2021 Annual Report for Authorization 8808

Atlantic Power - Williams Lake Power Plant

Jacob Steyl

4455 Mackenzie Ave N, Williams Lake, V2G 5E8

Executive Summary

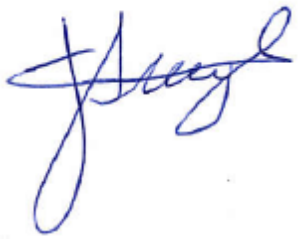
This Report details the Environmental Emissions from January 1, 2021 to December 31, 2021 and fulfils the requirement of section 3.6 of Authorization 8808 [1].

No rail ties or greater than 1% construction and demolition (C&D) waste were used as feedstock during the reporting period. A total of 480,258 wet tonnes of clean biomass was incinerated during 6,420 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

February 7, 2022

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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
mt – Metric Tonnes
MW – Megawatt
pg/g – Picogram per Gram (0.001ppb)
ppb - Parts Per Billion
ppm - Parts Per Million (1,000 ppb)

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 2021 to 00:00 1 January 2022. The Plant was curtailed for an extended period during the year, as show in Figure 1-1 and Table 2-1.

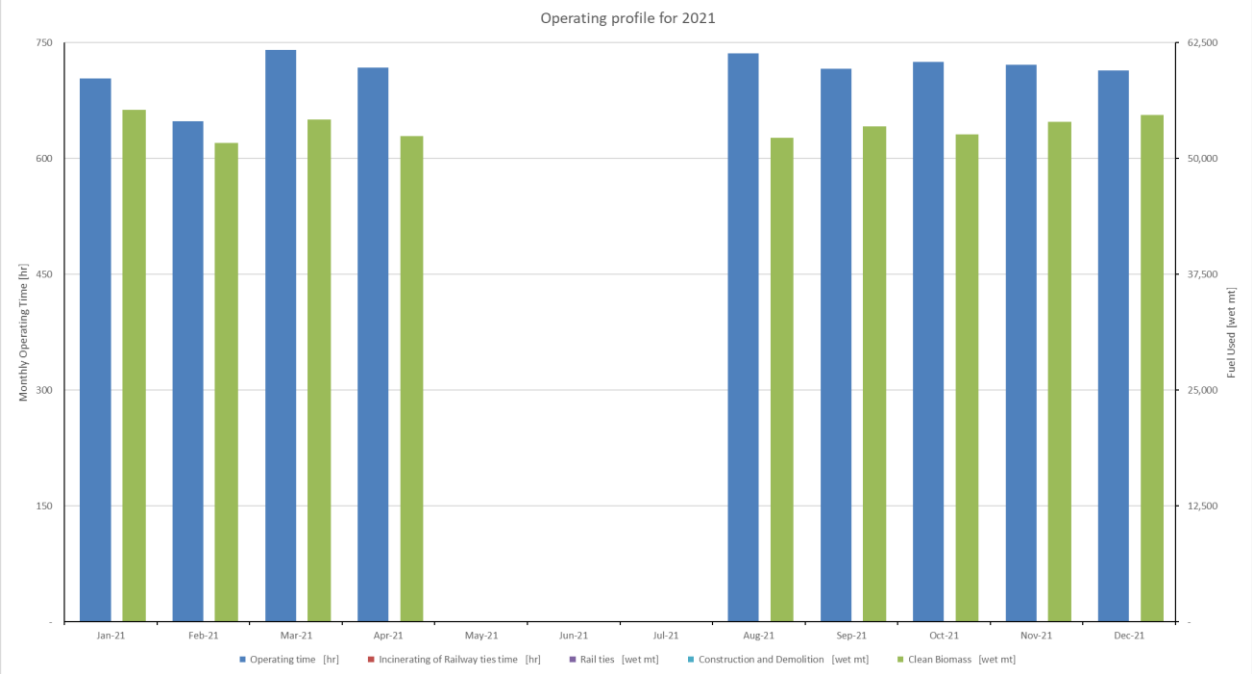

Figure 1-1: Normal Operating time for 2021

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

Figure 1-1 and Table 2-1 shows the operating time for each month.

Table 2-1: Operating hours per month

	Operating time[1] *hr*	**Incinerating of Railway ties time[2]** *hr*
Jan-2021	703	0
Feb-2021	648	0
Mar-2021	740	0
Apr-2021	718	0
May-2021	-	-
Jun-2021	-	-
Jul-2021	-	-
Aug-2021	736	0
Sep-2021	716	0
Oct-2021	725	0
Nov-2021	721	0
Dec-2021	714	0
2021 Totals	**6,420**	**0**

3 Fuel

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

Table 3-1: Monthly and Annual Amounts of Fuel

	Rail ties *wet mt*	**Construction and Demolition** *wet mt*	**Clean Biomass** *wet mt*
Jan-2021	0	0	55,220
Feb-2021	0	0	51,646
Mar-2021	0	0	54,214
Apr-2021	0	0	52,374
May-2021	0	0	-
Jun-2021	0	0	-
Jul-2021	0	0	-
Aug-2021	0	0	52,240
Sep-2021	0	0	53,423
Oct-2021	0	0	52,558
Nov-2021	0	0	53,921
Dec-2021	0	0	54,662
2021 Totals	**0**	**0**	**480,258**

[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 NO_x as NO_2 per month and average for the Month

	Maximum Hourly Average *mg/m³*	**Monthly Average** *mg/m³*
Jan-2021	278	232
Feb-2021	279	228
Mar-2021	261	212
Apr-2021	257	218
May-2021	-	-
Jun-2021	-	-
Jul-2021	-	-
Aug-2021	253	221
Sep-2021	268	220
Oct-2021	257	215
Nov-2021	290	255
Dec-2021	315	253

The average NO_x emissions for the year was 228 mg/m³ at 8% O_2. The maximum hourly average for the year is 315 mg/m³ at 8%O_2.

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 October 27, 2021 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)	93	110
Particulate (mg/m^3 @ 8% O_2)	2.9	20

Both parameters measure is below permitted levels.

The average steam flow during the Stack Test on October 27 was 603.1 klb/hr (76.0 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 results from the test is summarised in Table 5-2. The complete reports can be found in Appendix B - Ash Analysis Report.

Table 5-2: Schedule D Discrete Monitoring Results

Parameter	**Average**	**Permitted Limits** [2]
Arsenic (mg/L)	<0.1	2.5
Barium (mg/L)	2.5	100
Boron (mg/L)	<0.1	500
Cadmium (mg/L)	<0.1	0.5
Chromium (mg/L)	<0.1	5
Copper (mg/L)	<0.1	100
Lead (mg/L)	<0.1	5
Mercury (mg/L)	<0.0020	0.1
Selenium (mg/L)	<0.1	1
Silver (mg/L)	<0.01	5
Uranium (mg/L)	<0.1	10
Zinc (mg/L)	<0.1	500
Dioxin/Furan TEQ (ppb)	0.020	100
Polycyclic Aromatic Hydrocarbon TEQ (ppm)	0.026	100

Parameter values marked with a less-than sign (<) are below the Reportable Detection Limit.

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

The average steam flow when the Ash Test sample was collected on October 27 was 603.1 klb/hr (76.0 kg/s). This meets the Operating Conditions requirements stipulated in section 3.3 of the Permit.

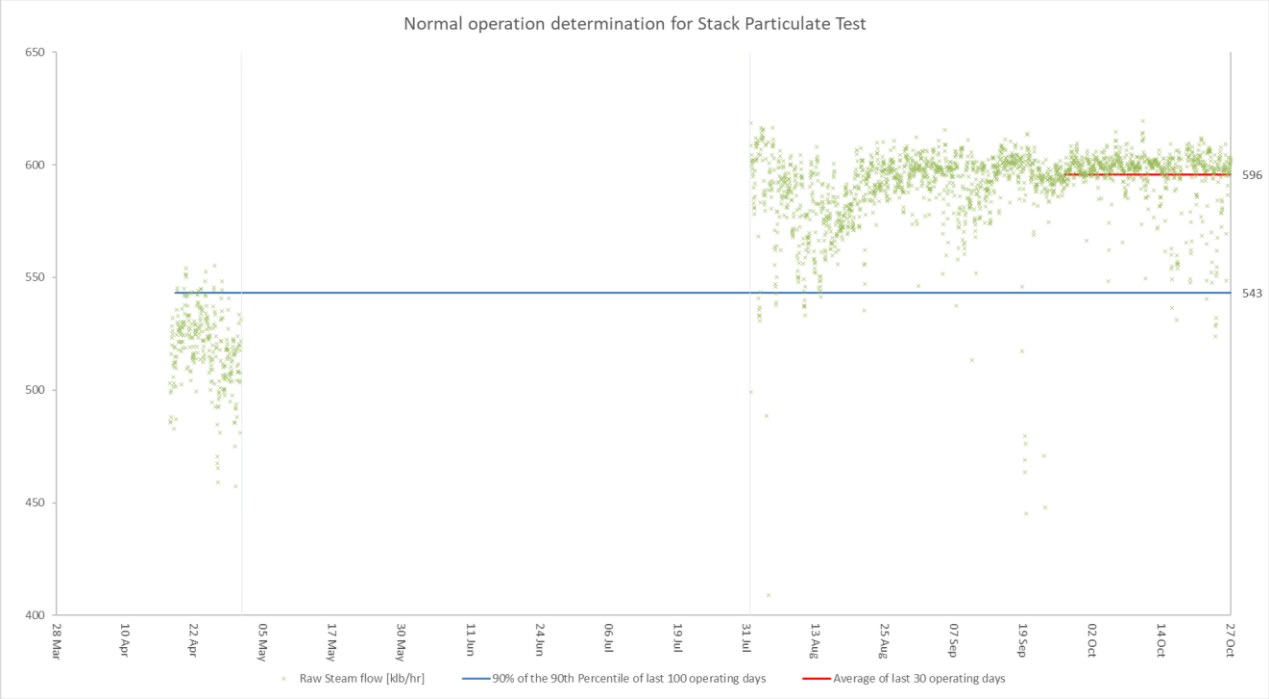

Figure 5-1: Hourly Average Steam Production data for October 27, 2021 Discrete Testing

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

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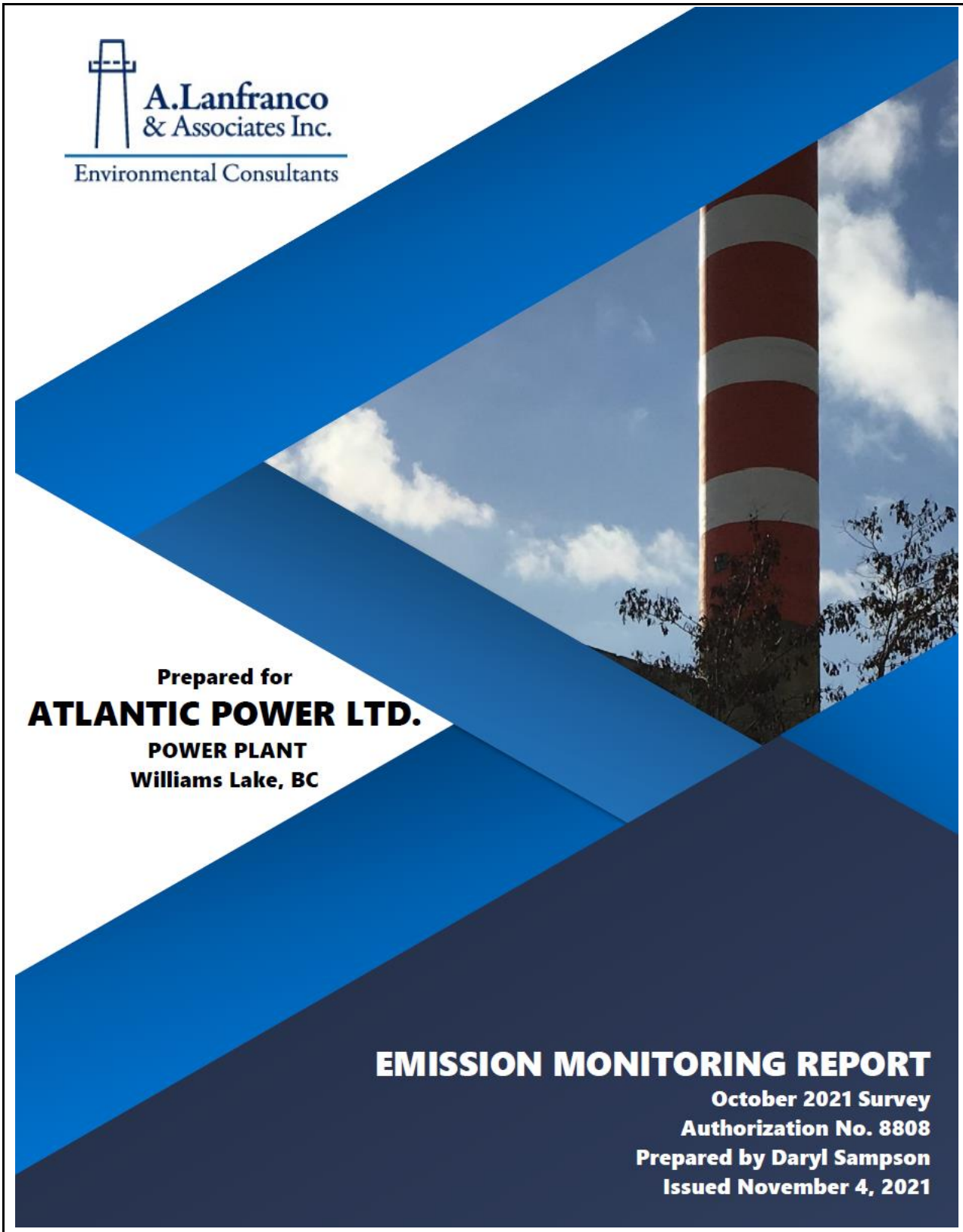
Environmental Consultants



Prepared for
ATLANTIC POWER LTD.
POWER PLANT
Williams Lake, BC

EMISSION MONITORING REPORT

October 2021 Survey
Authorization No. 8808
Prepared by Daryl Sampson
Issued November 4, 2021

A.Lanfranco & Associates Inc.
Environmental Consultants

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APPENDICES

A. Lanfranco and Associates Inc.
Surrey, BC, (604) 881-2582

A.Lanfranco & Associates Inc.
Environmental Consultants

SUMMARY

The following table presents the triplicate test average results for the listed parameters for the Biomass fuelled boiler stack on October 27, 2021.

Parameter	Average	Permit Limits
Particulate (mg/Sm^3)	3.5	
Particulate (mg/Sm^3 @ 8% O_2)	2.9	20
Particulate (kg/hr.)	1.2	
Flowrate (Sm^3/min)	5580	
Flowrate (Sm^3/sec)	93.0	110
O_2 (vol % dry)	5.0	
CO_2 (vol % dry)	16.0	

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

The 3-run average boiler stack results for total particulate (2.9 mg/Sm^3 @ 8% O_2) is marginally lower than the previous results from March 2020 (3.1 mg/Sm^3 @ 8% O_2) and is well below the permit limit. The 3-run average flowrate on the boiler stack for this survey is also slightly lower than that from March 2020 (93 compared to 97.7m^3/min) and is also below the permitted limit. The differences do not represent a significant change from previous surveys.

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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), Mr. J. Ching, and Mr. S. Baker.

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
Chief Operations Officer | Owner

A. Lanfranco and Associates Inc.
Surrey, BC, (604) 881-2582

A.Lanfranco & Associates Inc.
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A.Lanfranco & Associates Inc.
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1 TEST PROGRAM ORGANIZATION and INTRODUCTION

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. J. Ching - A. Lanfranco and Associates Inc. Mr. S. Baker - A. Lanfranco and Associates Inc.

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 October 27, 2021, 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)

A. Lanfranco and Associates was responsible for the gravimetric analysis for this survey. Justin Ching, the lab manager for ALAA can be reached at 604-881-2582 or 672-514-9350.

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

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2 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.

3 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

3.1 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.

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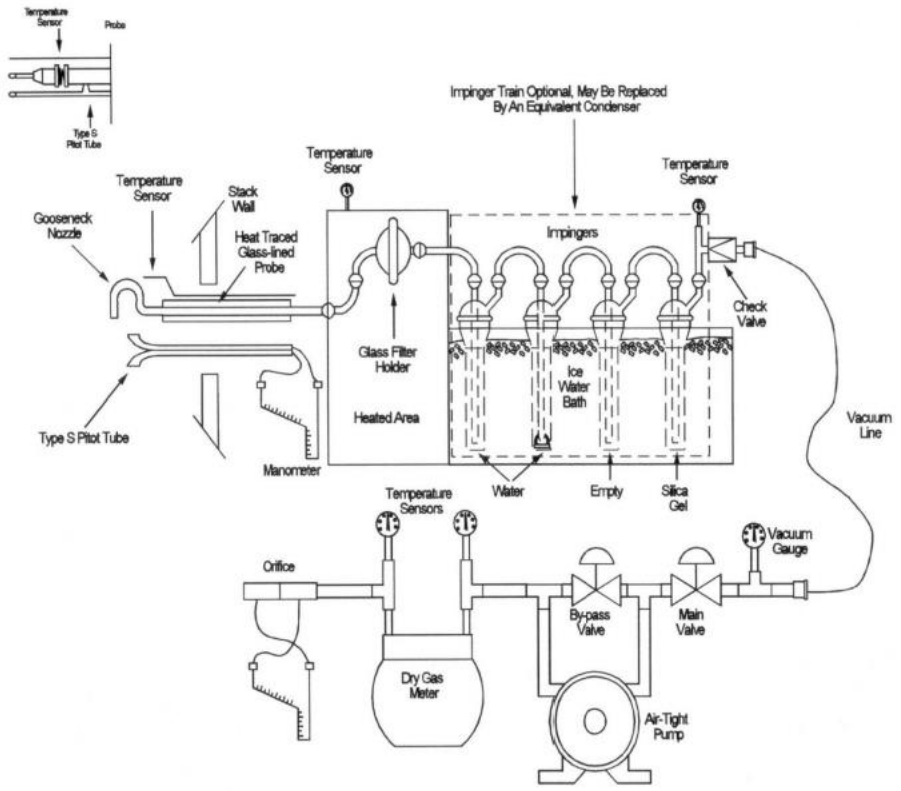

Figure 1: Method 5 Particulate Train

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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.

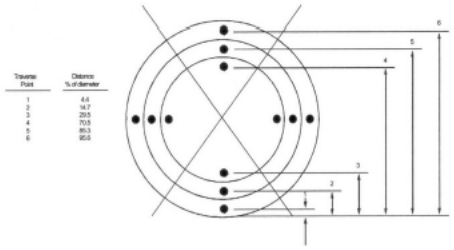

Figure 2. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points.

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.

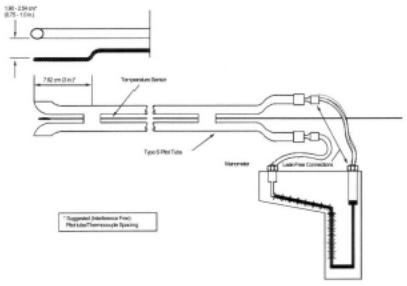

Figure 3. Type S Pitot Tube Manometer Assembly

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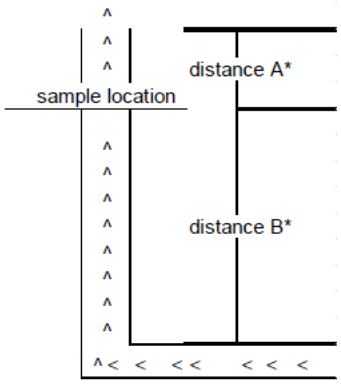
Figure - 4 **Location of Traverse Points in Circular Stacks**
(inches from inside wall to traverse point)

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 wall 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.

3.2 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.

4 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.

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TABLE 1: MAIN STACK EMISSION RESULTS

Parameter	Test 1	Test 2	Test 3	Average
Test Date	27-Oct-21	27-Oct-21	27-Oct-21	
Test Time	10:15 - 11:29	11:47 - 12:56	13:12 - 14:16	
Duration (minutes)	60	60	60	60
Particulate (mg/Sm^3)	3.8	4.0	2.8	3.5
Particulate (mg/Sm^3 @ 8% O_2)	3.2	3.2	2.2	2.9
Particulate (Kg/hr)	1.3	1.3	0.9	1.2
Particulate (Kg/day)	31.0	31.9	22.1	28.3
Flowrate (Sm^3/min)	5630	5571	5551	5584
Flowrate (Sm^3/sec)	93.8	92.8	92.5	93.1
Flowrate (Am^3/min)	11064	11032	11017	11038
Temperature (°C)	161	161	160	161
O_2 (vol % dry)	5.6	4.9	4.5	5.0
CO_2 (vol % dry)	15.9	16.0	16.1	16.0
H_2O (vol %)	17.6	18.3	18.5	18.1
Isokinetic Variation (%)	97.6	102.4	101.6	100.5

All results are at 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	0.3479	0.3498	0.0019	0.0018
Run 2	0.3478	0.3487	0.0009	0.0008
Run 3	0.3460	0.3470	0.0010	0.0009
Blank	0.3454	0.3455	0.0001	
Probe Washes				
Run 1	117.7409	117.7436	0.0027	0.0021
Run 2	102.6721	102.6761	0.0040	0.0034
Run 3	112.2302	112.2328	0.0026	0.0020
Blank	114.3514	114.3520	0.0006	
Silica Gels				
Run 1	200.0	208.5	8.5	8.5
Run 2	200.0	207.6	7.6	7.6
Run 3	200.0	206.4	6.4	6.4

TABLE 3: OPERATING CONDITIONS

	Steam Flow (K lbs./hour)
Boiler Stack	610

The steam flow is 16% greater than during testing in 2020 and is representative of normal operations.

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5 DISCUSSION OF RESULTS

The average particulate result for this survey was 2.9 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 quite comparable to previous results from this source.

The average flow rate measurement of 93.0 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:**	27-Oct-21
Jobsite:	Williams Lake, B.C.	**Run:**	1 - Particulate
Source:	Main Stack	**Run Time:**	10:15 - 11:29

Particulate Concentration:	**3.8 mg/dscm**	0.0017 gr/dscf
	1.9 mg/Acm	0.0009 gr/Acf
	3.2 mg/dscm (@ 8% O2)	0.0014 gr/dscf (@ 8% O2)
Emission Rate:	1.29 Kg/hr	2.850 lb/hr
Sample Gas Volume:	1.0193 dscm	35.996 dscf
Total Sample Time:	60.0 minutes	
Average Isokineticity:	97.6 %	

Flue Gas Characteristics

Moisture:	17.61 %	
Temperature	160.7 °C	321.3 °F
Flow	5630.2 dscm/min	198830 dscf/min
	93.84 dscm/sec	3313.8 dscf/sec
	11064.3 Acm/min	390736 Acf/min
Velocity	19.110 m/sec	62.70 f/sec
Gas Analysis	5.63 % O_2	15.88 % CO_2
	30.765 Mol. Wt (g/gmole) Dry	28.517 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:**	27-Oct-21
Jobsite:	Williams Lake, B.C.	**Run:**	1 - Particulate
Source:	Main Stack	**Run Time:**	10:15 - 11:29

Control Unit (Y)	1.0068
Nozzle Diameter (in.)	0.2427
Pitot Factor	0.8437
Baro. Press. (in. Hg)	27.39
Static Press. (in. H_2O)	-0.51
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
15.50	5.50
15.50	6.00
16.00	5.50
16.50	5.50
Average = **15.88**	**5.63**

Condensate Collection:

Impinger 1 (grams)	115.0
Impinger 2 (grams)	35.0
Impinger 3 (grams)	5.0
Impinger 4 (grams)	8.5
Total Gain (grams)	**163.5**

Collection:

Filter (grams)	**0.0018**
Washings (grams)	**0.0021**
Impinger (grams)	**0.0000**
Total (grams)	**0.0039**

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	880.518							
1	1	5.0	884.300	0.990	2.08	78	78	322	6.1	97.7
	2	10.0	888.030	0.960	2.02	79	79	323	20.1	97.7
	3	15.0	891.480	0.810	1.71	82	82	321	40.8	97.7
		0.0	891.480							
2	1	5.0	894.610	0.660	1.41	86	86	322	6.1	97.4
	2	10.0	897.880	0.720	1.53	86	86	322	20.1	97.5
	3	15.0	901.140	0.710	1.52	88	88	321	40.8	97.4
		0.0	901.140							
3	1	5.0	904.100	0.580	1.25	90	90	321	6.1	97.5
	2	10.0	907.090	0.590	1.27	92	92	322	20.1	97.3
	3	15.0	909.990	0.550	1.19	93	93	322	40.8	97.6
		0.0	909.990							
4	1	5.0	913.540	0.820	1.77	95	95	322	6.1	97.6
	2	10.0	917.380	0.950	2.07	97	97	321	20.1	97.8
	3	15.0	920.926	0.800	1.75	98	98	317	40.8	97.9
			Average:	0.762	1.631	88.7	88.7	321.3		97.6

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	27-Oct-21
Jobsite:	Williams Lake, B.C.	**Run:**	2 - Particulate
Source:	Main Stack	**Run Time:**	11:47 - 12:56

Particulate Concentration:	**4.0 mg/dscm**	0.0017 gr/dscf
	2.0 mg/Acm	0.0009 gr/Acf
	3.2 mg/dscm (@ 8% O2)	0.0014 gr/dscf (@ 8% O2)
Emission Rate:	1.33 Kg/hr	2.926 lb/hr
Sample Gas Volume:	1.0577 dscm	37.354 dscf
Total Sample Time:	60.0 minutes	
Average Isokineticity:	102.4 %	

Flue Gas Characteristics

Moisture:	18.29 %	
Temperature	160.5 °C	320.9 °F
Flow	5570.7 dscm/min	196730 dscf/min
	92.85 dscm/sec	3278.8 dscf/sec
	11031.8 Acm/min	389587 Acf/min
Velocity	19.054 m/sec	62.51 f/sec
Gas Analysis	4.88 % O_2	16.00 % CO_2
	30.755 Mol. Wt (g/gmole) Dry	28.422 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:**	27-Oct-21
Jobsite:	Williams Lake, B.C.	**Run:**	2 - Particulate
Source:	Main Stack	**Run Time:**	11:47 - 12:56

Control Unit (Y)	1.0068
Nozzle Diameter (in.)	0.2427
Pitot Factor	0.8437
Baro. Press. (in. Hg)	27.39
Static Press. (in. H_2O)	-0.51
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
16.00	5.00
16.00	4.50
Average = 16.00	**4.88**

Condensate Collection:

Impinger 1 (grams)	135.0
Impinger 2 (grams)	30.0
Impinger 3 (grams)	5.0
Impinger 4 (grams)	7.6
Total Gain (grams)	**177.6**

Collection:

Filter (grams)	**0.0008**
Washings (grams)	**0.0034**
Impinger (grams)	**0.0000**
Total (grams)	**0.0042**

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	921.235							
1	1	5.0	925.110	0.880	2.09	101	101	322	6.1	102.5
	2	10.0	929.120	0.950	2.25	100	100	323	20.1	102.4
	3	15.0	932.790	0.790	1.88	102	102	323	40.8	102.3
		0.0	932.790							
2	1	5.0	936.010	0.600	1.44	104	104	317	6.1	102.1
	2	10.0	939.270	0.610	1.47	106	106	316	20.1	102.1
	3	15.0	942.380	0.550	1.33	108	108	318	40.8	102.3
		0.0	942.380							
3	1	5.0	945.440	0.540	1.03	105	105	317	6.1	102.0
	2	10.0	948.790	0.640	1.55	105	105	324	20.1	103.2
	3	15.0	952.260	0.700	1.67	104	104	323	40.8	102.3
		0.0	952.260							
4	1	5.0	956.390	1.000	2.38	102	102	323	6.1	102.4
	2	10.0	960.400	0.950	2.24	99	99	323	20.1	102.6
	3	15.0	964.214	0.870	2.04	95	95	322	40.8	102.6
			Average:	0.757	1.781	102.6	102.6	320.9		102.4

A. Lanfranco and Associates Inc. - Emission Report

Client:	Atlantic Power	**Date:**	27-Oct-21
Jobsite:	Williams Lake, B.C.	**Run:**	3 - Particulate
Source:	Main Stack	**Run Time:**	13:12 - 14:16

Particulate Concentration:		**2.8**	**mg/dscm**	0.0012 gr/dscf
		1.4	mg/Acm	0.0006 gr/Acf
		2.2	mg/dscm (@ 8% O2)	0.0010 gr/dscf (@ 8% O2)
Emission Rate:		0.92	Kg/hr	2.033 lb/hr
Sample Gas Volume:		1.0471	dscm	36.977 dscf
Total Sample Time:		60.0	minutes	
Average Isokineticity:		101.6	%	
Flue Gas Characteristics				
	Moisture:	18.51	%	
	Temperature	160.3	°C	320.6 °F
	Flow	5550.6	dscm/min	196018 dscf/min
		92.51	dscm/sec	3267.0 dscf/sec
		11016.6	Acm/min	389052 Acf/min
	Velocity	19.028	m/sec	62.43 f/sec
	Gas Analysis	4.50	% O_2	16.13 % CO_2
		30.760	Mol. Wt (g/gmole) Dry	28.399 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:**	27-Oct-21
Jobsite:	Williams Lake, B.C.	**Run:**	3 - Particulate
Source:	Main Stack	**Run Time:**	13:12 - 14:16

Control Unit (Y)	1.0068
Nozzle Diameter (in.)	0.2427
Pitot Factor	0.8437
Baro. Press. (in. Hg)	27.39
Static Press. (in. H_2O)	-0.51
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
15.50	4.50
16.00	4.50
16.00	5.00
17.00	4.00
Average = 16.13	**4.50**

Condensate Collection:

Impinger 1 (grams)	150.0
Impinger 2 (grams)	20.0
Impinger 3 (grams)	2.0
Impinger 4 (grams)	6.4
Total Gain (grams)	**178.4**

Collection:

Filter (grams)	**0.0009**
Washings (grams)	**0.0020**
Impinger (grams)	**0.0000**
Total (grams)	**0.0029**

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	965.127							
1	1	5.0	969.000	0.980	2.19	76	76	321	6.1	101.8
	2	10.0	972.780	0.940	2.09	74	74	321	20.1	101.8
	3	15.0	976.370	0.850	1.89	73	73	320	40.8	101.8
		0.0	976.370							
2	1	5.0	979.430	0.620	1.38	73	73	320	6.1	101.4
	2	10.0	982.680	0.700	1.55	72	72	319	20.1	101.5
	3	15.0	985.980	0.720	1.60	72	72	319	40.8	101.7
		0.0	985.980							
3	1	5.0	988.730	0.500	1.11	73	73	321	6.1	101.5
	2	10.0	991.650	0.560	1.25	75	75	321	20.1	101.5
	3	15.0	994.540	0.550	1.22	74	74	321	40.8	101.5
		0.0	994.540							
4	1	5.0	998.240	0.900	2.00	74	74	321	6.1	101.8
	2	10.0	1002.050	0.960	2.13	73	73	321	20.1	101.7
	3	15.0	1005.483	0.780	1.73	73	73	322	40.8	101.7
			Average:	0.755	1.678	73.5	73.5	320.6		101.6

APPENDIX 2

CALCULATIONS

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

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

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

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

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

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

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

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

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

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

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

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)
$\%O_{2m}$	= 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

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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 (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

DSV

A. Lanfranco and Associates Inc.

CLIENT Atlantic Power	NOZZLE 5534 ~~02~~ DIAMETER, IN. 0.2427	IMPINGER VOLUMES	INITIAL (mL) / FINAL (mL) / TOTAL GAIN (mL)
SOURCE Energy Stack	PROBE 5A4 Cp 0.8437	Imp. #1	100 / 215 / 115
PARAMETER / RUN No Particulate/HCl Run 1	PORT LENGTH 8"	Imp. #2	100 / 135 / 35
DATE Oct. 27, 2021	STATIC PRESSURE, IN. H2O -0.51	Imp. #3	0 / 5 / 5
OPERATOR: Justin Chas	STACK DIAMETER	Imp. #4	200 / 210 / 10
CONTROL UNIT 5U14 Y 1.0068	STACK HEIGHT	Imp. #5	
ΔH@ 2.136		Imp. #6	
BAROMETRIC PRESSURE, IN. Hg 27.39	INITIAL LEAK TEST 0.002	Upstream Diameters	
ASSUMED MOISTURE, Bw 21%	FINAL LEAK TEST 0.002	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. %	O_2 Vol. %
	1015	880.518										
1		884.30	~~1.05~~ 0.99	2.08	78	327	263	255	55	6	15.5	5.5
2		888.03	0.96	2.07	79	323						
3		891.48	0.81	1.71	82	321	261	262	55	5		
1		894.61	0.66	1.41	86	322	242	256	55	4	15.5	6
2		897.88	0.72	1.53	86	322						
3		901.14	0.71	1.52	88	321	257	261	57	4		
1		904.10	0.58	1.25	90	321	255	256	56	4	16.0	5.5
2		907.09	0.59	1.27	92	322						
3		909.99	0.55	1.19	93	322	255	257	52	4	~~16.5~~	
1		913.54	0.82	1.77	95	322	259	259	54	4	16.5	5.5
2		917.38	0.95	2.07	97	321						
3	11:29 End of test	920.926	0.80	1.75	98	317	248	263	53	5		

DSL

A. Lanfranco and Associates Inc.

CLIENT Atlantic Power	NOZZLE 5S24 DIAMETER, IN. 0.2427	IMPINGER VOLUMES	INITIAL (mL) / FINAL (mL) / TOTAL GAIN (mL)
SOURCE Energy Stack	PROBE 5A4 Cp 0.8437	Imp. #1	100 / 235 / 135
PARAMETER / RUN No Particulate/HCl 2	PORT LENGTH 8"	Imp. #2	100 / 130 / 30
DATE Oct. 27, 2021	STATIC PRESSURE, IN. H2O -0.51	Imp. #3	0 / 5 / 5
OPERATOR: Justin Ching	STACK DIAMETER	Imp. #4	200 / 210 / 10
CONTROL UNIT SU 14 Y 1.0068 ΔH@ 2.136	STACK HEIGHT	Imp. #5	
		Imp. #6	
BAROMETRIC PRESSURE, IN. Hg 27.39	INITIAL LEAK TEST 0.002	Upstream Diameters	
ASSUMED MOISTURE, Bw ~~8 21%~~ 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. %		
	1147	921.235												
1		925.11	0.48	2.09	101	322	245	248	55	5	16	5.0		
2		929.12	0.95	2.25	100	323	265	267	54					
3		932.79	0.49	1.88	102	323				5				
1		936.01	0.60	1.44	104	317	259	260	54	5	16	5.0		
2		939.27	0.61	1.47	106	316								
3		942.38	0.55	1.33	108	318	258	258	55	4				
1		945.44	0.54	1.30	105	317	259	256	55	4	16	5.0		
2		948.79	0.65	1.55	107	324								
3		952.26	0.70	1.67	104	323	258	259	56	4				
1		956.39	1.00	2.38	102	323	256	245	57	6	16	4.5		
2		960.40	0.95	2.24	99	323								
3	12:56 End of test	964.214	0.87	2.04	95	322	255	257	56	6				

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CLIENT Atlantic Power	NOZZLE SS24 DIAMETER, IN. 0.2427	IMPINGER	INITIAL / FINAL / TOTAL GAIN
SOURCE Exhaust Stack	PROBE SA4 Cp 0.8437	VOLUMES	(mL) / (mL) / (mL)
PARAMETER / RUN No Particulate HCl R3	PORT LENGTH 8"	Imp. #1	100 / 250 / 150
DATE Oct. 27 2021	STATIC PRESSURE, IN. H2O -0.57	Imp. #2	100 / 120 / 20
OPERATOR: Justin Chinn	STACK DIAMETER	Imp. #3	0 / 2 / 2
CONTROL UNIT SW14 Y 1.0068	STACK HEIGHT	Imp. #4	200 / 210 / 10
ΔH@ 2.136		Imp. #5	
BAROMETRIC PRESSURE, IN. Hg 27.39	INITIAL LEAK TEST 0.002	Imp. #6	
ASSUMED MOISTURE, Bw 19%	FINAL LEAK TEST 0.002	Upstream Diameters	
		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. %
1	13:12	965.127										
1		969.00	0.98	2.19	76	321	245	251	53	6	15.5	4.5
2		972.78	0.94	2.09	74	321						
3		976.37	0.85	1.89	73	320	261	258	55	5		
1		979.43	0.62	1.38	73	320	259	263	56	4	16.0	4.5
2		982.68	0.70	1.55	72	319						
3		985.98	0.72	1.60	72	319	258	264	57	4		
1		988.73	0.50	1.11	73	321	257	260	57	4	16.0	5.0
2		991.65	0.56	1.25	75	321						
3		994.54	0.55	1.22	74	321	250	256	56	4		
1		998.24	0.90	2.00	74	321	255	259	56	5	17.0	4.0
2		1002.05	0.96	2.13	73	321						
3	14:16 END	1005.483	0.78	1.73	73	322	257	255	56	5		

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 #: 0028-030615-1

Date: 28-Jun-21
Barometric Pressure: 29.65 (in. Hg)
Theoretical Critical Vacuum: 13.99 (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)	Final (deg F)	Average (deg F)
4.10	15.00	22.200	38.323	16.123	92.0	92.0	95.0	95.0	73	0.8185	14.0	101.0	103.0	102.0
2.15	23.00	980.100	997.858	17.758	85.0	85.0	86.0	86.0	63	0.5956	18.5	86.0	97.0	91.5
1.35	15.00	12.900	21.986	9.086	90.0	90.0	92.0	92.0	55	0.4606	19.0	99.0	97.0	98.0
0.78	32.00	998.100	1012.776	14.676	87.0	87.0	90.0	90.0	48	0.3560	20.0	95.0	102.0	98.5
0.39	15.00	38.600	43.355	4.755	95.0	95.0	96.0	96.0	40	0.2408	20.5	103.0	109.0	106.0

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

--- DRY GAS METER ---		------- ORIFICE -------			– DRY GAS METER –		------- ORIFICE -------			
VOLUME CORRECTED Vm(std) (cu ft)	VOLUME CORRECTED Vm(std) (liters)	VOLUME CORRECTED Vcr(std) (cu ft)	VOLUME CORRECTED Vcr(std) (liters)	VOLUME NOMINAL Vcr (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)
15.390	435.9	15.356	434.9	16.500	0.998	-0.009	2.080	52.84	-0.056	0.669
17.117	484.8	17.296	489.8	18.237	1.010	0.004	2.051	52.10	-0.085	0.667
8.654	245.1	8.672	245.6	9.252	1.002	-0.005	2.157	54.80	0.021	0.656
14.021	397.1	14.293	404.8	15.262	1.019	0.013	2.098	53.29	-0.038	0.655
4.481	126.9	4.502	127.5	4.871	1.005	-0.002	2.294	58.27	0.158	0.636
				Average Y-------->	1.0068		Average dH@----->	2.136	54.3	Average Ko----> 0.656

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 28, 2021

Pitot Tube Calibration

Date: 07-Jul-21 Temp (R): 530
Pbar (in.Hg): 30.01 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)
0.090	0.125	19.8	0.8400	0.0052
0.180	0.250	28.0	0.8400	0.0052
0.260	0.350	33.7	0.8533	0.0080
0.420	0.570	42.8	0.8498	0.0046
0.580	0.800	50.3	0.8430	0.0023
		Average :	0.8452	0.0051

Pitot ID: 5A-2

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.040	0.055	13.2	0.8443	0.0037
0.145	0.200	25.2	0.8430	0.0023
0.270	0.380	34.3	0.8345	0.0061
0.360	0.500	39.7	0.8400	0.0006
0.650	0.900	53.3	0.8413	0.0007
		Average :	0.8406	0.0027

Pitot ID: ST 5A

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.060	0.085	16.2	0.8318	0.0108
0.180	0.250	28.0	0.8400	0.0025
0.250	0.340	33.1	0.8489	0.0064
0.505	0.700	47.0	0.8409	0.0017
0.680	0.920	54.5	0.8511	0.0086
		Average :	0.8425	0.0060

Pitot ID: ST 5B

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.055	0.075	15.5	0.8478	0.0012
0.125	0.180	23.4	0.8250	0.0216
0.200	0.280	29.6	0.8367	0.0099
0.360	0.500	39.7	0.8400	0.0066
0.680	0.840	54.5	0.8907	0.0441
		Average :	0.8466	0.0167

Pitot ID: 5A-3

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.040	0.055	13.2	0.8443	0.0023
0.110	0.150	21.9	0.8478	0.0013
0.300	0.410	36.2	0.8468	0.0003
0.460	0.630	44.8	0.8459	0.0006
0.660	0.900	53.7	0.8478	0.0013
		Average :	0.8465	0.0011

Pitot ID: 5A - 4

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.080	0.110	18.7	0.8443	0.0005
0.170	0.230	27.3	0.8511	0.0074
0.280	0.390	35.0	0.8388	0.0049
0.500	0.700	46.7	0.8367	0.0070
0.660	0.900	53.7	0.8478	0.0040
		Average :	0.8437	0.0048

Pitot ID:

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

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:  Date: July 7, 2021

A. LANFRANCO and ASSOCIATES INC.

ENVIRONMENTAL CONSULTANTS

NOZZLE DIAMETER CALIBRATION FORM

Calibrated by: Justin Ching
Date: June 28, 2021
Signature:

Nozzle I.D.	d1 (inch)	d2 (inch)	d3 (inch)	difference (inch)	average dia. (inch)	average area (ft^2)
ST01	0.1290	0.1300	0.1295	0.0010	0.1295	0.0000915
SS-7	0.1750	0.1740	0.1750	0.0010	0.1747	0.0001664
ST05	0.1720	0.1730	0.1735	0.0015	0.1728	0.0001629
SS-1	0.1700	0.1720	0.1730	0.0030	0.1717	0.0001607
SS-8	0.2050	0.2020	0.2020	0.0030	0.2030	0.0002248
ST11	0.2050	0.2080	0.2080	0.0030	0.2070	0.0002337
ST10	0.2130	0.2130	0.2110	0.0020	0.2123	0.0002459
SS-18	0.2320	0.2300	0.2330	0.0030	0.2317	0.0002927
ST15	0.2370	0.2380	0.2360	0.0020	0.2370	0.0003064
SS-2	0.2410	0.2400	0.2400	0.0010	0.2403	0.0003150
SS-3	0.2412	0.2420	0.2410	0.0010	0.2414	0.0003178
SS-24	0.2410	0.2420	0.2450	0.0040	0.2427	0.0003212
B	0.2410	0.2420	0.2400	0.0020	0.2410	0.0003168
ST30	0.2470	0.2500	0.2480	0.0030	0.2483	0.0003364
SS-14	0.2450	0.2450	0.2470	0.0020	0.2457	0.0003292
ST20	0.2520	0.2540	0.2530	0.0020	0.2530	0.0003491
A	0.2510	0.2520	0.2530	0.0020	0.2520	0.0003464
SS-9	0.2680	0.2710	0.2720	0.0040	0.2703	0.0003986
ST40	0.2840	0.2830	0.2835	0.0010	0.2835	0.0004384
SS-30	0.2980	0.3010	0.3000	0.0030	0.2997	0.0004898
SS-13	0.3040	0.3010	0.3010	0.0030	0.3020	0.0004974
ST50	0.3020	0.3030	0.3030	0.0010	0.3027	0.0004996
ST60	0.3020	0.3030	0.3040	0.0020	0.3030	0.0005007
SS-10	0.3110	0.3140	0.3150	0.0040	0.3133	0.0005355
SS-327	0.3260	0.3285	0.3280	0.0025	0.3275	0.0005850
ST65	0.3280	0.3300	0.3270	0.0030	0.3283	0.0005880
ST66	0.3370	0.3390	0.3380	0.0020	0.3380	0.0006231
ST80	0.3650	0.3610	0.3610	0.0040	0.3623	0.0007161
SS-5	0.3700	0.3680	0.3660	0.0040	0.3680	0.0007386
ST75	0.3690	0.3660	0.3670	0.0030	0.3673	0.0007359
ST76	0.3710	0.3720	0.3730	0.0020	0.3720	0.0007548
SS-16	0.3710	0.3750	0.3710	0.0040	0.3723	0.0007561
ST85	0.3980	0.4000	0.4010	0.0030	0.3997	0.0008712
DD	0.4010	0.4020	0.4050	0.0040	0.4027	0.0008843
SS-15	0.4040	0.4040	0.4050	0.0010	0.4043	0.0008917
ST70	0.4170	0.4190	0.4160	0.0030	0.4173	0.0009499
SS-11	0.4160	0.4170	0.4200	0.0040	0.4177	0.0009515
ST86	0.4550	0.4560	0.4550	0.0010	0.4553	0.0011308
C	0.4900	0.4870	0.4880	0.0030	0.4883	0.0013006
SS-49	0.4960	0.4940	0.4950	0.0020	0.4950	0.0013364
SS-491	0.4910	0.4940	0.4950	0.0040	0.4933	0.0013274
SS-6	0.4950	0.4970	0.4960	0.0020	0.4960	0.0013418
SS-492	0.4950	0.4970	0.4950	0.0020	0.4957	0.0013400
ST90	0.4950	0.4970	0.4970	0.0020	0.4963	0.0013436
ST92	0.5020	0.5030	0.5040	0.0020	0.5030	0.0013800
SS-558	0.5600	0.5600	0.5600	0.0000	0.5600	0.0017104
ST96	0.5569	0.5541	0.5548	0.0028	0.5553	0.0016816
SS-635	0.6320	0.6350	0.6330	0.0030	0.6333	0.0021877
SS-12	0.7470	0.7460	0.7480	0.0020	0.7470	0.0030435

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	29-Jun-21	100.7	29.74	29.61	29.68	0.06
DS	29-Jun-21	100.7	29.74	29.62	29.69	0.05
CL	29-Jun-21	100.7	29.74	29.63	29.70	0.04
ML	29-Jun-21	100.7	29.74	29.60	29.67	0.07
SB	29-Jun-21	100.7	29.74	29.62	29.69	0.05
SH	29-Jun-21	100.7	29.74	29.60	29.67	0.07
MG	29-Jun-21	100.7	29.74	29.65	29.72	0.02
SF	29-Jun-21	100.7	29.74	29.60	29.67	0.07
JG	29-Jun-21	100.7	29.74	29.65	29.72	0.02
JC	29-Jun-21	100.7	29.74	29.62	29.69	0.05
LF		101.8	30.07	30.08	30.15	-0.09

Calibrated by: Jeremy Gibbs Signature:  Date: 29-Jun-21

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.

https://weather.gc.ca/city/pages/bc-74_metric_e.html

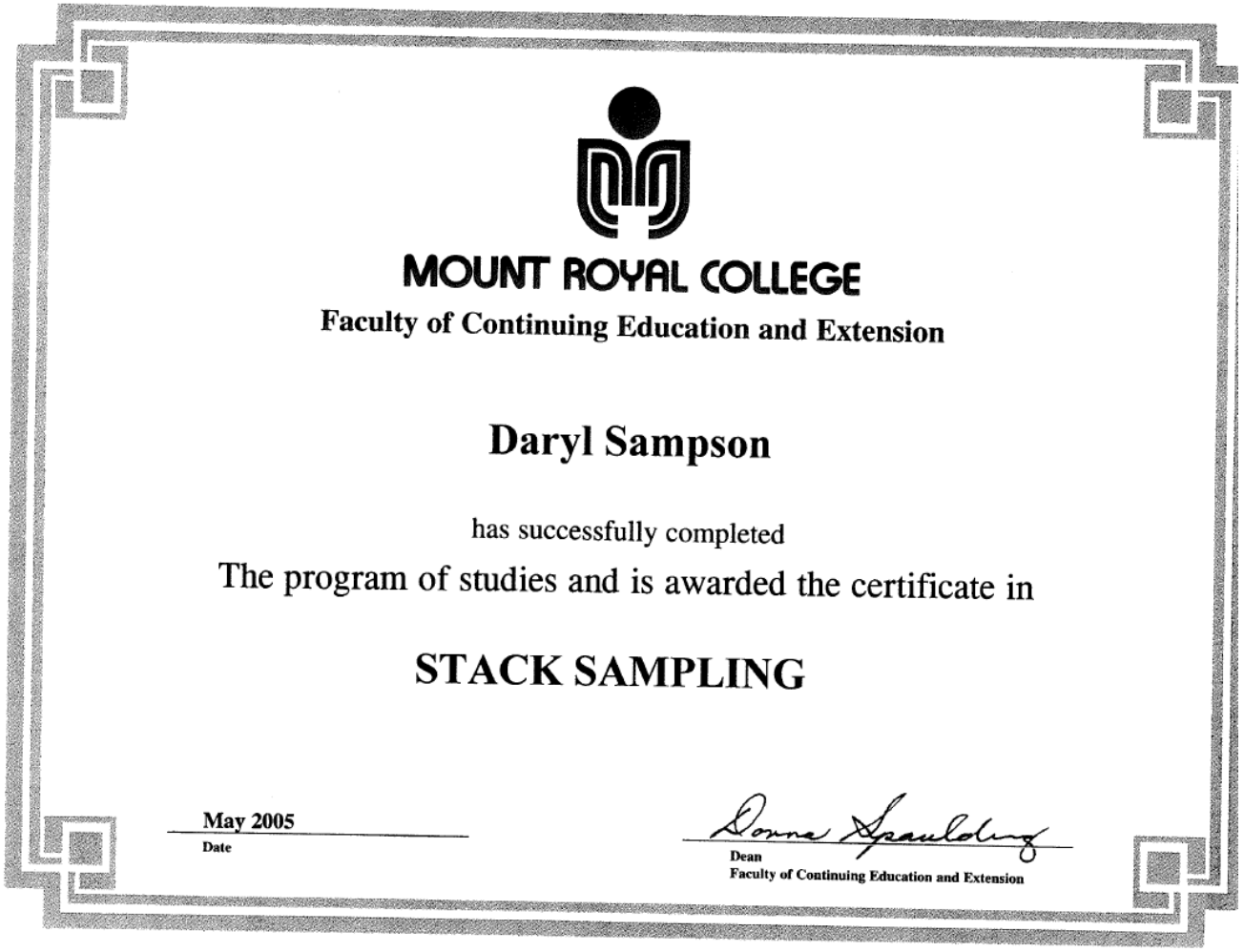
A. LANFRANCO and ASSOCIATES INC.
ENVIRONMENTAL CONSULTANTS

TEMPERATURE CALIBRATION FORM

Calibrated by: Justin Ching
Date: 07-Jul-21
Signature:

TEMPERATURE DEVICE CALIBRATIONS

Reference Device Model CL23A Calibrator			Temperature Settings (degrees F)													
			32		100		200		300		500		800		1700	
Device	ALA #	Serial #	Reading	Variation	Reading	Variation	Reading	Variation	Reading	Variation	Reading	Variation	Reading	Variation	Reading	V
Omega HH11A	3	300132	32.3	0.06%	99.3	-0.13%	200	0.00%	301	0.13%	498	-0.21%	798	-0.16%	1698	
Omega HH11A	4	200167		-6.51%		-17.87%		-30.32%		-39.49%		-52.10%		-63.51%		-
Omega HH11A	6	600059	33.1	0.22%	100	0.00%	202	0.30%	302	0.26%	499	-0.10%	798	-0.16%	1697	
TPI 341K	7	2.0315E+10	30.5	-0.31%	98.3	-0.30%	198.1	-0.29%	298	-0.26%	497	-0.31%	796.4	-0.29%	1693	
TPI 341K	8	2.0313E+10	32.1	0.02%	99.3	-0.13%	200.5	0.08%	299.9	-0.01%	499.3	-0.07%	798.7	-0.10%	1696	
Cont Cmpny	10	102008464	30.2	-0.37%	97.5	-0.45%	197.8	-0.33%	297.7	-0.30%	497.7	-0.24%	795.9	-0.33%	1693.8	
Omega HH11	14	409426		-6.51%		-17.87%		-30.32%		-39.49%		-52.10%		-63.51%		-
TPI 341K	16	400120029	30.7	-0.26%	99	-0.18%	199.4	-0.09%	299.2	-0.11%	499.6	-0.04%	800.2	0.02%	1703	
TPI 341K	18	2.0329E+10	31	-0.20%	98.9	-0.20%	198.9	-0.17%	298.7	-0.17%	498.5	-0.16%	798.4	-0.13%	1698	
TPI 341K	20	2.0329E+10	30	-0.41%	98.2	-0.32%	198.1	-0.29%	297.7	-0.30%	497.2	-0.29%	797.1	-0.23%	1696	
TPI 341K	22	2.0329E+10	30.5	-0.31%	98.6	-0.25%	198.5	-0.23%	298.3	-0.22%	497.7	-0.24%	797.4	-0.21%	1696	
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

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Conflict of Interest Disclosure Statement

A qualified professional [1] providing services to either the Ministry of Environment and Climate Change Strategy ("ministry"), or to a regulated person for the purpose of obtaining an authorization from the ministry, or pursuant to a requirement imposed under the *Environmental Management Act,* the *Integrated Pest Management Act* or the *Park Act* has a real or perceived conflict of interest when the qualified professional, or their relatives, close associates or personal friends have a financial or other interest in the outcome of the work being performed.

A real or perceived conflict of interest occurs when a qualified professional has

a) an ownership interest in the regulated person's business;

b) an opportunity to influence a decision that leads to financial benefits from the regulated person or their business other than a standard fee for service (e.g. bonuses, stock options, other profit sharing arrangements);

c) a personal or professional interest in a specific outcome;

d) the promise of a long term or ongoing business relationship with the regulated person, that is contingent upon a specific outcome of work;

e) a spouse or other family member who will benefit from a specific outcome; or

f) any other interest that could be perceived as a threat to the independence or objectivity of the qualified professional in performing a duty or function.

Qualified professionals who work under ministry legislation must take care in the conduct of their work that potential conflicts of interest within their control are avoided or mitigated. Precise rules in conflict of interest are not possible and professionals must rely on guidance of their professional associations, their common sense, conscience and sense of personal integrity.

Declaration

I Daryl Sampson, as a member of Air and Waste Management Association declare

Select one of the following:

☒ Absence from conflict of interest

Other than the standard fee I will receive for my professional services, I have no financial or other interest in the outcome of this project. I further declare that should a conflict of interest arise in the future during the course of this work, I will fully disclose the circumstances in writing and without delay to Mr. Sajid Barlas, erring on the side of caution.

1 of 2

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals[1], under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

1. Name of Qualified Professional Daryl Sampson

   Title Senior Environmental Technician/Project Manager

2. Are you a registered member of a professional association in B.C.? ☐ Yes ☒ No

   Name of Association: _____ Registration # _____

3. Brief description of professional services:

   Environmental consulting, specializing in air and atmospheric sciences

This declaration of competency is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature: Witnessed by:

x Daryl Sampson x

Print Name: Daryl Sampson Print Name: Louis Agassiz

Date signed: November 23, 2020

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

July 2019

Appendix B - Ash Analysis Report

Your P.O. #: CC
Site Location: Williams Lake Power Plant
Your C.O.C. #: 43160

Attention: Jacob Steyl

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

Report Date: 2022/02/03
Report #: R3129903
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C183281
Received: 2021/10/29, 08:00

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Metals - TCLP	1	2021/11/04	2021/11/04	BBY7SOP-00001	EPA 1311, 6020bR2 m
Moisture	1	2021/11/02	2021/11/02	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Non Routine/Non Validated Matrix Tested (2)	1	N/A	2021/11/01		
PAH in Soil by GC/MS (SIM)	1	2021/11/01	2021/11/02	BBY8SOP-00022	BCMOE BCLM Jul2017m
PAH TEQ Calculation, BC Reg. 132/92 (3)	1	N/A	2021/11/03	BBY WI-00033	Auto Calc
Total PAH and B(a)P Calculation (4)	1	N/A	2021/11/03	BBY WI-00033	Auto Calc
TCLP pH Measurements	1	N/A	2021/11/04	BBY7SOP-00005	EPA 1311
Dioxins/Furans in Soil (1613B) (1, 5)	1	2022/01/14	2022/01/28	BRL SOP-00406 (mod)	EPS 1/RM/23 m
2378TCDF Confirmation (M8290A/M1613) (1)	1	2022/01/13	2022/02/01	BRL SOP-00406	EPA M8290A / M1613

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas 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 Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas 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.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas 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 Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas 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 Bureau Veritas, 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 Bureau Veritas Campobello, 6740 Campobello Road , Mississauga, ON, L5N 2L8
(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.

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Your P.O. #: CC
Site Location: Williams Lake Power Plant
Your C.O.C. #: 43160

Attention: Jacob Steyl

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

Report Date: 2022/02/03
Report #: R3129903
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C183281
Received: 2021/10/29, 08:00

(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
(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) Soils are reported on a dry weight basis unless otherwise specified.

Confirmatory runs for 2,3,7,8-TCDF are performed only if the primary result is greater than the RDL.

Encryption Key

AUTHORIZED REPORT
RAPPORT AUTORISÉ

Bureau Veritas
03 Feb 2022 15:31:54

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Customer Solutions, Western Canada Customer Experience Team
Email: customersolutionswest@bureauveritas.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.

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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

RESULTS OF CHEMICAL ANALYSES OF SOIL

Bureau Veritas ID		AJJ409	
Sampling Date		2021/10/27 14:30	
COC Number		43160	
	UNITS	**Glass Jars (clear) filled with Ash**	**QC Batch**
MISCELLANEOUS			
Sample Matrix	N/A	ASH	ONSITE

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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

PHYSICAL TESTING (SOIL)

Bureau Veritas ID		AJJ409		
Sampling Date		2021/10/27 14:30		
COC Number		43160		
	UNITS	**Glass Jars (clear) filled with Ash**	**RDL**	**QC Batch**
Physical Properties				
Moisture	%	0.70	0.30	A410555
RDL = Reportable Detection Limit				

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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

SEMIVOLATILE ORGANICS BY GC-MS (SOIL)

Bureau Veritas ID		AJJ409		
Sampling Date		2021/10/27 14:30		
COC Number		43160		
	UNITS	Glass Jars (clear) filled with Ash	RDL	QC Batch
Calculated Parameters				
PAH Toxicity Equivalency	mg/kg	0.026	0.020	A409088
RDL = Reportable Detection Limit				

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Bureau Veritas ID		AJJ409	
Sampling Date		2021/10/27 14:30	
COC Number		43160	
	UNITS	Glass Jars (clear) filled with Ash	QC Batch
TCLP Extraction Procedure			
Initial pH of Sample	pH	12.6	A412807
pH after HCl	pH	1.69	A412807
Final pH of Leachate	pH	12.5	A412807
pH of Leaching Fluid	pH	4.90	A412807

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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

SUBCONTRACTED ANALYSIS (SOIL)

Bureau Veritas ID		AJJ409						
Sampling Date		2021/10/27 14:30						
COC Number		43160			TOXIC EQUIVALENCY		# of	
	UNITS	Glass Jars (clear) filled with Ash	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
TCDF Confirmation								
Confirmation 2,3,7,8-Tetra CDF **	pg/g	27.3	0.62	5.0	0.100	2.73		A489523
TOTAL TOXIC EQUIVALENCY	pg/g					2.73		
Surrogate Recovery (%)								
Confirmation C13-2378 TetraCDF **	%	93						A489523

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

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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

DIOXIN AND FURANS BY HRMS (SOIL)

Bureau Veritas ID		AJJ409						
Sampling Date		2021/10/27 14:30						
COC Number		43160			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	<1.40 (1)	1.40	24.9	0.0100	0.0140	0	A489522
1,2,3,4,7,8-Hexa CDD *	pg/g	<0.689 (1)	0.689	24.9	0.100	0.0689	0	A489522
1,2,3,6,7,8-Hexa CDD *	pg/g	0.991	0.477	24.9	0.100	0.0991	1	A489522
1,2,3,7,8,9-Hexa CDD *	pg/g	<1.56 (2)	1.56	24.9	0.100	0.156	0	A489522
1,2,3,7,8-Penta CDD *	pg/g	3.91	0.538	24.9	1.00	3.91	1	A489522
2,3,7,8-Tetra CDD *	pg/g	3.85	0.652	4.98	1.00	3.85	1	A489522
Octa CDD *	pg/g	1.33	0.812	49.8	0.000300	0.000399	1	A489522
Total Hepta CDD *	pg/g	<1.40	1.40	24.9			0	A489522
Total Hexa CDD *	pg/g	9.46	0.484	24.9			4	A489522
Total Penta CDD *	pg/g	26.0	0.538	24.9			7	A489522
Total Tetra CDD *	pg/g	52.3	0.652	4.98			12	A489522
FURANS								
1,2,3,4,6,7,8-Hepta CDF **	pg/g	1.47	0.562	24.9	0.0100	0.0147	1	A489522
1,2,3,4,7,8,9-Hepta CDF **	pg/g	1.34	0.673	24.9	0.0100	0.0134	1	A489522
1,2,3,4,7,8-Hexa CDF **	pg/g	4.32	0.577	24.9	0.100	0.432	1	A489522
1,2,3,6,7,8-Hexa CDF **	pg/g	3.97	0.547	24.9	0.100	0.397	1	A489522
1,2,3,7,8,9-Hexa CDF **	pg/g	8.19	0.694	24.9	0.100	0.819	1	A489522
1,2,3,7,8-Penta CDF **	pg/g	16.9	0.561	24.9	0.0300	0.507	1	A489522
2,3,4,6,7,8-Hexa CDF **	pg/g	<1.44 (1)	1.44	24.9	0.100	0.144	0	A489522
2,3,4,7,8-Penta CDF **	pg/g	12.6	0.506	24.9	0.300	3.78	1	A489522

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
(1) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.
(2) RT>2 seconds - PCDD/DF analysis-Peak maxima of monitored ions exceeds 2 seconds

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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

DIOXIN AND FURANS BY HRMS (SOIL)

Bureau Veritas ID		AJJ409						
Sampling Date		2021/10/27 14:30						
COC Number		43160			TOXIC EQUIVALENCY		# of	
	UNITS	Glass Jars (clear) filled with Ash	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
2,3,7,8-Tetra CDF **	pg/g	61.2	0.505	4.98	0.100	6.12	1	A489522
Octa CDF **	pg/g	<0.816 (1)	0.816	49.8	0.000300	0.000245	0	A489522
Total Hepta CDF **	pg/g	2.81	0.613	24.9			2	A489522
Total Hexa CDF **	pg/g	27.3	0.576	24.9			6	A489522
Total Penta CDF **	pg/g	137	0.532	24.9			14	A489522
Total Tetra CDF **	pg/g	389	0.505	4.98			17	A489522
TOTAL TOXIC EQUIVALENCY	pg/g					20.3		
Surrogate Recovery (%)								
37CL4 2378 Tetra CDD *	%	108						A489522
C13-1234678 HeptaCDD *	%	113						A489522
C13-1234678 HeptaCDF **	%	107						A489522
C13-123478 HexaCDD *	%	122						A489522
C13-123478 HexaCDF **	%	120						A489522
C13-1234789 HeptaCDF **	%	116						A489522
C13-123678 HexaCDD *	%	120						A489522
C13-123678 HexaCDF **	%	117						A489522
C13-12378 PentaCDD *	%	91						A489522
C13-12378 PentaCDF **	%	86						A489522
C13-123789 HexaCDF **	%	119						A489522
C13-234678 HexaCDF **	%	131						A489522
C13-23478 PentaCDF **	%	90						A489522
C13-2378 TetraCDD *	%	93						A489522
C13-2378 TetraCDF **	%	95						A489522
C13-OCDD *	%	88						A489522

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

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

TCLP METALS (SOIL)

Bureau Veritas ID		AJJ409		
Sampling Date		2021/10/27 14:30		
COC Number		43160		
	UNITS	Glass Jars (clear) filled with Ash	RDL	QC Batch
TCLP Extraction Procedure				
Leachate Antimony (Sb)	mg/L	<0.10	0.10	A414333
Leachate Arsenic (As)	mg/L	<0.10	0.10	A414333
Leachate Barium (Ba)	mg/L	2.50	0.10	A414333
Leachate Beryllium (Be)	mg/L	<0.10	0.10	A414333
Leachate Boron (B)	mg/L	<0.10	0.10	A414333
Leachate Cadmium (Cd)	mg/L	<0.10	0.10	A414333
Leachate Chromium (Cr)	mg/L	<0.10	0.10	A414333
Leachate Cobalt (Co)	mg/L	<0.10	0.10	A414333
Leachate Copper (Cu)	mg/L	<0.10	0.10	A414333
Leachate Iron (Fe)	mg/L	<0.50	0.50	A414333
Leachate Lead (Pb)	mg/L	<0.10	0.10	A414333
Leachate Mercury (Hg)	mg/L	<0.0020	0.0020	A414333
Leachate Molybdenum (Mo)	mg/L	<0.10	0.10	A414333
Leachate Nickel (Ni)	mg/L	<0.10	0.10	A414333
Leachate Selenium (Se)	mg/L	<0.10	0.10	A414333
Leachate Silver (Ag)	mg/L	<0.010	0.010	A414333
Leachate Thallium (Tl)	mg/L	<0.10	0.10	A414333
Leachate Uranium (U)	mg/L	<0.10	0.10	A414333
Leachate Vanadium (V)	mg/L	<0.10	0.10	A414333
Leachate Zinc (Zn)	mg/L	<0.10	0.10	A414333
Leachate Zirconium (Zr)	mg/L	<0.10	0.10	A414333
RDL = Reportable Detection Limit				

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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

CSR PAH IN SOIL BY GC-MS (SOIL)

Bureau Veritas ID		AJJ409		
Sampling Date		2021/10/27 14:30		
COC Number		43160		
	UNITS	**Glass Jars (clear) filled with Ash**	**RDL**	**QC Batch**
Calculated Parameters				
Low Molecular Weight PAH`s	mg/kg	<0.050	0.050	A406709
High Molecular Weight PAH`s	mg/kg	<0.050	0.050	A406709
Total PAH	mg/kg	<0.050	0.050	A406709
B[a]P TPE Total Potency Equivalents	mg/kg	0.024	0.010	A406709
Polycyclic Aromatics				
Naphthalene	mg/kg	<0.010	0.010	A411449
2-Methylnaphthalene	mg/kg	<0.020	0.020	A411449
Acenaphthylene	mg/kg	<0.0050	0.0050	A411449
Acenaphthene	mg/kg	<0.0050	0.0050	A411449
Fluorene	mg/kg	<0.020	0.020	A411449
Phenanthrene	mg/kg	<0.010	0.010	A411449
Anthracene	mg/kg	<0.0040	0.0040	A411449
Fluoranthene	mg/kg	<0.020	0.020	A411449
Pyrene	mg/kg	<0.020	0.020	A411449
Benzo(a)anthracene	mg/kg	<0.020	0.020	A411449
Chrysene	mg/kg	<0.020	0.020	A411449
Benzo(b&j)fluoranthene	mg/kg	<0.020	0.020	A411449
Benzo(b)fluoranthene	mg/kg	<0.020	0.020	A411449
Benzo(k)fluoranthene	mg/kg	<0.020	0.020	A411449
Benzo(a)pyrene	mg/kg	<0.020	0.020	A411449
Indeno(1,2,3-cd)pyrene	mg/kg	<0.020	0.020	A411449
Dibenz(a,h)anthracene	mg/kg	<0.020	0.020	A411449
Benzo(g,h,i)perylene	mg/kg	<0.050	0.050	A411449
Surrogate Recovery (%)				
D10-ANTHRACENE (sur.)	%	0 (1)		A411449
D8-ACENAPHTHYLENE (sur.)	%	0 (1)		A411449
D8-NAPHTHALENE (sur.)	%	0 (1)		A411449
TERPHENYL-D14 (sur.)	%	0 (1)		A411449

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

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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

GENERAL COMMENTS

Sample AJJ409 [Glass Jars (clear) filled with Ash] : Non-routine matrix analyzed with client consent for PAH on batch: A411449. Please refer to BBY PDF -00149.

Results relate only to the items tested.

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Bureau Veritas Job #: C183281
Report Date: 2022/02/03

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
A410555	JUS	Method Blank	Moisture	2021/11/02	<0.30		%	
A410555	JUS	RPD [AJJ409-01]	Moisture	2021/11/02	15		%	20
A411449	RW4	Matrix Spike	D10-ANTHRACENE (sur.)	2021/11/02		87	%	50 - 140
			D8-ACENAPHTHYLENE (sur.)	2021/11/02		86	%	50 - 140
			D8-NAPHTHALENE (sur.)	2021/11/02		94	%	50 - 140
			TERPHENYL-D14 (sur.)	2021/11/02		86	%	50 - 140
			Naphthalene	2021/11/02		90	%	50 - 140
			2-Methylnaphthalene	2021/11/02		88	%	50 - 140
			Acenaphthylene	2021/11/02		81	%	50 - 140
			Acenaphthene	2021/11/02		82	%	50 - 140
			Fluorene	2021/11/02		86	%	50 - 140
			Phenanthrene	2021/11/02		79	%	50 - 140
			Anthracene	2021/11/02		78	%	50 - 140
			Fluoranthene	2021/11/02		80	%	50 - 140
			Pyrene	2021/11/02		81	%	50 - 140
			Benzo(a)anthracene	2021/11/02		78	%	50 - 140
			Chrysene	2021/11/02		76	%	50 - 140
			Benzo(b&j)fluoranthene	2021/11/02		77	%	50 - 140
			Benzo(b)fluoranthene	2021/11/02		76	%	50 - 140
			Benzo(k)fluoranthene	2021/11/02		77	%	50 - 140
			Benzo(a)pyrene	2021/11/02		78	%	50 - 140
			Indeno(1,2,3-cd)pyrene	2021/11/02		85	%	50 - 140
			Dibenz(a,h)anthracene	2021/11/02		84	%	50 - 140
			Benzo(g,h,i)perylene	2021/11/02		81	%	50 - 140
A411449	RW4	Spiked Blank	D10-ANTHRACENE (sur.)	2021/11/02		86	%	50 - 140
			D8-ACENAPHTHYLENE (sur.)	2021/11/02		87	%	50 - 140
			D8-NAPHTHALENE (sur.)	2021/11/02		94	%	50 - 140
			TERPHENYL-D14 (sur.)	2021/11/02		89	%	50 - 140
			Naphthalene	2021/11/02		88	%	50 - 140
			2-Methylnaphthalene	2021/11/02		85	%	50 - 140
			Acenaphthylene	2021/11/02		78	%	50 - 140
			Acenaphthene	2021/11/02		80	%	50 - 140
			Fluorene	2021/11/02		84	%	50 - 140
			Phenanthrene	2021/11/02		76	%	50 - 140
			Anthracene	2021/11/02		74	%	50 - 140
			Fluoranthene	2021/11/02		80	%	50 - 140
			Pyrene	2021/11/02		80	%	50 - 140
			Benzo(a)anthracene	2021/11/02		73	%	50 - 140
			Chrysene	2021/11/02		72	%	50 - 140
			Benzo(b&j)fluoranthene	2021/11/02		72	%	50 - 140
			Benzo(b)fluoranthene	2021/11/02		72	%	50 - 140
			Benzo(k)fluoranthene	2021/11/02		73	%	50 - 140
			Benzo(a)pyrene	2021/11/02		73	%	50 - 140
			Indeno(1,2,3-cd)pyrene	2021/11/02		80	%	50 - 140
			Dibenz(a,h)anthracene	2021/11/02		78	%	50 - 140
			Benzo(g,h,i)perylene	2021/11/02		76	%	50 - 140
A411449	RW4	Method Blank	D10-ANTHRACENE (sur.)	2021/11/02		89	%	50 - 140
			D8-ACENAPHTHYLENE (sur.)	2021/11/02		86	%	50 - 140
			D8-NAPHTHALENE (sur.)	2021/11/02		97	%	50 - 140
			TERPHENYL-D14 (sur.)	2021/11/02		88	%	50 - 140
			Naphthalene	2021/11/02	<0.010		mg/kg	
			2-Methylnaphthalene	2021/11/02	<0.020		mg/kg	
			Acenaphthylene	2021/11/02	<0.0050		mg/kg	
			Acenaphthene	2021/11/02	<0.0050		mg/kg	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Fluorene	2021/11/02	<0.020		mg/kg	
			Phenanthrene	2021/11/02	<0.010		mg/kg	
			Anthracene	2021/11/02	<0.0040		mg/kg	
			Fluoranthene	2021/11/02	<0.020		mg/kg	
			Pyrene	2021/11/02	<0.020		mg/kg	
			Benzo(a)anthracene	2021/11/02	<0.020		mg/kg	
			Chrysene	2021/11/02	<0.020		mg/kg	
			Benzo(b&j)fluoranthene	2021/11/02	<0.020		mg/kg	
			Benzo(b)fluoranthene	2021/11/02	<0.020		mg/kg	
			Benzo(k)fluoranthene	2021/11/02	<0.020		mg/kg	
			Benzo(a)pyrene	2021/11/02	<0.020		mg/kg	
			Indeno(1,2,3-cd)pyrene	2021/11/02	<0.020		mg/kg	
			Dibenz(a,h)anthracene	2021/11/02	<0.020		mg/kg	
			Benzo(g,h,i)perylene	2021/11/02	<0.050		mg/kg	
A411449	RW4	RPD	Naphthalene	2021/11/02	NC		%	50
			2-Methylnaphthalene	2021/11/02	NC		%	50
			Acenaphthylene	2021/11/02	NC		%	50
			Acenaphthene	2021/11/02	NC		%	50
			Fluorene	2021/11/02	NC		%	50
			Phenanthrene	2021/11/02	NC		%	50
			Anthracene	2021/11/02	NC		%	50
			Fluoranthene	2021/11/02	NC		%	50
			Pyrene	2021/11/02	NC		%	50
			Benzo(a)anthracene	2021/11/02	NC		%	50
			Chrysene	2021/11/02	NC		%	50
			Benzo(b&j)fluoranthene	2021/11/02	NC		%	50
			Benzo(b)fluoranthene	2021/11/02	NC		%	50
			Benzo(k)fluoranthene	2021/11/02	NC		%	50
			Benzo(a)pyrene	2021/11/02	NC		%	50
			Indeno(1,2,3-cd)pyrene	2021/11/02	NC		%	50
			Dibenz(a,h)anthracene	2021/11/02	NC		%	50
			Benzo(g,h,i)perylene	2021/11/02	NC		%	50
A412807	ERE	Method Blank	Initial pH of Sample	2021/11/04	4.90		pH	
			Final pH of Leachate	2021/11/04	4.88		pH	
			pH of Leaching Fluid	2021/11/04	4.90		pH	
A412807	ERE	RPD	Initial pH of Sample	2021/11/04	0.21		%	N/A
			pH after HCl	2021/11/04	0		%	N/A
			Final pH of Leachate	2021/11/04	0.21		%	N/A
			pH of Leaching Fluid	2021/11/04	0		%	N/A
A414333	JBN	Spiked Blank	Leachate Antimony (Sb)	2021/11/04		109	%	75 - 125
			Leachate Arsenic (As)	2021/11/04		106	%	75 - 125
			Leachate Barium (Ba)	2021/11/04		106	%	75 - 125
			Leachate Beryllium (Be)	2021/11/04		103	%	75 - 125
			Leachate Boron (B)	2021/11/04		103	%	75 - 125
			Leachate Cadmium (Cd)	2021/11/04		100	%	75 - 125
			Leachate Chromium (Cr)	2021/11/04		101	%	75 - 125
			Leachate Cobalt (Co)	2021/11/04		104	%	75 - 125
			Leachate Copper (Cu)	2021/11/04		100	%	75 - 125
			Leachate Iron (Fe)	2021/11/04		100	%	75 - 125
			Leachate Lead (Pb)	2021/11/04		103	%	75 - 125
			Leachate Mercury (Hg)	2021/11/04		99	%	75 - 125
			Leachate Molybdenum (Mo)	2021/11/04		105	%	75 - 125
			Leachate Nickel (Ni)	2021/11/04		99	%	75 - 125
			Leachate Selenium (Se)	2021/11/04		103	%	75 - 125

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Leachate Silver (Ag)	2021/11/04		98	%	75 - 125
			Leachate Thallium (Tl)	2021/11/04		101	%	75 - 125
			Leachate Uranium (U)	2021/11/04		101	%	75 - 125
			Leachate Vanadium (V)	2021/11/04		103	%	75 - 125
			Leachate Zinc (Zn)	2021/11/04		99	%	75 - 125
			Leachate Zirconium (Zr)	2021/11/04		114	%	75 - 125
A414333	JBN	Method Blank	Leachate Antimony (Sb)	2021/11/04	<0.10		mg/L	
			Leachate Arsenic (As)	2021/11/04	<0.10		mg/L	
			Leachate Barium (Ba)	2021/11/04	<0.10		mg/L	
			Leachate Beryllium (Be)	2021/11/04	<0.10		mg/L	
			Leachate Boron (B)	2021/11/04	<0.10		mg/L	
			Leachate Cadmium (Cd)	2021/11/04	<0.10		mg/L	
			Leachate Chromium (Cr)	2021/11/04	<0.10		mg/L	
			Leachate Cobalt (Co)	2021/11/04	<0.10		mg/L	
			Leachate Copper (Cu)	2021/11/04	<0.10		mg/L	
			Leachate Iron (Fe)	2021/11/04	<0.50		mg/L	
			Leachate Lead (Pb)	2021/11/04	<0.10		mg/L	
			Leachate Mercury (Hg)	2021/11/04	<0.0020		mg/L	
			Leachate Molybdenum (Mo)	2021/11/04	<0.10		mg/L	
			Leachate Nickel (Ni)	2021/11/04	<0.10		mg/L	
			Leachate Selenium (Se)	2021/11/04	<0.10		mg/L	
			Leachate Silver (Ag)	2021/11/04	<0.010		mg/L	
			Leachate Thallium (Tl)	2021/11/04	<0.10		mg/L	
			Leachate Uranium (U)	2021/11/04	<0.10		mg/L	
			Leachate Vanadium (V)	2021/11/04	<0.10		mg/L	
			Leachate Zinc (Zn)	2021/11/04	<0.10		mg/L	
			Leachate Zirconium (Zr)	2021/11/04	<0.10		mg/L	
A489522	éGP	Matrix Spike [AJJ409-02]	37CL4 2378 Tetra CDD	2022/01/28		99	%	35 - 197
			C13-123478 HexaCDD	2022/01/28		113	%	32 - 141
			C13-123478 HexaCDF	2022/01/28		104	%	26 - 152
			C13-1234789 HeptaCDF	2022/01/28		86	%	26 - 138
			C13-123789 HexaCDF	2022/01/28		103	%	29 - 147
			C13-234678 HexaCDF	2022/01/28		118	%	28 - 136
			C13-23478 PentaCDF	2022/01/28		85	%	21 - 178
			C13-1234678 HeptaCDD	2022/01/28		93	%	23 - 140
			C13-1234678 HeptaCDF	2022/01/28		82	%	28 - 143
			C13-123678 HexaCDD	2022/01/28		106	%	28 - 130
			C13-123678 HexaCDF	2022/01/28		101	%	26 - 123
			C13-12378 PentaCDD	2022/01/28		91	%	25 - 181
			C13-12378 PentaCDF	2022/01/28		81	%	24 - 185
			C13-2378 TetraCDD	2022/01/28		86	%	25 - 164
			C13-2378 TetraCDF	2022/01/28		84	%	24 - 169
			C13-OCDD	2022/01/28		84	%	17 - 157
			1,2,3,4,6,7,8-Hepta CDD	2022/01/28		95	%	70 - 140
			1,2,3,4,7,8-Hexa CDD	2022/01/28		103	%	70 - 164
			1,2,3,6,7,8-Hexa CDD	2022/01/28		105	%	76 - 134
			1,2,3,7,8,9-Hexa CDD	2022/01/28		87	%	64 - 162
			1,2,3,7,8-Penta CDD	2022/01/28		101	%	25 - 181
			2,3,7,8-Tetra CDD	2022/01/28		89	%	67 - 158
			Octa CDD	2022/01/28		106	%	78 - 144
			1,2,3,4,6,7,8-Hepta CDF	2022/01/28		90	%	82 - 122
			1,2,3,4,7,8,9-Hepta CDF	2022/01/28		88	%	78 - 138
			1,2,3,4,7,8-Hexa CDF	2022/01/28		97	%	72 - 134
			1,2,3,6,7,8-Hexa CDF	2022/01/28		98	%	84 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			1,2,3,7,8,9-Hexa CDF	2022/01/28		94	%	78 - 130
			1,2,3,7,8-Penta CDF	2022/01/28		105	%	80 - 134
			2,3,4,6,7,8-Hexa CDF	2022/01/28		88	%	70 - 156
			2,3,4,7,8-Penta CDF	2022/01/28		106	%	68 - 160
			2,3,7,8-Tetra CDF	2022/01/28		87	%	75 - 158
			Octa CDF	2022/01/28		96	%	63 - 170
A489522	éGP	Spiked Blank	37CL4 2378 Tetra CDD	2022/01/28		103	%	35 - 197
			C13-123478 HexaCDD	2022/01/28		106	%	32 - 141
			C13-123478 HexaCDF	2022/01/28		104	%	26 - 152
			C13-1234789 HeptaCDF	2022/01/28		85	%	26 - 138
			C13-123789 HexaCDF	2022/01/28		103	%	29 - 147
			C13-234678 HexaCDF	2022/01/28		117	%	28 - 136
			C13-23478 PentaCDF	2022/01/28		84	%	21 - 178
			C13-1234678 HeptaCDD	2022/01/28		90	%	23 - 140
			C13-1234678 HeptaCDF	2022/01/28		82	%	28 - 143
			C13-123678 HexaCDD	2022/01/28		113	%	28 - 130
			C13-123678 HexaCDF	2022/01/28		99	%	26 - 123
			C13-12378 PentaCDD	2022/01/28		88	%	25 - 181
			C13-12378 PentaCDF	2022/01/28		82	%	24 - 185
			C13-2378 TetraCDD	2022/01/28		86	%	25 - 164
			C13-2378 TetraCDF	2022/01/28		84	%	24 - 169
			C13-OCDD	2022/01/28		81	%	17 - 157
			1,2,3,4,6,7,8-Hepta CDD	2022/01/28		96	%	70 - 140
			1,2,3,4,7,8-Hexa CDD	2022/01/28		103	%	70 - 164
			1,2,3,6,7,8-Hexa CDD	2022/01/28		106	%	76 - 134
			1,2,3,7,8,9-Hexa CDD	2022/01/28		85	%	64 - 162
			1,2,3,7,8-Penta CDD	2022/01/28		103	%	25 - 181
			2,3,7,8-Tetra CDD	2022/01/28		88	%	67 - 158
			Octa CDD	2022/01/28		103	%	78 - 144
			1,2,3,4,6,7,8-Hepta CDF	2022/01/28		91	%	82 - 122
			1,2,3,4,7,8,9-Hepta CDF	2022/01/28		87	%	78 - 138
			1,2,3,4,7,8-Hexa CDF	2022/01/28		97	%	72 - 134
			1,2,3,6,7,8-Hexa CDF	2022/01/28		99	%	84 - 130
			1,2,3,7,8,9-Hexa CDF	2022/01/28		96	%	78 - 130
			1,2,3,7,8-Penta CDF	2022/01/28		106	%	80 - 134
			2,3,4,6,7,8-Hexa CDF	2022/01/28		87	%	70 - 156
			2,3,4,7,8-Penta CDF	2022/01/28		105	%	68 - 160
			2,3,7,8-Tetra CDF	2022/01/28		93	%	75 - 158
			Octa CDF	2022/01/28		95	%	63 - 170
A489522	éGP	RPD	1,2,3,4,6,7,8-Hepta CDD	2022/01/28	1.0		%	25
			1,2,3,4,7,8-Hexa CDD	2022/01/28	6.0		%	25
			1,2,3,6,7,8-Hexa CDD	2022/01/28	3.7		%	25
			1,2,3,7,8,9-Hexa CDD	2022/01/28	3.5		%	25
			1,2,3,7,8-Penta CDD	2022/01/28	0.98		%	25
			2,3,7,8-Tetra CDD	2022/01/28	0		%	25
			Octa CDD	2022/01/28	1.9		%	25
			1,2,3,4,6,7,8-Hepta CDF	2022/01/28	2.2		%	25
			1,2,3,4,7,8,9-Hepta CDF	2022/01/28	1.2		%	25
			1,2,3,4,7,8-Hexa CDF	2022/01/28	2.0		%	25
			1,2,3,6,7,8-Hexa CDF	2022/01/28	1.0		%	25
			1,2,3,7,8,9-Hexa CDF	2022/01/28	1.0		%	25
			1,2,3,7,8-Penta CDF	2022/01/28	0.95		%	25
			2,3,4,6,7,8-Hexa CDF	2022/01/28	1.2		%	25
			2,3,4,7,8-Penta CDF	2022/01/28	0		%	25

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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			2,3,7,8-Tetra CDF	2022/01/28	5.2		%	25
			Octa CDF	2022/01/28	1.1		%	25
A489522	éGP	Method Blank	37CL4 2378 Tetra CDD	2022/01/28		98	%	35 - 197
			C13-123478 HexaCDD	2022/01/28		103	%	32 - 141
			C13-123478 HexaCDF	2022/01/28		102	%	26 - 152
			C13-1234789 HeptaCDF	2022/01/28		86	%	26 - 138
			C13-123789 HexaCDF	2022/01/28		98	%	29 - 147
			C13-234678 HexaCDF	2022/01/28		114	%	28 - 136
			C13-23478 PentaCDF	2022/01/28		80	%	21 - 178
			C13-1234678 HeptaCDD	2022/01/28		90	%	23 - 140
			C13-1234678 HeptaCDF	2022/01/28		81	%	28 - 143
			C13-123678 HexaCDD	2022/01/28		107	%	28 - 130
			C13-123678 HexaCDF	2022/01/28		97	%	26 - 123
			C13-12378 PentaCDD	2022/01/28		84	%	25 - 181
			C13-12378 PentaCDF	2022/01/28		78	%	24 - 185
			C13-2378 TetraCDD	2022/01/28		80	%	25 - 164
			C13-2378 TetraCDF	2022/01/28		78	%	24 - 169
			C13-OCDD	2022/01/28		83	%	17 - 157
			1,2,3,4,6,7,8-Hepta CDD	2022/01/28	<0.620, EDL=0.620		pg/g	
			1,2,3,4,7,8-Hexa CDD	2022/01/28	<0.679, EDL=0.679		pg/g	
			1,2,3,6,7,8-Hexa CDD	2022/01/28	<0.611, EDL=0.611		pg/g	
			1,2,3,7,8,9-Hexa CDD	2022/01/28	<0.628, EDL=0.628		pg/g	
			1,2,3,7,8-Penta CDD	2022/01/28	<0.458, EDL=0.458		pg/g	
			2,3,7,8-Tetra CDD	2022/01/28	<0.580, EDL=0.580		pg/g	
			Octa CDD	2022/01/28	1.70, EDL=0.818		pg/g	
			Total Hepta CDD	2022/01/28	<0.620, EDL=0.620		pg/g	
			Total Hexa CDD	2022/01/28	<0.638, EDL=0.638		pg/g	
			Total Penta CDD	2022/01/28	<0.458, EDL=0.458		pg/g	
			Total Tetra CDD	2022/01/28	<0.580, EDL=0.580		pg/g	
			1,2,3,4,6,7,8-Hepta CDF	2022/01/28	<0.606, EDL=0.606		pg/g	
			1,2,3,4,7,8,9-Hepta CDF	2022/01/28	<0.747, EDL=0.747		pg/g	
			1,2,3,4,7,8-Hexa CDF	2022/01/28	<0.497, EDL=0.497		pg/g	
			1,2,3,6,7,8-Hexa CDF	2022/01/28	<0.489, EDL=0.489		pg/g	
			1,2,3,7,8,9-Hexa CDF	2022/01/28	<0.618, EDL=0.618		pg/g	
			1,2,3,7,8-Penta CDF	2022/01/28	<0.786, EDL=0.786		pg/g	
			2,3,4,6,7,8-Hexa CDF	2022/01/28	<0.434, EDL=0.434		pg/g	

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			2,3,4,7,8-Penta CDF	2022/01/28	<0.580, EDL=0.580		pg/g	
			2,3,7,8-Tetra CDF	2022/01/28	<0.591, EDL=0.591		pg/g	
			Octa CDF	2022/01/28	<0.878, EDL=0.878		pg/g	
			Total Hepta CDF	2022/01/28	<0.670, EDL=0.670		pg/g	
			Total Hexa CDF	2022/01/28	<0.502, EDL=0.502		pg/g	
			Total Penta CDF	2022/01/28	<0.755, EDL=0.755		pg/g	
			Total Tetra CDF	2022/01/28	<0.591, EDL=0.591		pg/g	
A489523	éCP	Method Blank	Confirmation C13-2378 TetraCDF	2022/01/31		105	%	40 - 135
			Confirmation 2,3,7,8-Tetra CDF	2022/01/31	<0.18		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 (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).

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Angel Guerrero, Supervisor, Ultra Trace Analysis, HRMS

Melissa DiGrazia, Supervisor – Environmental Customer Service

Sandy Yuan, M.Sc., QP, Scientific Specialist

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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C183281_COC

Custody Tracking Form

W43160

Please use this form for custody tracking when submitting the work instructions via eCOC (electronic Chain of Custody). Please ensure your form has a barcode or a Bureau Veritas eCOC confirmation number in the top right hand side. This number links your electronic submission to your samples. This form should be placed in the cooler with your samples.

First Sample:	Glass Jars (clear) filled with Ash
Last Sample:	Glass Jars (clear) filled with Ash
Sample Count:	1

Relinquished By				Received By			
Print	Sign			Print	Sign		
Jacob Stegl		Date	2021/10/27	ALFRED NGAI		Date	2021/10/29
		Time (24 HR)	14:56			Time (24 HR)	08:00
		Date				Date	
		Time (24 HR)				Time (24 HR)	
		Date				Date	
		Time (24 HR)				Time (24 HR)	

Unless otherwise agreed to, submissions and use of services are governed by Bureau Veritas' standard terms and conditions which can be found at www.bvna.com.

Triage Information

Sampled By (Print): Jacob Stegl

# of Coolers/Pkgs: 1

Rush ☐ Immediate Test ☐ Food Residue ☐

Micro ☐ Food Chemistry ☐

***** LABORATORY USE ONLY *****

Received At

Labeled By

Verified By

Lab Comments:

Custody Seal		Cooling Media	Temperature °C		
Present (Y/N)	Intact (Y/N)	Present (Y/N)	1	2	3
N	N/A	N	20	20	20
Drinking Water Metals Preservation Check Done (Circle)				YES	NO

COR FCD-00383/3

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eCOC: W43160

Project Information:	C183281
Job Received:	2021/10/29 08:00
Results Required By:	2021/11/05 08:00
Expected Arrival:	2021/10/29 08:00
Submitted By:	Jacob Steyl
Submitted To:	Burnaby ENV: 4606 Canada Way

Invoice Information

Attn: Jacob Steyl
ATLANTIC POWER (WILLIAMS LAKE) LTD.
4465 MACKENZIE AVENUE NORTH
WILLIAMS LAKE , BC , V2G 5E8
Email to:
jsteyl@atlanticpower.com

Report Information

Attn: Jacob Steyl
ATLANTIC POWER (WILLIAMS LAKE) LTD.
4465 MACKENZIE AVENUE NORTH
WILLIAMS LAKE , BC , V2G 5E8
Email to:
jsteyl@atlanticpower.com

Project Information

Quote #:	C10006, B71255
PO/AFE#:	CC
Project #:	
Site Location:	Williams Lake Power Plant

Analytical Summary

A: 2021/11/05 08:00

Client Sample ID	Clnt Ref	Sampling Date/Time	Matrix	#Cont	CSR PAH in Soil by GC-MS	TCLP Metals	Dioxins/Furans in Soil (EPS 1/RM/23)	Moisture	PAH TEQ Calculation, BC Reg. 132/92	TCLP pH Measurements
Glass Jars (clear) filled with Ash	1	2021/10/27 14:30	SOIL	4	A	A	A	A	A	A

Deadlines are estimates only and are subject to change. Please refer to your Job Confirmation report for final due dates.

Submission Information

# of Samples:	1
Details:	Add NONMATRIX code = ASH

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