

APPENDIX 7-C
2008 TO 2011 AIR QUALITY BASELINE REPORT

Seabridge Gold Inc.

KSM PROJECT 2008 to 2011 Air Quality Baseline Report

SEABRIDGE GOLD



KSM PROJECT

2008 TO 2011 AIR QUALITY BASELINE REPORT

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Prepared for:

SEABRIDGE GOLD

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Prepared by:



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Executive Summary

The proponent for the KSM Project is Seabridge Gold Inc. The KSM Project is a proposed gold/copper mining project located in the mountainous terrain of northwestern British Columbia, approximately 950 km northwest of Vancouver and approximately 65 km north of Stewart, BC. The proposed KSM Project will include open pit and underground mining, a processing plant, facilities for management of tailing and waste rock, access roads and transport tunnels. Baseline data is required for environmental assessment predictions and ongoing monitoring during mine operations.

The KSM air quality monitoring program included five locations in 2008, nine locations in 2009 and 2010, and ten locations in 2011. Dustfall was monitored and samples were analyzed at an accredited laboratory in Vancouver for total dustfall, soluble dustfall, insoluble dustfall, sulphate, nitrate and total metals. This report presents monitoring results from 2008 to 2011.

The 1979 BC MOE Pollution Control Objectives for the Mining, Smelting and Related industries of BC (BC MOE 1979) lists dustfall objectives of 1.7 to 2.9 mg/dm²/day. The most stringent objective of 1.7 mg/dm²/day was exceeded four times: DF-05 in June 2010, DF-05 and DF-09 in July 2010, and DF-01 and DF-06 in August of 2010. The least stringent objective of 2.9 mg/dm²/day was also exceeded at DF-01 and DF-06 in August 2010; The dustfall deposition results for all other periods and locations were below the guidelines.

During the 2008 to 2011 period, the highest acid deposition was 341 eq/ha/year at DF-04 in August 2009. The highest median during this period was 182 eq/ha/year at DF-01 in 2011. All of the acid deposition results are less than the median critical load of 750 eq/ha/year for BC and the lowest reported provincial median critical load of 354 eq/ha/year for Saskatchewan (Aherne 2008). It is important to note that the acid deposition calculations do not consider any neutralizing compounds found in the dustfall and soil; therefore, actual loading is likely well below.

Maximum copper deposition rates were 0.0055, 0.0016, 0.00065 and 0.0012 mg/dm²/day for 2008, 2009, 2010 and 2011, respectively. The maximum deposition rates for the reporting period of 2008 to 2011 were 0.00002 mg/dm²/day in 2009 for arsenic, 0.000011 mg/dm²/day in 2008 for cadmium, and 0.0049 mg/dm²/day in 2010 for lead. Mercury deposition rates were below detection limits except one measurable result at DF-05 in 2010. Other metal deposition results, however, are difficult to summarize as mg/dm²/day as the majority of samples were at or below the laboratory detection limits.

KSM PROJECT

2008 TO 2011 AIR QUALITY BASELINE

REPORT

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Acronyms and Abbreviations

ARTG	Acid Rain Task Group
BC MOE	British Columbia Ministry of Environment
CCME	Canadian Council of Ministers of the Environment
Critical Load	The amount of acid deposition that a particular region can receive without being adversely affected
eq/ha/yr	Equivalent hectares per year
KSM	Kerr-Sulphurets-Mitchell
mg/dm²/day	Milligrams per square decimetre per day
NEG-ECP	New England Governor-Eastern Canadian Premiers
NO₃⁻	Nitrate ion
NO_x	Oxides of Nitrogen
PM	Particulate Matter
SO₂	Sulphur Dioxide
SO₄²⁻	Sulphate ion

1. Introduction

Air quality is an important environmental factor in ensuring the conservation of local vegetation, wildlife and the human population. Baseline data is required to assess the potential implications of KSM operations. Poor air quality in current or future conditions has the potential to adversely affect the growth of vegetation and can pose a risk to the general health of wildlife and human populations. Higher sulphate and nitrate concentrations in particulate matter (PM), at baseline or during mine operations, may also indicate the potential for acid deposition or acid rain. Similarly, high metal content in PM can lead to concentrations of metals in plant and wildlife tissues that exceed safe levels.

Previously, ambient air quality baseline reports were completed for the years 2008 to 2010 (Rescan 2009, 2010, 2011). This report presents novel monitoring results from 2011 and also summarizes results from 2008 to 2010.

1.1 PROJECT PROPONENT

Seabridge Gold Inc. (Seabridge) is the proponent for the proposed KSM Project (the Project), a gold, copper, silver, molybdenum mine.

1.2 PROJECT LOCATION

The Project is located in the coastal mountains of northwestern British Columbia. It is approximately 950 km northwest of Vancouver and 65 km northwest of Stewart, within 30 km of the British Columbia-Alaska border (Figure 1.2-1).

1.3 PROJECT OVERVIEW

The Project is located in two geographical areas: the Mine Site and Processing and Tailing Management Area (PTMA), connected by twin 23-km tunnels, the Mitchell-Treaty Twinned Tunnels (Figure 1.3-1). The Mine Site is located south of the closed Eskay Creek Mine, within the Mitchell, McTagg, and Sulphurets Creek valleys. Sulphurets Creek is a main tributary of the Unuk River, which flows to the Pacific Ocean. The PTMA is located in the upper tributaries of Teigen and Treaty creeks. Both creeks are tributaries of the Bell-Irving River, which flows to the Nass River and into the Pacific Ocean. The PTMA is located about 19 km southwest of Bell II on Highway 37.

The Mine Site will be accessed by a new road, the Coulter Creek Access Road, which will be built from km 70 on the Eskay Creek Mine Road. This road will follow Coulter and Sulphurets creeks to the Mine Site. The PTMA will also be accessed by a new road, the Treaty Creek Access Road, the first 3-km segment of which is a forest service road off of Highway 37. The Treaty Creek Access Road will parallel Treaty Creek.

Four deposits will be mined at the KSM Project—Kerr, Sulphurets, Mitchell, and Iron Cap—using a combination of open pit and underground mining methods. Waste rock will be stored in engineered rock storage facilities located in the Mitchell and McTagg valleys at the Mine Site. Ore will be crushed and transported through one of the Mitchell-Treaty Twinned Tunnels to the PTMA. This tunnel will also be used to route the electrical power transmission lines. The second tunnel will be used to transport personnel and bulk materials. The Process Plant will process an average of 130,000 tpd of ore to produce a daily average of 1,200 t of concentrate. Tailing will be pumped to the Tailing Management Facility from the Process Plant. Copper concentrate will be trucked from the PTMA along highways 37 and 37A to the Port of Stewart, which is approximately 170 km away via road.



Figure 1.2-1

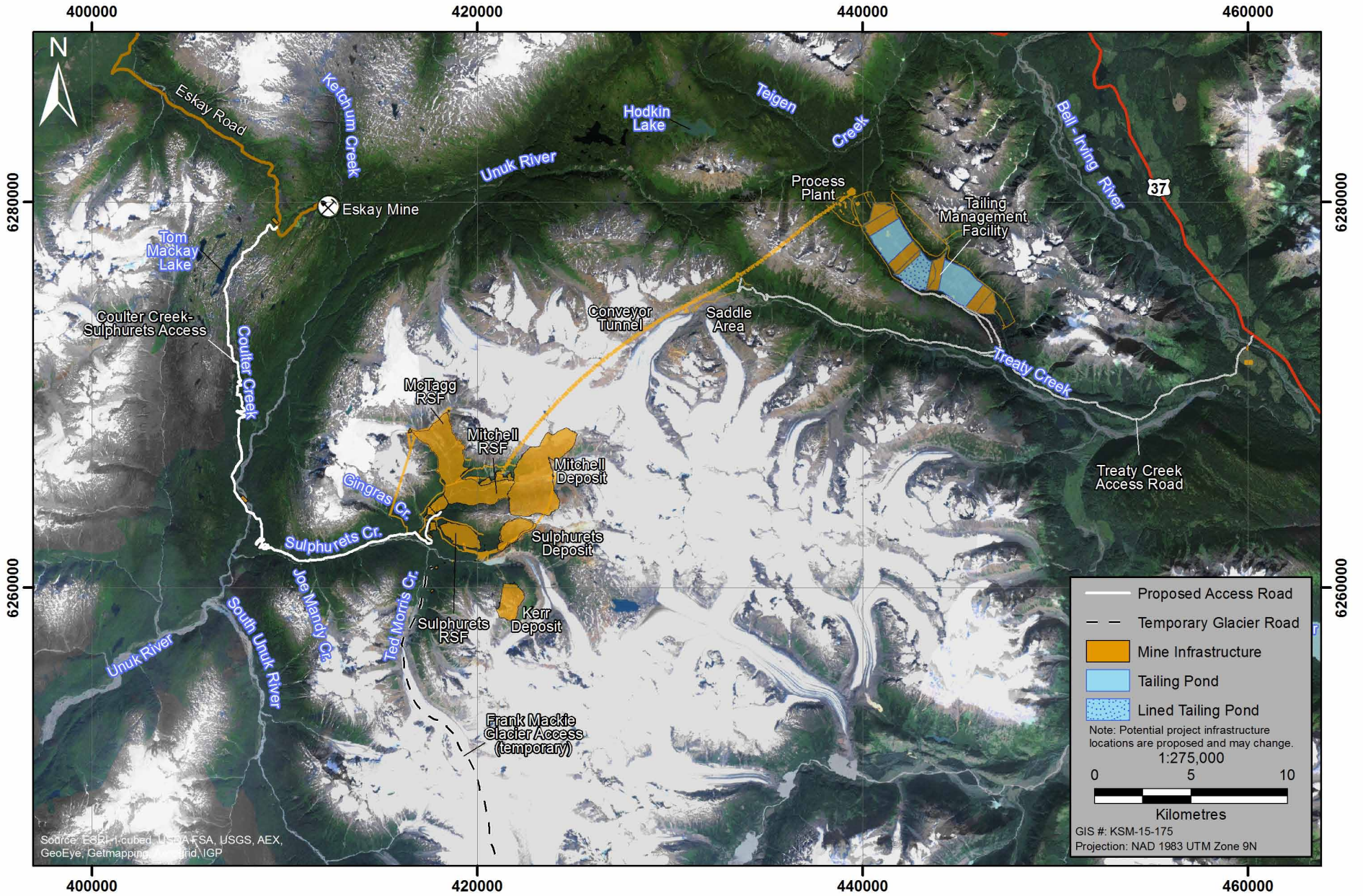


Figure 1.3-1

Figure 1.3-1

The mine operating life is estimated at 51.5 years. Approximately 1,800 people will be employed annually during the Operation Phase. Project Construction will take about five years, and the capital cost of the Project is approximately US\$5.3 billion.

2. Methods

2.1 STUDY AREA

The 2011 air quality baseline study area encompasses the proposed Mining Area in the drainage basin of the Sulphurets Creek, as well as within the proposed TMF and process plant to be located in the upper tributaries of the Teigen and Treaty Creeks (Figure 2.1-1).

2.2 SITE SELECTION

Five dustfall monitoring stations (DF-01, DF-02, DF-03, DF-04 and DF-05) were installed on May 30, 2008. An additional four dustfall monitoring stations (DF-06, DF-07, DF-08 and DF-09) were added to the baseline program on July 21 and July 23, 2009. In 2010, avalanche conditions at DF-04 prevented the station from being installed in May. As a result, DF-10 was installed near DF-04 to gather spring dustfall data in the area.

Table 2.2-1 lists the coordinates and the date of install for the dustfall stations. Four dustfall monitoring stations (DF-04, DF-05, DF-09, and DF-10) were installed in the area of the Mitchell and Sulphurets valleys. Another four stations were installed surrounding the TMF (DF-03, DF-06, DF-07, and DF-08). Dustfall locations DF-01 and DF-02 were installed along the proposed access roads.

Table 2.2-1. Dustfall Coordinates and Installation Dates

Dustfall ID	DF-01	DF-02	DF-03	DF-04	DF-05
Easting (m)	431,941	442,451	439,795	422,713	407,641
Northing (m)	6,277,640	6,287,664	6,279,600	6,265,427	6,262,303
Date Installed	30-May-08	30-May-08	30-May-08	30-May-08	30-May-08

Dustfall ID	DF-06	DF-07	DF-08	DF-09	DF-10
Easting (m)	440,497	442,593	447,382	416,024	420,444
Northing (m)	6,277,085	6,274,638	6273071	6,262,506	6,265,221
Date Installed	23-Jul-09	23-Jul-09	23-Jul-09	21-Jul-09	5-May-11

Notes: UTM coordinates in map datum NAD83 zone 9

2.3 MONITORING METHOD

The purpose of the dustfall monitoring program is to quantify the amount of dust deposition near the proposed Project area and compare the results to provincial standards.

The dustfall monitoring stations were sited in accordance with ASTM Standard D1739-98 (Reapproved 2010). The dustfall monitoring stations are in open areas that are free of structures higher than 1 m within a 20 m radius of the collection container. The dustfall monitoring stations collect particulates small enough to pass through a 1 mm screen and large enough to settle by virtue of their weight. This requires containers of a standard size and shape, which are partially filled with deionised water and algicide to prevent the growth of algae in the canisters. Each dustfall monitoring station consisted of two canisters each surrounded by a wind screen and mounted on a 2 m pole (Plate 2.3-1). The contents of the first containers were analyzed for total particulate, soluble particulate, insoluble particulate, sulphate (SO₄²⁻), nitrate (NO₃⁻), ammonia (NH₃ and NH₄⁺), and chloride anions (Cl⁻). The contents of the second container were analyzed for total metals and base cations (Mg²⁺, Ca²⁺, K⁺). The

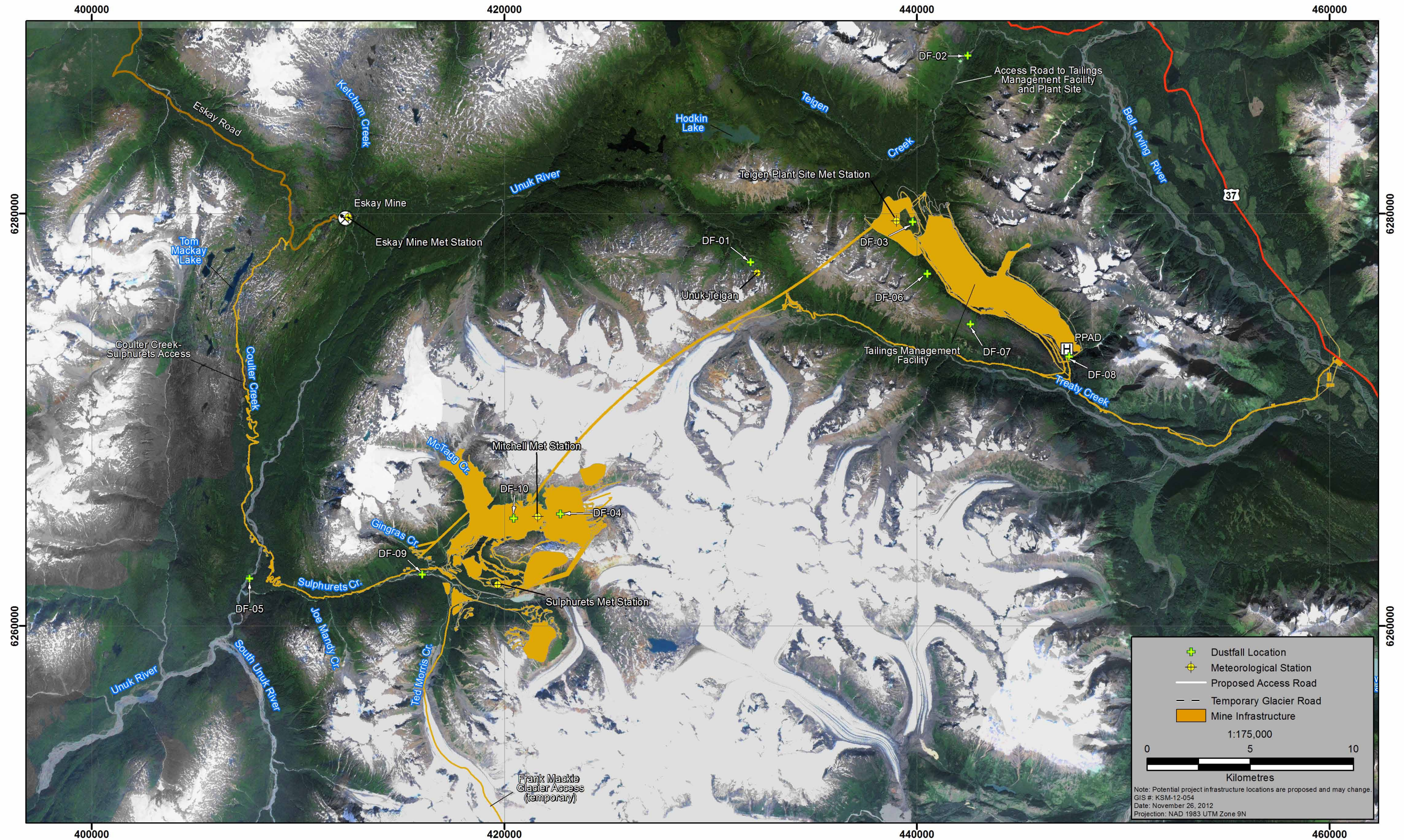
wind screen improves the dustfall collection efficiency and bird spikes are used to minimize contaminants from bird faeces (Plate 2.3-2). The canisters are left open to the atmosphere for approximately 30 days before being switched out and sent to the laboratory for analysis. Each site requires a monthly visit to exchange canisters and ensure that the equipment and samples have not been tampered with. Dustfall results are prorated by the laboratory to a 30-day average, so that they can be compared with relevant dustfall criteria and objectives.



Plate 2.3-1. Dustfall station DF-04.



Plate 2.3-2. Close up view of a dustfall collector and wind screen. Bird spikes surround the wind screen and prevent contamination of the samples from birds.



3. Results

The following section presents results of the 2008 to 2011 air quality monitoring program in the KSM Project area. The dustfall laboratory results are presented in Appendix 1.

3.1 TOTAL DUSTFALL

Table 3.1-1 summarizes total dustfall results from June 2008 to October 2011. The 1979 BC MOE Pollution Control Objectives for the Mining, Smelting and Related industries of BC lists a range of 1.7 to 2.9 mg/dm²/day as the acceptable limits (BC MOE 1979). In 2008, the highest total dustfall deposition rate was 5.93 mg/dm²/day at DF-01 in August. The result was unusually high in comparison to other sampling results during the same period with no fugitive dust sources identified by the field staff near DF-01. Moreover, dustfall levels reported at the other stations in the same month were low; therefore, this value was deemed an outlier and omitted from further analysis. All of the other results were below the most stringent objective of 1.7 mg/dm²/day with the highest being 0.38 mg/dm²/day at DF-01 in July.

In 2009, the highest total dustfall deposition rate was 1.66 mg/dm²/day at DF-01 in July. In 2010, the dustfall deposition rates were above the least stringent objective of 2.9 mg/dm²/day at DF-01 (3.75 mg/dm²/day) and DF-06 (3.06 mg/dm²/day) in August. The average wind speed in October 2010 was 20 m/s which was higher than the annual average wind speed of 14 m/s. High wind speed in the summer tends to be the cause of high dustfall deposition rate where dust is blown from various sources. The dustfall depositions of 2.04 mg/dm²/day at DF-05 and 1.81 mg/dm²/day at DF-09 in July 2010 were above the most stringent objective of 1.7 mg/dm²/day. In 2011, the highest total dustfall deposition rate was 0.95 mg/dm²/day at DF-09 in October. The total dustfall measurements for 2008 to 2011 are shown in Figures 3.1-1 to 3.1-2. The complete dustfall deposition reports are presented in Appendix 1. There was no clear seasonal trend established, however, in general, average dustfall deposition rates were highest during the dry summer months.

3.2 ACID DEPOSITION

Acid deposition occurs when acid-forming pollutants in the air are deposited on the earth's surface. The primary acid-forming pollutants are sulphur dioxide (SO₂) and oxides of nitrogen (NO_x) emitted from industrial facilities. The sulphate and nitrate deposition results from 2008 to 2011 are summarized in Tables 3.2-1 and 3.2-2. Environment Canada (EC) has studied the sources and potential adverse effects of acid deposition on the Canadian environment since its emergence in the public conscience in the early 1980s. Critical load estimates have been established for both aquatic and terrestrial ecosystems for forested areas throughout Canada (EC 2004). Since nitrate and sulphate have different atomic weights, it is impossible to report combined critical load value on a mass basis. They are typically reported on a charge equivalency basis. The unit conversion factors used in this calculation were obtained from 2004 Canadian Acid Deposition Science Assessment (EC 2004). Acid deposition rates are presented in Table 3.2-3.

Environment Canada measures acid deposition in terms of 'critical load', which is defined as the amount of acid deposition that a particular region can receive without being adversely affected. Critical loads have been determined and mapped for upland forest soils in eastern Canada following guidelines established by the New England Governor-Eastern Canadian Premiers (NEG-ECP) Environmental Task Group on Forest Mapping (NEG-ECP 2001) reported in the 2004 Canadian Acid Deposition Assessment. In Western Canada, the Acid Rain Task Group (ARTG) mandated by the Air Management Committee of the Canadian Council of Ministers of the Environment (CCME) has supported the determination of critical loads (Table 3.2-4).

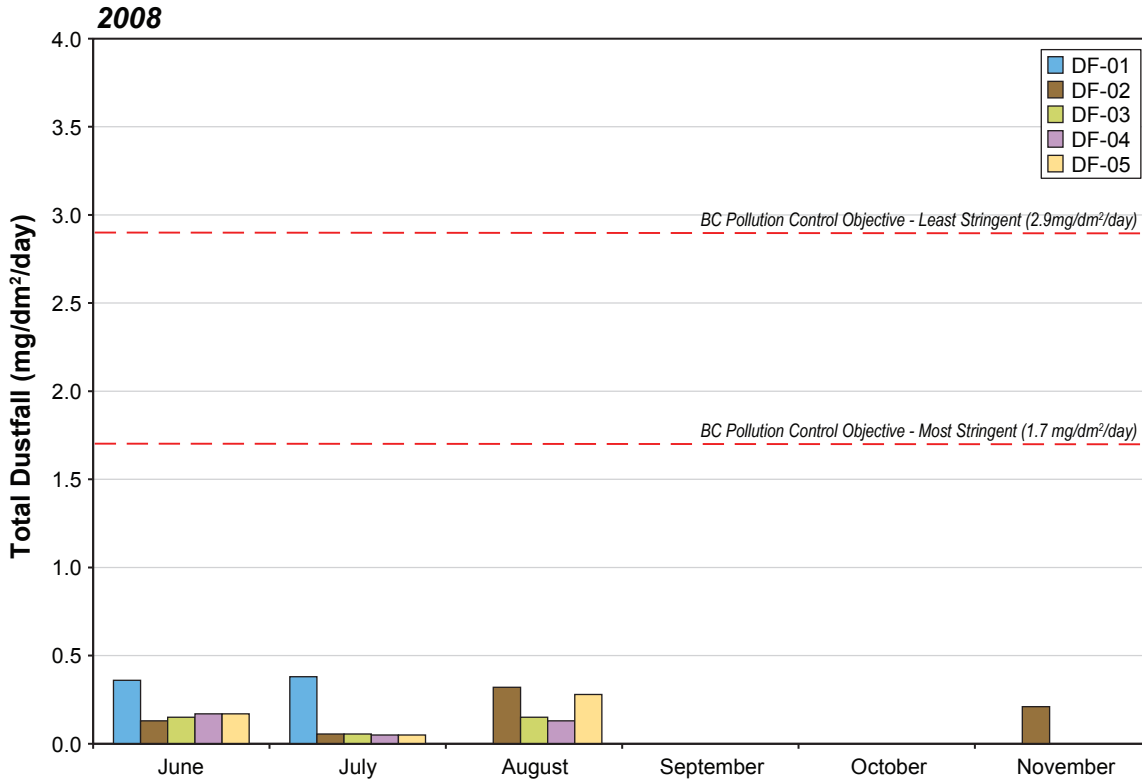


Figure 3.1-1

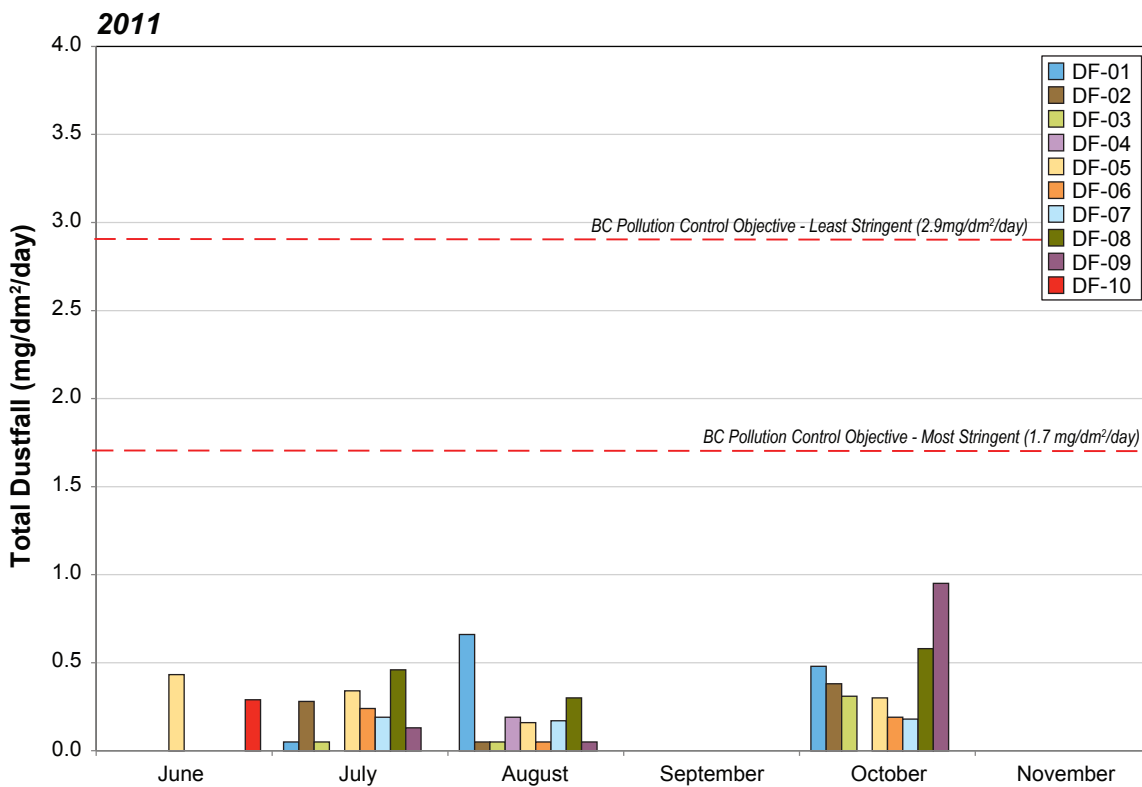
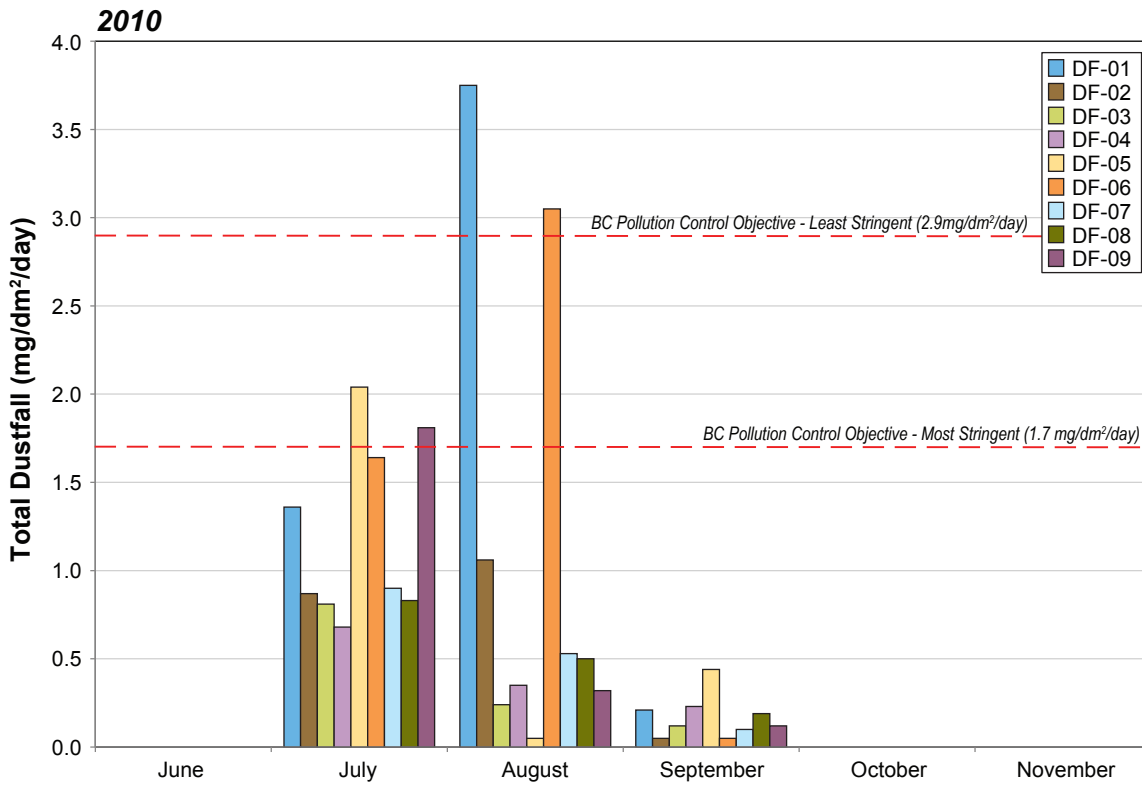


Table 3.1-1. 2008 - 2011 Total Dustfall Results (mg/dm²/day)

	DF-01	DF-02	DF-03	DF-04	DF-05	DF-06	DF-07	DF-08	DF-09	DF-10	Average
Jun-08	0.36	0.13	0.15	0.17	0.17	-	-	-	-	-	0.20
Jul-08	0.38	<0.11	<0.11	<0.10	<0.10	-	-	-	-	-	0.12
Aug-08	5.93*	0.32	0.15	0.13	0.28	-	-	-	-	-	0.22
Nov-08	-	0.21	-	-	-	-	-	-	-	-	0.21
2008 Average	0.37	0.18	0.12	0.12	0.17	-	-	-	-	-	-
Jun-09	<0.11	0.13	<0.12	0.21	0.41	-	-	-	-	-	-
Jul-09	1.66	void ^a	<0.10	<0.10	0.2	0.31	0.2	0.15	0.22	-	0.17
Aug-09	<0.10	0.53	<0.10	<0.10	0.18	0.13	<0.10	<0.10	<0.10	-	0.36
Sep-09	0.36	0.37	0.32	0.29	0.22	0.51	0.66	0.32	0.29	-	0.13
2009 Average	0.53	0.34	0.12	0.15	0.25	0.32	0.30	0.17	0.19	-	-
Jul-10	1.36	0.87	0.81	0.68	2.04	1.64	0.90	0.83	1.81	-	1.22
Aug-10	3.75	1.06	0.24	0.35	<0.10	3.05 ^b	0.53	0.50	0.32	-	1.09
Sep-10	0.21	<0.10	0.12	0.23	0.44	<0.10	0.10	0.19	0.12	-	0.17
2010 Average	1.77	0.66	0.39	0.42	0.84	1.58	0.51	0.51	0.75	-	-
Jun-11 ^d	-	-	-	-	0.43	-	-	-	-	0.29 ^c	0.36
Jul-11	<0.10	0.28	<0.10	void ^e	0.34	0.24	0.19	0.46	0.13	-	0.19
Aug-11	0.66	<0.10	<0.10	0.19	0.16	<0.10	0.17	0.30	<0.10	-	0.19
Sep-11	void	void	void	void	void	void	void	void	void	-	-
Oct-11	0.48	0.38	0.31	void ^d	0.30	0.19	0.18	0.58	0.95	-	0.42
2011 Average	0.40	0.24	0.14	0.10	0.31	0.16	0.18	0.45	0.38	0.29	-

Notes: Values less than detection limit were considered to be half of the detection limit for calculation purposes.

*This value was deemed an outlier and excluded from the calculation of the monthly and overall average.

Bold values indicate exceedances over the least stringent objective of 2.9 mg/dm²/day

Samples from September and October 2008 were not available due to sampler error.

^a DF-02 sample in July 2009 was discovered on the ground with no liquid inside; therefore, the samples were voided.

^b DF-06 in August 2010 had fallen over. Most of the liquid in the dustfall canister was still within the jar and sent to the lab for analysis. The sample could have been contaminated.

^c DF-10 was only installed for one month near dustfall station DF-04 to gather spring dustfall data for DF-04. Avalanche condition at DF-04 prevented the station from being installed in May 2011.

^d Only DF-05, DF-09 and Df-10 were installed in May 2011 but both stands at DF-09 fell over. The samples were voided.

^e The dustfall stand at DF-04 used for total dustfall sampling fell over in July 2011 and both stands at DF-4 were washed away due to flooding in October 2011. The samples were voided.

Table 3.2-1. Sulphate Deposition (mg/dm²/day)

	DF-01	DF-02	DF-03	DF-04	DF-05	DF-06	DF-07	DF-08	DF-09	DF-10
Jun-08	<0.0060	<0.0040	<0.0030	0.0051	<0.0040	-	-	-	-	-
Jul-08	0.0053	<0.0030	<0.0020	<0.0040	<0.0050	-	-	-	-	-
Aug-08	0.233*	<0.010	0.014	<0.010	<0.020	-	-	-	-	-
Nov-08	-	<0.020	-	-	-	-	-	-	-	-
Jun-09	<0.020	<0.020	<0.020	<0.020	<0.010	-	-	-	-	-
Jul-09	0.0526	-	<0.0040	<0.0040	<0.0050	0.0067	<0.0040	<0.0040	<0.0030	-
Aug-09	<0.030	<0.030	<0.030	<0.090	<0.030	<0.030	<0.040	<0.020	<0.020	-
Sep-09	<0.040	<0.040	<0.040	<0.050	<0.060	<0.040	<0.040	<0.050	<0.060	-

(continued)

Table 3.2-1. Sulphate Deposition (mg/dm²/day) (completed)

	DF-01	DF-02	DF-03	DF-04	DF-05	DF-06	DF-07	DF-08	DF-09	DF-10
Jul-10	<0.010	<0.0070	<0.0050	<0.0050	<0.0040	<0.0060	<0.0060	<0.0040	<0.0080	-
Aug-10	<0.0047	0.0179	<0.0053	<0.0047	<0.0046	<0.0066	<0.0046	<0.0057	<0.0089	-
Sep-10	<0.023	<0.024	<0.021	<0.022	<0.030	<0.020	<0.021	<0.025	<0.032	-
Jun-11	-	-	-	-	0.0010	-	-	-	-	0.0011
Jul-11	0.0008	0.0007	0.0004	Void	0.0011	0.0007	0.0006	0.0008	0.0010	-
Aug-11	0.0289	0.0044	0.0087	0.0032	0.0028	0.0015	0.0011	0.0095	0.0019	-
Sep-11	Void	Void	Void	Void	Void	Void	Void	Void	Void	-
Oct-11	0.0012	0.0014	0.0013	Void	0.0010	0.0012	0.0010	0.0014	0.0091	-

Notes: Values less than detection limit were considered to be half of the detection limit for calculation purposes.

Samples from September and October 2008 were not available due to sampler error.

DF-02 sample in July 2009 was discovered on the ground with no liquid inside; therefore, the samples were voided.

DF-10 was only installed for one month near dustfall station DF-04 to gather spring dustfall data for DF-04. Avalanche condition at DF-04 prevented the station from being installed in May 2011.

Only DF-05, DF-09 and Df-10 were installed in May 2011 but both stands at DF-09 fell over. The samples were voided.

The dustfall stand at DF-04 used for total dustfall sampling fell over in July 2011 and both stands at DF-4 were washed away due to flooding in October 2011. The samples were voided.

*This value was deemed an outlier and excluded from the calculation of the monthly and overall average.

Table 3.2-2. Nitrate Deposition (mg/dm²/day)

	DF-01	DF-02	DF-03	DF-04	DF-05	DF-06	DF-07	DF-08	DF-09	DF-10
Jun-08	0.00089	0.00089	0.00052	0.0012	0.00083	-	-	-	-	-
Jul-08	0.324*	0.261*	0.16*	0.391*	0.23*	-	-	-	-	-
Aug-08	0.00043	0.0011	0.00123	0.00101	0.00131	-	-	-	-	-
Nov-08	-	0.00081	-	-	-	-	-	-	-	-
Jun-09	0.0003	<0.00020	0.0002	0.0006	0.0005	-	-	-	-	-
Jul-09	0.0001	-	0.0002	0.0006	0.0003	0.0001	0.0003	0.0002	0.0002	-
Aug-09	0.0014	0.0011	0.0015	0.0101	0.0017	0.0017	0.0021	0.0016	0.0012	-
Sep-09	0.0012	0.0011	0.0010	0.0011	0.0007	0.0008	0.0010	0.0011	0.0009	-
Jul-10	0.00071	0.000644	0.000585	0.000782	0.000549	0.000627	0.000552	0.000243	0.000596	-
Aug-10	0.000329	0.000386	<0.000053	0.000589	<0.000046	0.000341	0.000392	0.000274	0.000447	-
Sep-10	0.00206	0.00190	0.00125	0.00161	0.00238	0.00093	0.00100	0.00169	0.00202	-
Jun-11	-	-	-	-	<0.0053	-	-	-	-	<0.0072
Jul-11	<0.0120	<0.0081	<0.0041	void	<0.0110	<0.0093	<0.0110	<0.0120	<0.0110	-
Aug-11	<0.0140	<0.0150	<0.0160	<0.0110	<0.0150	<0.0150	<0.0140	<0.0140	<0.0140	-
Sep-11	Void	Void	Void	Void	Void	Void	Void	Void	Void	-
Oct-11	<0.0460	<0.0530	<0.0460	Void	<0.0480	<0.0420	<0.0350	<0.0510	<0.0470	-

Notes: Values less than detection limit were considered to be half of the detection limit for calculation purposes.

Samples from September and October 2008 were not available due to sampler error.

DF-02 sample in July 2009 was discovered on the ground with no liquid inside; therefore, the samples were voided.

DF-10 was only installed for one month near dustfall station DF-04 to gather spring dustfall data for DF-04. Avalanche condition at DF-04 prevented the station from being installed in May 2011.

Only DF-05, DF-09 and Df-10 were installed in May 2011 but both stands at DF-09 fell over. The samples were voided.

The dustfall stand at DF-04 used for total dustfall sampling fell over in July 2011 and both stands at DF-4 were washed away due to flooding in October 2011. The samples were voided.

*This value was deemed an outlier and excluded from the calculation of the monthly and overall average.

Table 3.2-3. Acid Loading Results (eq/ha/yr)

	DF-01	DF-02	DF-03	DF-04	DF-05	DF-06	DF-07	DF-08	DF-09	DF-10	Median
Jun-08	46	38	25	70	37	-	-	-	-	-	38
Jul-08	40	11	8	15	19	-	-	-	-	-	15
Aug-08	11	67	138	64	110	-	-	-	-	-	67
Nov-08	-	97	-	-	-	-	-	-	-	-	97
2008 Median	40	53	25	64	37	-	-	-	-	-	
Jun-09	83	79	82	91	51	-	-	-	-	-	82
Jul-09	401	-	21	30	27	52	22	20	15	-	24
Aug-09	151	143	152	605	158	158	207	116	108	-	152
Sep-09	184	181	178	218	247	172	177	218	251	-	184
2009 Median	168	143	117	154	105	158	177	116	108	-	
Jul-10	56	43	34	39	29	39	37	22	46	-	39
Aug-10	26	146	21	33	18	34	28	29	45	-	29
Sep-10	141	141	112	125	176	100	106	139	174	-	139
2010 Median	56	141	34	39	29	39	37	29	46	-	39
Jun-11	-	-	-	-	-	-	-	-	-	102	102
Jul-11	163	111	57	0	151	126	148	163	151	-	148
Aug-11	402	228	274	168	216	207	191	255	197	-	216
Sep-11	-	-	-	-	-	-	-	-	-	-	-
Oct-11	609	701	609	-	633	556	464	675	682	-	621
2011 Median	402	228	274	84	216	207	191	255	197	102	-

Notes: Samples from September and October 2008 were not available due to sampler error.

DF-02 sample in July 2009 was discovered on the ground with no liquid inside; therefore, the samples were voided.

DF-06 in August 2010 had fallen over. Most of the liquid in the dustfall canister was still within the jar and sent to the lab for analysis. The sample could have been contaminated.

DF-10 was only installed for one month near dustfall station DF-04 to gather spring dustfall data for DF-04. Avalanche condition at DF-04 prevented the station from being installed in May 2011.

Only DF-05, DF-09 and Df-10 were installed in May 2011 but both stands at DF-09 fell over. The samples were voided.

The dustfall stand at DF-04 used for total dustfall sampling fell over in July 2011 and both stands at DF-4 were washed away due to flooding in October 2011. The samples were voided.

Table 3.2-4. Summary of Critical Loads for all Canadian Provinces (eq/ha/yr)

Province	Mean	Median	Mode	Minimum	Maximum
Alberta	872	868	264	216	3421
British Columbia	856	750	532	174	4026
Manitoba	1119	870	259	185	3240
New Brunswick	1361	1150	1267	178	6131
Newfoundland and Labrador	749	602	263	193	4635
Nova Scotia	950	805	405	220	5181
Ontario	775	525	250	213	4276
Prince Edward Island	1936	1950	2513	201	5930
Quebec	747	525	377	250	3219
Saskatchewan	539	354	303	208	2885

Source: (Aherne 2008)

Sulphate and nitrate deposition was detected in many of the dustfall collectors at the KSM Project area. In 2008, the sulphate deposition measured in August at DF-01 and all nitrate deposition measured in July were voided from result analysis because the unusually high values were deemed outliers. The highest acid loadings for each year are 138 eq/ha/year at DF-03 in August 2008, 605 eq/ha/year at DF-04 in August 2009, 176 eq/ha/year at DF-09 in September 2010 and 701 eq/ha/year at DF-09 in October 2011. In British Columbia, the preliminary estimates of critical load median is 750 eq/ha/yr (Aherne 2008). The highest median acid deposition rate during the 2008 to 2011 period is 701 eq/ha/yr at DF-01 in 2011. The median acid load ranged from 25 to 402 eq/ha/year from all ten stations during the monitoring period, which is below the median critical load in BC but slightly higher than the lowest reported median critical load of 354 eq/ha/year for Saskatchewan. It is important to note that the acid deposition calculations do not consider any neutralizing compounds found in the dustfall and soil. Therefore, actual loading is likely well below the calculated value. Figures 3.2-1 and 3.2-2 summarize the acid deposition for the KSM project area from 2008 to 2011.

3.3 METAL DEPOSITION

Heavy metals such as cadmium, lead and mercury are common air pollutants typically emitted from industrial activities, traffic and energy production. Although the atmospheric levels are low, they tend to deposit and collect in soils. Heavy metals are persistent in the environment and are subject to bioaccumulation in food-chains. Tables 3.3-1 to 3.3-4 show the maximum metal deposition from all months for 2008 to 2011.

There is currently no ambient air criterion for metal deposition in Canada; however, metal deposition rates were monitored as a baseline level future reference. Since copper is in the ore in the area, copper deposition rate would likely be monitored after the project commencement. The maximum copper deposition rates were 0.0055, 0.0016, 0.00065 and 0.0012 mg/dm²/day for 2008, 2009, 2010 and 2011, respectively. For other elements, the maximum deposition rates during the reporting period of 2008 to 2011 were 0.00002 mg/dm²/day in 2009 for arsenic, 0.000011 mg/dm²/day in 2008 for cadmium, 0.0049 mg/dm²/day in 2010 for lead. Mercury deposition rates were below detection limits except one measurable result at DF-05 in 2010. Other metal deposition results, however, are difficult to summarize because the majority of samples were at or below the detection limits.

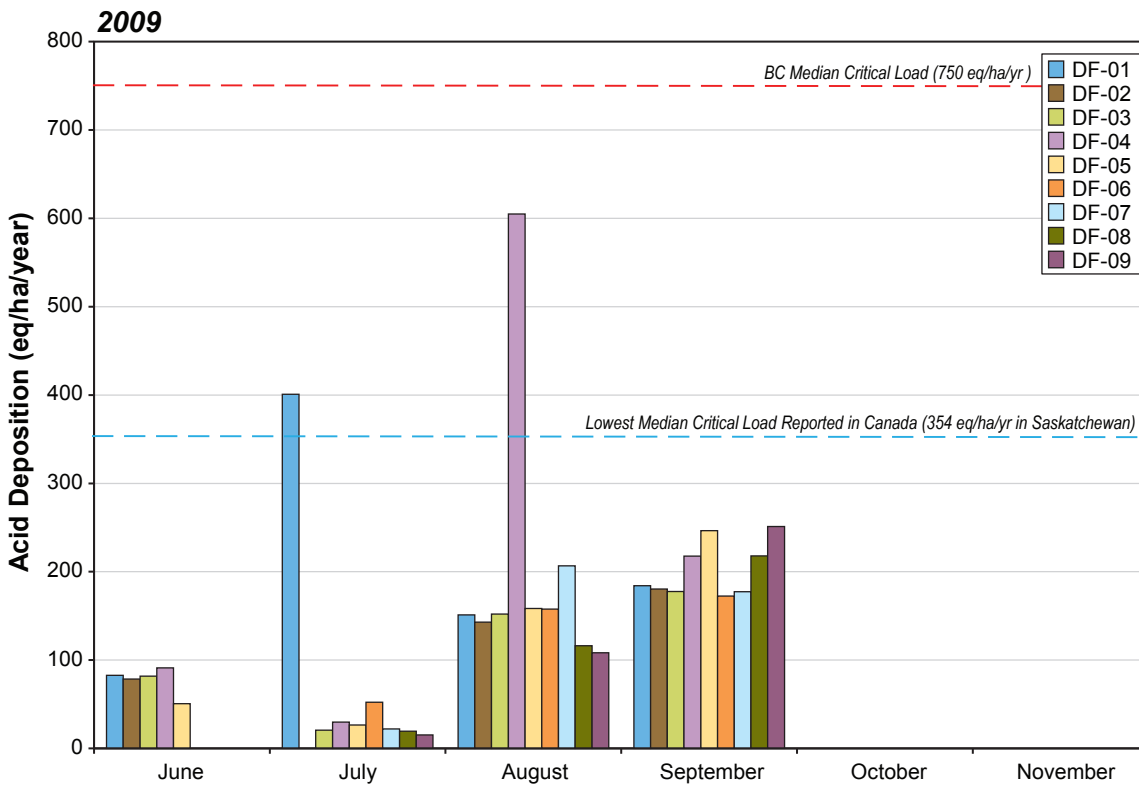
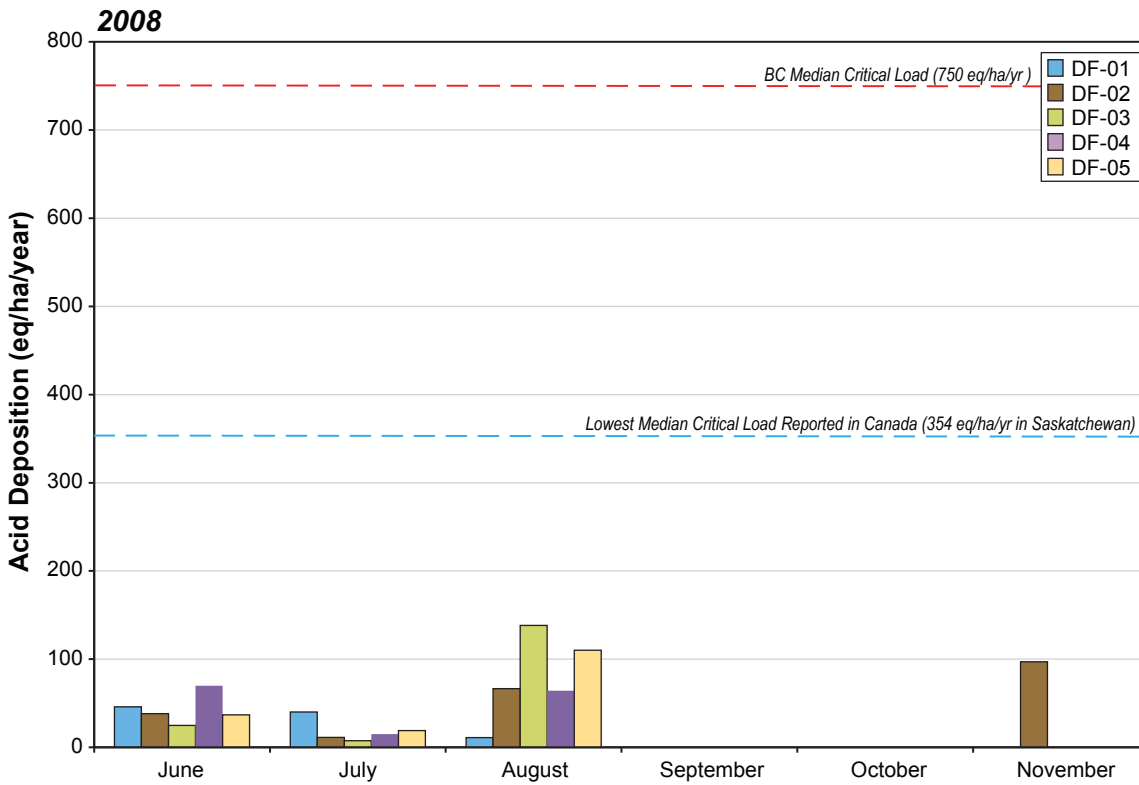


Figure 3.2-1

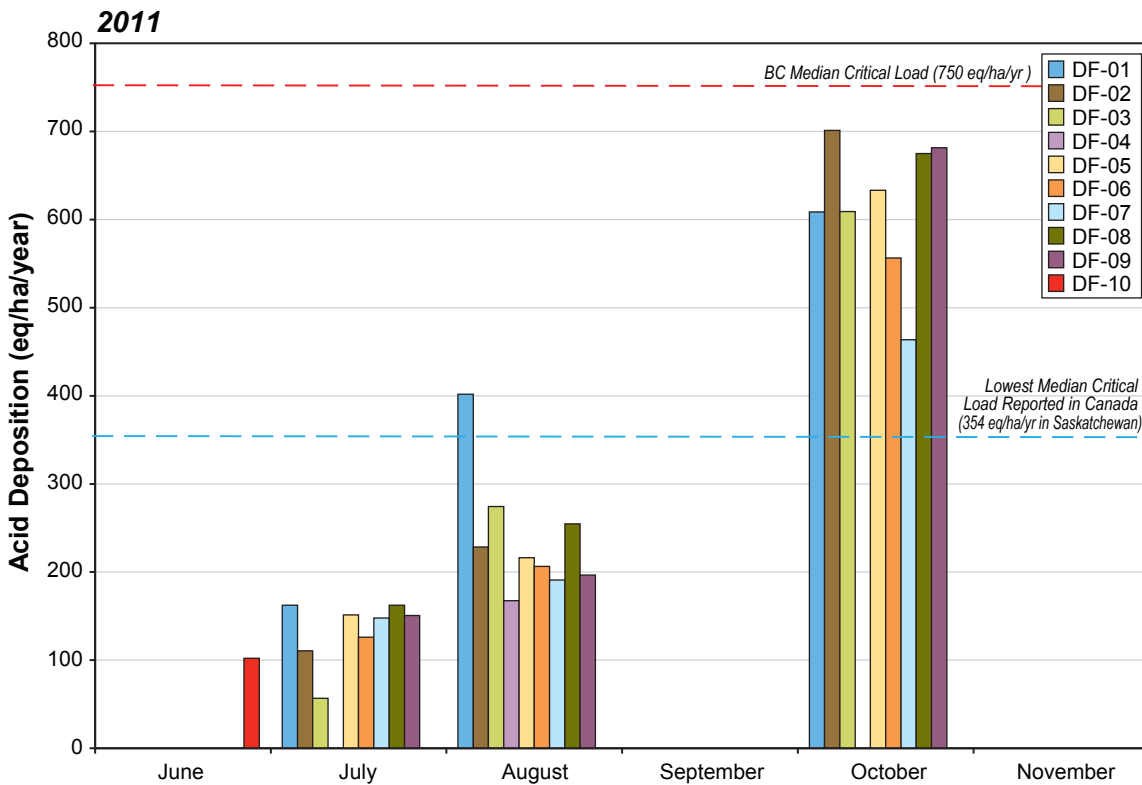
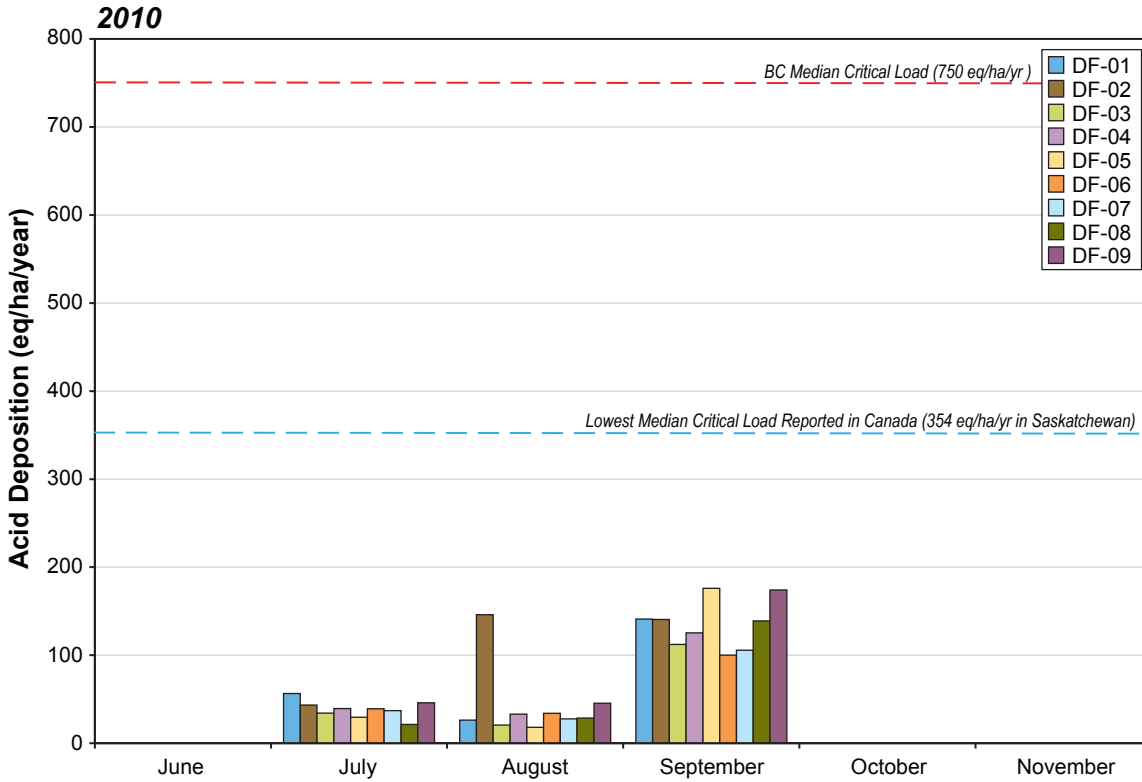


Figure 3.2-2

Table 3.3-1. 2008 Maximum Metal Deposition Summary (mg/dm²/day)

Station	DF-01	DF-02	DF-03	DF-04	DF-05	2008 Maximum
Aluminum (Al)-Total	7.5E-4	3.2E-4	1.8E-4	1.3E-4	4.6E-4	7.5E-4
Antimony (Sb)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Arsenic (As)-Total	1.5E-6	BDL	BDL	BDL	BDL	1.5E-6
Barium (Ba)-Total	2.8E-5	2.4E-5	1.8E-5	5.8E-5	4.7E-5	5.8E-5
Beryllium (Be)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Bismuth (Bi)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Boron (B)-Total	7.2E-4	BDL	BDL	BDL	BDL	7.2E-4
Cadmium (Cd)-Total	1.1E-5	1.3E-6	BDL	BDL	BDL	1.1E-5
Calcium (Ca)-Total	1.5E-2	3.6E-3	1.6E-3	2.4E-3	2.2E-3	1.5E-2
Chromium (Cr)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Cobalt (Co)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Copper (Cu)-Total	2.9E-3	5.5E-3	3.2E-3	3.5E-3	3.7E-3	5.5E-3
Iron (Fe)-Total	2.2E-3	BDL	BDL	BDL	6.9E-4	2.2E-3
Lead (Pb)-Total	9.8E-6	1.8E-6	2.7E-6	3.3E-6	8.4E-6	9.8E-6
Lithium (Li)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Magnesium (Mg)-Total	3.4E-2	BDL	BDL	BDL	BDL	3.4E-2
Manganese (Mn)-Total	2.7E-4	9.7E-5	3.9E-5	6.9E-5	6.4E-5	2.7E-4
Mercury (Hg)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Molybdenum (Mo)-Total	4.8E-6	BDL	BDL	BDL	BDL	4.8E-6
Nickel (Ni)-Total	3.1E-5	9.3E-6	BDL	BDL	BDL	3.1E-5
Phosphorus (P)-Total	2.0E-1	8.8E-3	BDL	BDL	BDL	2.0E-1
Potassium (K)-Total	3.1E-1	BDL	BDL	BDL	BDL	3.1E-1
Selenium (Se)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Silicon (Si)-Total	8.4E-4	BDL	BDL	BDL	BDL	8.4E-4
Silver (Ag)-Total	4.1E-6	BDL	2.9E-7	BDL	BDL	4.1E-6
Sodium (Na)-Total	5.4E-2	BDL	BDL	BDL	BDL	5.4E-2
Strontium (Sr)-Total	5.4E-5	1.8E-5	4.7E-6	9.9E-6	7.2E-6	5.4E-5
Thallium (Tl)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Tin (Sn)-Total	7.3E-6	BDL	BDL	BDL	BDL	7.3E-6
Titanium (Ti)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Uranium (U)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium (V)-Total	BDL	BDL	BDL	BDL	BDL	BDL
Zinc (Zn)-Total	1.3E-3	3.0E-4	9.5E-5	1.9E-4	1.9E-4	1.3E-3

Note: BDL = Below detection limit

Table 3.3-2. 2009 Maximum Metal Deposition Summary (mg/dm²/day)

Station	DF-01	DF-02	DF-03	DF-04	DF-05	DF-06	DF-07	DF-08	DF-09	2009 Maximum
Aluminum (Al)-Total	1.00E-03	4.90E-04	1.80E-03	8.90E-04	8.30E-04	1.50E-03	7.10E-03	7.00E-04	3.40E-03	7.10E-03
Antimony (Sb)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.50E-06	1.50E-06
Arsenic (As)-Total	1.40E-06	1.10E-05	1.20E-05	9.90E-06	1.60E-05	2.00E-05	1.70E-05	1.00E-05	1.30E-05	2.00E-05
Barium (Ba)-Total	2.50E-05	2.10E-05	1.90E-05	1.50E-04	6.40E-05	2.30E-05	8.50E-05	2.10E-05	8.30E-05	1.50E-04
Beryllium (Be)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bismuth (Bi)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Boron (B)-Total	1.90E-04	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.90E-04
Cadmium (Cd)-Total	7.40E-06	1.40E-06	BDL	9.30E-07	BDL	6.30E-06	BDL	BDL	BDL	7.40E-06
Calcium (Ca)-Total	5.10E-03	1.60E-03	1.50E-03	2.60E-03	5.60E-03	2.00E-03	3.10E-03	1.70E-03	1.90E-03	5.60E-03
Chromium (Cr)-Total	6.00E-06	BDL	BDL	1.20E-05	BDL	8.40E-06	4.80E-05	BDL	BDL	4.80E-05
Cobalt (Co)-Total	1.00E-05	8.50E-06	1.70E-06	2.30E-06	BDL	3.10E-06	1.70E-06	2.20E-06	3.60E-06	1.00E-05
Copper (Cu)-Total	1.20E-03	1.60E-03	1.10E-03	1.10E-03	1.10E-03	1.40E-03	7.30E-04	1.20E-03	8.30E-04	1.60E-03
Iron (Fe)-Total	2.20E-03	8.30E-04	8.40E-04	1.60E-03	9.60E-04	2.10E-03	5.00E-03	9.20E-04	5.90E-03	5.90E-03
Lead (Pb)-Total	5.30E-06	5.40E-06	5.80E-06	6.90E-06	3.10E-06	6.30E-06	7.40E-06	4.80E-06	8.20E-06	8.20E-06
Lithium (Li)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Magnesium (Mg)-Total	8.10E-03	BDL	BDL	BDL	BDL	1.80E-03	BDL	BDL	2.00E-03	8.10E-03
Manganese (Mn)-Total	1.80E-04	1.10E-04	1.30E-04	1.80E-04	1.80E-04	1.70E-04	1.30E-04	1.30E-04	1.90E-04	1.90E-04
Mercury (Hg)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Molybdenum (Mo)-Total	2.70E-06	5.40E-07	BDL	1.70E-06	BDL	BDL	9.40E-07	BDL	1.30E-06	2.70E-06
Nickel (Ni)-Total	4.70E-05	5.40E-06	1.50E-05	BDL	BDL	1.40E-05	BDL	BDL	BDL	4.70E-05
Phosphorus (P)-Total	7.50E-02	8.80E-03	BDL	BDL	BDL	1.00E-02	BDL	BDL	BDL	7.50E-02
Potassium (K)-Total	1.10E-01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.10E-01
Selenium (Se)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Silicon (Si)-Total	2.00E-03	1.20E-03	3.60E-03	1.90E-03	1.10E-03	1.90E-03	8.80E-03	1.40E-03	6.00E-03	8.80E-03
Silver (Ag)-Total	6.70E-07	BDL	BDL	2.50E-07	BDL	4.50E-07	BDL	4.50E-07	1.50E-07	6.70E-07
Sodium (Na)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Strontium (Sr)-Total	2.60E-05	2.30E-05	7.00E-06	1.40E-05	3.00E-05	1.20E-05	3.30E-05	1.10E-05	2.90E-05	3.30E-05
Thallium (Tl)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Tin (Sn)-Total	BDL	BDL	BDL	6.00E-06	3.60E-06	BDL	BDL	BDL	7.60E-05	7.60E-05
Titanium (Ti)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Uranium (U)-Total	BDL	BDL	BDL	2.40E-07	BDL	BDL	BDL	BDL	1.70E-07	2.40E-07
Vanadium (V)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zinc (Zn)-Total	8.60E-04	1.90E-04	1.30E-04	2.50E-04	1.50E-04	1.70E-04	9.50E-05	5.90E-05	1.30E-04	8.60E-04

Note: BDL = Below detection limit

Table 3.3-3. 2010 Maximum Metal Deposition Summary (mg/dm²/day)

Station	DF-01	DF-02	DF-03	DF-04	DF-05	DF-06	DF-07	DF-08	DF-09	2010 Maximum
Aluminum (Al)-Total	3.30E-04	2.40E-04	3.00E-04	2.40E-03	4.60E-04	3.40E-04	3.40E-04	3.10E-04	5.70E-04	2.40E-03
Antimony (Sb)-Total	BDL	BDL	BDL	BDL	3.20E-03	BDL	BDL	BDL	BDL	3.20E-03
Arsenic (As)-Total	3.20E-06	3.50E-06	4.10E-06	9.40E-06	3.00E-06	9.90E-06	3.60E-06	3.80E-06	6.50E-06	9.90E-06
Barium (Ba)-Total	2.00E-05	1.70E-05	2.30E-05	9.40E-05	1.80E-05	2.10E-05	1.40E-05	2.40E-05	2.50E-05	9.40E-05
Beryllium (Be)-Total	BDL	BDL	BDL	BDL	1.40E-04	BDL	BDL	BDL	BDL	1.40E-04
Bismuth (Bi)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Boron (B)-Total	4.00E-04	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4.00E-04
Cadmium (Cd)-Total	4.00E-06	BDL	BDL	4.90E-06	8.20E-07	7.20E-07	1.70E-06	BDL	BDL	4.90E-06
Calcium (Ca)-Total	6.50E-03	1.80E-03	1.00E-03	3.40E-03	1.90E-03	2.90E-03	1.10E-03	1.90E-03	2.10E-03	6.50E-03
Chromium (Cr)-Total	BDL	BDL	BDL	BDL	1.60E-02	BDL	BDL	BDL	BDL	1.60E-02
Cobalt (Co)-Total	BDL	BDL	BDL	2.00E-06	BDL	2.50E-06	BDL	BDL	BDL	2.50E-06
Copper (Cu)-Total	2.30E-04	3.40E-05	6.70E-06	6.50E-04	4.10E-05	1.70E-05	6.60E-06	9.20E-06	5.20E-05	6.50E-04
Iron (Fe)-Total	8.90E-04	3.20E-04	4.90E-04	5.40E-03	8.00E-04	5.50E-04	BDL	BDL	1.00E-03	5.40E-03
Lead (Pb)-Total	5.90E-06	1.90E-06	2.30E-06	1.40E-05	4.90E-03	1.40E-06	4.30E-06	3.30E-06	3.80E-06	4.90E-03
Lithium (Li)-Total	BDL	BDL	BDL	BDL	3.60E-06	BDL	BDL	BDL	BDL	3.60E-06
Magnesium (Mg)-Total	1.40E-02	BDL	BDL	BDL	BDL	3.70E-03	BDL	BDL	BDL	1.40E-02
Manganese (Mn)-Total	2.40E-04	2.00E-04	8.90E-05	2.70E-04	7.10E-05	4.30E-04	8.50E-05	2.00E-04	1.00E-04	4.30E-04
Mercury (Hg)-Total	BDL	BDL	BDL	BDL	4.30E-04	BDL	BDL	BDL	BDL	4.30E-04
Molybdenum (Mo)-Total	9.50E-07	BDL	BDL	3.20E-06	BDL	BDL	BDL	2.70E-06	BDL	3.20E-06
Nickel (Ni)-Total	BDL	5.20E-05	BDL	1.20E-05	1.20E-05	7.20E-06	BDL	4.10E-05	1.60E-04	1.60E-04
Phosphorus (P)-Total	8.30E-02	6.70E-03	BDL	BDL	BDL	2.40E-02	BDL	BDL	BDL	8.30E-02
Potassium (K)-Total	1.20E-01	BDL	BDL	BDL	BDL	5.60E-02	BDL	BDL	BDL	1.20E-01
Selenium (Se)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Silicon (Si)-Total	BDL	BDL	BDL	3.30E-03	6.50E-04	BDL	BDL	BDL	BDL	3.30E-03
Silver (Ag)-Total	BDL	BDL	BDL	BDL	4.70E-03	BDL	BDL	BDL	BDL	4.70E-03
Sodium (Na)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Strontium (Sr)-Total	3.00E-05	1.10E-05	2.40E-05	4.70E-05	7.30E-06	1.50E-05	5.50E-06	1.50E-05	7.90E-06	4.70E-05
Thallium (Tl)-Total	BDL	BDL	BDL	BDL	8.00E-05	BDL	BDL	BDL	BDL	8.00E-05
Tin (Sn)-Total	BDL	BDL	BDL	5.00E-06	BDL	BDL	BDL	BDL	BDL	5.00E-06
Titanium (Ti)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Uranium (U)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium (V)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zinc (Zn)-Total	5.30E-04	1.50E-04	3.90E-05	1.80E-04	9.60E-05	1.00E-04	4.90E-05	7.10E-05	8.90E-05	5.30E-04

Note: BDL = Below detection limit

Table 3.3-4. 2011 Maximum Metal Deposition Summary (mg/dm²/day)

Station	DF-01	DF-02	DF-03	DF-04	DF-05	DF-06	DF-07	DF-08	DF-09	DF-10	2011 Maximum
Aluminum (Al)-Total	8.60E-04	1.60E-03	5.90E-04	9.30E-04	8.90E-04	6.70E-04	7.20E-04	5.90E-04	2.30E-03	4.00E-03	4.00E-03
Antimony (Sb)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Arsenic (As)-Total	BDL	BDL	BDL	7.90E-06	3.20E-06	BDL	BDL	BDL	1.20E-05	3.60E-06	1.20E-05
Barium (Ba)-Total	1.70E-05	5.20E-05	1.10E-05	4.40E-04	7.20E-05	3.20E-05	1.10E-05	1.00E-04	6.70E-05	4.30E-05	4.40E-04
Beryllium (Be)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bismuth (Bi)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Boron (B)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cadmium (Cd)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Calcium (Ca)-Total	2.20E-03	2.90E-03	1.10E-03	4.10E-03	2.20E-03	BDL	BDL	5.60E-03	1.70E-03	4.40E-03	5.60E-03
Chromium (Cr)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cobalt (Co)-Total	BDL	BDL	BDL	BDL	1.40E-06	BDL	BDL	BDL	BDL	1.70E-06	1.70E-06
Copper (Cu)-Total	3.60E-04	1.10E-03	4.00E-04	2.40E-04	9.60E-05	1.20E-03	3.60E-04	5.00E-04	6.00E-04	5.00E-04	1.20E-03
Iron (Fe)-Total	BDL	1.10E-03	8.30E-04	5.60E-03	1.40E-03	BDL	BDL	1.00E-03	4.40E-03	2.20E-03	5.60E-03
Lead (Pb)-Total	1.40E-05	2.40E-05	8.50E-06	8.30E-06	6.20E-06	1.90E-05	8.00E-06	1.10E-05	1.30E-05	1.70E-05	2.40E-05
Lithium (Li)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Magnesium (Mg)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Manganese (Mn)-Total	7.00E-05	5.40E-04	1.10E-04	1.90E-04	1.20E-04	1.40E-04	1.40E-04	3.20E-04	1.60E-04	BDL	5.40E-04
Mercury (Hg)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Molybdenum (Mo)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Nickel (Ni)-Total	BDL	BDL	BDL	BDL	BDL	6.00E-05	BDL	5.40E-05	BDL	BDL	6.00E-05
Phosphorus (P)-Total	2.00E-02	2.60E-02	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.60E-02
Potassium (K)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Selenium (Se)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Silicon (Si)-Total	BDL	BDL	BDL	BDL	8.90E-04	BDL	BDL	BDL	BDL	1.30E-03	1.30E-03
Silver (Ag)-Total	3.60E-07	3.20E-07	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sodium (Na)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Strontium (Sr)-Total	1.10E-05	2.40E-05	4.70E-06	3.80E-05	9.80E-06	1.10E-05	BDL	5.00E-05	1.20E-05	2.10E-05	5.00E-05
Thallium (Tl)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Tin (Sn)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Titanium (Ti)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Uranium (U)-Total	BDL	BDL	BDL	BDL	8.50E-08	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium (V)-Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zinc (Zn)-Total	2.90E-04	8.70E-04	2.60E-04	2.30E-04	3.20E-04	4.20E-04	1.60E-04	5.20E-04	1.40E-04	1.20E-04	8.70E-04

Note: BDL = Below detection limit

4. Conclusion

The KSM air quality monitoring program involved five locations in 2008, nine locations in 2009 and 2010, and ten locations in 2011. Dustfall samples were analyzed at an accredited laboratory in Vancouver for total dustfall, soluble dustfall, insoluble dustfall, sulphate, nitrate and total metals.

The highest total dustfall deposition rate, of 5.93 mg/dm²/day at DF-01 in August 2008, was deemed an outlier and removed from further analysis. In 2008, the highest total dustfall was 0.38 mg/dm²/day at DF-01 in July. In 2009, the highest total dustfall deposition rate was 1.66 mg/dm²/day at DF-01 in July. In 2010, the dustfall deposition rates were above the least stringent objective of 2.9 mg/dm²/day at DF-01 (3.75 mg/dm²/day) and DF-06 (3.06 mg/dm²/day) in August. The dustfall deposition of 2.04 mg/dm²/day at DF-05 in June 2010 was above the most stringent objective of 1.7 mg/dm²/day. In 2011, the highest dustfall deposition was 0.95 mg/dm²/day at DF-09 in October.

The 1979 BC MOE Pollution Control Objectives for the Mining, Smelting and Related industries of BC lists objectives of 1.7 to 2.9 mg/dm²/day for dustfall. The least stringent objective of 2.9 mg/dm²/day was exceeded twice at DF-01 and DF-06 in August 2010. The most stringent objective of 1.7 mg/dm²/day was exceeded three times including the two times when least stringent objective was exceeded and at DF-05 in June 2010. The dustfall deposition results for all the other periods were below the guidelines.

During the 2008 to 2011 period, the highest acid deposition was 341 eq/ha/year at DF-04 in August 2009. The highest median during this period was 182 eq/ha/year at DF-01 in 2011. All of acid deposition results were less than the median critical load of 750 eq/ha/year in BC and the lowest reported median provincial critical load of 354 eq/ha/year in Saskatchewan. It is important to note that the acid deposition calculations do not consider any neutralizing compounds found in the dustfall and soil. Therefore, actual loading is likely well below these calculated values.

The maximum copper deposition rates were 0.0055, 0.0016, 0.00065 and 0.0012 mg/dm²/day for 2008, 2009, 2010 and 2011, respectively. The maximum deposition rates for the reporting period of 2008 to 2011 were 0.00002 mg/dm²/day in 2009 for arsenic, 0.000011 mg/dm²/day in 2008 for cadmium, and 0.0049 mg/dm²/day in 2010 for lead. Mercury deposition rates were below detection limits except one measurable result at DF-05 in 2010. Other metal deposition results, however, are difficult to analyze because the majority were at or below the detection limits.

References

- Aherne, J. 2008. *Calculating Critical Loads of Acid Deposition for Forest Soils in Alberta: Critical Load, Exceedance and Limitations. Final Report. Canadian Council of Ministers of the Environment.*
- ASTM Standard D1739-98. Reapproved 2010. *Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter).* West Conshohocken, PA: ASTM International.
- BC MOE. 1979. *Pollution Control Objectives for The Mining, Smelting, and Related Industries of British Columbia.* Victoria, BC: BC Ministry of Environment.
- EC. 2004. *2004 Canadian acid deposition science assessment.* Downsview, Ontario: Meteorological Service of Canada.
- NEG-ECP. 2001. *Critical Load of Sulphur and Nitrogen Assessment and Mapping Protocol for Upland Forests, New England Governors and Eastern Canadian Premiers Environment Task Group, Acid Rain Action Plan, Halifax, Canada.*

Appendix 1

Dustfall Laboratory Results



RESCAN ENVIRONMENTAL SERVICES
ATTN: Cheryl Zandbergen
Sixth Floor
1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 13-JUN-11
Report Date: 28-JUN-11 12:27 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L1016848
Project P.O. #: NOT SUBMITTED
Job Reference: 0868-011-03
Legal Site Desc:
C of C Numbers: 10-047496

Comments: ADDITIONAL 22-JUN-11 16:51

Amber Springer
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1016848-1	L1016848-2	L1016848-3	L1016848-4
		07-JUN-11 17:55 DF-5-TP	07-JUN-11 17:55 DF-5-TM	07-JUN-11 16:20 DF-10-TP	07-JUN-11 16:20 DF-10-TM
Grouping	Analyte				
DUSTFALL					
Particulates	Total Dustfall (mg/dm2.day)	0.432		0.294	
	Total Insoluble Dustfall (mg/dm2.day)	0.109		<0.090	
	Total Soluble Dustfall (mg/dm2.day)	0.323		0.237	
Anions and Nutrients	Ammonia (as N) (mg/dm2.day)	0.000662		0.00109	
	Chloride (Cl) (mg/dm2.day)	0.0428		0.0367	
	Nitrate (as N) (mg/dm2.day)	0.000978		0.00109	
	Sulfate (SO4) (mg/dm2.day)	<0.0053		<0.0072	
Metals	Aluminum (Al)-Total (mg/dm2.day)		0.000525		0.00395
	Antimony (Sb)-Total (mg/dm2.day)		<0.00000084		<0.0000014
	Arsenic (As)-Total (mg/dm2.day)		0.00000316		0.0000036
	Barium (Ba)-Total (mg/dm2.day)		0.0000717		0.0000431
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000042		<0.0000069
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000042		<0.0000069
	Boron (B)-Total (mg/dm2.day)		<0.000084		<0.00014
	Cadmium (Cd)-Total (mg/dm2.day)		<0.00000042		<0.00000069
	Calcium (Ca)-Total (mg/dm2.day)		0.00111		0.00441
	Chromium (Cr)-Total (mg/dm2.day)		<0.0000042		<0.000041 ^{DLB}
	Cobalt (Co)-Total (mg/dm2.day)		0.00000139		0.0000017
	Copper (Cu)-Total (mg/dm2.day)		0.0000457		0.000497
	Iron (Fe)-Total (mg/dm2.day)		0.00139		0.00215
	Lead (Pb)-Total (mg/dm2.day)		0.00000621		0.0000170
	Lithium (Li)-Total (mg/dm2.day)		<0.000042		<0.000069
	Magnesium (Mg)-Total (mg/dm2.day)		<0.00084		<0.0014
	Manganese (Mn)-Total (mg/dm2.day)		0.000119		<0.00017 ^{DLB}
	Mercury (Hg)-Total (mg/dm2.day)		<0.00000084 ^{DLM}		<0.0000014 ^{DLM}
	Molybdenum (Mo)-Total (mg/dm2.day)		<0.00000075 ^{DLB}		<0.00000069
	Nickel (Ni)-Total (mg/dm2.day)		<0.0000042		<0.0000069
	Phosphorus (P)-Total (mg/dm2.day)		<0.0025		<0.0041
	Potassium (K)-Total (mg/dm2.day)		<0.017		<0.028
	Selenium (Se)-Total (mg/dm2.day)		<0.0000084		<0.000014
	Silicon (Si)-Total (mg/dm2.day)		0.00089		0.00130
	Silver (Ag)-Total (mg/dm2.day)		<0.00000084		<0.00000014
	Sodium (Na)-Total (mg/dm2.day)		<0.017		<0.028
	Strontium (Sr)-Total (mg/dm2.day)		0.00000654		0.0000213
	Thallium (Tl)-Total (mg/dm2.day)		<0.00000084		<0.0000014
Tin (Sn)-Total (mg/dm2.day)		<0.00000084		<0.0000014	
Titanium (Ti)-Total (mg/dm2.day)		<0.000084		<0.00014	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1016848-1	L1016848-2	L1016848-3	L1016848-4
		07-JUN-11 17:55 DF-5-TP	07-JUN-11 17:55 DF-5-TM	07-JUN-11 16:20 DF-10-TP	07-JUN-11 16:20 DF-10-TM
Grouping	Analyte				
DUSTFALL					
Metals	Uranium (U)-Total (mg/dm2.day)		0.000000085		<0.00000014
	Vanadium (V)-Total (mg/dm2.day)		<0.0000084		<0.000014
	Zinc (Zn)-Total (mg/dm2.day)		0.0000578		0.000121

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection limit was raised due to detection of analyte at comparable level in Method Blank.
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-VA	Dustfall	Dustfall Chloride by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined Dustfalls-Total, soluble, insol	BCMOE DUSTFALLS
<p>Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.</p>			
HG-DUST(DM2-CVAFS-VA)	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).</p>			
MET-DUST(DM2)-ICP-VA	Dustfall	Total Metals in Dustfalls by ICPOES	EPA 6010B
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).</p>			
MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).</p>			
NH3-F-VA	Dustfall	Dustfall Ammonia by Fluorescence	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.</p>			
NO3-IC-VA	Dustfall	Dustfall Nitrate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			
SO4-IC-VA	Dustfall	Dustfall Sulphate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulphate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BC, CANADA

Chain of Custody Numbers:

10-047496

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



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Client / Project Information
Job #: 0868-011-03
PO / AFE: _____
LSD: _____
Quote #: _____

ALS Contact: _____
Sampler: CP
Date: 7-JUN-11
Time (hh:mm): 17:55
Sample Type: OUSTARU

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	SOLUBLE PART	INSOLUBLE PART	SULPHATE NITRATE	AMMONIA CHLORIDE	TOTAL METALS	CATIONS Mg Ca K	Number of Containers
DF-5-TP		"	17:55	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
DF-5-TM		"	16:20	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
DF-10-TP		"	16:20	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
DF-10-TM		"	16:20	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

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RESCAN ENVIRONMENTAL SERVICES
ATTN: Cheryl Zandbergen
Sixth Floor
1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 14-JUL-11
Report Date: 25-JUL-11 14:17 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L1031631
Project P.O. #: NOT SUBMITTED
Job Reference: 0868-011-03
Legal Site Desc:
C of C Numbers: 10-175111

Amber Springer
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

25-JUL-11 14:17 (MT)

Version: FINAL

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1031631-1	L1031631-2	L1031631-3	L1031631-4	L1031631-5
					L1031631-1 DUSTFALL 10-JUL-11 09:20 DF-1 (JUN7- JUL10)	L1031631-2 DUSTFALL 09-JUL-10 09:30 DF-2 (JUN5-JUL9)	L1031631-3 DUSTFALL 09-JUL-10 09:00 DF-3 (JUN7-JUL9)	L1031631-4 DUSTFALL 09-JUL-10 12:30 DF-4 (JUN26- JUL9)	L1031631-5 DUSTFALL 09-JUL-10 11:12 DF-5 (JUN7-JUL9)
Grouping	Analyte								
DUSTFALL									
Particulates	Total Dustfall (mg/dm2.day)	<0.10	0.28	<0.10	10.9	0.34			
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10	10.5	0.15			
	Total Soluble Dustfall (mg/dm2.day)	<0.10	0.19	<0.10	0.44	0.19			
Anions and Nutrients	Ammonia (as N) (mg/dm2.day)	0.00036	0.00279	0.000127	0.00068	0.00027			
	Chloride (Cl) (mg/dm2.day)	0.040	0.0395	0.0094	0.085	0.043			
	Nitrate (as N) (mg/dm2.day)	0.00081	0.000668	0.000431	0.00295	0.00106			
	Sulfate (SO4) (mg/dm2.day)	<0.012	<0.0081	<0.0041	0.113	<0.011			
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000411	0.000329	0.000493	0.000933	0.000594			
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000024	<0.0000016	<0.0000018	<0.0000074	<0.0000022			
	Arsenic (As)-Total (mg/dm2.day)	<0.0000024	<0.0000016	<0.0000018	0.0000079	<0.0000022			
	Barium (Ba)-Total (mg/dm2.day)	0.0000174	0.00000715	0.0000108	0.000444	0.0000131			
	Beryllium (Be)-Total (mg/dm2.day)	<0.000012	<0.0000081	<0.0000092	<0.000037	<0.000011			
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000012	<0.0000081	<0.0000092	<0.000037	<0.000011			
	Boron (B)-Total (mg/dm2.day)	<0.00024	<0.00016	<0.00018	<0.00074	<0.00022			
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000012	<0.00000081	<0.00000092	<0.0000037	<0.0000011			
	Calcium (Ca)-Total (mg/dm2.day)	0.0022	0.00162	0.00111	0.0041	0.0022			
	Chromium (Cr)-Total (mg/dm2.day)	<0.000012	<0.0000081	<0.0000092	<0.000037	<0.000011			
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000024	<0.0000016	<0.0000018	<0.0000074	<0.0000022			
	Copper (Cu)-Total (mg/dm2.day)	0.000205	0.0000531	0.0000411	0.000244	0.0000654			
	Iron (Fe)-Total (mg/dm2.day)	<0.00071	<0.00048	0.00083	0.0056	0.00076			
	Lead (Pb)-Total (mg/dm2.day)	0.0000029	<0.00000081	0.00000151	0.0000083	0.0000018			
	Lithium (Li)-Total (mg/dm2.day)	<0.00012	<0.000081	<0.000092	<0.00037	<0.00011			
	Magnesium (Mg)-Total (mg/dm2.day)	<0.0024	<0.0016	<0.0018	<0.0074	<0.0022			
	Manganese (Mn)-Total (mg/dm2.day)	0.0000702	0.0000527	0.0000657	0.000187	0.0000587			
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000012	<0.00000081	<0.00000092	<0.0000037	<0.0000011			
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000012	<0.00000081	<0.00000092	<0.0000037	<0.0000011			
	Nickel (Ni)-Total (mg/dm2.day)	<0.000012	<0.0000081	<0.0000092	<0.000037	<0.000011			
	Phosphorus (P)-Total (mg/dm2.day)	<0.0071	<0.0048	<0.0055	<0.022	<0.0067			
	Potassium (K)-Total (mg/dm2.day)	<0.048	<0.032	<0.037	<0.15	<0.044			
	Selenium (Se)-Total (mg/dm2.day)	<0.000024	<0.000016	<0.000018	<0.000074	<0.000022			
	Silicon (Si)-Total (mg/dm2.day)	<0.0012	<0.00081	<0.00092	<0.0037	<0.0011			
	Silver (Ag)-Total (mg/dm2.day)	0.00000036	0.00000032	<0.00000018	<0.00000074	<0.00000022			
	Sodium (Na)-Total (mg/dm2.day)	<0.048	<0.032	<0.037	<0.15	<0.044			
	Strontium (Sr)-Total (mg/dm2.day)	0.0000090	0.0000088	0.0000047	0.0000383	0.0000098			
Thallium (Tl)-Total (mg/dm2.day)	<0.0000024	<0.0000016	<0.0000018	<0.0000074	<0.0000022				
Tin (Sn)-Total (mg/dm2.day)	<0.0000024	<0.0000016	<0.0000018	<0.0000074	<0.0000022				
Titanium (Ti)-Total (mg/dm2.day)	<0.00024	<0.00016	<0.00018	<0.00074	<0.00022				

ALS ENVIRONMENTAL ANALYTICAL REPORT

25-JUL-11 14:17 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID	L1031631-6 DUSTFALL 09-JUL-10 17:45 DF-6 (JUN7-JUL9)	L1031631-7 DUSTFALL 09-JUL-10 17:55 DF-7 (JUN8-JUL9)	L1031631-8 DUSTFALL 09-JUL-10 08:35 DF-8 (JUN9-JUL9)	L1031631-9 DUSTFALL 09-JUL-10 11:20 DF-9 (JUN8-JUL9)	
Grouping	Analyte				
DUSTFALL					
Particulates	Total Dustfall (mg/dm2.day)	0.24	0.19	0.46	0.13
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	0.46	<0.10
	Total Soluble Dustfall (mg/dm2.day)	0.19	0.19	<0.10	<0.10
Anions and Nutrients	Ammonia (as N) (mg/dm2.day)	0.000328	0.00018	0.00527	0.00021
	Chloride (Cl) (mg/dm2.day)	0.0380	0.044	0.039	0.033
	Nitrate (as N) (mg/dm2.day)	0.000657	0.00061	0.00081	0.00097
	Sulfate (SO4) (mg/dm2.day)	<0.0093	<0.011	<0.012	<0.011
Metals	Aluminum (Al)-Total (mg/dm2.day)			0.000586	0.000396
	Antimony (Sb)-Total (mg/dm2.day)			<0.0000023	<0.0000022
	Arsenic (As)-Total (mg/dm2.day)			<0.0000023	0.0000023
	Barium (Ba)-Total (mg/dm2.day)			0.000102	0.0000107
	Beryllium (Be)-Total (mg/dm2.day)			<0.000011	<0.000011
	Bismuth (Bi)-Total (mg/dm2.day)			<0.000011	<0.000011
	Boron (B)-Total (mg/dm2.day)			<0.00023	<0.00022
	Cadmium (Cd)-Total (mg/dm2.day)			<0.0000011	<0.0000011
	Calcium (Ca)-Total (mg/dm2.day)			0.0056	0.0017
	Chromium (Cr)-Total (mg/dm2.day)			<0.000011	<0.000011
	Cobalt (Co)-Total (mg/dm2.day)			<0.0000023	<0.0000022
	Copper (Cu)-Total (mg/dm2.day)			0.0000535	0.0000625
	Iron (Fe)-Total (mg/dm2.day)			<0.00068	<0.00065
	Lead (Pb)-Total (mg/dm2.day)			<0.0000011	0.0000014
	Lithium (Li)-Total (mg/dm2.day)			<0.00011	<0.00011
	Magnesium (Mg)-Total (mg/dm2.day)			<0.0023	<0.0022
	Manganese (Mn)-Total (mg/dm2.day)			0.000316	0.0000755
	Mercury (Hg)-Total (mg/dm2.day)			<0.0000011	<0.0000011
	Molybdenum (Mo)-Total (mg/dm2.day)			<0.0000011	<0.0000011
	Nickel (Ni)-Total (mg/dm2.day)			<0.000011	<0.000011
	Phosphorus (P)-Total (mg/dm2.day)			<0.0068	<0.0065
	Potassium (K)-Total (mg/dm2.day)			<0.046	<0.043
	Selenium (Se)-Total (mg/dm2.day)			<0.000023	<0.000022
	Silicon (Si)-Total (mg/dm2.day)			<0.0011	<0.0011
	Silver (Ag)-Total (mg/dm2.day)			<0.00000023	<0.00000022
	Sodium (Na)-Total (mg/dm2.day)			<0.046	<0.043
	Strontium (Sr)-Total (mg/dm2.day)			0.0000502	0.0000074
Thallium (Tl)-Total (mg/dm2.day)			<0.0000023	<0.0000022	
Tin (Sn)-Total (mg/dm2.day)			<0.0000023	<0.0000022	
Titanium (Ti)-Total (mg/dm2.day)			<0.00023	<0.00022	

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1031631-1	L1031631-2	L1031631-3	L1031631-4	L1031631-5
		Description	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL
		Sampled Date	10-JUL-11	09-JUL-10	09-JUL-10	09-JUL-10	09-JUL-10
		Sampled Time	09:20	09:30	09:00	12:30	11:12
		Client ID	DF-1 (JUN7-JUL10)	DF-2 (JUN5-JUL9)	DF-3 (JUN7-JUL9)	DF-4 (JUN26-JUL9)	DF-5 (JUN7-JUL9)
Grouping	Analyte						
DUSTFALL							
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000024	<0.00000016	<0.00000018	<0.00000074	<0.00000022	<0.00000022
	Vanadium (V)-Total (mg/dm2.day)	<0.000024	<0.000016	<0.000018	<0.000074	<0.000022	<0.000022
	Zinc (Zn)-Total (mg/dm2.day)	0.000073	0.000058	0.000030	0.000234	0.000071	0.000071

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1031631-6 DUSTFALL 09-JUL-10 17:45 DF-6 (JUN7-JUL9)	L1031631-7 DUSTFALL 09-JUL-10 17:55 DF-7 (JUN8-JUL9)	L1031631-8 DUSTFALL 09-JUL-10 08:35 DF-8 (JUN9-JUL9)	L1031631-9 DUSTFALL 09-JUL-10 11:20 DF-9 (JUN8-JUL9)
Grouping	Analyte				
DUSTFALL					
Metals	Uranium (U)-Total (mg/dm2.day)			<0.00000023	<0.00000022
	Vanadium (V)-Total (mg/dm2.day)			<0.000023	<0.000022
	Zinc (Zn)-Total (mg/dm2.day)			0.000057	0.000044

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-VA	Dustfall	Dustfall Chloride by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined Dustfalls-Total, soluble, insol	BCMOE DUSTFALLS
<p>Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.</p>			
HG-DUST(DM2-CVAFS-VA	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).</p>			
MET-DUST(DM2)-ICP-VA	Dustfall	Total Metals in Dustfalls by ICPOES	EPA 6010B
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).</p>			
MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).</p>			
NH3-F-VA	Dustfall	Dustfall Ammonia by Fluorescence	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.</p>			
NO3-IC-VA	Dustfall	Dustfall Nitrate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			
SO4-IC-VA	Dustfall	Dustfall Sulphate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulphate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BC, CANADA

Chain of Custody Numbers:

10-175111

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

Rush Processing



Analytical Request Form #
 Fee: 1 800 668 9878
 jsglobal.com

10-175111

Page 1 of 1

Report To
 Company: RESCAN ENVIRONMENTAL SERVICES
 Contact: CHERYL ZANDBERGEN
 Address: 6TH FLR 1111 W HASTINGS ST VANCOUVER BC
 Phone: 604 681-9410 Fax:
 Invoiced To: Same as Report? (circle) Yes (X) or No (if No, provide details)
 Copy of Invoice with Report? (circle) Yes or No
 Company:
 Contact:
 Address:
 Phone:
 Fax:

Client / Project Information
 Job #: 0868-011-03
 PO / AFE:
 LSD:
 Quote #:
 ALS Contact: AMBER SPRING 2
 Sampler: C DOUGHTY

Sample #	Lab Work Order # (lab use only)	Sample Identification (This description will appear on the report)	Date (dd-mm-yy)	Time (hr:mm)	Sample Type	Analysis Request (Indicate Filtered or Preserved, F/P)							Number of Containers		
						FORM PREPARED	SOLUBLE PREPARED	INSOLUBLE PART.	SUBSTRATE	NITRATE	AMMONIA NH4+	CHLORIDE		TOTAL METALS	CATIONS Mg+Na+K+
DF-1		L1031631	10 JUL 11	09:20	DUSTPALL	✓	✓	✓	✓	✓	✓	✓	✓	✓	2
DF-2			9 JUL 11	09:30	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	2
DF-3			"	09:00	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	2
DF-4			"	12:30	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	2
DF-5			"	11:12	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	2
DF-6			"	17:45	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	1
DF-7			"	17:55	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	1
DF-8			"	08:35	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	2
DF-9			"	11:20	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	2

Special Instructions / Regulation with water or land use (CCME - Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/ETC) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)		SHIPMENT RECEPTION (lab use only)		SHIPMENT VERIFICATION (lab use only)	
Released by: CHRIS DOUGHTY	Date: 11/7/11	Received by: WALTER	Date: JUL 14 19:40	Verified by:	Date:
Time: 13:30	Temperature: 15.8 °C	Temperature:	Time:	Time:	Time:

Observations: Yes / No ? If Yes add SIF

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

GENF 18.01 Front



RESCAN ENVIRONMENTAL SERVICES
ATTN: Cheryl Zandbergen
Sixth Floor
1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 04-AUG-11
Report Date: 15-AUG-11 16:26 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L1040337
Project P.O. #: NOT SUBMITTED
Job Reference: 0868-011-03
C of C Numbers: 10-176514
Legal Site Desc:

STEFANIE TEO
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1040337-1 DUSTFALL 02-AUG-11 13:12 DF-1	L1040337-2 DUSTFALL 02-AUG-11 17:15 DF-2	L1040337-3 DUSTFALL 02-AUG-11 08:34 DF-3	L1040337-4 DUSTFALL 02-AUG-11 10:45 DF-4	L1040337-5 DUSTFALL 02-AUG-11 11:55 DF-5	
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.66	<0.10	<0.10	0.19	0.16
	Total Insoluble Dustfall (mg/dm2.day)	0.20	<0.10	<0.10	<0.10	<0.10
	Total Soluble Dustfall (mg/dm2.day)	0.45	<0.10	<0.10	0.19	0.16
Anions and Nutrients	Ammonia (as N) (mg/dm2.day)	<0.0036	0.00138	<0.00016	0.00025	0.00056
	Chloride (Cl) (mg/dm2.day)	0.068	0.066	0.067	0.058	0.068
	Nitrate (as N) (mg/dm2.day)	0.0289	0.00435	0.00867	0.00320	0.00275
	Sulfate (SO4) (mg/dm2.day)	<0.014	<0.015	<0.016	<0.011	<0.015
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000515	0.000383	<0.00018 ^{DLB}	0.000362	0.000604
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000036	<0.0000030	<0.0000029	<0.0000021	<0.0000030
	Arsenic (As)-Total (mg/dm2.day)	<0.0000036	<0.0000030	<0.0000029	<0.0000021	<0.0000030
	Barium (Ba)-Total (mg/dm2.day)	0.0000118	0.0000521	0.0000051	0.0000268	0.0000118
	Beryllium (Be)-Total (mg/dm2.day)	<0.000018	<0.000015	<0.000015	<0.000010	<0.000015
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000018	<0.000015	<0.000015	<0.000010	<0.000015
	Boron (B)-Total (mg/dm2.day)	<0.00036	<0.00030	<0.00029	<0.00021	<0.00030
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000018	<0.0000015	<0.0000015	<0.0000010	<0.0000015
	Calcium (Ca)-Total (mg/dm2.day)	0.0019	0.0029	<0.0015	0.0013	<0.0015
	Chromium (Cr)-Total (mg/dm2.day)	<0.000018	<0.000015	<0.000015	<0.000010	<0.000015
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000036	<0.0000030	<0.0000029	<0.0000021	<0.0000030
	Copper (Cu)-Total (mg/dm2.day)	0.000143	0.0000695	0.0000254	0.0000769	0.0000197
	Iron (Fe)-Total (mg/dm2.day)	<0.0011	0.00106	<0.00088	0.00123	0.00141
	Lead (Pb)-Total (mg/dm2.day)	0.0000029	0.0000016	<0.0000015	0.0000024	<0.0000015
	Lithium (Li)-Total (mg/dm2.day)	<0.00018	<0.00015	<0.00015	<0.00010	<0.00015
	Magnesium (Mg)-Total (mg/dm2.day)	<0.0036	<0.0030	<0.0029	<0.0021	<0.0030
	Manganese (Mn)-Total (mg/dm2.day)	0.0000699	0.000539	0.0000430	0.0000545	0.0000441
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000018	<0.0000015	<0.0000015	<0.0000010	<0.0000015
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000018	<0.0000015	<0.0000015	<0.0000010	<0.0000015
	Nickel (Ni)-Total (mg/dm2.day)	<0.000018	<0.000015	<0.000015	<0.000010	<0.000015
	Phosphorus (P)-Total (mg/dm2.day)	0.020	0.0257	<0.0088	<0.0063	<0.0090
	Potassium (K)-Total (mg/dm2.day)	<0.071	<0.060	<0.059	<0.042	<0.060
	Selenium (Se)-Total (mg/dm2.day)	<0.000036	<0.000030	<0.000029	<0.000021	<0.000030
	Silicon (Si)-Total (mg/dm2.day)	<0.0018	<0.0015	<0.0015	<0.0010	<0.0015
	Silver (Ag)-Total (mg/dm2.day)	<0.00000036	<0.00000030	<0.00000029	<0.00000021	<0.00000030
	Sodium (Na)-Total (mg/dm2.day)	<0.071	<0.060	<0.059	<0.042	<0.060
	Strontium (Sr)-Total (mg/dm2.day)	0.0000114	0.0000236	0.0000031	0.0000085	0.0000067
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000036	<0.0000030	<0.0000029	<0.0000021	<0.0000030
Tin (Sn)-Total (mg/dm2.day)	<0.0000036	<0.0000030	<0.0000029	<0.0000021	<0.0000030	
Titanium (Ti)-Total (mg/dm2.day)	<0.00036	<0.00030	<0.00029	<0.00021	<0.00030	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1040337-6	L1040337-7	L1040337-8	L1040337-9
					L1040337-6 DUSTFALL 02-AUG-11 08:26 DF-6	L1040337-7 DUSTFALL 02-AUG-11 08:20 DF-7	L1040337-8 DUSTFALL 02-AUG-11 08:10 DF-8	L1040337-9 DUSTFALL 02-AUG-11 11:41 DF-9
Grouping	Analyte							
DUSTFALL								
Particulates	Total Dustfall (mg/dm2.day)	<0.10	0.17	0.30	<0.10			
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10	<0.10			
	Total Soluble Dustfall (mg/dm2.day)	<0.10	0.17	0.25	<0.10			
Anions and Nutrients	Ammonia (as N) (mg/dm2.day)	0.00077	0.00026	0.00471	0.00033			
	Chloride (Cl) (mg/dm2.day)	0.067	0.064	0.067	0.065			
	Nitrate (as N) (mg/dm2.day)	0.00146	0.00113	0.00953	0.00187			
	Sulfate (SO4) (mg/dm2.day)	<0.015	<0.014	<0.014	<0.014			
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000626		0.000482	0.000324			
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000031		<0.0000030	<0.0000026			
	Arsenic (As)-Total (mg/dm2.day)	<0.0000031		<0.0000030	0.0000034			
	Barium (Ba)-Total (mg/dm2.day)	0.0000140		0.0000275	0.0000071			
	Beryllium (Be)-Total (mg/dm2.day)	<0.000015		<0.000015	<0.000013			
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000015		<0.000015	<0.000013			
	Boron (B)-Total (mg/dm2.day)	<0.00031		<0.00030	<0.00026			
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000015		<0.0000015	<0.0000013			
	Calcium (Ca)-Total (mg/dm2.day)	<0.0015		0.0016	<0.0013			
	Chromium (Cr)-Total (mg/dm2.day)	<0.000015		<0.000015	<0.000013			
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000031		<0.0000030	<0.0000026			
	Copper (Cu)-Total (mg/dm2.day)	0.0000224		0.0000398	0.0000276			
	Iron (Fe)-Total (mg/dm2.day)	<0.00092		0.00102	<0.00077			
	Lead (Pb)-Total (mg/dm2.day)	0.0000016		0.0000018	0.0000021			
	Lithium (Li)-Total (mg/dm2.day)	<0.00015		<0.00015	<0.00013			
	Magnesium (Mg)-Total (mg/dm2.day)	<0.0031		<0.0030	<0.0026			
	Manganese (Mn)-Total (mg/dm2.day)	0.0000768		0.000165	0.0000538			
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000015		<0.0000015	<0.0000013			
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000015		<0.0000015	<0.0000013			
	Nickel (Ni)-Total (mg/dm2.day)	0.0000060		0.000054	<0.000013			
	Phosphorus (P)-Total (mg/dm2.day)	<0.0092		<0.0090	<0.0077			
	Potassium (K)-Total (mg/dm2.day)	<0.062		<0.060	<0.051			
	Selenium (Se)-Total (mg/dm2.day)	<0.000031		<0.000030	<0.000026			
	Silicon (Si)-Total (mg/dm2.day)	<0.0015		<0.0015	<0.0013			
	Silver (Ag)-Total (mg/dm2.day)	<0.00000031		<0.00000030	<0.00000026			
	Sodium (Na)-Total (mg/dm2.day)	<0.062		<0.060	<0.051			
	Strontium (Sr)-Total (mg/dm2.day)	0.0000055		0.0000138	0.0000046			
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000031		<0.0000030	<0.0000026			
	Tin (Sn)-Total (mg/dm2.day)	<0.0000031		<0.0000030	<0.0000026			
	Titanium (Ti)-Total (mg/dm2.day)	<0.00031		<0.00030	<0.00026			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1040337-1 DUSTFALL 02-AUG-11 13:12 DF-1	L1040337-2 DUSTFALL 02-AUG-11 17:15 DF-2	L1040337-3 DUSTFALL 02-AUG-11 08:34 DF-3	L1040337-4 DUSTFALL 02-AUG-11 10:45 DF-4	L1040337-5 DUSTFALL 02-AUG-11 11:55 DF-5
Grouping	Analyte					
DUSTFALL						
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000036	<0.00000030	<0.00000029	<0.00000021	<0.00000030
	Vanadium (V)-Total (mg/dm2.day)	<0.000036	<0.000030	<0.000029	<0.000021	<0.000030
	Zinc (Zn)-Total (mg/dm2.day)	0.000101	0.000134	0.000041	0.000057	0.000037

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1040337-6 DUSTFALL 02-AUG-11 08:26 DF-6	L1040337-7 DUSTFALL 02-AUG-11 08:20 DF-7	L1040337-8 DUSTFALL 02-AUG-11 08:10 DF-8	L1040337-9 DUSTFALL 02-AUG-11 11:41 DF-9
Grouping	Analyte				
DUSTFALL					
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000031		<0.00000030	<0.00000026
	Vanadium (V)-Total (mg/dm2.day)	<0.000031		<0.000030	<0.000026
	Zinc (Zn)-Total (mg/dm2.day)	0.000163		0.000234	0.000054

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection limit was raised due to detection of analyte at comparable level in Method Blank.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-VA	Dustfall	Dustfall Chloride by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined Dustfalls-Total, soluble, insol	BCMOE DUSTFALLS
<p>Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.</p>			
HG-DUST(DM2-CVAFS-VA)	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).</p>			
MET-DUST(DM2)-ICP-VA	Dustfall	Total Metals in Dustfalls by ICPOES	EPA 6010B
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).</p>			
MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).</p>			
NH3-F-VA	Dustfall	Dustfall Ammonia by Fluorescence	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.</p>			
NO3-IC-VA	Dustfall	Dustfall Nitrate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			
SO4-IC-VA	Dustfall	Dustfall Sulphate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulphate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BC, CANADA

Chain of Custody Numbers:

10-176514

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Analytical Request Form
Free: 1 800 668 9878
vatsglobal.com



Report To
 Company: **RESCAN**
 Contact: **CHERYL ZANDBERGEN**
 Address: **6TH FLOOR, 1111 W HASTINGS ST VANCOUVER, BC**
 Phone: **(604) 689-9490** Fax:
 Invoice To: Same as Report? (circle) Yes or No (if No, provide details)
 Copy of invoice with Report? (circle) Yes or No
 Company:
 Contact:
 Address:
 Phone:

Report Format / Distribution
 Standard: Other (specify):
 Select: PDF Excel Digital Fax
 Email 1: **czandbergen@rescan.com**
 Email 2:
Client / Project Information
 Job #: **0868-011-03**
 PO / AFE:
 LSD:

Service Request (Rush subject to availability - Contact ALS to confirm TAT)
 Regular (Standard Turnaround Times - Business Days)
 Priority (2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
 Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT
 Same Day or Weekend Emergency - Contact ALS to confirm TAT

Analysis Request
 (Indicate Filtered or Preserved, F/P)

Sample #	Lab Work Order # (lab use only)	Sample Identification (This description will appear on the report)	ALS Contact	Date (dd-mm-yy)	Time (hh:mm)	Sampler	Sample Type	TOXIC METALS	CHLORIDE Cl ⁻	AMMONIA NH ₃ -NH ₄ ⁺	NITRATE	SULPHATE	INSOLUBLE PHOSPHATE	SOLUBLE PHOSPHATE	TOXIC PHOSPHATE	
1	DF-1	L1040337	AMBER SPRAINER	2-AUG-11	13:12	CHRIS DOUGHTY	DUST/FAL	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	DF-2			"	17:15		"	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	DF-3			"	08:34		"	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	DF-4			"	10:45		"	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	DF-5			"	11:55		"	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	DF-6			"	08:26		"	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	DF-7			"	08:20		"	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	DF-8			"	08:10		"	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	DF-9			"	11:41		"	✓	✓	✓	✓	✓	✓	✓	✓	✓

Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/ETC) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)
 Released by: **C DOUGHTY** Date: **3 AUG 11** Time: **09 30**

SHIPMENT RECEPTION (lab use only)
 Received by: **Ryan** Date: **Aug 11** Time: **10:18** Temperature: **13 °C**

SHIPMENT VERIFICATION (lab use only)
 Verified by: _____ Date: _____ Time: _____

Observations: Yes / No? If Yes add SIF



RESCAN ENVIRONMENTAL SERVICES
ATTN: Cheryl Zandbergen
Sixth Floor
1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 11-OCT-11
Report Date: 20-OCT-11 11:27 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L1070114
Project P.O. #: NOT SUBMITTED
Job Reference: 0868-011-04
C of C Numbers: 10-049315
Legal Site Desc:

Amber Springer
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

20-OCT-11 11:27 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID	L1070114-1 DUSTFALL 06-OCT-11 16:10 DF-1	L1070114-2 DUSTFALL 06-OCT-11 17:40 DF-2	L1070114-3 DUSTFALL 06-OCT-11 16:40 DF-3	L1070114-4 DUSTFALL 05-OCT-11 09:50 DF-5	L1070114-5 DUSTFALL 06-OCT-11 17:15 DF-6	
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.48	0.38	0.31	0.30	0.19
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10	<0.11	<0.10
	Total Soluble Dustfall (mg/dm2.day)	0.47	0.38	0.31	0.30	0.19
Anions and Nutrients	Ammonia (as N) (mg/dm2.day)	0.00996	0.00399	<0.00046	<0.00048	0.00066
	Chloride (Cl) (mg/dm2.day)	<0.046	<0.053	<0.046	0.058	<0.042
	Nitrate (as N) (mg/dm2.day)	0.00122	0.00139	0.00128	0.00102	0.00120
	Sulfate (SO4) (mg/dm2.day)	<0.046	<0.053	<0.046	<0.048	<0.042
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000861	0.00156	0.000594	0.000889	0.000672
	Antimony (Sb)-Total (mg/dm2.day)	<0.000013 ^{DLB}	<0.000011	<0.000090	<0.000098	<0.000086
	Arsenic (As)-Total (mg/dm2.day)	<0.000089	<0.000011	<0.000090	<0.000098	<0.000086
	Barium (Ba)-Total (mg/dm2.day)	0.0000147	0.0000345	0.0000114	0.0000251	0.0000316
	Beryllium (Be)-Total (mg/dm2.day)	<0.000045	<0.000053	<0.000045	<0.000049	<0.000043
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000045	<0.000053	<0.000045	<0.000049	<0.000043
	Boron (B)-Total (mg/dm2.day)	<0.00089	<0.0011	<0.00090	<0.00098	<0.00086
	Cadmium (Cd)-Total (mg/dm2.day)	<0.000045	<0.000053	<0.000045	<0.000049	<0.000043
	Calcium (Ca)-Total (mg/dm2.day)	<0.0045	<0.0053	<0.0045	<0.0049	<0.0043
	Chromium (Cr)-Total (mg/dm2.day)	<0.000045	<0.000053	<0.000045	<0.000049	<0.000043
	Cobalt (Co)-Total (mg/dm2.day)	<0.000089	<0.000011	<0.000090	<0.000098	<0.000086
	Copper (Cu)-Total (mg/dm2.day)	0.000363	0.00113	0.000401	0.0000955	0.00119
	Iron (Fe)-Total (mg/dm2.day)	<0.0027	<0.0032	<0.0027	<0.0030	<0.0026
	Lead (Pb)-Total (mg/dm2.day)	0.0000142	0.0000239	0.0000085	<0.000049	0.0000193
	Lithium (Li)-Total (mg/dm2.day)	<0.00045	<0.00053	<0.00045	<0.00049	<0.00043
	Magnesium (Mg)-Total (mg/dm2.day)	<0.0089	<0.011	<0.0090	<0.0098	<0.0086
	Manganese (Mn)-Total (mg/dm2.day)	0.0000341	0.000192	0.000108	0.0000712	0.000137
	Mercury (Hg)-Total (mg/dm2.day)	<0.000045	<0.000053	<0.000045	<0.000049	<0.000043
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.000045	<0.000053	<0.000045	<0.000049	<0.000043
	Nickel (Ni)-Total (mg/dm2.day)	<0.000045	<0.000053	<0.000045	<0.000049	<0.000043
	Phosphorus (P)-Total (mg/dm2.day)	<0.027	<0.032	<0.027	<0.030	<0.026
	Potassium (K)-Total (mg/dm2.day)	<0.18	<0.21	<0.18	<0.20	<0.17
	Selenium (Se)-Total (mg/dm2.day)	<0.000089	<0.00011	<0.000090	<0.000098	<0.000086
	Silicon (Si)-Total (mg/dm2.day)	<0.0045	<0.0053	<0.0045	<0.0049	<0.0043
	Silver (Ag)-Total (mg/dm2.day)	<0.0000018 ^{DLB}	<0.0000032 ^{DLB}	<0.0000018 ^{DLB}	<0.0000098	<0.0000017 ^{DLB}
	Sodium (Na)-Total (mg/dm2.day)	<0.18	<0.21	<0.18	<0.20	<0.17
	Strontium (Sr)-Total (mg/dm2.day)	<0.000089	0.000014	<0.000090	<0.000098	0.0000110
Thallium (Tl)-Total (mg/dm2.day)	<0.000089	<0.000011	<0.000090	<0.000098	<0.000086	
Tin (Sn)-Total (mg/dm2.day)	<0.000089	<0.000011	<0.000090	<0.000098	<0.000013 ^{DLB}	
Titanium (Ti)-Total (mg/dm2.day)	<0.00089	<0.0011	<0.00090	<0.00098	<0.00086	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1070114-6 DUSTFALL 06-OCT-11 16:25 DF-7	L1070114-7 DUSTFALL 06-OCT-11 17:25 DF-8	L1070114-8 DUSTFALL 05-OCT-11 12:05 DF-9		
Grouping	Analyte				
DUSTFALL					
Particulates	Total Dustfall (mg/dm2.day)	0.18	0.58	0.95	
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	0.43	
	Total Soluble Dustfall (mg/dm2.day)	0.18	0.51	0.52	
Anions and Nutrients	Ammonia (as N) (mg/dm2.day)	<0.00035	0.00150	<0.00047	
	Chloride (Cl) (mg/dm2.day)	0.041	0.072	0.061	
	Nitrate (as N) (mg/dm2.day)	0.00100	0.00135	0.00091	
	Sulfate (SO4) (mg/dm2.day)	<0.035	<0.051	<0.047	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000721	<0.00051 ^{DLB}	0.00226	
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000098	<0.000010	<0.0000091	
	Arsenic (As)-Total (mg/dm2.day)	<0.0000098	<0.000010	0.0000118	
	Barium (Ba)-Total (mg/dm2.day)	0.0000110	0.0000266	0.0000671	
	Beryllium (Be)-Total (mg/dm2.day)	<0.000049	<0.000051	<0.000046	
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000049	<0.000051	<0.000046	
	Boron (B)-Total (mg/dm2.day)	<0.00098	<0.0010	<0.00091	
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000049	<0.0000051	<0.0000046	
	Calcium (Ca)-Total (mg/dm2.day)	<0.0049	0.0055	<0.0046	
	Chromium (Cr)-Total (mg/dm2.day)	<0.000049	<0.000051	<0.000046	
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000098	<0.000010	<0.0000091	
	Copper (Cu)-Total (mg/dm2.day)	0.000359	0.000495	0.000595	
	Iron (Fe)-Total (mg/dm2.day)	<0.0029	<0.0031	0.0044	
	Lead (Pb)-Total (mg/dm2.day)	0.0000080	0.0000105	0.0000126	
	Lithium (Li)-Total (mg/dm2.day)	<0.00049	<0.00051	<0.00046	
	Magnesium (Mg)-Total (mg/dm2.day)	<0.0098	<0.010	<0.0091	
	Manganese (Mn)-Total (mg/dm2.day)	0.000137	0.000194	0.000162	
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000049	<0.0000051	<0.0000046	
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000049	<0.0000051	<0.0000046	
	Nickel (Ni)-Total (mg/dm2.day)	<0.000049	<0.000051	<0.000046	
	Phosphorus (P)-Total (mg/dm2.day)	<0.029	<0.031	<0.027	
	Potassium (K)-Total (mg/dm2.day)	<0.20	<0.21	<0.18	
	Selenium (Se)-Total (mg/dm2.day)	<0.000098	<0.00010	<0.000091	
	Silicon (Si)-Total (mg/dm2.day)	<0.0049	<0.0051	<0.0046	
	Silver (Ag)-Total (mg/dm2.day)	<0.0000020 ^{DLB}	<0.0000021 ^{DLB}	<0.0000018 ^{DLB}	
	Sodium (Na)-Total (mg/dm2.day)	<0.20	<0.21	<0.18	
	Strontium (Sr)-Total (mg/dm2.day)	<0.0000098	0.000020	0.0000116	
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000098	<0.000010	<0.0000091	
	Tin (Sn)-Total (mg/dm2.day)	<0.0000098	<0.000010	<0.0000091	
	Titanium (Ti)-Total (mg/dm2.day)	<0.00098	<0.0010	<0.00091	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1070114-1 DUSTFALL 06-OCT-11 16:10 DF-1	L1070114-2 DUSTFALL 06-OCT-11 17:40 DF-2	L1070114-3 DUSTFALL 06-OCT-11 16:40 DF-3	L1070114-4 DUSTFALL 05-OCT-11 09:50 DF-5	L1070114-5 DUSTFALL 06-OCT-11 17:15 DF-6
Grouping	Analyte					
DUSTFALL						
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000089	<0.0000011	<0.00000090	<0.00000098	<0.00000086
	Vanadium (V)-Total (mg/dm2.day)	<0.000089	<0.00011	<0.000090	<0.000098	<0.000086
	Zinc (Zn)-Total (mg/dm2.day)	0.000291	0.00087	0.000257	0.000323	0.000415

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1070114-6 DUSTFALL 06-OCT-11 16:25 DF-7	L1070114-7 DUSTFALL 06-OCT-11 17:25 DF-8	L1070114-8 DUSTFALL 05-OCT-11 12:05 DF-9		
Grouping	Analyte				
DUSTFALL					
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000098	<0.0000010	<0.00000091	
	Vanadium (V)-Total (mg/dm2.day)	<0.000098	<0.00010	<0.000091	
	Zinc (Zn)-Total (mg/dm2.day)	0.000163	0.00052	0.000141	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection limit was raised due to detection of analyte at comparable level in Method Blank.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-VA	Dustfall	Dustfall Chloride by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined Dustfalls-Total, soluble, insol	BCMOE DUSTFALLS
<p>Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.</p>			
HG-DUST(DM2-CVAFS-VA)	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).</p>			
MET-DUST(DM2)-ICP-VA	Dustfall	Total Metals in Dustfalls by ICPOES	EPA 6010B
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).</p>			
MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).</p>			
NH3-F-VA	Dustfall	Dustfall Ammonia by Fluorescence	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.</p>			
NO3-IC-VA	Dustfall	Dustfall Nitrate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			
SO4-IC-VA	Dustfall	Dustfall Sulphate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
<p>The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulphate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".</p>			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BC, CANADA

Chain of Custody Numbers:

10-049315

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



* L 1 0 7 0 1 1 4 - C O F C *

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Client / Project Information
 Job #: 0868-011-04
 PO / AFE:
 LSD:
 Quote #:
Analysis Request
 (Indicate Filtered or Preserved, F/P)
 SOLUBLE PARTICULATE / INSOLUBLE PARTICULATE
 TOTAL PARTICULATE / TOTAL METALS
 AMMONIA CHLORIDE
 SULPHATE, NITRATE
 CATIONS Mg+Ca+K

ALS Contact: SPRINGER
 Sampler: CHRIS DOUGHTY
 Date (dd-mmm-yy) Time (hh:mm) Sample Type
 6-OCT-11 16:10 DUSTFAN
 6-OCT-11 17:40 " "
 6-OCT-11 16:40 " "
 5-OCT-11 09:50 " "
 6-OCT-11 17:15 " "
 6-OCT-11 16:25 " "
 6-OCT-11 17:25 " "
 5-OCT-11 12:05 " "

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	SOLUBLE PARTICULATE	INSOLUBLE PARTICULATE	TOTAL PARTICULATE	AMMONIA CHLORIDE	SULPHATE, NITRATE	TOTAL METALS	CATIONS Mg+Ca+K
DF-1		6-OCT-11	16:10	DUSTFAN	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DF-2		6-OCT-11	17:40	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DF-3		6-OCT-11	16:40	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DF-5		5-OCT-11	09:50	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DF-6		6-OCT-11	17:15	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DF-7		6-OCT-11	16:25	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DF-8		6-OCT-11	17:25	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DF-9		5-OCT-11	12:05	"	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Special Instructions / Regulations / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
 By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.
 Released by: C DOUGHTY Date: 7 OCT 11 18:00
 Received by: [Signature] Date: [Signature] Time: 11:35 Temperature: 8 °C
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 Observation Yes / No? If Yes add _____
 GENF 18.01 From

Appendix 2

ASTM 2010 Dustfall Method



Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter)¹

This standard is issued under the fixed designation D1739; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a procedure for collection of dustfall and its measurement. This test method is not appropriate for determination of the dustfall rate in small areas affected by specific sources. This test method describes determination of both water-soluble and insoluble particulate matter.

1.2 This test method is inappropriate for industrial hygiene use except where other more specific methods are also used.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

B57 Discontinued 1942; Specification for Copper-Alloy Condenser Tube Plates; Replaced by B 171³

D1193 Specification for Reagent Water

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

IEEE/ASTM SI-10 American National Standard for Use of the International System of Units (SI): The Modern Metric System

¹ This test method is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.03 on Ambient Atmospheres and Source Emissions.

Current edition approved Oct. 1, 2010. Published March 2011. Originally approved in 1960. Last previous edition approved in 2004 as D1739 - 98(2004). DOI: 10.1520/D1739-98R10.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology **D1356**. An explanation of units, symbols, and conversion factors may be found in Practice E380.

3.2 *Definition of Terms Specific to This Standard:*

3.2.1 *settleable particulate material*—any material composed of particles small enough to pass through a 1-mm screen (see Specification **E11**) and large enough to settle by virtue of their weight into the container from the ambient air.

4. Summary of Test Method

4.1 Containers of a standard size and shape are prepared and sealed in a laboratory and then opened and set up at appropriately chosen sites so that particulate matter can settle into them for periods of about 30 days. The containers are then closed and returned to the laboratory. The masses of the water-soluble and -insoluble components of the material collected are determined. The results are reported as grams per square metre per 30 days $\text{g}/(\text{m}^2 \cdot 30 \text{ d})$.

5. Significance and Use

5.1 This test method has the advantage of extreme simplicity. It is a crude and non-specific test method, but it is useful in the study of long-term trends. It requires very little investment in equipment and can be carried out without a large technically-skilled staff.

5.2 This test method is useful for obtaining samples of settleable particulate matter for further chemical analysis (**1**)⁴.

6. Interferences

6.1 The results from this test method are obtained by weighings. Any material that gets into the container and passes through the sieve used in analysis, but which did not settle into the container after air entrainment can be considered an interferent.

⁴ The boldface numbers in parentheses refer to the list of references at the end of this test method.

7. Apparatus

7.1 *Container*—An open-topped cylinder not less than 150 mm [6 in.] in diameter with height not less than twice its diameter. Containers should be made of stainless steel or weatherproof plastic. They shall be capable of accepting legible, weatherproof, identification markings. A tight-fitting lid is needed for each container.

7.2 *Stand, for the container*, which will hold the top of the container at a height of 2 m above ground. It will also include a wind shield constructed in accordance with Figs. 1 and 2. Experiments reported in Kohler and Fleck (2) indicate that much better precision is obtained when this simple aerodynamic shield is provided, and that there is a wide variability in the concentration of particles subject to settling at heights of less than 2 m.

- 7.3 *Sieve*, 1 mm (No. 18), stainless steel.
- 7.4 *Drying Oven*, with temperature controlled at 105°C.
- 7.5 *Buchner Funnel*, and 2 L filtering flask.
- 7.6 *Filter Paper*, fast filtering type, circles to fit the Buchner funnel.

7.7 *Evaporating Dishes*, 100-mL capacity, capable of being unambiguously identified.

- 7.8 *Desiccators*.
- 7.9 *Analytical Balance*, to weigh with a precision of ±0.1 mg.
- 7.10 *Flexible Spatula*.
- 7.11 *Crate*, or frame in which to carry the containers.
- 7.12 *Graduated Cylinder*, 1 L capacity, whose graduations have been checked for calibration accuracy, ±5 mL, using, for example, volumetric flasks or pipettes.

8. Reagents

8.1 *Purity of Water*—Unless otherwise indicated, reference to water shall be understood to mean reagent water as defined by Type II of Specification D1193.

9. Sampling

9.1 *Sites (3, 4)*; for general sampling strategy, see Specifications B57.

9.1.1 *Location:*

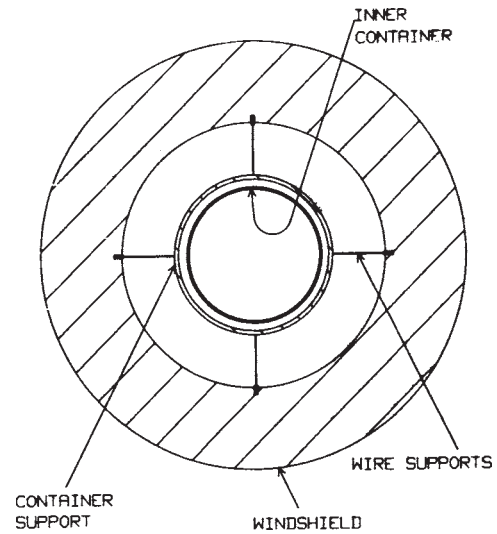


FIG. 2 Plan View of Wind Shield

9.1.1.1 These recommendations are a guide to the selection of a site. In cases where these guidelines cannot be followed, results should only be presented accompanied by an appropriate caveat.

9.1.1.2 The sampling site should be in an open area, free of structures higher than 1 m within a 20-m radius of the container stand. It should be away from local sources of pollution and objects that could affect the settling of particulate matter, such as trees, and air exhausts and intakes. Accessibility and security from vandalism are major considerations in the selection of a site.

9.1.1.3 Elevations to higher objects within 20 m should not exceed 30° from the horizontal.

9.1.1.4 Open areas around police and fire stations and libraries are often suitable because of their accessibility and security.

9.1.1.5 Avoid sitting the containers near chimneys. Whenever possible, the sampling site shall be more than ten stack-lengths from an operating stack and upwind from it in accordance with the most frequent wind direction.

NOTE 1—Do not assume that stacks are unused without making direct inquiry.

9.1.2 *Number of Sites (5)*—For each region to be surveyed, a minimum of four sampling sites shall be provided, to allow for rejected samples and to provide some evidence for quality assurance checks. An orderly spacing of the stations should be made approximately at the vertices of an equilateral triangular grid. The availability of staff will often be a constraining factor, but it is suggested that the spacing between sites be between 5 and 8 km.

9.1.3 *Site Records*—A file which will contain physical information specific to each site, such as the approximate elevation above sea level, map co-ordinates, and so forth, should be maintained for each site. It should include a detailed description, or photographs of the container stand that include its surroundings. Also included should be photographs or detailed descriptions of the surrounding area in the four compass point directions from the container stand. Unusual

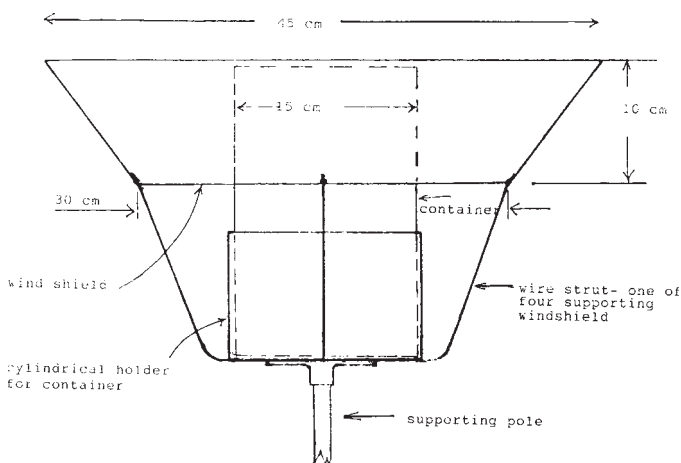


FIG. 1 Wind Shield for Dustfall Container

activities occurring in the neighborhood of the site that emit large amounts of particulate matter into the air should be recorded in the site file. Such events are fires, construction and demolition work, traffic diversions, and so forth. Records of these events will greatly increase the value of the data gathered from this test method. Records of rain and snowfall for the sites may also be helpful in interpreting the results from this test method.

9.2 Preparation of the Containers—Thoroughly clean the containers and lids, using detergent solution. Rinse the containers twice with reagent water. The containers should be sealed with their lids, labelled with identification numbers, and placed in the rack or crate.

9.3 Sample Collection:

9.3.1 Set out the containers at the sites. Record the date, time and identification number as each container is set out and its lid removed.

9.3.2 At the end of the sampling period, reseal the containers with their lids and place them in the crates or racks and return them to the laboratory for analysis. The date and time of pick up and the identification number of the containers should be recorded at each site as they are collected.

9.3.3 Rain or snow will collect in and evaporate from the containers during the exposure period, and containers may have liquid in them when they are picked up. This liquid is later processed and therefore should not be discarded. If enough inches of rain or snow are known to have fallen at a site that it is likely that the container was filled with either, the corresponding sample should be voided.

9.4 Sampling Period—The sampling period shall be one calendar month with an allowance of ± 2 days permissible when the set-out and pick-up dates are chosen. Results are normalized to a thirty day period.

9.5 Handling:

9.5.1 No attempt should be made to remove the collected material from the containers at the sampling site.

9.5.2 As the containers are loaded into the crates to go to the field and again after they are returned to the laboratory, records should be made in a permanent log book. The outgoing and incoming records should be reconciled immediately and any discrepancies investigated immediately, so that missing samples can be found before their exposure period exceeds the maximum permissible 32 days.

10. Procedure

10.1 The procedures are described below in terms of a single sample, but normally many samples will be analyzed simultaneously using multiple evaporating dishes, filters, etc.

10.2 Insoluble Matter:

10.2.1 Prepare an evaporating dish by washing, drying and marking it with an identification number.

10.2.2 Place a folded filter paper in the prepared dish and dry it for at least 1 h in the oven. Cool it in the desiccator, then weigh the filter in the dish to the nearest 0.1 mg. Record the weight as the tare weight for insoluble matter.

10.2.3 Seat the filter paper (**10.2.2**) in the Buchner funnel by wetting it with a small amount of reagent water. Place the funnel on the filter flask. If the container to be analyzed is dry or has less than 200 mL of water in it, add enough reagent

water to it to bring the volume of liquid up to about 200 mL. Swirl the water around to entrain the settled particulate matter. Use a clean flexible spatula rinsed with reagent water to swab down the walls of the container and ensure that all the particulate matter is freed from the walls and bottom of the container. Pour the liquid and entrained particulate matter into the filter funnel through the No. 18 sieve. The filtrate collected in the flask will be used later for determination of soluble matter.

10.2.4 Measure and record the volume of the filtrate in the graduated cylinder and retain it for determination of the soluble material. Rinse the container with approximately 100 mL of reagent water and transfer any solid material remaining in the container to the filter through the sieve, using the flexible spatula if necessary. Discard the filtrate from the rinsing and any material retained by the sieve.

10.2.5 Remove the filter paper with the insoluble material from the filter funnel, place it in the tared dish and put them in the oven for at least 90 min. Cool them in a desiccator for at least 1 h. Weigh the dried dish and filter with insoluble material to within 0.1 mg. Repeat the drying procedure until a constant mass is obtained.

10.2.6 Calculate the weight of insoluble particulate matter by deducting the tare weight of the filter and dish from the weight found in **10.2.5**.

10.3 Total Soluble Matter:

10.3.1 Prepare an evaporating dish as in **10.2.1**.

10.3.2 Put all, or a measured 500 mL, whichever is less, of the filtrate from **10.2.4** into a 1000 mL beaker. Concentrate the solution slowly to approximately 50 mL on a hot plate by boiling away water. If the total filtrate volume was less than 500 mL, make note of this fact.

10.3.3 Dry the prepared evaporating dish in the oven and cool it in the desiccator. Weigh it and record the weight to the nearest 0.1 mg as the tare weight.

10.3.4 Quantitatively transfer the concentrated filtrate from **10.3.1** to the tared dish and continue the evaporation very slowly on a hot-plate to dryness. Dry the dish and contents in the oven for 2 h, and cool in the desiccator for at least 1 h. Weigh the evaporating dish and contents and record the mass to the nearest 0.1 mg. Repeat the drying and cooling until a constant mass is obtained.

10.3.5 Calculate the net mass of the material dissolved in the solution taken in **10.3.1** by subtracting the tare mass from the mass determined in **10.3.3**. If the whole volume of the filtrate was not taken in **10.3.1**, normalize the net mass to the whole volume. Report the resultant figure as soluble particulate matter.

11. Calculation

11.1 Calculate a deposition rate, *D*, in grams/square metre/30 day period, $g/(m^2 \cdot 30 \text{ d})$, for the two masses of material obtained in Section 10:

$$D = W/A \text{ g}/(m^2/30)$$

where:

A = collection area, the cross sectional area of the inside diameter of the top of the container, m^2 , and

W = masses determined in 10.2 and 10.3, normalized if necessary to a 30 day period, g.

12. Precision and Bias (2, 3, 7)

12.1 An investigation into the precision of this test method (a similar method now being withdrawn) was made as part of an interlaboratory study of air pollution monitoring methods called Project Threshold in 1968. The test method as then defined was not exactly the one described in this standard. The container was not equipped with the aerodynamic shield defined now, and the height for the container was much less loosely defined. In addition, the acceptance criteria for sites were not as stringent as in this standard; roof-top locations were acceptable. Meetham (6) reports a strong variation in the amount of sample collected in containers at the same site separated by vertical height. The results from Project Threshold are presented in 12.1.2 through 12.1.7 and more information is available with respect to the precision to be expected in sampling with different types of containers in Ref 6.

12.1.1 *Reproducibility*—The standard deviation for variations among single dustfall measurements by different laboratories is 1.46 g/(m²·30 d) and is associated with a mean dustfall of 6.45 g/(m²·30 d). Measurements at three dustfall rates over the range of 3.28 to 10.47 g/(m²·30 d) do not exhibit an apparent relationship between dustfall rate and reproducibility.

12.1.2 *Repeatability*—The standard deviation for variations among repeated dustfall measurements within laboratories is 1.03 g/(m²·30 d) and is associated with a mean dustfall of 6.45 g/(m²·30 d). Measurements at three dustfall rates in the range

of 3.28 to 10.47 g/(m²·30 d) did not show an apparent relationship between dustfall rate and repeatability.

12.1.3 Known quantities of water soluble and water insoluble particulate materials were added to some dustfall samples after their collection and prior to analysis. The average recovery of the dust spikes was 96 % based upon all measurements. The standard deviation of the spike recovery measurements is 16 %.

12.1.4 The standard deviations of between- and within-laboratory determinations of the water insoluble fraction of the ambient dustfall samples are 1.18 and 0.78 g/(m²·30 d) respectively, and are associated with a mean water insoluble dustfall of 3.50 g/(m²·30 d).

12.1.5 The average recovery of water insoluble dustfall spikes by all laboratories and at all sites is 91 % and the standard deviation of the recovery measurements is 18 %.

12.1.6 The standard deviations of between- and within-laboratory determinations of the water soluble fraction of ambient dustfall samples are 1.64 and 0.59 g/(m²·30 d), respectively and are associated with a mean water soluble dustfall of 2.59 g/(m²·30 d).

12.1.7 The average recovery of water soluble dustfall spikes by all laboratories and at all sites is 95 % and the standard deviation of the recovery measurements is 37 %.

12.2 Better results were obtained by Kohler and Fleck (2) using the aerodynamic vane specified in this test method.

13. Keywords

13.1 ambient atmospheres; dustfall; settleable particulate matter

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- (7) Foster, J. F., Beatty, G. H., and Howes, J. E. Jr., "Interlaboratory Co-Operative Study of the Precision and Accuracy of the Measurement of Dustfall using ASTM Method D1739," *ASTM Data Series Publication DS 55-S4*, ASTM, 1916 Race Street, Philadelphia, PA 19103.

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