2019 Annual Report for Authorization 8808

Atlantic Power - Williams Lake Power Plant

Jacob Steyl

4455 Mackenzie Ave N, Williams Lake, V2G 5E8

Executive Summary

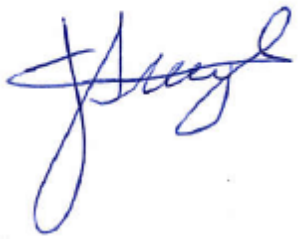
This Report details the Environmental Emissions from January 1, 2019 to December 31, 2019 and fulfils the requirement of section 3.6 of Authorization 8808 [1].

No rail ties or greater than 1% construction and demolition (C&D) waste were used as feedstock during the reporting period. A total of 240,218 wet tonnes of clean biomass was incinerated during 3283 hours of normal operation.

During this time two discrete monitoring sessions (one for Air Discharge from the Stack and one for Ash Analysis) were performed. The test results were compared against the levels in Permit 8808 and the Hazardous Waste Regulation, and no exceedances of any of the parameters in Schedules A and D of the Permit measured.

Continuous Emissions Monitoring System (CEMS) measurements were also taken as required by the Permit throughout this Period, with no exceedances recorded.

Respectfully,



Jacob Steyl, P.Eng

January 13, 2020

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Nomenclature and Abbreviations

C&D - Construction and Demolition waste
MoE - Ministry of Environment
NO_2 - Nitrogen Dioxide
NO_x - Nitrogen Oxides
O_2 - Molecular Oxygen
TEQ - Toxic Equivalency
USEPA - United States Environmental Protection Agency

hr - Hour
kg/s - Kilograms per Second
lb/hr - Pounds per Hour
m^3/s - Cubic Meter per second
mg/kg – Milligrams per Kilogram (1 ppm)
mg/L - Milligrams per Liter
mg/m^3 - Milligrams per cubic Meter
MW – Megawatt
pg/g – Picogram per Gram (0.001ppb)
ppb - Parts Per Billion
ppm - Parts Per Million (1,000 ppb)
ton/hr - Imperial Ton per Hour
tonnes/hr - Metric Tonnes per Hour

1 Introduction

An amendment was issued for permit 8808 on 18 September 2019 to Atlantic Power Preferred Equity Ltd located at 4455 Mackenzie Ave N, Williams Lake, B.C., V2G 4R7. The revised permit calls for an Annual Report outlined in Section 3.6 of the Permit [1].

Jacob Steyl P.Eng, Maintenance Manager and Chris Turner, Controls Specialist were responsible for collecting data and compiling this report. A. Lanfranco & Associates Inc. and Bureau Veritas conducted discrete monitoring outlined in sections 3.1.2 Schedule A and 3.1.3 Schedule D of the Permit [1].

The reporting window for this Report is 00:00 on 1 January 2019 to 00:00 1 January 2020. The Plant was curtailed for extended periods during the year, as show in Figure 1-1 and Table 2-1.

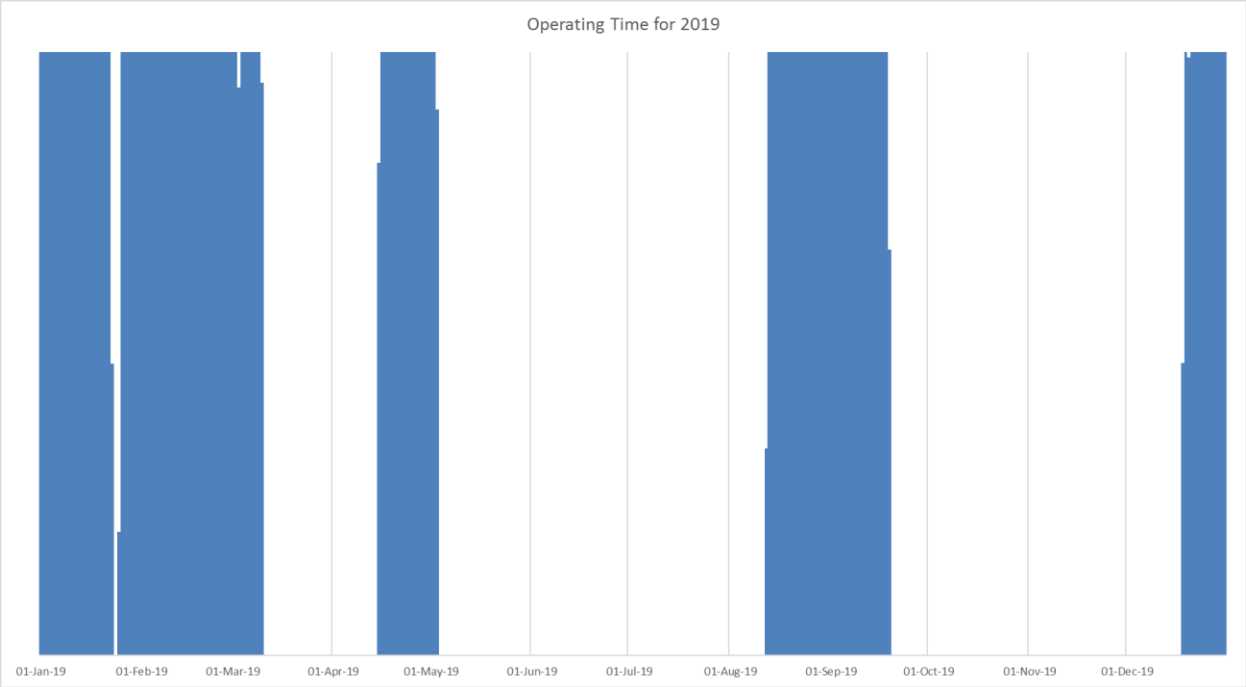


Figure 1-1: Normal Operating time for 2019

As no rail tie material was used as feedstock during the reporting period – Test Regimes Schedule A and D apply.

Corrective and preventative maintenance, as well as calibrations, were performed on the Air Emissions Controls and Continuous Emissions Monitoring System (CEMS) equipment of the Authorized Works during the reporting period.

2 Monthly Operating Hours

Table 2-1 shows the operating time and time incinerating railway ties for each month.

Table 2-1: Operating hours per month

	Operating time[1] *hr*	**Incinerating of Railway ties time[2]** *hr*
Jan-19	689	0
Feb-19	672	0
Mar-19	237	0
Apr-19	380	0
May-19	70	0
Jun-19	0	0
Jul-19	0	0
Aug-19	464	0
Sep-19	448	0
Oct-19	0	0
Nov-19	0	0
Dec-19	323	0
2019 Totals	**3283**	**0**

3 Fuel

The fuel usage for the reporting period is shown in Table 3-1.

Table 3-1: Monthly and Annual Amounts of Fuel

	Rail ties *wet tonnes*	**Construction and Demolition** *wet tonnes*	**Clean Biomass** *wet tonnes*
Jan-19	0	0	54,458
Feb-19	0	0	53,030
Mar-19	0	0	17,808
Apr-19	0	0	29,432
May-19	0	0	5,135
Jun-19	0	0	0
Jul-19	0	0	0
Aug-19	0	0	33,722
Sep-19	0	0	29,469
Oct-19	0	0	0
Nov-19	0	0	0
Dec-19	0	0	17,165
2019 Totals	**0**	**0**	**240,218**

[1] Operating time for Figure 1-1 and Table 2-1 is taken as combusting-biomass and breaker-closed time
[2] Number of hours incinerating rail ties or greater than 1% construction and demolition waste

4 Continuous Emissions Monitoring

4.1 Sulphur Oxides

No rail ties or greater than 1% C&D waste was used as feedstock during the reporting period, therefore no monitoring for Sulphur Oxides was required or conducted.

4.2 Nitrogen Oxides

The maximum hourly Nitrogen Oxides (NO_x) as Nitrogen Dioxide (NO_2) per month and average for the month at 8% O_2 is show Table 4-1. The Permitted hourly average is 320 mg/m³ at 8% O_2 [1].

Table 4-1: Maximum hourly NOx as NO_2 per month and average for the Month

	Maximum Hourly Average *mg/m³*	**Monthly Average** *mg/m³*
Jan-19	251	217
Feb-19	245	219
Mar-19	244	219
Apr-19	239	222
May-19	249	224
Jun-19	-	-
Jul-19	-	-
Aug-19	251	233
Sep-19	245	229
Oct-19	-	-
Nov-19	-	-
Dec-19	242	210

The average NOx emissions for the year was 222 mg/m³ at 8% O_2. The maximum hourly average for the year is well below the Permitted level.

4.3 Hydrochloric Acid

No rail ties or greater than 1% C&D waste were used as feedstock during the reporting period, therefore no monitoring for Hydrochloric Acid was required or conducted.

4.4 Combustion Temperature

No rail ties or greater than 1% C&D waste were used as feedstock during the reporting period, therefore no monitoring of Combustion Temperature was required or conducted.

5 Discrete Monitoring

5.1 Air Emissions Stack Test

No rail ties or greater than 1% C&D waste were used as feedstock during the reporting period: Only Schedule A applies.

The permitted levels under Schedule A [1] is stated in Table 5-1.

A. Lanfranco & Associates Inc was retained to perform an Emission Compliance Survey and Monitoring Report, as per Schedule A of the Permit. The Triplicate test average results for the listed parameters for the Main Stack on September 19, 2019 are summarised in Table 5-1. The complete report can be found in Appendix A – Stack Particulate Test.

Table 5-1: Schedule A Discrete Monitoring Results

Parameter	Test Average	Permit Limits
Rate of Discharge (m^3/s)	96.8	110
Particulate (mg/m^3 @ 8% O_2)	2.0	20

Both parameters measure are below permitted levels.

The average steam flow during the Stack Test on Sep 19 was 593.5 klb/hr (74.8 kg/s). This is 99% of the 90th percentile for the last 100 operating days and 108% of the average steam flow for the last 30 full operating days before the date of the test. The dates used for the last 100 operating days (shown in Figure 5-1) was 27 Jan 2019 to 11 Mar 2019, 15 Apr 2019 to 04 May 2019 and 12 Aug 2019 to 19 Sep 2019. The dates used for the last 30 full operating days was 20 Aug 2019 thru 19 Sep 2019.

5.2 Ash Testing

No rail ties or greater than 1% C&D waste were used as feedstock during the reporting period: Only Schedule D applies.

The permitted levels as per Schedule D [1] is stated in Table 5-2.

Bureau Veritas was commissioned to perform ash analysis on a single ash sample collected before ash conditioning during normal operation. The ash sample was collected on 19 September 2019 under the same conditions as the stack test was conducted. The results from the test is summarised in Table 5-2. The complete reports can be found in Appendix B - Ash Analysis .

Table 5-2: Schedule D Discrete Monitoring Results

Parameter	**Average**	**Permitted Limits** [2]
Arsenic (mg/L)	<0.10	2.5
Barium (mg/L)	1.45	100
Boron (mg/L)	2.62	500
Cadmium (mg/L)	<0.10	0.5
Chromium (mg/L)	<0.10	5
Copper (mg/L)	<0.10	100
Lead (mg/L)	<0.10	5
Mercury (mg/L)	<0.0020	0.1
Selenium (mg/L)	<0.10	1
Silver (mg/L)	<0.010	5
Uranium (mg/L)	<0.10	10
Zinc (mg/L)	<0.10	500
Dioxin/Furan TEQ (ppb)	0.06630	100
Polycyclic Aromatic Hydrocarbon TEQ (ppm)	0.026	100

All the parameters measured were well below the values stipulated in the Hazardous Waste Regulation [2].

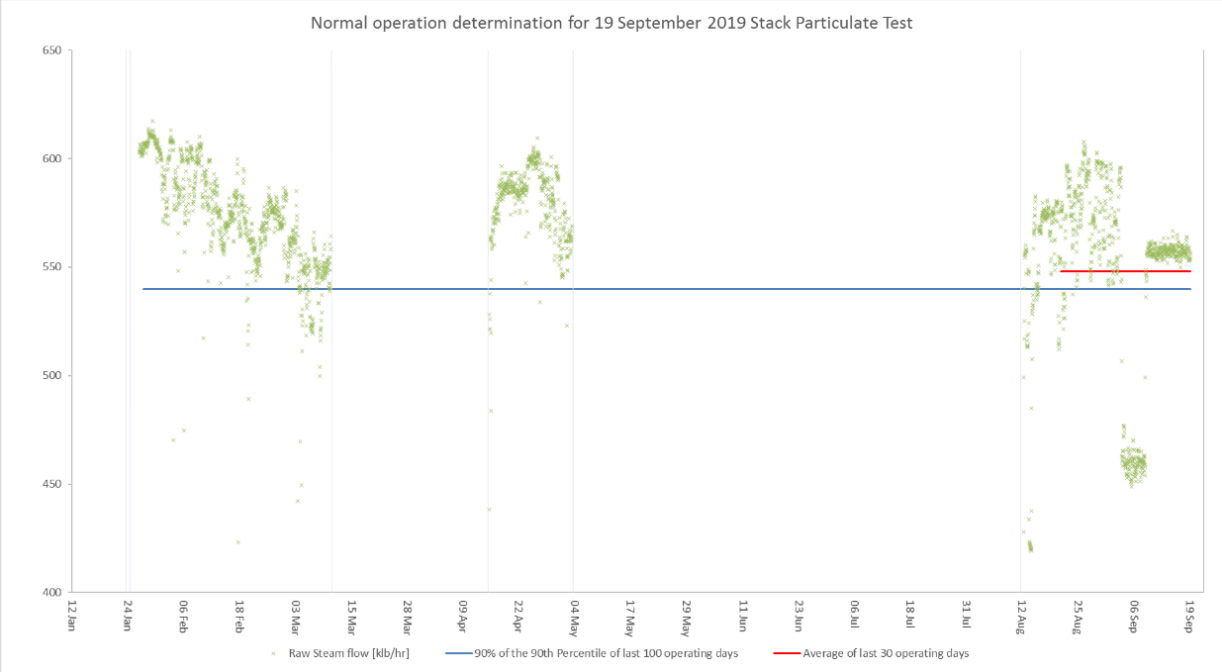


Figure 5-1: Hourly Average Steam Production data for 19 September 2019 Discrete Testing

6 Exceedances

No exceedances were recorded under normal operating conditions during the reporting period.

7 References

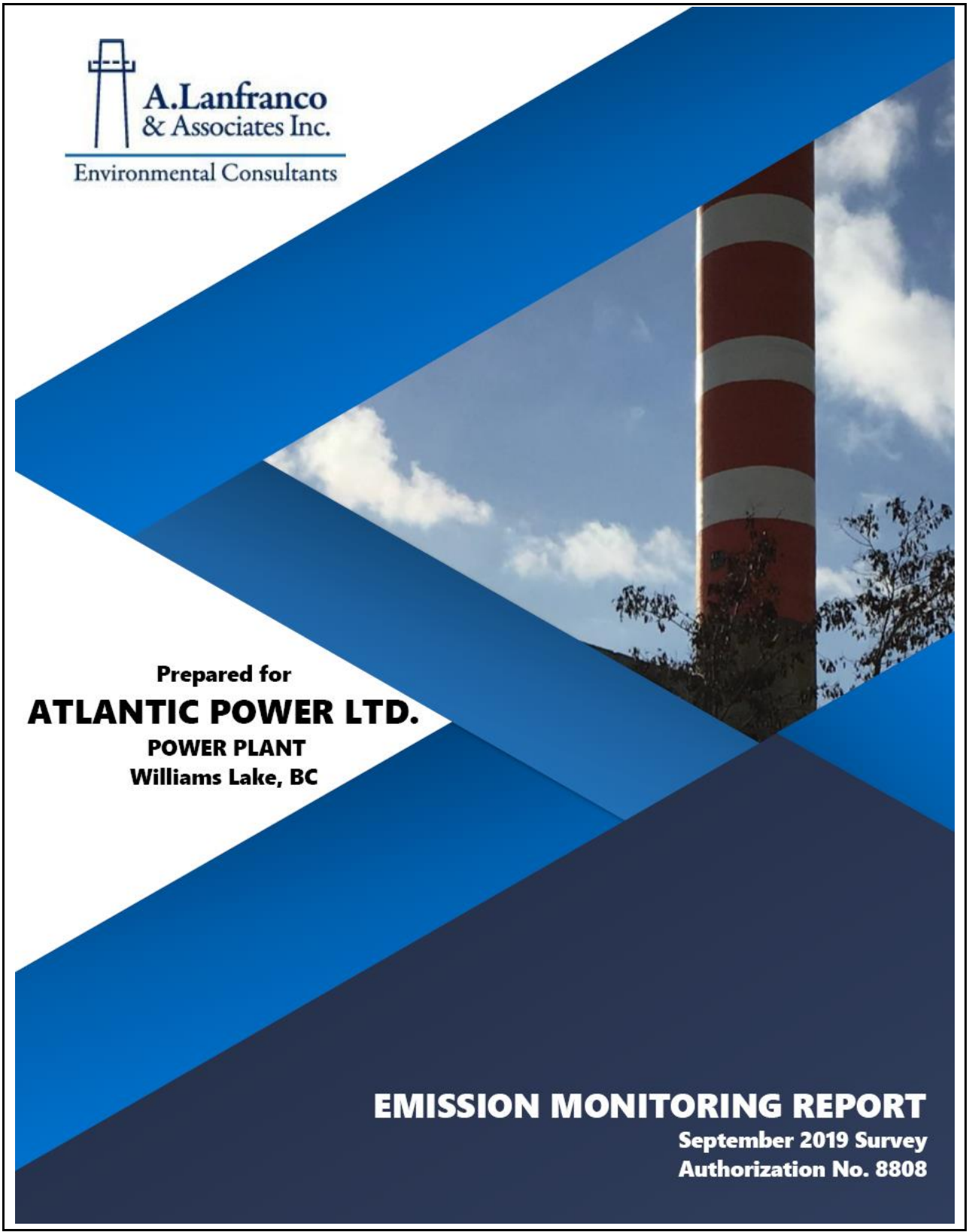
[1] Ministry of Environment, "Permit 8808 Amended 18 September 2019," Enviroment Canada, Williams Lake, 2016.

[2] Ministry of Attorney General, Hazardous Waste Regulation BC Reg 63/88, Victoria: Queens Printer, 1988.

Appendices

Appendix A – Stack Particulate Test

A.Lanfranco & Associates Inc.
Environmental Consultants



Prepared for

ATLANTIC POWER LTD.

POWER PLANT
Williams Lake, BC

EMISSION MONITORING REPORT

September 2019 Survey
Authorization No. 8808

A.Lanfranco & Associates Inc.
Environmental Consultants

CERTIFICATION

The field monitoring for this survey was conducted by certified stack test technicians as required by the British Columbia Ministry of Environment (BC MOE) Field Sampling Manual. The field crew consisted of:

Mr. L. Agassiz (certified) and Mr. M. Goods (certified).

The report was prepared by Mr. D. Sampson using reporting principles and guidelines generally acceptable to BC MOE.

The field crew and A. Lanfranco and Associates Inc. certify that the test methods used were BC MOE approved reference methods for the parameters investigated.

Report reviewed by:

Mark Lanfranco, CST
President | Owner

A.Lanfranco & Associates Inc.
Environmental Consultants

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APPENDICES

A.Lanfranco & Associates Inc.
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1 TEST PROGRAM ORGANIZATION

Plant Testing Coordinator:	Mr. Jacob Steyl Maintenance Manager 4455 Mackenzie Avenue North Williams Lake, B.C. Canada V2G 5E8 Email: steyl@atlanticpower.com
Project Manager/Sampling Contractor:	Mr. Mark Lanfranco President | Owner A. Lanfranco and Associates Inc. 101-9488 189 St Surrey, B.C. Canada V4N 4W7 Email: mark.lanfranco@alanfranco.com
Sampling Crew:	Mr. L. Agassiz - A. Lanfranco and Associates Inc. Mr. M. Goods - A. Lanfranco and Associates Inc.

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2 SUMMARY

The following table presents the triplicate test average results for the listed parameters for the Biomass fuelled boiler stack on September 19, 2019.

Parameter	Average	Permit Limits
Particulate (mg/Sm^3)	2.4	
Particulate (mg/Sm^3 @ 8% O_2)	2.0	20
Particulate (kg/hr)	0.8	
Flowrate (Sm^3/min)	5810	
Flowrate (Sm^3/sec)	96.8	110
O_2 (vol % dry)	5.5	
CO_2 (vol % dry)	15.3	

All results are at standard conditions of 20 °C and 101.325 kPa (dry)

A.Lanfranco & Associates Inc.
Environmental Consultants

3 INTRODUCTION

Atlantic Power Corporation commissioned A. Lanfranco & Associates Inc. to conduct an emission survey at their Power Plant in Williams Lake, BC. Emission tests were conducted on a waste-wood fired co-generation power plant to meet the air monitoring requirement prescribed by British Columbia Ministry of Environment (BC MOE) Permit PA-8808.

On September 19, 2019 triplicate emission tests were performed for the following parameters:

- particulate concentration and emission rate
- discharge rate (flow rate)
- gas composition (CO_2, O_2 and moisture)

This report contains details of the test results and methodologies utilized.

4 PROCESS DESCRIPTION

The process under investigation during this survey is a wood fuelled Boiler discharging through a 3.5 meter stack. This process discharges to atmosphere following emission control by multi-clones, and a five field electrostatic precipitator.

Operational data is shown in Table 3 in the results section, with additional data in Appendix 3.

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5 METHODOLOGY

The sampling and analytical methods used throughout this survey conform to the procedures outlined in the BC source testing code and the BC air analytical manual. The following table shows the methodology followed.

Parameter	Reference Method
Sample and Velocity traverse points	EPS 1/RM/8 A Determination of Sampling Site and Traverse Points
Velocity and flowrate	EPS 1/RM/8 B Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
Gas molecular weight (O_2/CO_2)	EPA Method 3 Gas Analysis for the Determination of Dry Molecular Weight
Flue gas Moisture	EPS 1/RM/8 D Determination of Moisture Content
Particulate Matter	EPA Method 5 Determination of Particulate Matter Emissions from Stationary Sources

5.1 Sampling Techniques

Sampling of particulate (EPA Method 5) from the Main Stack was conducted using CAE and Apex sampling trains equipped with heated filter assemblies and a heated four-foot probe (Fig. 1). The impinger sections of the sampling trains were charged with de-ionized water for moisture determination. Cyclones were not used as part of the sampling apparatus.

The stack was checked for cyclonic flow using methods outlined in the source test code. No cyclonic flow condition existed.

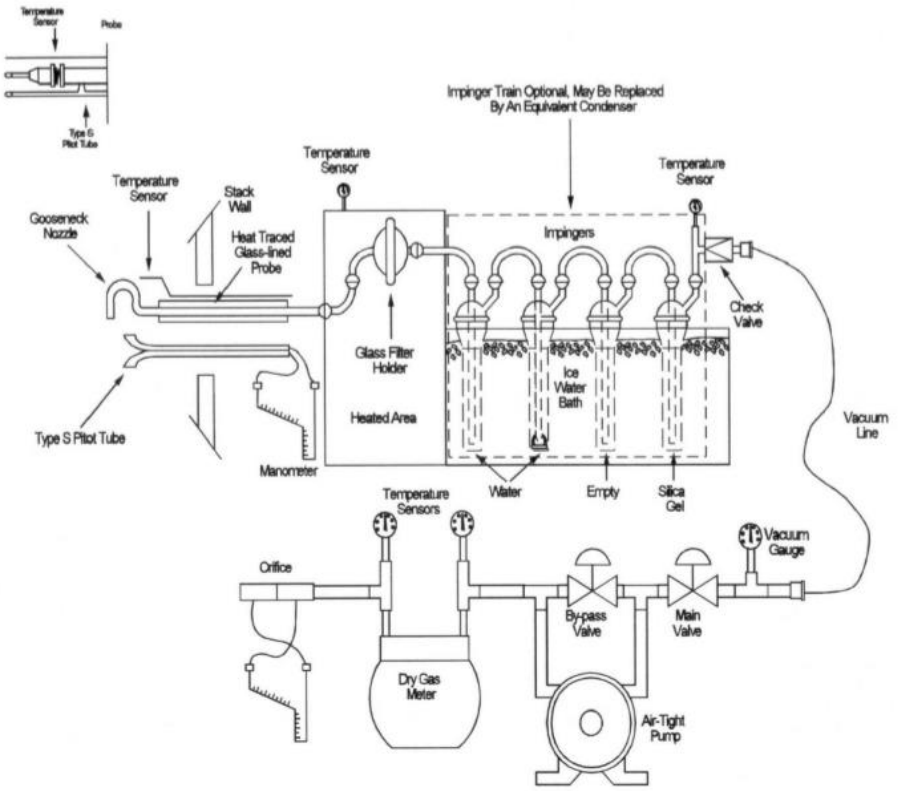

Figure 1: Method 5 Particulate Train

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Sampling Site and Traverse Points — Primary: EPA Method 1

This method is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source. A measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. Traverse points are then located within each of these equal areas. At Williams Lake, four traverses of 3 points for a total of 12 points were measured per test.

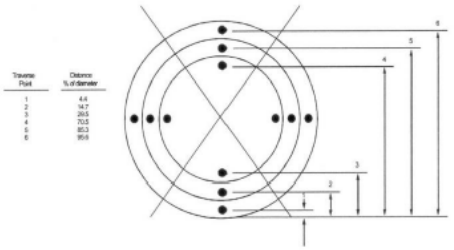

Figure 2. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points.

Each point (equal area method) was sampled for 5 minutes (figure 4/4a) resulting in final sample volumes of about 1.1-1.13 cubic meters.

Stack Gas Velocity and Volumetric Flow Rate — Primary: EPA Method 2

The average gas velocity in a stack or duct is determined from the gas density and from the measurement of velocity pressure with an S-type pitot tube. A standard pitot tube may be used where plugging of the tube openings due to particulate matter and/or moisture is not likely to occur. Stack gas volumetric flow rate is determined from measurements of stack gas velocity, temperature, absolute pressure, dry gas composition, moisture content, and stack diameter.

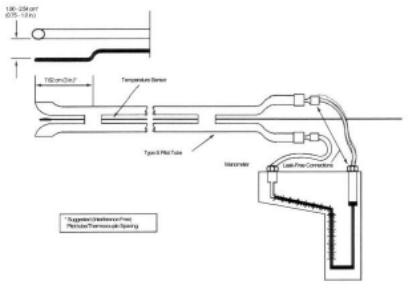

Figure 3. Type S Pitot Tube Manometer Assembly

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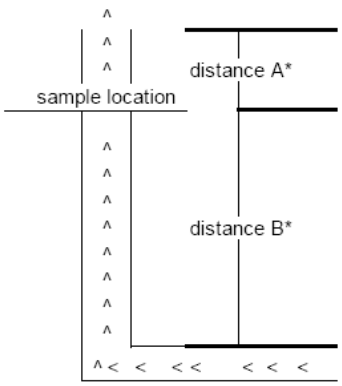
Figure - 4 **Location of Traverse Points in Circular Stacks**
(inches from inside w all to traverse point)

Client Stack I.D.: Atlantic Power

Diameter (inches)	138		
Total Points	12	Diameters Upstream:	> 2
# of Ports Used	4		
Points / Traverse	3	Diameters Downstream:	> 8

Point	Distance from Wall
1	6.1
2	20.1
3	40.8



* distance A : duct diameters upstream from flow disturbance
* distance B : duct diameters downstream from flow disturbance
< < < < : flow direction

Figure 4a **Location of Traverse Points in Circular Stacks**
(percent of diameter from inside w all to traverse point)

Traverse Point Number on a Diameter	Number of Traverse Points on a Diameter					
	2	4	6	8	10	12
1	14.6%	6.7%	4.4%	3.2%	2.6%	2.1%
2	85.4%	25.0%	14.6%	10.5%	8.2%	6.7%
3		75.0%	29.6%	19.4%	14.6%	11.8%
4		93.3%	70.4%	32.3%	22.6%	17.7%
5			85.4%	67.7%	34.2%	25.0%
6			95.6%	80.6%	65.8%	35.6%
7				89.5%	77.4%	64.4%
8				96.8%	85.4%	75.0%
9					91.8%	82.3%
10					97.4%	88.2%
11						93.3%
12						97.9%

Molecular Weight by Gas Analysis Primary: EPA Method 3/3a

An integrated or grab sample is extracted from a single point in the gas stream and analyzed for its components using a Fyrite analyzer, a gas chromatograph, or calibrated continuous analyzers.

Moisture Content Primary: EPA Method 4

A gas sample is extracted from a single point in the enclosed gas stream being sampled. The moisture is condensed and its weight measured. This weight, together with the volume of gas sampled, enables the stack gas moisture content to be calculated.

5.2 Analytical Techniques

Gravimetric analysis of the particulate samples was conducted by A. Lanfranco and Associates Inc. at their Surrey laboratory. All filters were conditioned by 105 °C drying, desiccation for 24 hours, and weighing of the particulate.

Probe washings were evaporated to dryness in porcelain dishes, desiccated for 24 hours and weighed. Blanks were carried through all procedures.

6 RESULTS

The results of the particulate and stack parameters were calculated using a computer program consistent with reporting requirements of BC MOE. Standard conditions used were 20 °C and 101.325 kPa (dry). Particulate concentrations were corrected to 8% O_2.

The "actual" flowrates results are volumetric flowrates at stack conditions. Detailed test results are presented in Table 1. Supporting data is presented in Table 2 and the Appendices. Calculations are presented in Appendix 2.

TABLE 1: MAIN STACK EMISSION RESULTS

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Parameter	Test 1	Test 2	Test 3	Average
Test Date	19-Sep-19	19-Sep-19	19-Sep-19	
Test Time	09:59 - 11:05	11:35 - 12:41	12:59 - 14:03	
Duration (minutes)	60	60	60	60
Particulate (mg/Sm^3)	2.3	2.4	2.4	2.4
Particulate (mg/Sm^3 @ 8% O_2)	1.9	2.0	2.0	2.0
Particulate (Kg/hr)	0.8	0.8	0.9	0.8
Particulate (Kg/day)	20.1	19.4	20.5	20.0
Flowrate (Sm^3/min)	5936	5663	5843	5814
Flowrate (Sm^3/sec)	98.9	94.4	97.4	96.9
Flowrate (Am^3/min)	11317	10850	11193	11120
Temperature (°C)	153	153	153	153
O_2 (vol % dry)	5.3	5.8	5.5	5.5
CO_2 (vol % dry)	15.5	15.3	15.0	15.3
H_2O (vol %)	17.3	17.6	17.6	17.5
Isokinetic Variation (%)	101	92.5	91.5	94.9

Standard conditions of 20 °C and 101.325 kPa (dry)

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TABLE 2: GRAVIMETRIC RESULTS

	Initial (g)	Final (g)	Net (g)	Blank Corrected Net (g)
Atlantic Power Main Stack				
Filters				
Run 1	0.3527	0.3552	0.0025	0.0027
Run 2	0.3536	0.3558	0.0022	0.0024
Run 3	0.3399	0.3422	0.0023	0.0025
Blank	0.3541	0.3539	-0.0002	
Probe Washes				
Run 1	113.6068	113.6100	0.0032	0.0000
Run 2	115.0542	115.0572	0.0030	0.0000
Run 3	99.7506	99.7525	0.0019	0.0000
Blank	116.2408	116.7525	0.5117	
Silica Gels				
Run 1	200.0	210.4	10.4	10.4
Run 2	200.0	208.0	8.0	8.0
Run 3	200.0	207.0	7.0	7.0

TABLE 3: OPERATING CONDITIONS

	Steam Flow (K lbs./hour)
Main Stack	593

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7 DISCUSSION OF RESULTS

The average particulate result for this survey was 2.0 mg/Sm^3 @ 8% O_2 and is well below the permitted level of 20 mg/Sm^3 @ 8% O_2. The results for particulate matter are comparable to previous results from this source.

The average flow rate measurement of 96.8 Sm^3/sec was also within the allowable limit of 110 Sm^3/sec.

There were no problems encountered in sample collection or analysis. Samples were collected isokinetically at all points and sampling equipment was operated in a normal steady manner during testing. The test results, therefore, are considered to be an accurate representation of emission characteristics for the process conditions maintained on the test date.

APPENDIX 1

COMPUTER OUTPUTS OF MEASURED AND CALCULATED DATA

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	19-Sep-19
Jobsite:	Williams Lake, B.C.	**Run:**	1 - Particulate
Source:	Main Stack	**Run Time:**	09:59 - 11:05

Particulate Concentration:		**2.3**	**mg/dscm**	0.0010 gr/dscf
		1.2	mg/Acm	0.0005 gr/Acf
		1.9	mg/dscm (@ 8% O2)	0.0008 gr/dscf (@ 8% O2)
Emission Rate:		0.84	Kg/hr	1.842 lb/hr
Sample Gas Volume:		1.1507	dscm	40.637 dscf
Total Sample Time:		60.0	minutes	
Average Isokineticity:		100.8	%	
Flue Gas Characteristics				
	Moisture:	17.28	%	
	Temperature	152.5	°C	306.6 °F
	Flow	5936.1	dscm/min	209633 dscf/min
		98.93	dscm/sec	3493.9 dscf/sec
		11317.2	Acm/min	399665 Acf/min
	Velocity	19.547	m/sec	64.13 f/sec
	Gas Analysis	5.25	% O_2	15.50 % CO_2
		30.690	Mol. Wt (g/gmole) Dry	28.497 Mol. Wt (g/gmole) Wet

*** Standard Conditions:** Metric: 20 deg C, 101.325 kPa
Imperial: 68 deg F, 29.92 in.Hg

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	19-Sep-19
Jobsite:	Williams Lake, B.C.	**Run:**	1 - Particulate
Source:	Main Stack	**Run Time:**	09:59 - 11:05

Control Unit (Y)	0.9902
Nozzle Diameter (in.)	0.2471
Pitot Factor	0.8473
Baro. Press. (in. Hg)	27.57
Static Press. (in. H_2O)	-0.25
Stack Height (ft)	200
Stack Diameter (in.)	138.0
Stack Area (sq.ft.)	103.869
Minutes Per Reading	5.0
Minutes Per Point	5.0
Port Length (inches)	8.0

Gas Analysis (Vol. %):

CO_2	O_2
16.00	5.00
16.00	5.00
15.00	5.50
15.00	5.50
Average = **15.50**	**5.25**

Condensate Collection:

Impinger 1 (grams)	140.0
Impinger 2 (grams)	21.0
Impinger 3 (grams)	9.0
Impinger 4 (grams)	10.4
Total Gain (grams)	**180.4**

Collection:

Filter (grams)	**0.0027**
Washings (grams)	**0.0000**
Impinger (grams)	**0.0000**
Total (grams)	**0.0027**

Traverse	Point	Time (min.)	Dry Gas Meter (ft^3)	Pitot ^P (in. H_2O)	Orifice ^H (in. H_2O)	Dry Gas Temperature Inlet (°F)	Dry Gas Temperature Outlet (°F)	Stack (°F)	Wall Dist. (in.)	Isokin. (%)
		0.0	439.551							
1	1	5.0	443.830	1.100	2.26	62	62	308	6.1	101.1
	2	10.0	448.110	1.100	2.26	62	62	308	20.1	101.1
	3	15.0	452.090	0.950	1.96	63	63	307	40.8	100.9
		0.0	452.090							
2	1	5.0	455.380	0.640	1.33	65	65	305	6.1	100.9
	2	10.0	458.810	0.700	1.45	65	65	308	20.1	100.8
	3	15.0	462.270	0.710	1.47	66	66	308	40.8	100.8
		0.0	462.270							
3	1	5.0	465.280	0.550	1.11	68	68	306	6.1	99.0
	2	10.0	468.370	0.560	1.17	69	69	307	20.1	100.6
	3	15.0	471.420	0.540	1.13	70	70	305	40.8	100.8
		0.0	471.420							
4	1	5.0	475.500	0.960	2.02	73	73	306	6.1	100.9
	2	10.0	479.870	1.100	2.52	73	73	307	20.1	101.1
	3	15.0	483.850	0.900	1.91	75	75	304	40.8	101.1
			Average:	0.818	1.716	67.6	67.6	306.6		100.8

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	19-Sep-19
Jobsite:	Williams Lake, B.C.	**Run:**	2 - Particulate
Source:	Main Stack	**Run Time:**	11:35 - 12:41

Particulate Concentration:		**2.4**	**mg/dscm**	0.0010 gr/dscf
		1.2	mg/Acm	0.0005 gr/Acf
		2.0	mg/dscm (@ 8% O2)	0.0009 gr/dscf (@ 8% O2)
Emission Rate:		0.81	Kg/hr	1.783 lb/hr
Sample Gas Volume:		1.0082	dscm	35.604 dscf
Total Sample Time:		60.0	minutes	
Average Isokineticity:		92.5	%	
Flue Gas Characteristics				
	Moisture:	17.64	%	
	Temperature	152.8	°C	307.1 °F
	Flow	5663.0	dscm/min	199987 dscf/min
		94.38	dscm/sec	3333.1 dscf/sec
		10850.0	Acm/min	383168 Acf/min
	Velocity	18.740	m/sec	61.48 f/sec
	Gas Analysis	5.75	% O_2	15.25 % CO_2
		30.670	Mol. Wt (g/gmole) Dry	28.435 Mol. Wt (g/gmole) Wet

*** Standard Conditions:** Metric: 20 deg C, 101.325 kPa
Imperial: 68 deg F, 29.92 in.Hg

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	19-Sep-19
Jobsite:	Williams Lake, B.C.	**Run:**	2 - Particulate
Source:	Main Stack	**Run Time:**	11:35 - 12:41

Control Unit (Y)	0.9902
Nozzle Diameter (in.)	0.2471
Pitot Factor	0.8473
Baro. Press. (in. Hg)	27.57
Static Press. (in. H_2O)	-0.25
Stack Height (ft)	200
Stack Diameter (in.)	138.0
Stack Area (sq.ft.)	103.869
Minutes Per Reading	5.0
Minutes Per Point	5.0
Port Length (inches)	8.0

Gas Analysis (Vol. %):

CO_2	O_2
15.00	6.00
15.00	6.00
15.50	5.50
15.50	5.50
Average = **15.25**	**5.75**

Condensate Collection:

Impinger 1 (grams)	130.0
Impinger 2 (grams)	22.0
Impinger 3 (grams)	2.0
Impinger 4 (grams)	8.0
Total Gain (grams)	**162.0**

Collection:

Filter (grams)	**0.0024**
Washings (grams)	**0.0000**
Impinger (grams)	**0.0000**
Total (grams)	**0.0024**

Traverse	Point	Time (min.)	Dry Gas Meter (ft^3)	Pitot ^P (in. H_2O)	Orifice ^H (in. H_2O)	Dry Gas Temperature Inlet (°F)	Dry Gas Temperature Outlet (°F)	Stack (°F)	Wall Dist. (in.)	Isokin. (%)
		0.0	485.660							
1	1	5.0	489.310	0.890	1.59	80	80	305	6.1	92.6
	2	10.0	493.150	0.990	1.77	80	80	307	20.1	92.6
	3	15.0	496.700	0.840	1.50	80	80	305	40.8	92.7
		0.0	496.700							
2	1	5.0	499.270	0.440	0.79	82	82	307	6.1	92.3
	2	10.0	502.080	0.530	0.95	80	80	307	20.1	92.4
	3	15.0	504.840	0.510	0.91	80	80	306	40.8	92.4
		0.0	504.840							
3	1	5.0	507.690	0.540	0.97	82	82	307	6.1	92.5
	2	10.0	511.030	0.740	1.33	83	83	308	20.1	92.6
	3	15.0	514.300	0.710	1.25	83	83	307	40.8	92.4
		0.0	514.300							
4	1	5.0	517.970	0.890	1.60	85	85	309	6.1	92.5
	2	10.0	521.860	1.000	1.80	85	85	309	20.1	92.6
	3	15.0	525.580	0.910	1.64	85	85	308	40.8	92.7
			Average:	0.749	1.342	82.1	82.1	307.1		92.5

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	19-Sep-19
Jobsite:	Williams Lake, B.C.	**Run:**	3 - Particulate
Source:	Main Stack	**Run Time:**	12:59 - 14:03

Particulate Concentration:	**2.4 mg/dscm**	0.0011	gr/dscf
	1.3 mg/Acm	0.0006	gr/Acf
	2.0 mg/dscm (@ 8% O2)	0.0009	gr/dscf (@ 8% O2)
Emission Rate:	0.85 Kg/hr	1.880	lb/hr
Sample Gas Volume:	1.0280 dscm	36.305	dscf
Total Sample Time:	60.0 minutes		
Average Isokineticity:	91.5 %		

Flue Gas Characteristics

Moisture:	17.62 %		
Temperature	152.8 °C	307.1	°F
Flow	5843.1 dscm/min	206351	dscf/min
	97.39 dscm/sec	3439.2	dscf/sec
	11193.0 Acm/min	395281	Acf/min
Velocity	19.333 m/sec	63.43	f/sec
Gas Analysis	5.50 % O_2	15.00	% CO_2
	30.620 Mol. Wt (g/gmole) Dry	28.396	Mol. Wt (g/gmole) Wet

*** Standard Conditions:** Metric: 20 deg C, 101.325 kPa
Imperial: 68 deg F, 29.92 in.Hg

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	19-Sep-19
Jobsite:	Williams Lake, B.C.	**Run:**	3 - Particulate
Source:	Main Stack	**Run Time:**	12:59 - 14:03

Control Unit (Y)	0.9902
Nozzle Diameter (in.)	0.2471
Pitot Factor	0.8473
Baro. Press. (in. Hg)	27.57
Static Press. (in. H_2O)	-0.25
Stack Height (ft)	200
Stack Diameter (in.)	138.0
Stack Area (sq.ft.)	103.869
Minutes Per Reading	5.0
Minutes Per Point	5.0
Port Length (inches)	8.0

Gas Analysis (Vol. %):

CO_2	O_2
15.00	5.00
15.00	5.00
15.00	6.00
15.00	6.00
Average = **15.00**	**5.50**

Condensate Collection:

Impinger 1 (grams)	127.0
Impinger 2 (grams)	28.0
Impinger 3 (grams)	3.0
Impinger 4 (grams)	7.0
Total Gain (grams)	**165.0**

Collection:

Filter (grams)	**0.0025**
Washings (grams)	**0.0000**
Impinger (grams)	**0.0000**
Total (grams)	**0.0025**

Traverse	Point	Time (min.)	Dry Gas Meter (ft³)	Pitot ^P (in. H_2O)	Orifice ^H (in. H_2O)	Dry Gas Temperature Inlet (°F)	Outlet (°F)	Stack (°F)	Wall Dist. (in.)	Isokin. (%)
		0.0	526.552							
1	1	5.0	530.310	0.950	1.67	86	86	309	6.1	91.5
	2	10.0	534.110	0.970	1.71	86	86	309	20.1	91.6
	3	15.0	537.850	0.940	1.66	86	86	309	40.8	91.5
		0.0	537.850							
2	1	5.0	540.780	0.570	1.01	88	88	307	6.1	91.5
	2	10.0	544.110	0.740	1.31	87	87	308	20.1	91.5
	3	15.0	547.600	0.810	1.43	88	88	308	40.8	91.6
		0.0	547.600							
3	1	5.0	550.440	0.530	0.95	91	91	305	6.1	91.3
	2	10.0	553.410	0.580	1.03	90	90	306	20.1	91.5
	3	15.0	556.280	0.540	0.97	91	91	303	40.8	91.3
		0.0	556.280							
4	1	5.0	560.110	0.970	1.73	90	90	307	6.1	91.5
	2	10.0	564.020	1.000	1.79	92	92	307	20.1	91.7
	3	15.0	567.770	0.920	1.65	93	93	307	40.8	91.5
			Average:	0.793	1.409	89.0	89.0	307.1		91.5

APPENDIX 2

CALCULATIONS

Appendix 2 Calculations

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The following sections show the equations and define the variables that were used for this survey. The equations are organized in three sections. Equations 1-12 were used to calculate particulate concentration at standard conditions on a dry basis. Equations 13-27 were used to sample within the 100 ± 10% isokinetic variation and to confirm that sampling meets this isokinetic variation threshold. Equations 28-30 were used to calculate the volumetric flowrate of the stack flue gas.

A2.1 Contaminant Concentration Calculations

$$c = \frac{m}{V_{std}} \quad \textbf{Equation 1}$$

$$m_{part} = m_{filter} + m_{pw} \quad \textbf{Equation 2}$$

$$m_i = m_{ana,i} - m_{blank} \quad \textbf{Equation 3}$$

$$V_{std} = \frac{V_{std(imp)}}{35.315} \quad \textbf{Equation 4}$$

$$V_{std(imp)} = \frac{V_{samp} \times y \times P_m \times (T_{std} + 459.67)}{P_{std} \times (T_{m(ave)} + 459.67)} \quad \textbf{Equation 5}$$

$$V_{samp} = V_{final} - V_{init} \quad \textbf{Equation 6}$$

$$P_m = P_B + \frac{\Delta H_{ave}}{13.6} \quad \textbf{Equation 7}$$

$$\Delta H_{ave} = \frac{1}{n}\sum_{i=1}^{n} \Delta H_{i(act)}, where\ n = the\ number\ of\ points \quad \textbf{Equation 8}$$

$$OC = \frac{20.9 - \%O_{2c}}{20.9 - \%O_{2m}} \quad \textbf{Equation 9}$$

$$CO2C = \frac{\%CO_{2c}}{\%CO_{2m}} \quad \textbf{Equation 10}$$

$$\%O_{2m} = \frac{1}{n}\sum_{i=1}^{n} \%O_{2i}, where\ n = the\ number\ of\ O_2\ measurements \quad \textbf{Equation 11}$$

$$\%CO_{2m} = \frac{1}{n}\sum_{i=1}^{n} \%CO_{2i}, where\ n = the\ number\ of\ CO_2\ measurements \quad \textbf{Equation 12}$$

Where,

c	= Contaminant concentration
m	= Contaminant mass
m_i	= Net analytical mass (mg, ng, or µg)
$m_{ana,i}$	= Analytical mass (mg, ng, or µg)
m_{blank}	= Blank analytical mass (mg, ng, or µg)
m_{part}	= Total particulate mass (mg)
m_{filter}	= Net particulate gain from filter (mg)
m_{pw}	= Net particulate gain from probe wash (mg)
$V_{std(imp)}$	= Sample volume at standard conditions (ft^3)
V_{std}	= Sample volume at standard conditions (m^3)
V_{samp}	= Sample volume at actual conditions (ft^3)
V_{final}	= Final gas meter reading (ft^3)
V_{init}	= Initial gas meter reading (ft^3)
T_{std}	= Standard temperature (68 °F)
T_m	= Gas meter temperature (°F)
$T_{m(ave)}$	= Average gas meter temperature (°F)
P_m	= Absolute meter pressure (inches of Hg)
P_B	= Barometric pressure (inches of Hg)
ΔH_{ave}	= Average of individual point orifice pressures (inches of H_2O)
$\Delta H_{i(act)}$	= Individual recorded point orifice pressures (inches of H_2O)
OC	= Oxygen correction factor (dimensionless)
$CO2C$	= Carbon dioxide correction factor (dimensionless)
$\%O_{2c}$	= Oxygen concentration to correct to (% dry basis)
$\%O_{2m}$	= Average measured stack gas oxygen concentration (% dry basis)
$\%CO_{2c}$	= Carbon dioxide concentration to correct to (% dry basis)
$\%CO_{2m}$	= Average measured stack gas oxygen concentration (% dry basis)

Equation 1 is the general concentration calculation used for all contaminants. The contaminant mass, m, is the net analytic mass for the given contaminant. For particulate, m is the sum of the mass contributed from probe washing and filter particulate.

A2.2 Isokinetic Variation Calculations

$$\Delta H_i = \frac{2.62 \times 10^7 \times c_p \times A_n \times (1 - B_{wo}) \times M_D \times (T_m + 459.67) \times \Delta p_i}{k_o \times M_w \times (T_{Stk} + 459.67)}$$ **Equation 13**

$$R_m = 85.49 \times c_p \times \sqrt{\Delta p_i} \times \sqrt{\frac{(T_{stk_i} + 459.67)}{M_w \times P_B}} \times 60 \times A_n \times \frac{(T_{m_i} + 459.67) \times (1 - B_{wo})}{(T_{stk_i} + 459.67) \times y}$$ **Equation 14**

$$A_n = \pi \left(\frac{d_n}{24}\right)^2$$ **Equation 15**

$$M_w = M_D \times (1 - B_{wo}) + 18 \times B_{wo}$$ **Equation 16**

$$M_D = 0.44 \times \%CO_2 + 0.32 \times \%O_2 + 0.28 \times (100 - \%CO_2 - \%O_2)$$ **Equation 17**

$$T_{Stk} = \frac{1}{n}\sum_{i=1}^{n} T_{Stk_i}, where\ n = the\ number\ of\ points$$ **Equation 18**

$$B_{wo} = \frac{V_{cond}}{V_{cond} + V_{std(imp)}}$$ **Equation 19**

$$V_{cond} = 0.04707 \times V_{gain}$$ **Equation 20**

$$Iso = \frac{1}{n}\sum_{i=1}^{n} Iso_i, where\ n = the\ number\ of\ points$$ **Equation 21**

$$Iso_i = \frac{v_{nzi}}{v_i}$$ **Equation 22**

$$v_i = 85.49 \times c_p \times \sqrt{\Delta p_i} \times \sqrt{\frac{(T_{Stk_i} + 459.67)}{(P_{Stk} \times M_W)}}$$ **Equation 23**

$$v_{nzi} = \frac{(V_i - V_{i-1}) \times y \times (T_{Stk_i} + 459.67) \times (P_B + \frac{\Delta H_{i(act)}}{13.6})}{A_n \times t_i \times 60 \times (T_{m(i)} + 459.67) \times P_{stk} \times (1 - B_{wo})}$$ **Equation 24**

$$P_{stk} = P_B + \frac{P_g}{13.6}$$ **Equation 25**

Appendix 2 Calculations

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$$v_{stk} = \frac{1}{n}\sum_{i=1}^{n} v_i \text{ , where } n = \text{the number of points}$$ **Equation 26**

$$v_{nz} = \frac{1}{n}\sum_{i=1}^{n} v_{nzi} \text{ , where } n = \text{the number of points}$$ **Equation 27**

Where,

A_n	= Nozzle area (ft^2)
d_n	= Diameter of nozzle (inches)
c_p	= Pitot coefficient (dimensionless)
Δp_i	= Individual point differential pressures (inches of H_2O)
T_{Stk}	= Average flue gas temperature (°F), second subscript i, indicates individual point measurements
$\Delta H_{i(act)}$	= Calculated individual point orifice pressures (inches of H_2O)
P_g	= Stack Static pressure (inches of H_2O)
P_{stk}	= Absolute stack pressure (inches of Hg)
M_w	= Wet gas molecular weight (g/gmol)
M_D	= Dry gas molecular weight (g/gmol)
$\%CO_2$	= Stack gas carbon dioxide concentration (% dry basis)
$\%O_2$	= Stack gas oxygen concentration (% dry basis)
B_{wo}	= Stack gas water vapour, proportion by volume
V_{cond}	= Total volume of water vapor collected, corrected to standard conditions (ft^3)
V_{gain}	= Condensate gain of impinger contents (mL)
P_{std}	= Standard pressure (29.92 inches of Hg)
v_{stk}	= Average flue gas velocity (ft/sec)
v_i	= Individual point flue gas velocity (ft/sec)
v_{nz}	= Average velocity at nozzle(ft/sec)
v_{nzi}	= Individual point velocity at nozzle(ft/sec)
Iso_i	= Individual point isokinetic variation (%)
Iso	= Average isokinetic variation (%)
R_m	= Isokinetic sampling rate (ft^3/min)

A2.3 Volumetric Flowrate Calculations

$$Q_S = Q_A \times \frac{(T_{Std} + 459.67)}{(T_{Stk} + 459.67)} \times \frac{P_{Stk}}{P_{Std}}$$ **Equation 28**

$$Q_A = \frac{v_{stk} \times 60 \times A_{stk}}{35.315}$$ **Equation 29**

$$A_{stk} = \pi \left(\frac{d}{24}\right)^2$$ **Equation 30**

Where,

Q_A = *Actual flowrate (Am³/min)*
Q_S = *Flowrate (m³/min) at standard conditions on a dry basis*
A_{stk} = *Area of stack (ft²)*
d = *Diameter of stack (inches)*

APPENDIX 3

FIELD DATA SHEETS AND PROCESS DATA

A. Lanfranco and Associates Inc.

4

CLIENT Atlantic Power	NOZZLE ST-30 DIAMETER, IN. .2471	IMPINGER VOLUMES	INITIAL (mL) / FINAL (mL) / TOTAL GAIN (mL)
SOURCE Energy Stack	PROBE 4A-2 Cp 0.8475	Imp. #1	100 / 240 / 140
PARAMETER / RUN NO Particle RUN #1	PORT LENGTH 8"	Imp. #2	100 / 221 / 121
DATE Sept-19-2014	STATIC PRESSURE, IN. H2O -0.25	Imp. #3	0 / 9 / 9
OPERATOR:	STACK DIAMETER 138"	Imp. #4	Gel / 4 / 4
CONTROL UNIT CAE 5040 Y 0.9902	STACK HEIGHT 200'	Imp. #5	/ /
ΔH@ 1.804		Imp. #6	/ /
BAROMETRIC PRESSURE, IN. Hg 27.57	INITIAL LEAK TEST 0.0001 @ 15"	Upstream Diameters	
ASSUMED MOISTURE, Bw 1%	FINAL LEAK TEST 0.001 @ 15"	Downstream Diameters	

Point	Clock Time	Dry Gas Meter ft³	Pitot ΔP IN. H_2O	Orifice ΔH IN. H_2O	Temperature °F: Dry Gas Outlet	Stack	Probe	Box	Impinger Exit	Pump Vac. IN. Hg	Fyrites: CO_2 Vol. %	Fyrites: O_2 Vol. %		
	0959	439.554												
1		443.83	1.1	2.26	62	308	255	258	50	7.5	16	5		
2		448.11	1.1	2.26	62	308								
3		452.09	0.95	1.98	63	307	255	255	57	6				
1		455.38	0.64	1.33	65	305								
2		458.81	0.70	1.45	65	308	255	256	55	5	16	5		
3		462.27	0.71	1.47	66	308								
1		465.28	0.55	1.11	68	306	253	253	56	4	15	5.5		
2		468.37	0.56	1.17	69	307								
3		471.42	0.54	1.13	70	305	254	255	53	4				
1		475.5	0.96	2.09	73	306								
2		479.87	1.1	2.52	73	307	255	256	52	7	15	5.5		
3	1105	483.85	0.9	1.91	75	304								

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4A

CLIENT Atlantic Power	NOZZLE ST-50 DIAMETER, IN. 0.2471	IMPINGER	INITIAL / FINAL / TOTAL GAIN
SOURCE Energy Stack	PROBE 4A-2 Cp 0.8475	VOLUMES	(mL) / (mL) / (mL)
PARAMETER / RUN No Particle RUN #2		Imp. #1	100 / 230 / 130
DATE 9/26-19-2019	PORT LENGTH 8"	Imp. #2	100 / 123 / 23
OPERATOR:	STATIC PRESSURE, IN. H2O -0.25	Imp. #3	0 / 2 / 2
CONTROL UNIT CAE 5099 Y 0.9902	STACK DIAMETER 138"	Imp. #4	GEL / 3 / 3
ΔH@ 1.804	STACK HEIGHT 200'	Imp. #5	
BAROMETRIC PRESSURE, IN. Hg 27.57		Imp. #6	
ASSUMED MOISTURE, Bw 24%	INITIAL LEAK TEST 0.0001 @ 15"	Upstream Diameters	
	FINAL LEAK TEST 0.0001 @ 15"	Downstream Diameters	

Point	Clock Time	Dry Gas Meter ft³	Pitot ΔP IN. H_2O	Orifice ΔH IN. H_2O	Temperature °F					Pump Vac. IN. Hg	Fyrites			
					Dry Gas Outlet	Stack	Probe	Box	Impinger Exit		CO_2 Vol. %	O_2 Vol. %		
	1135	485.660												
1		489.31	0.89	1.59	80	305	254	261	52	4	15	6		
2		493.15	0.99	1.77	80	307								
3		49.6.7	0.84	1.5	80	305	256	256	46	4				
1		499.27	0.44	0.79	82	307	255	258	50	2.5	15	6		
2		502.08	0.53	0.95	80	307								
3		504.84	0.51	0.91	80	306	256	256	51	3				
1		507.69	0.54	0.97	82	307	255	252	54	3	15.5	5.5		
2		511.03	0.74	1.33	83	308								
3		514.3	0.71	1.28	83	307	255	255	52	3.5				
1		517.97	0.89	1.6	85	309	255	256	53	3.5	15.5	5.5		
2		521.86		1.8	85	309								
3	1241	525.58	0.91	1.64	85	308	255	255	51	4				

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4A

CLIENT Atlantic Power	NOZZLE ST-3B DIAMETER, IN. 0.2471	IMPINGER VOLUMES	INITIAL (mL) / FINAL (mL) / TOTAL GAIN (mL)
SOURCE Energy Stacks	PROBE 4A-1 Cp 0.8473	Imp. #1	100 / 227 / 127
PARAMETER / RUN NO Partic Run #3	PORT LENGTH 8"	Imp. #2	100 / 428 / 328
DATE Sept-	STATIC PRESSURE, IN. H20 -0.25	Imp. #3	0 / 3 / 3
OPERATOR: M. Goops	STACK DIAMETER 136"	Imp. #4	Gel
CONTROL UNIT CAE 3099 Y 0.9902	STACK HEIGHT 200'	Imp. #5	
ΔH@ 1.804		Imp. #6	
BAROMETRIC PRESSURE, IN. Hg 27.57	INITIAL LEAK TEST 0.0001 @ 15"	Upstream Diameters	
ASSUMED MOISTURE, Bw 2#8	FINAL LEAK TEST 0.0001 @ 15"	Downstream Diameters	

Point	Clock Time	Dry Gas Meter ft³	Pitot ΔP IN. H_2O	Orifice ΔH IN. H_2O	Temperature °F					Pump Vac. IN. Hg	Fyrites			
					Dry Gas Outlet	Stack	Probe	Box	Impinger Exit		CO_2 Vol. %	O_2 Vol. %		
1	1259	526.552	0.95	1.67	86	304	255	257	52	3.5	15	5		
2		534.11	0.97	1.71	86	309								
3		537.85	0.94	1.66	86	309	255	257	48	4				
1		540.78	0.57	1.01	88	307	255	254	51	3	15	5		
2		544.11	0.74	1.31	87	308								
3		547.6	0.81	1.43	88	308	252	256	54	3.5				
1		550.44	0.53	0.95	91	305	254	256	53	3	15	6		
2		553.41	0.58	1.03	90	306	254							
3		556.28	0.54	0.97	91	303	255	254	54					
1		560.11	0.97	1.73	90	307	255	255	55	3	15	6		
2		564.02	1	1.79	92	307								
3	1403	567.77	0.92	1.65	93	307	255	255	54	5				

APPENDIX 4

CALIBRATION DATA AND CERTIFICATIONS

Pitot Tube Calibration

Date: 15-Jul-19 Temp (R): 530
Pbar (in.Hg): 29.50 Dn (in.): 0.25

Pitot ID: 4A-1

Reference HT-4A (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.225	0.315	31.6	0.8367	0.0120
0.335	0.465	38.6	0.8403	0.0156
0.490	0.685	46.7	0.8373	0.0126
0.660	0.950	54.2	0.8252	0.0005
0.690	1.100	55.4	0.7841	0.0406
		Average :	0.8247	0.0163

Pitot ID: HT-4A

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.050	0.070	14.9	0.8367	0.0042
0.145	0.200	25.4	0.8430	0.0020
0.510	0.700	47.6	0.8450	0.0041
0.790	1.100	59.3	0.8390	0.0019
		Average :	0.8409	0.0031

Pitot ID: 4A-2

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.150	0.200	25.8	0.8574	0.0100
0.345	0.475	39.2	0.8437	0.0036
0.410	0.565	42.7	0.8433	0.0040
0.575	0.770	50.6	0.8555	0.0082
0.750	1.050	57.7	0.8367	0.0106
		Average :	0.8473	0.0073

Pitot ID: HT-4B

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.065	0.090	17.0	0.8413	0.0049
0.145	0.200	25.4	0.8430	0.0033
0.340	0.460	38.9	0.8511	0.0049
0.670	0.910	54.6	0.8495	0.0033
		Average :	0.8462	0.0041

Pitot ID: 4A-3

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.240	0.335	32.7	0.8380	0.0006
0.360	0.495	40.0	0.8443	0.0070
0.455	0.645	45.0	0.8315	0.0058
0.660	0.905	54.2	0.8454	0.0081
0.695	0.995	55.6	0.8274	0.0099
		Average :	0.8373	0.0063

Pitot ID: HT-4C

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.065	0.090	17.0	0.8413	0.0022
0.170	0.240	27.5	0.8332	0.0103
0.420	0.570	43.2	0.8498	0.0063
0.700	0.950	55.8	0.8498	0.0063
		Average :	0.8435	0.0063

Pitot ID:

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
		0.0	#DIV/0!	#DIV/0!
		0.0	#DIV/0!	#DIV/0!
		0.0	#DIV/0!	#DIV/0!
		0.0	#DIV/0!	#DIV/0!
		0.0	#DIV/0!	#DIV/0!
		Average :	#DIV/0!	#DIV/0!

Pitot ID: HT-4D

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.050	0.070	14.9	0.8367	0.0031
0.270	0.370	34.6	0.8457	0.0059
0.540	0.740	49.0	0.8457	0.0059
0.740	1.050	57.4	0.8311	0.0087
		Average :	0.8398	0.0059

* Average absolute deviation must not exceed 0.01.

Calibrated by: Jeremy Gibbs Signature: Date: July 15, 2019

BAROMETER CALIBRATION FORM

Device	Cal Date	Pbar Env Canada (kPa)	Pbar Env Canada (inches of Hg)	Device (inches of Hg) Reading	Device (inches of Hg) Elevation Corrected	Difference (Env Can - Elv Corr)
LA	January 17, 2019	99.9	29.51	29.43	29.50	0.00
DS	July 8, 2019	102.1	30.16	30.03	30.10	0.05
CL	July 8, 2019	102.1	30.16	30.04	30.11	0.04
ML	July 8, 2019	102.1	30.16	30.01	30.08	0.07
SB	January 17, 2019	99.9	29.51	29.43	29.50	0.00
SH	January 17, 2019	99.9	29.51	29.40	29.47	0.03
MG	January 7, 2019	101.2	29.89	29.80	29.87	0.02
JB	January 17, 2019	99.9	29.51	29.42	29.49	0.01
SF	July 8, 2019	102.1	30.16	30.07	30.14	0.01
JG	January 17, 2019	99.9	29.51	29.4	29.47	0.03

Calibrated by: Daryl Sampson Signature:  Date: July 8, 2019

Performance Specification is
Device Corrected for Elevation must be +/- 0.1 " Hg of ENV CANADA SEA-LEVEL Pbar
Enter Environment canada Pressure from their website for Vancouver (link below)
and the reading from your barometer on the ground floor of the office.

http://www.weatheroffice.gc.ca/city/pages/bc-74_metric_e.html

A.Lanfranco & Associates inc.

EPA Method 5
Meter Box Calibration
English Meter Box Units, English K' Factor

Model #: CAE JO99
Serial #: 0028-022210-1

Date: 25-Jun-19
Barometric Pressure: 29.80 (in. Hg)
Theoretical Critical Vacuum: 14.06 (in. Hg)

IMPORTANT For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.
IMPORTANT The Critical Orifice Coefficient, K', must be entered in English units, (ft)^3*(deg R)^0.5)/(in.Hg*(min)).

DRY GAS METER READINGS									CRITICAL ORIFICE READINGS					
dH (in H2O)	Time (min)	Volume Initial (cu ft)	Volume Final (cu ft)	Volume Total (cu ft)	Initial Temps. Inlet (deg F)	Initial Temps. Outlet (deg F)	Final Temps. Inlet (deg F)	Final Temps. Outlet (deg F)	Orifice Serial# (number)	K' Orifice Coefficient (see above)	Actual Vacuum (in Hg)	Ambient Temperature Initial (deg F)	Ambient Temperature Final (deg F)	Ambient Temperature Average (deg F)
3.55	35.00	783.705	791.250	37.545	71.0	71.0	74.0	74.0	73	0.8185	15.5	81.0	81.0	81.0
1.90	19.00	791.500	806.325	14.825	74.0	74.0	75.0	75.0	83	0.5958	18.5	82.0	82.0	82.0
1.15	16.00	806.500	816.205	9.705	75.0	75.0	76.0	76.0	55	0.4606	20.0	82.0	82.0	82.0
0.66	17.00	816.550	824.345	7.845	76.0	76.0	76.0	76.0	48	0.3550	21.5	86.0	89.0	87.5
0.31	16.00	824.800	829.837	5.037	76.0	76.0	77.0	77.0	40	0.2408	22.5	86.0	90.0	88.0

RESULTS

DRY GAS METER: VOLUME CORRECTED Vm(std) (cu ft)	DRY GAS METER: VOLUME CORRECTED Vm(std) (liters)	ORIFICE: VOLUME CORRECTED Vcr(std) (cu ft)	ORIFICE: VOLUME CORRECTED Vcr(std) (liters)	ORIFICE: VOLUME NOMINAL Vcr (cu ft)	DRY GAS METER: CALIBRATION FACTOR Y Value (number)	DRY GAS METER: CALIBRATION FACTOR Y Variation (number)	ORIFICE: CALIBRATION FACTOR dH@ Value (in H2O)	ORIFICE: CALIBRATION FACTOR dH@ Value (mm H2O)	ORIFICE: CALIBRATION FACTOR dH@ Variation (in H2O)	ORIFICE: Ko (value)
37.388	1058.8	38.703	1039.4	37.773	0.9817	-0.009	1.793	45.55	-0.011	0.721
14.648	414.8	14.485	410.2	14.935	0.9889	-0.001	1.809	45.95	0.005	0.714
9.554	270.6	9.433	267.1	9.726	0.9874	-0.003	1.828	46.42	0.023	0.712
7.706	218.2	7.708	218.3	8.028	1.0002	0.010	1.772	45.01	-0.032	0.714
4.939	139.9	4.905	138.9	5.113	0.9930	0.003	1.819	46.20	0.015	0.710
				Average Y ——>	0.9902		Average dH@ ——>	1.804	45.8	Average Ko ——> 0.714

TEMPERATURE CALIBRATION

Calibration Standard ——> Omega Model CL23A S/N:T-218768

Reference Temperature Set-Point (deg F)	Temperature Device Reading (deg F)	Results Variation (degF)	Results Percent of Absolute
32	32	0	0.00%
100	100	0	0.00%
300	300	0	0.00%
500	500	0	0.00%
1000	1000	0	0.00%

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.
For Orifice Calibration Factor dH@, the orifice differential pressure in inches of H20 that equates to 0.75 cfm of air at 68 F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +-0.2.
For Temperature Devices, the reading must be within 1.5% of certified calibration standard (absolute temperature) to be acceptable.

Calibrated by: Scott Ferguson Signature: _____ Date: June 25, 2019

A. LANFRANCO and ASSOCIATES INC.

ENVIRONMENTAL CONSULTANTS

NOZZLE DIAMETER CALIBRATION FORM

Calibrated by: Justin Ching
Date: July 3, 2019

Signature:

Nozzle I.D.	d1 (inch)	d2 (inch)	d3 (inch)	difference (inch)	average dia. (inch)	average area (ft^2)
ST01				0.0000	#DIV/0!	#DIV/0!
SS-1	0.1722	0.1718	0.1706	0.0016	0.1715	0.0001605
ST05	0.1723	0.1730	0.1739	0.0016	0.1731	0.0001634
SS-7	0.1803	0.1798	0.1805	0.0007	0.1802	0.0001771
SS-8	0.1958	0.1983	0.1980	0.0025	0.1974	0.0002125
ST11	0.2058	0.2061	0.2060	0.0003	0.2060	0.0002314
ST10	0.2152	0.2181	0.2145	0.0036	0.2159	0.0002543
SS-18	0.2341	0.2345	0.2355	0.0014	0.2347	0.0003004
ST15	0.2362	0.2372	0.2392	0.0030	0.2375	0.0003077
SS-2	0.2438	0.2440	0.2441	0.0003	0.2440	0.0003246
SS-3	0.2431	0.2435	0.2450	0.0019	0.2439	0.0003244
SS-24	0.2490	0.2455	0.2469	0.0035	0.2471	0.0003331
ST30	0.2470	0.2461	0.2489	0.0028	0.2473	0.0003337
B	0.2466	0.2498	0.2502	0.0036	0.2489	0.0003378
SS-14	0.2498	0.2507	0.2519	0.0021	0.2508	0.0003431
ST20	0.2559	0.2530	0.2521	0.0038	0.2537	0.0003510
SS-9	0.2721	0.2689	0.2710	0.0032	0.2707	0.0003996
A	0.2603	0.2618	0.2592	0.0026	0.2604	0.0003699
ST40	0.2855	0.2846	0.2850	0.0009	0.2850	0.0004431
SS-13	0.2972	0.2986	0.2994	0.0022	0.2984	0.0004857
SS-30	0.3022	0.3023	0.3023	0.0001	0.3023	0.0004983
ST50	0.3032	0.3022	0.3049	0.0027	0.3034	0.0005022
ST60	0.3068	0.3052	0.3063	0.0016	0.3061	0.0005110
SS-10	0.3163	0.3172	0.3168	0.0009	0.3168	0.0005473
ST65	0.3251	0.3272	0.3279	0.0028	0.3267	0.0005823
ST66	0.3371	0.3362	0.3380	0.0018	0.3371	0.0006198
ST80	0.3578	0.3607	0.3593	0.0029	0.3593	0.0007040
SS-5	0.3672	0.3711	0.3705	0.0039	0.3696	0.0007451
ST75	0.3692	0.3679	0.3690	0.0013	0.3687	0.0007414
ST76	0.3732	0.3732	0.3721	0.0011	0.3728	0.0007582
SS-16	0.3735	0.3774	0.3755	0.0039	0.3755	0.0007689
ST85	0.4029	0.4036	0.4015	0.0021	0.4027	0.0008843
SS-15				0.0000	#DIV/0!	#DIV/0!
DD	0.4049	0.4058	0.4088	0.0039	0.4065	0.0009013
SS-11	0.4211	0.4220	0.4185	0.0035	0.4205	0.0009646
ST70	0.4232	0.4242	0.4230	0.0012	0.4235	0.0009781
ST86				0.0000	#DIV/0!	#DIV/0!
C	0.4917	0.4888	0.4908	0.0029	0.4904	0.0013119
SS-49				0.0000	#DIV/0!	#DIV/0!
SS-6	0.4944	0.4962	0.4946	0.0018	0.4951	0.0013368
ST90	0.4982	0.5012	0.4995	0.0030	0.4996	0.0013615
ST92	0.5085	0.5062	0.5071	0.0023	0.5073	0.0014035
ST96				0.0000	#DIV/0!	#DIV/0!
SS-12	0.7488	0.7507	0.7478	0.0029	0.7491	0.0030606

Where:

(a) D1, D2, D3 = three different nozzle diameters; each diameter must be measured to within (0.025mm) 0.001 in.

(b) Difference = maximum difference between any two diameters; must be less than or equal to (0.1mm) 0.004 in.

(c) Average = average of D1, D2 and D3

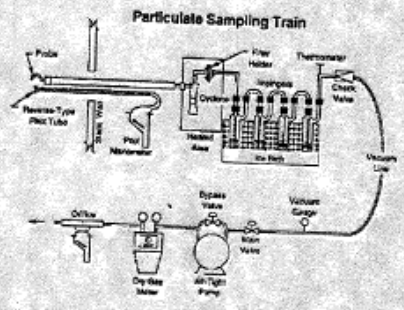
Walter Smith & Associates, Inc.

is hereby granted to:

Louis Agassiz

to certify that they have completed to satisfaction

Source Sampling & CEMS Workshop



Granted: March 11, 2011

Walter S, Smith, PE, DEE **3.5 CEU**

Appendix B - Ash Analysis Report

Your P.O. #: CREDIT CARD (PHONE C
Your Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your C.O.C. #: 08473283

Attention: Jacob Steyl

ATLANTIC POWER (WILLIAMS LAKE) LTD.
4465 MACKENZIE AVENUE NORTH
WILLIAMS LAKE, BC
CANADA V2G 5E8

Report Date: 2019/11/18
Report #: R2812043
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B980737
Received: 2019/09/24, 08:15

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Metals - TCLP	1	2019/09/27	2019/09/27	BBY7SOP-00005 / BBY7SOP-00001	EPA 1311, 6020bR2 m
Moisture	1	2019/09/25	2019/09/26	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Non Routine/Non Validated Matrix Tested (1, 3)	1	N/A	2019/09/25		
PAH in Soil by GC/MS (SIM)	1	2019/09/25	2019/09/26	BBY8SOP-00022	BCMOE BCLM Jul2017m
PAH TEQ Calculation, BC Reg. 132/92 (4)	1	N/A	2019/09/27	BBY WI-00033	Auto Calc
Total PAH and B(a)P Calculation (5)	1	N/A	2019/09/27	BBY WI-00033	Auto Calc
TCLP pH Measurements	1	N/A	2019/09/27	BBY7SOP-00005	EPA 1311
Dioxins/Furans in Soil (EPS 1/RM/23) (2, 6)	1	2019/10/16	2019/11/08	BRL SOP-00406 (mod)	EPS 1/RM/23 m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Courtenay
(2) This test was performed by BV Labs Ontario (From Burnaby)
(3) Sample(s) analyzed using methodologies that have not been subjected to Bureau Veritas Laboratories' standard validation process for the submitted matrix and is not an accredited method. Analysis performed with client consent, however results should be viewed with discretion.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Your P.O. #: CREDIT CARD (PHONE C
Your Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your C.O.C. #: 08473283

Attention: Jacob Steyl

ATLANTIC POWER (WILLIAMS LAKE) LTD.
4465 MACKENZIE AVENUE NORTH
WILLIAMS LAKE, BC
CANADA V2G 5E8

Report Date: 2019/11/18
Report #: R2812043
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B980737
Received: 2019/09/24, 08:15

(4) PAH TEQ = 0.1*benzo(a)anthracene + 1.0*benzo(a)pyrene + 0.1*benzo(b)fluoranthene + 0.1*benzo(k)fluoranthene + 1.1*dibenzo(a,h)anthracene + 0.2*indeno(1,2,3-cd)pyrene
(5) Total PAHs in Soil include: Quinoline, Naphthalene, 1-Methylnaphthalene, 2-Methylnaphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Acridine, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b&j)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, and Benzo(g,h,i)perylene.

Total PAHs in Sediment include (B.C. Reg. 116/2018, Schedule 3.4): Naphthalene, 2-Methylnaphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(a)pyrene, and Dibenz(a,h)anthracene.
(6) Confirmatory runs for 2,3,7,8-TCDF are performed only if the primary result is greater than the RDL.

Encryption Key

Melissa McIntosh
Project Manager
18 Nov 2019 12:55:03

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Customer Solutions, Western Canada Customer Experience Team
Email: customersolutionswest@bvlabs.com
Phone# (604) 734 7276

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BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

RESULTS OF CHEMICAL ANALYSES OF SOIL

BV Labs ID		WO2208	
Sampling Date		2019/09/19 14:00	
COC Number		08473283	
	UNITS	**GLASS JARS (CLEAR) FILLED WITH ASH**	**QC Batch**
MISCELLANEOUS			
Sample Matrix	N/A	ASH	ONSITE

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

PHYSICAL TESTING (SOIL)

BV Labs ID		WO2208		
Sampling Date		2019/09/19 14:00		
COC Number		08473283		
	UNITS	GLASS JARS (CLEAR) FILLED WITH ASH	RDL	QC Batch
Physical Properties				
Moisture	%	<0.30	0.30	9602590
RDL = Reportable Detection Limit				

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

SEMIVOLATILE ORGANICS BY GC-MS (SOIL)

BV Labs ID		WO2208		
Sampling Date		2019/09/19 14:00		
COC Number		08473283		
	UNITS	GLASS JARS (CLEAR) FILLED WITH ASH	RDL	QC Batch
Calculated Parameters				
PAH Toxicity Equivalency	mg/kg	0.026	0.020	9601330
RDL = Reportable Detection Limit				

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

BV Labs ID		WO2208	
Sampling Date		2019/09/19 14:00	
COC Number		08473283	
	UNITS	**GLASS JARS (CLEAR) FILLED WITH ASH**	**QC Batch**
TCLP Extraction Procedure			
Initial pH of Sample	pH	12.2	9605581
pH after HCl	pH	10.4	9605581
Final pH of Leachate	pH	10.1	9605581
pH of Leaching Fluid	pH	2.85	9605581

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

DIOXIN AND FURANS BY HRMS (SOIL)

BV Labs ID		WO2208						
Sampling Date		2019/09/19 14:00						
COC Number		08473283			TOXIC EQUIVALENCY		# of	
	UNITS	GLASS JARS (CLEAR) FILLED WITH ASH	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
DIOXINS								
1,2,3,4,6,7,8-Hepta CDD *	pg/g	10.1	0.582	4.93	0.0100	0.101		9669763
1,2,3,4,7,8-Hexa CDD *	pg/g	5.61	0.585	4.93	0.100	0.561		9669763
1,2,3,6,7,8-Hexa CDD *	pg/g	5.24	0.519	4.93	0.100	0.524		9669763
1,2,3,7,8,9-Hexa CDD *	pg/g	4.97	0.538	4.93	0.100	0.497		9669763
1,2,3,7,8-Penta CDD *	pg/g	12.3	0.525	4.93	1.00	12.3		9669763
2,3,7,8-Tetra CDD *	pg/g	11.9	0.547	4.93	1.00	11.9		9669763
Octa CDD *	pg/g	9.49	0.566	49.3	0.000300	0.00285		9669763
Total Hepta CDD *	pg/g	16.6	0.582	4.93			2	9669763
Total Hexa CDD *	pg/g	60.2	0.546	4.93			7	9669763
Total Penta CDD *	pg/g	127	0.525	4.93			12	9669763
Total Tetra CDD *	pg/g	248	0.547	4.93			16	9669763
FURANS								
1,2,3,4,6,7,8-Hepta CDF **	pg/g	6.11	0.531	4.93	0.0100	0.0611		9669763
1,2,3,4,7,8,9-Hepta CDF **	pg/g	1.56	0.597	4.93	0.0100	0.0156		9669763
1,2,3,4,7,8-Hexa CDF **	pg/g	16.5	0.530	4.93	0.100	1.65		9669763
1,2,3,6,7,8-Hexa CDF **	pg/g	11.7	0.462	4.93	0.100	1.17		9669763
1,2,3,7,8,9-Hexa CDF **	pg/g	1.76	0.553	4.93	0.100	0.176		9669763
1,2,3,7,8-Penta CDF **	pg/g	32.2	1.07	4.93	0.0300	0.966		9669763
2,3,4,6,7,8-Hexa CDF **	pg/g	8.54	0.526	4.93	0.100	0.854		9669763
2,3,4,7,8-Penta CDF **	pg/g	51.3	0.995	4.93	0.300	15.4		9669763
2,3,7,8-Tetra CDF **	pg/g	201	0.559	4.93	0.100	20.1		9669763

EDL = Estimated Detection Limit

RDL = Reportable Detection Limit

TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

* CDD = Chloro Dibenzo-p-Dioxin

** CDF = Chloro Dibenzo-p-Furan

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BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

DIOXIN AND FURANS BY HRMS (SOIL)

BV Labs ID		WO2208						
Sampling Date		2019/09/19 14:00						
COC Number		08473283			TOXIC EQUIVALENCY		# of	
	UNITS	GLASS JARS (CLEAR) FILLED WITH ASH	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
Octa CDF **	pg/g	2.36	0.537	49.3	0.000300	0.000708		9669763
Total Hepta CDF **	pg/g	13.0	0.562	4.93			4	9669763
Total Hexa CDF **	pg/g	109	0.516	4.93			13	9669763
Total Penta CDF **	pg/g	425	1.03	4.93			15	9669763
Total Tetra CDF **	pg/g	1190	0.559	4.93			19	9669763
TOTAL TOXIC EQUIVALENCY	pg/g					66.3		
Surrogate Recovery (%)								
C13-1234678 HeptaCDD *	%	96						9669763
C13-1234678 HeptaCDF **	%	75						9669763
C13-123678 HexaCDD *	%	99						9669763
C13-123678 HexaCDF **	%	79						9669763
C13-12378 PentaCDD *	%	99						9669763
C13-12378 PentaCDF **	%	89						9669763
C13-2378 TetraCDD *	%	79						9669763
C13-2378 TetraCDF **	%	78						9669763
C13-OCDD *	%	89						9669763

EDL = Estimated Detection Limit
RDL = Reportable Detection Limit
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds
** CDF = Chloro Dibenzo-p-Furan
* CDD = Chloro Dibenzo-p-Dioxin

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BV Labs Job #: B980737
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ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

TCLP METALS (SOIL)

BV Labs ID		WO2208		
Sampling Date		2019/09/19 14:00		
COC Number		08473283		
	UNITS	GLASS JARS (CLEAR) FILLED WITH ASH	RDL	QC Batch
TCLP Extraction Procedure				
Leachate Antimony (Sb)	mg/L	<0.10	0.10	9606591
Leachate Arsenic (As)	mg/L	<0.10	0.10	9606591
Leachate Barium (Ba)	mg/L	1.45	0.10	9606591
Leachate Beryllium (Be)	mg/L	<0.10	0.10	9606591
Leachate Boron (B)	mg/L	2.62	0.10	9606591
Leachate Cadmium (Cd)	mg/L	<0.10	0.10	9606591
Leachate Chromium (Cr)	mg/L	<0.10	0.10	9606591
Leachate Cobalt (Co)	mg/L	<0.10	0.10	9606591
Leachate Copper (Cu)	mg/L	<0.10	0.10	9606591
Leachate Iron (Fe)	mg/L	<0.50	0.50	9606591
Leachate Lead (Pb)	mg/L	<0.10	0.10	9606591
Leachate Mercury (Hg)	mg/L	<0.0020	0.0020	9606591
Leachate Molybdenum (Mo)	mg/L	0.21	0.10	9606591
Leachate Nickel (Ni)	mg/L	<0.10	0.10	9606591
Leachate Selenium (Se)	mg/L	<0.10	0.10	9606591
Leachate Silver (Ag)	mg/L	<0.010	0.010	9606591
Leachate Thallium (Tl)	mg/L	<0.10	0.10	9606591
Leachate Uranium (U)	mg/L	<0.10	0.10	9606591
Leachate Vanadium (V)	mg/L	<0.10	0.10	9606591
Leachate Zinc (Zn)	mg/L	<0.10	0.10	9606591
Leachate Zirconium (Zr)	mg/L	<0.10	0.10	9606591
RDL = Reportable Detection Limit				

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ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

CSR PAH IN SOIL BY GC-MS (SOIL)

BV Labs ID		WO2208		
Sampling Date		2019/09/19 14:00		
COC Number		08473283		
	UNITS	GLASS JARS (CLEAR) FILLED WITH ASH	RDL	QC Batch
Calculated Parameters				
Low Molecular Weight PAH`s	mg/kg	<0.050	0.050	9600523
High Molecular Weight PAH`s	mg/kg	<0.050	0.050	9600523
Total PAH	mg/kg	<0.050	0.050	9600523
Polycyclic Aromatics				
Naphthalene	mg/kg	<0.010	0.010	9603442
1-Methylnaphthalene	mg/kg	<0.050	0.050	9603442
2-Methylnaphthalene	mg/kg	<0.020	0.020	9603442
Acenaphthylene	mg/kg	<0.0050	0.0050	9603442
Acenaphthene	mg/kg	<0.0050	0.0050	9603442
Fluorene	mg/kg	<0.020	0.020	9603442
Phenanthrene	mg/kg	<0.010	0.010	9603442
Anthracene	mg/kg	<0.0040	0.0040	9603442
Fluoranthene	mg/kg	<0.020	0.020	9603442
Pyrene	mg/kg	<0.020	0.020	9603442
Benzo(a)anthracene	mg/kg	<0.020	0.020	9603442
Chrysene	mg/kg	<0.020	0.020	9603442
Benzo(b&j)fluoranthene	mg/kg	<0.020	0.020	9603442
Benzo(b)fluoranthene	mg/kg	<0.020	0.020	9603442
Benzo(k)fluoranthene	mg/kg	<0.020	0.020	9603442
Benzo(a)pyrene	mg/kg	<0.020	0.020	9603442
Indeno(1,2,3-cd)pyrene	mg/kg	<0.020	0.020	9603442
Dibenz(a,h)anthracene	mg/kg	<0.020	0.020	9603442
Benzo(g,h,i)perylene	mg/kg	<0.050	0.050	9603442
Surrogate Recovery (%)				
D10-ANTHRACENE (sur.)	%	0.30 (1)		9603442
D8-ACENAPHTHYLENE (sur.)	%	0.10 (1)		9603442
D8-NAPHTHALENE (sur.)	%	0.40 (1)		9603442

RDL = Reportable Detection Limit
(1) Surrogate recovery below acceptance criteria due to matrix interference.

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BV Labs Job #: B980737
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ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

CSR PAH IN SOIL BY GC-MS (SOIL)

BV Labs ID		WO2208		
Sampling Date		2019/09/19 14:00		
COC Number		08473283		
	UNITS	GLASS JARS (CLEAR) FILLED WITH ASH	RDL	QC Batch
TERPHENYL-D14 (sur.)	%	0.10 (1)		9603442

RDL = Reportable Detection Limit
(1) Surrogate recovery below acceptance criteria due to matrix interference.

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BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

GENERAL COMMENTS

Sample WO2208 [GLASS JARS (CLEAR) FILLED WITH ASH] : Non-routine matrix analyzed with client consent for PAH on batch: 9603442. Please refer to BBY PDF-00149.

Results relate only to the items tested.

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BV Labs Job #: B980737
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ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9602590	LO1	Method Blank	Moisture	2019/09/26	<0.30		%	
9602590	LO1	RPD	Moisture	2019/09/26	4.3		%	20
9603442	JP1	Spiked Blank	D10-ANTHRACENE (sur.)	2019/09/26		83	%	50 - 140
			D8-ACENAPHTHYLENE (sur.)	2019/09/26		81	%	50 - 140
			D8-NAPHTHALENE (sur.)	2019/09/26		83	%	50 - 140
			TERPHENYL-D14 (sur.)	2019/09/26		88	%	50 - 140
			Naphthalene	2019/09/26		89	%	50 - 140
			1-Methylnaphthalene	2019/09/26		86	%	50 - 140
			2-Methylnaphthalene	2019/09/26		86	%	50 - 140
			Acenaphthylene	2019/09/26		89	%	50 - 140
			Acenaphthene	2019/09/26		86	%	50 - 140
			Fluorene	2019/09/26		82	%	50 - 140
			Phenanthrene	2019/09/26		85	%	50 - 140
			Anthracene	2019/09/26		86	%	50 - 140
			Fluoranthene	2019/09/26		91	%	50 - 140
			Pyrene	2019/09/26		91	%	50 - 140
			Benzo(a)anthracene	2019/09/26		81	%	50 - 140
			Chrysene	2019/09/26		84	%	50 - 140
			Benzo(b&j)fluoranthene	2019/09/26		87	%	50 - 140
			Benzo(b)fluoranthene	2019/09/26		88	%	50 - 140
			Benzo(k)fluoranthene	2019/09/26		87	%	50 - 140
			Benzo(a)pyrene	2019/09/26		89	%	50 - 140
			Indeno(1,2,3-cd)pyrene	2019/09/26		96	%	50 - 140
			Dibenz(a,h)anthracene	2019/09/26		99	%	50 - 140
			Benzo(g,h,i)perylene	2019/09/26		94	%	50 - 140
9603442	JP1	Method Blank	D10-ANTHRACENE (sur.)	2019/09/26		81	%	50 - 140
			D8-ACENAPHTHYLENE (sur.)	2019/09/26		80	%	50 - 140
			D8-NAPHTHALENE (sur.)	2019/09/26		83	%	50 - 140
			TERPHENYL-D14 (sur.)	2019/09/26		88	%	50 - 140
			Naphthalene	2019/09/26	<0.010		mg/kg	
			1-Methylnaphthalene	2019/09/26	<0.050		mg/kg	
			2-Methylnaphthalene	2019/09/26	<0.020		mg/kg	
			Acenaphthylene	2019/09/26	<0.0050		mg/kg	
			Acenaphthene	2019/09/26	<0.0050		mg/kg	
			Fluorene	2019/09/26	<0.020		mg/kg	
			Phenanthrene	2019/09/26	<0.010		mg/kg	
			Anthracene	2019/09/26	<0.0040		mg/kg	
			Fluoranthene	2019/09/26	<0.020		mg/kg	
			Pyrene	2019/09/26	<0.020		mg/kg	
			Benzo(a)anthracene	2019/09/26	<0.020		mg/kg	
			Chrysene	2019/09/26	<0.020		mg/kg	
			Benzo(b&j)fluoranthene	2019/09/26	<0.020		mg/kg	
			Benzo(b)fluoranthene	2019/09/26	<0.020		mg/kg	
			Benzo(k)fluoranthene	2019/09/26	<0.020		mg/kg	
			Benzo(a)pyrene	2019/09/26	<0.020		mg/kg	
			Indeno(1,2,3-cd)pyrene	2019/09/26	<0.020		mg/kg	
			Dibenz(a,h)anthracene	2019/09/26	<0.020		mg/kg	
			Benzo(g,h,i)perylene	2019/09/26	<0.050		mg/kg	
9605581	AP8	Method Blank	Initial pH of Sample	2019/09/27	4.96		pH	
			Final pH of Leachate	2019/09/27	4.93		pH	
			pH of Leaching Fluid	2019/09/27	4.96		pH	
9605581	AP8	RPD	Initial pH of Sample	2019/09/27	2.7		%	N/A

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BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Final pH of Leachate	2019/09/27	0.36		%	N/A
			pH of Leaching Fluid	2019/09/27	0		%	N/A
9606591	GS9	Matrix Spike [WO2208-01]	Leachate Antimony (Sb)	2019/09/27		106	%	75 - 125
			Leachate Arsenic (As)	2019/09/27		106	%	75 - 125
			Leachate Barium (Ba)	2019/09/27		99	%	75 - 125
			Leachate Beryllium (Be)	2019/09/27		102	%	75 - 125
			Leachate Boron (B)	2019/09/27		105	%	75 - 125
			Leachate Cadmium (Cd)	2019/09/27		103	%	75 - 125
			Leachate Chromium (Cr)	2019/09/27		104	%	75 - 125
			Leachate Cobalt (Co)	2019/09/27		100	%	75 - 125
			Leachate Copper (Cu)	2019/09/27		102	%	75 - 125
			Leachate Iron (Fe)	2019/09/27		104	%	75 - 125
			Leachate Lead (Pb)	2019/09/27		102	%	75 - 125
			Leachate Mercury (Hg)	2019/09/27		103	%	75 - 125
			Leachate Molybdenum (Mo)	2019/09/27		105	%	75 - 125
			Leachate Nickel (Ni)	2019/09/27		99	%	75 - 125
			Leachate Selenium (Se)	2019/09/27		103	%	75 - 125
			Leachate Silver (Ag)	2019/09/27		100	%	75 - 125
			Leachate Thallium (Tl)	2019/09/27		97	%	75 - 125
			Leachate Uranium (U)	2019/09/27		104	%	75 - 125
			Leachate Vanadium (V)	2019/09/27		105	%	75 - 125
			Leachate Zinc (Zn)	2019/09/27		100	%	75 - 125
			Leachate Zirconium (Zr)	2019/09/27		106	%	75 - 125
9606591	GS9	Spiked Blank	Leachate Antimony (Sb)	2019/09/27		106	%	75 - 125
			Leachate Arsenic (As)	2019/09/27		107	%	75 - 125
			Leachate Barium (Ba)	2019/09/27		102	%	75 - 125
			Leachate Beryllium (Be)	2019/09/27		103	%	75 - 125
			Leachate Boron (B)	2019/09/27		103	%	75 - 125
			Leachate Cadmium (Cd)	2019/09/27		106	%	75 - 125
			Leachate Chromium (Cr)	2019/09/27		106	%	75 - 125
			Leachate Cobalt (Co)	2019/09/27		102	%	75 - 125
			Leachate Copper (Cu)	2019/09/27		106	%	75 - 125
			Leachate Iron (Fe)	2019/09/27		108	%	75 - 125
			Leachate Lead (Pb)	2019/09/27		105	%	75 - 125
			Leachate Mercury (Hg)	2019/09/27		106	%	75 - 125
			Leachate Molybdenum (Mo)	2019/09/27		103	%	75 - 125
			Leachate Nickel (Ni)	2019/09/27		105	%	75 - 125
			Leachate Selenium (Se)	2019/09/27		105	%	75 - 125
			Leachate Silver (Ag)	2019/09/27		104	%	75 - 125
			Leachate Thallium (Tl)	2019/09/27		101	%	75 - 125
			Leachate Uranium (U)	2019/09/27		107	%	75 - 125
			Leachate Vanadium (V)	2019/09/27		107	%	75 - 125
			Leachate Zinc (Zn)	2019/09/27		105	%	75 - 125
			Leachate Zirconium (Zr)	2019/09/27		107	%	75 - 125
9606591	GS9	Method Blank	Leachate Antimony (Sb)	2019/09/27	<0.10		mg/L	
			Leachate Arsenic (As)	2019/09/27	<0.10		mg/L	
			Leachate Barium (Ba)	2019/09/27	<0.10		mg/L	
			Leachate Beryllium (Be)	2019/09/27	<0.10		mg/L	
			Leachate Boron (B)	2019/09/27	<0.10		mg/L	
			Leachate Cadmium (Cd)	2019/09/27	<0.10		mg/L	
			Leachate Chromium (Cr)	2019/09/27	<0.10		mg/L	

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BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Leachate Cobalt (Co)	2019/09/27	<0.10		mg/L	
			Leachate Copper (Cu)	2019/09/27	<0.10		mg/L	
			Leachate Iron (Fe)	2019/09/27	<0.50		mg/L	
			Leachate Lead (Pb)	2019/09/27	<0.10		mg/L	
			Leachate Mercury (Hg)	2019/09/27	<0.0020		mg/L	
			Leachate Molybdenum (Mo)	2019/09/27	<0.10		mg/L	
			Leachate Nickel (Ni)	2019/09/27	<0.10		mg/L	
			Leachate Selenium (Se)	2019/09/27	<0.10		mg/L	
			Leachate Silver (Ag)	2019/09/27	<0.010		mg/L	
			Leachate Thallium (Tl)	2019/09/27	<0.10		mg/L	
			Leachate Uranium (U)	2019/09/27	<0.10		mg/L	
			Leachate Vanadium (V)	2019/09/27	<0.10		mg/L	
			Leachate Zinc (Zn)	2019/09/27	<0.10		mg/L	
			Leachate Zirconium (Zr)	2019/09/27	<0.10		mg/L	
9669763	AGU	Matrix Spike [WO2208-02]	C13-1234678 HeptaCDD	2019/11/08		76	%	30 - 130
			C13-1234678 HeptaCDF	2019/11/08		61	%	30 - 130
			C13-123678 HexaCDD	2019/11/08		78	%	30 - 130
			C13-123678 HexaCDF	2019/11/08		65	%	30 - 130
			C13-12378 PentaCDD	2019/11/08		100	%	30 - 130
			C13-12378 PentaCDF	2019/11/08		89	%	30 - 130
			C13-2378 TetraCDD	2019/11/08		75	%	30 - 130
			C13-2378 TetraCDF	2019/11/08		74	%	30 - 130
			C13-OCDD	2019/11/08		74	%	30 - 130
			1,2,3,4,6,7,8-Hepta CDD	2019/11/08		95	%	80 - 140
			1,2,3,4,7,8-Hexa CDD	2019/11/08		102	%	80 - 140
			1,2,3,6,7,8-Hexa CDD	2019/11/08		91	%	80 - 140
			1,2,3,7,8,9-Hexa CDD	2019/11/08		91	%	80 - 140
			1,2,3,7,8-Penta CDD	2019/11/08		92	%	80 - 140
			2,3,7,8-Tetra CDD	2019/11/08		92	%	80 - 140
			Octa CDD	2019/11/08		89	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDF	2019/11/08		98	%	80 - 140
			1,2,3,4,7,8,9-Hepta CDF	2019/11/08		127	%	80 - 140
			1,2,3,4,7,8-Hexa CDF	2019/11/08		104	%	80 - 140
			1,2,3,6,7,8-Hexa CDF	2019/11/08		92	%	80 - 140
			1,2,3,7,8,9-Hexa CDF	2019/11/08		103	%	80 - 140
			1,2,3,7,8-Penta CDF	2019/11/08		97	%	80 - 140
			2,3,4,6,7,8-Hexa CDF	2019/11/08		101	%	80 - 140
			2,3,4,7,8-Penta CDF	2019/11/08		105	%	80 - 140
			2,3,7,8-Tetra CDF	2019/11/08		103	%	80 - 140
			Octa CDF	2019/11/08		93	%	80 - 140
9669763	AGU	Spiked Blank	C13-1234678 HeptaCDD	2019/11/08		63	%	30 - 130
			C13-1234678 HeptaCDF	2019/11/08		58	%	30 - 130
			C13-123678 HexaCDD	2019/11/08		75	%	30 - 130
			C13-123678 HexaCDF	2019/11/08		58	%	30 - 130
			C13-12378 PentaCDD	2019/11/08		85	%	30 - 130
			C13-12378 PentaCDF	2019/11/08		77	%	30 - 130
			C13-2378 TetraCDD	2019/11/08		67	%	30 - 130
			C13-2378 TetraCDF	2019/11/08		69	%	30 - 130
			C13-OCDD	2019/11/08		63	%	30 - 130
			1,2,3,4,6,7,8-Hepta CDD	2019/11/08		100	%	80 - 140
			1,2,3,4,7,8-Hexa CDD	2019/11/08		96	%	80 - 140

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BV Labs Job #: B980737
Report Date: 2019/11/18

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			1,2,3,6,7,8-Hexa CDD	2019/11/08		89	%	80 - 140
			1,2,3,7,8,9-Hexa CDD	2019/11/08		90	%	80 - 140
			1,2,3,7,8-Penta CDD	2019/11/08		93	%	80 - 140
			2,3,7,8-Tetra CDD	2019/11/08		92	%	80 - 140
			Octa CDD	2019/11/08		92	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDF	2019/11/08		93	%	80 - 140
			1,2,3,4,7,8,9-Hepta CDF	2019/11/08		120	%	80 - 140
			1,2,3,4,7,8-Hexa CDF	2019/11/08		102	%	80 - 140
			1,2,3,6,7,8-Hexa CDF	2019/11/08		92	%	80 - 140
			1,2,3,7,8,9-Hexa CDF	2019/11/08		106	%	80 - 140
			1,2,3,7,8-Penta CDF	2019/11/08		98	%	80 - 140
			2,3,4,6,7,8-Hexa CDF	2019/11/08		100	%	80 - 140
			2,3,4,7,8-Penta CDF	2019/11/08		102	%	80 - 140
			2,3,7,8-Tetra CDF	2019/11/08		92	%	80 - 140
			Octa CDF	2019/11/08		90	%	80 - 140
9669763	AGU	RPD	1,2,3,4,6,7,8-Hepta CDD	2019/11/08	5.1		%	25
			1,2,3,4,7,8-Hexa CDD	2019/11/08	12		%	25
			1,2,3,6,7,8-Hexa CDD	2019/11/08	5.5		%	25
			1,2,3,7,8,9-Hexa CDD	2019/11/08	2.2		%	25
			1,2,3,7,8-Penta CDD	2019/11/08	4.4		%	25
			2,3,7,8-Tetra CDD	2019/11/08	1.1		%	25
			Octa CDD	2019/11/08	1.1		%	25
			1,2,3,4,6,7,8-Hepta CDF	2019/11/08	2.2		%	25
			1,2,3,4,7,8,9-Hepta CDF	2019/11/08	0		%	25
			1,2,3,4,7,8-Hexa CDF	2019/11/08	0.99		%	25
			1,2,3,6,7,8-Hexa CDF	2019/11/08	3.3		%	25
			1,2,3,7,8,9-Hexa CDF	2019/11/08	9.9		%	25
			1,2,3,7,8-Penta CDF	2019/11/08	1.0		%	25
			2,3,4,6,7,8-Hexa CDF	2019/11/08	1.0		%	25
			2,3,4,7,8-Penta CDF	2019/11/08	3.0		%	25
			2,3,7,8-Tetra CDF	2019/11/08	4.3		%	25
			Octa CDF	2019/11/08	6.5		%	25
9669763	AGU	Method Blank	C13-1234678 HeptaCDD	2019/11/08		74	%	30 - 130
			C13-1234678 HeptaCDF	2019/11/08		63	%	30 - 130
			C13-123678 HexaCDD	2019/11/08		84	%	30 - 130
			C13-123678 HexaCDF	2019/11/08		68	%	30 - 130
			C13-12378 PentaCDD	2019/11/08		89	%	30 - 130
			C13-12378 PentaCDF	2019/11/08		80	%	30 - 130
			C13-2378 TetraCDD	2019/11/08		77	%	30 - 130
			C13-2378 TetraCDF	2019/11/08		70	%	30 - 130
			C13-OCDD	2019/11/08		70	%	30 - 130
			1,2,3,4,6,7,8-Hepta CDD	2019/11/08	<0.545, EDL=0.545		pg/g	
			1,2,3,4,7,8-Hexa CDD	2019/11/08	<0.582, EDL=0.582		pg/g	
			1,2,3,6,7,8-Hexa CDD	2019/11/08	<0.517, EDL=0.517		pg/g	
			1,2,3,7,8,9-Hexa CDD	2019/11/08	<0.536, EDL=0.536		pg/g	
			1,2,3,7,8-Penta CDD	2019/11/08	<0.438, EDL=0.438		pg/g	

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ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			2,3,7,8-Tetra CDD	2019/11/08	<0.544, EDL=0.544		pg/g	
			Octa CDD	2019/11/08	1.42, EDL=0.547		pg/g	
			Total Hepta CDD	2019/11/08	<0.545, EDL=0.545		pg/g	
			Total Hexa CDD	2019/11/08	<0.544, EDL=0.544		pg/g	
			Total Penta CDD	2019/11/08	<0.438, EDL=0.438		pg/g	
			Total Tetra CDD	2019/11/08	<0.544, EDL=0.544		pg/g	
			1,2,3,4,6,7,8-Hepta CDF	2019/11/08	<0.533, EDL=0.533		pg/g	
			1,2,3,4,7,8,9-Hepta CDF	2019/11/08	<0.600, EDL=0.600		pg/g	
			1,2,3,4,7,8-Hexa CDF	2019/11/08	<0.448, EDL=0.448		pg/g	
			1,2,3,6,7,8-Hexa CDF	2019/11/08	<0.390, EDL=0.390		pg/g	
			1,2,3,7,8,9-Hexa CDF	2019/11/08	<0.468, EDL=0.468		pg/g	
			1,2,3,7,8-Penta CDF	2019/11/08	<0.578, EDL=0.578		pg/g	
			2,3,4,6,7,8-Hexa CDF	2019/11/08	<0.445, EDL=0.445		pg/g	
			2,3,4,7,8-Penta CDF	2019/11/08	<0.536, EDL=0.536		pg/g	
			2,3,7,8-Tetra CDF	2019/11/08	<0.462, EDL=0.462		pg/g	
			Octa CDF	2019/11/08	<0.583, EDL=0.583		pg/g	
			Total Hepta CDF	2019/11/08	<0.564, EDL=0.564		pg/g	
			Total Hexa CDF	2019/11/08	<0.436, EDL=0.436		pg/g	
			Total Penta CDF	2019/11/08	<0.556, EDL=0.556		pg/g	
			Total Tetra CDF	2019/11/08	<0.462, EDL=0.462		pg/g	

N/A = Not Applicable

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

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

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

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

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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BV Labs Job #: B980737
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ATLANTIC POWER (WILLIAMS LAKE) LTD.
Client Project #: ANNUAL ASH SAMPLE
Site Location: WILLIAMS LAKE POWER PALNT-AC11
Your P.O. #: CREDIT CARD (PHONE C
Sampler Initials: AF

VALIDATION SIGNATURE PAGE

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

Andy Lu, Ph.D., P.Chem., Scientific Specialist

Owen Cosby, BSc.C.Chem, Supervisor, HRMS Services

Melissa McIntosh, Project Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

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CHAIN OF CUSTODY RE

08473283

BBY FCD-00077/05

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5. Toll Free (800) 665-8566

COC #:

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Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: Atlantic Power Williams Lake	Company Name:	Quotation #: e-mail	[x] Regular TAT 5 days (Most analyses)
Contact Name: Jacob Steyl	Contact Name:	P.O. #/ AFE#: Credit Card (phone cell)	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 4455 Mackenzie Ave N	Address:	Project #: Annual Ash Sample	Rush TAT (Surcharges will be applied)
Williams Lake PC: V2G 5E8	PC:	Site Location: Williams Lake Power Plant - AC11	[ ] Same Day [ ] 2 Days
Phone: 250-392-6394 250-267-2281 (cell)	Phone:	Site #:	[ ] 1 Day [ ] 3 Days
Email: jsteyl@atlanticpower.com	Email:	Sampled By: Al French	Date Required:

Regulatory Criteria	Special Instructions
[ ] BC CSR Soil [ ] BC CSR Water	[ ] Return Cooler
[ ] CCME (Specify) [x] Other (Specify)	[ ] Ship Sample Bottles (Please Specify)
BC MOE Methods specified	
[ ] Drinking Water [ ] BC Water Quality	

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Rush Confirmation #:

LABORATORY USE ONLY

CUSTODY SEAL Y / N: Present / Intact

COOLER TEMPERATURES: N/A

COOLING MEDIA PRESENT Y / N

	Sample Identification	Lab Identification	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	TCLP Metals as per EPA 1311	Dioxin/Furans TEQs per EPA 8290	PAH TEQ as per EPA 8275	# OF CONTAINERS SUBMITTED	HOLD - DO NOT ANALYZE	COMMENTS
1	Glass Jars (clear) filled with Ash		2019-09-19	14:00		x					Proceed with analysis on non-routine matrix
2	Glass Jars (clear) filled with Ash			14:00			x				
3	Glass Jars (clear) filled with Ash			14:00				x			
4											
5											
6											
7											
8											
9											
10											

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Jacob Steyl	2019/11/19	14:45	ABEJUMORE A	2019/09/24	08:15

B980737_COC