low Level | 1 | N/A | 2015/04/23 | BBY6SOP-00033 | SM 22 2540 C m |
| Total Dissolved Solids - Low Level | 4 | N/A | 2015/04/24 | BBY6SOP-00033 | SM 22 2540 C m |
| TKN (Calc. TN, N/N) total | 5 | N/A | 2015/04/22 | BBY WI-00033 | Calculation |
| Phosphorus-P (LL Tot, dissolved) - UF/UP | 5 | 2015/04/21 | 2015/04/21 | BBY6SOP-00013 | SM 22 4500-P E m |
| Total Phosphorus | 5 | N/A | 2015/04/21 | BBY6SOP-00013 | SM 22 4500-P E m |
| Total Suspended Solids-Low Level | 5 | 2015/04/20 | 2015/04/21 | BBY6SOP-00034 | SM 22 2540 D |
| Turbidity | 5 | N/A | 2015/04/24 | BBY6SOP-00027 | SM 22 2130 B m |

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Your P.O. #: K30524
Your Project #: SNP-A
PO # K30524
Your C.O.C. #: 08344578

**Attention:DDMI Environment**

DIAVIK DIAMOND MINES INC.
P.O. BOX 2498
300-5201 - 50th AVE.
YELLOWKNIFE, NT
CANADA X1A 2P8

**Report Date: 2015/04/28**
Report #: R1858782
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B531394**
**Received: 2015/04/18, 10:45**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Tabitha Rudkin, AScT, Burnaby Project Manager
Email: TRudkin@maxxam.ca
Phone# (604)638-2639
====================================================================
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.

## RESULTS OF CHEMICAL ANALYSES OF WATER

| **Maxxam ID** | | MB8316 | | MB8317 | MB8318 | MB8319 | | MB8320 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/02 | | 2015/04/02 | 2015/04/02 | 2015/03/31 | | 2015/03/31 | | |
| **COC Number** | | 08344578 | | 08344578 | 08344578 | 08344578 | | 08344578 | | |
| | **Units** | **SS1-4** | **QC Batch** | **SS1-5-4** | **SS1-5-5** | **SS2-1** | **QC Batch** | **SS2-2** | **RDL** | **QC Batch** |
| **Misc. Inorganics** | | | | | | | | | | |
| Acidity (pH 4.5) | mg/L | <0.50 | 7871286 | <0.50 | <0.50 | <0.50 | 7871286 | <0.50 | 0.50 | 7871286 |
| Acidity (pH 8.3) | mg/L | <0.50 | 7871286 | <0.50 | <0.50 | <0.50 | 7871286 | <0.50 | 0.50 | 7871286 |
| Fluoride (F) | mg/L | <0.010 | 7870414 | <0.010 | <0.010 | <0.010 | 7870414 | <0.010 | 0.010 | 7870414 |
| **Calculated Parameters** | | | | | | | | | | |
| Total Hardness (CaCO3) | mg/L | 2.39 | 7869264 | 1.56 | 1.94 | 12.1 | 7869264 | 7.59 | 0.50 | 7869264 |
| Nitrate (N) | mg/L | 0.0620 | 7869267 | 0.113 | 0.108 | 0.0819 | 7869267 | 0.0847 | 0.0020 | 7869267 |
| **Misc. Inorganics** | | | | | | | | | | |
| Alkalinity (Total as CaCO3) | mg/L | 0.66 | 7871308 | <0.50 | 0.51 | 1.68 | 7871308 | 1.63 | 0.50 | 7871308 |
| Alkalinity (PP as CaCO3) | mg/L | <0.50 | 7871308 | <0.50 | <0.50 | <0.50 | 7871308 | <0.50 | 0.50 | 7871308 |
| Bicarbonate (HCO3) | mg/L | 0.81 | 7871308 | <0.50 | 0.62 | 2.05 | 7871308 | 1.99 | 0.50 | 7871308 |
| Carbonate (CO3) | mg/L | <0.50 | 7871308 | <0.50 | <0.50 | <0.50 | 7871308 | <0.50 | 0.50 | 7871308 |
| Hydroxide (OH) | mg/L | <0.50 | 7871308 | <0.50 | <0.50 | <0.50 | 7871308 | <0.50 | 0.50 | 7871308 |
| **Anions** | | | | | | | | | | |
| Orthophosphate (P) | mg/L | 0.0028 (1) | 7871334 | 0.0023 (1) | 0.0023 (1) | 0.0042 (1) | 7871334 | 0.0045 (1) | 0.0010 | 7871334 |
| Dissolved Sulphate (SO4) | mg/L | <0.50 | 7871060 | <0.50 | <0.50 | <0.50 | 7871060 | <0.50 | 0.50 | 7871060 |
| Dissolved Chloride (Cl) | mg/L | 1.7 | 7871055 | <0.50 | <0.50 | <0.50 | 7871055 | <0.50 | 0.50 | 7871055 |
| **Nutrients** | | | | | | | | | | |
| Total Ammonia (N) | mg/L | 0.045 | 7878425 | 0.035 | 0.035 | 0.078 | 7878426 | 0.094 | 0.0050 | 7878426 |
| Dissolved Phosphorus (P) | mg/L | 0.0095 (1) | 7873711 | 0.0045 (1) | 0.0031 (1) | 0.0152 (1) | 7873711 | 0.0127 (1) | 0.0020 | 7873711 |
| Total Total Kjeldahl Nitrogen (Calc) | mg/L | 0.041 | 7869268 | 0.059 | 0.047 | 0.094 | 7869268 | 0.147 | 0.020 | 7869268 |
| Nitrate plus Nitrite (N) | mg/L | 0.0644 (1) | 7869335 | 0.116 (1) | 0.113 (1) | 0.0855 (1) | 7869335 | 0.0887 (1) | 0.0020 | 7869335 |
| Nitrite (N) | mg/L | 0.0024 (1) | 7869336 | 0.0037 (1) | 0.0044 (1) | 0.0036 (1) | 7869336 | 0.0040 (1) | 0.0020 | 7869336 |
| Total Nitrogen (N) | mg/L | 0.105 | 7871414 | 0.175 | 0.160 | 0.179 | 7871414 | 0.236 | 0.020 | 7871414 |
| Total Phosphorus (P) | mg/L | 0.0156 | 7873754 | 0.0104 | 0.0104 | 0.0280 | 7873754 | 0.0266 | 0.0020 | 7873796 |
| **Physical Properties** | | | | | | | | | | |
| Conductivity | uS/cm | 4.6 | 7871309 | 4.9 | 4.9 | 6.4 | 7871309 | 6.0 | 1.0 | 7871309 |
| pH | pH | 5.60 | 7871310 | 5.51 | 5.46 | 6.21 | 7871310 | 6.29 | N/A | 7871310 |
| **Physical Properties** | | | | | | | | | | |
| Total Suspended Solids | mg/L | 9.3 (1) | 7869980 | 8.2 (1) | 7.9 (1) | 17.2 (1) | 7869980 | 12.5 (1) | 1.0 | 7869980 |
| Total Dissolved Solids | mg/L | 2.0 (1) | 7869204 | 6.4 (1) | 3.2 (1) | 8.4 (1) | 7872399 | 6.8 (1) | 1.0 | 7872399 |
| Turbidity | NTU | 3.19 (1) | 7877321 | 2.14 (1) | 2.50 (1) | 3.71 (1) | 7877321 | 6.22 (1) | 0.10 | 7877321 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Sample arrived to laboratory past recommended hold time.

## MERCURY BY COLD VAPOR (WATER)

| **Maxxam ID** | | MB8316 | MB8317 | MB8318 | MB8319 | MB8320 | | |
|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/02 | 2015/04/02 | 2015/04/02 | 2015/03/31 | 2015/03/31 | | |
| **COC Number** | | 08344578 | 08344578 | 08344578 | 08344578 | 08344578 | | |
| | **Units** | **SS1-4** | **SS1-5-4** | **SS1-5-5** | **SS2-1** | **SS2-2** | **RDL** | **QC Batch** |
| **Elements** | | | | | | | | |
| Total Mercury (Hg) | ug/L | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | 0.0020 | 7877792 |
| RDL = Reportable Detection Limit | | | | | | | | |

## ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

| **Maxxam ID** | | MB8316 | MB8317 | MB8318 | MB8319 | MB8320 | | |
|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/02 | 2015/04/02 | 2015/04/02 | 2015/03/31 | 2015/03/31 | | |
| **COC Number** | | 08344578 | 08344578 | 08344578 | 08344578 | 08344578 | | |
| | **Units** | **SS1-4** | **SS1-5-4** | **SS1-5-5** | **SS2-1** | **SS2-2** | **RDL** | **QC Batch** |
| **Total Metals by ICPMS** | | | | | | | | |
| Total Aluminum (Al) | ug/L | 135 | 78.3 | 114 | 599 | 377 | 0.20 | 7872610 |
| Total Antimony (Sb) | ug/L | <0.020 | <0.020 | <0.020 | 0.069 | <0.020 | 0.020 | 7872610 |
| Total Arsenic (As) | ug/L | 0.117 | 0.062 | 0.089 | 0.277 | 0.238 | 0.020 | 7872610 |
| Total Barium (Ba) | ug/L | 3.98 | 2.72 | 3.34 | 15.7 | 12.9 | 0.020 | 7872610 |
| Total Beryllium (Be) | ug/L | <0.010 | <0.010 | <0.010 | 0.018 | 0.011 | 0.010 | 7872610 |
| Total Bismuth (Bi) | ug/L | 0.0213 | 0.0132 | 0.0229 | 0.133 | 0.0600 | 0.0050 | 7872610 |
| Total Boron (B) | ug/L | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | 5.0 | 7872610 |
| Total Cadmium (Cd) | ug/L | <0.0050 | 0.0051 | 0.0057 | 0.0158 | 0.0101 | 0.0050 | 7872610 |
| Total Chromium (Cr) | ug/L | 1.02 | 0.592 | 0.863 | 8.06 | 4.60 | 0.050 | 7872610 |
| Total Cobalt (Co) | ug/L | 0.187 | 0.113 | 0.149 | 1.10 | 0.682 | 0.0050 | 7872610 |
| Total Copper (Cu) | ug/L | 0.289 | 0.219 | 0.262 | 1.88 | 0.873 | 0.050 | 7872610 |
| Total Iron (Fe) | ug/L | 220 | 116 | 180 | 1180 | 711 | 1.0 | 7872610 |
| Total Lead (Pb) | ug/L | 0.245 | 0.166 | 0.264 | 0.779 | 0.522 | 0.0050 | 7872610 |
| Total Lithium (Li) | ug/L | <0.50 | <0.50 | <0.50 | 2.02 | 0.90 | 0.50 | 7872610 |
| Total Manganese (Mn) | ug/L | 3.65 | 2.57 | 3.27 | 18.3 | 10.9 | 0.050 | 7872610 |
| Total Molybdenum (Mo) | ug/L | <0.050 | <0.050 | 0.056 | 0.111 | 0.122 | 0.050 | 7872610 |
| Total Nickel (Ni) | ug/L | 2.25 | 1.49 | 1.89 | 13.9 | 9.83 | 0.020 | 7872610 |
| Total Selenium (Se) | ug/L | <0.040 | <0.040 | <0.040 | <0.040 | <0.040 | 0.040 | 7872610 |
| Total Silicon (Si) | ug/L | 334 | 179 | 263 | 1420 | 966 | 50 | 7872610 |
| Total Silver (Ag) | ug/L | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.0050 | 7872610 |
| Total Strontium (Sr) | ug/L | 1.84 | 1.52 | 1.59 | 5.09 | 4.42 | 0.050 | 7872610 |
| Total Thallium (Tl) | ug/L | 0.0038 | 0.0026 | 0.0024 | 0.0093 | 0.0077 | 0.0020 | 7872610 |
| Total Tin (Sn) | ug/L | 0.014 | <0.010 | <0.010 | 0.024 | 0.015 | 0.010 | 7872610 |
| Total Titanium (Ti) | ug/L | 10.8 | 5.16 | 8.20 | 47.1 | 26.4 | 0.50 | 7872610 |
| Total Uranium (U) | ug/L | 0.172 | 0.0873 | 0.128 | 0.939 | 0.564 | 0.0020 | 7872610 |
| Total Vanadium (V) | ug/L | 0.43 | 0.24 | 0.18 | 1.48 | 0.85 | 0.10 | 7872610 |
| Total Zinc (Zn) | ug/L | 2.27 | 2.55 | 1.84 | 7.27 | 3.60 | 0.10 | 7872610 |
| Total Zirconium (Zr) | ug/L | 0.117 | 0.180 | <0.050 | 0.112 | 0.139 | 0.050 | 7872610 |
| Total Calcium (Ca) | mg/L | 0.342 | 0.274 | 0.269 | 0.811 | 0.604 | 0.010 | 7869265 |
| Total Magnesium (Mg) | mg/L | 0.372 | 0.212 | 0.308 | 2.44 | 1.48 | 0.010 | 7869265 |
| Total Potassium (K) | mg/L | 0.099 | 0.070 | 0.092 | 0.313 | 0.212 | 0.010 | 7869265 |
| Total Sodium (Na) | mg/L | 0.244 | 0.217 | 0.211 | 0.242 | 0.128 | 0.010 | 7869265 |
| Total Sulphur (S) | mg/L | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | 0.10 | 7869265 |
| RDL = Reportable Detection Limit | | | | | | | | |

## GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

| | |
|---|---|
| Package 1 | 7.7°C |

**Results relate only to the items tested.**

## QUALITY ASSURANCE REPORT

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | Units | Value (%) | QC Limits |
| 7869204 | Total Dissolved Solids | 2015/04/23 | 100 | 80 - 120 | 102 | 80 - 120 | <1.0 | mg/L | 2.4 (1) | 20 |
| 7869335 | Nitrate plus Nitrite (N) | 2015/04/18 | | | 104 | 80 - 120 | <0.0020 | mg/L | | |
| 7869336 | Nitrite (N) | 2015/04/18 | | | 103 | 80 - 120 | <0.0020 | mg/L | | |
| 7869980 | Total Suspended Solids | 2015/04/21 | | | 99 | 80 - 120 | <1.0 | mg/L | | |
| 7870414 | Fluoride (F) | 2015/04/20 | 96 | 80 - 120 | 94 | 80 - 120 | <0.010 | mg/L | NC | 20 |
| 7871055 | Dissolved Chloride (Cl) | 2015/04/20 | 111 | 80 - 120 | 102 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871060 | Dissolved Sulphate (SO4) | 2015/04/20 | 106 | 80 - 120 | 94 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871286 | Acidity (pH 4.5) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871286 | Acidity (pH 8.3) | 2015/04/20 | | | 101 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871308 | Alkalinity (PP as CaCO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871308 | Alkalinity (Total as CaCO3) | 2015/04/20 | 102 | 80 - 120 | 97 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871308 | Bicarbonate (HCO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871308 | Carbonate (CO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871308 | Hydroxide (OH) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871309 | Conductivity | 2015/04/20 | | | 100 | 80 - 120 | <1.0 | uS/cm | NC | 20 |
| 7871310 | pH | 2015/04/20 | | | 101 | 97 - 103 | | | 5.3 | N/A |
| 7871334 | Orthophosphate (P) | 2015/04/20 | 119 | 80 - 120 | 92 | 80 - 120 | <0.0010 | mg/L | NC | 20 |
| 7871414 | Total Nitrogen (N) | 2015/04/21 | NC | 80 - 120 | 97 | 80 - 120 | <0.020 | mg/L | 1.3 | 20 |
| 7872399 | Total Dissolved Solids | 2015/04/24 | 100 | 80 - 120 | 96 | 80 - 120 | 2.0, RDL=1.0 | mg/L | 8.0 | 20 |
| 7872610 | Total Aluminum (Al) | 2015/04/22 | NC | 80 - 120 | 104 | 80 - 120 | <0.20 | ug/L | 0.66 | 20 |
| 7872610 | Total Antimony (Sb) | 2015/04/22 | 100 | 80 - 120 | 100 | 80 - 120 | <0.020 | ug/L | 0.81 | 20 |
| 7872610 | Total Arsenic (As) | 2015/04/22 | 105 | 80 - 120 | 103 | 80 - 120 | <0.020 | ug/L | 0.0097 | 20 |
| 7872610 | Total Barium (Ba) | 2015/04/22 | NC | 80 - 120 | 105 | 80 - 120 | <0.020 | ug/L | 0.98 | 20 |
| 7872610 | Total Beryllium (Be) | 2015/04/22 | 96 | 80 - 120 | 94 | 80 - 120 | <0.010 | ug/L | NC | 20 |
| 7872610 | Total Bismuth (Bi) | 2015/04/22 | 90 | 80 - 120 | 96 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7872610 | Total Boron (B) | 2015/04/22 | | | | | <5.0 | ug/L | 2.9 | 20 |
| 7872610 | Total Cadmium (Cd) | 2015/04/22 | 96 | 80 - 120 | 102 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7872610 | Total Chromium (Cr) | 2015/04/22 | 96 | 80 - 120 | 100 | 80 - 120 | <0.050 | ug/L | 1.9 | 20 |
| 7872610 | Total Cobalt (Co) | 2015/04/22 | 93 | 80 - 120 | 100 | 80 - 120 | <0.0050 | ug/L | 5.6 | 20 |
| 7872610 | Total Copper (Cu) | 2015/04/22 | 91 | 80 - 120 | 102 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| 7872610 | Total Iron (Fe) | 2015/04/22 | 99 | 80 - 120 | 107 | 80 - 120 | <1.0 | ug/L | NC | 20 |

## QUALITY ASSURANCE REPORT(CONT'D)

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch** | **Parameter** | **Date** | **% Recovery** | **QC Limits** | **% Recovery** | **QC Limits** | **Value** | **Units** | **Value (%)** | **QC Limits** |
| 7872610 | Total Lead (Pb) | 2015/04/22 | 95 | 80 - 120 | 98 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7872610 | Total Lithium (Li) | 2015/04/22 | NC | 80 - 120 | 103 | 80 - 120 | <0.50 | ug/L | 3.9 | 20 |
| 7872610 | Total Manganese (Mn) | 2015/04/22 | NC | 80 - 120 | 99 | 80 - 120 | <0.050 | ug/L | 1.7 | 20 |
| 7872610 | Total Molybdenum (Mo) | 2015/04/22 | NC | 80 - 120 | 98 | 80 - 120 | <0.050 | ug/L | 0.98 | 20 |
| 7872610 | Total Nickel (Ni) | 2015/04/22 | 95 | 80 - 120 | 101 | 80 - 120 | <0.020 | ug/L | 0.60 | 20 |
| 7872610 | Total Selenium (Se) | 2015/04/22 | 98 | 80 - 120 | 98 | 80 - 120 | <0.040 | ug/L | NC | 20 |
| 7872610 | Total Silicon (Si) | 2015/04/22 | | | | | <50 | ug/L | 3.8 | 20 |
| 7872610 | Total Silver (Ag) | 2015/04/22 | 95 | 80 - 120 | 88 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7872610 | Total Strontium (Sr) | 2015/04/22 | NC | 80 - 120 | 97 | 80 - 120 | <0.050 | ug/L | 1.9 | 20 |
| 7872610 | Total Thallium (Tl) | 2015/04/22 | 81 | 80 - 120 | 95 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| 7872610 | Total Tin (Sn) | 2015/04/22 | 95 | 80 - 120 | 98 | 80 - 120 | <0.010 | ug/L | NC | 20 |
| 7872610 | Total Titanium (Ti) | 2015/04/22 | 98 | 80 - 120 | 103 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 7872610 | Total Uranium (U) | 2015/04/22 | 102 | 80 - 120 | 100 | 80 - 120 | <0.0020 | ug/L | 1.2 | 20 |
| 7872610 | Total Vanadium (V) | 2015/04/22 | 101 | 80 - 120 | 105 | 80 - 120 | <0.10 | ug/L | 0.48 | 20 |
| 7872610 | Total Zinc (Zn) | 2015/04/22 | 91 | 80 - 120 | 103 | 80 - 120 | <0.10 | ug/L | NC | 20 |
| 7872610 | Total Zirconium (Zr) | 2015/04/22 | | | | | <0.050 | ug/L | NC | 20 |
| 7873711 | Dissolved Phosphorus (P) | 2015/04/21 | 103 | 80 - 120 | 104 | 80 - 120 | <0.0020 | mg/L | NC | 20 |
| 7873754 | Total Phosphorus (P) | 2015/04/21 | 106 | 80 - 120 | 95 | 80 - 120 | <0.0020 | mg/L | 0.62 | 20 |
| 7873796 | Total Phosphorus (P) | 2015/04/21 | 101 | 80 - 120 | 109 | 80 - 120 | <0.0020 | mg/L | 7.3 | 20 |
| 7877321 | Turbidity | 2015/04/24 | | | 99 | 80 - 120 | <0.10 | NTU | 7.1 | 20 |
| 7877792 | Total Mercury (Hg) | 2015/04/23 | 91 | 80 - 120 | 92 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| 7878425 | Total Ammonia (N) | 2015/04/22 | 94 | 80 - 120 | 97 | 80 - 120 | <0.0050 | mg/L | NC | 20 |

# QUALITY ASSURANCE REPORT(CONT'D)

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | Units | Value (%) | QC Limits |
| 7878426 | Total Ammonia (N) | 2015/04/22 | 98 | 80 - 120 | 94 | 80 - 120 | <0.0050 | mg/L | 0.028 | 20 |

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Sample analysed past recommended hold time.

# VALIDATION SIGNATURE PAGE

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

Rob Reinert, Data Validation Coordinator

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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.

B531394

Date Shipped: 2015-Apr-[illegible]16

Results Received:

Shipping Memo: ~~70655~~ 70658

04/1479

Maxxam Job #: 08344578

RioTinto

## Diavik Diamond Mines Inc. - Chain of Custody

| | |
|---|---|
| Diavik Diamond Mines Inc. | Contact Information - Sample Inquiry |
| P.O.Box 2496 | DDMI ENVIRONMENT |
| 5007-50 Ave | DDMI.ENVIRONMENT@RIOTINTO.COM |
| Yellowknife NT | Site Env. Supervisor: Sean Sinclair / Darcy Bourassa @ 867-669-6500 ext 5403 |
| X1A 2P6 | |

| REPORT TO | | REPORT DISTRIBUTION | |
|---|---|---|---|
| DDMI ENVIRONMENT | | Electronic PDF | ✓ |
| DDMI.ENVIRONMENT@RIOTINTO.COM | | Electronic Excel | ✓ |
| REFERENCE LAB ID # | MAXXAM | Hard Copy | |

| SERVICE REQUESTED | | INVOICE TO | |
|---|---|---|---|
| Regular (Default) | ✓ | DDMI ACCOUNTS PAYABLE | |
| Priority (50% Surcharge) | | DDMI.AP@RIOTINTO.COM | |
| Emergency (100% Surcharge) | | Reference PO # | K30524 (Maxxam 2015) |

SAMPLE INFORMATION / ANALYSIS REQUESTED

| Identification | Project | Collected By | Date | Type | Routine Parameters (pH, EC, Acidity, Alkalinity, Fl, K, Cl, SO4, PO4, NO2, NO3, Dissolved Phosphorus, TDS) | Nutrients (Ammonia, Total Phosphorus, TKN) PRESERVED | TOC (Total Organic Carbon) - analysis to be taken from the 120mL Nutrients bottle | DOC (Dissolved Organic Carbon) UNFILTERED & UNPRESERVED | Total Metals Low Level +Sb,Se ~~VN~~ PRESERVED | Total Mercury PRESERVED | Dissolved Metals Low Level + Sb,Se UNFILTERED & UNPRESERVED | Dissolved Mercury - UNFILTERED & UNPRESERVED | Oil & Grease and Mineral Oil & Grease PRESERVED | Biochemical Oxygen Demand (BoD) | BTEX -F1 (3 x 40 mL pre-preserved) | F2 - F4 (250 mL Amber pre-preserved) | Fecal Coliforms (2 bottles pre-preserved) | | TSS, Turb, pH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS1-4 | SNP-A | JG/SS | 2015-Apr-02 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | | MB8316 |
| [illegible] SS1-5-4 | SNP-A | JG/SS | 2015-Apr-02 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | | MB8317 |
| [illegible] SS1-5-5 | SNP-A | JG/SS | 2015-Apr-02 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | | MB8318 |
| SS2-1 | SNP-A | JG/SS | 2015-Mar-31 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | | MB8319 |
| SS2-2 | SNP-A | JG/SS | 2015-Mar-31 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | | MB8320 |

B531394

| SAMPLE CONDITION (Shipped) | | | SPECIAL INSTRUCTIONS | SAMPLE CONDITION (Received) | | |
|---|---|---|---|---|---|---|
| TEMP°C | FROZEN | | | TEMP°C | FROZEN | |
| 5.0 | COLD | ✓ | 25 Bottles Keep Cool Do Not Freeze | 5,6,4 | COLD | |
| | AMBIENT | | | | AMBIENT | |

RELINQUISHED BY: KG | DATE / TIME: 2015-Apr-[illegible]16 | RECEIVED BY: Jena Walter | 20150417 | DATE / TIME: 1009

Doc # ENVI-140-0112 R0

ice/seal present

Report Uploaded to MP5: Relinquished: FIONA CHANGIRWA

20150417 10:25

Data Checked for Breaches:

april 18/15 CSL

MARilou TRUAN 7,8,8

10:45

Your P.O. #: K30524
Your Project #: SNP-A
PO # K30524
Your C.O.C. #: 08344574

**Attention:DDMI Environment**

DIAVIK DIAMOND MINES INC.
P.O. BOX 2498
300-5201 - 50th AVE.
YELLOWKNIFE, NT
CANADA X1A 2P8

**Report Date: 2015/04/28**
Report #: R1858804
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B531409**
**Received: 2015/04/18, 10:45**

Sample Matrix: Water
# Samples Received: 5

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Acidity pH 4.5 & pH 8.3 (as CaCO3) | 5 | N/A | 2015/04/20 | BBY6SOP-00037 | SM 22 2310 B m |
| Alkalinity - Water | 5 | 2015/04/20 | 2015/04/20 | BBY6SOP-00026 | SM 22 2320 B m |
| Chloride by Automated Colourimetry | 5 | N/A | 2015/04/20 | BBY6SOP-00011 | SM 22 4500-Cl- G m |
| Conductance - water | 5 | N/A | 2015/04/20 | BBY6SOP-00026 | SM 22 2510 B m |
| Fluoride - Mining Clients | 5 | N/A | 2015/04/20 | BBY6SOP-00048 | SM 22 4500-F C m |
| Hardness Total (calculated as CaCO3) | 5 | N/A | 2015/04/24 | BBY7SOP-00002 | EPA 6020a R1 m |
| Mercury (Total-LowLevel) by CVAF | 5 | 2015/04/22 | 2015/04/23 | BBY7SOP-00015 | BCMOE BCLM Oct2013 m |
| Na, K, Ca, Mg, S by CRC ICPMS (total) | 5 | N/A | 2015/04/24 | BBY7SOP-00002 | EPA 6020A R1 m |
| Elements by ICPMS Low Level (total) | 5 | N/A | 2015/04/23 | BBY7SOP-00002 | EPA 6020A |
| Nitrogen (Total) | 5 | 2015/04/20 | 2015/04/21 | BBY6SOP-00016 | SM 22 4500-N C m |
| Ammonia-N (Preserved) | 5 | N/A | 2015/04/22 | BBY6SOP-00009 | SM 22 4500-NH3- G m |
| Nitrate+Nitrite (N) (low level) | 5 | N/A | 2015/04/21 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrite (N) (low level) | 5 | N/A | 2015/04/21 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrogen - Nitrate (as N) | 5 | N/A | 2015/04/21 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| pH Water (1) | 5 | N/A | 2015/04/20 | BBY6SOP-00026 | SM 22 4500-H+ B m |
| Orthophosphate by Konelab (low level) | 5 | N/A | 2015/04/20 | BBY6SOP-00013 | SM 22 4500-P E m |
| Sulphate by Automated Colourimetry | 5 | N/A | 2015/04/20 | BBY6SOP-00017 | SM 22 4500-SO42- E m |
| Total Dissolved Solids - Low Level | 5 | N/A | 2015/04/24 | BBY6SOP-00033 | SM 22 2540 C m |
| TKN (Calc. TN, N/N) total | 5 | N/A | 2015/04/22 | BBY WI-00033 | Calculation |
| Phosphorus-P (LL Tot, dissolved) - UF/UP | 5 | 2015/04/21 | 2015/04/21 | BBY6SOP-00013 | SM 22 4500-P E m |
| Total Phosphorus | 5 | N/A | 2015/04/21 | BBY6SOP-00013 | SM 22 4500-P E m |
| Total Suspended Solids-Low Level | 5 | 2015/04/20 | 2015/04/21 | BBY6SOP-00034 | SM 22 2540 D |
| Turbidity | 5 | N/A | 2015/04/24 | BBY6SOP-00027 | SM 22 2130 B m |

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Your P.O. #: K30524
Your Project #: SNP-A
PO # K30524
Your C.O.C. #: 08344574

**Attention:DDMI Environment**

DIAVIK DIAMOND MINES INC.
P.O. BOX 2498
300-5201 - 50th AVE.
YELLOWKNIFE, NT
CANADA X1A 2P8

**Report Date: 2015/04/28**
Report #: R1858804
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B531409**
**Received: 2015/04/18, 10:45**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Tabitha Rudkin, AScT, Burnaby Project Manager
Email: TRudkin@maxxam.ca
Phone# (604)638-2639
====================================================================
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.

## RESULTS OF CHEMICAL ANALYSES OF WATER

| **Maxxam ID** | | MB8411 | MB8412 | MB8413 | | MB8414 | | MB8415 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/03/31 | 2015/03/31 | 2015/04/10 | | 2015/04/10 | | 2015/04/05 | | |
| **COC Number** | | 08344574 | 08344574 | 08344574 | | 08344574 | | 08344574 | | |
| | **Units** | **SS2-3** | **SS2-4** | **SSC-1** | **QC Batch** | **SS5-5** | **QC Batch** | **SS3-6** | **RDL** | **QC Batch** |
| **Misc. Inorganics** | | | | | | | | | | |
| Acidity (pH 4.5) | mg/L | <0.50 | <0.50 | <0.50 | 7871286 | <0.50 | 7871290 | <0.50 | 0.50 | 7871290 |
| Acidity (pH 8.3) | mg/L | <0.50 | <0.50 | <0.50 | 7871286 | <0.50 | 7871290 | <0.50 | 0.50 | 7871290 |
| Fluoride (F) | mg/L | <0.010 | <0.010 | <0.010 | 7870673 | <0.010 | 7870673 | 0.012 | 0.010 | 7870673 |
| **Calculated Parameters** | | | | | | | | | | |
| Total Hardness (CaCO3) | mg/L | 1.66 | 5.01 | 2.85 | 7869264 | 12.0 | 7869264 | 115 | 0.50 | 7869264 |
| Nitrate (N) | mg/L | 0.0637 | 0.0798 | 0.0771 | 7869267 | 0.0661 | 7869267 | 0.148 | 0.0020 | 7869267 |
| **Misc. Inorganics** | | | | | | | | | | |
| Alkalinity (Total as CaCO3) | mg/L | 0.83 | <0.50 | 0.74 | 7871313 | 0.53 | 7871313 | 9.45 | 0.50 | 7871313 |
| Alkalinity (PP as CaCO3) | mg/L | <0.50 | <0.50 | <0.50 | 7871313 | <0.50 | 7871313 | <0.50 | 0.50 | 7871313 |
| Bicarbonate (HCO3) | mg/L | 1.01 | <0.50 | 0.90 | 7871313 | 0.65 | 7871313 | 11.5 | 0.50 | 7871313 |
| Carbonate (CO3) | mg/L | <0.50 | <0.50 | <0.50 | 7871313 | <0.50 | 7871313 | <0.50 | 0.50 | 7871313 |
| Hydroxide (OH) | mg/L | <0.50 | <0.50 | <0.50 | 7871313 | <0.50 | 7871313 | <0.50 | 0.50 | 7871313 |
| **Anions** | | | | | | | | | | |
| Orthophosphate (P) | mg/L | 0.0042 (1) | 0.0037 (1) | 0.0028 (1) | 7871334 | 0.0052 (1) | 7871336 | 0.023 (1) | 0.0010 | 7871336 |
| Dissolved Sulphate (SO4) | mg/L | <0.50 | <0.50 | <0.50 | 7871060 | <0.50 | 7871067 | 1.10 | 0.50 | 7871060 |
| Dissolved Chloride (Cl) | mg/L | <0.50 | 0.55 | <0.50 | 7871055 | 0.58 | 7871061 | 1.0 | 0.50 | 7871055 |
| **Nutrients** | | | | | | | | | | |
| Total Ammonia (N) | mg/L | 0.030 | 0.068 | 0.028 | 7878427 | 0.019 | 7878427 | 0.19 | 0.0050 | 7878425 |
| Dissolved Phosphorus (P) | mg/L | 0.0104 (1) | 0.0049 (1) | 0.0070 (1) | 7873711 | 0.0055 (1) | 7873751 | 0.0518 (1) | 0.0020 | 7873711 |
| Total Total Kjeldahl Nitrogen (Calc) | mg/L | <0.020 | 0.059 | <0.020 | 7869268 | 0.046 | 7869268 | 0.176 | 0.020 | 7869268 |
| Nitrate plus Nitrite (N) | mg/L | 0.0664 (1) | 0.0818 (1) | 0.0793 (1) | 7873755 | 0.0661 (1) | 7873755 | 0.153 (1) | 0.0020 | 7873755 |
| Nitrite (N) | mg/L | 0.0027 (1) | 0.0020 (1) | 0.0022 (1) | 7873797 | <0.0020 (1) | 7873797 | 0.0054 (1) | 0.0020 | 7873797 |
| Total Nitrogen (N) | mg/L | 0.065 | 0.140 | 0.092 | 7871415 | 0.112 | 7871415 | 0.329 | 0.020 | 7871413 |
| Total Phosphorus (P) | mg/L | 0.0111 | 0.0131 | 0.0046 | 7873796 | 0.0090 | 7873796 | 0.293 | 0.0020 | 7873754 |
| **Physical Properties** | | | | | | | | | | |
| Conductivity | uS/cm | 3.6 | 3.9 | 4.0 | 7871316 | 4.7 | 7871316 | 27.9 | 1.0 | 7871316 |
| pH | pH | 5.77 | 5.48 | 5.88 | 7871317 | 5.64 | 7871317 | 7.47 | N/A | 7871317 |
| **Physical Properties** | | | | | | | | | | |
| Total Suspended Solids | mg/L | 9.8 (1) | 13.2 (1) | 2.6 (1) | 7869980 | 7.9 (1) | 7869980 | 81.2 (1) | 1.0 | 7869980 |
| Total Dissolved Solids | mg/L | 4.8 (1) | 5.6 (1) | <1.0 (1) | 7872399 | 6.4 (1) | 7872399 | 18.0 (1) | 1.0 | 7872399 |
| Turbidity | NTU | 3.00 (1) | 3.49 (1) | 0.70 (1) | 7877321 | 1.19 (1) | 7877321 | 14.1 (1) | 0.10 | 7877321 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Sample arrived to laboratory past recommended hold time.

# MERCURY BY COLD VAPOR (WATER)

| **Maxxam ID** | | MB8411 | MB8412 | MB8413 | MB8414 | MB8415 | | |
|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/03/31 | 2015/03/31 | 2015/04/10 | 2015/04/10 | 2015/04/05 | | |
| **COC Number** | | 08344574 | 08344574 | 08344574 | 08344574 | 08344574 | | |
| | **Units** | **SS2-3** | **SS2-4** | **SSC-1** | **SS5-5** | **SS3-6** | **RDL** | **QC Batch** |
| **Elements** | | | | | | | | |
| Total Mercury (Hg) | ug/L | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | 0.0020 | 7877871 |

RDL = Reportable Detection Limit

## ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

| **Maxxam ID** | | MB8411 | MB8412 | MB8413 | MB8414 | MB8415 | | |
|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/03/31 | 2015/03/31 | 2015/04/10 | 2015/04/10 | 2015/04/05 | | |
| **COC Number** | | 08344574 | 08344574 | 08344574 | 08344574 | 08344574 | | |
| | **Units** | **SS2-3** | **SS2-4** | **SSC-1** | **SS5-5** | **SS3-6** | **RDL** | **QC Batch** |
| **Total Metals by ICPMS** | | | | | | | | |
| Total Aluminum (Al) | ug/L | 52.5 | 418 | 151 | 455 | 4260 | 0.20 | 7877009 |
| Total Antimony (Sb) | ug/L | <0.020 | 0.021 | <0.020 | <0.020 | 0.060 | 0.020 | 7877009 |
| Total Arsenic (As) | ug/L | 0.052 | 0.377 | 0.058 | 0.109 | 0.770 | 0.020 | 7877009 |
| Total Barium (Ba) | ug/L | 2.78 | 8.90 | 2.94 | 14.8 | 133 | 0.020 | 7877009 |
| Total Beryllium (Be) | ug/L | <0.010 | 0.011 | <0.010 | 0.012 | 0.149 | 0.010 | 7877009 |
| Total Bismuth (Bi) | ug/L | 0.0192 | 0.0447 | 0.0180 | 0.0639 | 1.60 | 0.0050 | 7877009 |
| Total Boron (B) | ug/L | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | 5.0 | 7877009 |
| Total Cadmium (Cd) | ug/L | 0.0086 | 0.0064 | 0.0144 | 0.0108 | 0.0795 | 0.0050 | 7877009 |
| Total Chromium (Cr) | ug/L | 0.654 | 4.35 | 1.76 | 6.37 | 53.0 | 0.050 | 7877009 |
| Total Cobalt (Co) | ug/L | 0.0989 | 0.442 | 0.164 | 0.852 | 8.01 | 0.0050 | 7877009 |
| Total Copper (Cu) | ug/L | 0.709 | 1.31 | 0.356 | 0.781 | 8.53 | 0.050 | 7877009 |
| Total Iron (Fe) | ug/L | 112 | 996 | 333 | 1040 | 10100 | 1.0 | 7877009 |
| Total Lead (Pb) | ug/L | 0.142 | 0.710 | 0.264 | 0.589 | 6.56 | 0.0050 | 7877009 |
| Total Lithium (Li) | ug/L | <0.50 | 1.47 | <0.50 | 0.63 | 17.4 | 0.50 | 7877009 |
| Total Manganese (Mn) | ug/L | 2.18 | 10.3 | 3.89 | 10.9 | 166 | 0.050 | 7877009 |
| Total Molybdenum (Mo) | ug/L | 0.088 | 0.357 | 0.071 | 0.129 | 0.585 | 0.050 | 7877009 |
| Total Nickel (Ni) | ug/L | 1.34 | 5.12 | 2.13 | 12.9 | 127 | 0.020 | 7877009 |
| Total Selenium (Se) | ug/L | <0.040 | <0.040 | <0.040 | <0.040 | <0.040 | 0.040 | 7877009 |
| Total Silicon (Si) | ug/L | 149 | 975 | 404 | 1720 | 10400 | 50 | 7877009 |
| Total Silver (Ag) | ug/L | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.0284 | 0.0050 | 7877009 |
| Total Strontium (Sr) | ug/L | 1.55 | 2.02 | 0.781 | 4.29 | 47.1 | 0.050 | 7877009 |
| Total Thallium (Tl) | ug/L | 0.0040 | 0.0093 | 0.0060 | 0.0068 | 0.0820 | 0.0020 | 7877009 |
| Total Tin (Sn) | ug/L | 0.014 | 0.046 | 0.015 | 0.028 | 0.173 | 0.010 | 7877009 |
| Total Titanium (Ti) | ug/L | 3.89 | 31.3 | 12.3 | 25.6 | 317 | 0.50 | 7877009 |
| Total Uranium (U) | ug/L | 0.109 | 0.639 | 0.105 | 0.253 | 9.34 | 0.0020 | 7877009 |
| Total Vanadium (V) | ug/L | 0.12 | 1.30 | 0.84 | 1.61 | 10.3 | 0.10 | 7877009 |
| Total Zinc (Zn) | ug/L | 1.65 | 3.59 | 2.40 | 4.22 | 29.0 | 0.10 | 7877009 |
| Total Zirconium (Zr) | ug/L | <0.050 | 0.116 | 0.053 | 0.117 | 1.78 | 0.050 | 7877009 |
| Total Calcium (Ca) | mg/L | 0.357 | 0.352 | 0.181 | 0.392 | 8.59 | 0.010 | 7869265 |
| Total Magnesium (Mg) | mg/L | 0.188 | 1.00 | 0.582 | 2.67 | 22.7 | 0.010 | 7869265 |
| Total Potassium (K) | mg/L | 0.062 | 0.216 | 0.077 | 0.175 | 2.04 | 0.010 | 7869265 |
| Total Sodium (Na) | mg/L | 0.086 | 0.139 | 0.054 | 0.259 | 0.365 | 0.010 | 7869265 |
| Total Sulphur (S) | mg/L | <0.10 | <0.10 | <0.10 | <0.10 | 0.68 | 0.10 | 7869265 |

RDL = Reportable Detection Limit

## GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

| | |
|---|---|
| Package 1 | 4.3°C |

Samples arrived to laboratory past recommended hold time for Alkalinity analysis.

**Results relate only to the items tested.**

Maxxam Job #: B531409
Report Date: 2015/04/28

## QUALITY ASSURANCE REPORT

DIAVIK DIAMOND MINES INC.
Client Project #: SNP-A
Your P.O. #: K30524
Sampler Initials: JG

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | Units | Value (%) | QC Limits |
| 7869980 | Total Suspended Solids | 2015/04/21 | | | 99 | 80 - 120 | <1.0 | mg/L | | |
| 7870673 | Fluoride (F) | 2015/04/20 | NC | 80 - 120 | 96 | 80 - 120 | <0.010 | mg/L | 2.9 | 20 |
| 7871055 | Dissolved Chloride (Cl) | 2015/04/20 | 111 | 80 - 120 | 102 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871060 | Dissolved Sulphate (SO4) | 2015/04/20 | 106 | 80 - 120 | 94 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871061 | Dissolved Chloride (Cl) | 2015/04/20 | NC | 80 - 120 | 99 | 80 - 120 | <0.50 | mg/L | 8.8 | 20 |
| 7871067 | Dissolved Sulphate (SO4) | 2015/04/20 | NC | 80 - 120 | 92 | 80 - 120 | <0.50 | mg/L | 3.8 | 20 |
| 7871286 | Acidity (pH 4.5) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871286 | Acidity (pH 8.3) | 2015/04/20 | | | 101 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871290 | Acidity (pH 4.5) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871290 | Acidity (pH 8.3) | 2015/04/20 | | | 102 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871313 | Alkalinity (PP as CaCO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871313 | Alkalinity (Total as CaCO3) | 2015/04/20 | 101 | 80 - 120 | 96 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871313 | Bicarbonate (HCO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871313 | Carbonate (CO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871313 | Hydroxide (OH) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871316 | Conductivity | 2015/04/20 | | | 100 | 80 - 120 | <1.0 | uS/cm | NC | 20 |
| 7871317 | pH | 2015/04/20 | | | 101 | 97 - 103 | | | 1.0 | N/A |
| 7871334 | Orthophosphate (P) | 2015/04/20 | 119 | 80 - 120 | 92 | 80 - 120 | <0.0010 | mg/L | NC | 20 |
| 7871336 | Orthophosphate (P) | 2015/04/20 | 95 | 80 - 120 | 96 | 80 - 120 | <0.0010 | mg/L | NC | 20 |
| 7871413 | Total Nitrogen (N) | 2015/04/21 | NC | 80 - 120 | 95 | 80 - 120 | <0.020 | mg/L | 0.030 | 20 |
| 7871415 | Total Nitrogen (N) | 2015/04/21 | NC | 80 - 120 | 97 | 80 - 120 | <0.020 | mg/L | 1.3 | 20 |
| 7872399 | Total Dissolved Solids | 2015/04/24 | 100 | 80 - 120 | 96 | 80 - 120 | 2.0, RDL=1.0 | mg/L | 8.0 | 20 |
| 7873711 | Dissolved Phosphorus (P) | 2015/04/21 | 103 | 80 - 120 | 104 | 80 - 120 | <0.0020 | mg/L | NC | 20 |
| 7873751 | Dissolved Phosphorus (P) | 2015/04/21 | | | 95 | 80 - 120 | <0.0020 | mg/L | | |
| 7873754 | Total Phosphorus (P) | 2015/04/21 | 106 | 80 - 120 | 95 | 80 - 120 | <0.0020 | mg/L | 0.62 | 20 |
| 7873755 | Nitrate plus Nitrite (N) | 2015/04/21 | 104 | 80 - 120 | 104 | 80 - 120 | <0.0020 | mg/L | 0.38 | 25 |
| 7873796 | Total Phosphorus (P) | 2015/04/21 | 101 | 80 - 120 | 109 | 80 - 120 | <0.0020 | mg/L | 7.3 | 20 |
| 7873797 | Nitrite (N) | 2015/04/21 | 99 | 80 - 120 | 101 | 80 - 120 | <0.0020 | mg/L | NC | 25 |
| 7877009 | Total Aluminum (Al) | 2015/04/22 | NC | 80 - 120 | 101 | 80 - 120 | <0.20 | ug/L | 3.5 | 20 |
| 7877009 | Total Antimony (Sb) | 2015/04/22 | 103 | 80 - 120 | 100 | 80 - 120 | <0.020 | ug/L | 2.4 | 20 |
| 7877009 | Total Arsenic (As) | 2015/04/22 | 110 | 80 - 120 | 105 | 80 - 120 | <0.020 | ug/L | 0.98 | 20 |

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | Units | Value (%) | QC Limits |
| 7877009 | Total Barium (Ba) | 2015/04/22 | NC | 80 - 120 | 103 | 80 - 120 | <0.020 | ug/L | 0.29 | 20 |
| 7877009 | Total Beryllium (Be) | 2015/04/22 | 98 | 80 - 120 | 98 | 80 - 120 | <0.010 | ug/L | NC | 20 |
| 7877009 | Total Bismuth (Bi) | 2015/04/22 | 92 | 80 - 120 | 101 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7877009 | Total Boron (B) | 2015/04/22 | | | | | <5.0 | ug/L | 1.0 | 20 |
| 7877009 | Total Cadmium (Cd) | 2015/04/22 | 98 | 80 - 120 | 103 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7877009 | Total Chromium (Cr) | 2015/04/22 | 99 | 80 - 120 | 101 | 80 - 120 | <0.050 | ug/L | 5.1 | 20 |
| 7877009 | Total Cobalt (Co) | 2015/04/22 | 97 | 80 - 120 | 100 | 80 - 120 | <0.0050 | ug/L | 1.5 | 20 |
| 7877009 | Total Copper (Cu) | 2015/04/22 | 94 | 80 - 120 | 100 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| 7877009 | Total Iron (Fe) | 2015/04/22 | 101 | 80 - 120 | 105 | 80 - 120 | <1.0 | ug/L | NC | 20 |
| 7877009 | Total Lead (Pb) | 2015/04/22 | 98 | 80 - 120 | 101 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7877009 | Total Lithium (Li) | 2015/04/22 | NC | 80 - 120 | 108 | 80 - 120 | <0.50 | ug/L | 4.6 | 20 |
| 7877009 | Total Manganese (Mn) | 2015/04/22 | NC | 80 - 120 | 101 | 80 - 120 | <0.050 | ug/L | 1.4 | 20 |
| 7877009 | Total Molybdenum (Mo) | 2015/04/22 | NC | 80 - 120 | 96 | 80 - 120 | <0.050 | ug/L | 1.2 | 20 |
| 7877009 | Total Nickel (Ni) | 2015/04/22 | 95 | 80 - 120 | 102 | 80 - 120 | <0.020 | ug/L | 3.4 | 20 |
| 7877009 | Total Selenium (Se) | 2015/04/22 | 103 | 80 - 120 | 97 | 80 - 120 | <0.040 | ug/L | NC | 20 |
| 7877009 | Total Silicon (Si) | 2015/04/22 | | | | | <50 | ug/L | 0.90 | 20 |
| 7877009 | Total Silver (Ag) | 2015/04/22 | 92 | 80 - 120 | 87 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7877009 | Total Strontium (Sr) | 2015/04/22 | NC | 80 - 120 | 96 | 80 - 120 | <0.050 | ug/L | 3.6 | 20 |
| 7877009 | Total Thallium (Tl) | 2015/04/22 | 80 | 80 - 120 | 98 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| 7877009 | Total Tin (Sn) | 2015/04/22 | 96 | 80 - 120 | 98 | 80 - 120 | <0.010 | ug/L | 0.51 | 20 |
| 7877009 | Total Titanium (Ti) | 2015/04/22 | 101 | 80 - 120 | 104 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 7877009 | Total Uranium (U) | 2015/04/22 | 107 | 80 - 120 | 103 | 80 - 120 | <0.0020 | ug/L | 0.67 | 20 |
| 7877009 | Total Vanadium (V) | 2015/04/22 | 104 | 80 - 120 | 103 | 80 - 120 | <0.10 | ug/L | 0.78 | 20 |
| 7877009 | Total Zinc (Zn) | 2015/04/22 | 97 | 80 - 120 | 104 | 80 - 120 | <0.10 | ug/L | NC | 20 |
| 7877009 | Total Zirconium (Zr) | 2015/04/22 | | | | | <0.050 | ug/L | NC | 20 |
| 7877321 | Turbidity | 2015/04/24 | | | 99 | 80 - 120 | <0.10 | NTU | 7.1 | 20 |
| 7877871 | Total Mercury (Hg) | 2015/04/23 | 88 | 80 - 120 | 93 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| 7878425 | Total Ammonia (N) | 2015/04/22 | 94 | 80 - 120 | 97 | 80 - 120 | <0.0050 | mg/L | NC | 20 |

## QUALITY ASSURANCE REPORT(CONT'D)

|  |  |  | Matrix Spike |  | Spiked Blank |  | Method Blank |  | RPD |  |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | Units | Value (%) | QC Limits |
| 7878427 | Total Ammonia (N) | 2015/04/22 | 133 (1) | 80 - 120 | 101 | 80 - 120 | <0.0050 | mg/L | NC | 20 |

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

## VALIDATION SIGNATURE PAGE

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

Andy Lu, Data Validation Coordinator

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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.

B53 1409

Date Shipped: 2015-Apr-16

Shipping Memo: ~~70655~~ 70658

04/48

Results Received:

Maxxam Job #: 08344574

RioTinto

## Diavik Diamond Mines Inc. - Chain of Custody

| | | | |
|---|---|---|---|
| Diavik Diamond Mines Inc. | Contact Information - Sample Inquiry | | |
| P.O.Box 2498 | DDMI ENVIRONMENT | | |
| 5007-50 Ave | DDMI.ENVIRONMENT@RIOTINTO.COM | | |
| Yellowknife NT<br>X1A 2P8 | Site Env. Supervisor | Sean Sinclair / Darcy Bourassa @ 867-669-6500 ext 5403 | |
| REPORT TO | | REPORT DISTRIBUTION | |
| DDMI ENVIRONMENT | | Electronic PDF | ✓ |
| DDMI.ENVIRONMENT@RIOTINTO.COM | | Electronic Excel | ✓ |
| REFERENCE LAB ID # | MAXXAM | Hard Copy | |

| | | | |
|---|---|---|---|
| SERVICE REQUESTED | | INVOICE TO | |
| Regular (Default) | ✓ | DDMI ACCOUNTS PAYABLE | |
| Priority (50% Surcharge) | | DDMI.AP@RIOTINTO.COM | |
| Emergency (100% Surcharge) | | Reference PO # | K30524 (Maxxam 2015) |

SAMPLE INFORMATION / ANALYSIS REQUESTED

| Identification | Project | Collected By | Date | Type | Routine Parameters: (pH, EC, Acidity, Alkalinity, Fl, K, Cl, SO4, PO4, NO2, NO3, Dissolved Phosphorus, TDS) | Nutrients: (Ammonia, Total Phosphorus, TKN) PRESERVED | TOC (Total Organic Carbon) - analysis to be taken from the 120mL Nutrients bottle | DOC (Dissolved Organic Carbon) UNFILTERED & UNPRESERVED | Total Metals Low Level +Sb,Se PRESERVED | Total Mercury PRESERVED | Dissolved Metals Low Level + Sb,Se UNFILTERED & UNPRESERVED | Dissolved Mercury - UNFILTERED & UNPRESERVED | Oil & Grease and Mineral Oil & Grease PRESERVED | Biochemical Oxygen Demand (BoD) | BTEX -F1 (3 x 40 mL pre-preserved) | F2 - F4 (250 mL Amber per-preserved) | Fecal Coliforms (2 bottles pre-preserved) | | TSS, Turb, pH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS2-3 MB8411 | SNP-A | JG/SS | 2015-Mar-31 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS2-4 MB8412 | SNP-A | JG/SS | 2015-Mar-31 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SSC-1 MB8413 | SNP-A | DD/DB | 2015-Apr-10 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS5-5 MB8414 | SNP-A | DD/DB | 2015-Apr-10 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS3-6 MB8415 | SNP-A | JG/DB/S | 2015-Apr-05 | GS | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |

B531409

| | | | | | | |
|---|---|---|---|---|---|---|
| SAMPLE CONDITION (Shipped) | | | SPECIAL INSTRUCTIONS | SAMPLE CONDITION (Received) | | |
| TEMP°C | FROZEN | | 25 Bottles Total Keep Cool Do Not Freeze | TEMP°C | FROZEN | |
| 5.0 | COLD | ✓ | | 4,6,3 | COLD | |
| | AMBIENT | | | | AMBIENT | |
| RELINQUISHED BY: KG | | DATE / TIME: 2015-Apr-16 | RECEIVED BY: Jenna Walter 20150417 | DATE / TIME: 1009 | | |

Doc # ENVI-140-0112 R0

Report Uploaded to MP5: Relinquished: Fiona Changirua 20150417 10:24

Data Checked for Breaches:

apr 18/15 MARILOU TRUANI ice/seal/present 5,4,4 10:45 cs✓

Your P.O. #: K30524
Your Project #: SNP-A
PO # K30524
Your C.O.C. #: 08344635

**Attention:DDMI Environment**

DIAVIK DIAMOND MINES INC.
P.O. BOX 2498
300-5201 - 50th AVE.
YELLOWKNIFE, NT
CANADA X1A 2P8

**Report Date: 2015/04/30**
Report #: R1862936
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B531410**
**Received: 2015/04/18, 10:45**

Sample Matrix: Water
# Samples Received: 6

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Acidity pH 4.5 & pH 8.3 (as CaCO3) | 6 | N/A | 2015/04/20 | BBY6SOP-00037 | SM 22 2310 B m |
| Alkalinity - Water | 6 | 2015/04/20 | 2015/04/20 | BBY6SOP-00026 | SM 22 2320 B m |
| Chloride by Automated Colourimetry | 6 | N/A | 2015/04/20 | BBY6SOP-00011 | SM 22 4500-Cl- G m |
| Conductance - water | 6 | N/A | 2015/04/20 | BBY6SOP-00026 | SM 22 2510 B m |
| Fluoride - Mining Clients | 6 | N/A | 2015/04/20 | BBY6SOP-00048 | SM 22 4500-F C m |
| Hardness Total (calculated as CaCO3) | 6 | N/A | 2015/04/24 | BBY7SOP-00002 | EPA 6020a R1 m |
| Mercury (Total-LowLevel) by CVAF | 6 | 2015/04/22 | 2015/04/23 | BBY7SOP-00015 | BCMOE BCLM Oct2013 m |
| Na, K, Ca, Mg, S by CRC ICPMS (total) | 6 | N/A | 2015/04/24 | BBY7SOP-00002 | EPA 6020A R1 m |
| Elements by ICPMS Low Level (total) | 6 | N/A | 2015/04/23 | BBY7SOP-00002 | EPA 6020A |
| Nitrogen (Total) | 4 | 2015/04/20 | 2015/04/21 | BBY6SOP-00016 | SM 22 4500-N C m |
| Nitrogen (Total) | 1 | 2015/04/28 | 2015/04/28 | BBY6SOP-00016 | SM 22 4500-N C m |
| Nitrogen (Total) | 1 | 2015/04/30 | 2015/04/30 | BBY6SOP-00016 | SM 22 4500-N C m |
| Ammonia-N (Preserved) | 4 | N/A | 2015/04/22 | BBY6SOP-00009 | SM 22 4500-NH3- G m |
| Ammonia-N (Preserved) | 1 | N/A | 2015/04/27 | BBY6SOP-00009 | SM 22 4500-NH3- G m |
| Ammonia-N (Preserved) | 1 | N/A | 2015/04/28 | BBY6SOP-00009 | SM 22 4500-NH3- G m |
| Nitrate+Nitrite (N) (low level) | 4 | N/A | 2015/04/21 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrate+Nitrite (N) (low level) | 1 | N/A | 2015/04/25 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrate+Nitrite (N) (low level) | 1 | N/A | 2015/04/28 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrite (N) (low level) | 6 | N/A | 2015/04/21 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| Nitrogen - Nitrate (as N) | 6 | N/A | 2015/04/21 | BBY6SOP-00010 | SM 22 4500-NO3- I m |
| pH Water (1) | 6 | N/A | 2015/04/20 | BBY6SOP-00026 | SM 22 4500-H+ B m |
| Orthophosphate by Konelab (low level) | 6 | N/A | 2015/04/20 | BBY6SOP-00013 | SM 22 4500-P E m |
| Sulphate by Automated Colourimetry | 6 | N/A | 2015/04/20 | BBY6SOP-00017 | SM 22 4500-SO42- E m |
| Total Dissolved Solids - Low Level | 6 | N/A | 2015/04/24 | BBY6SOP-00033 | SM 22 2540 C m |
| TKN (Calc. TN, N/N) total | 6 | N/A | 2015/04/22 | BBY WI-00033 | Calculation |
| Phosphorus-P (LL Tot, dissolved) - UF/UP | 6 | 2015/04/21 | 2015/04/21 | BBY6SOP-00013 | SM 22 4500-P E m |
| Total Phosphorus | 6 | N/A | 2015/04/21 | BBY6SOP-00013 | SM 22 4500-P E m |
| Total Suspended Solids-Low Level | 5 | 2015/04/20 | 2015/04/21 | BBY6SOP-00034 | SM 22 2540 D |
| Total Suspended Solids-Low Level | 1 | 2015/04/20 | 2015/04/28 | BBY6SOP-00034 | SM 22 2540 D |

Your P.O. #: K30524
Your Project #: SNP-A
PO # K30524
Your C.O.C. #: 08344635

**Attention:DDMI Environment**

DIAVIK DIAMOND MINES INC.
P.O. BOX 2498
300-5201 - 50th AVE.
YELLOWKNIFE, NT
CANADA X1A 2P8

**Report Date: 2015/04/30**
Report #: R1862936
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B531410**
**Received: 2015/04/18, 10:45**

Sample Matrix: Water
# Samples Received: 6

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Turbidity | 6 | N/A | 2015/04/24 | BBY6SOP-00027 | SM 22 2130 B m |

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Tabitha Rudkin, AScT, Burnaby Project Manager
Email: TRudkin@maxxam.ca
Phone# (604)638-2639
====================================================================
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 Job #: B531410
Report Date: 2015/04/30

DIAVIK DIAMOND MINES INC.
Client Project #: SNP-A
Your P.O. #: K30524
Sampler Initials: DB

## RESULTS OF CHEMICAL ANALYSES OF WATER

| **Maxxam ID** | | MB8416 | | MB8417 | | MB8418 | | MB8419 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/08 | | 2015/04/08 | | 2015/04/08 | | 2015/04/08 | | |
| **COC Number** | | 08344635 | | 08344635 | | 08344635 | | 08344635 | | |
| | **Units** | **SSC-2** | **QC Batch** | **SS4-5-4** | **QC Batch** | **SS4-5-5** | **QC Batch** | **SS4-4** | **RDL** | **QC Batch** |
| **Misc. Inorganics** | | | | | | | | | | |
| Acidity (pH 4.5) | mg/L | <0.50 | 7871290 | <0.50 | 7871290 | <0.50 | 7871290 | <0.50 | 0.50 | 7871290 |
| Acidity (pH 8.3) | mg/L | <0.50 | 7871290 | <0.50 | 7871290 | <0.50 | 7871290 | <0.50 | 0.50 | 7871290 |
| Fluoride (F) | mg/L | <0.010 | 7870673 | <0.010 | 7870673 | <0.010 | 7870673 | <0.010 | 0.010 | 7870673 |
| **Calculated Parameters** | | | | | | | | | | |
| Total Hardness (CaCO3) | mg/L | 7.39 | 7869264 | 22.9 | 7869264 | 20.9 | 7869264 | 43.1 | 0.50 | 7869264 |
| Nitrate (N) | mg/L | 0.0662 | 7869267 | 0.0794 | 7869267 | 0.0770 | 7869267 | 0.126 | 0.0020 | 7869267 |
| **Misc. Inorganics** | | | | | | | | | | |
| Alkalinity (Total as CaCO3) | mg/L | 0.83 | 7871313 | 1.54 | 7871313 | 1.38 | 7871313 | 2.77 | 0.50 | 7871313 |
| Alkalinity (PP as CaCO3) | mg/L | <0.50 | 7871313 | <0.50 | 7871313 | <0.50 | 7871313 | <0.50 | 0.50 | 7871313 |
| Bicarbonate (HCO3) | mg/L | 1.01 | 7871313 | 1.88 | 7871313 | 1.68 | 7871313 | 3.38 | 0.50 | 7871313 |
| Carbonate (CO3) | mg/L | <0.50 | 7871313 | <0.50 | 7871313 | <0.50 | 7871313 | <0.50 | 0.50 | 7871313 |
| Hydroxide (OH) | mg/L | <0.50 | 7871313 | <0.50 | 7871313 | <0.50 | 7871313 | <0.50 | 0.50 | 7871313 |
| **Anions** | | | | | | | | | | |
| Orthophosphate (P) | mg/L | 0.0049 (1) | 7871336 | 0.0062 (1) | 7871336 | 0.0063 (1) | 7871334 | 0.0087 (1) | 0.0010 | 7871336 |
| Dissolved Sulphate (SO4) | mg/L | <0.50 | 7871067 | 0.74 | 7871067 | <0.50 | 7871060 | 0.66 | 0.50 | 7871067 |
| Dissolved Chloride (Cl) | mg/L | <0.50 | 7871061 | <0.50 | 7871061 | 0.50 | 7871055 | 0.57 | 0.50 | 7871061 |
| **Nutrients** | | | | | | | | | | |
| Total Ammonia (N) | mg/L | 0.040 | 7878425 | 0.065 | 7878427 | 0.081 | 7878427 | 0.068 | 0.0050 | 7878427 |
| Dissolved Phosphorus (P) | mg/L | 0.0045 (1) | 7873751 | 0.0085 (1) | 7873751 | 0.0120 (1) | 7873711 | 0.0286 (1) | 0.0020 | 7873751 |
| Total Total Kjeldahl Nitrogen (Calc) | mg/L | 0.075 | 7869268 | 0.038 | 7869268 | 0.082 | 7869268 | 0.047 | 0.020 | 7869268 |
| Nitrate plus Nitrite (N) | mg/L | 0.0662 (1) | 7873755 | 0.0794 (1) | 7873755 | 0.0770 (1) | 7873755 | 0.128 (1) | 0.0020 | 7873755 |
| Nitrite (N) | mg/L | <0.0020 (1) | 7873797 | <0.0020 (1) | 7873797 | <0.0020 (1) | 7873797 | 0.0024 (1) | 0.0020 | 7873797 |
| Total Nitrogen (N) | mg/L | 0.141 | 7871413 | 0.118 | 7871415 | 0.159 | 7871415 | 0.175 | 0.020 | 7871415 |
| Total Phosphorus (P) | mg/L | 0.0116 | 7873754 | 0.0231 | 7873796 | 0.0237 | 7873796 | 0.0642 | 0.0020 | 7873796 |
| **Physical Properties** | | | | | | | | | | |
| Conductivity | uS/cm | 3.9 | 7871316 | 6.0 | 7871316 | 5.9 | 7871316 | 11.7 | 1.0 | 7871316 |
| pH | pH | 5.84 | 7871317 | 6.35 | 7871317 | 6.15 | 7871317 | 6.63 | N/A | 7871317 |
| **Physical Properties** | | | | | | | | | | |
| Total Suspended Solids | mg/L | 9.0 (1) | 7869980 | 19.7 (1) | 7869980 | 16.9 (1) | 7869980 | 38.5 (1) | 1.0 | 7869980 |
| Total Dissolved Solids | mg/L | <1.0 (1) | 7872399 | 7.6 (1) | 7872399 | 7.2 (1) | 7872399 | 13.0 (1) | 1.0 | 7872399 |
| Turbidity | NTU | 2.93 (1) | 7877321 | 2.82 (1) | 7877321 | 3.94 (1) | 7877321 | 3.72 (1) | 0.10 | 7877321 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Sample arrived to laboratory past recommended hold time.

Maxxam Job #: B531410
Report Date: 2015/04/30

DIAVIK DIAMOND MINES INC.
Client Project #: SNP-A
Your P.O. #: K30524
Sampler Initials: DB

## RESULTS OF CHEMICAL ANALYSES OF WATER

| **Maxxam ID** | | MB8420 | | MB8421 | | |
|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/05 | | 2015/04/05 | | |
| **COC Number** | | 08344635 | | 08344635 | | |
| | **Units** | **SSC-3** | **QC Batch** | **SS3-8** | **RDL** | **QC Batch** |
| **Misc. Inorganics** | | | | | | |
| Acidity (pH 4.5) | mg/L | <0.50 | 7871290 | <0.50 | 0.50 | 7871290 |
| Acidity (pH 8.3) | mg/L | <0.50 | 7871290 | <0.50 | 0.50 | 7871290 |
| Fluoride (F) | mg/L | <0.010 | 7870673 | 0.013 | 0.010 | 7870673 |
| **Calculated Parameters** | | | | | | |
| Total Hardness (CaCO3) | mg/L | 59.6 | 7869264 | 81.2 | 0.50 | 7869264 |
| Nitrate (N) | mg/L | 0.0806 | 7869267 | 0.135 | 0.0020 | 7869267 |
| **Misc. Inorganics** | | | | | | |
| Alkalinity (Total as CaCO3) | mg/L | 1.80 | 7871313 | 11.0 | 0.50 | 7871313 |
| Alkalinity (PP as CaCO3) | mg/L | <0.50 | 7871313 | <0.50 | 0.50 | 7871313 |
| Bicarbonate (HCO3) | mg/L | 2.20 | 7871313 | 13.4 | 0.50 | 7871313 |
| Carbonate (CO3) | mg/L | <0.50 | 7871313 | <0.50 | 0.50 | 7871313 |
| Hydroxide (OH) | mg/L | <0.50 | 7871313 | <0.50 | 0.50 | 7871313 |
| **Anions** | | | | | | |
| Orthophosphate (P) | mg/L | 0.0058 (1) | 7871334 | 0.035 (1) | 0.0010 | 7871336 |
| Dissolved Sulphate (SO4) | mg/L | <0.50 | 7871060 | 1.14 | 0.50 | 7871060 |
| Dissolved Chloride (Cl) | mg/L | <0.50 | 7871055 | 1.0 | 0.50 | 7871055 |
| **Nutrients** | | | | | | |
| Total Ammonia (N) | mg/L | 0.054 | 7884066 | 0.15 | 0.0050 | 7885070 |
| Dissolved Phosphorus (P) | mg/L | 0.0065 (1) | 7873711 | 0.0923 (1) | 0.0020 | 7873751 |
| Total Total Kjeldahl Nitrogen (Calc) | mg/L | 0.089 | 7869268 | 0.170 | 0.020 | 7869268 |
| Nitrate plus Nitrite (N) | mg/L | 0.0831 (1) | 7882928 | 0.143 (1) | 0.0020 | 7885193 |
| Nitrite (N) | mg/L | 0.0025 (1) | 7873797 | 0.0082 (1) | 0.0020 | 7873797 |
| Total Nitrogen (N) | mg/L | 0.172 | 7885157 | 0.313 | 0.020 | 7888043 |
| Total Phosphorus (P) | mg/L | 0.0193 | 7873796 | 0.0930 | 0.0020 | 7873796 |
| **Physical Properties** | | | | | | |
| Conductivity | uS/cm | 7.1 | 7871316 | 31.7 | 1.0 | 7871316 |
| pH | pH | 6.34 | 7871317 | 7.49 | N/A | 7871317 |
| **Physical Properties** | | | | | | |
| Total Suspended Solids | mg/L | 8.6 (1) | 7869980 | 36.9 (2) | 1.0 | 7884713 |
| Total Dissolved Solids | mg/L | 8.0 (1) | 7872399 | 23.0 (1) | 1.0 | 7872399 |
| Turbidity | NTU | 4.09 (1) | 7882145 | 19.0 (1) | 0.10 | 7882145 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Sample arrived to laboratory past recommended hold time.
(2) Sample analyzed past recommended hold time.

## MERCURY BY COLD VAPOR (WATER)

| **Maxxam ID** | | MB8416 | MB8417 | MB8418 | MB8419 | | MB8420 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/08 | 2015/04/08 | 2015/04/08 | 2015/04/08 | | 2015/04/05 | | |
| **COC Number** | | 08344635 | 08344635 | 08344635 | 08344635 | | 08344635 | | |
| | **Units** | **SSC-2** | **SS4-5-4** | **SS4-5-5** | **SS4-4** | **QC Batch** | **SSC-3** | **RDL** | **QC Batch** |
| **Elements** | | | | | | | | | |
| Total Mercury (Hg) | ug/L | <0.0020 | <0.0020 | <0.0020 | <0.0020 | 7877792 | <0.0020 | 0.0020 | 7877871 |
| RDL = Reportable Detection Limit | | | | | | | | | |

| **Maxxam ID** | | MB8421 | | |
|---|---|---|---|---|
| **Sampling Date** | | 2015/04/05 | | |
| **COC Number** | | 08344635 | | |
| | **Units** | **SS3-8** | **RDL** | **QC Batch** |
| **Elements** | | | | |
| Total Mercury (Hg) | ug/L | <0.0020 | 0.0020 | 7877943 |
| RDL = Reportable Detection Limit | | | | |

## ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

| **Maxxam ID** | | MB8416 | MB8417 | MB8418 | MB8419 | MB8420 | MB8421 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2015/04/08 | 2015/04/08 | 2015/04/08 | 2015/04/08 | 2015/04/05 | 2015/04/05 | | |
| **COC Number** | | 08344635 | 08344635 | 08344635 | 08344635 | 08344635 | 08344635 | | |
| | **Units** | **SSC-2** | **SS4-5-4** | **SS4-5-5** | **SS4-4** | **SSC-3** | **SS3-8** | **RDL** | **QC Batch** |
| **Total Metals by ICPMS** | | | | | | | | | |
| Total Aluminum (Al) | ug/L | 226 | 882 | 770 | 1740 | 2230 | 3000 | 0.20 | 7877009 |
| Total Antimony (Sb) | ug/L | 0.070 | <0.020 | 0.033 | 0.036 | 0.087 | 0.056 | 0.020 | 7877009 |
| Total Arsenic (As) | ug/L | 0.072 | 0.239 | 0.199 | 0.357 | 0.348 | 0.491 | 0.020 | 7877009 |
| Total Barium (Ba) | ug/L | 14.0 | 22.4 | 23.8 | 45.2 | 59.5 | 109 | 0.020 | 7877009 |
| Total Beryllium (Be) | ug/L | <0.010 | 0.024 | 0.020 | 0.053 | 0.061 | 0.119 | 0.010 | 7877009 |
| Total Bismuth (Bi) | ug/L | 0.0301 | 0.118 | 0.154 | 0.281 | 0.418 | 1.24 | 0.0050 | 7877009 |
| Total Boron (B) | ug/L | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | 5.0 | 7877009 |
| Total Cadmium (Cd) | ug/L | 0.0806 | 0.0140 | 0.0226 | 0.0705 | 0.0341 | 0.0507 | 0.0050 | 7877009 |
| Total Chromium (Cr) | ug/L | 4.41 | 12.8 | 11.0 | 21.5 | 32.4 | 36.7 | 0.050 | 7877009 |
| Total Cobalt (Co) | ug/L | 0.498 | 1.67 | 1.50 | 3.38 | 4.62 | 5.30 | 0.0050 | 7877009 |
| Total Copper (Cu) | ug/L | 0.836 | 1.54 | 1.80 | 3.13 | 3.40 | 6.48 | 0.050 | 7877009 |
| Total Iron (Fe) | ug/L | 881 | 2260 | 2000 | 4050 | 5450 | 6970 | 1.0 | 7877009 |
| Total Lead (Pb) | ug/L | 0.569 | 1.05 | 0.875 | 1.89 | 2.32 | 5.46 | 0.0050 | 7877009 |
| Total Lithium (Li) | ug/L | 1.17 | 2.77 | 3.27 | 5.46 | 7.09 | 9.27 | 0.50 | 7877009 |
| Total Manganese (Mn) | ug/L | 9.89 | 25.6 | 23.6 | 54.2 | 71.7 | 104 | 0.050 | 7877009 |
| Total Molybdenum (Mo) | ug/L | 0.350 | 0.320 | 0.277 | 0.369 | 0.309 | 0.607 | 0.050 | 7877009 |
| Total Nickel (Ni) | ug/L | 7.15 | 22.0 | 20.0 | 45.6 | 63.4 | 85.4 | 0.020 | 7877009 |
| Total Selenium (Se) | ug/L | <0.040 | <0.040 | <0.040 | 0.043 | <0.040 | <0.040 | 0.040 | 7877009 |
| Total Silicon (Si) | ug/L | 804 | 2990 | 2550 | 4860 | 6340 | 8220 | 50 | 7877009 |
| Total Silver (Ag) | ug/L | 0.0059 | 0.0062 | <0.0050 | 0.0122 | 0.0103 | 0.0238 | 0.0050 | 7877009 |
| Total Strontium (Sr) | ug/L | 2.91 | 5.95 | 6.01 | 13.3 | 11.4 | 37.8 | 0.050 | 7877009 |
| Total Thallium (Tl) | ug/L | 0.0111 | 0.0176 | 0.0101 | 0.0240 | 0.0309 | 0.0459 | 0.0020 | 7877009 |
| Total Tin (Sn) | ug/L | 0.049 | 0.062 | 0.070 | 0.093 | 0.085 | 0.154 | 0.010 | 7877009 |
| Total Titanium (Ti) | ug/L | 16.7 | 73.1 | 65.1 | 140 | 180 | 225 | 0.50 | 7877009 |
| Total Uranium (U) | ug/L | 0.260 | 0.978 | 0.841 | 2.35 | 1.98 | 6.60 | 0.0020 | 7877009 |
| Total Vanadium (V) | ug/L | 1.11 | 2.92 | 2.40 | 4.99 | 6.17 | 7.45 | 0.10 | 7877009 |
| Total Zinc (Zn) | ug/L | 5.64 | 8.59 | 11.6 | 12.5 | 14.8 | 21.6 | 0.10 | 7877009 |
| Total Zirconium (Zr) | ug/L | 0.088 | 0.216 | 0.164 | 0.367 | 0.341 | 1.24 | 0.050 | 7877009 |
| Total Calcium (Ca) | mg/L | 0.363 | 0.807 | 0.828 | 2.02 | 1.76 | 7.03 | 0.010 | 7869265 |
| Total Magnesium (Mg) | mg/L | 1.57 | 5.07 | 4.57 | 9.24 | 13.4 | 15.5 | 0.010 | 7869265 |
| Total Potassium (K) | mg/L | 0.242 | 0.415 | 0.489 | 0.849 | 0.918 | 1.46 | 0.010 | 7869265 |
| Total Sodium (Na) | mg/L | 0.422 | 0.147 | 0.350 | 0.313 | 0.160 | 0.452 | 0.010 | 7869265 |
| Total Sulphur (S) | mg/L | <0.10 | <0.10 | 0.26 | 0.35 | 0.26 | 0.60 | 0.10 | 7869265 |
| RDL = Reportable Detection Limit | | | | | | | | | |

## GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

| | |
|---|---|
| Package 1 | 6.7°C |

Samples analyzed past recommended hold time for alkalinity analysis.

**Results relate only to the items tested.**

## QUALITY ASSURANCE REPORT

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | Units | Value (%) | QC Limits |
| 7869980 | Total Suspended Solids | 2015/04/21 | | | 99 | 80 - 120 | <1.0 | mg/L | | |
| 7870673 | Fluoride (F) | 2015/04/20 | NC | 80 - 120 | 96 | 80 - 120 | <0.010 | mg/L | 2.9 | 20 |
| 7871055 | Dissolved Chloride (Cl) | 2015/04/20 | 111 | 80 - 120 | 102 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871060 | Dissolved Sulphate (SO4) | 2015/04/20 | 106 | 80 - 120 | 94 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871061 | Dissolved Chloride (Cl) | 2015/04/20 | NC | 80 - 120 | 99 | 80 - 120 | <0.50 | mg/L | 8.8 | 20 |
| 7871067 | Dissolved Sulphate (SO4) | 2015/04/20 | NC | 80 - 120 | 92 | 80 - 120 | <0.50 | mg/L | 3.8 | 20 |
| 7871290 | Acidity (pH 4.5) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871290 | Acidity (pH 8.3) | 2015/04/20 | | | 102 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871313 | Alkalinity (PP as CaCO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871313 | Alkalinity (Total as CaCO3) | 2015/04/20 | 101 | 80 - 120 | 96 | 80 - 120 | <0.50 | mg/L | NC | 20 |
| 7871313 | Bicarbonate (HCO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871313 | Carbonate (CO3) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871313 | Hydroxide (OH) | 2015/04/20 | | | | | <0.50 | mg/L | NC | 20 |
| 7871316 | Conductivity | 2015/04/20 | | | 100 | 80 - 120 | <1.0 | uS/cm | NC | 20 |
| 7871317 | pH | 2015/04/20 | | | 101 | 97 - 103 | | | 1.0 | N/A |
| 7871334 | Orthophosphate (P) | 2015/04/20 | 119 | 80 - 120 | 92 | 80 - 120 | <0.0010 | mg/L | NC | 20 |
| 7871336 | Orthophosphate (P) | 2015/04/20 | 95 | 80 - 120 | 96 | 80 - 120 | <0.0010 | mg/L | NC | 20 |
| 7871413 | Total Nitrogen (N) | 2015/04/21 | NC | 80 - 120 | 95 | 80 - 120 | <0.020 | mg/L | 0.030 | 20 |
| 7871415 | Total Nitrogen (N) | 2015/04/21 | NC | 80 - 120 | 97 | 80 - 120 | <0.020 | mg/L | 1.3 | 20 |
| 7872399 | Total Dissolved Solids | 2015/04/24 | 100 | 80 - 120 | 96 | 80 - 120 | 2.0, RDL=1.0 | mg/L | 8.0 | 20 |
| 7873711 | Dissolved Phosphorus (P) | 2015/04/21 | 103 | 80 - 120 | 104 | 80 - 120 | <0.0020 | mg/L | NC | 20 |
| 7873751 | Dissolved Phosphorus (P) | 2015/04/21 | | | 95 | 80 - 120 | <0.0020 | mg/L | | |
| 7873754 | Total Phosphorus (P) | 2015/04/21 | 106 | 80 - 120 | 95 | 80 - 120 | <0.0020 | mg/L | 0.62 | 20 |
| 7873755 | Nitrate plus Nitrite (N) | 2015/04/21 | 104 | 80 - 120 | 104 | 80 - 120 | <0.0020 | mg/L | 0.38 | 25 |
| 7873796 | Total Phosphorus (P) | 2015/04/21 | 101 | 80 - 120 | 109 | 80 - 120 | <0.0020 | mg/L | 7.3 | 20 |
| 7873797 | Nitrite (N) | 2015/04/21 | 99 | 80 - 120 | 101 | 80 - 120 | <0.0020 | mg/L | NC | 25 |
| 7877009 | Total Aluminum (Al) | 2015/04/22 | NC | 80 - 120 | 101 | 80 - 120 | <0.20 | ug/L | 3.5 | 20 |
| 7877009 | Total Antimony (Sb) | 2015/04/22 | 103 | 80 - 120 | 100 | 80 - 120 | <0.020 | ug/L | 2.4 | 20 |
| 7877009 | Total Arsenic (As) | 2015/04/22 | 110 | 80 - 120 | 105 | 80 - 120 | <0.020 | ug/L | 0.98 | 20 |
| 7877009 | Total Barium (Ba) | 2015/04/22 | NC | 80 - 120 | 103 | 80 - 120 | <0.020 | ug/L | 0.29 | 20 |
| 7877009 | Total Beryllium (Be) | 2015/04/22 | 98 | 80 - 120 | 98 | 80 - 120 | <0.010 | ug/L | NC | 20 |

## QUALITY ASSURANCE REPORT(CONT'D)

| | | | Matrix Spike | | Spiked Blank | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | Units | Value (%) | QC Limits |
| 7877009 | Total Bismuth (Bi) | 2015/04/22 | 92 | 80 - 120 | 101 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7877009 | Total Boron (B) | 2015/04/22 | | | | | <5.0 | ug/L | 1.0 | 20 |
| 7877009 | Total Cadmium (Cd) | 2015/04/22 | 98 | 80 - 120 | 103 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7877009 | Total Chromium (Cr) | 2015/04/22 | 99 | 80 - 120 | 101 | 80 - 120 | <0.050 | ug/L | 5.1 | 20 |
| 7877009 | Total Cobalt (Co) | 2015/04/22 | 97 | 80 - 120 | 100 | 80 - 120 | <0.0050 | ug/L | 1.5 | 20 |
| 7877009 | Total Copper (Cu) | 2015/04/22 | 94 | 80 - 120 | 100 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| 7877009 | Total Iron (Fe) | 2015/04/22 | 101 | 80 - 120 | 105 | 80 - 120 | <1.0 | ug/L | NC | 20 |
| 7877009 | Total Lead (Pb) | 2015/04/22 | 98 | 80 - 120 | 101 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7877009 | Total Lithium (Li) | 2015/04/22 | NC | 80 - 120 | 108 | 80 - 120 | <0.50 | ug/L | 4.6 | 20 |
| 7877009 | Total Manganese (Mn) | 2015/04/22 | NC | 80 - 120 | 101 | 80 - 120 | <0.050 | ug/L | 1.4 | 20 |
| 7877009 | Total Molybdenum (Mo) | 2015/04/22 | NC | 80 - 120 | 96 | 80 - 120 | <0.050 | ug/L | 1.2 | 20 |
| 7877009 | Total Nickel (Ni) | 2015/04/22 | 95 | 80 - 120 | 102 | 80 - 120 | <0.020 | ug/L | 3.4 | 20 |
| 7877009 | Total Selenium (Se) | 2015/04/22 | 103 | 80 - 120 | 97 | 80 - 120 | <0.040 | ug/L | NC | 20 |
| 7877009 | Total Silicon (Si) | 2015/04/22 | | | | | <50 | ug/L | 0.90 | 20 |
| 7877009 | Total Silver (Ag) | 2015/04/22 | 92 | 80 - 120 | 87 | 80 - 120 | <0.0050 | ug/L | NC | 20 |
| 7877009 | Total Strontium (Sr) | 2015/04/22 | NC | 80 - 120 | 96 | 80 - 120 | <0.050 | ug/L | 3.6 | 20 |
| 7877009 | Total Thallium (Tl) | 2015/04/22 | 80 | 80 - 120 | 98 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| 7877009 | Total Tin (Sn) | 2015/04/22 | 96 | 80 - 120 | 98 | 80 - 120 | <0.010 | ug/L | 0.51 | 20 |
| 7877009 | Total Titanium (Ti) | 2015/04/22 | 101 | 80 - 120 | 104 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 7877009 | Total Uranium (U) | 2015/04/22 | 107 | 80 - 120 | 103 | 80 - 120 | <0.0020 | ug/L | 0.67 | 20 |
| 7877009 | Total Vanadium (V) | 2015/04/22 | 104 | 80 - 120 | 103 | 80 - 120 | <0.10 | ug/L | 0.78 | 20 |
| 7877009 | Total Zinc (Zn) | 2015/04/22 | 97 | 80 - 120 | 104 | 80 - 120 | <0.10 | ug/L | NC | 20 |
| 7877009 | Total Zirconium (Zr) | 2015/04/22 | | | | | <0.050 | ug/L | NC | 20 |
| 7877321 | Turbidity | 2015/04/24 | | | 99 | 80 - 120 | <0.10 | NTU | 7.1 | 20 |
| 7877792 | Total Mercury (Hg) | 2015/04/23 | 91 | 80 - 120 | 92 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| 7877871 | Total Mercury (Hg) | 2015/04/23 | 88 | 80 - 120 | 93 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| 7877943 | Total Mercury (Hg) | 2015/04/23 | 95 | 80 - 120 | 97 | 80 - 120 | <0.0020 | ug/L | NC | 20 |
| 7878425 | Total Ammonia (N) | 2015/04/22 | 94 | 80 - 120 | 97 | 80 - 120 | <0.0050 | mg/L | NC | 20 |
| 7878427 | Total Ammonia (N) | 2015/04/22 | 133 (1) | 80 - 120 | 101 | 80 - 120 | <0.0050 | mg/L | NC | 20 |
| 7882145 | Turbidity | 2015/04/24 | | | 101 | 80 - 120 | <0.10 | NTU | 12 | 20 |
| 7882928 | Nitrate plus Nitrite (N) | 2015/04/25 | 105 | 80 - 120 | 108 | 80 - 120 | <0.0020 | mg/L | 2.1 | 25 |

## QUALITY ASSURANCE REPORT(CONT'D)

|  |  |  | Matrix Spike |  | Spiked Blank |  | Method Blank |  | RPD |  |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch** | **Parameter** | **Date** | **% Recovery** | **QC Limits** | **% Recovery** | **QC Limits** | **Value** | **Units** | **Value (%)** | **QC Limits** |
| 7884066 | Total Ammonia (N) | 2015/04/27 | 96 | 80 - 120 | 109 | 80 - 120 | <0.0050 | mg/L | NC | 20 |
| 7884713 | Total Suspended Solids | 2015/04/28 |  |  | 103 | 80 - 120 | <1.0 | mg/L |  |  |
| 7885070 | Total Ammonia (N) | 2015/04/28 |  |  | 94 | 80 - 120 | <0.0050 | mg/L |  |  |
| 7885157 | Total Nitrogen (N) | 2015/04/28 | NC | 80 - 120 | 94 | 80 - 120 | <0.020 | mg/L | 3.4 | 20 |
| 7885193 | Nitrate plus Nitrite (N) | 2015/04/28 | 105 | 80 - 120 | 107 | 80 - 120 | <0.0020 | mg/L | 0.33 | 25 |
| 7888043 | Total Nitrogen (N) | 2015/04/30 | NC | 80 - 120 | 98 | 80 - 120 | <0.020 | mg/L | 2.7 | 20 |

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

## VALIDATION SIGNATURE PAGE

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

Andy Lu, Data Validation Coordinator

---

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.

Date Shipped: 2015-Apr-16

04/478

Results Received:

B531410

Shipping Memo: 70658

Maxxam Job #: 08344635

RioTinto

## Diavik Diamond Mines Inc. - Chain of Custody

| | |
|---|---|
| Diavik Diamond Mines Inc. | Contact Information - Sample Inquiry |
| P.O.Box 2498 | DDMI ENVIRONMENT |
| 5007-50 Ave | DDMI.ENVIRONMENT@RIOTINTO.COM |
| Yellowknife NT | Site Env. Supervisor: Sean Sinclair / Darcy Bourassa @ 867-669-6500 ext 5403 |
| X1A 2P8 | |

| REPORT TO | | REPORT DISTRIBUTION | |
|---|---|---|---|
| DDMI ENVIRONMENT | | Electronic PDF | ✓ |
| DDMI.ENVIRONMENT@RIOTINTO.COM | | Electronic Excel | ✓ |
| REFERENCE LAB ID # | MAXXAM | Hard Copy | |

| SERVICE REQUESTED | | INVOICE TO | |
|---|---|---|---|
| Regular (Default) | ✓ | DDMI ACCOUNTS PAYABLE | |
| Priority (50% Surcharge) | | DDMI.AP@RIOTINTO.COM | |
| Emergency (100% Surcharge) | | Reference PO # | K30524 (Maxxam 2015) |

SAMPLE INFORMATION / ANALYSIS REQUESTED

| Identification | Project | Collected By | Date | Type | Routine Parameters: (pH, EC, Acidity, Alkalinity, Fl, K, Cl, SO4, PO4, NO2, NO3, Dissolved Phosphorus, TDS) | Nutrients: (Ammonia, Total Phosphorus, TKN) PRESERVED | TOC (Total Organic Carbon) - analysis to be taken from the 120mL Nutrients bottle | DOC (Dissolved Organic Carbon) UNFILTERED & UNPRESERVED | TotalMetals Low Level +Sb,Se PRESERVED | Total Mercury PRESERVED | Dissolved Metals Low Level + Sb,Se UNFILTERED & UNPRESERVED | Dissolved Mercury - UNFILTERED & UNPRESERVED | Oil & Grease and Mineral Oil & Grease PRESERVED | Biochemical Oxygen Demand (BoD) | BTEX -F1 (3 x 40 mL pre-preserved) | F2 - F4 (250 mL Amber pre-preserved) | Fecal Coliforms (2 bottles pre-preserved) | | TSS, Turb, pH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SSC-2 MB8416 | SNP-A | DD/SS/I | 2015-Apr-08 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS4-5-4 MB8417 | SNP-A | DB/DD | 2015-Apr-08 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS4-5-5 MB8418 | SNP-A | DB/DD | 2015-Apr-08 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS4-4 MB8419 | SNP-A | DD/SS | 2015-Apr-08 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SSC-3 MB8420 | SNP-A | DB/SS | 2015-Apr-05 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
| SS3-8 MB8421 | SNP-A | JG/DB | 2015-Apr-05 | GW | ✓ | ✓ | | | ✓ | ✓ | | | | | | | | | ✓ | |
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B531410

| SAMPLE CONDITION (Shipped) | | | SPECIAL INSTRUCTIONS | SAMPLE CONDITION (Received) | | |
|---|---|---|---|---|---|---|
| TEMP°C | FROZEN | | | TEMP°C | FROZEN | |
| 5.0 | COLD | ✓ | 30 bottles total keep cool do not freeze | 6,7,6 | COLD | |
| | AMBIENT | | | | AMBIENT | |
| RELINQUISHED BY: KG | | | DATE / TIME: 2015-Apr-16 | RECEIVED BY: Jena Walter 20150417 | DATE / TIME: 1009 | |

Doc # ENVI-140-0112 R0

ice/Seal present

Report Uploaded to MP5: Relinquished: FIONA CHANGIRWA 20150417 10:26

8,6,6 apr/8/15

MARILOU TRUANT 10:45

CS ✓

Data Checked for Breaches:

# *Appendix E*

## *Dust Gauge Collection Standard Operating Procedure*

DIAVIK DIAMOND MINE

**2015 Dust Deposition Report**

# ENVIRONMENT
# STANDARD OPERATING PROCEDURE

| | | | |
|---|---|---|---|
| **Area No.:** | **8000** | **Document #:** | **ENVR-508-0112** |
| | | **Revision:** | **0** |
| **Task Title:** | **SOP – Dust Gauge Collection** | | |
| | Supersedes ENV SOP 508 | | |

**FOR DOCUMENT CONTROL USE ONLY:**
**Next Review:** **1 year from Area Manager Authorized Signature Date below**
**Effective Date:** **See Area Manager Authorized Signature Date below**

## 1 REFERENCES/RELATED DOCUMENTS

1.1 **ENVI-178-0312 - Dust Gauge Collection Field Sheet** – Located in: P:\DDMIEnvironment\10.0 Operational Control\10.2 Forms\2012 Active Forms

1.2 **ENVI-403-0112 R0 - SOP Total Suspended Solids** - Located in: Diavik Intranet - SOPs – Environment Folder

1.3 **ENVR-301-0112 – SOP General Laboratory Safety** - Located in: Diavik Intranet – SOPs – Environment Folder

1.4 **ENVR-605-0112 R0 - SOP Snowmobiles** – Located in: Diavik Intranet – SOPs – Environment Folder

1.5 **ENVR-602-0112 R0 - SOP Watercraft** – Located in: Diavik Intranet – SOPs – Environment Folder

1.6 **ENVR-504-0112 R0- SOP Remote Field Safety** – Located in: Diavik Intranet – SOPs – Environment Folder

1.7 **ENVR-601-0112 R0 – SOP Aircraft -** Located in: Diavik Intranet – SOPs – Environment Folder

1.8 **ENVI-135-0112 R0 - Remote Field Safety Permit Form** – Located in: P:\DDMIEnvironment\10.0 Operational Control\10.2 Forms\2012 Active Forms

**Revision History**

| Revision | Revision Description | Date of Revision | Author |
|---|---|---|---|
| 0 | Initial Release | 11-Jan-12 | D. Meredith |
| | | | |
| | | | |
| | | | |

**Authorized By:**

| | | |
|---|---|---|
| **Area Superintendent:** | D. Wells | **Date:** |
| **Area Manager:** | S. Bourn | **Date:** |

(Document owners will be prompted annually to update content, however, changes may or may not result.)

Dust5

## Description

Dust gauge collections involves twelve dust gauge stations including two control stations. Dust gauges are monitored quarterly; in order to measure dust deposition at stations surrounding Diavik Mine site.

## 2 PURPOSE

The purpose of this Standard Operating Procedure is to outline the methodology for collecting dust gauges. This program is aimed at understanding dust deposition rates associated with project activities. Results collected for this program are complied and placed in the Appendix for the annual AEMP report.

## 3 SCOPE

### 3.1 Scope of Procedure

There are 12 dust gauges (10 stations, plus 2 control), established on and around East Island for monitoring airborne dust particles. All dust gauges should be collected quarterly during both summer and winter. . Before heading out, be sure to check the clean replacement tubes for leakage by filling them with water and placing them in the sink. If they leak, they must be repaired with acrylic epoxy before use. A map illustrating coordinates and where the gauges are located is on the last page of this SOP.

| STATION | EASTING | NORTING | STATION | EASTING | NORTING |
|---|---|---|---|---|---|
| **Dust 01** | 533964 | 7154321 | **Dust 7** | 536819 | 7150510 |
| **Dust 2A** | 535678 | 7151339 | **Dust 8** | 531401 | 7154146 |
| **Dust 3** | 535024 | 7151872 | **Dust 9** | 541204 | 7152154 |
| **Dust 4** | 531397 | 7152127 | **Dust 10** | 532908 | 7148924 |
| **Dust 5** | 535696 | 7155138 | **Dust C1** | 534979 | 7144270 |
| **Dust 6** | 537502 | 7152934 | **Dust C2** | 528714 | 7153276 |

## 4 DEFINITIONS

N/A

## 5 RESPONSIBILITIES

### 5.1 Environment Superintendant

It is the responsibility of the superintendent to ensure that satisfactory provisions for safety and health are made for remote field activities by:

- Instituting, maintaining and communicating this procedure and ensuring technical best practice requirements are properly incorporated;
- Ensuring that the responsibilities for safety and health are communicated to all participants;
- Ensuring that the risks associated with remote field activities are managed effectively;
- Providing appropriate information, instruction and training to all participants

### 5.2 Environment Supervisor

The Environment Supervisor has a responsibility to ensure that:

- All personnel have read and understand the appropriate SOPs
- Ensuring proper tools are used for risk management (JHAs, Take5s, Hazard IDs)
- All legal requirements are followed
- All equipment and PPE required for the sampling program are available and have had the scheduled maintenance and repair completed
- The appropriate quality control/quality assurance practices are followed
- All personnel have completed the required training before completing the tasks assigned

### 5.3 Technicians and Contractors

Each staff member, student and contractor has a moral and legal responsibility for ensuring that his or her work environment is conductive to good health, safety and environment practices by:

- Complying with all standard operating procedures;
- Undertaking relevant safety and health training;
- Reviewing and becoming familiar with all related documents and reference material;
- Taking action to eliminate, minimize, avoid and report hazards of which they are aware;
- Making proper use of all safety devices and PPE;
- Not placing at risk the safety and health of themselves or any others;
- Ensuring all equipment is maintained and in a safe working condition;
- Ensuring samples are obtained using proper quality assurance and control procedures;
- Attending and participating in daily Field Work Planning sessions;
- Documenting any safety or procedural issues that occur during the program
- Ensuring all field equipment is in good repair and ready to work

## 6 PROCEDURE

### 6.1 Key HSEQ Aspects

#### 6.1.1 Remote field work/Environmental Exposure

When travelling further in to the field, the completion of a detailed Remote Field Work Permit ENVI-135-0112 , is mandatory. The plan must be signed by all field personnel as well as the on-site supervisor, and a copy made available to the field crew as well as on-site staff. Environmental exposure can be a significant risk for those who are unprepared. Risks are seasonal, and winter time considerations include frost nip/frostbite, hypothermia, dehydration, windburn, sunburn and snow blindness. Summer time risks include heat exhaustion/heat stroke, insect bites, dehydration, sunburn, windburn and hypothermia (due to cold water exposure/submersion). During winter it is extremely important to dress appropriately for the conditions and bring extra clothing and winter gear with you. Conditions can quickly change in this area; be prepared and continuously monitor the weather while you work. If you notice a front moving in, ensure you allow enough time to get back to site. If you do not think that you can get back to site, consider alternative areas for shelter. The waypoint file GPS_Essentials on the p-drive should be uploaded into all GPS's; this file contains coordinates for many alternative shelters around Lac de Gras. If you must wait out the storm at your present location, prepare your survival kit and erect a temporary, make-shift shelter. Always be sure to communicate your plans to your on-site designate so that they are aware of the situation and can begin to coordinate a response as required. Environment staff are the first choice for on-site designate. If they are not available, a Safety representative would be assigned this role.

#### 6.1.2 Equipment Operation and Break Downs

Operating equipment in this environment can involve risks such as: collision with rocks or other equipment, rollovers, spinning out/loss of control, machine fire, exhaust inhalation, vibration impacts, hearing damage, muscle sprains/strains, spills, cold water submersion (due to man-overboard, boat accident, aircraft crash or falling through the ice), aircraft crash, getting lost and becoming stranded in unfavourable conditions. In order to control these risks, it is important to conduct all required mechanical inspections prior to using equipment for field work. Ensure all field equipment is well maintained throughout the season, and that you are familiar with machine operation and basic field maintenance. Also ensure that you have and use the correct PPE for the equipment you are using. A survival kit must be carried for work farther afield; know the contents of this kit and wilderness survival skills.

### 6.2 Tools Required

| | | |
|---|---|---|
| Clean Replacement Cylinders | | Glass Beakers (1000 mL) |
| Large/Clear/Heavy-duty Plastic Bags | | TSS Filters |
| Duct Tape | | High Temp Oven |
| Permanent Marker | | Fire Proof Gloves/Tongs |
| Map/GPS With Coordinates | | Tweezers |
| Multi-tool (Leatherman) | | Boat/Snowmobile (Seasonal) |
| Spot Locator / Satellite Phone | | Survival Kit |
| XL Latex Gloves | | |

### 6.3 Procedural Steps

#### 6.3.1 Sample Collection

- Samples are collected through various methods, depending on location. You can walk, drive, boat, snowmobile or use helicopter to access the various sites. Be sure to bring clean tubes with you to replace the ones you will be collecting. Clean tubes are stored in the Environment field lab.
- Pull the copper tube out of the center of the fiberglass shield, keeping it upright. If the tube is stuck or frozen to the bottom, try wiggling it from the top, or tapping it with a multi-tool near the bottom. If it will not come free, you can remove the shield and then pop the tube out. Be sure to replace the shield and insert a new copper tube afterwards.

- Once you retrieve the tube, cover it right-side-up with a sampling glove and then with a large, heavy-duty plastic bag. Fold the bag around the tube and secure it to the tube using duct tape. Label the bag with the station number, date and time collected. Keep the tube upright and secure at all times during transport. If it is going to be a rough boat or sled ride, you may want to consider double-bagging the tube with one bag on top and another from below.
- (Summer Samples) Once sample tubes are back in the lab, the sample is transferred into a labeled glass beaker. Clear as much of the dried-on algae, dust, etc. that is found on the inside of the tube with distilled water and add it to the beaker. Run the water through the TSS analysis (ENVI-403-0112 R0). It may take multiple filters to complete one sample.
- (Winter Samples) Once sample tubes are back in the lab, let the snow melt within the tube by leaving them at room temperature secured in a cooler. Once all the snow has melted, transfer the sample into a labelled glass beaker. From here, follow the same procedures as those outlined above in summer collection.
- The resulting filter(s) with the dust particles are put into ceramic crucibles (1 filter per crucible) and dried in DDMI's high temperature oven at 650˚C for 1 hour. This will burn off any organic materials from the filter. You are required to wear heavy-duty fire-proof gloves and use a long set of tongs designed to hold the crucibles. The high temperature oven should be set up within the fume hood and be sure to turn on the fume hood fan. Ensure that you record the sample number on the crucibles <u>in pencil</u> before they are put into the oven.
- When samples are removed from the oven, Let the Crucibles initially cool, and then place the crucibles into the labeled tin tray that the filter originally came in. Place this combination into the dessicator to allow the sample to cool off for an hour at minimum.
- Once cooled, remove the filter from the crucible using tweezers and weigh only the filter according to the procedure outlined in the TSS analysis SOP ENVI-403-0112 R0 If any of the dust has fallen into the crucible during drying in the oven, be sure to tip the crucible and add this dust to the top of the filter prior to weighing.
- Record the results on the Dust Gauge Data Form (ENVI-178-0312).
- To determine the dustfall deposition rate, use the equation below:

***Daily Dustfall Deposition (mg/dm$_2$/d) = (TP (mg) / SA (dm$_2$)) / TDD (d)***

*Where:*

**TP (mg)** = Total Particulate

**SA (dm$_2$)** = Surface Area of Dust Gauge Collection Tube

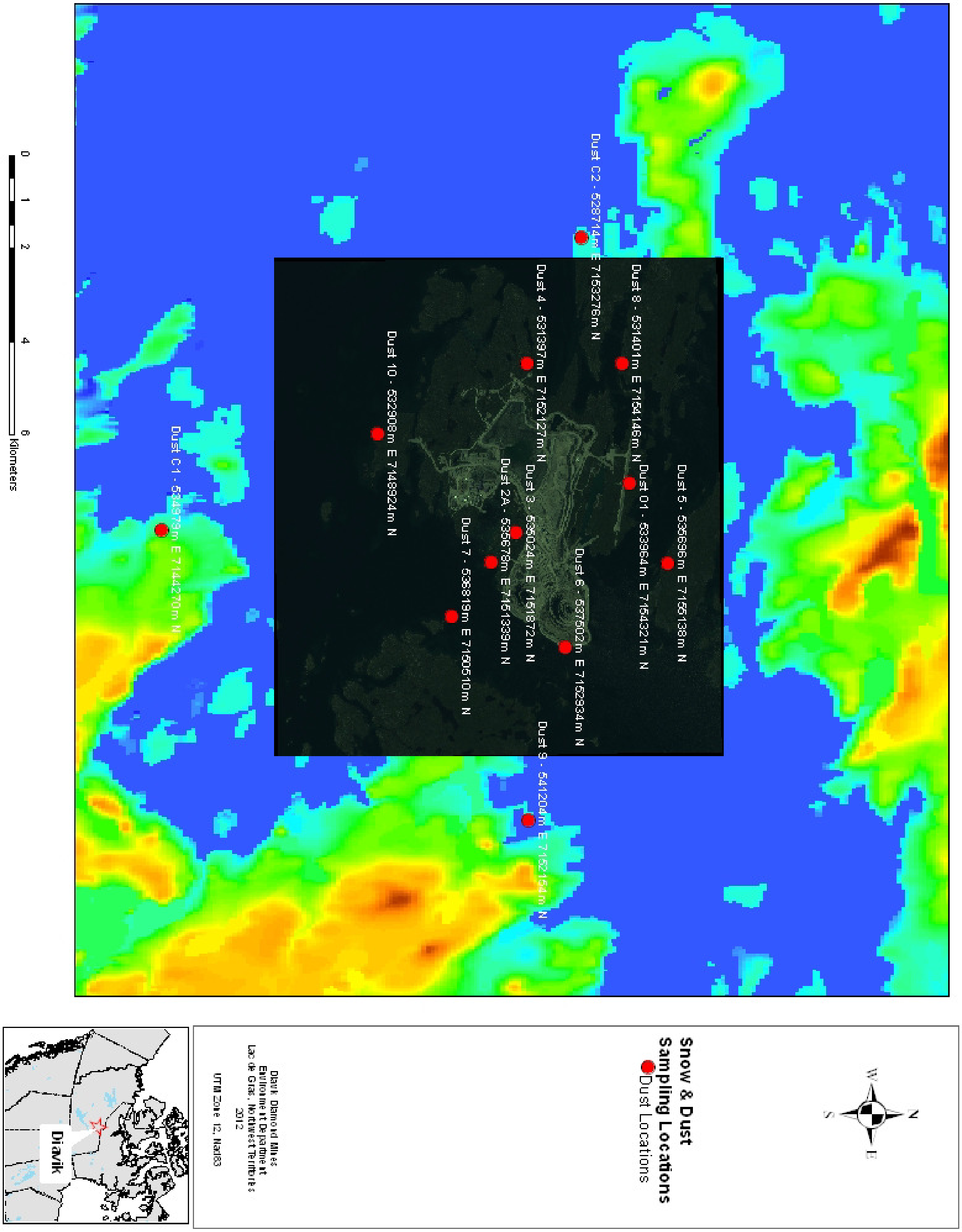
**TDD** = Total Days Gauge was Deployed

## 7 QUALITY OUTCOMES AND EXPECTATIONS

**7.1** This SOP will allow procedures to be conducted safely in order to avoid injury.

**7.2** Adherence to this SOP as well as reference to the related documents will ensure successful retrieval of the dust samples for analysis.

**7.3** It is also expected that all employees and contractors adhere to this SOP.


Dust C2 - 528714m E 7153276m N
Dust 8 - 531401m E 7154146m N
Dust 5 - 535696m E 7155138m N
Dust 01 - 533964m E 7154321m N
Dust 4 - 531397m E 7152127m N
Dust 6 - 537502m E 7152934m N
Dust 3 - 535024m E 7151872m N
Dust 2A - 535678m E 7151339m N
Dust 7 - 536819m E 7150510m N
Dust 10 - 532908m E 7148924m N
Dust C1 - 534979m E 7144270m N
Dust 9 - 541204m E 7152154m N
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Kilometers
Snow & Dust Sampling Locations
● Dust Locations
Diavik Diamond Mines
Environment Department
Lac de Gras, Northwest Territories
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Diavik

# *Appendix F*

## *Snow Survey Standard Operating Procedure*

# ENVIRONMENT
# STANDARD OPERATING PROCEDURE

| | | | |
|---|---|---|---|
| **Area No.:** | **8000** | **Document #:** | **ENVR-512-0213** |
| | | **Revision:** | **0** |
| **Task Title:** | **Snow Survey** | | |
| | *supersedes ENV SOP 512* | | |

**FOR DOCUMENT CONTROL USE ONLY:**
**Next Review:** **1 year from Area Manager Authorized Signature Date below**
**Effective Date:** **See Area Manager Authorized Signature Date below**

## 1 REFERENCES/RELATED DOCUMENTS

**1.1 ENVR-501-0112 – SOP Remote Field Safety -** Located in: Diavik Intranet – SOPs – Environment Folder

**1.2 ENVR-602-0112 - SOP Snowmobile Operation -** Located in: Diavik Intranet – SOPs – Environment Folder

**1.3 ENVR-301-0112 - SOP General Laboratory Safety -** Located in: Diavik Intranet – SOPs – Environment Folder

**1.4 ENVR-303-0112 - SOP Quality assurance and Quality Control -** Located in: Diavik Intranet – SOPs – Environment Folder

**1.5 ENVR-206-0112 - SOP Chain of Custody and Sample Shipment -** Located in: Diavik Intranet – SOPs – Environment Folder

**1.6 ENVR-403-0112 - SOP Total Suspended Solids Analysis -** Located in: Diavik Intranet – SOPs – Environment Folder

**1.7 ENVI-099-1011- Snowmobile Inspection Checklist -** Located in: P:\DDMI Environment\10.0 Operational Control\10.2 Forms\2012 Active Forms

**1.8 ENVI-135-0112 R0 – Remote Field Safety Permit -** Located in: P:\DDMI Environment\10.0 Operational Control\10.2 Forms\2012 Active Forms

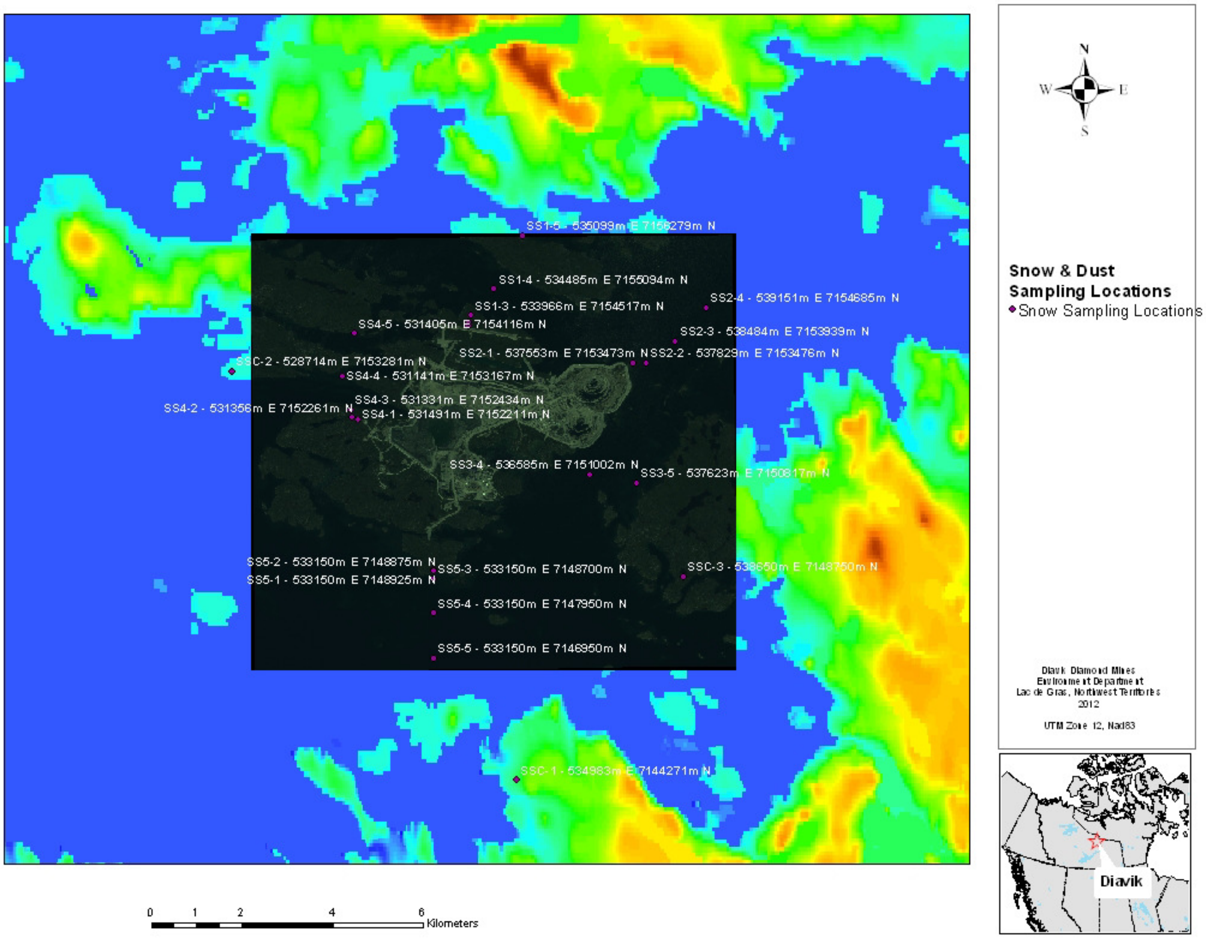
**1.9 ENVI-177-0312 R0 – Snow Sampling Field Sheet -** Located in: P:\DDMI Environment\10.0 Operational Control\10.2 Forms\2012 Active Forms

**Revision History**

| Revision | Revision Description | Date of Revision | Author |
|---|---|---|---|
| 0 | Original Issue | 08-FEB-2012 | D.Grabke |
| | | | |
| | | | |
| | | | |

| Authorized By: | | |
|---|---|---|
| **Area Supervisor:** | Type names (example) R. Morrison (signature will go beside name) | **Date:** |
| **Area Manager:** | Type name here – signature goes beside | **Date:** |

(Document owners will be prompted annually to update content, however, changes may or may not result.)



**Snow Survey Sample Program Map**

## Description

Snow sampling at the Diavik Diamond Mine consists of snow core sampling to monitor dust deposition rates relative to predictions outlined in the DDMI Environmental Effects Report (1998), and snow water quality sampling in support of the DDMI Aquatic Effects Monitoring Program (AEMP).

## 2 PURPOSE

The purpose of this guide is to promote efficient and accurate snow surveying and to establish uniform sampling procedures.

## 3 SCOPE

### 3.1 Scope of Procedure

This standard operating procedure (SOP) describes the responsibilities and processes for collecting, documenting, and processing snow samples from at the Diavik mine site a surrounding Lac de Gras area (during ice cover). This procedure applies to all Diavik Diamond Mines personnel and contractor personnel authorized to collect samples under the current years Aurora Research Institute – Aquatic Effects Monitoring Program (AEMP) Research Permit.

### 3.2 Scope of Activities

This procedure has been developed to be consistent with the requirements of the AEMP design document and Environmental Effects Monitoring.

## 4 DEFINITIONS

### 4.1 QA/QC

- quality assurance/quality control. Methods undertaken to ensure sampling procedures and handling are accurate and precise. QA/QC can also refer to a type of sample used to assess field and laboratory performance, e.g. duplicate samples.

## 5 RESPONSIBILITIES

### 5.1 Environment Superintendent

**It is the responsibility of the superintendent to ensure that satisfactory provisions for safety and health are made for remote field activities by:**

- Instituting, maintaining and communicating this procedure and ensuring technical best practice requirements are properly incorporated;
- Ensuring that the responsibilities for safety and health are communicated to all participants;
- Ensuring that the risks associated with remote field activities are managed effectively;
- Providing appropriate information, instruction and training to all participants;

### 5.2 Environment Supervisor

The Environment Supervisor has a responsibility to ensure that:

- All personnel have read and understand the appropriate SOPs

- Ensuing proper tools are used for risk management (JHAs, Take5s, Hazard IDs)
- All legal requirements are followed
- All equipment and PPE required for the sampling program are available and have had the scheduled maintenance and repair completed
- The appropriate quality control/quality assurance practices are followed
- All personnel have completed the required training before completing the tasks assigned

### 5.3 Environment Technicians and contractors:

Each staff member, student and contractor has a moral and legal responsibility for ensuring that his or her work environment is conductive to good health, safety and environment practices by:

- Complying with all standard operating procedures;
- Undertaking relevant safety and health training;
- Reviewing and becoming familiar with all related documents and reference material;
- Taking action to eliminate, minimize, avoid and report hazards of which they are aware;
- Making proper use of all safety devices and PPE;
- Not placing at risk the safety and health of themselves or any others;
- Ensuring all equipment is maintained and in a safe working condition;
- Ensuring samples are obtained using proper quality assurance and control procedures;
- Attending and participating in daily Field Work Planning sessions;
- Documenting any safety or procedural issues that occur during the program.

## 6 PROCEDURE

### 6.1 Key HSEQ Aspects

Sampling requires physical labour in a cold environment with potentially inclement weather. All field personnel must be trained to recognize signs of frostbite, hypothermia, fatigue and heat stress; and avoid these symptoms with proper hydration, dress, and work schedules.

Due to the remote nature of sampling locations, all field personnel are to use extreme caution, and must be equipped with appropriate personal protective equipment. This may include cut resistant & latex gloves, hearing protection, safety glasses and emergency survival kits.

Field personnel must be competent, with appropriate training, skills and experience required to carry out the activities safely. Fieldwork requires an awareness of potential hazards and common sense. Under no circumstances should field work be conducted alone, and participants must always be aware of changing weather conditions.

Completion of a detailed Field Work Permit is mandatory prior to undertaking any off-site activities. The plan must be signed by all field personnel as well as the on-site supervisor, and a copy made available to the field crew as well as on-site staff.

Prior to initiating any off-site sampling programs, personnel must be familiar with the Remote Field Safety ENVR-501-0112

## 6.2 Planning

### 6.2.1 Program Management

The sampling snow survey will be completed annually in April. The survey design consists of 24 sample stations, including 3 control areas established along 5 transect lines originating from East Island and extending onto Lac de Gras.

**Table 1 - Snowcore Sampling Locations**

| Transect Line | Station | UTM E (NAD 83) | UTM W (NAD 83) | Description |
|---|---|---|---|---|
| 1 | SS1-1 | 533911 | 7154288 | Land |
| | SS1-2 | 533924 | 7154367 | Land |
| | SS1-3 | 533966 | 7154517 | Land |
| | SS1-4 | 534485 | 7155094 | Ice |
| | SS1-5 | 535099 | 7156279 | Ice |
| 2 | SS2-1 | 537553 | 7153473 | Ice |
| | SS2-2 | 537829 | 7153476 | Ice |
| | SS2-3 | 538484 | 7153939 | Ice |
| | SS2-4 | 539151 | 7154685 | Ice |
| 3 | SS3-4 | 536585 | 7151002 | Ice |
| | SS3-5 | 537623 | 7150817 | Ice |
| 4 | SS4-1 | 531491 | 7152211 | Land |
| | SS4-2 | 531356 | 7152261 | Land |
| | SS4-3 | 531331 | 7152434 | Land |
| | SS4-4 | 531141 | 7153167 | Ice |
| | SS4-5 | 531405 | 7154116 | Ice |
| 5 | SS5-1 | 533150 | 7148925 | Land |
| | SS5-2 | 533150 | 7148875 | Land |
| | SS5-3 | 533150 | 7148700 | Ice |
| | SS5-4 | 533150 | 7147950 | Ice |
| | SS5-5 | 533150 | 7146950 | Ice |
| | Control 1 | 534983 | 7144271 | Land |
| | Control 2 | 528714 | 7153281 | Land |
| | Control 3 | 538650 | 7148750 | Land |

### 6.2.2 Sampling Requirements – Dust Deposition

Dust deposition will be measured in-house using standard DDMI Total Suspended Solids laboratory procedures ENVR-403-0112. To facilitate this analysis, a composite sample comprised of a minimum of 3 snow cores will be collected at **ALL** (land and Ice) of the snow sampling stations. In areas with low snow pack a minimum of 35 SWE should be collected to a sufficient volume of water is available for processing. This may require more than the minimum 3 cores.

### 6.2.3 Sampling Requirements – Snow Water Quality

Snow water quality samples are required for all sample stations on Lac de Gras identified as **on-ice** locations, as well as at the **three control** areas Table 1 - Snowcore Sampling Locations. Snow chemistry analysis will be conducted by Maxxam Analytics. To facilitate the required analysis Table 2- Snow Water Quality Sample Requirements, a composite sample comprised of a minimum of 3 snow cores will be collected at all of the snow water quality stations.

**Table 2- Snow Water Quality Sample Requirements**

| Maxxam Bottle | Analysis | Minimum Volume of Sample Required (ml) | Preservative |
|---|---|---|---|
| Metals | Total ICP Metals (Ultra Low) | 120 | 1ml Nitric Acid – $HNO_3$ |
| Nutrients | Ammonia | 120 | 0.5 ml Sulfuric Acid |
| Routine | Sulfates, Nitrates, and Nitrites | 1000 | None Required |
| TSS, Turbidity & pH (Routine, 2nd Bottle) | TSS, Turbidity & pH | 1000 | None Required |
| Total Sample Volume Required | | 2240ml + 30% Triple Rinse | **3000ml = 100SWE** |

**Determining anticipated sample volume from Snow Water Equivalent (SWE)**
**Sample Water (ml) = SWE (cm) x 30(cm$^2$)**
**3000ml /30cm$^2$ = SWE = 100cm SWE**

**Therefore the aggregate SWE collected at a sample site must be at lease 100cm to ensure sufficient volume for water quality analysis.**

## 6.3 Quality Assurance and Quality Control

Quality Control will be achieved through the use of duplicate and blank samples.

- Duplicate samples will be collected for a minimum 10% of the total samples (both Dust and Water Quality).

- At least **two** duplicate samples for the **dust** deposition samples
- At least **two** duplicate samples for the **water quality** samples
- One **equipment blank** will be collected and processed by Maxxam for water quality chemical analysis. Maxxam DI water batch number will be recorded on the field sheet. Equipment blank will be completed from a single batch of DI water. Ensure that information from the DI water is recorded on the field sheet. Batch ID and Expiry date.

Quality assurance will be achieved via the following processes;

- Field data sheets will be utilized to document any and all observations, or occurrences that may impact the integrity of the samples, as well as corrective actions implemented to deal with those occurrences.
- If a sample becomes compromised, it will be recorded on the field data sheet, the sample will be discarded and a new sample collected.
- Individuals collecting the samples will take precautions to eliminate sample contamination during handling. Avoid touching insides of sample bags, avoid contacting the snow samples with anything other than the sampling corer.

Steps will be taken prior to, during, and after sampling to ensure all samples are correctly labeled with the sample date, sample ID, and sample type.

### 6.4 Equipment Inspection & Preparation

Prior to commencing the sampling program, inspect all sampling equipment for fouling, contamination, or damage. All of the polyacrylic tubes that will be utilized will be rinsed with a 10% Nitric Acid solution to ensure they are clean prior to the initiation of the program.

**Snow Corer** – Inspect the core tube to ensure measurement etchings are legible. Check the cutting edge to ensure blade is not deformed or damaged. Inspect the handles and threads to ensure they will assemble and disassemble without binding. Ensure the corer has been de-contaminated (acid rinsed) prior to commencing the program.

**Weighing Scale and Cradle** – Inspect the scale and cradle for deformity or damage

**Snowmobiles –** Inspection and use of snowmobiles will be in accordance with ENVR-603-0112

**Communication** – Inspect all communication equipment (Radios/Sat Phones, Spot Personal Locator) to ensure they are operational and functional. Ensure batteries (including spares) are fully charged. Ensure check-in times and procedures are clearly identified on the Field Work Permit.

**Navigation** – Inspect GPS and spare batteries to ensure equipment is functioning correctly. Verify that all sample locations are present and correct, and that the GPS Essentials file is loaded. Ensure an appropriate map is present to allow navigation back to site should the GPS fail.

**Personnel Gear** – In addition to winter survival equipment, each individual participating in off-site activities is expected to carry appropriate personal gear and equipment as is deemed necessary for the individual well being in an emergency situation.

**Survival Kit** – Inspect survival kit and Ice Rescue kits to ensure that they are complete and all items are functional and ready for use.

**Misc –** Individual core samples will be compiled into plastic bags (soil sampling bags) and sealed with zip-ties until they are ready for processing. Prior to the program commencing bags must be inspected to ensure they are new and clean.

## 6.5 Tools Required

**Table 3 - Tools and Gear Required**

| | | | |
|---|---|---|---|
| | Snow Corer & Handles | | Snow Survey Map |
| | Transport Case | | GPS & Waypoints |
| | Weighing Scale & Cradle | | Satellite Phone |
| | Sample Collection Bags & Zip Ties | | Spot Personal Locator |
| | Black Permanent Marker | | Survival Kit |
| | Field Data Sheets (Pens/Pencils) & Clipboard | | Ice Rescue Kit |

## 6.6 Procedural Steps

### 6.6.1 Sample Collection

Navigate to the sampling locations – If the sample point falls on or immediately adjacent to the winter road adjusts your location to the nearest area with natural snow coverage (ie not impacted by the road or snow clearing).

Assemble the corer by threading the handles onto the tube, and re-inspect the snow corer for fouling and/or damage that may have occurred during transportation.

Fill in station location and weather information on the field data sheet. Identify snow conditions and dust observations in the comments section.

Prior to collecting a sample re-inspect the tube to check for cleanliness.

- **Take the weight of the empty snowcorer at each station prior to collecting any samples.**
- **For all station requiring snow water chemistry, collect the dust sample first – this will effectively rinse the corer with ambient snow minimizing cross contamination from locations.**

Hold the corer vertically (cutter end down) and drive it through the snow to the ground/ice surface below. Be sure the cutter contacts the ground/ice as compacted snow/ice may feel like the ground and result in an incomplete core.

Before raising the corer, read the depth of the snow (nearest cm) and record on the field datasheet.

Turn the corer at least one full turn to cut the core loose from the ground/ice surface. Carefully raise the corer and record the length of the core extracted. [ Note: this could potentially be different from the depth of snow, see next]

Inspect the cutter end of the tube for dirt or litter, with gloves on carefully remove soil and litter from the core. If need be correct the length of the core extracted by subtracting the depth of the soil or litter (plug). Record adjusted core length and litter/soil observations on the field data sheet.

Carefully balance the corer containing the core on the weighing cradle.

- **Suspend the corer (like a pendulum) do not hold the corer tube or handles**

To ensure and accurate reading, gently tap the scale to be sure it is not sticking or binding.

Read the weight of the tube and core from the graduations on the scale. The scale is marked in cm of water.

Record the weight of the corer and the core to the nearest one-half cm.

To collect the core, lift the tube from the cradle and turn cutter und up. Gently tap the corer and the extracted core will slide out the top end. Be sure to use a clean/new sample bag to catch the core sample.

- **Ensure all sample bags are clearly labelled with the station ID, sample type, date, and number of cores included in the composite**
- **Ensure all bags are sealed using a clean zip-tie**

Weigh the empty sampling tube following the first and at least every fourth sample as the weight will change as small particle of water or snow accumulate/cling to the inside and outside of the tube and checking will make the data more accurate. Record the weight of the empty corer on the field data sheet.

Subtract the weight of the empty tube from the weight of the tube and core to obtain the water content of the sample.

Density calculations can be completed back in the lab following the completion of the program.

**Density (g/cm$^3$) = Total SWE Collected (g/cm$^{2*}$) / Total Snow Core Length Collected (cm)**

***assumes pure water density 1g/cm$^3$**

Prior to moving to the next sampling location ensure the field datasheet is complete.

### 6.6.2 Sample Processing

Prior to processing, all samples must be kept in a frozen state to minimize sample degradation.

When preparing the samples for decanting and analysis, remove the sample bags from the freezer. Check to ensure that the top of the bag is well twisted and the zip-tie is tight. Place the sample bag into a new (clean) sample bag and affix a zip-tie to seal the second bag. This double bagging will help to ensure no sample is lost during the melting process. To process samples, they will require anywhere from 12-36 hours to thaw at room temperature.

Place the sealed sample bags upright in clean coolers in the lab to thaw overnight.

Once a sample is completely melted it is ready for processing.

Sample volume can be determined using a scale accurate to 1g, set up scale, tare the sampling basin with two bags and 2 zip-ties. Place sample bags in the basin and record the weight of each of the bags on the field sheet.

Dust deposition samples will be processed in the DDMI Lab for TSS.

- **The entire volume of sample must be processed – this may require the use of multiple filters.**
- **For samples with large quantities of organics (twigs/leaves etc.) it may be necessary to sieve the sample through a course filter prior to processing.**
- **Given the possibility of the samples containing organic matter, sample filters will be dried in the high temperature oven (650°F) for 1hr to burn off any organics on the filter.**
- **Allow Samples to cool in the desiccator prior to weighing the filters.**

Snow Water Quality samples will be decanted to fill the appropriate (pre-labelled) Maxxam sample bottles as per standard water sampling procedures. Any excess sample water can be discarded.

### 6.6.3 Sample Chain of Custody

For all samples collected, a complete, accurate and clearly legible field data sheet must be filled out.

All samples collected must be logged in the Environment Sample Bible immediately following return to the office.

Results from DDMI Lab TSS analysis are to be recorded on the field sheet and electronically input into the MP5 database.

Prior to placing any field samples into the lab refrigerator or freezer for storage, field personnel must recheck all bag labels to ensure accuracy.

Prior to placing any Maxxam samples into the lab refrigerator for storage, personnel must recheck all bottle labels to ensure accuracy.

Samples will be shipped to Maxxam Analystics as per ENVR-206-0112 – CHAIN OF CUSTODY & SAMPLE SHIPPING – and accompanied by CoC documentation.

## 7 QUALITY OUTCOMES AND EXPECTATIONS

- Successful completion of the Snow Sampling program
- No safety or environmental incidents for the duration of the program
- No errors in sample labelling, shipping and analysis
- Thorough documentation on field datasheets, COCs and program sample schedule

# *Appendix B*

## *Total Suspended Particulates Sampler Support Memorandum*

# Memorandum

**Date:** February 26, 2016

**To:** David Wells, Superintendent - Environment - HSE

**From:** Philip Porter, Senior Atmospheric Scientist

**Cc:** Jem Morrison, Atmospheric Scientist
Benjamin Beall, Project Manager
Marc Wen, Partner In Charge

**Subject:** DRAFT - Total Suspended Particulates Sampler Support Memorandum

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## 1. BACKGROUND

Diavik Diamond Mine (2012) Inc. (DDMI) installed two continuous total suspended particulate (TSP) samplers at the Diavik Diamond Mine (Mine) in accordance with their Environmental Air Quality Monitoring Plan (EAQMP; DDMI 2013) in June 2013. The locations of the monitors were selected based on proximity to the Mine boundary, with careful consideration of the TSP results from the updated air dispersion modelling assessment, and in consideration of the availability of power (DDMI 2013).

It is ERM's understanding based on discussions with DDMI that the TSP samplers have been returning inconsistent results since installation in 2013. DDMI has requested technical assistance with TSP sampler maintenance, calibration, and audits as well as data screening, analysis, and reporting.

## 2. INTRODUCTION

In February 2016, DDMI requested ERM initiate a trip to the Property to perform maintenance and troubleshoot operational issues on the two TSP samplers at the Mine. Remote downloads and historical data analysis showed that specific alarms and data anomalies have been frequent. The vendor of the TSP samplers, CD Nova, was contracted by DDMI to facilitate troubleshooting, calibrate the instruments, and train ERM and DDMI employees on the maintenance and calibration of the samplers.

Prior to the visit to the Mine, DDMI personnel provided ERM and CD Nova with raw particulate data with alarm codes resulting from the issues being observed by DDMI personnel. These issues included TSP concentration values below 0.0 $\mu g/m^3$ (negative values), the inability to connect remotely, and issues with screen operation of one of the TSP samplers.

Appendix A contains the field data sheets for the calibrations performed during the site visit. Appendix B is the updated DDMI TSP sampler Standard Operating Procedure (SOP) updated by ERM personnel. Appendix C provides the service report provided by the CD Nova technician.

# 3. METHODS

## 3.1. Monitoring Locations

TSP monitoring is undertaken at two locations—one sampler is near the A154 Dike (along the south-east corner of the A154 pit) and the second sampler is within the Communications Building (CB) adjacent to the accommodations complex. The location of the A154 Dike monitor was selected based on the proximity to the boundary of the Mine footprint and the results of the updated air dispersion modelling assessment and power requirements. The site near the CB was selected based on its proximity to the boundary of the Mine footprint and the results of the updated air dispersion modelling assessment and power requirements. The approximate locations of the DDMI TSP stations are:

- CB TSP station coordinates: 12W 534460 7150847 (Google Earth Pro™)
- A154 Dike TSP station coordinates: 12W 537258 7152609 (Google Earth Pro™)

## 3.2. Monitoring Methods

The TSP monitors are SHARP 5014i instruments that measure TSP using beta attenuation. Ambient air is drawn through a subsonic orifice at a controlled flow rate; continuous mass measurements are conducted and hourly mass concentrations are calculated and stored in the iSeries platform data logging system. The sampling equipment is contained within a climate-controlled shelter to minimize data loss during extreme weather conditions as recommended by the manufacturer.

The monitoring of TSP concentrations mass loadings as micrograms/cubic meter (µg/m$^3$) is continuous, and hourly concentrations average values are recorded. TSP monitoring is conducted continuously over throughout the year. After each monitoring year, the monitoring program will be re-assessed to determine the suitability of the monitoring locations and to determine if the monitoring is still required. The analysis of temporal and spatial TSP trends support comparison to measured particulate concentrations at the CB to those at the A154 Dike. The readings at the CB are expected to consistently be higher than those at the A154 Dike due the communication building's proximity to many of the diesel combustion sources (boilers and power house), the processing plant and the run of Mine (ROM) ore stockpiles. There is the possibility that unusual events in the region (e.g., a dust storm transporting airborne particulate) could result in higher measured particulate concentrations at the A154 Dike.

Meteorological data plays a key role in the interpretation of air quality data; it informs the characterization of general air quality trends and shows specific meteorological conditions at the Mine (i.e., wind direction and speed) that directly affect the direction and dispersion of TSP. Unusual TSP events, which may be the result of conditions such as dust storms or prolonged dry periods, can be analyzed in conjunction with the on-site meteorological data to identify the cause of the event. Daily documentation of local events that may contribute to unusually high or low loadings will also be examined.

## 4. HISTORICAL DATA REVIEW

Historical data provided to ERM was subject to post processing and quality assurance and quality control (QA/QC) to determine possible systematic trends, correlations and potential issues with the TSP samplers in anticipation for the field component of the program. TSP monitoring data from 2013 and 2014 was contained in the DDMI 2013 – 2014 Environmental Air Quality Monitoring Report (DDMI 2014) and accompanying Peer Review of the 2013-2014 Environmental Air Quality Monitoring Report by SENES Consultants (SENES 2014). 2015 TSP data was provided to ERM in separate Excel spreadsheets for the CB and A154 Dike Stations.

SHARP 5014i monitor alarms codes observed in the data were:

- CB TSP Station alarm codes:
  - cflag:
    - 0 - No alarm
    - 200 - Ambient Relative Humidity alarm
    - 202 - Ambient Relative Humidity alarm, filter tape change alarm (critical) unit will not run until cleared.
    - 802 - Barometric pressure alarm, filter tape change alarm.
  - aflag:
    - 0 - No alarm
    - 4 - Beta. Det. alarm (>5K)
    - 8000 - Flow alarm
    - 8004 - Flow alarm, Beta Det. alarm
    - c000 - Sample Relative Humidity alarm, sample Temperature alarm
    - c004 - Sample Relative Humidity alarm, sample Temperature alarm, Beta Det. Alarm.
- A154 Dike TSP Station does not have any alarm codes headings programmed into downloadable data.

Another QA/QC examination of the TSP data is that of air flow, which is supposed to be at 16.67 litres per minute (l/min) and if the flow is out the range of 16 - 17.5 l/min then the data excluded on the basis of being inaccurate and is not included in the analysis of valid data.

### 4.1. 2013-2014 TSP Data Review

ERM found the following during the QA/QC of the 2013-2014 data:

- Both TSP Station concentrations show instances of continuous negative readings over the monitoring period. Continuous negatives readings indicate calibration issues with the monitoring equipment. Negative values were observed in July, November and December 2013, as well as January 2014 (SENES 2014).

- Graphical representation of 2013-2014 data suggests that instrument drift was a recurring problem over the entire monitoring period, especially for the A154 Dike monitor (SENES 2014).
- Based on the data, it appears that recorded results underestimated true TSP concentrations at the Mine in 2013-2014 (SENES 2014).
- ERM found that no calibration records or notable discussion of calibration procedures were provided in the 2013-2014 Environmental Air Quality Monitoring Report. Calibration certificates and records should be provided with the Report. Without these reports no baseline adjustments could be made to the 2013-2014 data especially for the A154 Dike Station.

### 4.2. 2015 TSP Data Review

ERM found the following during the QA/QC of the 2015 data:

*Communications Building TSP Station*

- On February 5, 2015 a 24 hour mean value of 124 µg/m$^3$ was recorded at the TSP monitor located at the Communications Building. This is above the Northwest Territories 24 hour standard for TSP. No observations were recorded on this day that would indicate a false reading; however, due to the magnitude of the value compared to the remainder of the dataset, it is believed this value is an outlier.
- There were 596 hourly data gaps in 2015 (up to December 24, 2015) at the CB Station.
- There were 1,164 negative hourly values recorded out of 7,991 valid values (missing data excluded). Any negative values greater than -5.0 µg/m$^3$ (936 in total) were set to zero (0).
- Using the *Alberta Air Monitoring Directive Chapter 6: Ambient Data Quality* a 24 hour monitoring period must have 75% of base hourly data available for averaging.
- Missing data, TSP values below -5.0 µg/m$^3$, and daily data with less than 75% hourly data available for averaging, represents 11% of the data recorded or a total of 40 missing days of data:
  - January 15 , 2015 (1 day);
  - June 1, 2015 (1 day);
  - October 1 to 2, and 8 to 10 2015 (4 days);
  - October 15 and 16, (2 days);
  - October 22 to November 6, 2015 (16 days);
  - November 11, 19 and 26, 2015 (3 days); and
  - December 3, 4, 10, 11, 18 to 24, 2015 (12 days).
- The CB TSP Station recorded:
  - 2 Ambient Relative Humidity alarms;
  - 16 Barometric pressure alarm or filter tape change alarms;
  - 496 Ambient Relative Humidity alarms;

  - 37 Sample Relative Humidity alarm, sample Temperature alarms;
  - 300 Flow alarms;
  - 4 Beta. Det. alarms (>5K);
  - 7 Flow or Beta Det. alarms; and
  - 1 Sample Relative Humidity alarm, sample Temperature alarm or Beta Det. alarm.

*A154 Dike TSP Station*

- There were 1369 hourly data gaps in 2015.
- There were 1,994 negative hourly values recorded out of 7,391 values (missing data not included). Any negative values greater than -5.0 µg/m$^3$ (1778 in total) were set to zero (0).
- Using the *Alberta Air Monitoring Directive Chapter 6: Ambient Data Quality* a 24 hour monitoring period must have 75% of base hourly data available for averaging.
- Missing data, TSP values below -5.0 µg/m$^3$, and daily data with less than 75% hourly data available for averaging, represents 34% of the data recorded or a total of 72 missing days of data:
  - January 1 to January 17, 2015 (17 days);
  - October 18 to October 21, 2015 (4 days);
  - October 25 to November 19, 2015 (26 days);
  - November 30 to December 11, 2015 (12 days); and
  - December 16 to 20 and 22 to 29, 2015 (13 days).
- The alarm codes were not programmed into the headings of the data received by ERM from DDMI.
- ERM was not provided calibration records or notable discussion of calibration procedures for 2015. Without these reports no baseline adjustments could be made to the 2015 data especially for the A154 Dike Station.

## 5. FIELD WORK SUMMARY

ERM conducted onsite field work on February 15 - 18, 2016. The purpose of the site visit was to inspect, calibrate and maintain/repair the DDMI TSP samplers. The following is a summary of the work completed at the site:

*Monday February 15, 2016*

- At the A154 Dike TSP Station, ERM:
  - brought the sampler and pump back to the environment department laboratory for inspection and performed a pump rebuild (Plate 1);
  - replaced the detector assembly and the detector amplifier assembly (Plate 2; Plate 3); and
  - relocated the pressure circuit board.

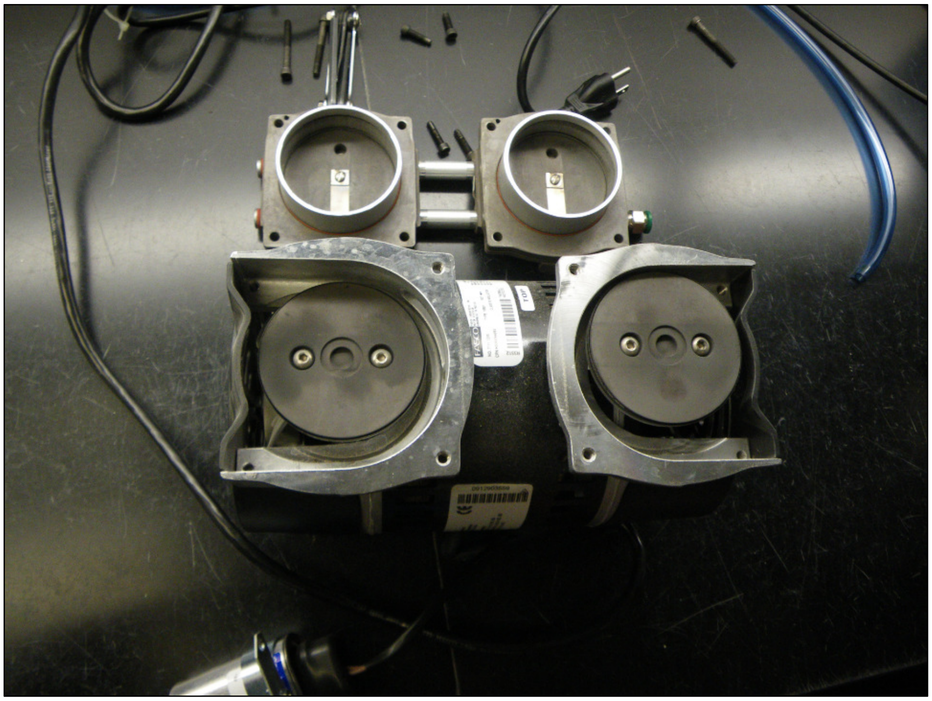

*Plate 1. A154 Dike TSP station pump rebuild.*

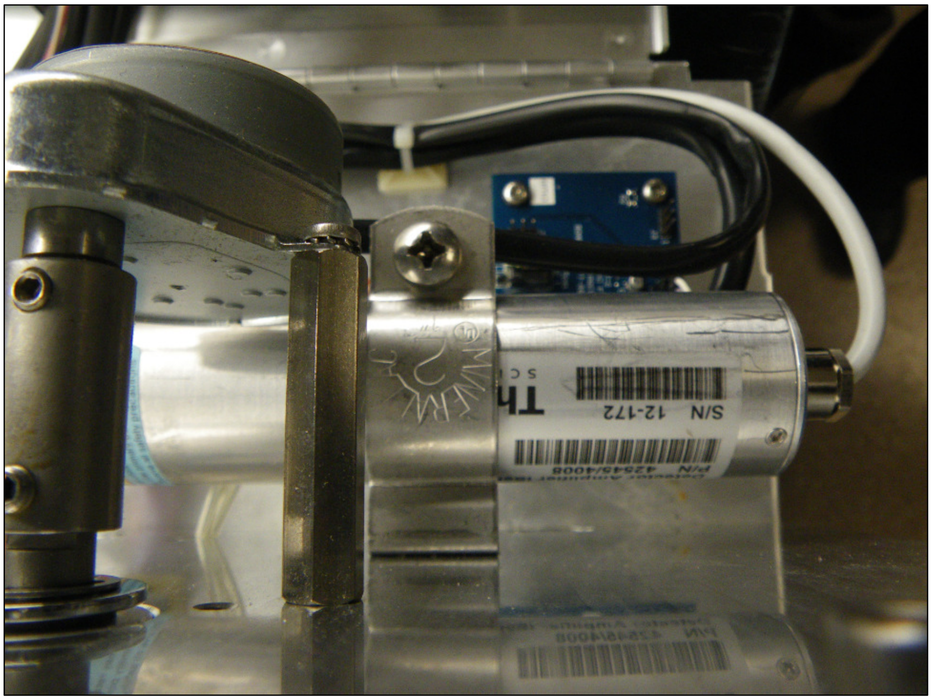

*Plate 2. A154 Dike TSP Station replaced beta detector amplifier assembly.*

*Plate 3. A154 Dike TSP Station replaced beta detector assembly.*

*Tuesday February 16, 2016*

- At the A154 Dike TSP Station, ERM:
  - performed a calibration audit;
  - set vacuum and pressure;
  - performed an auto beta calibration; and
  - performed a leak check which failed (Plate 4); and
  - replaced the motherboard.
- At the CB TSP Station, ERM:
  - completed a pump rebuild;
  - replaced the motherboard (Plate 5);
  - relocated the pressure circuit board;
  - completed a temperature, relative humidity and barometer calibration; and
  - calibrated the flow pressure and vacuum pressure.

*Wednesday February 17, 2016*

- At the CB TSP Station (Plate 6), ERM:
  - calibrated the flow temperature;
  - calibrated the air flow;
  - performed a mass calibration;
  - performed an auto detector calibration; and
  - successfully passed a leak check test.

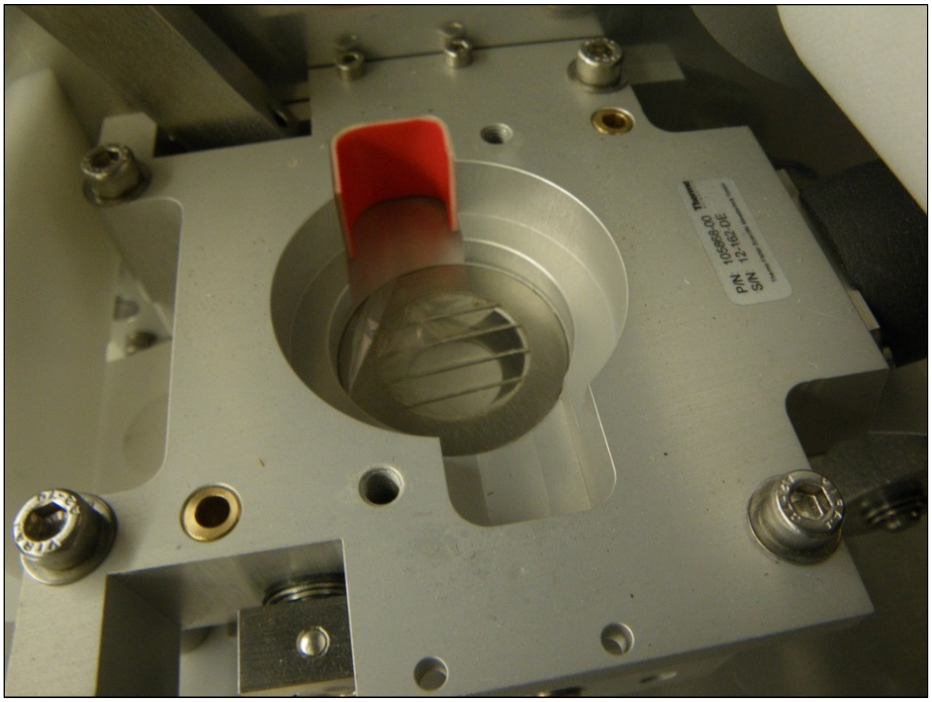

*Plate 4. The damaged membrane was noted during the maintenance. No additional parts were available. The A154 Dike was taken off site for further repair at the CD Nova location in Vancouver.*

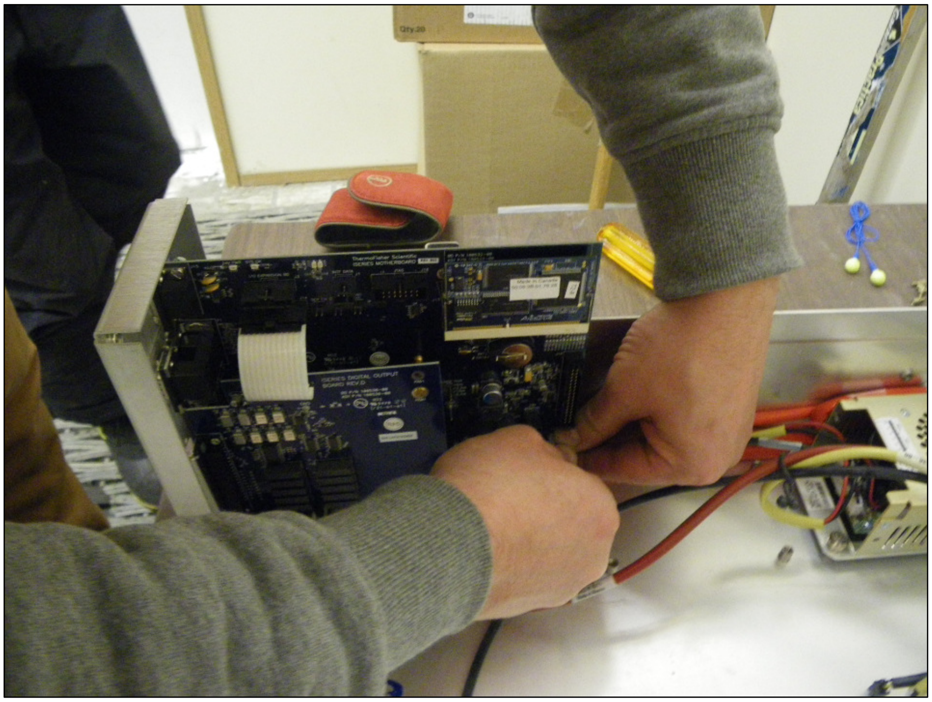

*Plate 5. CB TSP Station motherboard replacement.*

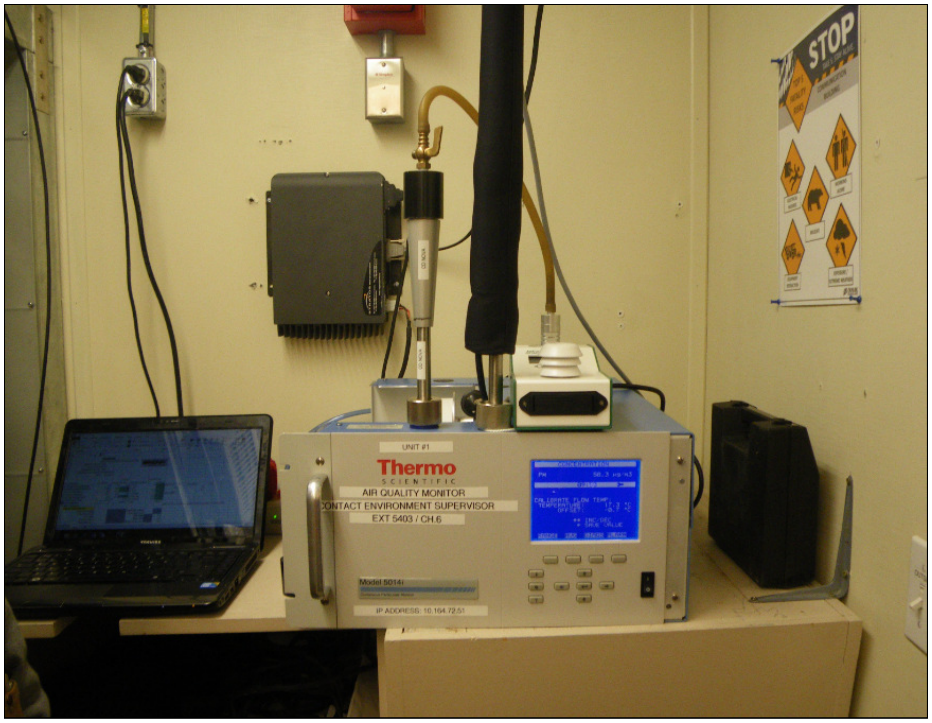

*Plate 6. CB TSP Station calibrations and leak test.*

*Thursday February 18, 2016*

- DDMI personnel could not connect remotely to the CB TSP Station. On arrival at the sampler, the screen had been frozen since 7:00 am. As observed by DDMI personnel this time in the day is frequently when the sampler will freeze. Potentially power surges at the communication building could be an issue. As a troubleshooting option, the power supply from the A154 Dike TSP Station was installed in the CB TSP sampler.

Based on the field work completed by ERM, ERM has updated the DDMI TSP Sampler SOP (Appendix B).

## 6. RECOMMENDATIONS

Based on the ERM QA/QC of DDMI TSP data and the Field Visit, ERM recommends that DDMI complete the following going forward:

- use the updated DDMI TSP Sampler SOP (Appendix B) going forward during Mine operations;
- maintain all audit, calibration and maintenance records at the Mine;
- complete calibration and maintenance log sheets;
- purchase a short inlet tube for the TSP samplers;
- purchase a Temperature/Relative Humidity meter as the one currently at site is not functioning;

- purchase a manometer for calibration;
- calibrate the Streamline Pro annually and maintain records;
- purchase an additional Temperature/Relative Humidity cord to calibrate inside in the environment department laboratory; and
- ensure alarm headings for the A154 Dike TSP sampler are available in the downloaded data.

Table 1 summarizes the audits and calibrations to perform:

**Table 1. DDMI TSP Sampler Audit and Calibration Schedule**

| TSP Sampler Parameter/Component | Audit Frequency | Calibration / Maintenance Frequency |
|---|---|---|
| Replace Filter Tape | N/A | Upon 10% Remaining Alarm |
| Clean Air Inlet System | N/A | Annually |
| Rebuild Vacuum Pump | N/A | Every 12 to 18 Months |
| Clean Ambient Temperature/Relative Humidity Shield and Assembly | N/A | Annually |
| Ambient Temperature | Quarterly | Annually |
| Ambient Pressure | Quarterly | Annually |
| Flow | Quarterly | Annually |
| Leak Check | Quarterly | N/A |
| Auto Mass coefficient | N/A | Annually |
| Streamline Pro | N/A | Annually |

Documentation of maintenance and calibration records should be kept. The calendar system used by the environment department should be updated to include the procedural items outlined in section 6.3 of the SOP.

## 7. CONCLUSION

ERM performed the following work, which is the basis for this memo:

- reviewed the specifications of the on-site TSP samplers;
- reviewed and conducted QA/QC of historical data to identify possible sources of sampler error;
- conducted a site visit to inspect, calibrate, and maintain/repair the TSP samplers;
- developed a TSP Sampler SOP; and
- conducted a site visit to train on site personnel in the inspection, calibration, and routine maintenance/repair of particulate samplers.

Historical data provided to ERM by DDMI showed significant data quality issues. Site visits confirmed TSP Samplers required significant maintenance and repairs. Based on the findings, ERM has updated the TSP Sampler SOP and will review and provide QA/QC for particulate sampler data on a monthly basis and provide a brief memorandum outlining any issues with data along with recommendations for resolving the issues following the data review and QA/QC each month.

Prepared By:

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Reviewed By:

DRAFT

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Senior Consultant, Project Manager

DRAFT

Marc Wen (M.Sc.)
Partner in Charge

## REFERENCES

Alberta Environment and Sustainable Resource Development. 2014. *Air Monitoring Directive Chapter 6: Ambient Data Quality*. http://aep.alberta.ca/air/legislation/air-monitoring-directive/default.aspx (accessed January 2016).

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DDMI 2014. 2013-2014 Environmental Air Quality Monitoring Report (ENVI-394-0614 R0). Diavik Diamond Mine (2012) Inc. September 2014.

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GNWT. 2014. Guideline for Ambient Air Quality Standards in the Northwest Territories. http://www.enr.gov.nt.ca/sites/default/files/guidelines/air_quality_standards_guideline.pdf. Accessed February 2016.

SENES. 2014. Peer Review of the 2013 – 2014 Environmental Air Quality Monitoring Report (ENVI-394-0614 R0). Diavik Diamond Mine (2012) Inc. October 2014.

## — Appendix A —

## Field Data Calibration Sheets

CD Nova Thermo 5014i Calibration Inspection

Work Order Number N160103
Customer Name Diavik
Instrument Part Number 5014i
Instrument Serial Number 5014i203191211 Communication Shack instrument
Date 16-Feb-16

| **Description** | As found | Standard | As found variance | Allowable variance | Adjusted to | Final variance | As found offset | Adjusted offset |
|---|---|---|---|---|---|---|---|---|
| **Ambient Air Temperature** | -32.9 | -29 | 3.90 | +/- 0.2°C | -29 | 0.00 | 0 | -3.9 |
| **Ambient Relative Humidity** | 65.80% | 68% | -3.2% | +/- 3% | 68% | 0.00 | 13.7 | 11 |
| **Flow Temperature** | 16.2 | 16.2 | 0.00 | +/- 0.2°C | 16.2 | 0.00 | 0.8 | |
| **Barometer Pressure** | 701.7 | 711 | 9.30 | +/- 5 mmHg | 711 | 0.00 | span 0.9889 | |
| **Vacuum Pressure Span** | 54.9 | 55.3 | 0.73% | 50-70 mmHg | 54.9 | Pass | | |
| **Flow Pressure Span** | 25.4 | 25.0 | -1.57% | 20-30 mmHg | 25.4 | Pass | | |
| **Flow calibration** | 16.67 | 17.09 | 2.52% | +/- 2% | 17.09 | 0.00% | | |
| **Mass Calibration** | Mass calibration performed using customer supplied zero and 1201 microgram foils.<br>Foil set calibrated 22 Jan. 2013. Reference foil set 5301 from Thermo Fisher Scientific. | | | | | | | |

**Auto Detector Calibration**

| | | | | |
|---|---|---|---|---|
| **Initial High Voltage** | 1370 | **Final High Voltage** | 1410 | |
| **Initial Beta Count** | 8136 | **Final Beta Count** | 8573 | |
| **Final Beta** | 8573 | **8000-13000** | | Pass |

**Leak Test**

| | | | | |
|---|---|---|---|---|
| **Start Value VAC** | 65 | mmHg | | |
| **Start Value FLOW (instrument)** | 16.66 | LPM | | |
| **Start Value FLOW (standard)** | 16.45 | LPM | | |
| **Leak Check Adapter VAC** | 72 | mmHg | | |
| **Leak Check Adapter FLOW (instrument)** | 16.64 | LPM | | |
| **Leak Check Adapter FLOW (standard)** | 16.41 | LPM | | |
| **Flow Variance standard** | 0.04 | LPM | +/-0.42 LPM | Pass |

| Standards Used | Description | S/N | Calibration Date |
|---|---|---|---|
| Flow | TetraCal | 888 | 3-Nov-15 |
| Temperature | TetraCal | 888 | 3-Nov-15 |
| Pressure | TetraCal | 888 | 3-Nov-15 |
| Relative Humidity | Diavik Airport | | |
| Manometer | Omega 8205 | 9900631 | 9-Feb-16 |
| Technical Data | Thermo Manual P/N 106428-00 dated 2 April 2014<br>Thermo Fisher Scientific Procedure Number 106430-00 revision A<br>Thermo Fisher Scientific Bulletin # 5014i / 5030i Rev 5/2011 | | |

Calibration Complete By Dan Molloy, Service Manager, Western Region

Signature: ____________________________________________

Ambient temperature and ambient relative humidity calibration standard numbers provided by the Diavik Airport.

# CD Nova Thermo 5014i Calibration Inspection

Work Order Number N160103
Customer Name Diavik
Instrument Part Number 5014i
Instrument Serial Number 5014i203141210 Dyke instrument
Date 15-Feb-16

| **Description** | As found | Standard | As found variance | Allowable variance | Adjusted to | Final variance | As found offset | Adjusted offset |
|---|---|---|---|---|---|---|---|---|
| **Ambient Air Temperature** | -32.9 | -34 | -1.10 | +/- 0.2°C | -34 | 0.00 | -1.1 | 0 |
| **Ambient Relative Humidity** | 63.20% | 67% | -5.7% | +/- 3% | 67% | 0.00 | 17.6 | 13.1 |
| **Flow Temperature** | 10.7 | 10.6 | 0.10 | +/- 0.2°C | 10.7 | 0.10 | | |
| **Barometer Pressure** | 720.3 | 715.4 | -4.90 | +/- 5 mmHg | 715.4 | 0.00 | span 0.9762 | |
| **Vacuum Pressure Span** | 74.8 | 69.5 | -7.09% | 50-70 mmHg | 69.5 | Pass | | |
| **Flow Pressure Span** | 27.8 | 27.4 | -1.44% | 20-30 mmHg | 27.8 | Pass | | |
| **Flow calibration** | 16.67 | 17.02 | 2.10% | +/- 2% | 17.02 | 0.00% | | |

**Mass Calibration** Mass calibration performed using customer supplied zero and 1201 microgram foils. Foil set calibrated 22 Jan. 2013. Reference foil set 5301 from Thermo Fisher Scientific.

**Auto Detector Calibration**

| | | | | |
|---|---|---|---|---|
| **Initial High Voltage** | 1460 | **Final High Voltage** | 1370 | |
| **Initial Beta Count** | 12430 | **Final Beta Count** | 12266 | |
| **Final Beta** | 12266 | **8000-13000** | | Pass |

**Leak Test**

| | | | | |
|---|---|---|---|---|
| **Start Value VAC** | not recorded | mmHg | | |
| **Start Value FLOW (standard)** | 16.66 | LPM | | |
| **Leak Check Adapter VAC** | not recorded | mmHg | | |
| **eak Check Adapter  FLOW (standard)** | 13.3 | LPM | | |
| **Flow Variance** | 3.36 | LPM | +/-0.42 LPM | Fail |

| Standards Used | Description | S/N | Calibration Date |
|---|---|---|---|
| Flow | TetraCal | 888 | 3-Nov-15 |
| Temperature | TetraCal | 888 | 3-Nov-15 |
| Pressure | TetraCal | 888 | 3-Nov-15 |
| Relative Humidity | Diavik Airport | | |
| Manometer | Omega 8205 | 9900631 | 9-Feb-16 |
| Technical Data | Thermo Manual P/N 106428-00 dated 2 April 2014<br>Thermo Fisher Procedure Number 106430-00 revision A<br>Thermo Fisher Scientific Bulletin # 5014i / 5030i Rev 5/2011 | | |

Calibration Complete By Dan Molloy, Service Manager, Western Region

Signature: ____________________________________________

Ambient temperature and ambient relative humidity calibration standard numbers provided by the Diavik Airport.

Instrument pulled from service due to failed leak test.

# — Appendix B —

## TSP Sampler Standard Operating Procedure

# Environment
# STANDARD OPERATING PROCEDURE

| | | | |
|---|---|---|---|
| **Area No.:** | **8000** | **Document #:** | **ENVR-801-0613 R4** |
| | | **Revision:** | **4** |
| **Task Title:** | **TSP Monitoring** | | |

**FOR DOCUMENT CONTROL USE ONLY:**
**Next Review:** **1 year from Area Manager Authorized Signature Date below**
**Effective Date:** **See Area Manager Authorized Signature Date below**

## 1 REFERENCES/RELATED DOCUMENTS

**1.1 Thermo Scientific Model 5014*i* Beta Instruction Manual**

**1.2 Thermo Scientific Technical Bulletin 5030 5014 leak test procedure**

**1.3 Thermo Scientific *i*Port Instruction Manual**

**1.4 Diavik Diamond Mine Environmental Air Quality Monitoring Plan. Document #: ENVI-302-0613 R0**

**1.5 MP5 Monitoring Schedules "AQ Weekly Inspection/Download", "AQ Monthly Audit" and "AQ Quarterly Flow Rate Calibration"**

**1.6 ENVI-443-0415 - Environment Term Definitions** - Located in: Diavik Intranet – SOPs – Environment

**1.7 ENVI-445-0415 - Environment Hazard Definitions** - Located in: Diavik Intranet – SOPs – Environment

**1.8 ENVI-444-0415 - Environment Roles and Responsibilities** - Located in: Diavik Intranet – SOPs – Environment

**Revision History**

| Revision | Revision Description | Date of Revision | Author |
|---|---|---|---|
| 0 | Initial Release | 01-Jun-13 | D. Wells |
| 1 | Update SOP template | 28-Apr-14 | K. Moore |
| 2 | Updates to procedures | 20-Apr-15 | D. Bourassa |
| 3 | General updates | 27-Apr-15 | S. Sinclair |
| 4 | Updates to iPort set-up & Troubleshooting | 12-Dec-15 | K. Raymond |
| 5 | Updates to procedures | 18-Feb-16 | J. Morrison |

**Authorized By:**

| | | |
|---|---|---|
| **Area Supervisor:** | D.Wells | **Date:** |
| **Area Manager:** | S.Bourn | **Date:** |

(Document owners will be prompted annually to update content, however, changes may or may not result.)

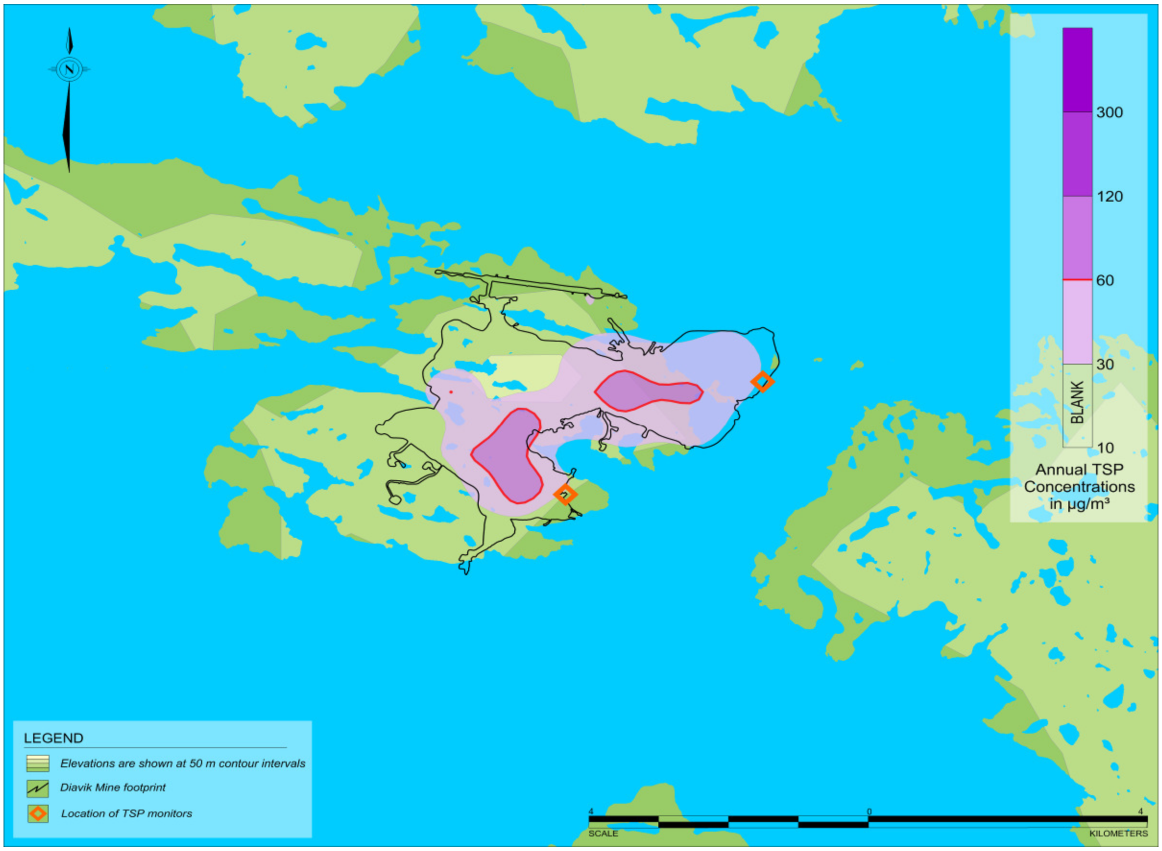


**Figure 1. TSP Monitoring Map**

Plate 1. Communication Building (Monitor Located on Northeast Corner)

Plate 2. A154 Dike Road Location

Plate 3. TSP Monitor at the A154 Dike Road

**Description**

This SOP covers the maintenance, calibration and data download for two TSP monitors (Thermo Scientific 4015*i* Beta continuous ambient particulate monitors) located at Diavik site.

## 2 PURPOSE

The purpose of this standard operating procedure (SOP) is to outline the responsibilities and processes required for performing maintenance, calibration and data download of the total suspended particulate (TSP) monitoring equipment.

## 3 SCOPE

### 3.1 Scope of Procedure

This SOP describes the responsibilities and processes for maintaining, calibrating, and downloading data from the two Thermo Scientific 4015*i* Beta continuous ambient particulate monitors for the measurement of TSP at the Diavik mine site. This procedure applies to those authorized to download data from the TSP monitors. It should be noted that during all procedures listed in this SOP, the 5014i operating manual should be referenced and understanding the procedures in the operating manual is recommended.

### 3.2 Scope of Activities

This SOP is designed to satisfy expectations of our organization, including industry best practices, Rio Tinto Health, Safety and Environment (HS & E) standards and the Health, Safety, Environment and Quality (HSEQ) Management System.

## 4 DEFINITIONS

| Definitions | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PPE** | ✓ | **GPS** | ✗ | **DO** | ✗ | **NTU** | ✗ |
| **MSDS** | ✗ | **SOP** | ✓ | **DI Water** | ✗ | **ELT** | ✗ |
| **Problem Bear** | ✗ | **JHA** | ✓ | **AEMP** | ✗ | **WLWB** | ✗ |
| **QA** | ✗ | **Groundwater** | ✗ | **COC** | ✗ | **PAL** | ✗ |
| **QC** | ✗ | **Seepage** | ✗ | **WHMIS** | ✗ | **ACTS** | ✗ |
| **Remote Work** | ✗ | **SNP** | ✗ | **TSS** | ✗ | **PROVE** | ✗ |
| **TSP** | ✓ | | ✗ | | ✗ | | ✗ |

See: ENVI-443-0415 - Environment Term Definitions - Located in: Diavik Intranet – SOPs – Environment Folder

## 5 RESPONSIBILITIES

See: ENVI-444-0415 - Environment Roles and Responsibilities - Located in: Diavik Intranet – SOPs – Environment Folder

## 6 PROCEDURE

### 6.1 Key HSEQ Aspects

| Task Hazards | | | | | | | |
|---|---|---|---|---|---|---|---|
| Slip, Trip, Fall | ✓ | Chemical Contact | ✗ | Rotating Parts | ✗ | Uneven Terrain / Ground | ✗ |
| Sprain / Strain | ✓ | Fall into Water | ✗ | Firearms / Deterrents | ✓ | Perception | ✗ |
| Working Remotely | ✗ | Overhead Objects | ✓ | Dehydration | ✗ | Risk to Wildlife | ✗ |
| Aircraft | ✗ | Visibility | ✗ | Ergonomics | ✗ | Unfamiliar Area | ✗ |
| Watercraft Operation | ✗ | Fire | ✗ | Glass | ✗ | Falling | ✗ |
| Snowmobile Operation | ✗ | Line of Fire | ✓ | Fumes / Gases | ✗ | Confined Space | ✗ |
| Light Vehicle | ✓ | Cuts /Scrapes | ✓ | Entanglement | ✗ | Heavy Equipment | ✗ |
| Lifting | ✗ | Pinch Points | ✓ | Stored Energy | ✓ | Extreme Weather | ✗ |
| Manual Labour | ✗ | Noise | ✗ | Burns | ✗ | Electrical | ✓ |
| Wildlife | ✓ | Spills | ✗ | Equipment Loss or Damage | ✓ | Sample Loss or Damage | ✓ |

See: ENVI-445-0415 - Environment Hazard Definitions - Located in: Diavik Intranet – SOPs – Environment Folder

### 6.2 Tools Required

| Supplies, Tools and Equipment | | | |
|---|---|---|---|
| **Tool / Equipment** | **Quantity** | **Supplies** | **Quantity** |
| **Streamline Pro Multi Cal System : contains barometer and temperature probe (Plate 4)** | **1** | **Relative humidity (hygrometer) standard readable to the nearest 0.5%** | **1** |
| **Flow Audit Adapter** | **1** | **Airport Meteorological Station (Can be used for audit temp, pressure and RH)** | **1** |
| **Leak Check Adapter** | **1** | **Hygrometer (RH/Temperature Probe; airport can be used)** | **1** |
| **Mass Foil Calibrations Kits x 2 (1 kit is left at each TSP sampler; Plate 5)** | **2** | **Short inlet adapter** | **1** |
| **Manometer (annual calibration only)** | **1** | **Lint free cloth and cleaning solution** | **1** |

**Plate 4. Streamline Pro and flow/leak check adapter on the left.**

**Plate 5. Mass foil calibration kit.**

## 6.3 Procedural Timeline

### 6.3.1 Bi-Weekly

The following can be completed remotely bi-weekly:

1. Perform data downloads and import to MP5.
2. Ensure ambient temperature, relative humidity and barometric pressure is similar to airport conditions.
3. Check that the time is reading correctly on the unit.
4. Check for alarms.

### 6.3.2 Monthly

1. Inspections of the units to ensure all parts are in good working condition (no physical damage).
2. Fan filter inspection.
3. Housekeeping (everything is stored properly, no items are restricting access).
4. Check the temperature in the AQ Unit (Start fan in summer months).
5. Check that the time is reading correct on the unit.
6. Check for alarms.
7. Download Data and import to MP5 (completed back at office).

### 6.3.3 Quarterly

1. One-point temperature, relative humidity, barometric pressure and flow rate verification: see manual **chapter 2, pages 2-7 through 2-8** for procedures and percent tolerance ranges.
2. Auto Detector Calibration: see manual **chapter 4, page 4-12**.
3. Perform a leak check: see Thermo "**Technical Document: Leak Test Procedure**" document.
4. Clean inlet assemblies and sample tubes.
5. Check cam for proper greasing.

### 6.3.4 Annually

1. Ambient Temperature, Relative humidity, flow temperature calibration (**manual chapter 4, page 4-3 through 4-4**).
2. Pressure vacuum calibration (**manual chapter 4, page 4-4 through 4-7**)
3. Flow calibration (**manual chapter 4, page 4-7**).
4. Mass Calibration (**manual chapter 4, page 4-7 through 4-12**)
5. Leak check (Thermo “**Technical Document: Leak Test Procedure**” document).

## 6.4 General Preventative Equipment Maintenance

Preventative equipment maintenance as indicated in Chapter 5 “Preventative Maintenance” of the manual for the Thermo Scientific 5014i continuous beta attenuation monitor must be ongoing. Since usage and environmental conditions vary greatly, inspect the components frequently and clean or replace components as indicated in the sections below or as required based on site conditions. Figures 2 and 3 provide a general schematic of the TSP samplers.

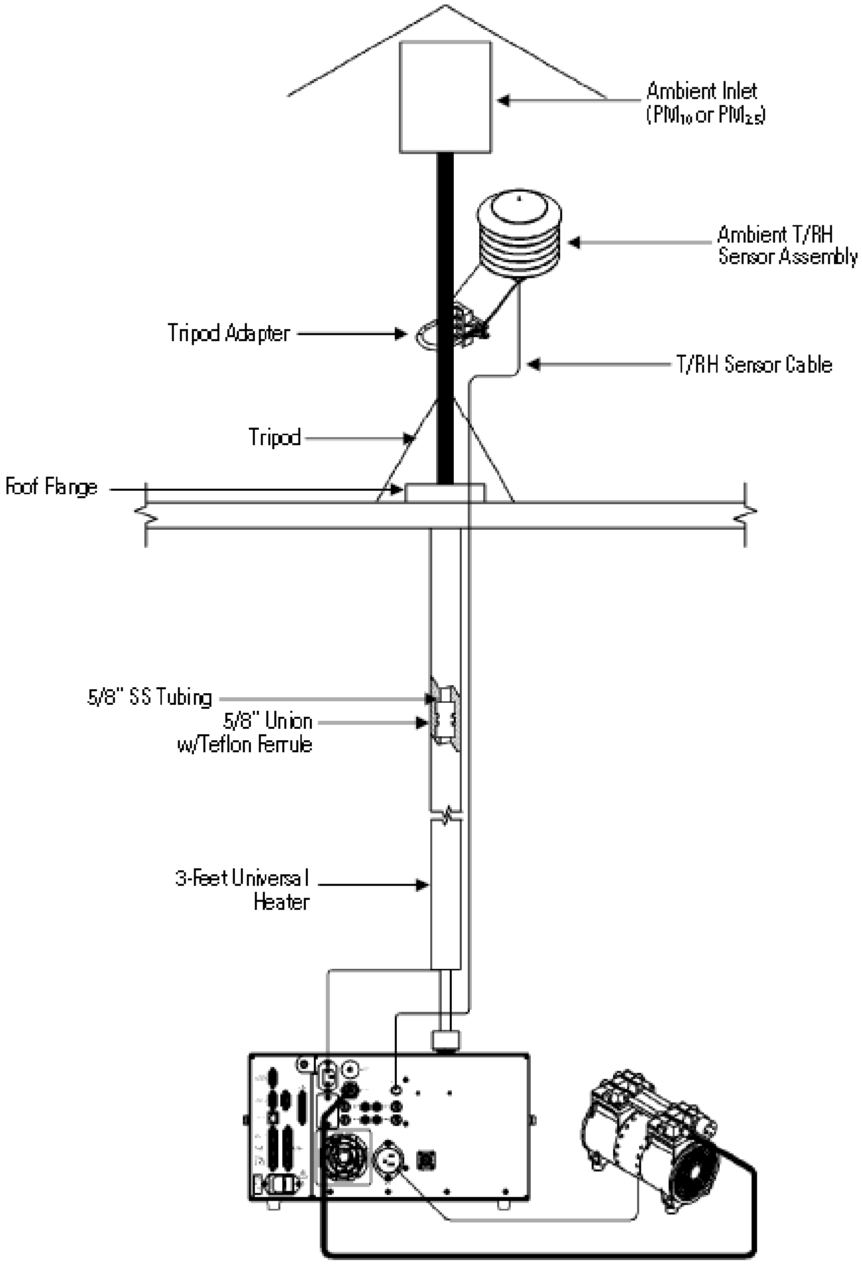


**Figure 2. Model 5024i Vertical View**

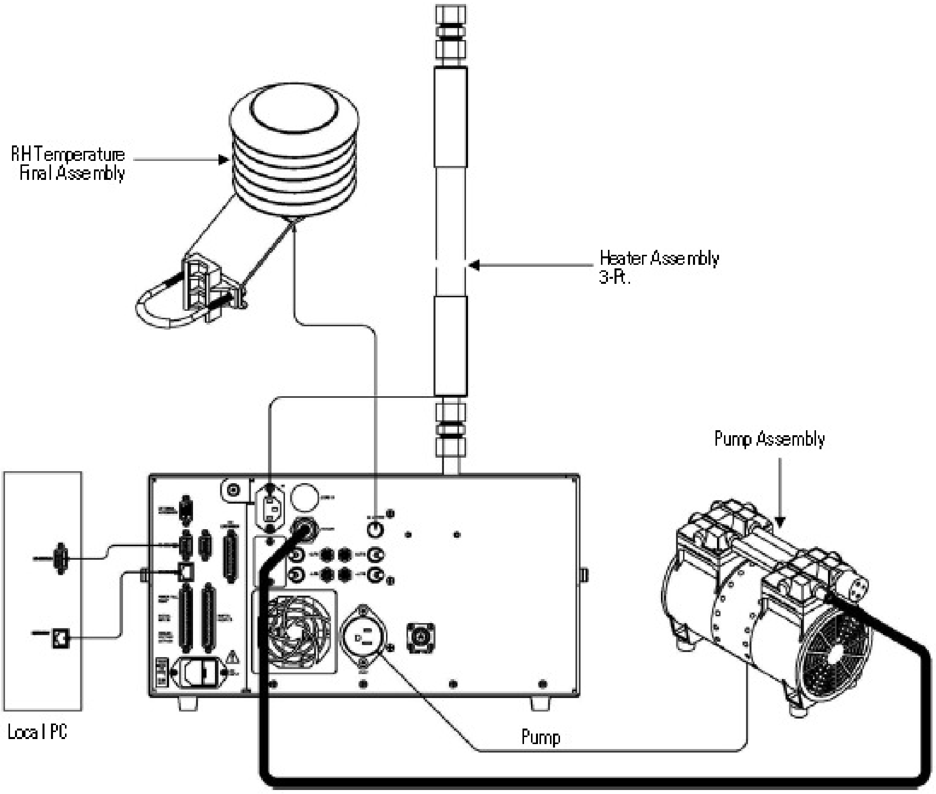


Figure 3. Rear Panel Plumbing Assembly

### 6.4.1 Replacement Parts

If a part requires replacing, refer to the Chapter 7 “Servicing” of the Model 5014i Instruction Manual.

### 6.4.2 Cleaning the Inlets

Inlet assemblies should be cleaned on a quarterly interval with mild soap solution, a thorough rinsing, and dried with a lint-free cloth. A general inspection of O-rings should be completed and the rings replaced if necessary.

### 6.4.3 Heater and Sample Tubes

On at least an annual basis (more frequently in heavily polluted environments) the sample tube that attaches to the inlet and to the Model 5014i Beta should be removed and cleaned. The use of a bottle brush and string will allow you to remove any deposits within the sample tube. This same procedure also applies to the heater tube.

### 6.4.4 Weather Proofing

The weather-proof installation should be checked at all interfaces exposed to ambient conditions, ensure that the condition of the roof flange and silicone caulking will prevent any precipitation from entering the shelter and possibly damaging the instrument's electronics.

### 6.4.5 Fan Filter Inspection and Cleaning

Fan filter inspection and cleaning should occur quarterly. To inspect and clean the fan filter, first disconnect the power by unplugging the unit, remove the fan guard from the fan and remove the filter. Flush the filter with water and let dry or blow the filter clean with compressed air. Re-install the filter and fan. The illustration below located on page 5-4 of the manual provides a schematic of the fan filter assembly (Figure 4).

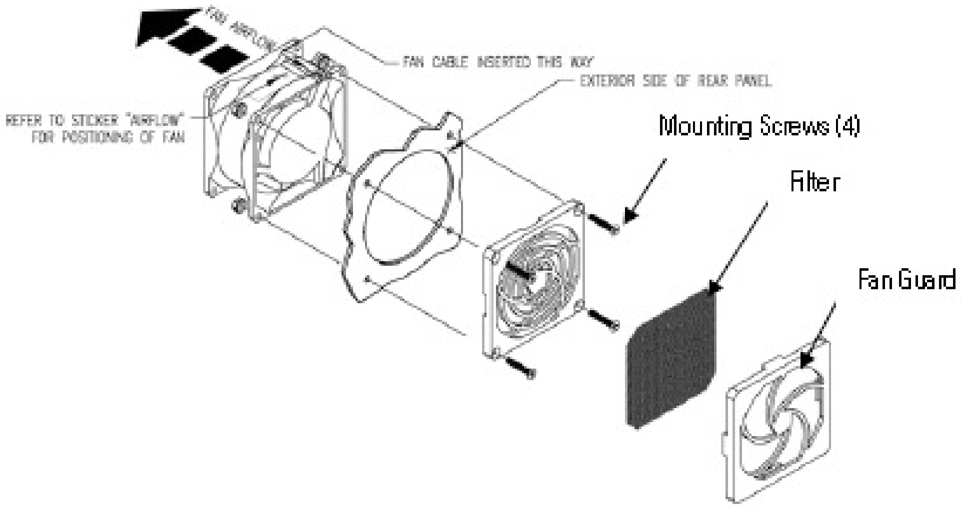


**Figure 4. Fan Filter Assembly**

### 6.4.6 Pump Rebuilding

The sample pump should be rebuilt once every 12-18 months. The pump repair kit contains detailed instructions for rebuilding the pump. In Chapter 7 "Servicing" of the Model 5014i Instruction Manual the list of replacement is included in Table 7-1 on page 7-5.

### 6.4.7 Filter Tape Replacement

If the filter tape breaks or the tape runs out, refer to Chapter 5 "Preventative Maintenance" on **page 5-8 and Figure 5-6 on page 5-9 of the manual** as illustrated in Figure 5.

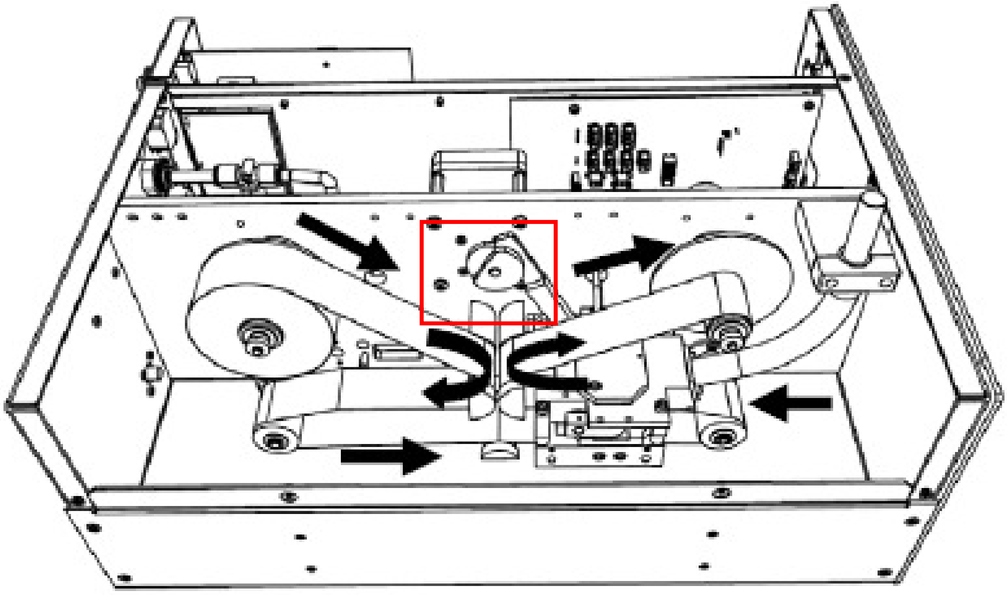


**Figure 5. Filter Tape Assembly. The Cam is located in the center of the filter tape assembly.**

The following procedure is used to replace the filter tape:

1. Remove left side cover;
2. From the main menu choose Instrument Controls > Filter Tape Control > Manual > **Bench(s)**. Press enter;
3. Loosen the reel nuts on the tape spindles. Remove the used filter tape and the empty tape spool from the tape spindles;
4. Insert the new filter tape on the left tape spindle (with the loose end of the tape pointing to the center when on top) and tighten the reel nut;
5. Insert the new blank pick up spool on the right tape spindle;
6. Route the tape from top of left spindle down to the left-center guide, then around the lower left roller, along the bottom to the lower right roller, up to the right-center guide, and up to the right spindle;
7. Attach the end of the tape to the blank tape spool on the right tape spindle with 2 inches of tape;
8. Turn the blank tape spool until there are two complete wrappings of tape and hand tighten the right reel nut;
9. From Filter Tape Control > Manual choose **Tape** and press enter to MOVE tape;
10. From the main menu choose Alarms > **Instrument Alarms** to verify there are no filter tape alarms; and
11. Replace left side cover.

### 6.4.8 Greasing the Cam

The cam should be checked every 3 months and greased if needed. To grease the cam, metal assembly paste should be applied to the perimeter of the cam. Dow Corning Molykote G-N metal assembly paste should be used. The cam is shown in centre of the Filter Tape Assembly in the above section and in Figure 5-6 on page 5-9.

### 6.4.9 Leak Test

The leak test should be conducted annually. This leak test procedure uses a volumetric flow meter and a custom leak check adapter. Use the following procedure to verify no leaks. Please refer to the **Technical Bulletin, 5014 and 5030 Leak Test Procedure** for more detailed information on leak test procedures.

1. Place a reference volumetric flow meter (e.g., Streamline Pro) onto the inlet adapter and calibrate the 5014i so that the reference flow meter and the 5014i monitor read the same flow rate.
2. Install the custom leak check adapter onto the inlet adapter and then place the reference flow meter onto the leak check adapter.
3. Record the reference volumetric flow meter reading and the instant flow reading. If the difference between both readings is less than 0.42 L/min (±2.5%), the leak check passes.

## 6.5 Calibration

To perform the calibration steps the analyzer will need to be put into “service mode”. See the manual **chapter 3, page 3-72 through 3-88**, for additional information on the service menu. To enter the service menu from the main menu:

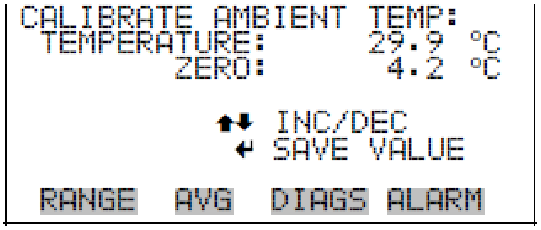
- choose Instrument controls < **Service Mode.**
- Go back to the main menu choose **service.**

It is recommended that Thermo Scientific monitors be calibrated annually as noted in **Chapter 4 “Calibration”** of the manual. The instruction manual details the procedures for **temperature and relative humidity (page 4-3), pressure (page 4-4), flow rate (page 4-7), mass coefficient (page 4-7) and detector calibration (page 4-12).** All screens referred to in this section are referenced in Chapter 3 of the operating manual.

Calibration is also recommended after any physical relocation, or following an interruption of more than a few days or any indication of monitor malfunction. A visual inspection of the monitor, where possible, and an assessment of the operating parameters of the monitor is recommended during each downloading session. A final leak check should be performed on the equipment after calibrations are performed.

### 6.5.1 Ambient Temperature

Using a NIST-traceable thermometer (Streamline Pro) as a reference collocated next to the ambient RH/temperature sensor assembly, measure and compare three individual readings between both the reference and the 5014i response. Taking an average of both sets of readings, calculate the average difference between the two readings and record that as your offset. This offset (ZERO) should now be entered in the screen below (Figure 6):



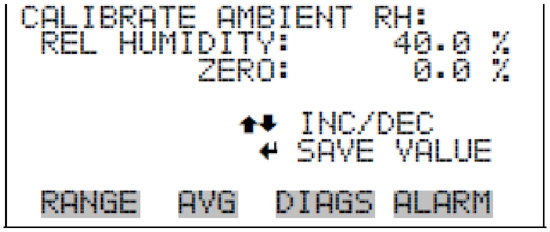
```
CALIBRATE AMBIENT TEMP:
 TEMPERATURE:     29.9 °C
       ZERO:       4.2 °C

           ↑↓ INC/DEC
            ↵ SAVE VALUE

 RANGE   AVG   DIAGS ALARM
```

**Figure 6. Ambient Temperature Calibration Screen**

Be sure to save the entry and compare the values once more. If it appears that the temperature has shifted into the wrong direction, change the sign of your offset value.

### 6.5.2 Ambient Relative Humidity

Using a NIST-traceable hygrometer as a reference collocated next to the ambient RH/temperature sensor assembly, measure and compare three individual readings between both the reference and the 5014i response. Taking an average of both sets of readings, calculate the average difference between the two readings and record that as your offset. This offset (ZERO) should now be entered in the screen below (Figure 7):



```
CALIBRATE AMBIENT RH:
 REL HUMIDITY:     40.0 %
        ZERO:       0.0 %

           ↑↓ INC/DEC
            ↵ SAVE VALUE

 RANGE   AVG   DIAGS ALARM
```

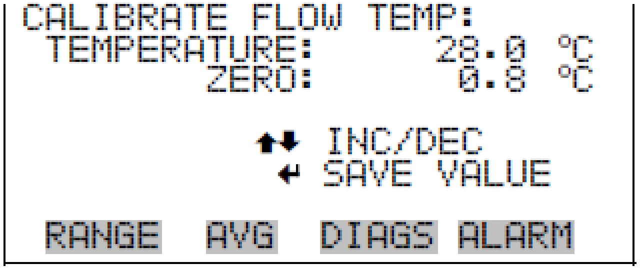
**Figure 7. Ambient Relative Humidity Calibration Screen**

Be sure to save the entry and compare the values once more. If it appears that the temperature has shifted into the wrong direction, change the sign of your offset value.

### 6.5.3 Flow Temperature

Assuming the instrument cover has been removed, the heater has been turned off and removed from the instrument and the instrument has been sampling room temperature air for 1 hour, this calibration can now proceed.

Using a NIST-traceable thermometer as a reference collocated next to the small sample tube inlet on top of the instrument, measure and compare three individual readings between both the reference and the 5014i response. Taking an average of both sets of readings, calculate the average difference between the two readings and record that as your offset. This offset (ZERO) should now be entered in the screen below (Figure 8):



```
CALIBRATE FLOW TEMP:
 TEMPERATURE:     28.0 °C
        ZERO:      0.8 °C

          ↑↓ INC/DEC
           ↵ SAVE VALUE

 RANGE   AVG   DIAGS ALARM
```

**Figure 8. Flow Temperature Calibration screen**

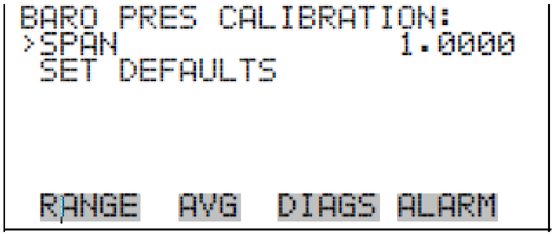
Be sure to save the entry and compare the values once more. If it appears that the temperature has shifted into the wrong direction, change the sign of your offset value.

### 6.5.4 Pressure/Vacuum Calibration

There are three pressure sensors that can be calibrated, however, the primary sensor to be calibrated is the barometric pressure sensor. Both the vacuum sensor and pressure flow sensors are re-zeroed automatically with every filter tape change.

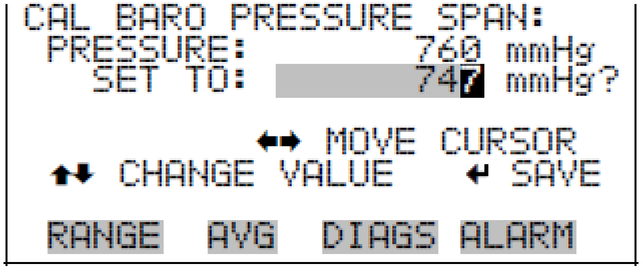
Using a NIST-traceable barometer (Streamline Pro), measure the barometric pressure (and convert as necessary) in units of millimetres of mercury (mmHg). Use the SPAN feature from the barometric calibration submenu (Figure 9 and Figure 10).

Be sure to save the entry and compare the values once more. Repeat the calibration as necessary so that the pressure is within 2 mmHg.



```
BARO PRES CALIBRATION:
>SPAN              1.0000
 SET DEFAULTS



 RANGE  AVG  DIAGS ALARM
```

**Figure 9. Barometric SPAN menu**

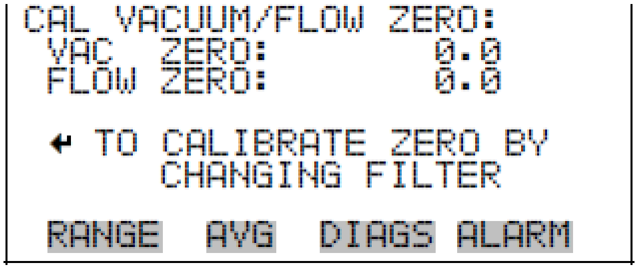


```
CAL BARO PRESSURE SPAN:
 PRESSURE:        760 mmHg
   SET TO:        747 mmHg?

          ↔ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE
```

**Figure 10. Barometric Pressure SPAN**

### 6.5.5 Calibrate Vacuum/Flow Zero

The Calibrate Vacuum/Flow Zero screen calibrates the vacuum/flow sensor at zero value. This is done automatically with every filter tape change. However, if for any reason this needs to be done, proceed to the following screen below to execute a zeroing filter tape change (Figure 11).



```
CAL VACUUM/FLOW ZERO:
 VAC  ZERO:         0.0
 FLOW ZERO:         0.0

 ↵ TO CALIBRATE ZERO BY
      CHANGING FILTER
```

**Figure 11. Barometric Pressure SPAN**

The Calibrate Vacuum Pressure Span screen allows the user to view and set the vacuum sensor calibration span point. To calibrate the vacuum sensor, zero a digital manometer (capable of measuring up to 100 mmHg) to the +ΔP port on the rear panel. Then push the toggle switch on the right inward to open (see Figure 12). The manometer reading can now be used to calibrate the vacuum sensor.

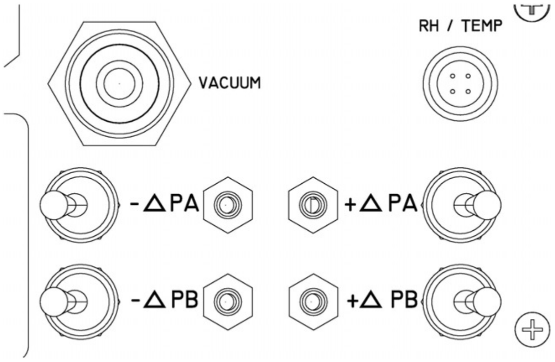
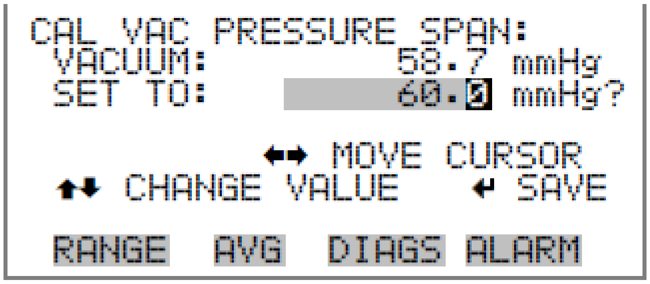


**Figure 12. Differential Pressure and Vacuum Calibration Ports**

- In the Main Menu, choose **Service** > **Pres/Vacuum Calibration** > **Vac/Flow** > **Vac Pres Span** (Figure 13).

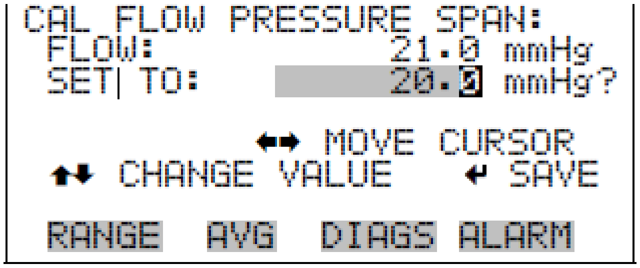


```
CAL VAC PRESSURE SPAN:
 VACUUM:           58.7 mmHg
 SET TO:           60.0 mmHg?

            ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 RANGE  AVG  DIAGS ALARM
```

**Figure 13. Calibrate Vacuum Pressure**

### 6.5.6 Calibrate Flow Pressure Span

The Flow Pressure Span screen allows the user to view and set the flow sensor calibration span point. To calibrate the flow pressure sensor span point, the instrument must by pulling an active flow through the filter tape. Connect the respective +/- ports of NIST-traceable manometer to the respective rear panel +/- ports. (Please be certain to zero any digital manometers prior to connecting!) Open the ports by pressing the toggle switches inward. Calculate an average reading from the reference manometer in units of mmHg. Enter this span value into the screen below (Figure 14):



```
CAL FLOW PRESSURE SPAN:
 FLOW:             21.0 mmHg
 SET| TO:          20.0 mmHg?

            ←→ MOVE CURSOR
 ↑↓ CHANGE VALUE    ↵ SAVE

 RANGE  AVG  DIAGS ALARM
```

**Figure 14. Flow Pressure SPAN**

- In the Main Menu, choose **Service** > **Pres/Vacuum Calibration** > **Vac/Flow** > **Flow Pres Span**.

Be sure to save the entry and compare the values once more. Repeat the calibration as necessary so that the pressure is within 2 mmHg.

### 6.5.7 Flow Calibration, Mass Calibration and Detector Calibration

Please follow the instructions in the operating manual, **pages 4-7 to 4-12.**

## 6.6 Data Download

### 6.6.1 Installing iPort

If iPort is not already set-up, install the program from the following filepath:

P:\DDMI Environment\10.0 Operational Control\10.5 Equipment\AQ TSP Units\iPort_v1.4.1.39_setup

1. Open up File Explorer and browse to C:\Program Files (x86)\
2. Right-click on the "**Thermo**" folder and choose 'Properties'
3. Click the '**Security'** tab
4. Click '**Edit'**
5. If prompted, enter your username/password
6. Click '**Add'**
7. Click on '**Locations'**
8. Choose your computer name from the top of the list
9. Type "**Everyone**" in the box
10. Press '**OK'**
11. Choose "**Everyone**" from the list
12. Click the check box for 'Full Control' in the 'Allow' column
13. Press '**OK'**. Press '**OK'**
14. Transfer data from iPort

The above steps are required to be able to properly load data from the iPort program without Windows 7 blocking it.

### 6.6.2 Set-up iPort

1. Click **File** > **Preferences**.
2. On the right hand side of the box under 'Ethernet', it says 'Direct TCP/IP'. Check the 'Enable' box.
3. To the left of this section, 'Instruments', see 'Size' and select 'Full' (otherwise your remote connection will appear too tiny to read)
4. Press 'OK'
5. Click **Instrument** > **TCP Connect** > **IP Addresses**
6. Type in "10.164.72.51 192.168.0.232". There is a space between the two IP addresses; the left represents TSP-1 (Comm Shack AQ monitor) and the right represents TSP-2 (A154 Dyke AQ Monitor)

### 6.6.3 Data Download

Data is to be downloaded weekly after calibration for the first two months, then biweekly thereafter, using the iPort communication software. iPort is a program which allows complete remote access and control of the SHARP 5014i Beta TSP monitor. To download records:

- Select the pull down menu Instrument;
- Select Load Records starting at the date of the previous download; and
- Save the records by selecting Save to File and specify a file name.

The file will be stored in the iPort folder under the Program Files of the download computer (C:\Program Files (x86)\Thermo\iPort). Transfer the file to the appropriate data management location (on the P: drive in 13.7) and send to a qualified professional for QA and analysis purposes.

## 6.7 Encountered Issues

1. The screen is no longer functioning and unable to connect to the equipment.
    - Replace the motherboard, see **manual chapter 7, page 7-26.**
    - Power supply replaced.
2. Low beta count alarms and negative TSP concentrations.
    - Replace the detector amplifier assembly and the detector assembly and the, see **manual chapter 7, pages page 7-12 to 7-13 and 7-31 to 7-33** respectively.

### 6.7.1 Troubleshooting

The Instruction Manual for Model 5014*i* Beta should be referenced for alarm troubleshooting and other errors. However common issues are outlined in steps below:

### 6.7.2 Filter Tape Counter Alarm:

A filter tape alarm may be fixed by manually telling the filter tape to change using the following steps (see manual chapter 3, page 3-17 and 3-18):

1. Go to the main menu on the machine.
2. Choose ‘Instrument Controls’
3. Choose ‘Filter Tape Control’
4. Choose ‘Tape’

# 7 QUALITY OUTCOMES AND EXPECTATIONS

## 7.1 To safely complete the tasks outlined in this SOP, without incident.

## 7.2 Producing quality, accurate and repeatable results.

# — Appendix C —

## CD Nova Service Report

**CD Nova Ltd**
5330 Imperial Street
Burnaby, BC
1-800-663-0615
604-430-5612
www.cdnova.com

# REPORT

## Diavik Diamond Mine Inc.

## THERMO 5014i SERVICE

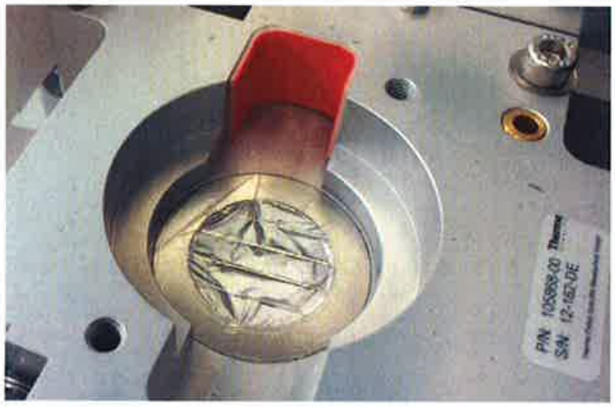
On-site: February 15 – 18 2016

Purpose of visit is to troubleshoot a low beta issue with one instrument and a lock up issue with the second instrument along with a calibration of both instruments. Training is to be provided on maintenance and calibration procedures for onsite staff as well as a representative from ERM.

## Dyke instrument serial number 5014i302141210:

Prior to the arrival of a CD Nova representative troubleshooting had been performed to determine that the instrument alarm was al low beta alarm (approx. count 3500). The instrument was removed from the Dyke and brought to the lab for maintenance. The following was performed;

- Pump rebuild
- Fan filter changed
- Pressure board was moved to a vertical rear location
- Beta detector was replaced with a used known good part
- Beta amplifier board replaced with a new part



Damaged membrane in detector head assembly

It was noted during this maintenance that the membrane in the head assembly was damaged but as no replacement part was available on site the instrument would be reinstalled, function tested and calibrated. During the calibration process the instrument failed a leak test with a reading of 3.36 lpm of leakage measured. The serviceable limit for a leak test is +/-0.42 lpm. The instrument was removed from the Dyke and returned to the lab.

At this point in time a decision was made to use this instrument for parts to troubleshoot the Communication Shack instrument as the suspected causer of the leak is the damaged membrane in the head assembly and no replacement parts are available on site.

The power supply, processor board and mother board were removed from this instrument and installed into the Communication Shack instrument serial number 5014i203191211.

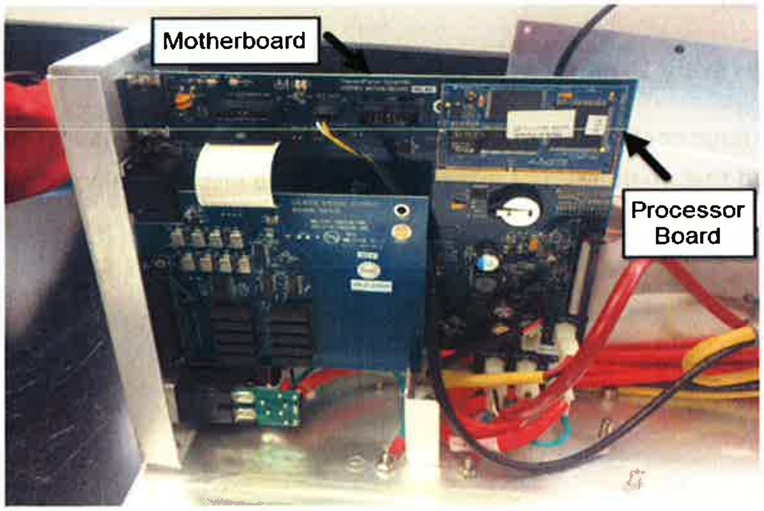
The Dyke instrument was reassembled with the processor board and motherboard from the other instrument and used for training purposes. After training was completed the instrument was prepared for shipment to CD Nova for further troubleshooting.

**Note:** The TSP inlet was not removed from the shack for cleaning and inspection due to weather conditions. It is recommended that this be performed when weather permits.

**Communication Shack instrument serial number 5014i203191211:**

Prior to the arrival of a CD Nova representative the customer had reported that the instrument would lock up into a blank blue screen state approximately once per week. The instrument was removed from its operating position and moved to a suitable location within the Communication Shack for maintenance. The following was performed;

- Pump rebuild
- Fan filter changed
- Pressure board was moved to a vertical rear location
- Motherboard was replaced with the motherboard from instrument s/n: 5014i203141210
- Processor board was replaced with the processor board from instrument s/n: 5014i203141210
- Configuration and communication data from the original motherboard and processor board were programed into the boards that were installed.



Motherboard and Processor board

After maintenance was completed the instrument was reinstalled and a functional check and calibration were performed with serviceable results.

The instrument was run for approxmatly 24 hours and rechecked. It was noted at this time that the instrument had locked up and would not respond to inputs on the keypad or connect to iport software. At this point in time the internal power supply from instrument s/n: 5014i203141210 was installed.

A calibration sheet was provided.

**Note:** The TSP inlet was not removed from the shack for cleaning and inspection due to weather conditions. It is recommended that this be performed when weather permits.

**Recommendations:**

The following recommendations

- An annual calibration and servicing should be performed each year.
- Quarterly service and inspection of the instruments.
- The annual calibration would be better suited to be performed during times of more favorable weather to allow for the safe removal of the inlets for servicing and inspection.
- Removal of the RH/Temp sensor for the Dyke instrument during calibration.
- Perform annual calibration of the Dyke instrument in the onsite environmental lab where conditions are better controlled.
- Purchase a five inch inlet tube and nut for calibration.
- Purchase a RH Temperature Connector Assembly to allow for calibration of the Dyke instrument in the onsite lab.
- Rebuild pumps every 18 months.
- If the lock up issue continues to affect the instrument in the Communication Shack it is recommended that an uninteruptable power supply be installed to power the instrument.

**Note:** A quote will be provided for the recommend parts.

Report prepared by:

Dan Molloy,
Service Manager, Western Region,
CD Nova Ltd.
Email: dmolloy@cdnova.com
February 19, 2016

DRAFT

AND ASSOCIATED COMPANIES

CD Nova Thermo 5014i Calibration Inspection

| | |
|---|---|
| Work Order Number | N160103 |
| Customer Name | Diavik |
| Instrument Part Number | 5014i |
| Instrument Serial Number | 5014i203191211 Communication Shack instrument |
| Date | 16-Feb-16 |

| Description | As found | Standard | As found variance | Allowable variance | Adjusted to | Final variance | As found offset | Adjusted offset |
|---|---|---|---|---|---|---|---|---|
| **Ambient Air Temperature** | -32.9 | -29 | 3.90 | +/- 0.2°C | -29 | 0.00 | 0 | -3.9 |
| **Ambient Relative Humidity** | 65.80% | 68% | -3.2% | +/- 3% | 68% | 0.00 | 13.7 | 11 |
| **Flow Temperature** | 16.2 | 16.2 | 0.00 | +/- 0.2°C | 16.2 | 0.00 | 0.8 | |
| **Barometer Pressure** | 701.7 | 711 | 9.30 | +/- 5 mmHg | 711 | 0.00 | span 0.9889 | |
| **Vacuum Pressure Span** | 54.9 | 55.3 | 0.73% | 50-70 mmHg | 54.9 | Pass | | |
| **Flow Pressure Span** | 25.4 | 25.0 | -1.57% | 20-30 mmHg | 25.4 | Pass | | |
| **Flow calibration** | 16.67 | 17.09 | 2.52% | +/- 2% | 17.09 | 0.00% | | |
| **Mass Calibration** | Mass calibration performed using customer supplied zero and 1201 microgram foils.<br>Foil set calibrated 22 Jan. 2013. Reference foil set 5301 from Thermo Fisher Scientific. | | | | | | | |

**Auto Detector Calibration**

| | | | | |
|---|---|---|---|---|
| **Initial High Voltage** | 1370 | **Final High Voltage** | 1410 | |
| **Initial Beta Count** | 8136 | **Final Beta Count** | 8573 | |
| **Final Beta** | 8573 | **8000-13000** | | Pass |

**Leak Test**

| | | | |
|---|---|---|---|
| **Start Value VAC** | 65 mmHg | | |
| **Start Value FLOW (instrument)** | 16.66 LPM | | |
| **Start Value FLOW (standard)** | 16.45 LPM | | |
| **Leak Check Adapter VAC** | 72 mmHg | | |
| **Leak Check Adapter FLOW (instrument)** | 16.64 LPM | | |
| **Leak Check Adapter FLOW (standard)** | 16.41 LPM | | |
| **Flow Variance standard** | 0.04 LPM | +/-0.42 LPM | Pass |

| Standards Used | Description | S/N | Calibration Date |
|---|---|---|---|
| Flow | TetraCal | 888 | 3-Nov-15 |
| Temperature | TetraCal | 888 | 3-Nov-15 |
| Pressure | TetraCal | 888 | 3-Nov-15 |
| Relative Humidity | Diavik Airport | | |
| Manometer | Omega 8205 | 9900631 | 9-Feb-16 |
| Technical Data | Thermo Manual P/N 106428-00 dated 2 April 2014<br>Thermo Fisher Scientific Procedure Number 106430-00 revision A<br>Thermo Fisher Scientific Bulletin # 5014i / 5030i Rev 5/2011 | | |

Calibration Complete By Dan Molloy, Service Manager, Western Region

Signature: ______________________

Ambient temperature and ambient relative humidity calibration standard numbers provided by the Diavik Airport.

CDNOVA

*AND ASSOCIATED COMPANIES*

# QUOTE # Diavik22FEB2016

**5330 Imperial Street, Burnaby BC, V5J 1E6**
**Phone: (604)430.5612 Fax: (604)437.1036**
**www.cdnova.com**

Date: FEBRUARY 22, 2016

Expiry Date: **MARCH 22, 2016**

**TO** Diavik Diamond Mine Inc.
PO Box 2498, #300 – 5201 50th Ave.
Yellowknife NT X1A 2P8
T: 867 669 6500

| SALESPERSON | DELIVERY | PAYMENT TERMS | FOB |
|---|---|---|---|
| Dan Molloy |  | Net 30 Days | Burnaby BC |

| QTY | DESCRIPTION | UNIT PRICE | LINE TOTAL |
|---|---|---|---|
| 1 | Short inlet tube - FH10819 | $210.00 | $210.00 |
| 1 | Nut for inlet tube - FH113 | $115.00 | $115.00 |
| 1 | Cable, RH/Temp sensor - 106400-00 | $980.00 | $980.00 |
| 1 | Sentra 1000XL 900 watt UPS | $400.00 | $400.00 |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  | Net 30 days. |  |  |
|  | Shipping not included. |  |  |
|  |  | **SUBTOTAL** | $1705.00 |
|  |  | **SALES TAX** | $85.25 |
|  |  | **TOTAL** | $1790.25 |

Quotation prepared by: Dan Molloy, Service Manager, Western Region.

**CD Nova and Associated Companies is a distributor of Gas and Chemical Analyzers, Stack Sampling Systems, and Meteorological Instruments. In support of all products we supply, our in-house and field service technicians have been factory trained and certified thus providing fast and efficient resolution to our customers' instrument problems.**

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