2020 Annual Report for Authorization 8808

Atlantic Power - Williams Lake Power Plant

Jacob Steyl

4455 Mackenzie Ave N, Williams Lake, V2G 5E8

Executive Summary

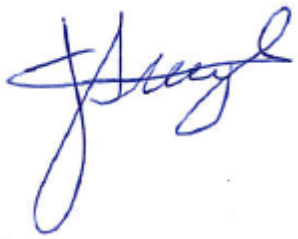
This Report details the Environmental Emissions from January 1, 2020 to December 31, 2020 and fulfils the requirement of section 3.6 of Authorization 8808 [1].

No rail ties or greater than 1% construction and demolition (C&D) waste were used as feedstock during the reporting period. A total of 368,819 wet tonnes of clean biomass was incinerated during 5,362 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 04, 2021

Table of Contents

Table of Tables and Figures

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 2020 to 00:00 1 January 2021. The Plant was curtailed for extended periods during the year, as show in Figure 1-1 and Table 2-1.

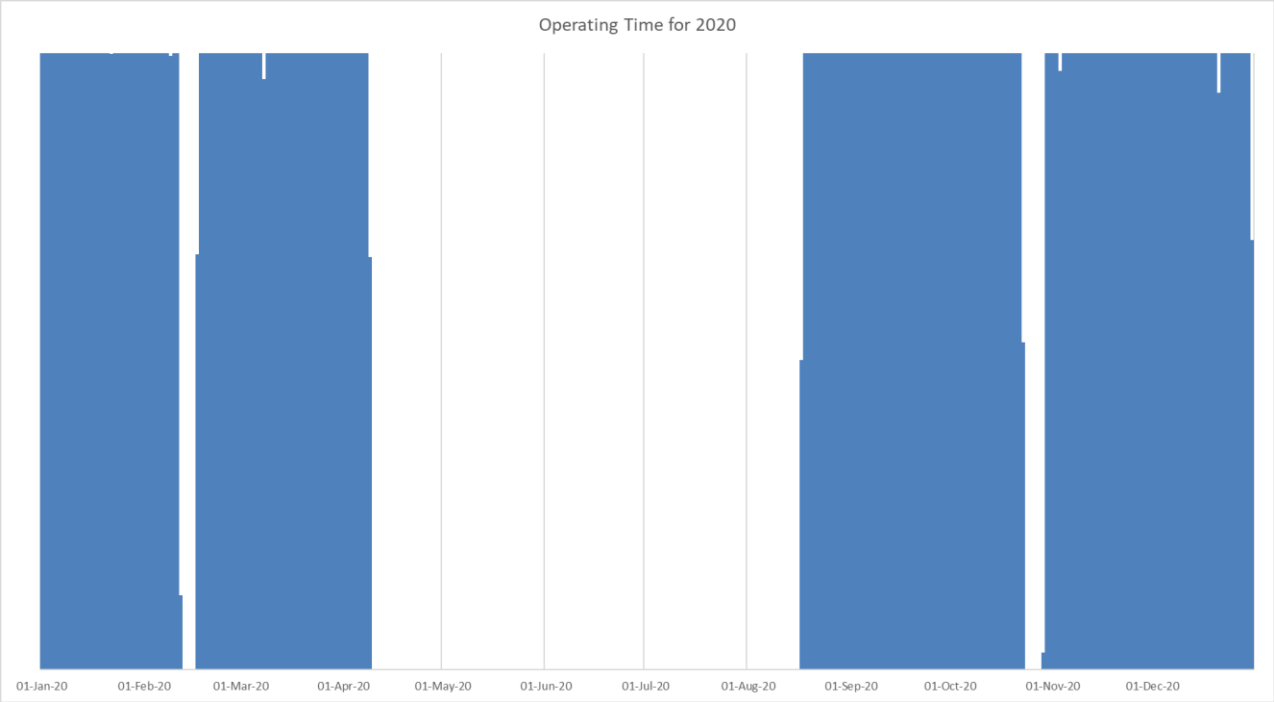


Figure 1-1: Normal Operating time for 2020

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-20	744	0
Feb-20	571	0
Mar-20	743	0
Apr-20	208	0
May-20	-	-
Jun-20	-	-
Jul-20	-	-
Aug-20	348	0
Sep-20	720	0
Oct-20	589	0
Nov-20	720	0
Dec-20	718	0
2020 Totals	**5,362**	**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-20	0	0	44,905
Feb-20	0	0	36,300
Mar-20	0	0	49,517
Apr-20	0	0	13,217
May-20	0	0	-
Jun-20	0	0	-
Jul-20	0	0	-
Aug-20	0	0	22,701
Sep-20	0	0	50,190
Oct-20	0	0	41,127
Nov-20	0	0	53,672
Dec-20	0	0	57,191
2020 Totals	**0**	**0**	**368,819**

[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-20	253	209
Feb-20	265	225
Mar-20	280	244
Apr-20	231	201
May-20	-	-
Jun-20	-	-
Jul-20	-	-
Aug-20	274	210
Sep-20	233	210
Oct-20	275	167
Nov-20	247	215
Dec-20	243	223

The average NOx emissions for the year was 213 mg/m³ at 8% O_2. The maximum hourly average for the year is 280 mg/m³ at 8%O_2 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 March 11, 2020 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)	97.7	110
Particulate (mg/m^3 @ 8% O_2)	3.1	20

Both parameters measure is below permitted levels.

The average steam flow during the Stack Test on Mar 11 was 525.7 klb/hr (66.2 kg/s). This meets the Operating Conditions requirements stipulated in section 3.3 of the Permit.

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 11 March 2020 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)	0.37	2.5
Barium (mg/L)	5.11	100
Boron (mg/L)	1.41	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)	1.01	500
Dioxin/Furan TEQ (ppb)	0.0436	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].

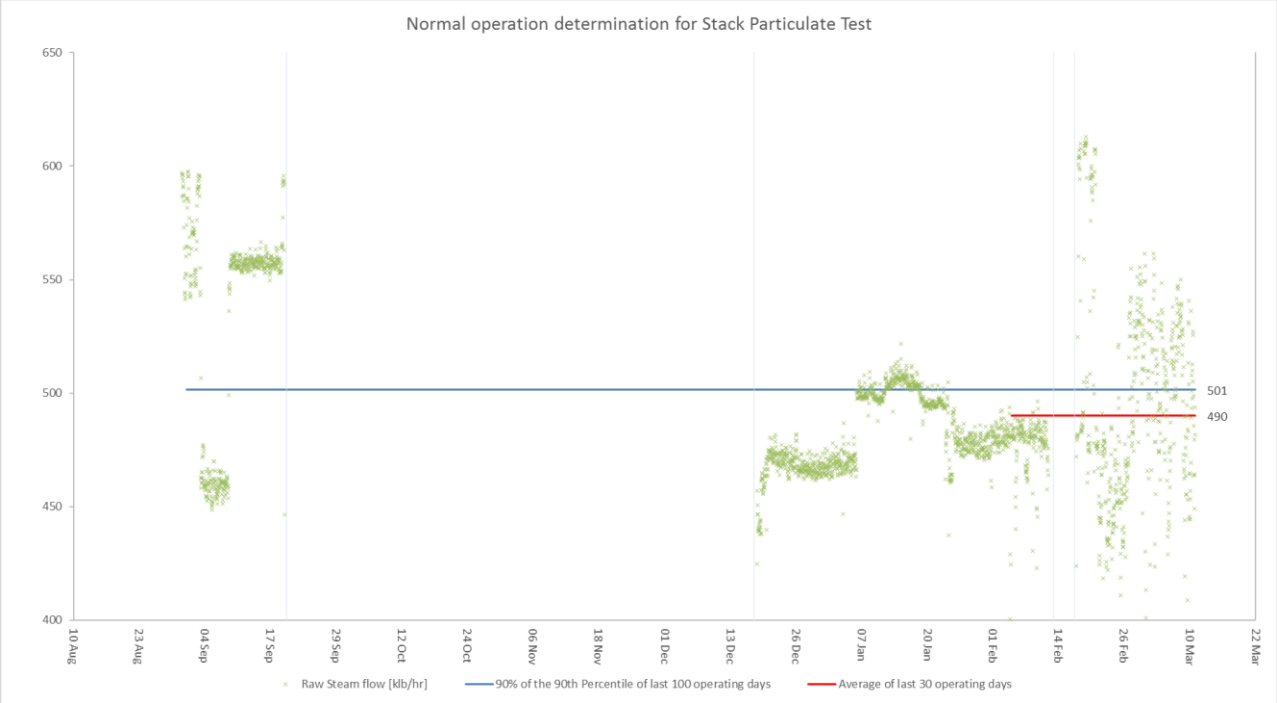


Figure 5-1: Hourly Average Steam Production data for 11 March 2020 Discrete Testing

6 Exceedances

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

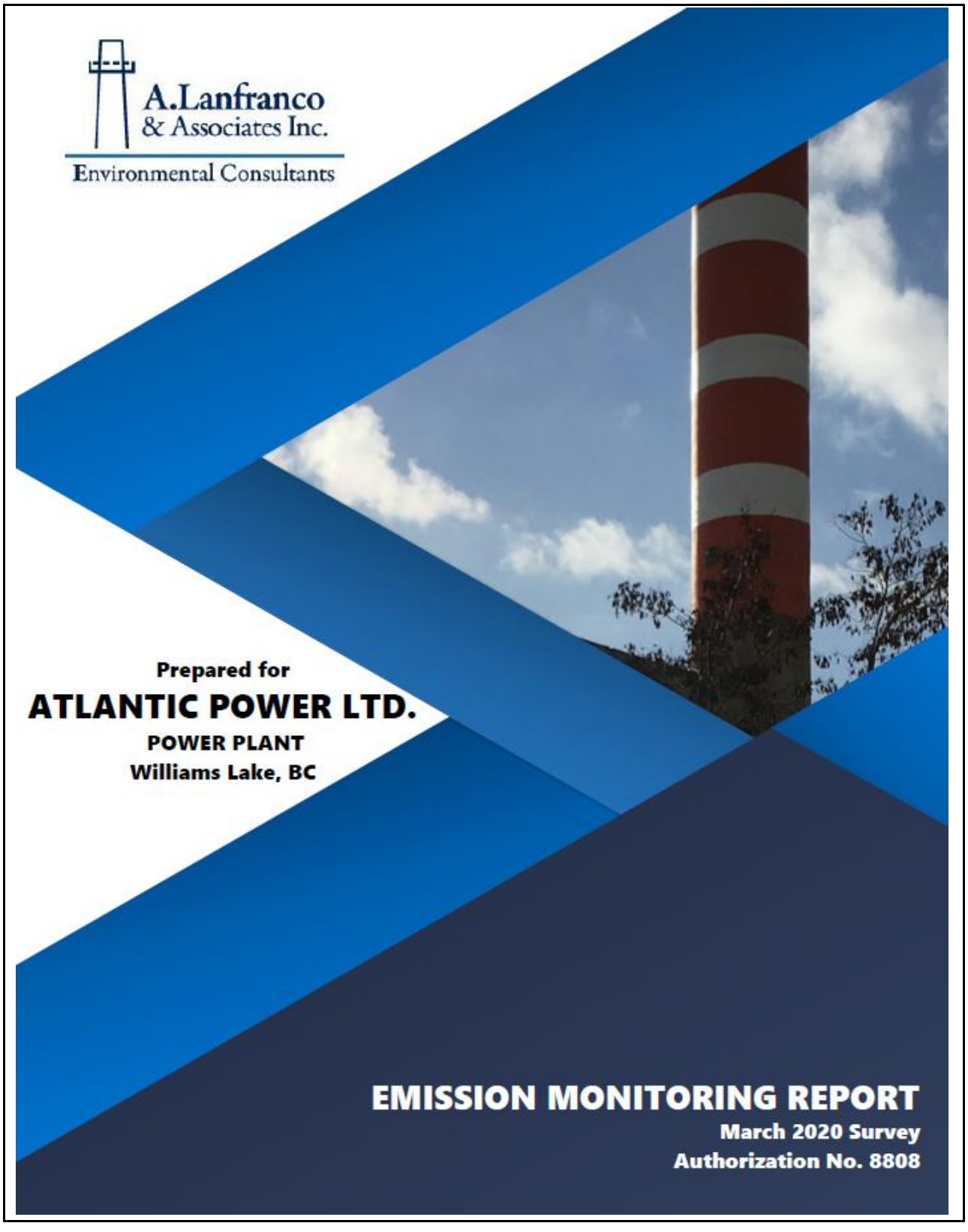
7 References

[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
March 2020 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. D. Sampson (certified) and Mr. M. Goods (certified).

The report was prepared by Mr. M. Goods 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:

CL

Carter Lanfranco, CST
Chief Operations Officer | Owner

A.Lanfranco & Associates Inc.
Environmental Consultants

TABLE OF CONTENTS

APPENDICES

A.Lanfranco & Associates Inc.
Environmental Consultants

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. D. Sampson - A. Lanfranco and Associates Inc. Mr. M. Goods - A. Lanfranco and Associates Inc.

A.Lanfranco & Associates Inc.
Environmental Consultants

2 SUMMARY

The following table presents the triplicate test average results for the listed parameters for the Biomass fuelled boiler stack on March 11, 2020.

Parameter	Average	Permit Limits
Particulate (mg/Sm^3)	3.6	
Particulate (mg/Sm^3 @ 8% O_2)	3.1	20
Particulate (kg/hr)	1.3	
Flowrate (Sm^3/min)	5860	
Flowrate (Sm^3/sec)	97.7	110
O_2 (vol % dry)	6.2	
CO_2 (vol % dry)	14.2	

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 March 11, 2020 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.

A.Lanfranco & Associates Inc.
Environmental Consultants

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.

A.Lanfranco & Associates Inc.
Environmental Consultants

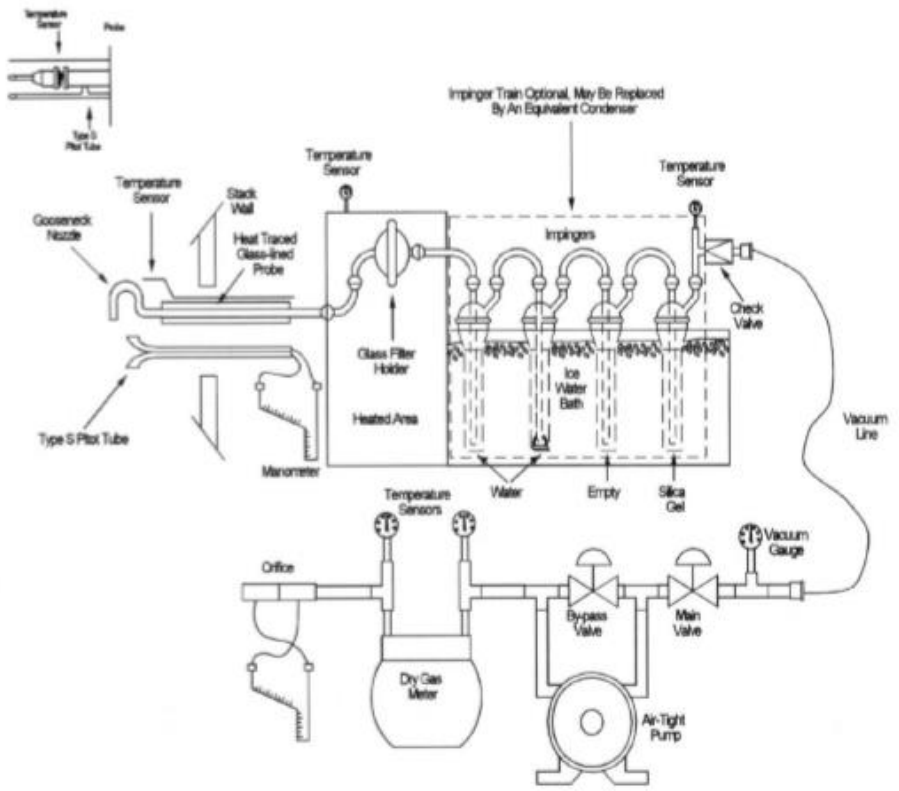


Figure 1: Method 5 Particulate Train

A.Lanfranco & Associates Inc.
Environmental Consultants

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.

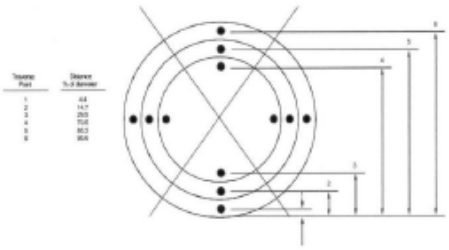


Figure 2. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points.

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.

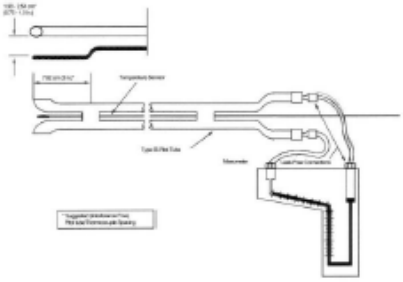


Figure 3. Type S Pitot Tube Manometer Assembly

A.Lanfranco & Associates Inc.
Environmental Consultants

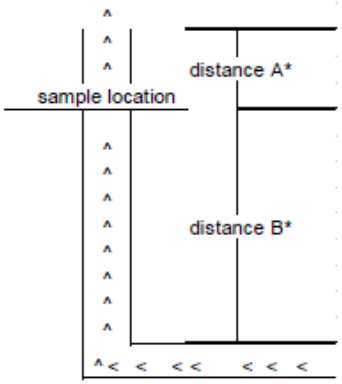
Figure - 4 **Location of Traverse Points in Circular Stacks**

(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.

A.Lanfranco & Associates Inc.
Environmental Consultants

TABLE 1: MAIN STACK EMISSION RESULTS

Parameter	Test 1	Test 2	Test 3	Average
Test Date	11-Mar-20	11-Mar-20	11-Mar-20	
Test Time	11:49 - 12:57	13:16 - 14:22	14:39 - 15:43	
Duration (minutes)	60	60	60	60
Particulate (mg/Sm^3)	5.6	3.3	1.7	3.6
Particulate (mg/Sm^3 @ 8% O_2)	5.0	2.9	1.5	3.1
Particulate (Kg/hr)	2.0	1.2	0.6	1.3
Particulate (Kg/day)	47.8	28.1	14.6	30.2
Flowrate (Sm^3/min)	5939	5836	5800	5858
Flowrate (Sm^3/sec)	99.0	97.3	96.7	97.6
Flowrate (Am^3/min)	11654	11744	11516	11638
Temperature (°C)	157	158	157	157
O_2 (vol % dry)	6.4	6.3	5.8	6.2
CO_2 (vol % dry)	14.5	13.6	14.4	14.2
H_2O (vol %)	18.8	20.7	19.7	19.7
Isokinetic Variation (%)	101.1	102.8	101.8	101.9

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

A.Lanfranco & Associates Inc.
Environmental Consultants

TABLE 2: GRAVIMETRIC RESULTS

	Initial (g)	Final (g)	Net (g)	Blank Corrected Net (g)
Atlantic Power - Main Stack				
Filters				
Run 1	0.3638	0.3657	0.0019	0.0021
Run 2	0.3659	0.3665	0.0006	0.0008
Run 3	0.3606	0.3613	0.0007	0.0009
Blank	0.3737	0.3735	-0.0002	
Probe Washes				
Run 1	111.7478	111.7514	0.0036	0.0041
Run 2	128.2247	128.2271	0.0024	0.0029
Run 3	115.7439	115.7444	0.0005	0.0010
Blank	113.3619	113.3614	-0.0005	
Silica Gels				
Run 1	200.0	207.4	7.4	7.4
Run 2	200.0	207.0	7.0	7.0
Run 3	200.0	208.8	8.8	8.8

TABLE 3: OPERATING CONDITIONS

	Steam Flow (K lbs./hour)
Main Stack	525

A.Lanfranco & Associates Inc.
Environmental Consultants

7 DISCUSSION OF RESULTS

The average particulate result for this survey was 3.1 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 98.4 Sm^3/sec was also within the allowable limit of 110.0 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:**	11-Mar-20
Jobsite:	Williams Lake, B.C.	**Run:**	1 - Particulate
Source:	Main Stack	**Run Time:**	11:49 - 12:57

Particulate Concentration:		**5.6**	**mg/dscm**	0.0024 gr/dscf
		2.9	mg/Acm	0.0012 gr/Acf
		5.0	mg/dscm (@ 8% O2)	0.0022 gr/dscf (@ 8% O2)
Emission Rate:		1.99	Kg/hr	4.394 lb/hr
Sample Gas Volume:		1.1084	dscm	39.143 dscf
Total Sample Time:		60.0	minutes	
Average Isokineticity:		101.1	%	
Flue Gas Characteristics				
	Moisture:	18.79	%	
	Temperature	156.9	°C	314.4 °F
	Flow	5938.8	dscm/min	209730 dscf/min
		98.98	dscm/sec	3495.5 dscf/sec
		11654.2	Acm/min	411570 Acf/min
	Velocity	20.129	m/sec	66.04 f/sec
	Gas Analysis	6.38	% O_2	14.50 % CO_2
		30.575	Mol. Wt (g/gmole) Dry	28.212 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:**	11-Mar-20
Jobsite:	Williams Lake, B.C.	**Run:**	1 - Particulate
Source:	Main Stack	**Run Time:**	11:49 - 12:57

Control Unit (Y)	1.0042
Nozzle Diameter (in.)	0.2420
Pitot Factor	0.8261
Baro. Press. (in. Hg)	27.58
Static Press. (in. H_2O)	-0.52
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
14.00	6.50
15.00	5.60
15.00	5.90
14.00	7.50
Average = **14.50**	**6.38**

Condensate Collection:

Impinger 1 (grams)	100.0
Impinger 2 (grams)	80.0
Impinger 3 (grams)	5.0
Impinger 4 (grams)	7.4
Total Gain (grams)	**192.4**

Collection:

Filter (grams)	**0.0021**
Washings (grams)	**0.0041**
Impinger (grams)	**0.0000**
Total (grams)	**0.0062**

Traverse	Point	Time (min.)	Dry Gas Meter (ft³)	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	322.415							
1	1	5.0	326.300	1.100	2.14	61	61	311	6.1	101.3
	2	10.0	330.080	1.050	2.03	60	60	314	20.1	101.2
	3	15.0	333.770	1.000	1.94	60	60	314	40.8	101.3
		0.0	333.770							
2	1	5.0	337.050	0.790	1.54	56	56	303	6.1	101.2
	2	10.0	340.400	0.840	1.61	56	56	315	20.1	101.1
	3	15.0	343.780	0.850	1.63	57	57	316	40.8	101.2
		0.0	343.780							
3	1	5.0	346.600	0.580	1.13	60	60	308	6.1	101.0
	2	10.0	349.750	0.730	1.41	61	61	319	20.1	101.2
	3	15.0	352.920	0.740	1.42	63	63	317	40.8	100.6
		0.0	352.920							
4	1	5.0	356.590	0.980	1.90	64	64	320	6.1	101.3
	2	10.0	360.300	1.000	1.94	65	65	319	20.1	101.2
	3	15.0	363.931	0.950	1.85	66	66	317	40.8	101.2
			Average:	0.884	1.712	60.8	60.8	314.4		101.1

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	11-Mar-20
Jobsite:	Williams Lake, B.C.	**Run:**	2 - Particulate
Source:	Main Stack	**Run Time:**	13:16 - 14:22

Particulate Concentration:		3.3	mg/dscm	0.0015 gr/dscf
		1.7	mg/Acm	0.0007 gr/Acf
		2.9	mg/dscm (@ 8% O2)	0.0013 gr/dscf (@ 8% O2)
Emission Rate:		1.17	Kg/hr	2.582 lb/hr
Sample Gas Volume:		1.1064	dscm	39.071 dscf
Total Sample Time:		60.0	minutes	
Average Isokineticity:		102.8	%	
Flue Gas Characteristics				
	Moisture:	20.72	%	
	Temperature	157.7	°C	315.8 °F
	Flow	5835.7	dscm/min	206088 dscf/min
		97.26	dscm/sec	3434.8 dscf/sec
		11744.4	Acm/min	414753 Acf/min
	Velocity	20.285	m/sec	66.55 f/sec
	Gas Analysis	6.28	% O_2	13.63 % CO_2
		30.431	Mol. Wt (g/gmole) Dry	27.855 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:**	11-Mar-20
Jobsite:	Williams Lake, B.C.	**Run:**	2 - Particulate
Source:	Main Stack	**Run Time:**	13:16 - 14:22

Control Unit (Y)	1.0042
Nozzle Diameter (in.)	0.2420
Pitot Factor	0.8261
Baro. Press. (in. Hg)	27.60
Static Press. (in. H_2O)	-0.52
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
14.50	6.30
13.00	6.90
14.00	6.70
13.00	5.20
Average = 13.63	6.28

Condensate Collection:

Impinger 1 (grams)	130.0
Impinger 2 (grams)	75.0
Impinger 3 (grams)	5.0
Impinger 4 (grams)	7.0
Total Gain (grams)	217.0

Collection:

Filter (grams)	**0.0008**
Washings (grams)	**0.0029**
Impinger (grams)	**0.0000**
Total (grams)	**0.0037**

Traverse	Point	Time (min.)	Dry Gas Meter (ft³)	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	364.272							
1	1	5.0	367.990	0.990	1.93	69	69	318	6.1	102.9
	2	10.0	371.900	1.100	2.14	69	69	319	20.1	102.8
	3	15.0	375.730	1.050	2.05	70	70	318	40.8	102.8
		0.0	375.730							
2	1	5.0	378.580	0.570	1.14	70	70	302	6.1	102.5
	2	10.0	381.800	0.740	1.44	70	70	319	20.1	102.8
	3	15.0	385.020	0.730	1.44	72	72	315	40.8	102.9
		0.0	385.020							
3	1	5.0	388.160	0.680	1.36	74	74	305	6.1	102.8
	2	10.0	391.600	0.840	1.65	73	73	320	20.1	102.6
	3	15.0	394.990	0.810	1.59	74	74	321	40.8	102.9
		0.0	394.990							
4	1	5.0	398.870	1.050	2.08	74	74	312	6.1	102.9
	2	10.0	402.750	1.060	2.08	75	75	321	20.1	102.8
	3	15.0	406.580	1.030	2.03	75	75	320	40.8	102.9
			Average:	0.888	1.744	72.1	72.1	315.8		102.8

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	11-Mar-20
Jobsite:	Williams Lake, B.C.	**Run:**	3 - Particulate
Source:	Main Stack	**Run Time:**	14:39 - 15:43

Particulate Concentration:	**1.7**	**mg/dscm**	0.0008	gr/dscf
	0.9	mg/Acm	0.0004	gr/Acf
	1.5	mg/dscm (@ 8% O2)	0.0007	gr/dscf (@ 8% O2)
Emission Rate:	0.61	Kg/hr	1.338	lb/hr
Sample Gas Volume:	1.0898	dscm	38.485	dscf
Total Sample Time:	60.0	minutes		
Average Isokineticity:	101.8	%		
Flue Gas Characteristics				
Moisture:	19.72	%		
Temperature	157.1	°C	314.8	°F
Flow	5800.3	dscm/min	204837	dscf/min
	96.67	dscm/sec	3414.0	dscf/sec
	11515.9	Acm/min	406685	Acf/min
Velocity	19.890	m/sec	65.26	f/sec
Gas Analysis	5.80	% O_2	14.38	% CO_2
	30.532	Mol. Wt (g/gmole) Dry	28.061	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:**	11-Mar-20
Jobsite:	Williams Lake, B.C.	**Run:**	3 - Particulate
Source:	Main Stack	**Run Time:**	14:39 - 15:43

Control Unit (Y)	1.0042
Nozzle Diameter (in.)	0.2420
Pitot Factor	0.8261
Baro. Press. (in. Hg)	27.59
Static Press. (in. H_2O)	-0.52
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
14.00	5.40
14.50	5.30
14.00	6.10
15.00	6.40
Average = 14.38	5.80

Condensate Collection:

Impinger 1 (grams)	165.0
Impinger 2 (grams)	20.0
Impinger 3 (grams)	7.0
Impinger 4 (grams)	8.8
Total Gain (grams)	**200.8**

Collection:

Filter (grams)	**0.0009**
Washings (grams)	**0.0010**
Impinger (grams)	**0.0000**
Total (grams)	**0.0019**

Traverse	Point	Time (min.)	Dry Gas Meter (ft³)	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	407.101							
1	1	5.0	410.990	1.060	2.09	75	75	318	6.1	102.0
	2	10.0	414.780	1.020	2.00	72	72	318	20.1	101.8
	3	15.0	418.600	1.040	2.04	70	70	316	40.8	101.9
		0.0	418.600							
2	1	5.0	421.590	0.640	1.26	67	67	310	6.1	101.7
	2	10.0	424.890	0.790	1.53	67	67	319	20.1	101.6
	3	15.0	428.250	0.820	1.59	65	65	318	40.8	101.9
		0.0	428.250							
3	1	5.0	431.070	0.570	1.12	65	65	306	6.1	101.7
	2	10.0	434.200	0.710	1.38	66	66	318	20.1	101.8
	3	15.0	437.290	0.690	1.34	66	66	314	40.8	101.7
		0.0	437.290							
4	1	5.0	440.980	0.980	1.92	66	66	311	6.1	101.8
	2	10.0	444.740	1.020	1.98	66	66	315	20.1	102.0
	3	15.0	448.450	0.990	1.93	67	67	315	40.8	101.9
			Average:	0.861	1.682	67.7	67.7	314.8		101.8

APPENDIX 2

CALCULATIONS

Appendix 2 Calculations

A.Lanfranco & Associates Inc. Environmental Consultants

The following sections show the equations and define the variables that were used for this survey. The equations are organized in three sections. Equations 1-9 were used to calculate particulate concentration at standard conditions on a dry basis. Equations 11-25 were used to sample within the 100 ± 10% isokinetic variation and to confirm that sampling meets this isokinetic variation threshold. Equations 26-28 were used to calculate the volumetric flowrate of the stack flue gas.

A2.1 Contaminant Concentration Calculations

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

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

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

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

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

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

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

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

$$\%O_{2m} = \frac{1}{n}\sum_{i=1}^{n} \%O_{2i}, \text{where } n = \text{the number of } O_2 \text{ measurements} \quad \textbf{Equation 9}$$

$$\%CO_{2m} = \frac{1}{n}\sum_{i=1}^{n} \%CO_{2i}, \text{where } n = \text{the number of } CO_2 \text{ measurements} \quad \textbf{Equation 10}$$

Where,

c	= Contaminant concentration
m	= Contaminant mass
m_i	= Net analytical mass (mg, ng, or µg)

Appendix 2 Calculations

A.Lanfranco & Associates Inc.
Environmental Consultants

$m_{ana,i}$	= 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)
$\%O_{2m}$	= Average measured stack gas oxygen concentration (% 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. For this survey, if the analysis came back with a non-detect analysis, ½ of the detection limit was used as the contaminant mass.

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 11**

$$R_m = 85.49 \times c_p \times \sqrt{\Delta p_i} \times \sqrt{\frac{(T_{stk_i} + 459.67)}{M_w \times P_B}} \times 60 \times A_n \times \frac{(T_{m_i} + 459.67) \times (1 - B_{wo})}{(T_{stk_i} + 459.67) \times y}$$ **Equation 12**

$$A_n = \pi \left(\frac{d_n}{24}\right)^2$$ **Equation 13**

$$M_w = M_D \times (1 - B_{wo}) + 18 \times B_{wo}$$ **Equation 14**

$$M_D = 0.44 \times \%CO_2 + 0.32 \times \%O_2 + 0.28 \times (100 - \%CO_2 - \%O_2)$$ **Equation 15**

$$T_{Stk} = \frac{1}{n}\sum_{i=1}^{n} T_{Stk_i}, where\ n = the\ number\ of\ points$$ **Equation 16**

$$B_{wo} = \frac{V_{cond}}{V_{cond} + V_{std(imp)}}$$ **Equation 17**

$$V_{cond} = 0.04707 \times V_{gain}$$ **Equation 18**

$$Iso = \frac{1}{n}\sum_{i=1}^{n} Iso_i, where\ n = the\ number\ of\ points$$ **Equation 19**

$$Iso_i = \frac{v_{nzi}}{v_i}$$ **Equation 20**

$$v_i = 85.49 \times c_p \times \sqrt{\Delta p_i} \times \sqrt{\frac{(T_{stk_i} + 459.67)}{(P_{Stk} \times M_W)}}$$ **Equation 21**

$$v_{nzi} = \frac{(V_i - V_{i-1}) \times y \times (T_{stk_i} + 459.67) \times (P_B + \frac{\Delta H_{i(act)}}{13.6})}{A_n \times t_i \times 60 \times (T_{m(i)} + 459.67) \times P_{stk} \times (1 - B_{wo})}$$ **Equation 22**

$$P_{stk} = P_B + \frac{P_g}{13.6}$$ **Equation 23**

Appendix 2 Calculations

A.Lanfranco & Associates Inc.
Environmental Consultants

Equation 24

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

Equation 25

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

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 26**

$$Q_A = \frac{v_{stk} \times 60 \times A_{stk}}{35.315}$$ **Equation 27**

$$A_{stk} = \pi \left(\frac{d}{24}\right)^2$$ **Equation 28**

Where,

Q_A = *Actual flowrate (Am^3/min)*
Q_S = *Flowrate (m^3/min) at standard conditions on a dry basis*
A_{stk} = *Area of stack (ft^2)*
d = *Diameter of stack (inches)*

APPENDIX 3

FIELD DATA SHEETS

A. Lanfranco and Associates Inc.

CLIENT Atlantic Power					NOZZLE B DIAMETER, IN. .2420					IMPINGER	INITIAL	FINAL	TOTAL GAIN			
SOURCE Main Stack					PROBE ST54 Cp .8261					VOLUMES	(mL)	(mL)	(mL)			
PARAMETER / RUN No PM RUN1										Imp. #1	100	200	100			
DATE March-11-2020					PORT LENGTH 8"					Imp. #2	100	180	80			
OPERATOR: ML					STATIC PRESSURE, IN. H2O ~~135~~ -0.52					Imp. #3	0	5	5			
CONTROL UNIT DU 14 Y 1.0062					STACK DIAMETER 138"					Imp. #4	Gel	5				
ΔH@ 2.003					STACK HEIGHT 200					Imp. #5						
										Imp. #6						
BAROMETRIC PRESSURE, IN. Hg 27.58					INITIAL LEAK TEST 0.010 @15"					Upstream Diameters						
ASSUMED MOISTURE, Bw 18%					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					Pump Vac. IN. Hg	Fyrites					
					Dry Gas Outlet	Stack	Probe	Box	Impinger Exit		CO_2 Vol. %	O_2 Vol. %				
	1149	322.415														
1		326.3	1.1	2.14	61	311	252	250	43	4.5	14	6.5				
2		330.08	1.05	2.03	60	314										
3		333.77	1.0	1.94	60	314	252	249	45	4						
1		337.05	~~0.79~~	1.54	56	303	258	252	41	3.5	15	5.6				
2		340.4	0.84	1.61	56	315										
3		343.78	0.85	1.63	57	316	260	255	45	3.5						
1		346.6	0.58	1.13	60	308	242	240	47	3	15	5.9				
2		349.75	0.73	1.41	61	319										
3		352.92	0.74	1.42	63	317	255	257	45	3.5						
1		356.59	0.98	1.9	64	320	258	252	47	4	14	7.5				
2		360.3	1.0	1.94	65	319										
3		363.431	0.95	1.85	66	317	250	250	48	4						
	1257															

A. Lanfranco and Associates Inc.

MG

CLIENT	Atlantic Power				NOZZLE	13	DIAMETER, IN.	.2620	IMPINGER	INITIAL	FINAL	TOTAL GAIN				
SOURCE	Main Stack				PROBE	ST SA	Cp	.8261	VOLUMES	(mL)	(mL)	(mL)				
PARAMETER / RUN No	PM RUN 2								Imp. #1	100	230	130				
DATE	March-11-20				PORT LENGTH	8"			Imp. #2	100	175	75				
OPERATOR:	MG				STATIC PRESSURE, IN. H2O	-0.58			Imp. #3	0	5	5				
CONTROL UNIT	SU 14	Y	1.0042		STACK DIAMETER	138"			Imp. #4	Gel						
		ΔH@	2.003		STACK HEIGHT	200'			Imp. #5							
									Imp. #6							
BAROMETRIC PRESSURE, IN. Hg	27.60				INITIAL LEAK TEST	0.007 @ 15"			Upstream Diameters							
ASSUMED MOISTURE, Bw	18%				FINAL LEAK TEST	0.003 @ 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. %		
	1316	364.272												
1		367.99	0.99	1.93	69	318	265	262	55	4	14.5	6.3		
2		371.9	1.1	2.14	69	319								
3		375.73	1.05	2.05	70	318	255	256	49	4				
1		378.58	0.57	1.14	70	302	248	248	48	2.5	13	6.9		
2		381.8	0.74	1.44	70	319								
3		385.02	0.73	1.44	72	315	245	250	45	2.5				
1		388.16	0.68	1.36	74	305	259	264	45	.3	14	6.7		
2		391.6	0.84	1.65	73	320								
3		394.99	0.81	1.59	74	321	256	263	47	3.5				
1		398.87	1.05	2.08	74	312	238	239	47	4.5	13	5.2		
2		402.75	1.06	2.08	75	321								
3		406.58	1.03	2.03	75	320	248	248	46	4.5				
	1422													

M6

A. Lanfranco and Associates Inc.

CLIENT Atlantic Power	NOZZLE S DIAMETER, IN. .2420	IMPINGER VOLUMES	INITIAL (mL) / FINAL (mL) / TOTAL GAIN (mL)
SOURCE Main Stack	PROBE STS.A Cp .8261	Imp. #1	100 / 265 / 165
PARAMETER / RUN No PM Run 3	PORT LENGTH 8"	Imp. #2	100 / 120 / 20
DATE March - 11-20	STATIC PRESSURE, IN. H2O -0.52	Imp. #3	0 / 7 / 7
OPERATOR: MC	STACK DIAMETER 138"	Imp. #4	0 / /
CONTROL UNIT DGM Y 1.0003	STACK HEIGHT 200'	Imp. #5	
ΔH@ 2.003		Imp. #6	
BAROMETRIC PRESSURE, IN. Hg 27.59	INITIAL LEAK TEST 0.001 @ 15"	Upstream Diameters	
ASSUMED MOISTURE, Bw 18%	FINAL LEAK TEST	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. %		
	1439	407.101												
1		410.99	1.06	2.09	75	318	240	251	43	3.5	14	5.4		
2		414.78	1.02	2	72	318								
3		418.6	1.04	2.06	70	316	260	260	41	3				
1		421.59	0.64	1.26	67	310	254	255	44	2.5	14.5	5.3		
2		424.87	0.79	1.53	67	314								
3		428.25	0.82	1.59	65	318	256	247	41	2.5				
1		431.07	0.57	1.12	65	308	243	251	43	2.5	14	6.1		
2		434.2	0.71	1.38	66	318								
3		437.29	0.69	1.34	66	314	240	240	43	2.5				
1		440.98	0.98	1.92	66	311	262	263	46	3.5	15	6.4		
2		444.76	1.02	1.98	66	315								
3		448.45	0.99	1.93	67	315	254	251	48	3.5				
	1543													

APPENDIX 4

CALIBRATION DATA AND CERTIFICATIONS

A.Lanfranco & Associates inc.

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

Model #: JU 14
Serial #: 0028-030816-1

Date: 09-Jan-20
Barometric Pressure: 29.72 (in. Hg)
Theoretical Critical Vacuum: 14.02 (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)
4.10	18.00	770.900	789.742	18.842	56.0	56.0	56.0	56.0	73	0.8186	15.0	55.0	62.0	58.5
2.15	20.00	790.400	805.582	15.182	56.0	56.0	57.0	57.0	63	0.5956	17.0	62.0	58.0	60.0
1.30	18.00	805.400	817.032	10.632	57.0	57.0	59.0	59.0	55	0.4606	18.5	61.0	58.0	59.5
0.74	18.00	817.400	824.582	7.182	58.0	58.0	57.0	57.0	48	0.3560	20.0	60.0	65.0	62.5
0.33	18.00	824.900	829.813	4.913	54.0	54.0	54.0	54.0	40	0.2408	21.0	52.0	56.0	54.0

********** RESULTS **********

-- DRY GAS METER --		------- ORIFICE -------			-- DRY GAS METER --		------- ORIFICE -------			
VOLUME CORRECTED Vm(std) (cu ft)	VOLUME CORRECTED Vm(std) (liters)	VOLUME CORRECTED Vor(std) (cu ft)	VOLUME CORRECTED Vor(std) (liters)	VOLUME NOMINAL Vor (cu ft)	CALIBRATION FACTOR Y Value (number)	CALIBRATION FACTOR Y Variation (number)	CALIBRATION FACTOR dH@ Value (in H2O)	CALIBRATION FACTOR dH@ Value (mm H2O)	CALIBRATION FACTOR dH@ Variation (in H2O)	Ko (value)
19.338	547.6	19.229	544.6	19.018	0.994	-0.010	2.054	52.17	0.051	0.674
15.492	438.7	15.525	439.7	15.389	1.002	-0.002	2.038	51.76	0.035	0.673
10.795	305.7	10.811	306.2	10.712	1.001	-0.003	2.053	52.13	0.050	0.672
7.269	205.4	7.406	209.7	7.381	1.018	0.012	1.969	50.01	-0.034	0.678
5.015	142.0	5.051	143.0	4.952	1.007	0.003	1.901	48.28	-0.102	0.696
				Average Y------->	1.0042		Average dH@---->	2.003	50.9	Average Ko---->	0.676

TEMPERATURE CALIBRATION

Calibration Standard ------> Omega Model CL23A S/N:T-215788

Reference Temperature Set-Point (deg F)	Temperature Device Reading (deg F)	Results Variation (deg F)	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: January 8, 2020

Pitot Tube Calibration

Date: 10-Jan-20
Pbar (in.Hg): 29.98

Temp (R): 530
Dn (in.): 0.25

Pitot ID: 5A-1

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.045	0.060	14.0	0.8574	0.0038
0.110	0.150	21.9	0.8478	0.0058
0.210	0.280	30.3	0.8574	0.0038
0.420	0.570	42.9	0.8498	0.0038
0.650	0.870	53.3	0.8557	0.0021
		Average :	0.8536	0.0038

Pitot ID: 5A-3

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.045	0.060	14.0	0.8574	0.0056
0.110	0.150	21.9	0.8478	0.0040
0.210	0.280	30.3	0.8574	0.0056
0.440	0.590	43.9	0.8549	0.0032
0.650	0.900	53.3	0.8413	0.0104
		Average :	0.8518	0.0058

Pitot ID: 5A-2

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.100	0.140	20.9	0.8367	0.0008
0.115	0.160	22.4	0.8393	0.0018
0.320	0.450	37.4	0.8348	0.0027
0.580	0.800	50.4	0.8430	0.0054
0.610	0.860	51.7	0.8338	0.0037
		Average :	0.8375	0.0029

Pitot ID:

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

Pitot ID: ST 5A

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.070	0.100	17.5	0.8283	0.0022
0.105	0.150	21.4	0.8283	0.0022
0.190	0.270	28.8	0.8305	0.0044
0.550	0.800	49.0	0.8209	0.0052
0.690	1.000	54.9	0.8224	0.0037
		Average :	0.8261	0.0036

Pitot ID:

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

Pitot ID: ST 5B

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 :	0.8466	#DIV/0!

Pitot ID:

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

* Average absolute deviation must not exceed 0.01.

Calibrated by: Michael Goods   Signature: [signature]   Date: January 10, 2020

A. LANFRANCO and ASSOCIATES INC.

ENVIRONMENTAL CONSULTANTS

NOZZLE DIAMETER CALIBRATION FORM

Calibrated by: Scott Ferguson
Date: January 28, 2020

Signature:

Nozzle I.D.	d1 (inch)	d2 (inch)	d3 (inch)	difference (inch)	average dia. (inch)	average area (ft^2)
ST01	0.1280	0.1280	0.1270	0.0010	0.1277	0.0000889
SS-7	0.1685	0.1710	0.1710	0.0025	0.1702	0.0001579
ST05	0.1705	0.1700	0.1720	0.0020	0.1708	0.0001592
SS-1	0.1705	0.1705	0.1720	0.0015	0.1710	0.0001595
SS-8	0.1970	0.1960	0.1975	0.0015	0.1968	0.0002113
ST11	0.2050	0.2050	0.2060	0.0010	0.2053	0.0002300
ST10	0.2100	0.2110	0.2120	0.0020	0.2110	0.0002428
SS-18	0.2285	0.2285	0.2270	0.0015	0.2280	0.0002835
ST15	0.2380	0.2360	0.2360	0.0020	0.2367	0.0003055
SS-2	0.2400	0.2400	0.2395	0.0005	0.2398	0.0003137
SS-3	0.2395	0.2400	0.2405	0.0010	0.2400	0.0003142
B	0.2405	0.2425	0.2430	0.0025	0.2420	0.0003194
SS-24	0.2445	0.2430	0.2460	0.0030	0.2445	0.0003261
ST30	0.2470	0.2480	0.2475	0.0010	0.2475	0.0003341
SS-14	0.2480	0.2485	0.2490	0.0010	0.2485	0.0003368
ST20	0.2480	0.2485	0.2490	0.0010	0.2485	0.0003368
A	0.2525	0.2530	0.2520	0.0010	0.2525	0.0003477
SS-9	0.2690	0.2670	0.2710	0.0040	0.2690	0.0003947
ST40	0.2820	0.2805	0.2800	0.0020	0.2808	0.0004302
SS-30	0.2955	0.2970	0.2955	0.0015	0.2960	0.0004779
SS-13	0.2985	0.2965	0.2980	0.0020	0.2977	0.0004833
ST50	0.3010	0.3005	0.3005	0.0005	0.3007	0.0004931
ST60	0.3040	0.3030	0.3005	0.0035	0.3025	0.0004991
SS-10	0.3110	0.3120	0.3120	0.0010	0.3117	0.0005298
SS-327	0.3275	0.3255	0.3275	0.0020	0.3268	0.0005826
ST65	0.3290	0.3305	0.3310	0.0020	0.3302	0.0005945
ST66	0.3335	0.3340	0.3345	0.0010	0.3340	0.0006084
ST80	0.3560	0.3550	0.3570	0.0020	0.3560	0.0006912
ST75	0.3640	0.3635	0.3660	0.0025	0.3645	0.0007246
SS-5	0.3675	0.3680	0.3660	0.0020	0.3672	0.0007353
ST76	0.3705	0.3710	0.3700	0.0010	0.3705	0.0007487
SS-16	0.3725	0.3720	0.3710	0.0015	0.3718	0.0007541
ST85	0.3970	0.3960	0.3975	0.0015	0.3968	0.0008589
DD	0.3980	0.3990	0.3990	0.0010	0.3987	0.0008669
SS-15	0.4010	0.4005	0.4000	0.0010	0.4005	0.0008748
ST70	0.4150	0.4160	0.4170	0.0020	0.4160	0.0009439
SS-11	0.4165	0.4170	0.4150	0.0020	0.4162	0.0009445
ST86	0.4535	0.4560	0.4550	0.0025	0.4548	0.0011283
C	0.4840	0.4830	0.4835	0.0010	0.4835	0.0012750
SS-49	0.4900	0.4920	0.4895	0.0025	0.4905	0.0013122
SS-491	0.4920	0.4895	0.4925	0.0030	0.4913	0.0013167
SS-492	0.4925	0.4925	0.4920	0.0005	0.4923	0.0013220
SS-6	0.4935	0.4930	0.4950	0.0020	0.4938	0.0013301
ST90	0.4955	0.4950	0.4930	0.0025	0.4945	0.0013337
ST92	0.5020	0.5030	0.5020	0.0010	0.5023	0.0013763
ST96	0.5560	0.5525	0.5530	0.0035	0.5538	0.0016730
SS-558	0.5575	0.5585	0.5585	0.0010	0.5582	0.0016992
SS-635	0.6340	0.6340	0.6370	0.0030	0.6350	0.0021993
SS-12	0.7430	0.7460	0.7455	0.0030	0.7448	0.0030258

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

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 16, 2020	100.3	29.62	29.55	29.62	0.00
DS	January 22, 2020	101.6	30.01	29.87	29.94	0.07
CL	January 16, 2020	100.3	29.62	29.56	29.63	-0.01
ML	January 6, 2020	101.8	30.07	29.96	30.03	0.03
SB	January 16, 2020	100.3	29.62	29.54	29.61	0.01
SH	January 16, 2020	100.3	29.62	29.46	29.53	0.09
JB	January 16, 2020	100.3	29.62	29.51	29.58	0.04
SF	January 6, 2020	101.8	30.07	29.96	30.03	0.03
JG	January 16, 2020	100.3	29.62	29.52	29.59	0.03

Calibrated by: Scott Ferguson Signature:  Date: January 16th, 2020

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 and ASSOCIATES INC.
ENVIRONMENTAL CONSULTANTS

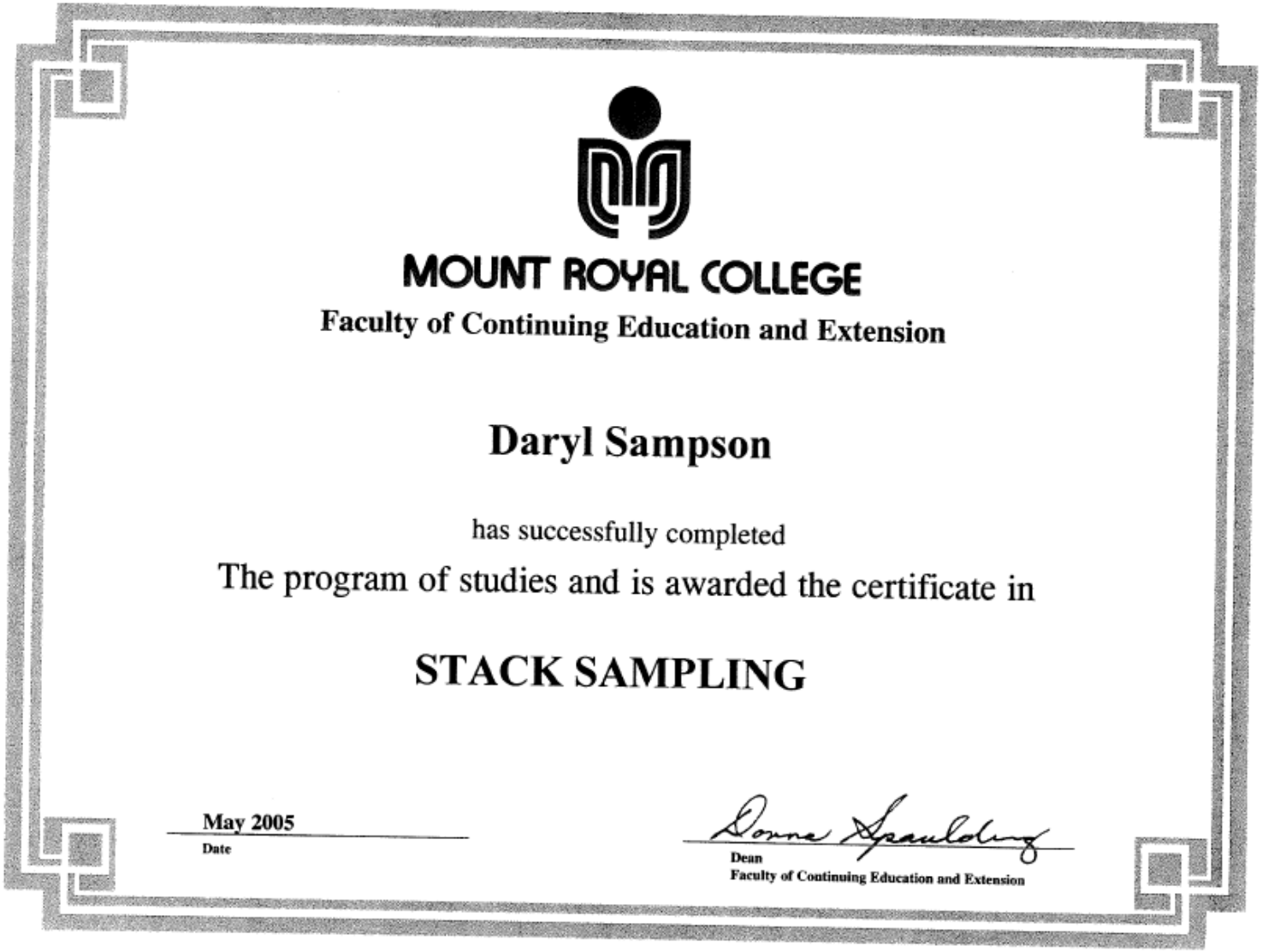
TEMPERATURE CALIBRATION FORM

Calibrated by: Scott Ferguson
Date: 20-Jan-20
Signature:

TEMPERATURE DEVICE CALIBRATIONS

Reference Device			Temperature Settings (degrees F)													
Model CL23A Calibrator			32		100		200		300		500		800		1700	
Device	ALA #	Serial #	Reading	Variation	Reading	Variation	Reading	Variation	Reading	Variation	Reading	Variation	Reading	Variation	Reading	Variation
Omega HH11A	3	300132	33	0.20%	101	0.18%	200	0.00%	300	0.00%	499	-0.10%	800	0.00%	1700	0.00%
Omega HH11A	4	200167	33	0.20%	101	0.18%	200	0.00%	301	0.13%	500	0.00%	801	0.08%	1699	-0.05%
Omega HH11A	6	600059	32	0.00%	100	0.00%	199	-0.15%	299	-0.13%	501	0.10%	799	-0.08%	1699	-0.05%
TPI 341K	7	2.0315E+10	29.8	-0.45%	97.4	-0.46%	197.2	-0.42%	297	-0.39%	496.4	-0.38%	795.8	-0.33%	1693	-0.32%
TPI 341K	8	2.0313E+10	31	-0.20%	98	-0.36%	200	0.00%	300	0.00%	500	0.00%	800	0.00%	1697	-0.14%
Cont Cmpny	10	102008464	31.3	-0.14%	98.8	-0.21%	198.9	-0.17%	298.9	-0.14%	498.6	-0.15%	796.3	-0.29%	1693.8	-0.29%
Omega HH11	14	409426	33.2	0.24%	100.2	0.04%	202	0.30%	302	0.26%	500	0.00%	799	-0.08%	1699	-0.05%
TPI 341K	16	400120029	32	0.00%	99	-0.18%	200	0.00%	301	0.13%	500	0.00%	800	0.00%	1700	0.00%
TPI 341K	18	2.0329E+10	32	0.00%	101	0.18%	200	0.00%	300	0.00%	501	0.10%	799	-0.08%	1699	-0.05%
TPI 341K	20	2.0329E+10	30.4	-0.33%	98.2	-0.32%	198.2	-0.27%	298	-0.26%	497.1	-0.30%	796.8	-0.25%	1695	-0.23%

Reference device is a NIST certified digital thermocouple calibrator
Variation expressed as a percentage of the absolute temperature must be within 1.5 %



MOUNT ROYAL COLLEGE

Faculty of Continuing Education and Extension

Daryl Sampson

has successfully completed

The program of studies and is awarded the certificate in

STACK SAMPLING

May 2005
Date

Donna Spaulding
Dean
Faculty of Continuing Education and Extension

MOUNT ROYAL UNIVERSITY

Faculty of Continuing Education and Extension

Michael Eugene Goods

has successfully completed

Stack Sampling

35 Hours / 2019

May 22, 2019

Date

Dean
Faculty of Continuing Education and Extension

MOUNT ROYAL
UNIVERSITY
1910

Appendix B - Ash Analysis Report

Your P.O. #: CC
Site Location: Williams Lake Power Plant
Your C.O.C. #: 22958

Attention: Jacob Steyl

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

Report Date: 2020/04/07
Report #: R2866679
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C021982
Received: 2020/03/27, 08:30

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Metals - TCLP	1	2020/04/02	2020/04/02	BBY7SOP-00005 / BBY7SOP-00001	EPA 1311, 6020bR2 m
Moisture	1	2020/03/27	2020/03/30	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Non Routine/Non Validated Matrix Tested (2)	1	N/A	2020/03/30		
PAH in Soil by GC/MS (SIM)	1	2020/03/31	2020/03/31	BBY8SOP-00022	BCMOE BCLM Jul2017m
PAH TEQ Calculation, BC Reg. 132/92 (3)	1	N/A	2020/04/01	BBY WI-00033	Auto Calc
Total PAH and B(a)P Calculation (4)	1	N/A	2020/04/01	BBY WI-00033	Auto Calc
TCLP pH Measurements	1	N/A	2020/04/02	BBY7SOP-00005	EPA 1311
Dioxins/Furans in Soil (EPS 1/RM/23) (1, 5)	1	2020/03/31	2020/04/03	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.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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 BV Labs Ontario (From Burnaby)

(2) 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.

(3) 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

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

Your P.O. #: CC
Site Location: Williams Lake Power Plant
Your C.O.C. #: 22958

Attention: Jacob Steyl

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

Report Date: 2020/04/07
Report #: R2866679
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C021982
Received: 2020/03/27, 08:30

(4) 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.
(5) 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
07 Apr 2020 12:00:13

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

==========

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 #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

RESULTS OF CHEMICAL ANALYSES OF SOIL

BV Labs ID		XP1740	
Sampling Date		2020/03/11 15:00	
COC Number		22958	
	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 #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

PHYSICAL TESTING (SOIL)

BV Labs ID		XP1740		
Sampling Date		2020/03/11 15:00		
COC Number		22958		
	UNITS	**Glass Jars (clear) filled with Ash**	**RDL**	**QC Batch**
Physical Properties				
Moisture	%	0.40	0.30	9809688
RDL = Reportable Detection Limit				

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

SEMIVOLATILE ORGANICS BY GC-MS (SOIL)

BV Labs ID		XP1740		
Sampling Date		2020/03/11 15:00		
COC Number		22958		
	UNITS	Glass Jars (clear) filled with Ash	RDL	QC Batch
Calculated Parameters				
PAH Toxicity Equivalency	mg/kg	0.026	0.020	9809683
RDL = Reportable Detection Limit				

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

BV Labs ID		XP1740	
Sampling Date		2020/03/11 15:00	
COC Number		22958	
	UNITS	Glass Jars (clear) filled with Ash	QC Batch
TCLP Extraction Procedure			
Initial pH of Sample	pH	12.4	9813358
pH after HCl	pH	11.5	9813358
Final pH of Leachate	pH	6.51	9813358
pH of Leaching Fluid	pH	2.85	9813358

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

DIOXIN AND FURANS BY HRMS (SOIL)

BV Labs ID		XP1740						
Sampling Date		2020/03/11 15:00						
COC Number		22958			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	3.31	0.571	4.91	0.0100	0.0331		9818287
1,2,3,4,7,8-Hexa CDD *	pg/g	2.53	0.608	4.91	0.100	0.253		9818287
1,2,3,6,7,8-Hexa CDD *	pg/g	2.42	0.580	4.91	0.100	0.242		9818287
1,2,3,7,8,9-Hexa CDD *	pg/g	1.86	0.531	4.91	0.100	0.186		9818287
1,2,3,7,8-Penta CDD *	pg/g	7.47	0.756	4.91	1.00	7.47		9818287
2,3,7,8-Tetra CDD *	pg/g	9.94	0.512	4.91	1.00	9.94		9818287
Octa CDD *	pg/g	2.55	0.580	49.1	0.000300	0.000765		9818287
Total Hepta CDD *	pg/g	5.16	0.571	4.91			2	9818287
Total Hexa CDD *	pg/g	12.8	0.571	4.91			4	9818287
Total Penta CDD *	pg/g	55.6	0.756	4.91			9	9818287
Total Tetra CDD *	pg/g	138	0.512	4.91			14	9818287
FURANS								
1,2,3,4,6,7,8-Hepta CDF **	pg/g	2.32	0.523	4.91	0.0100	0.0232		9818287
1,2,3,4,7,8,9-Hepta CDF **	pg/g	0.804	0.616	4.91	0.0100	0.00804		9818287
1,2,3,4,7,8-Hexa CDF **	pg/g	7.21	0.595	4.91	0.100	0.721		9818287
1,2,3,6,7,8-Hexa CDF **	pg/g	5.54	0.576	4.91	0.100	0.554		9818287
1,2,3,7,8,9-Hexa CDF **	pg/g	0.834	0.658	4.91	0.100	0.0834		9818287
1,2,3,7,8-Penta CDF **	pg/g	21.5	1.57	4.91	0.0300	0.645		9818287
2,3,4,6,7,8-Hexa CDF **	pg/g	3.80	0.576	4.91	0.100	0.380		9818287
2,3,4,7,8-Penta CDF **	pg/g	28.2	1.61	4.91	0.300	8.46		9818287
2,3,7,8-Tetra CDF **	pg/g	146	0.917	4.91	0.100	14.6		9818287
Octa CDF **	pg/g	1.80	0.527	49.1	0.000300	0.000540		9818287
Total Hepta CDF **	pg/g	4.35	0.566	4.91			3	9818287

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

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

DIOXIN AND FURANS BY HRMS (SOIL)

BV Labs ID		XP1740						
Sampling Date		2020/03/11 15:00						
COC Number		22958			TOXIC EQUIVALENCY		# of	
	UNITS	Glass Jars (clear) filled with Ash	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
Total Hexa CDF **	pg/g	43.5	0.599	4.91			11	9818287
Total Penta CDF **	pg/g	239	1.59	4.91			12	9818287
Total Tetra CDF **	pg/g	915	0.917	4.91			17	9818287
TOTAL TOXIC EQUIVALENCY	pg/g					43.6		
Surrogate Recovery (%)								
C13-1234678 HeptaCDD *	%	82						9818287
C13-1234678 HeptaCDF **	%	74						9818287
C13-123678 HexaCDD *	%	73						9818287
C13-123678 HexaCDF **	%	69						9818287
C13-12378 PentaCDD *	%	74						9818287
C13-12378 PentaCDF **	%	64						9818287
C13-2378 TetraCDD *	%	76						9818287
C13-2378 TetraCDF **	%	64						9818287
C13-OCDD *	%	78						9818287

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

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

TCLP METALS (SOIL)

BV Labs ID		XP1740		
Sampling Date		2020/03/11 15:00		
COC Number		22958		
	UNITS	Glass Jars (clear) filled with Ash	RDL	QC Batch
TCLP Extraction Procedure				
Leachate Antimony (Sb)	mg/L	<0.10	0.10	9814258
Leachate Arsenic (As)	mg/L	0.37	0.10	9814258
Leachate Barium (Ba)	mg/L	5.11	0.10	9814258
Leachate Beryllium (Be)	mg/L	<0.10	0.10	9814258
Leachate Boron (B)	mg/L	1.41	0.10	9814258
Leachate Cadmium (Cd)	mg/L	<0.10	0.10	9814258
Leachate Chromium (Cr)	mg/L	<0.10	0.10	9814258
Leachate Cobalt (Co)	mg/L	<0.10	0.10	9814258
Leachate Copper (Cu)	mg/L	<0.10	0.10	9814258
Leachate Iron (Fe)	mg/L	<0.50	0.50	9814258
Leachate Lead (Pb)	mg/L	<0.10	0.10	9814258
Leachate Mercury (Hg)	mg/L	<0.0020	0.0020	9814258
Leachate Molybdenum (Mo)	mg/L	<0.10	0.10	9814258
Leachate Nickel (Ni)	mg/L	0.11	0.10	9814258
Leachate Selenium (Se)	mg/L	<0.10	0.10	9814258
Leachate Silver (Ag)	mg/L	<0.010	0.010	9814258
Leachate Thallium (Tl)	mg/L	<0.10	0.10	9814258
Leachate Uranium (U)	mg/L	<0.10	0.10	9814258
Leachate Vanadium (V)	mg/L	<0.10	0.10	9814258
Leachate Zinc (Zn)	mg/L	1.01	0.10	9814258
Leachate Zirconium (Zr)	mg/L	<0.10	0.10	9814258
RDL = Reportable Detection Limit				

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

CSR PAH IN SOIL BY GC-MS (SOIL)

BV Labs ID		XP1740		
Sampling Date		2020/03/11 15:00		
COC Number		22958		
	UNITS	Glass Jars (clear) filled with Ash	RDL	QC Batch
Calculated Parameters				
Low Molecular Weight PAH`s	mg/kg	<0.050	0.050	9809606
High Molecular Weight PAH`s	mg/kg	<0.050	0.050	9809606
Total PAH	mg/kg	<0.050	0.050	9809606
B[a]P TPE Total Potency Equivalents	mg/kg	0.024	0.010	9809606
Polycyclic Aromatics				
Naphthalene	mg/kg	<0.010	0.010	9811939
2-Methylnaphthalene	mg/kg	<0.020	0.020	9811939
Acenaphthylene	mg/kg	<0.010 (1)	0.010	9811939
Acenaphthene	mg/kg	<0.010 (1)	0.010	9811939
Fluorene	mg/kg	<0.020	0.020	9811939
Phenanthrene	mg/kg	<0.010	0.010	9811939
Anthracene	mg/kg	<0.0080 (1)	0.0080	9811939
Fluoranthene	mg/kg	<0.020	0.020	9811939
Pyrene	mg/kg	<0.020	0.020	9811939
Benzo(a)anthracene	mg/kg	<0.020	0.020	9811939
Chrysene	mg/kg	<0.020	0.020	9811939
Benzo(b&j)fluoranthene	mg/kg	<0.020	0.020	9811939
Benzo(b)fluoranthene	mg/kg	<0.020	0.020	9811939
Benzo(k)fluoranthene	mg/kg	<0.020	0.020	9811939
Benzo(a)pyrene	mg/kg	<0.020	0.020	9811939
Indeno(1,2,3-cd)pyrene	mg/kg	<0.020	0.020	9811939
Dibenz(a,h)anthracene	mg/kg	<0.020	0.020	9811939
Benzo(g,h,i)perylene	mg/kg	<0.050	0.050	9811939
Surrogate Recovery (%)				
D10-ANTHRACENE (sur.)	%	0.20 (2)		9811939
D8-ACENAPHTHYLENE (sur.)	%	0.30 (2)		9811939
D8-NAPHTHALENE (sur.)	%	0.21 (2)		9811939
TERPHENYL-D14 (sur.)	%	0.10 (2)		9811939

RDL = Reportable Detection Limit
(1) Detection limits raised based on sample weight used for analysis.
(2) Surrogate recovery below acceptance criteria due to matrix interference. Reanalysis yields similar results.

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

GENERAL COMMENTS

Sample XP1740 [Glass Jars (clear) filled with Ash] : Sample analyzed past method specified hold time for PAH in Soil by GC/MS (SIM). Sample received past method specified hold time for PAH in Soil by GC/MS (SIM).
Non-routine matrix analyzed with client consent for PAH on batch: 9811939. Please refer to BBY PDF-00149.

Results relate only to the items tested.

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9809688	MPE	Method Blank	Moisture	2020/03/30	<0.30		%	
9809688	MPE	RPD	Moisture	2020/03/30	1.5		%	20
9811939	JP1	Matrix Spike	D10-ANTHRACENE (sur.)	2020/03/31		66	%	50 - 140
			D8-ACENAPHTHYLENE (sur.)	2020/03/31		69	%	50 - 140
			D8-NAPHTHALENE (sur.)	2020/03/31		70	%	50 - 140
			TERPHENYL-D14 (sur.)	2020/03/31		64	%	50 - 140
			Naphthalene	2020/03/31		74	%	50 - 140
			2-Methylnaphthalene	2020/03/31		76	%	50 - 140
			Acenaphthylene	2020/03/31		78	%	50 - 140
			Acenaphthene	2020/03/31		108	%	50 - 140
			Fluorene	2020/03/31		98	%	50 - 140
			Phenanthrene	2020/03/31		594 (1)	%	50 - 140
			Anthracene	2020/03/31		261 (1)	%	50 - 140
			Fluoranthene	2020/03/31		1300 (1)	%	50 - 140
			Pyrene	2020/03/31		1150 (1)	%	50 - 140
			Benzo(a)anthracene	2020/03/31		671 (1)	%	50 - 140
			Chrysene	2020/03/31		634 (1)	%	50 - 140
			Benzo(b&j)fluoranthene	2020/03/31		377 (1)	%	50 - 140
			Benzo(b)fluoranthene	2020/03/31		463 (1)	%	50 - 140
			Benzo(k)fluoranthene	2020/03/31		294 (1)	%	50 - 140
			Benzo(a)pyrene	2020/03/31		507 (1)	%	50 - 140
			Indeno(1,2,3-cd)pyrene	2020/03/31		256 (1)	%	50 - 140
			Dibenz(a,h)anthracene	2020/03/31		126	%	50 - 140
			Benzo(g,h,i)perylene	2020/03/31		242 (1)	%	50 - 140
9811939	JP1	Spiked Blank	D10-ANTHRACENE (sur.)	2020/03/31		74	%	50 - 140
			D8-ACENAPHTHYLENE (sur.)	2020/03/31		72	%	50 - 140
			D8-NAPHTHALENE (sur.)	2020/03/31		73	%	50 - 140
			TERPHENYL-D14 (sur.)	2020/03/31		69	%	50 - 140
			Naphthalene	2020/03/31		75	%	50 - 140
			2-Methylnaphthalene	2020/03/31		76	%	50 - 140
			Acenaphthylene	2020/03/31		78	%	50 - 140
			Acenaphthene	2020/03/31		73	%	50 - 140
			Fluorene	2020/03/31		70	%	50 - 140
			Phenanthrene	2020/03/31		73	%	50 - 140
			Anthracene	2020/03/31		73	%	50 - 140
			Fluoranthene	2020/03/31		70	%	50 - 140
			Pyrene	2020/03/31		71	%	50 - 140
			Benzo(a)anthracene	2020/03/31		68	%	50 - 140
			Chrysene	2020/03/31		68	%	50 - 140
			Benzo(b&j)fluoranthene	2020/03/31		73	%	50 - 140
			Benzo(b)fluoranthene	2020/03/31		74	%	50 - 140
			Benzo(k)fluoranthene	2020/03/31		68	%	50 - 140
			Benzo(a)pyrene	2020/03/31		71	%	50 - 140
			Indeno(1,2,3-cd)pyrene	2020/03/31		70	%	50 - 140
			Dibenz(a,h)anthracene	2020/03/31		70	%	50 - 140
			Benzo(g,h,i)perylene	2020/03/31		70	%	50 - 140
9811939	JP1	Method Blank	D10-ANTHRACENE (sur.)	2020/03/31		71	%	50 - 140
			D8-ACENAPHTHYLENE (sur.)	2020/03/31		67	%	50 - 140
			D8-NAPHTHALENE (sur.)	2020/03/31		67	%	50 - 140
			TERPHENYL-D14 (sur.)	2020/03/31		65	%	50 - 140
			Naphthalene	2020/03/31	<0.010		mg/kg	
			2-Methylnaphthalene	2020/03/31	<0.020		mg/kg	
			Acenaphthylene	2020/03/31	<0.0050		mg/kg	
			Acenaphthene	2020/03/31	<0.0050		mg/kg	

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Fluorene	2020/03/31	<0.020		mg/kg	
			Phenanthrene	2020/03/31	<0.010		mg/kg	
			Anthracene	2020/03/31	<0.0040		mg/kg	
			Fluoranthene	2020/03/31	<0.020		mg/kg	
			Pyrene	2020/03/31	<0.020		mg/kg	
			Benzo(a)anthracene	2020/03/31	<0.020		mg/kg	
			Chrysene	2020/03/31	<0.020		mg/kg	
			Benzo(b&j)fluoranthene	2020/03/31	<0.020		mg/kg	
			Benzo(b)fluoranthene	2020/03/31	<0.020		mg/kg	
			Benzo(k)fluoranthene	2020/03/31	<0.020		mg/kg	
			Benzo(a)pyrene	2020/03/31	<0.020		mg/kg	
			Indeno(1,2,3-cd)pyrene	2020/03/31	<0.020		mg/kg	
			Dibenz(a,h)anthracene	2020/03/31	<0.020		mg/kg	
			Benzo(g,h,i)perylene	2020/03/31	<0.050		mg/kg	
9811939	JP1	RPD	Naphthalene	2020/03/31	NC		%	50
			2-Methylnaphthalene	2020/03/31	NC		%	50
			Acenaphthylene	2020/03/31	NC		%	50
			Acenaphthene	2020/03/31	NC		%	50
			Fluorene	2020/03/31	NC		%	50
			Phenanthrene	2020/03/31	NC		%	50
			Anthracene	2020/03/31	NC		%	50
			Fluoranthene	2020/03/31	NC		%	50
			Pyrene	2020/03/31	NC		%	50
			Benzo(a)anthracene	2020/03/31	NC		%	50
			Chrysene	2020/03/31	NC		%	50
			Benzo(b&j)fluoranthene	2020/03/31	NC		%	50
			Benzo(b)fluoranthene	2020/03/31	NC		%	50
			Benzo(k)fluoranthene	2020/03/31	NC		%	50
			Benzo(a)pyrene	2020/03/31	NC		%	50
			Indeno(1,2,3-cd)pyrene	2020/03/31	NC		%	50
			Dibenz(a,h)anthracene	2020/03/31	NC		%	50
			Benzo(g,h,i)perylene	2020/03/31	NC		%	50
9813358	BTM	Method Blank	Initial pH of Sample	2020/04/02	4.92		pH	
			Final pH of Leachate	2020/04/02	4.93		pH	
			pH of Leaching Fluid	2020/04/02	4.92		pH	
9813358	BTM	RPD	Initial pH of Sample	2020/04/02	0.45		%	N/A
			pH after HCl	2020/04/02	0.77		%	N/A
			Final pH of Leachate	2020/04/02	0.20		%	N/A
			pH of Leaching Fluid	2020/04/02	0		%	N/A
9814258	VBA	Matrix Spike [XP1740-02]	Leachate Antimony (Sb)	2020/04/02		97	%	75 - 125
			Leachate Arsenic (As)	2020/04/02		105	%	75 - 125
			Leachate Barium (Ba)	2020/04/02		NC	%	75 - 125
			Leachate Beryllium (Be)	2020/04/02		100	%	75 - 125
			Leachate Boron (B)	2020/04/02		100	%	75 - 125
			Leachate Cadmium (Cd)	2020/04/02		101	%	75 - 125
			Leachate Chromium (Cr)	2020/04/02		104	%	75 - 125
			Leachate Cobalt (Co)	2020/04/02		100	%	75 - 125
			Leachate Copper (Cu)	2020/04/02		104	%	75 - 125
			Leachate Iron (Fe)	2020/04/02		103	%	75 - 125
			Leachate Lead (Pb)	2020/04/02		100	%	75 - 125
			Leachate Mercury (Hg)	2020/04/02		101	%	75 - 125
			Leachate Molybdenum (Mo)	2020/04/02		100	%	75 - 125
			Leachate Nickel (Ni)	2020/04/02		98	%	75 - 125
			Leachate Selenium (Se)	2020/04/02		104	%	75 - 125

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Leachate Silver (Ag)	2020/04/02		90	%	75 - 125
			Leachate Thallium (Tl)	2020/04/02		98	%	75 - 125
			Leachate Uranium (U)	2020/04/02		103	%	75 - 125
			Leachate Vanadium (V)	2020/04/02		102	%	75 - 125
			Leachate Zinc (Zn)	2020/04/02		96	%	75 - 125
			Leachate Zirconium (Zr)	2020/04/02		104	%	75 - 125
9814258	VBA	Spiked Blank	Leachate Antimony (Sb)	2020/04/02		103	%	75 - 125
			Leachate Arsenic (As)	2020/04/02		110	%	75 - 125
			Leachate Barium (Ba)	2020/04/02		106	%	75 - 125
			Leachate Beryllium (Be)	2020/04/02		102	%	75 - 125
			Leachate Boron (B)	2020/04/02		103	%	75 - 125
			Leachate Cadmium (Cd)	2020/04/02		105	%	75 - 125
			Leachate Chromium (Cr)	2020/04/02		110	%	75 - 125
			Leachate Cobalt (Co)	2020/04/02		106	%	75 - 125
			Leachate Copper (Cu)	2020/04/02		111	%	75 - 125
			Leachate Iron (Fe)	2020/04/02		110	%	75 - 125
			Leachate Lead (Pb)	2020/04/02		105	%	75 - 125
			Leachate Mercury (Hg)	2020/04/02		105	%	75 - 125
			Leachate Molybdenum (Mo)	2020/04/02		102	%	75 - 125
			Leachate Nickel (Ni)	2020/04/02		104	%	75 - 125
			Leachate Selenium (Se)	2020/04/02		108	%	75 - 125
			Leachate Silver (Ag)	2020/04/02		95	%	75 - 125
			Leachate Thallium (Tl)	2020/04/02		100	%	75 - 125
			Leachate Uranium (U)	2020/04/02		104	%	75 - 125
			Leachate Vanadium (V)	2020/04/02		107	%	75 - 125
			Leachate Zinc (Zn)	2020/04/02		107	%	75 - 125
			Leachate Zirconium (Zr)	2020/04/02		108	%	75 - 125
9814258	VBA	Method Blank	Leachate Antimony (Sb)	2020/04/02	<0.10		mg/L	
			Leachate Arsenic (As)	2020/04/02	<0.10		mg/L	
			Leachate Barium (Ba)	2020/04/02	<0.10		mg/L	
			Leachate Beryllium (Be)	2020/04/02	<0.10		mg/L	
			Leachate Boron (B)	2020/04/02	<0.10		mg/L	
			Leachate Cadmium (Cd)	2020/04/02	<0.10		mg/L	
			Leachate Chromium (Cr)	2020/04/02	<0.10		mg/L	
			Leachate Cobalt (Co)	2020/04/02	<0.10		mg/L	
			Leachate Copper (Cu)	2020/04/02	<0.10		mg/L	
			Leachate Iron (Fe)	2020/04/02	<0.50		mg/L	
			Leachate Lead (Pb)	2020/04/02	<0.10		mg/L	
			Leachate Mercury (Hg)	2020/04/02	<0.0020		mg/L	
			Leachate Molybdenum (Mo)	2020/04/02	<0.10		mg/L	
			Leachate Nickel (Ni)	2020/04/02	<0.10		mg/L	
			Leachate Selenium (Se)	2020/04/02	<0.10		mg/L	
			Leachate Silver (Ag)	2020/04/02	<0.010		mg/L	
			Leachate Thallium (Tl)	2020/04/02	<0.10		mg/L	
			Leachate Uranium (U)	2020/04/02	<0.10		mg/L	
			Leachate Vanadium (V)	2020/04/02	<0.10		mg/L	
			Leachate Zinc (Zn)	2020/04/02	<0.10		mg/L	
			Leachate Zirconium (Zr)	2020/04/02	<0.10		mg/L	
9818287	éOI	Matrix Spike [XP1740-03]	C13-1234678 HeptaCDD	2020/04/03		78	%	30 - 130
			C13-1234678 HeptaCDF	2020/04/03		65	%	30 - 130
			C13-123678 HexaCDD	2020/04/03		64	%	30 - 130
			C13-123678 HexaCDF	2020/04/03		60	%	30 - 130
			C13-12378 PentaCDD	2020/04/03		71	%	30 - 130
			C13-12378 PentaCDF	2020/04/03		58	%	30 - 130

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			C13-2378 TetraCDD	2020/04/03		73	%	30 - 130
			C13-2378 TetraCDF	2020/04/03		58	%	30 - 130
			C13-OCDD	2020/04/03		71	%	30 - 130
			1,2,3,4,6,7,8-Hepta CDD	2020/04/03		94	%	80 - 140
			1,2,3,4,7,8-Hexa CDD	2020/04/03		109	%	80 - 140
			1,2,3,6,7,8-Hexa CDD	2020/04/03		122	%	80 - 140
			1,2,3,7,8,9-Hexa CDD	2020/04/03		117	%	80 - 140
			1,2,3,7,8-Penta CDD	2020/04/03		101	%	80 - 140
			2,3,7,8-Tetra CDD	2020/04/03		90	%	80 - 140
			Octa CDD	2020/04/03		96	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDF	2020/04/03		92	%	80 - 140
			1,2,3,4,7,8,9-Hepta CDF	2020/04/03		110	%	80 - 140
			1,2,3,4,7,8-Hexa CDF	2020/04/03		109	%	80 - 140
			1,2,3,6,7,8-Hexa CDF	2020/04/03		115	%	80 - 140
			1,2,3,7,8,9-Hexa CDF	2020/04/03		114	%	80 - 140
			1,2,3,7,8-Penta CDF	2020/04/03		102	%	80 - 140
			2,3,4,6,7,8-Hexa CDF	2020/04/03		110	%	80 - 140
			2,3,4,7,8-Penta CDF	2020/04/03		106	%	80 - 140
			2,3,7,8-Tetra CDF	2020/04/03		99	%	80 - 140
			Octa CDF	2020/04/03		94	%	80 - 140
9818287	é0I	Spiked Blank	C13-1234678 HeptaCDD	2020/04/03		64	%	30 - 130
			C13-1234678 HeptaCDF	2020/04/03		70	%	30 - 130
			C13-123678 HexaCDD	2020/04/03		66	%	30 - 130
			C13-123678 HexaCDF	2020/04/03		65	%	30 - 130
			C13-12378 PentaCDD	2020/04/03		74	%	30 - 130
			C13-12378 PentaCDF	2020/04/03		65	%	30 - 130
			C13-2378 TetraCDD	2020/04/03		76	%	30 - 130
			C13-2378 TetraCDF	2020/04/03		64	%	30 - 130
			C13-OCDD	2020/04/03		66	%	30 - 130
			1,2,3,4,6,7,8-Hepta CDD	2020/04/03		120	%	80 - 140
			1,2,3,4,7,8-Hexa CDD	2020/04/03		112	%	80 - 140
			1,2,3,6,7,8-Hexa CDD	2020/04/03		126	%	80 - 140
			1,2,3,7,8,9-Hexa CDD	2020/04/03		116	%	80 - 140
			1,2,3,7,8-Penta CDD	2020/04/03		104	%	80 - 140
			2,3,7,8-Tetra CDD	2020/04/03		97	%	80 - 140
			Octa CDD	2020/04/03		107	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDF	2020/04/03		105	%	80 - 140
			1,2,3,4,7,8,9-Hepta CDF	2020/04/03		109	%	80 - 140
			1,2,3,4,7,8-Hexa CDF	2020/04/03		115	%	80 - 140
			1,2,3,6,7,8-Hexa CDF	2020/04/03		119	%	80 - 140
			1,2,3,7,8,9-Hexa CDF	2020/04/03		116	%	80 - 140
			1,2,3,7,8-Penta CDF	2020/04/03		102	%	80 - 140
			2,3,4,6,7,8-Hexa CDF	2020/04/03		116	%	80 - 140
			2,3,4,7,8-Penta CDF	2020/04/03		106	%	80 - 140
			2,3,7,8-Tetra CDF	2020/04/03		109	%	80 - 140
			Octa CDF	2020/04/03		110	%	80 - 140
9818287	é0I	RPD	1,2,3,4,6,7,8-Hepta CDD	2020/04/03	25		%	25
			1,2,3,4,7,8-Hexa CDD	2020/04/03	2.6		%	25
			1,2,3,6,7,8-Hexa CDD	2020/04/03	0		%	25
			1,2,3,7,8,9-Hexa CDD	2020/04/03	3.5		%	25
			1,2,3,7,8-Penta CDD	2020/04/03	0		%	25
			2,3,7,8-Tetra CDD	2020/04/03	2.0		%	25
			Octa CDD	2020/04/03	1.9		%	25
			1,2,3,4,6,7,8-Hepta CDF	2020/04/03	4.9		%	25

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			1,2,3,4,7,8,9-Hepta CDF	2020/04/03	0.92		%	25
			1,2,3,4,7,8-Hexa CDF	2020/04/03	1.8		%	25
			1,2,3,6,7,8-Hexa CDF	2020/04/03	4.3		%	25
			1,2,3,7,8,9-Hexa CDF	2020/04/03	1.7		%	25
			1,2,3,7,8-Penta CDF	2020/04/03	3.8		%	25
			2,3,4,6,7,8-Hexa CDF	2020/04/03	0.86		%	25
			2,3,4,7,8-Penta CDF	2020/04/03	12		%	25
			2,3,7,8-Tetra CDF	2020/04/03	0		%	25
			Octa CDF	2020/04/03	1.8		%	25
9818287	é0I	Method Blank	C13-1234678 HeptaCDD	2020/04/03		77	%	30 - 130
			C13-1234678 HeptaCDF	2020/04/03		73	%	30 - 130
			C13-123678 HexaCDD	2020/04/03		70	%	30 - 130
			C13-123678 HexaCDF	2020/04/03		69	%	30 - 130
			C13-12378 PentaCDD	2020/04/03		76	%	30 - 130
			C13-12378 PentaCDF	2020/04/03		67	%	30 - 130
			C13-2378 TetraCDD	2020/04/03		77	%	30 - 130
			C13-2378 TetraCDF	2020/04/03		68	%	30 - 130
			C13-OCDD	2020/04/03		72	%	30 - 130
			1,2,3,4,6,7,8-Hepta CDD	2020/04/03	<0.539, EDL=0.539		pg/g	
			1,2,3,4,7,8-Hexa CDD	2020/04/03	<0.546, EDL=0.546		pg/g	
			1,2,3,6,7,8-Hexa CDD	2020/04/03	<0.521, EDL=0.521		pg/g	
			1,2,3,7,8,9-Hexa CDD	2020/04/03	<0.476, EDL=0.476		pg/g	
			1,2,3,7,8-Penta CDD	2020/04/03	<0.741, EDL=0.741		pg/g	
			2,3,7,8-Tetra CDD	2020/04/03	<0.530, EDL=0.530		pg/g	
			Octa CDD	2020/04/03	<0.543, EDL=0.543		pg/g	
			Total Hepta CDD	2020/04/03	<0.539, EDL=0.539		pg/g	
			Total Hexa CDD	2020/04/03	<2.35, EDL=2.35 (2)		pg/g	
			Total Penta CDD	2020/04/03	<0.741, EDL=0.741		pg/g	
			Total Tetra CDD	2020/04/03	<0.530, EDL=0.530		pg/g	
			1,2,3,4,6,7,8-Hepta CDF	2020/04/03	<0.496, EDL=0.496		pg/g	
			1,2,3,4,7,8,9-Hepta CDF	2020/04/03	<0.585, EDL=0.585		pg/g	
			1,2,3,4,7,8-Hexa CDF	2020/04/03	<0.482, EDL=0.482		pg/g	
			1,2,3,6,7,8-Hexa CDF	2020/04/03	<0.467, EDL=0.467		pg/g	
			1,2,3,7,8,9-Hexa CDF	2020/04/03	<0.533, EDL=0.533		pg/g	
			1,2,3,7,8-Penta CDF	2020/04/03	<0.573, EDL=0.573		pg/g	
			2,3,4,6,7,8-Hexa CDF	2020/04/03	<0.467, EDL=0.467		pg/g	

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			2,3,4,7,8-Penta CDF	2020/04/03	<0.585, EDL=0.585		pg/g	
			2,3,7,8-Tetra CDF	2020/04/03	<0.558, EDL=0.558		pg/g	
			Octa CDF	2020/04/03	<0.504, EDL=0.504		pg/g	
			Total Hepta CDF	2020/04/03	<0.537, EDL=0.537		pg/g	
			Total Hexa CDF	2020/04/03	<0.486, EDL=0.486		pg/g	
			Total Penta CDF	2020/04/03	<0.579, EDL=0.579		pg/g	
			Total Tetra CDF	2020/04/03	<0.586, EDL=0.586 (2)		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.

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

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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

(2) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.

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

BV Labs Job #: C021982
Report Date: 2020/04/07

ATLANTIC POWER (WILLIAMS LAKE) LTD.
Site Location: Williams Lake Power Plant
Your P.O. #: CC

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.

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