A.Lanfranco & Associates Inc.
Environmental Consultants

Prepared for

METRO VANCOUVER

Metrotower III
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Waste-to-Energy Facility

Emissions Test Report
Third Quarter 2024 Survey
Operational Certificate 107051

Prepared by Mr. Louis Agassiz

Issued: August 22, 2024

CERTIFICATION

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

The field crew consisted of:

Mr. J. Ching (certified), Mr. L. Agassiz (certified), Mr. J. Gibbs (certified), Mr. D. Sampson (certified), Mr. C. De La O, and Mr B. Lester.

The report was prepared by Mr. L. Agassiz using reporting principles and guidelines generally acceptable to the BC MOE and Metro Vancouver (MV).

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

Report reviewed on August 22, 2024, by:

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Mr. Mark Lanfranco, CST
Principal

TEST PROGRAM ORGANIZATION

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SUMMARY

The following table displays the emission results from the three units located at Metro Vancouver's Waste-To-Energy Facility (WTEF) as well as the current emission limits as defined by the Operational Certificate (OC) issued by BC Ministry of Environment & Climate Change Strategy. This compliance survey represents the third quarter of 2024.

Table 1: Summary Comparison of Emissions Test Results with Limits

Parameter	Limit	Unit 1	Unit 2	Unit 3	Facility Average
Test Date		18-19 July-24	17-18 July-24	16-17 July-24	
Particulate (mg/Sm^3 @ 11% O_2)	**9.0**	1.22	1.12	1.17	**1.17**
Hydrogen Fluoride (mg/Sm^3 @ 11% O_2)	**1.0**	0.036	0.013	0.024	**0.02**
Hexavalent Chromium (mg/Sm^3 @11% O_2**)**	**-**	**-**	**-**	0.00019	**0.00019**
Trace Metals - OC Class (mg/Sm^3 @ 11% O_2)					
Lead (Pb)	**-**	0.0025	0.0006	0.0037	**0.0023**
Arsenic (As)	**-**	0.0010	0.0004	0.0004	**0.0006**
Chromium (Cr)	**-**	0.0008	0.0031	0.0028	**0.0022**
OC Class Sum (Pb, As and Cr)	**0.064**	0.0043	0.0041	0.0069	**0.0051**
Mercury (mg/Sm^3 @ 11% O_2)	**0.02**	0.000055	0.000047	0.000020	**0.00004**
Cadmium (mg/Sm^3 @ 11% O_2)	**0.007**	0.000294	0.000222	0.000115	**0.00021**

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Compared to previous testing in 2024, the results for all three units are slightly higher. The results are within the expected range based on normal operations and the variability observed is not considered significant.

Hexavalent Chromium was measured on Unit 3 this survey and reported in Table 4. These results are similar to historical data and at the analytical reporting limit.

1 INTRODUCTION

Metro Vancouver (MV) commissioned an emission survey at the Waste-To-Energy Facility (WTEF) in Burnaby BC, as required by the provincially approved Operational Certificate (OC). This report documents the results of a survey on Units 1, 2 and 3 for the third survey of four for the year 2024. This survey includes filterable particulate matter, trace metals, mercury (Hg), hydrogen fluoride (HF), hexavalent chromium (Cr^{6+}), volatile organic compounds (VOC), and nitrous oxide (N_2O). A. Lanfranco and Associates Inc. (ALAA), of Surrey, B.C., conducted the sampling program on behalf of MV. The sampling program consisted of, but was not limited to, the planning, execution, analysis, and reporting of three emission sources located at the WTEF.

This report includes a comparison of emission results to limits established in the OC, detailed emission results, a brief outline of methods employed, equipment used, and a discussion of the survey. All supporting data and appendices are presented under separate cover.

The individual sources that were monitored for compliance are identified as Unit 1, Unit 2 and Unit 3 which represent the three distinct processing lines at the WTEF. The three boilers are identified as discharge E300670 in the operational certificate.

Most of the sampling was conducted on July 16-29, 2024. Hexavalent Chromium emission tests were performed on July 22-23, 2024, and N_2O was measured on July 25-26, 2024.

2 METHODOLOGY

All services provided by A. Lanfranco and Associates Inc. were conducted in accordance with approved reference methods as issued by:

- Metro Vancouver (MV)
- BC Ministry of Environment & Climate Change Strategy (BC MOE)
- Environment Canada (EC)
- US Environmental Protection Agency (EPA)

2.1 Sampling and Analytical Methods

The following table lists the test methods used for the different parameters measured. The subsequent paragraphs briefly describe each method.

Table 2: Reference Methods

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)	EPS 1/RM/8 C Determination of Molecular Weight by Gas Analysis
Flue gas Moisture	EPS 1/RM/8 D Determination of Moisture Content
Particulate Matter	EPS 1/RM/8 E Determination of Particulate Matter Emissions from Stationary Sources
Trace Metals with Mercury	EPA Method 29 Determination of Metals Emissions from Stationary Sources
Hydrogen Fluoride (HF)	EPS1/RM/1 Reference Method for Source Testing: Measurement of Releases of Gaseous Hydrogen Chloride from Stationary Sources
Nitrous Oxide (N_2O)	N/A
Ammonia	EPA Method CTM 027 Procedure For Collection and Analysis of Ammonia in Stationary Sources
Volatile Organic Compounds (VOC)	EPA Method TO-15 Determination of Volatile Organic Compounds in Air
Hexavalent Chromium (Cr^{6+})	EPA Method 0061

Sampling Site and Traverse Points

Primary: EPS 1/RM/8 Method A
Supporting: 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.

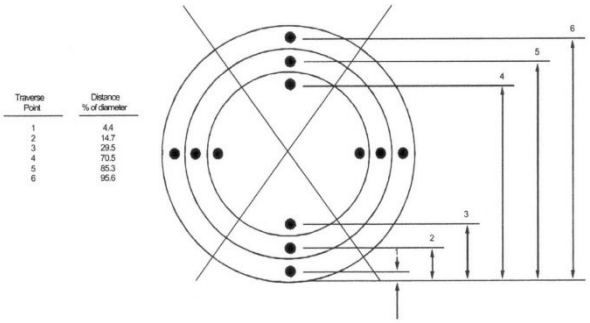

Figure 1: Example showing circular stack cross section divided

Stack Gas Velocity and Volumetric Flow Rate

Primary: EPS 1/RM/8 Method B
Supporting: 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.

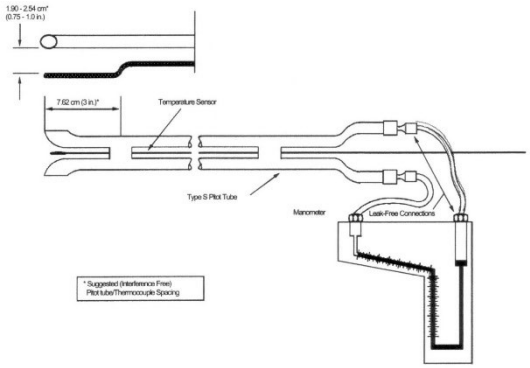

Figure 2: Type S Pitot Tube Manometer Assembly

Molecular Weight by Gas Analysis — Primary: EPS 1/RM/8 Method C; Supporting: EPA Method 3

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: EPS 1/RM/8 Method D; Supporting: 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.

Particulate Matter — Primary: EPS 1/RM/8 Method E; Supporting: EPA Method 5

Particulate matter is withdrawn isokinetically from a number of sampling or traverse points in an enclosed gas stream. The particulate sample is collected in the nozzle, probe, and on a glass fibre filter, all maintained at a temperature of 120 ± 14°C or such other temperature as is necessary to prevent blinding of the filter from condensation. The particulate weight is determined gravimetrically after removal of uncombined water. Simultaneous determinations of the gas stream moisture content, velocity, temperature, and molecular weight allow calculations of the particulate concentration and the particulate mass emission or release rate to be made.

Trace Metal Primary: EPA Method 29 (modified)

This method is used in conjunction with the above Method 5. A stack sample is withdrawn isokinetically from the source. Particulate emissions are collected in the probe and on a heated filter, and gaseous emissions are then collected in an aqueous acidic solution of hydrogen peroxide (analyzed for all metals including Hg) and an aqueous acidic solution of potassium permanganate (analyzed only for Hg). The recovered samples are digested, and appropriate fractions are analyzed for Hg by cold vapour atomic absorption spectroscopy (CVAAS). The remaining trace metals are analyzed with inductively coupled argon plasma emission spectroscopy (ICAP), atomic absorption spectroscopy (AAS) and graphite furnace atomic absorption spectroscopy (GFAAS). Figure 3 displays the sample train and its configuration.

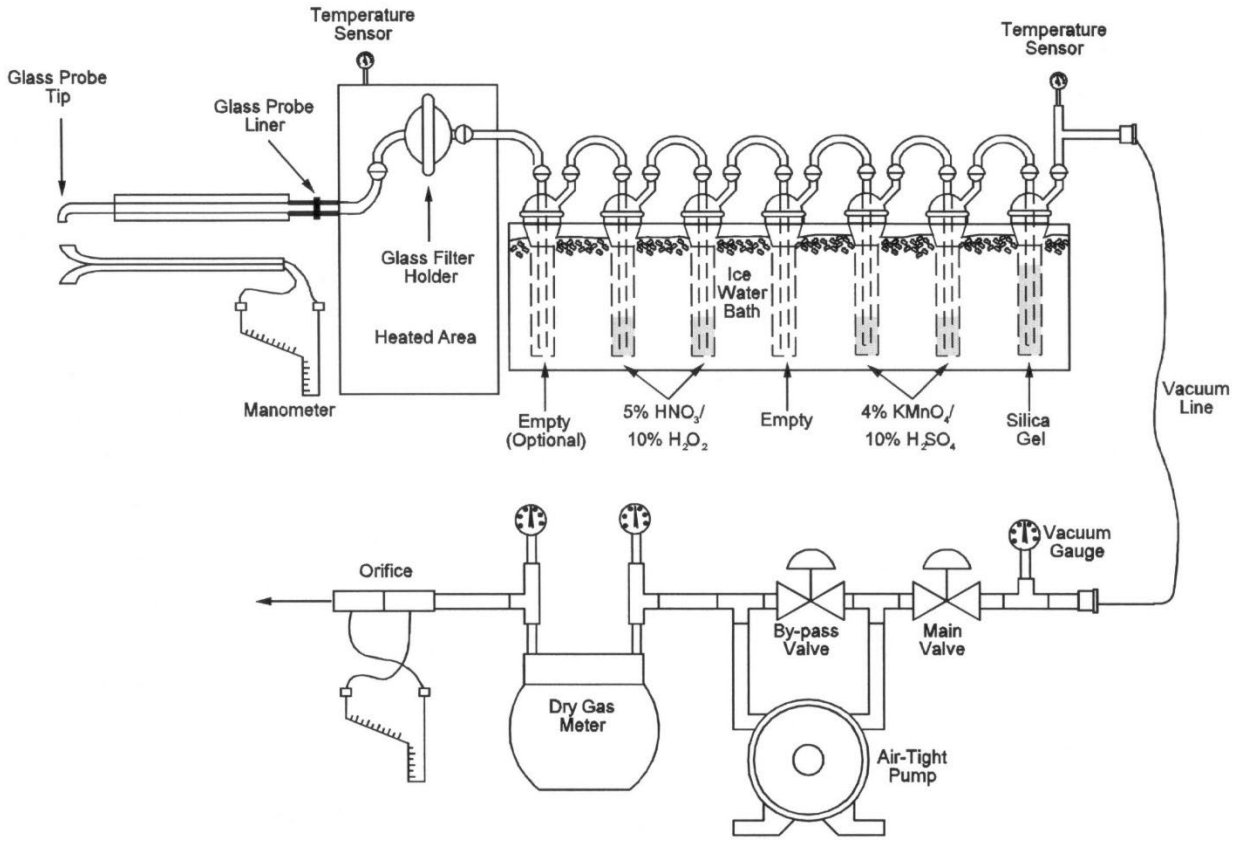

Figure 3: Particulate / Trace Metals Sampling Train

Hydrogen Fluoride Primary: EPS 1/RM/1

Supporting: BC Method 7176106 & 7066101

HF is sampled in a four-impinger train consisting of two impingers containing distilled/deionized H_2O, one empty impinger, and a fourth containing silica gel. A sample of the stack gas is extracted from a single point near the centre of the stack over the sample duration at a constant rate. The collected samples are measured for F by ion chromatography at ALS Environmental in Burnaby, BC.

N_2O Primary: EPA Method 18/in-house

Three N_2O samples were collected from each source into 10L tedlar bags at approximately 0.1 l/min. The bags were immediately transported to Bureau Veritas laboratory for analysis by GC/MS.

Ammonia Primary: EPA Method CTM-027

The absorbing solution in the first two impingers is 0.1 N H_2SO_4 and the triplicate samples were extracted at a constant rate for 60-minute durations. The collected samples are analyzed at Element laboratory in Surrey, BC.

Chromium $^{+6}$ Primary: EPA Method 0061

The Method 0061 sampling train (see Fig. 4) was used to collect samples, where all train components were Teflon or borosilicate glass. A small amount of 0.1 N KOH is re-circulated through the probe and first impinger via peristaltic pump. The impinger components were:

Stack Impingers
150 ml 0.1 N KOH
75 ml 0.1 N KOH
75 ml 0.1 N KOH
Empty
200 silica gel

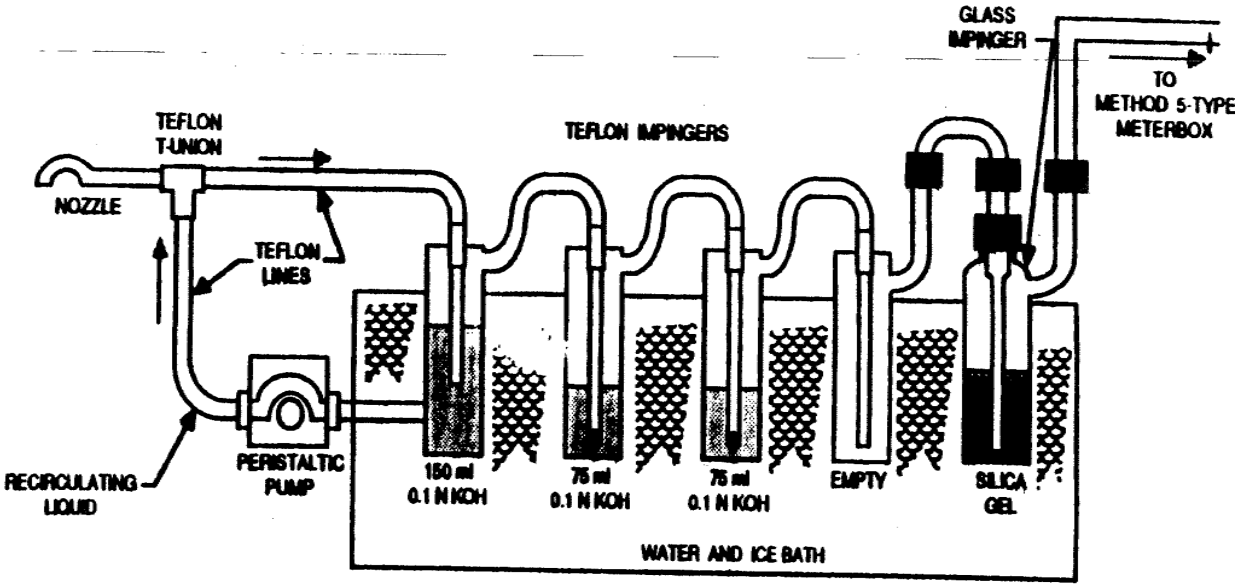

Figure 4: Hexavalent Chromium Sampling Train

Method Modifications

Three minor method modifications were instituted for this work.

1. Reagent blanks for metals trains were made to the same volumes as all samples. In other words, exactly 100 ml of the various reagents used to recover samples was NOT done, as some sample components (probe washing for example) required more than 100 ml to adequately clean and rinse the probe. Instead, sample recovery was conducted with however much rinsing was deemed adequate. In the laboratory, the blanks and samples were made up with the appropriate reagent so that all samples and blanks were the same volume.

2. Filter and residue weighing were not conducted with the six-hour interval technique. Instead, the sample filters and beakers were conditioned with cooling and desiccation and then weighed on two separate laboratory scales after 24 hours. Duplicate or triplicate Blank samples were carried through the gravimetric analysis, and the sample results were adjusted with the Blank data to determine the net filter and probe wash residue weight gain. This is the Environment Canada approved modified approach for weighing probe wash residue.

3. For the purposes of calculating a result, all parameters were given the value of ½ the detection limit when the analysis yielded 'non-detect' results.

All results are expressed using the metric system and corrected to standard conditions of 20 °C and 101.325 kPa, dry gas (unless otherwise noted).

2.2 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 1-11 were used to calculate parameter concentration at standard conditions on a dry basis. Equations 12-26 were used to sample within the 100 ± 10% isokinetic variation and to confirm that sampling meets this isokinetic variation threshold. Equations 27-29 were used to calculate the volumetric flowrate of the stack flue gas.

2.2.1 Parameter Concentration Calculations

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

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

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

$$m_{HF} = \frac{20.006}{18.998}(m_F - m_{blank})/1000 \quad \textbf{Equation 4}$$

$$V_{std} = \frac{V_{std(imp)}}{35.315} \quad \textbf{Equation 5}$$

$$V_{std(imp)} = \frac{V_{samp} \times y \times P_m \times (T_{std} + 459.67)}{P_{std} \times (T_{m(ave)} + 459.67)} \quad \textbf{Equation 6}$$

$$V_{samp} = V_{final} - V_{init} \quad \textbf{Equation 7}$$

$$P_m = P_B + \frac{\Delta H_{ave}}{13.6} \quad \textbf{Equation 8}$$

$$\Delta H_{ave} = \frac{1}{n}\sum_{i=1}^{n} \Delta H_{i(act)}, where\ n = the\ number\ of\ points \quad \textbf{Equation 9}$$

$$OC = \frac{20.9 - \%O_{2c}}{20.9 - \%O_{2m}} \quad \textbf{Equation 10}$$

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

Where,

c	= *Parameter concentration*
m	= *Parameter 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)*
m_{HF}	= *Net mass of HF(mg)*
m_F	= *Net mass of F (µg)*
$V_{std(imp)}$	= *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)*
P_{std}	= *Standard barometric pressure (29.92 inches of Hg)*
ΔH_{ave}	= *Average of individual point orifice pressures (inches of H_2O)*
$\Delta H_{i(act)}$	= *Individual recorded point orifice pressures (inches of H_2O)*
OC	= *Oxygen correction factor (dimensionless)*
$\%O_{2c}$	= *Oxygen concentration to correct to (% dry basis)*
$\%O_{2i}$	= *Individual oxygen measurements (% dry basis)*
$\%O_{2m}$	= *Average measured stack gas oxygen concentration (% dry basis)*

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

For trace metals and Hg, *m* is the blank corrected (Equation 3) analytical result (Appendix 1) for each metals species and run. If the analytical result was below the detection limit, half of the detection limit (DL) was used for *m* in Equation 1.

The HF concentration was calculated from analytic results. Equation 4 was used to convert the F mass to HF, and this result was used as *m* in equation 1. As with the trace metals, half the detection limit was substituted for results that were non-detectable.

2.2.2 Isokinetic Variation Calculations

$$\Delta H_i = \frac{2.62 \times 10^7 \times c_p \times A_n \times (1 - B_{wo}) \times M_D \times (T_m + 459.67) \times \Delta p_i}{k_o \times M_w \times (T_{Stk} + 459.67)} \quad \textbf{Equation 12}$$

$$R_m = 85.49 \times c_p \times \sqrt{\Delta p_i} \times \sqrt{\frac{(T_{stk_i} + 459.67)}{M_w \times P_B}} \times 60 \times A_n \times \frac{(T_{m_i} + 459.67) \times (1 - B_{wo})}{(T_{stk_i} + 459.67) \times y} \quad \textbf{Equation 13}$$

$$A_n = \pi \left(\frac{d_n}{24}\right)^2 \quad \textbf{Equation 14}$$

$$M_w = M_D \times (1 - B_{wo}) + 18 \times B_{wo} \quad \textbf{Equation 15}$$

$$M_D = 0.44 \times \%CO_2 + 0.32 \times \%O_2 + 0.28 \times (100 - \%CO_2 - \%O_2) \quad \textbf{Equation 16}$$

$$T_{Stk} = \frac{1}{n}\sum_{i=1}^{n} T_{Stk_i}, where\ n = the\ number\ of\ points \quad \textbf{Equation 17}$$

$$B_{wo} = \frac{V_{cond}}{V_{cond} + V_{std(imp)}} \quad \textbf{Equation 18}$$

$$V_{cond} = 0.04707 \times V_{gain} \quad \textbf{Equation 19}$$

$$Iso = \frac{1}{n}\sum_{i=1}^{n} Iso_i, where\ n = the\ number\ of\ points \quad \textbf{Equation 20}$$

$$Iso_i = \frac{v_{nzi}}{v_i} \quad \textbf{Equation 21}$$

$$v_i = 85.49 \times c_p \times \sqrt{\Delta p_i} \times \sqrt{\frac{(T_{Stk_i} + 459.67)}{(P_{Stk} \times M_W)}} \quad \textbf{Equation 22}$$

$$v_{nzi} = \frac{(V_i - V_{i-1}) \times y \times (T_{Stk_i} + 459.67) \times (P_B + \frac{\Delta H_{i(act)}}{13.6})}{A_n \times t_i \times 60 \times (T_{m(i)} + 459.67) \times P_{stk} \times (1 - B_{wo})} \quad \textbf{Equation 23}$$

$$P_{stk} = P_B + \frac{P_g}{13.6}$$ **Equation 24**

$$v_{stk} = \frac{1}{n}\sum_{i=1}^{n} v_i \text{ , where } n = \text{the number of points}$$ **Equation 25**

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

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*
T_m = *Average gas meter temperature (°F), second subscript i, indicates individual point measurements*
k_o = *Gas meter calibration constant (dimensionless)*
y = *Gas meter calibration factor (dimensionless)*
$\Delta H_{i(act)}$ = *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_i = *Gas meter reading at individual point(ft^3)*
t_i = *Sample time at each point (minutes)*
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)*

2.2.3 Volumetric Flowrate Calculations

$$Q_S = Q_A \times \frac{(T_{Std} + 459.67)}{(T_{Stk} + 459.67)} \times \frac{P_{Stk}}{P_{Std}}$$ **Equation 27**

$$Q_A = \frac{v_{stk} \times 60 \times A_{stk}}{35.315}$$ **Equation 28**

$$A_{stk} = \pi \left(\frac{d}{24}\right)^2$$ **Equation 29**

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)*

3 DETAILED TEST RESULTS

The results of stack emissions were calculated using a "STACK" computer program developed by A. Lanfranco and Associates for BC MOE requirements.

Tables 3-14 present the detailed results of all emissions parameters tested and operational conditions for each of the units. Additional data and the computer outputs can be found in the accompanying Appendices.

Table 3: Unit 1 Summary of Emission Test Results

Parameter	Run 1	Run 2	Run 3	Average
Test Date - Particulate/Metals	18-Jul-24	18-Jul-24	19-Jul-24	
Test Time - Particulate/Metals	08:31 - 10:34	11:14 - 13:16	08:45 - 10:49	
Duration - Minutes	120	120	120	
Test Date - Acid Gases	18-Jul-24	18-Jul-24	19-Jul-24	
Test Time - Acid Gases	11:18 - 12:18	13:39 - 13:39	09:01 - 10:01	
Duration - Minutes	60	60	60	
Stack Temperature (°C)	151	153	153	152
Average Gas Velocity (m/s)	14.9	15.1	13.8	14.6
Dry Flow Rate (Sm^3/min)	1323	1326	1212	1287
Moisture (Vol. %)	12.6	13.2	13.0	12.9
Oxygen (Vol. %)(dry basis)	10.9	11.2	10.0	10.7
Carbon Dioxide (Vol. %)(dry basis)	9.75	9.70	8.85	9.43
Particulate (mg/Sm^3 @ 11% O_2)	1.02	1.17	1.46	**1.22**
Hydrogen Fluoride (mg/Sm^3 @ 11% O_2)	0.047	0.049	0.011	**0.036**
Ammonia (mg/Sm^3 @ 11% O_2)	3.60	2.09	0.26	**1.98**
Nitrous Oxide (mg/Sm^3 @ 11% O_2)*	9.96	12.36	8.34	**10.22**
Total Hydrocarbons (mg/Sm^3 @ 11% O_2)	4.66	4.49	3.36	**4.17**
Trace Metals - Operational Certificate List (mg/Sm^3 @ 11% O_2)				
OC Class (Pb, As and Cr)	0.00456	0.00484	0.00337	**0.00426**
Aluminum (mg/Sm^3 @ 11% O_2)	0.01178	0.01174	0.01145	0.01166
Cadmium (mg/Sm^3 @ 11% O_2)	0.00031	0.00040	0.00017	0.00029
Lead (mg/Sm^3 @ 11% O_2)	0.00253	0.00244	0.00263	0.00253
Mercury (mg/Sm^3 @ 11% O_2)	0.00005	0.00007	0.00005	0.000055
Phosphorus (mg/Sm^3 @ 11% O_2)	0.00393	0.00587	0.00276	0.00419
Isokinetic Variation (%)	100	104	101	102

*N_2O was sampled on July 26, 2024

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Table 4: Unit 1 Trace Metals Emissions (OC Class)

Metal	Test 1 (mg/m^3 @ 11% O_2)	Test 2 (mg/m^3 @ 11% O_2)	Test 3 (mg/m^3 @ 11% O_2)	Average (mg/m^3 @ 11% O_2)
OC Class				
Pb	0.00253	0.00244	0.00263	0.00253
As	0.00039	0.00211	0.00039	0.00097
Cr	0.00164	0.00029	0.00034	0.00076
Sum of OC Class	0.00456	0.00484	0.00337	0.00426
Other				
Al	0.01178	0.01174	0.01145	0.01166
Cd	0.00031	0.00040	0.00017	0.00029
P	0.00393	0.00587	0.00276	0.00419
Hg	0.00005	0.00007	0.00005	0.00005

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Table 5: Unit 1 Detailed Trace Metals Emissions

Metal	Test 1 (mg/m^3 @ 11% O_2)	Test 2 (mg/m^3 @ 11% O_2)	Test 3 (mg/m^3 @ 11% O_2)	Average (mg/m^3 @ 11% O_2)
Pb	0.00253	0.00244	0.00263	0.00253
Sb	0.00098	0.00244	0.00099	0.00147
Cu	0.00110	0.00059	0.00037	0.00068
Mn	0.00067	0.00010	0.00028	0.00035
V	0.00039	0.00039	0.00039	0.00039
Zn	0.01405	0.01244	0.00960	0.01203
As	0.00039	0.00211	0.00039	0.00097
Cr	0.00164	0.00029	0.00034	0.00076
Co	0.00010	0.00010	0.00010	0.00010
Ni	0.00184	0.00106	0.00253	0.00181
Se	0.00059	0.00059	0.00059	0.00059
Te	0.00079	0.00078	0.00079	0.00079
Tl	0.00059	0.00010	0.00024	0.00031
Cd	0.00031	0.00040	0.00017	0.00029
Hg	0.00005	0.00007	0.00005	0.00005

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Table 6: Unit 1 - Summary of Operating Data

Parameter		Run 1	Run 2	Run 3	Normal
Test Date - Particulate/Metals		18-Jul-24	18-Jul-24	19-Jul-24	
Test Time - Particulate/Metals		08:31 - 10:34	11:14 - 13:16	08:45 - 10:49	
Boiler Steam Production	(kg/hr)	36899	35893	37294	37194
Percentage of normal	(%)	99%	97%	100%	
Boiler Secondary Combustion Zone Temp	(°C)	931	939	983	935
Percentage of normal	(%)	100%	100%	105%	
Rate of refuse fired	(kg/hr)	10394	10111	10505	10477
Percentage of normal	(%)	99%	97%	100%	
Rate of aux. fuel fired (Natural Gas)	m^3/hr	0	0	0	60.1
Percentage of normal (%)	(%)	0%	0%	0%	

*Normal refers to the average operating rate from the previous 30 days

Table 7: Unit 2 Summary of Emission Test Results

Parameter	Run 1	Run 2	Run 3	Average
Test Date - Particulate/Metals	17-Jul-24	17-Jul-24	18-Jul-24	
Test Time - Particulate/Metals	11:24 - 13:26	13:48 - 15:49	09:25 - 11:27	
Duration - Minutes	120	120	120	
Test Date - Acid Gases	17-Jul-24	17-Jul-24	18-Jul-24	
Test Time - Acid Gases	14:16 - 15:16	15:29 - 16:29	08:48 - 09:48	
Duration - Minutes	60	60	60	
Stack Temperature (°C)	150	151	151	151
Average Gas Velocity (m/s)	13.4	14.2	13.5	13.7
Dry Flow Rate (Sm^3/min)	1170	1210	1176	1186
Moisture (Vol. %)	13.6	15.0	13.0	13.9
Oxygen (Vol. %)(dry basis)	10.8	11.5	11.1	11.1
Carbon Dioxide (Vol. %)(dry basis)	8.88	9.35	9.10	9.11
Particulate (mg/Sm^3 @ 11% O_2)	0.84	1.17	1.35	**1.12**
Hydrogen Fluoride (mg/Sm^3 @ 11% O_2)	0.013	0.013	0.012	**0.013**
Ammonia (mg/Sm^3 @ 11% O_2)	1.55	0.19	0.70	**0.81**
Nitrous Oxide (mg/Sm^3 @ 11% O_2)*	7.19	3.27	7.40	**5.95**
Total Hydrocarbons (mg/Sm^3 @ 11% O_2)	3.99	5.68	8.15	**5.94**
Trace Metals - Operational Certificate List (mg/Sm^3 @ 11% O_2)				
OC Class (Pb, As and Cr)	0.00358	0.00446	0.00420	**0.00408**
Aluminum (mg/Sm^3 @ 11% O_2)	0.01460	0.01246	0.00489	0.01065
Cadmium (mg/Sm^3 @ 11% O_2)	0.00012	0.00031	0.00023	0.00022
Lead (mg/Sm^3 @ 11% O_2)	0.00033	0.00058	0.00101	0.00064
Mercury (mg/Sm^3 @ 11% O_2)	0.00005	0.00005	0.00005	0.00005
Phosphorus (mg/Sm^3 @ 11% O_2)	0.00073	0.00156	0.00075	0.00101
Isokinetic Variation (%)	101	102	100	101

*N_2O was sampled on July 25, 2024

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Table 8: Unit 2 Trace Metals Emissions (OC Class)

Metal	Test 1 (mg/m^3 @ 11% O_2)	Test 2 (mg/m^3 @ 11% O_2)	Test 3 (mg/m^3 @ 11% O_2)	Average (mg/m^3 @ 11% O_2)
OC Class				
Pb	0.0003	0.0006	0.0010	0.0006
As	0.0004	0.0004	0.0004	0.0004
Cr	0.0029	0.0035	0.0028	0.0031
Sum of OC Class	0.0036	0.0045	0.0042	0.0041
Other				
Al	0.01460	0.01246	0.00489	0.0106
Cd	0.00012	0.00031	0.00023	0.0002
P	0.00073	0.00156	0.00075	0.0010
Hg	0.00005	0.00005	0.00005	0.0000

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Table 9: Unit 2 Detailed Trace Metals Emissions

Metal	Test 1 (mg/m^3 @ 11% O_2)	Test 2 (mg/m^3 @ 11% O_2)	Test 3 (mg/m^3 @ 11% O_2)	Average (mg/m^3 @ 11% O_2)
Pb	0.00033	0.00058	0.00101	0.00064
Sb	0.00091	0.00097	0.00047	0.00079
Cu	0.00168	0.00067	0.00027	0.00087
Mn	0.00029	0.00031	0.00009	0.00023
V	0.00036	0.00039	0.00038	0.00038
Zn	0.01142	0.02258	0.01165	0.01522
As	0.00036	0.00039	0.00038	0.00038
Cr	0.00289	0.00349	0.00281	0.00306
Co	0.00009	0.00020	0.00009	0.00013
Ni	0.00434	0.00315	0.00353	0.00368
Se	0.00055	0.00228	0.00056	0.00113
Te	0.00073	0.00300	0.00233	0.00202
Tl	0.00305	0.00271	0.00056	0.00211
Cd	0.00012	0.00031	0.00023	0.00022
Hg	0.00005	0.00005	0.00005	0.00005

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Table 10: Unit 2 - Summary of Operating Data

Parameter		Run 1	Run 2	Run 3	Normal
Test Date - Particulate/Metals		17-Jul-24	17-Jul-24	18-Jul-24	
Test Time - Particulate/Metals		11:24 - 13:26	13:48 - 15:49	09:25 - 11:27	
Boiler Steam Production	(kg/hr)	38097	37853	37129	38935
Percentage of normal	(%)	98%	97%	95%	
Boiler Secondary Combustion Zone Temp	(°C)	947	921	916	950
Percentage of normal	(%)	100%	97%	96%	
Rate of refuse fired	(kg/hr)	10732	10663	10459	10968
Percentage of normal	(%)	98%	97%	95%	
Rate of aux. fuel fired (Natural Gas)	m^3/hr	0	0	0	29.4
Percentage of normal (%)	(%)	0%	0%	0%	

*Normal refers to the average operating rate from the previous 30 days

Table 11: Unit 3 Summary of Emission Test Results

Parameter	Run 1	Run 2	Run 3	Average
Test Date - Particulate/Metals	16-Jul-24	17-Jul-24	17-Jul-24	
Test Time - Particulate/Metals	09:22 - 11:25	09:00 - 11:02	11:38 - 13:40	
Duration - Minutes	120	120	120	
Test Date - Acid Gases	17-Jul-24	17-Jul-24	17-Jul-24	
Test Time - Acid Gases	09:42 - 10:42	11:00 - 12:00	12:16 - 13:16	
Duration - Minutes	60	60	60	
Stack Temperature (°C)	159	159	158	159
Average Gas Velocity (m/s)	12.9	13.7	13.1	13.2
Dry Flow Rate (Sm^3/min)	1088	1140	1098	1109
Moisture (Vol. %)	15.7	16.1	15.3	15.7
Oxygen (Vol. %)(dry basis)	10.13	9.50	9.35	9.66
Carbon Dioxide (Vol. %)(dry basis)	10.4	10.9	11.1	10.8
Particulate (mg/Sm^3 @ 11% O_2)	1.19	1.09	1.22	**1.17**
Hydrogen Fluoride (mg/Sm^3 @ 11% O_2)	0.049	0.011	0.011	**0.024**
Ammonia (mg/Sm^3 @ 11% O_2)	1.19	2.80	0.78	**1.59**
Nitrous Oxide (mg/Sm^3 @ 11% O_2)*	10.11	6.84	6.28	**7.74**
Total Hydrocarbons (mg/Sm^3 @ 11% O_2)	3.31	3.87	3.58	**3.59**
Hexavalent Chromium (mg/Sm^3 @11% O_2)**	0.00019	0.00020	0.00019	**0.00019**
Trace Metals - Operational Certificate List (mg/Sm^3 @ 11% O_2)				
OC Class (Pb, As and Cr)	0.00757	0.00519	0.00797	**0.00691**
Aluminum (mg/Sm^3 @ 11% O_2)	0.00181	0.00546	0.00211	0.00312
Cadmium (mg/Sm^3 @ 11% O_2)	0.00012	0.00005	0.00018	0.00012
Lead (mg/Sm^3 @ 11% O_2)	0.00327	0.00236	0.00550	0.00371
Mercury (mg/Sm^3 @ 11% O_2)	0.00002	0.00002	0.00002	0.00002
Phosphorus (mg/Sm^3 @ 11% O_2)	0.00108	0.00312	0.00591	0.00337
Isokinetic Variation (%)	103	103	102	103

*N_2O was sampled on July 25, 2024

**Cr+6 was sampled on July 22-23, 2024

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Table 12: Unit 3 Trace Metals Emissions (OC Class)

Metal	Test 1 (mg/m^3 @ 11% O_2)	Test 2 (mg/m^3 @ 11% O_2)	Test 3 (mg/m^3 @ 11% O_2)	Average (mg/m^3 @ 11% O_2)
OC Class				
Pb	0.00327	0.00236	0.00550	0.00371
As	0.00036	0.00039	0.00042	0.00039
Cr	0.00394	0.00244	0.00204	0.00281
Sum of OC Class	0.00757	0.00519	0.00797	0.00691
Other				
Al	0.00181	0.00546	0.00211	0.0031
Cd	0.00012	0.00005	0.00018	0.0001
P	0.00108	0.00312	0.00591	0.0034
Hg	0.00002	0.00002	0.00002	0.0000

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Table 13: Unit 3 Detailed Trace Metals Emissions

Metal	Test 1 (mg/m^3 @ 11% O_2)	Test 2 (mg/m^3 @ 11% O_2)	Test 3 (mg/m^3 @ 11% O_2)	Average (mg/m^3 @ 11% O_2)
Pb	0.00327	0.00236	0.00550	0.00371
Sb	0.00090	0.00097	0.00053	0.00080
Cu	0.00048	0.00005	0.00011	0.00021
Mn	0.00058	0.00010	0.00011	0.00026
V	0.00036	0.00039	0.00042	0.00039
Zn	0.01666	0.01430	0.01464	0.01520
As	0.00036	0.00039	0.00042	0.00039
Cr	0.00394	0.00244	0.00204	0.00281
Co	0.00033	0.00010	0.00011	0.00018
Ni	0.00687	0.00546	0.00186	0.00473
Se	0.00054	0.00058	0.00063	0.00059
Te	0.00253	0.00222	0.00084	0.00186
Tl	0.00251	0.00058	0.00133	0.00148
Cd	0.00012	0.00005	0.00018	0.00012
Hg	0.00002	0.00002	0.00002	0.00002

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry) unless otherwise noted.

Table 14: Unit 3 - Summary of Operating Data

Parameter		Run 1	Run 2	Run 3	Normal
Test Date - Particulate/Metals		16-Jul-24	17-Jul-24	17-Jul-24	
Test Time - Particulate/Metals		09:22 - 11:25	09:00 - 11:02	11:38 - 13:40	
Boiler Steam Production	(kg/hr)	36117	38464	37145	37067
Percentage of normal	(%)	97%	104%	100%	
Boiler Secondary Combustion Zone Temp	(°C)	905	926	912	927
Percentage of normal	(%)	98%	100%	98%	
Rate of refuse fired	(kg/hr)	10174	10835	10463	10441
Percentage of normal	(%)	97%	104%	100%	
Rate of aux. fuel fired (Natural Gas)	m^3/hr	0	0	0	70.6
Percentage of normal (%)	(%)	0%	0%	0%	

*Normal refers to the average operating rate from the previous 30 days

Parameter		Run 1	Run 2	Run 3	Normal
Test Date - Hexavalent Chromium		22-Jul-24	23-Jul-24	23-Jul-24	
Test Time - Hexavalent Chromium		14:08 - 16:09	09:34 - 11:36	12:17 - 14:14	
Boiler Steam Production	(kg/h)	36060	37728	37759	37181
Percentage of normal	(%)	97%	101%	102%	
Boiler Secondary Combustion Zone Temp	(°C)	903	919	919	925
Percentage of normal	(%)	98%	99%	99%	
Rate of refuse fired	(kg/hr)	10158	10628	10636	10474
Percentage of normal	(%)	97%	101%	102%	
Rate of aux. fuel fired (Natural Gas)	m^3/hr	0	0	0	81.4
Percentage of normal (%)	(%)	0%	0%	0%	

*Normal refers to the average operating rate from the previous 30 days

4 DISCUSSION

All Units are in compliance with limits as set out in the OC.

This survey meets the third quarter requirements and includes the annual test for hexavalent chromium. This year, Unit 3 was chosen for the hexavalent chromium testing.

The survey was delayed one day at the beginning of the week. Typically, N_2O is measured with the trace metals and acid gases; however, due to the time constraints it was pushed back to the following week with the Cr^{+6} and Dioxin testing.

As stated in Section 2.1, EPA Method 5/29 was modified slightly to accommodate performance based analytical protocols utilized in B.C. for trace metals sampling and analysis. The analytical modification consists of using volumes of recovery reagents different than the method stipulates. In order to validate (ie performance-based QA) the modification, sample Blanks and all samples were made up to the same volume, so that subtraction of the Blank data, was done on equivalent sample sizes. In addition, special Hg spiking of blank filters and peroxide solutions was conducted. This spiking is referred to as a “matrix spike” and is reported in Appendix B, Quality Control for mercury, where the recovery of spiked mercury was calculated to be an acceptable 85 to 115%. It should be noted that independent front half/back half analysis of all trace metals was conducted for this survey. In addition, individual quartz filter blanks were analyzed for each unit.

Sampling was conducted in accordance with their respective reference methods (EPA 29 except as discussed) and passed all appropriate quality assurance and quality control criteria. None of the sample points on any of the three units were outside of the allowable +/- 10% for isokinetic rate.

All sampling was conducted/supervised by certified emission testing personnel, using calibrated source sampling equipment and quality-controlled reagents. It is therefore

stated that the survey and this report complies with the MV's WTEF compliance testing requirements for this third survey in 2024.