

Appendix I

Hope Bay Project Incinerator Source Emissions Testing 2019



Incinerator Source Emissions Testing 2019

Final Report

December 20, 2019

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Executive Summary

TMAC Resources Inc. (TMAC) retained Nunami Stantec Limited Partnership (Nunami Stantec) to conduct dioxins and furans and mercury source emissions testing on the waste incinerator currently in operation at the Hope Bay Mine/Mill site in Nunavut. The testing was conducted to assess compliance of the emissions concentrations of mercury and dioxins and furans with the standards set out in the Nunavut Water Board, Water Licence 2AM-DOH1323 Amendment No. 1, Part G-5, and the Government of Nunavut's "Environmental Guideline for the Burning and Incineration of Solid Waste", based on the Canadian Council of Ministers of the Environment (CCME) Canada Wide Standards (CWS). Particulate matter analysis was also completed concurrently with mercury testing.

The source emission testing was conducted during the period of September 15 to September 18, 2019. Source emission testing was completed with the incinerator operating under normal steady state conditions (i.e. after the primary chamber burner ignited and stabilized) for the duration of the sampling period.

The average concentration of particulate matter was 57.2 mg/Rm³, corrected to 11% oxygen. There are no limits specified for particulate matter emissions in the "Guideline for the Burning and Incineration of Solid Waste".

The average concentration of mercury for the three tests was 0.26 µg/Rm³, which is below the CWS/Nunavut stack limit of 20 µg/Rm³, corrected to 11% oxygen.

The average stack concentrations of dioxins and furans was 1.27 ng TEQ/m³ which is above the CWS/Nunavut stack limit of 0.08 ng TEQ/Rm³ (dry, reference conditions of 25°C and 1 atm, corrected to 11% oxygen).

Based on the results of the dioxins and furans testing, it is recommended that TMAC review potential options to reduce these emissions. Options could include:

- Reviewing the incinerator emissions performance with the manufacturer,
- Ensuring manufacturer recommended operational procedures for the incinerator have been implemented and ensuring all operators are adequately trained and,
- Reviewing TMAC's waste segregation practices.

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1.0 INTRODUCTION

TMAC Resources Inc. (TMAC) retained Nunami Stantec Limited Partnership (Nunami Stantec) to conduct mercury and dioxins and furans source emissions testing of one of the waste Incinerator located at the Hope Bay Mine/Mill site. The testing was conducted to assess compliance of the emissions concentrations of mercury, and dioxins and furans with the standards set out in the Nunavut Water Board, Water Licence 2AM-DOH1323 Amendment No. 1, Part G-5, and the Government of Nunavut's "Environmental Guideline for the Burning and Incineration of Solid Waste", based on the Canadian Council of Ministers of the Environment (CCME) Canada Wide Standards (CWS). Particulate matter analysis was also completed concurrently with mercury testing.

The source emission testing was conducted during the period of September 15, 2019 to September 18, 2019. The testing was conducted in accordance with the Environment and Climate Change Canada (ECCC) reference methods EPS 1/RM/2, 1/RM/3, EPS 1/RM/15, and US EPA Method 29.

The source emissions testing campaign and results are outlined in this report in five sections. A brief introduction to the report, including the scope and objectives of the project, is in Section 1. The source emissions testing locations are described in Section 2. The methodology is outlined in Section 3 and results of the source emissions testing program are in Section 4. Closing remarks are in Section 5. Supporting information, field sheets, raw data, calculations and laboratory data are provided in the Appendices.

2.0 SOURCE DESCRIPTION AND SAMPLING LOCATION DETAILS

2.1 INCINERATOR

The process parameters associated with the incinerator are provided in Table 2.1, and the parameters associated with the stacks tested are presented in Table 2.2.

Testing for dioxins and furans, particulate matter and mercury was conducted on the incinerator.

Table 2.1 Process Parameters - Incinerator

Process Parameter	Incinerator
Model ID:	CY-100-CA
Mode of operation	Batch Process 3 cycles per 24 hours @ 4-5 hrs, cool time = 8 hrs
Material feed rate & composition	150-185 kg/batch (food and paper waste)
Supplementary fuel	Diesel, liquefied petroleum gas, natural gas
Normal operating temperatures (°C)	650 (primary chamber), 1000 (secondary chamber)
Process parameters affecting emissions	waste generation and composition
Data verifying operating conditions	Mass of material processed

Table 2.2 Stack Parameters - Incinerators

Stack Parameter	Incinerator
Stack Height - Above Grade (m)	8.9
Stack / Duct Description	Vertical Circular
Stack Diameter (m)	0.508
Number of Sample Ports	2
Sample Port Configuration	2@90°
Sample Port Diameters (m)	0.10
Location Downstream from any Disturbance (m)	6
Location Upstream from any Disturbance (m)	>2
Ideal or Non-ideal	Non-ideal
Sampling Time for DF testing (min)	188
Sampling time for Hg testing (min)	120

Table 2.2 Stack Parameters - Incinerators

Stack Parameter	Incinerator
Total Number of Sample Points	24
Number of Readings per Point	2
Sample Time per Point – DF testing (min)	8
Sample Time per Point – Hg testing (min)	5
Time per Reading – DF testing (min)	4
Time per Reading – Hg testing (min)	2.5
Physical and Chemical Nature of Pollutants	Products of waste combustion and diesel combustion

3.0 STUDY METHODOLOGY

3.1 SCOPE OF WORK AND OVERVIEW OF METHODOLOGY

Nunami Stantec conducted the source emissions testing at the incinerator over the period of September 15 – September 18, 2019. Source emission testing was completed with the incinerator operating under normal steady state conditions (i.e. after the primary chamber burner ignited and stabilized) for the duration of the sampling period.

The testing was conducted in accordance with the ECCC reference methods EPS 1/RM/2 and 1/RM/3 (for dioxins and furans), US EPA Method 29 (for particulate and mercury) and EPS 1/RM/15 (combustion gases). Three replicate tests were conducted for each contaminant from each incinerator exhaust stack. The specific contaminants tested and their associated source emissions testing reference methods used in the campaign are presented in Table 3.1.

Table 3.1 Test Methods

Source	Contaminant	Reference Method	No. of Tests
Incinerator	Velocity Traverse / Flowrate, Molecular Weight, Moisture Content	EPS 1/RM/8 Methods B, C and D	3
	Oxygen (O ₂)	EPS 1/RM/15	3
	Carbon Dioxide (CO ₂)	EPS 1/RM/15	3
	Polychlorinated dibenzo- <i>para</i> -dioxins and Polychlorinated dibenzofurans	EPS 1/RM/2 and 1/RM/3	3
	Total Particulate Matter and Mercury (Hg)	US EPA Method 29	3

The testing methodology and specific work-task breakdown is described in the following subsections.

3.2 TASK 1 – INITIAL PREPARATION

Following award of the contract, Nunami Stantec made initial preparations for the work, including ensuring the preparation of the sampling locations and the ordering of equipment and reagents. Equipment was shipped to site in preparation for the arrival of the source testing crew.

3.3 TASK 2 – ON-SITE SOURCE EMISSIONS TESTING

Source testing was conducted while the process was under normal operation, in accordance with the applicable source testing reference methods. Three repetitions of each test method were completed.

Details of each of the source emissions testing reference methods used as part of the testing campaign are provided in the following subsections.

3.3.1 Preliminary Testing

Upon arrival at the stack sampling location, the source emissions testing equipment was set up and a preliminary survey conducted to measure the average flue gas velocity, moisture content, and flue gas composition in the stack in accordance with the ECCC Reference Method EPS 1/RM/8 Methods B, C, and D entitled “Reference Method for Source Testing: Measurement of Releases of Particulate from Stationary Sources”.

The data from the preliminary survey was used to determine the appropriate nozzle size to conduct isokinetic sampling (where the velocity of the gas entering the nozzle is equal to the gas velocity in the stack) during the source emissions testing, and in calculations for reporting emission rates and concentrations of the sampled contaminants. Verification for cyclonic or reverse flow was also conducted during the preliminary survey, according to procedures outlined in EPS 1/RM/8.

3.3.2 Dioxins and Furans

The emissions of dioxins and furans from the exhaust stacks were measured in accordance with the ECCC reference methods EPS 1/RM/2 and 1/RM/3, entitled “Method for Source Testing: Measurement of Releases Selected Semi-volatile Organic Compounds from Stationary Sources” and “Method for the Analysis of Polychlorinated Dibenzo-Para-Dioxins (PCDDs), Polychlorinated Dibenzofurans (PCDFs), and Polychlorinated Biphenyls (PCBs) in Samples from the Incineration of PCB Waste”, respectively. A schematic of the sampling train is provided in Figure 3-1.

The sampling train has several components which include: a heated sampling probe (a nozzle, glass liner, thermocouple, and pitot tube assembly); a heated sample case containing a filter; an ice box containing a condenser; an XAD-2 solid sorbent trap; a condensate trap; impinger glassware (consisting of 3 impingers); and an umbilical cord leading to the pump and control console. Its operation can be generally described as follows:

- Stack gases are drawn through the probe nozzle at or near isokinetic conditions (where the gas velocity in the nozzle is at the same velocity as the gas in the stack). The gases then flow through the inner liner of the electrically heated sampling probe.
- A pitot tube assembly is located on the probe and next to the nozzle to measure the stack gas velocity in the area of the probe nozzle. Using the differential pressure reading on the control console, the desired nozzle flowrate is determined from the differential pressure across the calibrated orifice.
- The stack gases are drawn from the probe liner through a quartz fibre filter (in the hot side of the sampling train), and then through a condenser to cool the gas prior to contacting the XAD-2 sorbent media. The gas then travels through a condensate trap prior to entering the first pre-weighed impinger (empty). The second impinger contains ethylene glycol, the third is also empty and the fourth impinger contains silica gel. The glassware is placed and operated in an ice bath to cool the gases and condense the moisture in the exhaust gas before the gas enters the umbilical cord.
- The umbilical cord carries the filtered, cooled stack gases from the sampling site to the control console. The control console contains a fibre vane vacuum pump, which is used to draw the stack gases through the sampling train. A calibrated dry gas meter measures the volume of gas sampled.

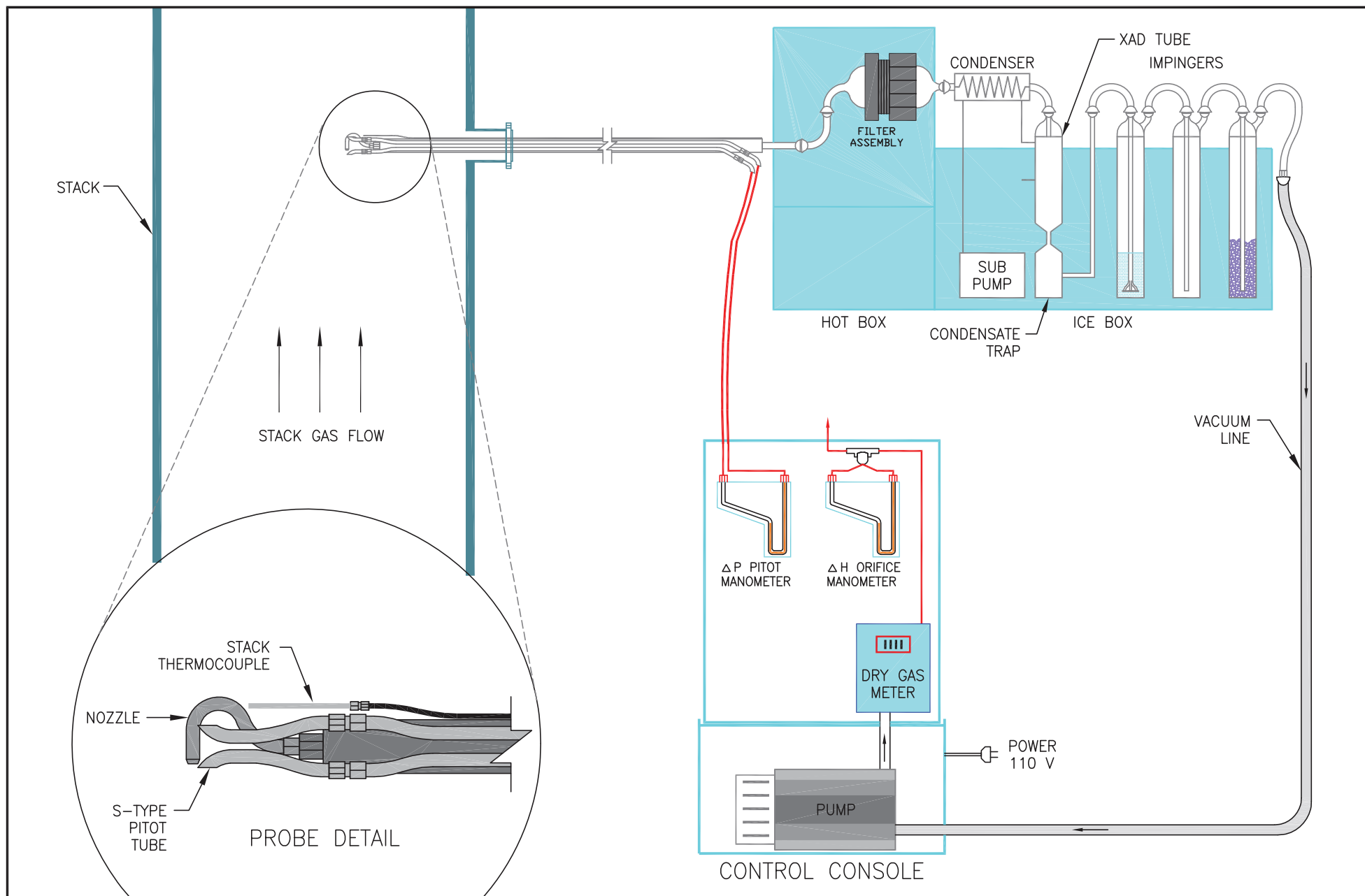
- After the completion of the test, the glassware is re-weighed and the differences in weight are used to calculate the stack gas moisture content. The glassware is rinsed with hexane and acetone, and the rinses are added to the recovered samples prior to being sent to the laboratory for analysis. Front and back half recoveries were combined for analysis.
- A field blank is also recovered onsite to take into account any dioxins and furans that may be present in the atmosphere where the leak checks are being conducted. The total volume of gas that is obtained during the leak pre- and post-leak checks is calculated, and that volume of ambient air is then sampled using a fourth sampling train. This train is then recovered following the same process outlined above and sent to the lab for analysis.

The pre-cleaning and proofing of glassware, preparation of capture solutions, and post-test sample analysis was conducted by ALS Global Laboratories. The laboratory proofing report is provided in Appendix C. The test results for dioxins and furans are expressed as international total equivalent concentrations (I-TEQ).

3.3.3 Particulate Matter/Mercury Testing

Total particulate matter and mercury emissions were determined using concurrent sampling in accordance with US EPA Method 29, entitled *Determination of Metals Emissions from Stationary Sources*. The sampling train, used specifically for isokinetic sampling, is described in detail in US EPA Method 29 and EPS 1/RM/8. Seven impingers were connected in series and contained a variety of reagents to capture trace metals. A schematic of the sampling train is provided in Figure 3-2.

Following testing, the amount of particulate matter present on the filter and in the probe rinse was measured gravimetrically in the laboratory and used in the determination of total particulate matter emissions from the sources tested. The particulate matter samples captured in the probe and filter, and the impinger solutions were analyzed for mercury.

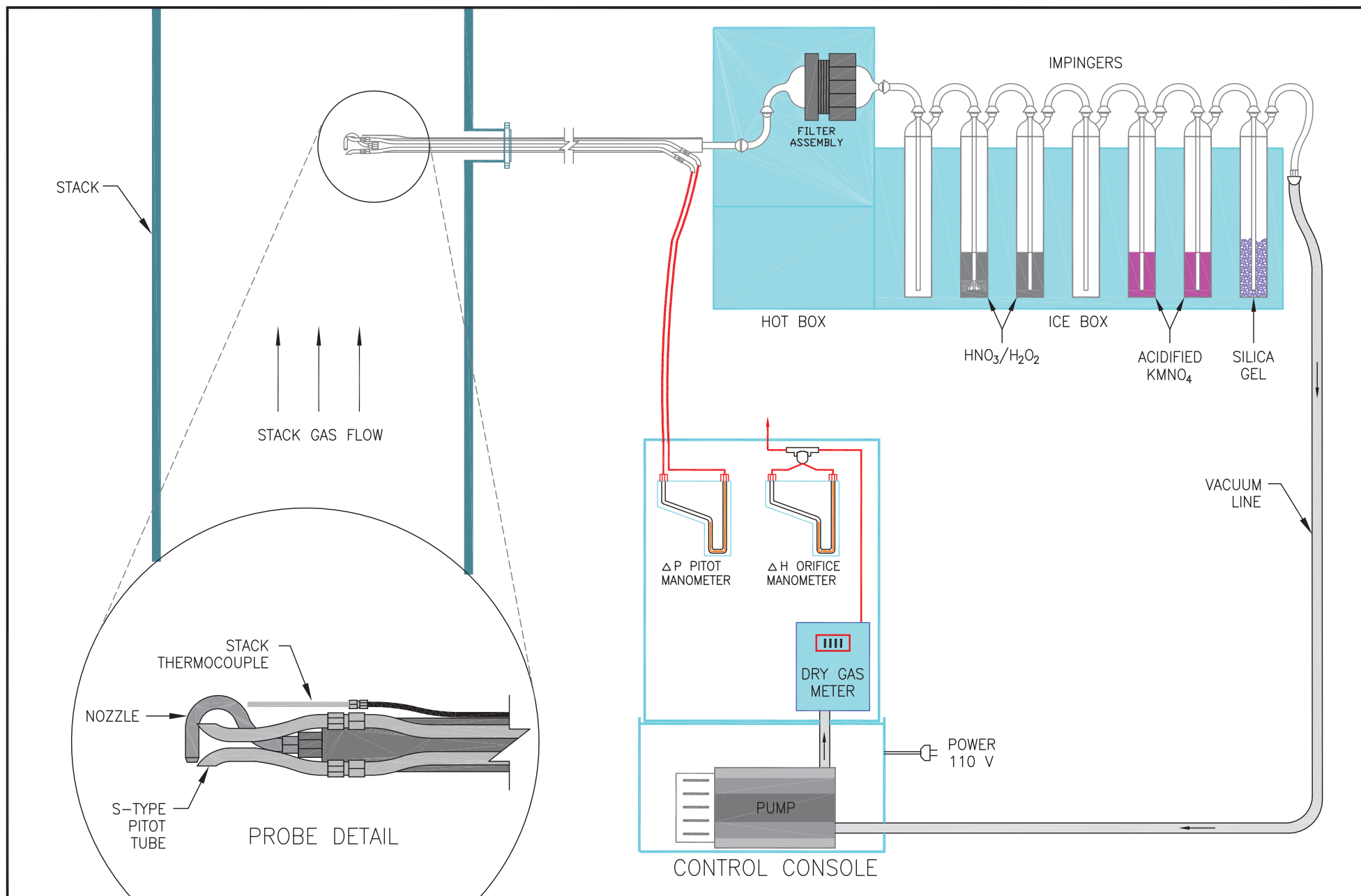


SOURCE EMISSIONS TESTING
EPS 1/RM/2 SAMPLING TRAIN

Scale:

N.T.S.

Fig. No.: 3-1



3.3.4 Combustion Gas Testing

The combustion gases (O_2 , CO_2) were sampled according to the ECCC reference method EPS 1/RM/15, entitled *Reference Method for the Monitoring of Gaseous Emissions from Fossil Fuel-fired Burners*. In this method, samples of flue gas are drawn through a probe, non-isokinetically, from a single point near the centre of the stack.

The combustion gases for the incinerator were analyzed using an Enerac 500 portable Gas Analyzer, manufactured by Enerac Co. This unit is equipped with electrochemical cells that are used to measure the concentrations of oxygen in accordance with EPS 1/RM/15. CO_2 is then calculated based on the oxygen concentrations and the fuel being consumed. This system is equipped with a flue gas probe that has an integrated filter trap and condensate trap and a housing unit that contains the pump and the electrochemical cells.

Calibration data for the Enerac 500 are included in Appendix A.

3.4 TASK 3 - LABORATORY ANALYSIS OF COLLECTED SAMPLES

The recoveries and analyses for dioxins and furans were performed by the ALS Global Laboratories laboratory in Burlington, Ontario, in accordance with the ECCC reference methods EPS 1/RM/2 and 1/RM/3, entitled “Method for Source Testing: Measurement of Releases Selected Semi-volatile Organic Compounds from Stationary Sources” and “Method for the Analysis of Polychlorinated Dibenzo-Para-Dioxins (PCDDs), Polychlorinated Dibenzofurans (PCDFs), and Polychlorinated Biphenyls (PCBs) in Samples from the Incineration of PCB Waste”.

The recoveries and analyses for total particulate matter and mercury were performed by the ALS Global laboratory in Burlington, Ontario, in accordance with the US EPA Method 29, entitled “Determination of Metals Emissions from Stationary Sources”.

ALS Global is accredited by the National Environmental Laboratory Accreditation Program.

Detailed laboratory reports are provided in Appendix C.

3.5 TASK 4 - DATA ANALYSIS AND EMISSION CALCULATIONS

After the source emissions testing work and the laboratory analyses were completed, the Nunami Stantec team reviewed and analyzed the data and calculated the concentrations and emission rates for the contaminants described above. The data and calculations have been subjected to quality assurance and quality control protocols to confirm their accuracy.

3.6 TASK 5 - REPORTING

Following the laboratory and data analysis, the results of the source emissions testing program described above were summarized and described in this report.

Emission concentrations are reported in ng I-TEQ/Rm³ (calculated using the Toxic equivalency factors from the World Health Organization, 2005) for dioxins and furans, corrected to reference conditions (25°C and 101.3 kPa) and the corresponding mass emission rates are reported in pg/s. Concentrations have been corrected to 11% oxygen for comparison with the CWS/Nunavut limits.

3.7 QUALITY ASSURANCE AND QUALITY CONTROL

Throughout the source emissions testing program, quality assurance and quality control procedures were applied to confirm the collection of reliable and accurate emissions data. Quality control checks were performed at several stages during the testing program to confirm the collection of representative samples and the generation of valid results.

The Quality Control (QC) checks included the following:

- use of standardized checklists and field notebooks to confirm completeness, traceability, and comparability of the process information and samples;
- field checking of standardized forms by a second person to confirm accuracy and completeness;
- adherence to sample chain-of-custody procedures;
- testing for cyclonic or reverse flow, as well as stratified flow conditions; and
- leak checks of sampling trains.

Field equipment was calibrated according to the ECCC and US EPA protocols. These calibrations include the following:

Pitot tubes: Calibrated in a wind tunnel with probe and nozzles attached.

Gas meters: Calibrated using a critical orifice calibration set.

Nozzle: Four diameter measurements made using a micrometer across the sharpened edges.

Thermocouples: Calibrated using a potentiometric technique.

Gas Analyzers: Zeroed using nitrogen and calibrated against reference gases (US EPA protocol 1 calibration gases)

Calibration data for all equipment is provided in Appendix A.

Additional information may be found in the description of the reference test methods for stationary source emissions testing published by ECCC (EPS 1/RM/2, 1/RM/3, 1/RM/15) and US EPA (Method 29). Copies of these documents are available upon request from Nunami Stantec.

4.0 RESULTS AND DISCUSSION

Tables 4.1 and 4.2 present the measured stack parameters, concentrations and emission rates of particulate matter, mercury, and dioxins and furans from the incinerator.

Table 4.1 Total Particulate Matter, Mercury Source Testing Results

Parameter	Test 1	Test 2	Test 3	Average	Method Criteria/CWS Limits
Test Date	Sept 17, 2019	Sept 17, 2019	Sept 18, 2019	NA	-
Test Period	12:34 – 14:34	16:06 – 18:06	10:48 – 12:48	NA	-
Test Duration (min)	120	120	120	120	-
Stack Gas Static Pressure (kPa)	0.005	0.005	0.005	0.005	-
Volume of Gas Sampled (m ³)	1.58	1.69	1.66	1.64	-
Average Isokineticity (%)	102	103	101	102	90 - 110
Total Particulate Matter not including Impingers (mg)	97.9	101	82.7	93.9	-
Total Mass of waste combusted (kg)	191	191	161	181	-
Exhaust Gas Parameters					
Stack Gas Temperature (°C)	600	646	633	626	-
Stack Gas Moisture Content (%)	12.8	9.83	11.9	11.5	-
Stack Gas Velocity (m/s)	5.03	5.45	5.48	5.32	-
Stack Gas Flow Rate (Rm ³ /s)	0.24	0.26	0.26	0.25	-
Oxygen - O ₂ Concentration (%)	5.93	9.64	6.96	7.51	-
Carbon Dioxide CO ₂ Concentration (%)	18.5	13.9	17.1	16.5	-
<u>Particulate Matter (PM)</u>					
Concentration (mg/Rm ³)	61.9	59.8	49.9	57.2	-
Concentration at 11% O ₂ (mg/Rm ³)	40.9	52.6	35.4	43.0	-
Emission Rate (kg/hr)	0.05	0.06	0.05	0.05	-
<u>Mercury (Hg)</u>					
Concentration (µg/Rm ³)	0.33	0.31	0.39	0.35	-
Concentration at 11% O ₂ (µg/Rm ³)	0.22	0.28	0.28	0.26	20
Emission Rate (kg/hr)	2.92E-07	2.91E-07	3.61E-07	3.15E-07	-
Notes: Rm ³ Cubic meters (corrected to 25° C and 101.3 kPa). mg/Rm ³ Milligrams per reference cubic meter. µg/Rm ³ Micrograms per reference cubic meter kg/hr Kilograms per hour.					

The average concentration of mercury for the three tests was 0.26 µg/Rm³, which is below the CWS/Nunavut stack limit of 20 µg/Rm³ (corrected to 11% oxygen).

There are no limits specified for particulate matter emissions in the Nunavut Department of the Environment's "Guideline for the Burning and Incineration of Solid Waste".

Table 4.2 Dioxins and Furans Source Testing Results

Parameter	Test 1	Test 2	Test 3	Average	Method Criteria/CWS Limits
Test Date	15-Sep-19	16-Sep-19	16-Sep-19	-	-
Test Period	10:55 – 14:05	10:00 – 12:00	14:18 – 16:18	-	-
Test Duration (min)	188	188	188	188	240
Stack Gas Static Pressure (kPa)	0.005	0.005	0.005	0.005	-
Volume of Gas Sampled (Rm ³)	2.72	1.83	2.27	2.27	3
Average Isokineticity (%)	107	99.7	99.6	102.1	90-110
Total Mass of waste combusted (kg)*	181	181	181	181	-
Stack Gas Temperature (°C)	827	811	804	814	-
Stack Gas Moisture Content (%)	15.1	12.7	10.9	12.9	-
Stack Gas Velocity (m/s)	6.84	4.70	5.65	5.73	-
Stack Gas Flow Rate (Rm ³ /s)	0.25	0.18	0.23	0.22	-
Oxygen - O ₂ Concentration (%)	3.73	4.76	9.87	6.12	-
Carbon Dioxide - CO ₂ Concentration (%)	18.5	19.5	14.2	17.4	-
2,3,7,8-Tetra CDD (pg/TEQ pg)**	448	87.0	42.9	193	-
1,2,3,7,8-Penta CDD (pg/TEQ pg)**	1,730	289	314	778	-
1,2,3,4,7,8-Hexa CDD (pg/TEQ pg)**	1,800	330	756	96.2	-
1,2,3,6,7,8-Hexa CDD (pg/TEQ pg)**	2,420	556	2,160	171	-
1,2,3,7,8,9-Hexa CDD (pg/TEQ pg)**	1,980	422	1,360	125	-
1,2,3,4,6,7,8-Hepta CDD (pg/TEQ pg)**	21,300	6,940	37,200	218	-
Octa CDD (pg/TEQ pg)**	28,500	12,400	95,500	13.6	-
2,3,7,8-Tetra CDF (pg/TEQ pg)**	2,310	359	249	97.3	-
1,2,3,7,8-Penta CDF (pg/TEQ pg)**	4,400	676	879	59.6	-
2,3,4,7,8-Penta CDF (pg/TEQ pg)**	5,760	1,280	2,310	935	-
1,2,3,4,7,8-Hexa CDF (pg/TEQ pg)**	5,240	1,220	2,970	314	-
1,2,3,6,7,8-Hexa CDF (pg/TEQ pg)**	5,930	1,320	4,080	378	-
2,3,4,6,7,8-Hexa CDF (pg/TEQ pg)**	4,780	2,340	11,200	611	-

Table 4.2 Dioxins and Furans Source Testing Results

Parameter	Test 1	Test 2	Test 3	Average	Method Criteria/CWS Limits
1,2,3,7,8,9-Hexa CDF (pg/TEQ pg)**	1,190	668	3,170	168	-
1,2,3,4,6,7,8-Hepta CDF (pg/TEQ pg)**	10,300	6480	28,300	150	-
1,2,3,4,7,8,9-Hepta CDF (pg/TEQ pg)**	1,680	1,470	10,300	44.8	-
Octa CDF (pg/TEQ pg)**	2,200	8,370	69,700	8.03	-
Total TEQ (pg TEQ)	6,945.01	1,656.91	4,478.33	4,360	-
Concentration uncorrected (pg TEQ/Rm ³)	2,553	907	1,972	1,811	-
Concentration corrected to 11 % O ₂ (pg TEQ/Rm ³)	1,472	556	1,769	1,266	
Concentration corrected to 11 % O ₂ (ng/TEQ/Rm ³)	1.47	0.56	1.77	1.27	0.08
Emission Rate (pg TEQ/s)	651	166	449	422	--
Legend: CDD Chloro Dibenzo-p-Dioxin. CDF Chloro Dibenzofuran. TEF Toxic equivalency factor (2005 World Health Organization) TEQ Tetrachlorodibenzo-para-dioxin equivalent (TEQ). pg TEQ Picograms tetrachlorodibenzo-para-dioxin equivalent. pg TEQ/Rm ³ Picograms tetrachlorodibenzo-para-dioxin equivalent per dry cubic meter at reference conditions. pg TEQ/s Picograms tetrachlorodibenzo-para-dioxin equivalent per second.					
*Total mass of waste combusted for September 15 and 16, 2019 was estimated by taking an average of the mass of waste combusted on September 17 and 18, 2019, as the site records for the mass of waste combusted on September 15 and 16 were not available. **Individual test results reported in pg. Average reported in TEQ pg.					

The average concentration of dioxins and furans for the three tests was 1.27 ng/TEQ/Rm³, which is above the CWS/Nunavut stack limit of 0.08 ng TEQ/Rm³, corrected to 11% oxygen.

The sample volumes collected were slightly below the method recommended sample size of 3 to 4 m³, and test times were shorter than the 4-hour sample specified in the methodology. The shorter test times and lower sample volumes were required due to the relatively short batch runs of 3 hours and method dictated sample rates. Laboratory results show measurable amounts of target analytes, therefore, the lower sample volume and shorter test times is not considered to have materially affected the validity of the testing. The source testing raw data, laboratory analytical results, and detailed calculations are provided in Appendices B, C, and D, respectively.

The velocity profiles across the exhaust stack, as shown in Appendix D, were consistent between tests and did not indicate the presence of cyclonic or reverse flow.

December 20, 2019

Based on the results of the dioxins and furans testing, it is recommended that TMAC review potential options to reduce these emissions. Options could include:

- Reviewing the incinerator emissions performance with the manufacturer,
- Ensuring manufacturer recommended operational procedures for the incinerator have been implemented and ensuring all operators are adequately trained and,
- Reviewing TMAC's waste segregation practices.

5.0 CLOSING REMARKS

This report has been prepared by Nunami Stantec for the sole benefit of TMAC Resources Inc. The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Nunami Stantec and TMAC Resources Inc. This report was undertaken exclusively for the purpose outlined herein and was limited to the scope and purpose specifically expressed in this report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Nunami Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Nunami Stantec makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and used in the preparation of this report were assumed by Nunami Stantec to be accurate. Conclusions presented in this report should not be construed as legal advice.

The source testing measurements for each stack were taken over short periods of time and the emissions results are considered representative for the conditions present at the time of testing. The information provided in this report was compiled from such on-site measurements and by applying currently accepted industry standard mitigation and prevention principles. This report represents the best professional judgment of Nunami Stantec personnel available at the time of its preparation. Nunami Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect the any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

This report was prepared by Julie Reid, P.Eng., quality reviewed by Vicki Corning, P.Eng., and independently reviewed by Mike Murphy, PhD, P.Eng, on behalf of TMAC Resources Inc. If you have any questions or concerns about this report, please do not hesitate to contact the undersigned.

Respectfully Submitted,

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APPENDIX A

Calibration Data

VALLEY ENVIRONMENTAL CALIBRATION SERVICES

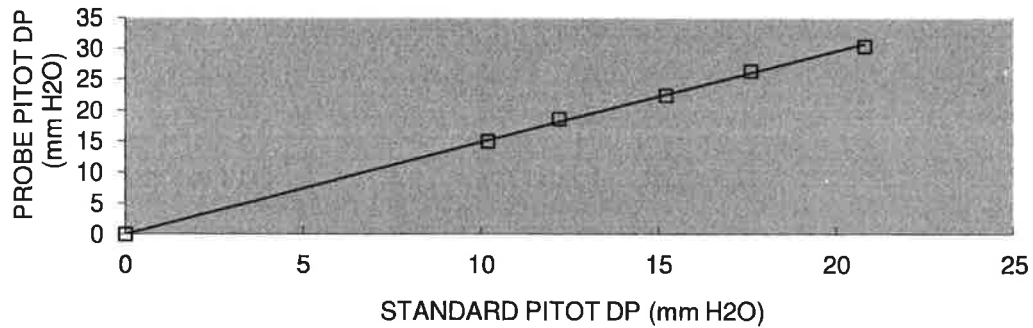
PITOT TUBE CALIBRATION REPORT

CLIENT - Stantech
PROBE ID - M5-2
NOZZLE - #16- 0.500"
DATE - 4-Mar-19

FAN SPEED	STANDARD	PROBE
	PITOT	PITOT
m/s	(mm H ₂ O)	(mm H ₂ O)
0.00	0.00	0.00
13.1	10.20	15.00
14.3	12.20	18.60
16.0	15.20	22.40
17.2	17.60	26.40
18.7	20.80	30.40

PITOT FACTOR C_p = 0.821

PITOT - M5-2 NOZZLE - #16- 0.500"
4-Mar-19



Technician: Andrew Murphy

Signature *Andrew Murphy*

VALLEY ENVIRONMENTAL SERVICES
160 Pony Drive #1
Newmarket, Ontario L3Y 7B6
PH: (905) 830 0136
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot C_p	0.999
Static	-0.25
Barometric	29.25
Temperature	70
Abs Static	29.23

Pre-Test Dry Gas Meter - Control Unit Calibration

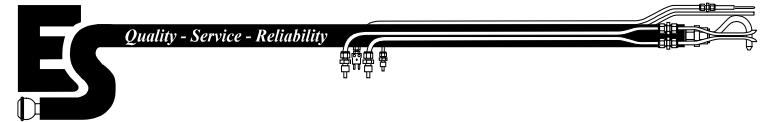
Date : 1/4/2019
 Barometric Pressure, Pb : 30
 Model Number : 2203
 Calibrated By : JJC
 Job #: 121899000

Orifice Manometer Setting, deltaH (in. H2O)				Dry Gas Meter Volume, Vm (cu.ft)			Temperatures (F)			Time, theta (min)	
								Dry Gas Meter			
						Total			Outlet, to		Average, tm
1.0						5.500			66	66	10
1.5						5.403			69	69	8
2.2						5.850			70	70	7

Calculations

Orifice Manometer Setting, deltaH (in. H2O)	Dry Gas Correction Factor, gamma (Tolerance = 0.95 - 1.05, +/-1.5% of avg)	Orifice Pressure Differential (delta H@) yielding 0.75 cfm of air at 68F and 29.92 in.Hg as in. H2O (Tolerance = +/- 0.15 in.)	Orifice Coefficient Ko
1.0	0.979	1.842	0.710
1.5	0.978	1.945	0.693
2.2	0.980	1.853	0.708
Average	0.979	1.880	0.704

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES



- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record data and information in the **GREEN** cells, YELLOW cells are calculated.

DATE:		METER SERIAL #:		BAROMETRIC PRESSURE (in Hg):		INITIAL		FINAL		AVG (P _{bar})		IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED						
METER PART #:		CRITICAL ORIFICE SET SERIAL #:								29.76								
ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)			TEMPERATURES °F				ELAPSED TIME (MIN) θ	DGM ΔH (in H ₂ O)	(1) V _m (STD)	(2) V _{cr} (STD)	(3) Y	Y VARIATION (%)	ΔH _@	
				INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET INITIAL FINAL	DGM OUTLET INITIAL FINAL	DGM AVG								
15	1	0.4164	18	179.70	185.19	5.490	69.1	65	65	65	65	10.00	0.95	5.5058	5.3889	0.979		1.85
	2	0.4164	18	196.19	201.70	5.510	69.6	67	68	67	68	10.00	0.95	5.4996	5.3864	0.979		1.84
	3	0.4164	18	190.69	196.19	5.50	69.4	66	67	66	67	10.00	0.95	5.5001	5.3874	0.980		1.84
													AVG =		0.979	0.05		
18	1	0.5085	18	202.10	207.69	5.590	69.6	67	69	67	69	8.00	1.50	5.5818	5.2622	0.943		1.95
	2	0.5085	18	207.69	212.91	5.220	69.8	69	69	69	69	8.00	1.50	5.2024	5.2612	1.011		1.94
	3	0.5085	18	212.91	218.31	5.40	69.8	69	70	69	70	8.00	1.50	5.3768	5.2612	0.979		1.94
													AVG =		0.978	-0.13		
23	1	0.6307	18	218.43	224.27	5.840	69.8	70	70	70	70	7.00	2.20	5.8194	5.7099	0.981		1.85
	2	0.6307	18	224.27	230.12	5.850	69.8	70	70	70	70	7.00	2.20	5.8293	5.7099	0.980		1.85
	3	0.6307	18	239.08	244.94	5.860	69.8	70	70	70	70	7.00	2.20	5.8393	5.7099	0.978		1.85
													AVG =		0.980	0.08		

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = **0.979**

AVERAGE ΔH_@ = **1.88**

$$(1) \quad V_{m(std)} = K_1 * V_m * \frac{P_{bar} + (\Delta H / 13.6)}{T_m}$$

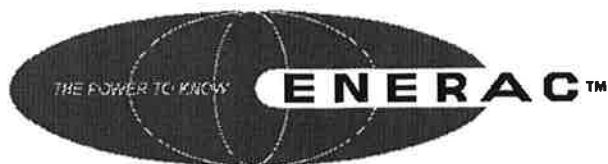
= Net volume of gas sample passed through DGM, corrected to standard conditions
 $K_1 = 17.64 \text{ °R/in. Hg (English), } 0.3858 \text{ °K/mm Hg (Metric)}$
 T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

$$(2) \quad V_{cr(std)} = K' * \frac{P_{bar} * \Theta}{\sqrt{T_{amb}}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions
 T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
 K' = Average K' factor from Critical Orifice Calibration

$$(3) \quad Y = \frac{V_{cr(std)}}{V_{m(std)}} \quad \text{= DGM calibration factor}$$

$$\Delta H_{@} = \left(\frac{0.75 \theta}{V_{cr(std)}} \right)^2 \Delta H \left(\frac{V_m(std)}{V_m} \right)$$



CALIBRATION CERTIFICATE

CALIBRATION DATE 08/23/19

MODEL 500

TESTED BY RD

SERIAL # 511458

THIS ANALYZER WAS SUCCESFULLY ZEROED IN CLEAN AIR AND SUCCESFULLY CALIBRATED USING 2% CERTIFIED ACCURACY NIST TRACEABLE SPAN GAS FOR THE MEASUREMENT OF THE FOLLOWING PARAMETERS AS NEEDED:

CALIBRATED SENSORS

CONCENTRATION

OXYGEN

☒

0.00/20.9 %

O₂ balance NITROGEN

COMBUSTIBLES

☒

1.01 %

CH₄ balance NITROGEN

CARBON MONOXIDE

☒

204 PPM

CO balance NITROGEN

NITRIC OXIDE

☒

198 PPM

NO balance NITROGEN

NITROGEN DIOXIDE

☒

104 PPM

NO₂ balance NITROGEN

SULFUR DIOXIDE

☒

203 PPM

SO₂ balance NITROGEN

DRAFT

☒

5.00 "

W.C.

1320 LINCOLN AVE., HOLBROOK, NY 11741

TEL: (516) 997-2100 (800) 695-3637

FAX: (516) 997-2129

www.enerac.com

EMAIL: info@enerac.com

Probe Stack Thermocouple Calibration

Calibration Date: 8-Feb-18

Calibrated By: JJC

Reference ID Fisher Scientific catalog #150414E



Ice Bath

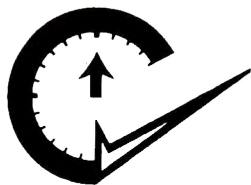
Thermocouple #	Reference Temp (F)	Observed Temp (F)
#1 -2' probe	32	32
#1 -3' probe	32	32
#1 -4' probe	32	32
#1 -5' probe	32	32
#1 - 6' probe	32	32
#1 - 8'-1 probe	NA	NA
#1 -8'-2 probe	32	32
#1 -10'-1 probe	NA	NA
#1 -10'-2 probe	32	32
#6 -1848	32	32
#7 -1848	32	32
#6 - 2203	32	32
#6 - 2257	32	32
3FT Pitot - no fittings	32	32
3FT Pitot - fittings	32	32
5ft Pitot	32	34

[illegible]

Boiling Water

Thermocouple #	Reference Temp (F)	Observed Temp (F)
#1 -2' probe	212	210
#1 -3' probe	212	212
#1 -4' probe	212	212
#1 -5' probe	212	210
#1 - 6' probe	212	213
#1 - 8'-1 probe	NA	NA
#1 -8'-2 probe	212	212
#1 -10'-1 probe	NA	NA
#1 -10'-2 probe	212	212
#6 -1848	212	212
#7 -1848	212	212
#6 -2203	212	212
#6 - 2257	212	212
3FT Pitot - no fittings	212	212
3FT Pitot - fittings	212	212
5ft Pitot	212	212

[illegible]



CAL-CHEK CANADA INC.

250 Governors Road - Dundas ON L9H 3K3

Telephone: (905) 628-4636

www.calchek.ca

Scale / Balance Certification

Date: February 12, 2019

Certificate Number: S190327

Customer: Stantec Consulting Ltd.
845 Prospect Street
Fredericton, New Brunswick E3B 2T7

Room Temperature: 19.7°C

Calibration Location: 10 Timothy Drive, Hanwell - North Kingsclear Lab

Scale / Balance Manufacturer: Mettler Toledo

Resolution: 0.1g

Model Number: PB8001

Serial Number: 1116222054

Capacity: 8,100 g

Capacity Calibrated To: 8,100 g

<u>ACTUAL WEIGHT</u>			<u>ACTUAL WEIGHT</u>		
<u>APPLIED</u>	<u>SCALE</u>	<u>ERROR</u>	<u>APPLIED</u>	<u>SCALE</u>	<u>ERROR</u>
<u>GRAMS</u>	<u>READINGS</u>	<u>AS FOUND</u>	<u>GRAMS</u>	<u>READINGS</u>	<u>AS LEFT</u>
0.5	0.5	0.0	0.5	0.5	0.0
1.0	1.0	0.0	1.0	1.0	0.0
5.0	5.0	0.0	5.0	5.0	0.0
10.0	10.0	0.0	10.0	10.0	0.0
20.0	20.0	0.0	20.0	20.0	0.0
50.0	50.0	0.0	50.0	50.0	0.0
100.0	100.0	0.0	100.0	100.0	0.0
200.0	200.0	0.0	200.0	200.0	0.0
500.0	500.0	0.0	500.0	500.0	0.0
1000.0	999.9	0.1	1000.0	1000.0	0.0
2000.0	1999.9	0.1	2000.0	2000.0	0.0
4000.0	3999.7	0.3	4000.0	4000.0	0.0
6000.0	5999.6	0.4	6000.0	6000.0	0.0
8000.0	7999.4	0.6	8000.0	8000.0	0.0
8100.0	8099.4	0.6	8100.0	8100.0	0.0

The above mentioned Scale / Balance has been checked for accuracy using the following N.I.S.T. calibrated dead weights as per the CSA method.

<u>STANDARD</u>	<u>CAL DATE</u>	<u>TRACEABLE #</u>
CCC-800	15/06/16	2449326

Obtained results are within the manufacturer's stated accuracy and/or are within +/-0.01% or 1 division whichever is greater at any point of the calibrated range.

Pass/Fail statements are based on data from measurements made, procedures utilized, professional experience and the uncertainty associated with this calibration. It is the responsibility of the user of this equipment to determine if the results identified meet specific requirements for its intended application.

Calibration Technician: Mike Gambicourt

Suggested Calibration Due Date: February 2020


Authorized Signatory: Roni Newitt

Due dates appearing on the certificate of calibration and label are determined by client for administrative purposes and do not imply continued conformance to specifications. All calibrations performed at customer location unless otherwise noted.

This certificate shall not be reproduced except in full, without the written approval of Cal-Chek Canada

APPENDIX B

Field Sheets

MOISTURE FIELD DATA SHEET - DIOXINS/FURANS/SVOC's

Client: TMAC
 Job No.: 1609 30343
 Plant: Incinerator
 Location: Hope Bay
 Test: SVOC - 1
 Date: 15 Sep.
 Analyst: B. Cole



Filter QZ6686

Moisture Data

Component	Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
Condenser	Empty	306.4	304.7	1.7
Resin Trap	XAD-2	350.6	347.9	2.7
Condensate Trap	Empty	817.5	490.1	327.4
First Impinger	100 ml Ethylene Glycol	770.2	752.8	17.4
Second Impinger	Empty	647.1	646.5	0.6
Third Impinger	200g Silica Gel	918.5	911.6	6.9
Total Weight Gain (g)				356.7
Moisture Volume (mL)				

#3

$$\begin{aligned}
 \text{DGM Final - Initial} &= 326.26 - 231.45 \\
 &= 94.81 \text{ cu. ft.} \\
 &\times 0.048 \\
 &= 4.55288
 \end{aligned}$$

$$\begin{aligned}
 &356.7 \\
 &\times 0.048 \\
 &= 17.1216 \text{ cu. ft.}
 \end{aligned}$$

$$\begin{aligned}
 &17.1216 \\
 &\hline
 &111.9316 \\
 &= 0.152965 \\
 &= 15.3 \%
 \end{aligned}$$

SOURCE TESTING FIELD DATA SHEET

Job No.: 160930343
 Client: T MAC
 Plant: Incinerator
 Location: Hope Rd
 Test: SVOC - 1
 Date: 15 Sep
 Operators: BC/KW
 Gamma: .979
 Delta H@: 1.880
 Pitot Coeff.: .821
 Ko Coeff.: .704
 Start: 10:55
 Finish: 2:05

Barometric Pressure (in.Hg):
 Static Pressure (in.H2O): 0.02
 Assumed Moisture (%): 0.098 9.8%
 Filter ID: Q26686
 Initial Filter Weight (g):
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): (.536)
 Ambient Temp. (F): 41

Test Traverses

Leak Checks:
 Before Traverse: 231.19 > 231.45
 Vacuum Pressure: -19
 After Traverse:
 Vacuum Pressure:

Fuel Type: diesel / garbage
 Steam Load:

Combustion Gases:
 O2 (%):
 CO2 (%):
 CO (ppm):
 SO2 (ppm):
 NO2 (ppm):
 NOx (ppm):
 Tamb (F):
 Tstack (F):

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	XAD-2 Inlet Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
										In	Out	
	0	1355	0.01		231.45			41	38	56		
	4	1355	0.02	0.42	231.92	250	251	41	38	58		-1
	8	1382	0.02	0.42	233.26		250	41	36	56		-1
	12	1418	0.02	0.41	234.66		250	40	36	55		-1
	16	1430	0.03	0.61	236.35		250	40	37	56		-2
	20	1462	0.04	0.80	238.29		252	40	36	56		-3
	24	1488	0.04	0.79	240.20		255	41	36	57		-4
	28	1493	0.04	0.79	242.14		249	42	36	58		-5
	32	1515	0.05	0.97	244.25		253	44	36	59		-6
	36	1533	0.05	0.96	246.42		248	45	36	59		-6
	40	1550	0.06	1.15	248.80		252	46	36	59		-6
	48	1562	0.06	1.14	251.17		251	48	37	60		-5
	52	1561	0.06	1.14	253.54		250	49	37	60		-5
	56	1575	0.05	0.95	255.68		249	47	36	60		-5
	60	1580	0.05	0.94	257.76		249	45	36	59		-5
	64	1591	0.04	0.75	259.65		250	44	36	59		-5
	68	1608	0.04	0.74	261.55		251	45	36	59		-6
	72	1540	0.03	0.58	263.20		251	44	36	58		-6
	76	1547	0.03	0.57	264.82		249	42	36	58		-6
	80	1561	0.03	0.57	266.48		250	42	36	56		-6
	84	1512	0.03	0.58	268.15		249	42	36	56		-7
	88	1531	0.03	0.58	269.82		249	42	36	56		-7
	92	1524	0.03	0.58	271.48		250	42	36	56		-7
	96	1519	0.04	0.77	273.41		248	42	36	56		-9
	100	1530	0.04	0.77	275.34		249	43	36	56		-9
	100	1518	0.04	0.77			252	44	36	57		

* 52 min - Unit primary opened for stirring

1/2

SOURCE TESTING FIELD DATA SHEET

Job No.: 1609 303 43
 Client: T MAC
 Plant: Incinerator
 Location: Haze Bay NU
 Test: SVOL-1
 Date: 15 Sep 2019
 Operators: BC/RW
 Gamma: 0.979
 Delta H@: 1.880
 Pitot Coeff.: 0.821
 Ko Coeff.: 0.704
 Start: 10:55
 Finish: 2:05

Barometric Pressure (in.Hg): _____
 Static Pressure (in.H2O): 0.02
 Assumed Moisture (%): 9.8
 Filter ID: QZ 6686
 Initial Filter Weight (g): _____
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): (.536)
 Ambient Temp. (F): _____

Test Traverses

Leak Checks:
 Before Traverse: _____
 Vacuum Pressure: _____
 After Traverse: 326.42
 Vacuum Pressure: -20
 Fuel Type: diesel/garbage
 Steam Load: _____

Combustion Gases:
 O2 (%): _____
 CO2 (%): _____
 CO (ppm): _____
 SO2 (ppm): _____
 NO2 (ppm): _____
 NOx (ppm): _____
 Tamb (F): _____
 Tstack (F): _____

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	XAD-2 Inlet Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
										In	Out	
	100	1518	0.04	0.77	277.29		252	44	36	57		-9
	104	1517	0.04	0.78	279.22		250	44	36	57		-9
	108	1530	0.04	0.77	281.17		252	36	35	57		-9
	112	1515	0.05	0.97	283.41		249	35	35	58		-11
	116	1508	0.05	0.98	285.56		250	42	35	58		-7
	120	1518	0.05	0.97	287.69		252	43	35	58		-8
	124	1504	0.05	0.98	289.87		251	44	36	58		-9
	128	1507	0.05	0.98	292.05		252	43	36	58		-9
	132	1520	0.05	0.97	294.20		247	43	36	58		-9
	136	1507	0.05	0.98	296.34		251	42	35	58		-10
	140	1515	0.05	0.97	298.54		252	42	35	59		-10
	144	1508	0.05	0.98	300.71		252	43	35	59		-10
	148	1514	0.05	0.97	302.93		246	43	35	59		-10
	152	1580	0.05	0.94	305.10		249	43	36	60		-7
	156	1565	0.05	0.95	307.23		251	44	36	60		-7
	160	1547	0.06	1.15	309.69		248	45	37	60		-9
	164	1545	0.06	1.15	312.05		251	45	37	60		-7
	168	1538	0.06	1.16	314.42		247	46	37	60		-8
	172	1535	0.06	1.16	316.80		251	46	37	60		-8
	176	1540	0.06	1.16	319.15		252	46	37	60		-8
	180	1535	0.06	1.16	321.52		247	46	37	60		-9
	184	1532	0.06	1.16	323.91		250	46	37	60		-9
	188	1535	0.06	1.16	326.26		249	46	38	61		-10

146 Unit opened for stirring
 - CO shoots up temporarily after stir

MOISTURE FIELD DATA SHEET - DIOXINS/FURANS/SVOC's

Client: TMAC
 Job No.: 1609 30343
 Plant: Incinerator
 Location: Hope Bay NM
 Test: SVOC-2
 Date: 16 Sep 2019
 Analyst: B. Cole



QZ 6687

Moisture Data

Component	Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
Condenser	Empty	229.6	227.1	2.5
Resin Trap	XAD-2	342.2	339.4	2.8
Condensate Trap	Empty	763.4	540.9	222.5
First Impinger	100 ml Ethylene Glycol	742.5	778.3	-35.8
Second Impinger	Empty	620.0	619.8	0.2
Third Impinger	200g Silica Gel	922.2	918.1	4.1
Total Weight Gain (g)				196.3
Moisture Volume (mL)				

39225
 -326.60
 65.65

196.3
 x 0.048 = 9.4224
 + 65.65
 75.0724

9.4224
 75.0724
 = 0.125511
 = 12.5%

SOURCE TESTING FIELD DATA SHEET

Job No.: 1609 30343
 Client: TMAC
 Plant: Incinerator
 Location: Free Ry NV
 Test: SVOC - 2
 Date: 16 Sep 2019
 Operators: BC/KW
 Gamma: .979
 Delta H@: 1.880
 Pitot Coeff.: .821
 Ko Coeff.: .704
 Start: 10:00
 Finish:

Barometric Pressure (in.Hg):
 Static Pressure (in.H2O): 0.02
 Assumed Moisture (%): 15.3
 Filter ID: Q2 6687
 Initial Filter Weight (g):
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): (.536)
 Ambient Temp. (F): 35

Test Traverses

Leak Checks: ☒
 Before Traverse: (326.42 → 326.60)
 Vacuum Pressure: - 20
 After Traverse:
 Vacuum Pressure:
 Fuel Type: diesel/geltype
 Steam Load:

Combustion Gases :
 O2 (%) :
 CO2 (%) :
 CO (ppm) :
 SO2 (ppm) :
 NO2 (ppm) :
 NOx (ppm) :
 Tamb (F) : 35
 Tstack (F) :

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	XAD-2 Inlet Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
										In	Out	
	0				326.60							
	4	1420	0.03	0.57	328.31		252	35	33	73		-1
	8	1427	0.03	0.57	329.91		248	35	33	73		-2
	12	1464	0.03	0.56	331.56		251	36	34	73		-3
	16	1480	0.03	0.55	333.19		252	36	34	73		-4
	20	1474	0.02	0.37	334.55		251	36	34	72		-4
	24	1480	0.02	0.37	335.87		250	36	34	73		-4
	28	1475	0.02	0.37	337.20		250	37	34	72		-4
	32	1478	0.02	0.37	338.55		250	37	34	73		-5
	36	1455	0.03	0.56	340.19		249	36	34	72		-6
	40	1447	0.03	0.56	341.87		250	36	34	72		-7
	44	1455	0.02	0.37	343.32		250	37	34	72		-5
	48	1430	0.02	0.38	344.64		247	37	34	72		-6
	52	1508	0.03	0.54	346.22		252	36	34	72		-9
	56	1580	0.03	0.52	347.82		249	36	37	72		-10
	60	1584	0.03	0.52	349.42		251	37	34	72		-10
	64	1536	0.02	0.36	350.77		247	38	34	72		-9
	68	1507	0.02	0.36	352.08		248	38	34	72		-8
	72	1505	0.02	0.36	353.42		251	37	34	71		-9
	76	1494	0.02	0.37	354.78		251	37	34	70		-9
	80	1520	0.02	0.36	356.12		249	37	34	72		-9
	84	1510	0.02	0.36	357.44		248	38	34	72		-9
	88	1499	0.02	0.36	358.79		254	37	34	71		-10
	92	1503	0.02	0.36	360.17		250	37	34	71		-10
	96	1506	0.02	0.36	361.51		251	38	34	71		-10
	100	1499	0.02	0.36			249	38	34	70		

*Primary unit opened for stirring @ 44 mins.

1/2

SOURCE TESTING FIELD DATA SHEET

Job No.: 160930343
Client: TMAC
Plant: Incinerator
Location: Hope Brg NM.
Test: SVBC-2
Date: 16 Sep 2019
Operators: BC/KW
Gamma: .479
Delta H@: 1.880
Pitot Coeff.: .821
Ko Coeff.: .704
Start: 10:00
Finish: 13:09

Barometric Pressure (in.Hg): _____
 Static Pressure (in.H2O): 0.02
 Assumed Moisture (%): 15.3
 Filter ID: QZ 6687
 Initial Filter Weight (g): _____
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): _____
 Ambient Temp. (F): 536

Test Traverses

Leak Checks:
Before Traverse: _____
Vacuum Pressure: _____
After Traverse: 392.48
Vacuum Pressure: -20

Fuel Type: diesel / garbage
Steam Load: _____

Combustion Gases :

O₂ (%) : _____

CO₂ (%) : _____

CO (ppm) : _____

SO₂ (ppm) : _____

NO₂ (ppm) : _____

NO_x (ppm) : _____

T_{amb} (F) : _____

T_{stack} (F) : _____

[illegible]

MOISTURE FIELD DATA SHEET - DIOXINS/FURANS/SVOC's

Client: TMAC
Job No.: 160930343



Plant: Incinerator
Location: Hope Bay
Test: SVOC-3
Date: Sept 16/19
Analyst: P.C./K.W.

Q2 6688

Moisture Data

Component	Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
Condenser	Empty	264.1	262.1	2.0
Resin Trap	XAD-2	338.6	341.4	-2.8
Condensate Trap	Empty	692.8	504.8	188.0
First Impinger	100 ml Ethylene Glycol	741.1	727.4	13.7
Second Impinger	Empty	634.3	634.3	0
Third Impinger	200g Silica Gel	925.3	922.2	3.1
Total Weight Gain (g)				206.8
Moisture Volume (mL)				206.8

473.00
-392.78
80.22

$$206.8 \times 0.048 = 9.9264$$

$$80.22 + 9.9264 = 90.1464$$

$$90.1464 \div 81.1114 = 11.0\%$$

SOURCE TESTING FIELD DATA SHEET

Job No.: 160930343
 Client: TMAC
 Plant: Incinerator
 Location: Hope Bay
 Test: SVOC-3
 Date: 16 Sep.
 Operators: BC/KW
 Gamma: .979
 Delta H@: 1.880
 Pitot Coeff.: .821
 Ko Coeff.: .704
 Start: 2:18 pm
 Finish:

Barometric Pressure (in.Hg):
 Static Pressure (in.H2O): 0.02
 Assumed Moisture (%): 12.5
 Filter ID: Q2 6688
 Initial Filter Weight (g):
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): .536
 Ambient Temp. (F): 40

Test Traverses

Leak Checks:
 Before Traverse: V-20
 Vacuum Pressure: 392.78 - 392.48
 After Traverse:
 Vacuum Pressure:
 Fuel Type: diesel/garbage
 Steam Load:

Combustion Gases :
 O2 (%) :
 CO2 (%) :
 CO (ppm) :
 SO2 (ppm) :
 NO2 (ppm) :
 NOx (ppm) :
 Tamb (F) :
 Tstack (F) :

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	XAD-2 Inlet Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
										In	Out	
	0				392.78							
	4	1650	0.04	0.70	394.57	252	252	38	35	59		-2
	8	1560	0.04	0.73	396.44		248	37	35	60		-3
	12	1538	0.04	0.74	398.30		250	36	35	60		-4
	16	1480	0.04	0.76	400.20		254	37	35	61		-5
	20	1430	0.04	0.78	402.14		251	37	34	61		-5
	24	1460	0.04	0.77	404.06		249	36	35	62		-5
	28	1400	0.03	0.66	405.77		244	37	34	62		-5
	32	1480	0.03	0.57	407.44		249	37	34	62		-5
	36	1495	0.03	0.57	409.08		247	37	34	63		-5
	40	1450	0.03	0.58	410.71		250	37	34	64		-5
	44	1495	0.03	0.57	412.41		249	37	34	64		-6
	48	1480	0.03	0.57	414.07		250	37	34	64		-6
	52	1510	0.02	0.38	415.45		248	38	34	63		-5
	56	1520	0.02	0.37	416.81		249	37	34	63		-5
	60	1460	0.03	0.58	418.42		250	37	34	64		-17
	64	1520	0.03	0.56	420.05		252	37	34	64		-8
	68	1470	0.03	0.58	421.69		250	37	34	65		-8
	72	1520	0.02	0.37	423.14		257	38	34	65		-7
	76	1500	0.03	0.57	424.79		251	38	35	65		-9
	80	1590	0.03	0.54	426.40		246	38	34	65		-9
	84	1470	0.02	0.38	427.82		247	38	34	65		-8
	88	1510	0.02	0.38	429.19		250	38	34	65		-7
	92	1515	0.02	0.38	430.56		248	38	35	65		-7
	96	1510	0.02	0.38	431.89		250	38	35	65		
	100	1490	0.03	0.57			250	38	35	65		

* primary unit opened @ 55 mins for stirring

Job No.: 1609 30343
Client: T MAC
Plant: Incinerator
Location: Hope Bay
Test: SVOC - 3
Date: 16 Sep 2019
Operators: BC/KW
Gamma: .979
Delta H@: 1.880
titot Coeff.: .821
Ko Coeff.: .704
Start :
Finish :

Barometric Pressure (in.Hg): _____
 Static Pressure (in.H2O): _____
 Assumed Moisture (%): 12.5
 Filter ID: _____
 Initial Filter Weight (g): _____
 Stack Dia. (in.): _____
 Probe Length (ft): _____
 Nozzle ID (in.): _____
 Ambient Temp. (F): _____

Fuel Type: _____
Steam Load: _____

Combustion Gases :
O2 (%) : _____
CO2 (%) : _____
CO (ppm) : _____
SO2 (ppm) : _____
NO2 (ppm) : _____
NOx (ppm) : _____
Tamb (F) : _____
Tstack (F) : _____

[illegible]

* Primary unit opened @ 137 Per stirring

MOISTURE FIELD DATA SHEET - DIOXINS/FURANS/SVOC's

Client: TMAC
Job No.: 1609 30343



Plant: Incinerator
Location: Hope Bay NV
Test: SVOC-4 - Blank train
Date: 17 Sep 2019
Analyst: BC/kw

Filter
QZ 6689

Moisture Data

Component	Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
Condenser	Empty	273.3	271.9	
Resin Trap	XAD-2	346.0	347.5	
Condensate Trap	Empty	496.4	496.4	
First Impinger	100 ml Ethylene Glycol	732.9	732.4	
Second Impinger	Empty	666.2	666.1	
Third Impinger	200g Silica Gel	926.5	924.7	
Total Weight Gain (g)				
Moisture Volume (mL)				

1.38 cu. ft
Leak Check ✓ - 20
473.70
+ 1.38
475.08 ✓

Combustion Gases, T Moc Incinerator Hope Bay Nu.
B Cole 17 Sep '19 Enerac 1609 30343.

<u>Time</u>	<u>O₂</u>	<u>CO₂</u>	<u>CO</u>	<u>SO₂</u>	<u>NO_x</u>	<u>NO</u>	<u>NO₂</u>
	5.0 6.0	19.2	0	0	115	115	0
1:04							
	5.5	19.4	0	0	102	102	0
1:09							
	6.1	18.2	0	0	107	107	0
1:14							
	6.2	19.0	0	0	107	107	0
1:19							
	6.2	18.3	0	0	116	116	0
1:24							
	6.5	17.3	0	0	109	109	0
1:29							
	6.0	18.1	0	0	110	110	0
1:34							

Combustion Gases - TMAC Indicator Hope Bay

BC/KW 17 Sep'19 Enerac 1609 303 43

<u>Time</u>	<u>O₂</u>	<u>CO₂</u>	<u>CO</u>	<u>SO₂</u>	<u>NO_x</u>	<u>NO</u>	<u>NO₂</u>
4:25	10.1	12.4	0	0	76	76	0
4:30	9.4	15.9	0	0	85	85	0
4:35	8.2	15.5	0	0	90	90	0
4:40	10.6	12.7	0	0	91	91	0
4:45	11.1	11.6	0	0	94	94	0
4:50	9.9	13.5	0	0	93	93	0
4:55	8.2	15.5	0	0	95	95	0

Combustion Gases - T Mac Incinerator Hope Bay

BC/Kw 18 Sep 2019

Enercc

160930343

<u>Time</u>	<u>O₂</u>	<u>CO₂</u>	<u>CO</u>	<u>SO₂</u>	<u>NO_x</u>	<u>NO</u>	<u>NO₂</u>
11:05	5.1	19.4	0	0	47	47	0
11:10	5.2	19.3	0	0	58	58	0
11:15	8.8	14.9	0	0	60	60	0
11:20	8.3	15.6	0	0	65	65	0
11:25	6.4	17.8	0	0	72	72	0
11:30	8.2	15.6	0	0	78	73	5
11:35	6.7	17.4	0	0	82	76	6

Combustion Gases, T-Mac Incinerator JVOC-3

16 Sep	BC/KW	160930343	Enerac				
	O ₂	CO ₂	CO	SO ₂	NO _x	NO ₂	NO
2:43	10.9	14.4	0	0	106	106	0
2:50	10.6	14.7	0	0	111	111	0
2:55	8.5	15.2	0	0	119	119	0
3:00	9.4	13.3	0	0	111	111	0
3:05	8.9	14.4	0	0	112	112	0
3:10	10.9	13.3	0	0	116	116	0

Combustion Gases,
T-MAC Hope Bay Incinerator

16 Sep. 2019
B. Cole / K. Wood
Enerco

<u>Time</u>	O_2 (%)	CO_2	CO	SO_2	NO_x	NO	NO_2
10:48	1.4	24.2	501	19	200	200	*
10:53	1.7	23.6	9	7	222	222	
10:58	3.2	20.8	6	8	186	186	
11:03	7.0	18.8	6	9	133	133	
11:08	6.0	16.6	3	10	145	145	
11:13	6.7	17.6	5	10	150	150	
11:20	7.3	15.2	5	11	133	133	

SUOC-1

Combustion Gases

<u>Time</u>	O ₂ %	CO ₂ %	SO ₂	CO	NO _x	NO	NO ₂
			6	4	219	219	0
11:30	2.2	18.2	9	1	230	230	0
11:35	2.1	18.3					
	3.0	18.8	351	<u>over (2000+)</u>	159	159	0
11:40							
	2.5	18.5	33	1337	122	122	0
11:45							
	3.3	18.8	35	174	188	188	0
11:50							
	6.4	14.5	36	69	132	132	0
11:55							
	6.6	14.9	36	46	126	126	0
12:00							
1:00	8.8	16.6	14	12	125		
1:10	9.9	15.3	12	10	151	151	0
1:15	6.6	17.5	11	9	131		
1:23(stir)	13.7	8.8	7	10	125		

MOISTURE FIELD DATA SHEET - METALS

Client: TMAC
Job No.: 160930343



Plant: Incinerator
Location: Hope Bay NV.
Test: Metals-2
Date: Sept 18/19
Analyst: BC/kw

filter
QZ 6110

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H ₂ O	866.0	736.3	129.7
2	50 ml 10% HNO ₃ 50 ml 20% H ₂ O ₂	750.9	727.7	23.2
3	50 ml 10% HNO ₃ 50 ml 20% H ₂ O ₂	733.8	730.8	3
4	Blank	612.3	612.0	0.3
5	50 ml 8% KMnO ₄ 50 ml 20% H ₂ SO ₄	766.8	766.5	0.3
6	50 ml 8% KMnO ₄ 50 ml 20% H ₂ SO ₄	755.3	755.3	0
7	200g Silica Gel	973.7	964.9	8.8
Total Weight Gain (g)				165.3
Moisture Volume (mL)				

652.68
- 593.50
59.18 ft²

165.3 x 0.048 = 7.9344
67.1144 = 0.118222
= 11.8%

SOURCE TESTING FIELD DATA SHEET

Job No.: 160930343
 Client: T Mac
 Plant: Incinerator
 Location: Hoppe Bay N.W.
 Test: Metals L3
 Date: 18 Sep 2019
 Operators: BC/KW
 Gamma: .979
 Delta H@: 1.880
 Pitot Coeff.: .821
 Start: 10:48
 Finish: _____

Static Pressure (in.H2O): 0.02
 Port Length (in): 6
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): (.536)
 Console S/N: 2203

Pre-Test Leak Check: ✓
 Vacuum Pressure: -20
 Post-Test Leak Check: _____
 Vacuum Pressure: _____

K: 72.02

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				593.50						
	2.5	1115	0.03	0.72	594.66	250	250	35	64		-1
	25	1160	0.03	0.70	595.81		250	35	64		-1
	7.5	1160	0.03	0.70	596.95		251	35	64		-1
	10	1165	0.03	0.70	598.09		252	36	64		-1
	12.5	1100	0.03	0.73	599.25		252	35	64		-1
	15	1120	0.03	0.72	600.40		251	35	64		-1
	17.5	1090	0.03	0.73	601.54		250	35	64		-1
	20	1140	0.03	0.71	602.69		249	35	65		-1
	22.5	1070	0.03	0.74	603.86		250	35	65		-1
	25	1080	0.03	0.74	605.04		250	35	64		-1
	27.5	1100	0.04	0.97	606.41		250	35	65		-1
	30	1140	0.04	0.95	607.72		251	35	65		-1
	32.5	1130	0.03	0.71	608.89		250	35	65		-1
	35	1200	0.03	0.68	610.05		250	35	65		-1
	37.5	1200	0.04	0.91	611.33		249	35	65		-1
	40	1220	0.04	0.90	612.65		249	35	65		-1
	42.5	1100	0.04	0.97	613.99		250	35	65		-1
	45	1230	0.03	0.67	615.13		249	35	65		-1
	47.5	1210	0.03	0.68	616.26		250	36	65		-1
	50	1220	0.03	0.68	617.36		250	36	65		-1
	52.5	1160	0.03	0.73	618.54		250	36	65		-1
	55	1240	0.03	0.67	619.67		251	36	66		-1
	57.5	1200	0.03	0.68	620.80		250	36	66		-1
	60	1230	0.03	0.67			251	36	66		

SOURCE TESTING FIELD DATA SHEET

Job No.: 160930343
 Client: T Mac
 Plant: Incinerator
 Location: Hoe Bay
 Test: Metals
 Date: 18 Sep 2019
 Operators: BC/KW
 Gamma: 0.979
 Delta H@: 1.880
 Pitot Coeff.: 0.821
 Start: 10:48
 Finish:

Static Pressure (in.H2O): 0.02
 Port Length (in): 6
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): (536)
 Console S/N: 2203

Pre-Test Leak Check: ☒
 Vacuum Pressure: -20
 Post-Test Leak Check: ☐
 Vacuum Pressure:

K': 72.02

Traverse Point	Time (min) (60+)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				621.93						-1
	2.5	1160	0.04	0.94	623.26		250	36	66		-2
	5	1240	0.04	0.89	624.55		250	36	66		-2
	7.5	1130	0.04	0.95	625.84		249	36	66		-2
	10	1130	0.03	0.71	627.10		250	35	65		-1
	12.5	1180	0.03	0.69	628.16		250	35	65		-1
	15	1140	0.03	0.71	629.29		250	35	65		-1
	17.5	1140	0.03	0.71	630.43		249	35	66		-1
	20	1160	0.03	0.70	631.57		250	35	66		-1
	22.5	1175	0.03	0.70	632.70		251	35	66		-1
	25	1130	0.03	0.71	633.85		251	35	66		-1
	27.5	1180	0.04	0.92	635.18		249	35	66		-2
	30	1170	0.04	0.93	636.48		250	35	65		-2
	32.5	1170	0.04	0.93	637.80		251	35	66		-2
	35	1165	0.04	0.93	639.11		251	35	66		-2
	37.5	1200	0.04	0.91	640.43		250	35	66		-2
	40	1200	0.04	0.91	641.71		249	35	66		-2
	42.5	1240	0.04	0.89	643.03		250	35	66		-2
	45	1240	0.04	0.89	644.31		250	35	66		-2
	47.5	1210	0.06	1.36	645.89		248	35	66		-3
	50	1225	0.05	1.13	647.33		250	36	67		-2
	52.5	1210	0.05	1.14	648.78		252	36	67		-3
	55	1250	0.04	0.89	650.07		250	36	67		-2
	57.5	1270	0.04	0.88	651.36		250	37	67		-2
	60	1200	0.04	0.91	652.68		250	37	67		-2

*unit opened for raking @ 1:41

2/2

MOISTURE FIELD DATA SHEET - METALS

Client: T MAC
 Job No.: 160930343
 Plant: Incinerator
 Location: Hope Bay Nw.
 Test: Metals - 2
 Date: 17 Sep 2019
 Analyst: BC/KW



Filter
QZ6117

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H ₂ O	835.9	741.8	94.1
2	50 ml 10% HNO ₃ 50 ml 20% H ₂ O ₂	754.7	728.5	26.2
3	50 ml 10% HNO ₃ 50 ml 20% H ₂ O ₂	735.7	731.3	4.4
4	Blank	611.4	611.0	0.4
5	50 ml 8% KMnO ₄ 50 ml 20% H ₂ SO ₄	763.9	763.3	0.6
6	50 ml 8% KMnO ₄ 50 ml 20% H ₂ SO ₄	757.2	756.5	0.5 0.7
7	200g Silica Gel	965.6	956.4	9.2
Total Weight Gain (g)				144.8
Moisture Volume (mL)				

593.16

- 532.30

60.86

$$144.8 \times 0.048 = 6.9504$$

$$\frac{6.9504}{67.8104}$$

$$= 0.102497 = 10.2\% \text{ Moisture}$$

SOURCE TESTING FIELD DATA SHEET

Job No.: 1609 30343
 Client: T-Mac
 Plant: Inverter
 Location: Hope Bay
 Test: Metals-2L
 Date: 17 Sep 2019
 Operators: BC/KW
 Gamma: .979
 Delta H@: 1.880
 Pitot Coeff.: .821
 Start: 4.06
 Finish:

Static Pressure (in.H2O): 0.02
 Port Length (in): 6
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): .536
 Console S/N: 2203

Pre-Test Leak Check: ✓
 Vacuum Pressure: -20
 Post-Test Leak Check:
 Vacuum Pressure:

K': 70.71

Traverse Point	Time (min) (60+)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				561.82						-5
	2.5	1175	0.04	0.91	563.13		250	36	68		-4
	5	1190	0.04	0.91	564.44		249	36	68		-4
	7.5	1190	0.04	0.91	565.73		250	36	68		-4
	10	1210	0.04	0.90	567.05		250	36	69		-5
	12.5	1190	0.04	0.91	568.35		251	36	69		-5
	15	1200	0.04	0.90	569.66		250	36	69		-5
	17.5	1195	0.04	0.90	570.95		250	37	69		-5
	20	1200	0.04	0.90	572.26		250	37	69		-5
	22.5	1200	0.04	0.90	573.56		250	37	69		-5
	25	1190	0.04	0.91	574.88		250	37	69		-5
	27.5	1200	0.04	0.90	576.19		250	38	69		-5
	30	1180	0.05	1.14	577.65		250	38	69		-6
	32.5	1230	0.04	0.89	578.94		251	38	69		-5
	35	1230	0.04	0.89	580.22		251	38	69		-5
	37.5	1230	0.04	0.89	581.51		249	39	69		-6
	40	1230	0.04	0.89	582.71	*	250	39	70		-6
	42.5	1230	0.04	0.89	584.08		250	39	70		-6
	45	1250	0.04	0.89	585.38		250	39	70		-6
	47.5	1230	0.04	0.89	586.68		250	39	70		-6
	50	1230	0.04	0.89	587.98		249	39	70		-7
	52.5	1230	0.04	0.89	589.28		250	39	70		-7
	55	1230	0.04	0.89	590.57		250	39	70		-7
	57.5	1220	0.04	0.89	591.87		250	39	70		-7
	60	1220	0.04	0.89	593.16		250	39	70		-7

*Unit opened for rekey @ 1:27 mins.

SOURCE TESTING FIELD DATA SHEET

Job No.: 160930343
 Client: T Mac
 Plant: Trimmer
 Location: Hape Bay
 Test: Metals-2
 Date: 17 Sep/19
 Operators: BC/KW
 Gamma: .979
 Delta H@: 1.880
 Pitot Coeff.: .821
 Start: 4:06
 Finish:

Static Pressure (in.H2O): 0.02
 Port Length (in): 6
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): .5361
 Console S/N: 2203

Pre-Test Leak Check: ☒
 Vacuum Pressure: -20
 Post-Test Leak Check: ☐
 Vacuum Pressure:

K': 70.71

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				532.30						
	2.5	1200	0.03	0.67	533.43		225	46	66		-1
	5	1230	0.03	0.66	534.55		234	41	66		-1
	7.5	1250	0.03	0.65	535.66		248	43	65		-1
	10	1240	0.03	0.66	536.77		253	41	66		-1
	12.5	1150	0.03	0.69	537.91		252	39	66		-1
	15	1150	0.03	0.69	539.03		251	37	65		-1
	17.5	1150	0.03	0.69	540.16		251	36	65		-1
	20	1150	0.03	0.69	541.29		250	36	65		-2
	22.5	1150	0.03	0.69	542.43		251	34	66		-2
	25	1160	0.03	0.69	543.56		251	34	66		-2
	27.5	1190	0.04	0.90	544.86		250	35	66		-3
	30	1170	0.04	0.91	546.18		250	35	66		-3
	32.5	1190	0.04	0.90	547.47		251	36	66		-3
	35	1165	0.04	0.92	548.77		250	36	66		-3
	37.5	1165	0.04	0.92	550.07		249	36	66		-4
	40	1170	0.04	0.91	551.36		250	36	67		-4
	42.5	1160	0.04	0.92	552.68		250	36	67		-4
	45	1160	0.04	0.92	553.98		250	36	67		-4
	47.5	1170	0.04	0.91	555.29		250	36	67		-4
	50	1165	0.04	0.92	556.59		250	36	67		-4
	52.5	1180	0.04	0.91	557.91		250	36	68		-4
	55	1160	0.04	0.92	559.20		250	36	68		-4
	57.5	1190	0.04	0.91	560.51		250	36	68		-4
	60	1170	0.04	0.92			249	36	68		

MOISTURE FIELD DATA SHEET - METALS

Client: TMAC
 Job No.: 160930343
 Plant: Incinerator
 Location: Hope Bay NW
 Test: Metals - 1
 Date: 17 Sep 2019
 Analyst: BC/KW

 **Stantec**
 Filter.
 QZ6690

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H ₂ O	862.4	740.6	121.8
2	50 ml 10% HNO ₃ 50 ml 20% H ₂ O ₂	747.8	722.8	25.0
3	50 ml 10% HNO ₃ 50 ml 20% H ₂ O ₂	731.6	727.4	4.2
4	Blank	607.5	607.0	0.5
5	50 ml 8% KMnO ₄ 50 ml 20% H ₂ SO ₄	769.3	760.3	9.0
6	50 ml 8% KMnO ₄ 50 ml 20% H ₂ SO ₄	754.2	753.7	0.5
7	200g Silica Gel	956.5	946.0	10.5
Total Weight Gain (g)				171.5
Moisture Volume (mL)				

$$\begin{array}{r}
 531.90 \\
 - 475.40 \\
 \hline
 56.5 \text{ H}_2\text{O}
 \end{array}$$

$$\begin{array}{r}
 171.5 \\
 \times 0.048 \\
 \hline
 8.232
 \end{array}$$

$$\begin{array}{r}
 8.232 \\
 \hline
 64.732
 \end{array}
 = 0.12717 = 12.7\%$$

SOURCE TESTING FIELD DATA SHEET

Job No.: 1609 30343
 Client: T Mac
 Plant: Incinerator
 Location: Hoppe Bay
 Test: Metals 21
 Date: 17 Sep 19
 Operators: BC/RW
 Gamma: 0.979
 Delta H@: 1.880
 Pitot Coeff.: 0.821
 Start: 12:34
 Finish: 2:34

Static Pressure (in.H2O): _____
 Port Length (in): 6
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): (536)
 Console S/N: 2203

Pre-Test Leak Check: ✓
 Vacuum Pressure: -20
 Post-Test Leak Check: _____
 Vacuum Pressure: _____

K': 70.71

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	60				504.19						-8
	0				505.36		268	35	67		-8
	2.5	1120	0.03	0.71	506.55		266	36	67		-8
	5	1100	0.03	0.72	507.70		261	37	67		-8
	7.5	1105	0.03	0.71	508.85		257	37	67		-8
	10	1120	0.03	0.71	510.02		252	36	67		-8
	12.5	1120	0.03	0.71	511.19		248	36	67		-8
	15	1120	0.03	0.71	512.33		245	36	67		-8
	17.5	1120	0.03	0.71	513.48		246	36	67		-9
	20	1120	0.03	0.71	514.65		249	36	68		-9
	22.5	1120	0.03	0.71	515.80		254	36	67		-9
	25	1130	0.03	0.70	516.94		260	36	67		-9
	27.5	1130	0.03	0.70	518.09		265	36	67		-9
	30	1130	0.03	0.70	519.25		267	36	68		-10
	32.5	1120	0.03	0.71	520.42		268	36	68		-10
	35	1130	0.03	0.70	521.56		266	36	68		-10
	37.5	1170	0.03	0.69	522.70		263	36	68		-10
	40	1140	0.03	0.70	523.85		258	36	68		-10
	42.5	1150	0.03	0.70	525.00		255	36	68		-10
	45	1140	0.03	0.70	526.16		249	36	68		-10
	47.5	1160	0.03	0.69	527.30		246	36	69		-10
	50	1150	0.03	0.70	528.45		245	36	69		-10
	52.5	1150	0.03	0.70	529.60		247	36	69		-10
	55	1160	0.03	0.69	530.75		252	36	69		-10
	57.5	1150	0.03	0.70	531.90		259	36	69		-11
	60	1140	0.03	0.70							

SOURCE TESTING FIELD DATA SHEET

Job No.: 1609 30343
 Client: T.M.C.
 Plant: Incinerator
 Location: Hope Bay, N.S.
 Test: Metals L1
 Date: 17 Sep '19
 Operators: BC/KW
 Gamma: .979
 Delta H@: 1.880
 Pitot Coeff.: .821
 Start: 12:34
 Finish:

Static Pressure (in.H2O): 0.02
 Port Length (in): 6
 Stack Dia. (in.): 20
 Probe Length (ft): 2
 Nozzle ID (in.): (536)
 Console S/N: 2203

Pre-Test Leak Check: ☒
 Vacuum Pressure: -20
 Post-Test Leak Check: ☐
 Vacuum Pressure:

K': 70.71

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				475.40						
	2.5	1180	0.03	0.71	476.56		242	35	65		-1
	5	1090	0.03	0.72	477.71		237	35	65		-1
	7.5	1040	0.03	0.74	478.90		238	35	65		-2
	10	1080	0.03	0.72	480.06		245	35	65		-2
	12.5	1070	0.03	0.73	481.23		250	35	65		-3
	15	1050	0.03	0.74	482.43		269	35	65		-4
	17.5	1090	0.03	0.72	483.57		275	35	65		-4
	20	1070	0.03	0.73	484.77		280	35	65		-5
	22.5	1100	0.03	0.72	485.94		280	35	66		-5
	25	1070	0.03	0.73	487.12		278	35	66		-5
	27.5	1070	0.03	0.73	488.32		273	35	66		-5
	30	1070	0.03	0.73	489.49		270	35	66		-5
	32.5	1060	0.03	0.73	490.67		263	35	66		-6
	35	1080	0.03	0.72	491.82		258	35	66		-6
	37.5	1060	0.03	0.73	493.02		255	35	66		-7
	40	1090	0.03	0.72	494.19		249	35	66		-7
	42.5	1080	0.03	0.72	495.36		247	35	66		-7
	45	1110	0.03	0.71	496.54		246	35	66		-7
	47.5	1100	0.04	0.95	497.85		248	35	66		-9
	50	1160	0.04	0.92	499.17		253	35	67		-9
	52.5	1120	0.04	0.94	500.53		259	35	67		-9
	55	1140	0.04	0.93	501.84		264	35	67		-9
	57.5	1130	0.03	0.70	503.04		268	35	67		-8
	60	1130	0.03	0.70			269	35	67		-8

APPENDIX C

Lab Analysis



1435 Norjohn Court, Unit 1, Burlington ON, L7L 0E6
Phone: 905-331-3111, FAX: 905-331-4567

Certificate of Analysis

ALS Project Contact: Claire Kocharakkal
ALS Project ID: 25282
ALS WO#: L2355428
Date of Report: 18-Oct-19
Date of Sample Receipt: 27-Sep-19

Client Name: Stantec Consulting, Ltd.
Client Address: 845 Prospect Street
Fredricton, NB E3B 2T7
Canada
Client Contact: Tristan Blair-Hicks
Client Project ID: 160930343 TASK 519.006 HOPE BAY

COMMENTS:

Sample Particulate Analysis via Gravimetric USEPA Method 5 (PE/TP 11-Oct-19)

REPORT FLAGS:

J - The value is uncertain and below what can be reliably identified as positive with a $\geq 99\%$ confidence limit (i.e. below the laboratory determined MDL).

LCB = Laboratory Control Blank

CVS = Continuing Verification Standard Sample (limits: ± 2 in the last decimal)

LOR = Limit of Reporting

Certified by: _____

Claire Kocharakkal
Project Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

Sample Analysis Summary Report

Sample Name	METALS-1 (TS1 THRU TS5C)	METALS-2 (TS1 THRU TS5C)	METALS-3 (TS1 THRU TS5C)	METALS-BLANK (TS7 THRU TS12)	MB
ALS Sample ID	L2355428-1	L2355428-2	L2355428-3	L2355428-4	L2355428-MB
Matrix	Stack	Stack	Stack	Stack	n/a
Analysis type	Sample	Sample	Sample	Sample	Sample
Sampling Date/Time	17-Sep-19	17-Sep-19	18-Sep-19	17-Sep-19	n/a
Date of Receipt	27-Sep-19	27-Sep-19	27-Sep-19	27-Sep-19	n/a
PM via Gravimetric Analysis					
Method 5	LOR				
	mg	mg	mg	mg	mg
Filter Particulate Matter	0.8	62.0	68.5	57.1	<0.1
Acetone Particulate Matter	0.4	35.9	32.6	25.6	0.2 J
	g	g	g	g	g
Acetone Mass	0.02	63.0	73.2	67.1	74.6
					31.8



1435 Norjohn Court, Unit 1, Burlington ON, L7L 0E6
Phone: 905-331-3111, FAX: 905-331-4567

Certificate of Analysis

ALS Project Contact: Claire Kocharakkal
ALS Project ID: 25282
ALS WO#: L2355428
Date of Report: 18-Oct-19
Date of Sample Receipt: 27-Sep-19

Client Name: Stantec Consulting Ltd.
Client Address: 845 Prospect Street
Fredericton, NB E3B 2T7
Canada
Client Contact: Tristan Blair-Hicks
Client Project ID: 160930343 TASK 519.006 HOPE BAY

COMMENTS:

Sample Preparation via USEPA Method 29 (AB 07,17-OCT-2019)
Mercury Analysis via CVAA using Method USEPA 7470A (AB 08,17-OCT-2019)

LOR = Limit of Reporting
LCB = Laboratory Control Blank (limits: <LOR)
LCS = Laboratory Control Sample (limits: hivol, solids: 85-115%, stack: 90-110%)
MS = Matrix Spike Sample (limits: 75-125%)
RPD = Relative Percent Difference (limits: <20%)
CCV/CVS = Calibration Verification Standard (limits: 85-115%)

Certified by: _____



Claire Kocharakkal
Project Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

Sample Analysis Summary Report

Sample Name	METALS-1 (TS1 THRU TS5C)	METALS-2 (TS1 THRU TS5C)	METALS-3 (TS1 THRU TS5C)	METALS-BLANK (TS7 THRU TS12)
ALS Sample ID	L2355428-1	L2355428-2	L2355428-3	L2355428-4
Matrix	Stack	Stack	Stack	Stack
Analysis type	Sample	Sample	Sample	Sample
Sampling Date/Time	17-Sep-19	17-Sep-19	18-Sep-19	17-Sep-19
Date of Receipt	27-Sep-19	27-Sep-19	27-Sep-19	27-Sep-19
Mercury via CVAA				
	Method 29	LOR		
		ug	ug	ug
Analytical Fraction 1B	0.015	<0.015	<0.015	0.0549
Analytical Fraction 2B	0.050	0.340	0.354	0.435
Analytical Fraction 3A	0.005	<0.01	<0.0095	<0.0097
Analytical Fraction 3B	0.025	<0.025	0.0270	0.0216
Analytical Fraction 3C	0.25	0.138	<0.125	<0.125

ALS Environmental

Sample QC Summary Report

Sample Name	LCB	LCS	LCS	LCSD	LCSD
ALS Sample ID	LCB	LCS	LCS	LCSD	LCSD
Analysis type	Method Blank	Blank Spike	Blank Spike	Blank Spike Dup	Blank Spike Dup
Sampling Date/Time	N/A	N/A	N/A	N/A	N/A
Date of Receipt	N/A	N/A	N/A	N/A	N/A
Mercury via CVAA					
	Method 29	LOR			
		ug	ug	% Rec	ug
					% Rec
Analytical Fraction 1B	0.015	<0.015	0.291	97%	0.292
Analytical Fraction 2B	0.050	<0.1	1.87	94%	1.92
Analytical Fraction 3A	0.005	<0.01	0.197	98%	0.197
Analytical Fraction 3B	0.025	<0.025	0.465	91%	0.461
Analytical Fraction 3C	0.25	<0.125	2.45	97%	2.46

ALS Environmental

Sample QC Summary Report

Sample Name		METALS-1 (TS1 THRU TS5C)	METALS-1 (TS1 THRU TS5C)	METALS-1 (TS1 THRU TS5C)	METALS-1 (TS1 THRU TS5C)	METALS-1 (TS1 THRU TS5C)	METALS-1 (TS1 THRU TS5C)
ALS Sample ID		L2355428-1	L2355428-1DUP	L2355428-1MS	L2355428-1MS	L2355428-1MSD	L2355428-1MSD
Matrix		Stack	Stack	Stack	Stack	Stack	Stack
Analysis type		Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date/Time		17-Sep-19	17-Sep-19	17-Sep-19	17-Sep-19	17-Sep-19	17-Sep-19
Date of Receipt		27-Sep-19	27-Sep-19	27-Sep-19	27-Sep-19	27-Sep-19	27-Sep-19
Mercury via CVAA							
	Method 29	LOR ug	ug	ug	% Rec	ug	% Rec
Analytical Fraction 1B	0.015	<0.015	<0.015	0.309	102%	0.306	101%
Analytical Fraction 2B	0.050	0.340	0.378	5.56	97%	5.35	93%
Analytical Fraction 3A	0.005	<0.01	<0.01	0.193	96%	0.193	95%
Analytical Fraction 3B	0.025	<0.025	<0.025	0.444	87%	0.435	85%
Analytical Fraction 3C	0.250	0.138	0.125	2.50	95%	2.48	94%



1435 Norjohn Court, Unit 1, Burlington, ON, Canada L7L 0E6
Phone: 905-331-3111, FAX: 905-331-4567

Certificate of Analysis

ALS Project Contact: Claire Kocharakkal
ALS Project ID: 25282
ALS WO#: L2355437
Date of Report: 24-Oct-19
Date of Sample Receipt: 27-Sep-19

Client Name: Stantec Consulting Ltd
Client Address: 845 Prospect Street
Fredericton, NB E3B 2T7
Canada
Client Contact: Tristan Blair-Hicks
Client Project ID: 160930343 TASK 519.006 HOPE BAY

COMMENTS: PCDD/F by EPA M23

Certified by:

A handwritten signature in black ink, appearing to read "Steve Kennedy", written over a horizontal line.

Steve Kennedy
Technical Supervisor

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Life Sciences					
Sample Analysis Summary Report					
Sample Name	SVOC-1 (TS1 THRU TS6)	SVOC-2 (TS1 THRU TS6)	SVOC-3 (TS1 THRU TS6)	SVOC-BLANK (TS1 THRU TS6)	TRIP BLANK (TS7 THRU TS10)
ALS Sample ID	L2355437-1	L2355437-2	L2355437-3	L2355437-4	L2355437-5
Sample Size	1	1	1	1	1
Sample size units	Train	Train	Train	Train	Train
Percent Moisture	n/a	n/a	n/a	n/a	n/a
Sample Matrix	Stack	Stack	Stack	Stack	Stack
Sampling Date	15-Sep-19	16-Sep-19	16-Sep-19	17-Sep-19	17-Sep-19
Extraction Date	8-Oct-19	8-Oct-19	8-Oct-19	8-Oct-19	8-Oct-19
Target Analytes	pg	pg	pg	pg	pg
2,3,7,8-TCDD	448	87.0	42.9	<0.83	<1.6
1,2,3,7,8-PeCDD	1730	289	314	0.840	<0.89
1,2,3,4,7,8-HxCDD	1800	330	756	<2.0	<1.2
1,2,3,6,7,8-HxCDD	2420	556	2160	2.73	<1.1
1,2,3,7,8,9-HxCDD	1980	422	1360	1.92	<1.1
1,2,3,4,6,7,8-HpCDD	21300	6940	37200	22.1	<2.6
OCDD	28500	12400	95500	62.2	16.6
2,3,7,8-TCDF	2310	359	249	<1.2	<1.2
1,2,3,7,8-PeCDF	4400	676	879	1.97	<1.1
2,3,4,7,8-PeCDF	5760	1280	2310	2.32	<0.55
1,2,3,4,7,8-HxCDF	5240	1220	2970	2.69	<0.75
1,2,3,6,7,8-HxCDF	5930	1320	4080	3.08	<0.70
2,3,4,6,7,8-HxCDF	4780	2340	11200	<5.0	<0.75
1,2,3,7,8,9-HxCDF	1190	668	3170	3.00	<0.94
1,2,3,4,6,7,8-HpCDF	10300	6480	28300	18.2	<0.77
1,2,3,4,7,8,9-HpCDF	1680	1470	10300	3.28	<0.91
OCDF	2200	8370	69700	24.1	<3.0
Field Spike Standards	% Rec	% Rec	% Rec	% Rec	% Rec
37Cl4-2,3,7,8-TCDD	87	92	91	92	NS
13C12-1,2,3,4,7,8-HxCDD	94	92	94	92	NS
13C12-2,3,4,7,8-PeCDF	99	105	97	97	NS
13C12-1,2,3,4,7,8-HxCDF	95	98	94	94	NS
13C12-1,2,3,4,7,8,9-HpCDF	86	91	86	91	NS
Extraction Standards					
13C12-2,3,7,8-TCDD	71	75	63	82	54
13C12-1,2,3,7,8-PeCDD	78	80	56	69	64
13C12-1,2,3,6,7,8-HxCDD	75	79	54	69	60
13C12-1,2,3,4,6,7,8-HpCDD	79	78	61	68	64
13C12-OCDD	75	75	61	70	59
13C12-2,3,7,8-TCDF	81	84	63	79	59
13C12-1,2,3,7,8-PeCDF	82	83	61	76	62
13C12-1,2,3,6,7,8-HxCDF	86	87	62	79	62
13C12-1,2,3,4,6,7,8-HpCDF	81	83	63	74	66
Cleanup Standard					
13C12-1,2,3,7,8,9-HxCDF	75	71	61	64	64
Homologue Group Totals	pg	pg	pg	pg	pg
Total-TCDD	11900	2020	1350	<0.83	<1.6
Total-PeCDD	21200	3390	5760	7.84	<0.89
Total-HxCDD	31700	6670	24100	11.3	<1.2
Total-HpCDD	41800	13500	68800	43.1	<1.1
Total-TCDF	81500	13000	15600	8.49	<1.2
Total-PeCDF	83300	14600	30000	19.0	<0.61
Total-HxCDF	52300	16500	51700	22.9	1.08
Total-HpCDF	18400	15100	80400	35.8	<0.91
Toxic Equivalency - (WHO 2005)					
Lower Bound PCDD/F TEQ (WHO 2005)	6950	1660	4480	3.40	0.00498
Mid Point PCDD/F TEQ (WHO 2005)	6950	1660	4480	4.63	1.83
Upper Bound PCDD/F TEQ (WHO 2005)	6950	1660	4480	5.05	3.51

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Quality Control Summary Report			
Sample Name	Method Blank	Method Blank	Laboratory Control Sample
ALS Sample ID	WG3174994-1	WG3174994-4	WG3174994-2
Sample Size	1	1	1
Sample size units	Train	Train	n/a
Percent Moisture	n/a	n/a	n/a
Sample Matrix	MEDIA	REAGENT	QC
Sampling Date	n/a	n/a	n/a
Extraction Date	8-Oct-19	8-Oct-19	8-Oct-19
Target Analytes	pg	pg	% Rec
2,3,7,8-TCDD	<0.69	<0.79	100
1,2,3,7,8-PeCDD	1.22	<0.42	107
1,2,3,4,7,8-HxCDD	<0.73	<0.79	103
1,2,3,6,7,8-HxCDD	<0.72	<0.72	103
1,2,3,7,8,9-HxCDD	2.06	<0.75	106
1,2,3,4,6,7,8-HpCDD	3.00	<1.9	102
OCDD	17.0	<11	98
2,3,7,8-TCDF	<0.47	<0.50	98
1,2,3,7,8-PeCDF	1.37	<1.1	110
2,3,4,7,8-PeCDF	<0.30	<0.38	96
1,2,3,4,7,8-HxCDF	<0.67	<0.57	107
1,2,3,6,7,8-HxCDF	<0.55	<0.53	104
2,3,4,6,7,8-HxCDF	<0.74	<0.57	102
1,2,3,7,8,9-HxCDF	<0.97	<1.7	100
1,2,3,4,6,7,8-HpCDF	<1.3	1.41	102
1,2,3,4,7,8,9-HpCDF	<1.9	<0.46	100
OCDF	<3.4	2.08	95
Field Spike Standards	% Rec	% Rec	% Rec
37Cl4-2,3,7,8-TCDD	NS	NS	NS
13C12-1,2,3,4,7,8-HxCDD	NS	NS	NS
13C12-2,3,4,7,8-PeCDF	NS	NS	NS
13C12-1,2,3,4,7,8-HxCDF	NS	NS	NS
13C12-1,2,3,4,7,8,9-HpCDF	NS	NS	NS
Extraction Standards			
13C12-2,3,7,8-TCDD	75	66	55
13C12-1,2,3,7,8-PeCDD	70	69	54
13C12-1,2,3,6,7,8-HxCDD	71	65	61
13C12-1,2,3,4,6,7,8-HpCDD	73	69	62
13C12-OCDD	85	66	60
13C12-2,3,7,8-TCDF	77	71	64
13C12-1,2,3,7,8-PeCDF	73	72	57
13C12-1,2,3,6,7,8-HxCDF	78	72	67
13C12-1,2,3,4,6,7,8-HpCDF	82	71	69
Cleanup Standard			
13C12-1,2,3,7,8,9-HxCDF	79	74	71
Homologue Group Totals	pg	pg	
Total-TCDD	<0.69	<0.79	
Total-PeCDD	1.22	<0.42	
Total-HxCDD	2.06	<0.79	
Total-HpCDD	4.84	<0.74	
Total-TCDF	<0.47	<0.50	
Total-PeCDF	1.37	<0.42	
Total-HxCDF	<0.65	<0.65	
Total-HpCDF	<0.38	1.41	
Toxic Equivalency - (WHO 2005)			
Lower Bound PCDD/F TEQ (WHO 2005)	1.50	0.0147	
Mid Point PCDD/F TEQ (WHO 2005)	2.35	1.13	
Upper Bound PCDD/F TEQ (WHO 2005)	2.80	2.01	

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Sample Analysis Report

Sample Name	SVOC-1 (TS1 THRU TS6)	Sampling Date	15-Sep-19	Approved: T.Patterson --e-signature-- 22-Oct-2019
ALS Sample ID	L2355437-1	Extraction Date	8-Oct-19	
Analysis Method	EPA M23	Sample Size	1	
Analysis Type	Sample	Percent Moisture	n/a	
Sample Matrix	Stack	Split Ratio	2	

Run Information	Run 1
Filename	7-191019A23
Run Date	19-Oct-19 21:34
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS-7 DB5MSUST470134H

Target Analytes	TEF (WHO 2005)	Ret. Time	Conc. pg	EDL pg	Flags	EMPC pg	LQL
2,3,7,8-TCDD	1	27.96	448	1.5			20
1,2,3,7,8-PeCDD	1	32.06	1730	2.3			100
1,2,3,4,7,8-HxCDD	0.1	34.10	1800	5.2			100
1,2,3,6,7,8-HxCDD	0.1	34.15	2420	4.8			100
1,2,3,7,8,9-HxCDD	0.1	34.27	1980	5.0			100
1,2,3,4,6,7,8-HpCDD	0.01	35.75	21300	5.1			100
OCDD	0.0003	37.24	28500	3.2			200
2,3,7,8-TCDF	0.1	27.04	2310	1.5			20
1,2,3,7,8-PeCDF	0.03	31.13	4400	410			100
2,3,4,7,8-PeCDF	0.3	31.85	5760	370			100
1,2,3,4,7,8-HxCDF	0.1	33.61	5240	6.0			100
1,2,3,6,7,8-HxCDF	0.1	33.68	5930	5.5			100
2,3,4,6,7,8-HxCDF	0.1	34.00	4780	5.9			100
1,2,3,7,8,9-HxCDF	0.1	34.44	1190	6.8			100
1,2,3,4,6,7,8-HpCDF	0.01	35.19	10300	2.8			100
1,2,3,4,7,8,9-HpCDF	0.01	36.00	1680	3.4			100
OCDF	0.0003	37.33	2200	1.4			200
Field Spike Standards	pg		% Rec	Limits			
37Cl4-2,3,7,8-TCDD	400	27.96	87	70-130			
13Cl12-1,2,3,4,7,8-HxCDD	4000	34.09	94	70-130			
13Cl12-2,3,4,7,8-PeCDF	4000	31.84	99	70-130			
13Cl12-1,2,3,4,7,8-HxCDF	4000	33.60	95	70-130			
13Cl12-1,2,3,4,7,8,9-HpCDF	4000	35.99	86	70-130			
Extraction Standards							
13Cl12-2,3,7,8-TCDD	4000	27.93	71	40-130			
13Cl12-1,2,3,7,8-PeCDD	4000	32.05	78	40-130			
13Cl12-1,2,3,6,7,8-HxCDD	4000	34.14	75	40-130			
13Cl12-1,2,3,4,6,7,8-HpCDD	4000	35.74	79	25-130			
13Cl12-OCDD	8000	37.23	75	25-130			
13Cl12-2,3,7,8-TCDF	4000	27.02	81	40-130			
13Cl12-1,2,3,7,8-PeCDF	4000	31.12	82	40-130			
13Cl12-1,2,3,6,7,8-HxCDF	4000	33.67	86	40-130			
13Cl12-1,2,3,4,6,7,8-HpCDF	4000	35.18	81	25-130			
Cleanup Standard	pg						
13Cl12-1,2,3,7,8,9-HxCDF	4000	34.41	75	40-130			
Homologue Group Totals	# peaks		Conc. pg	EDL pg			
Total-TCDD	17	11900	1.5				20
Total-PeCDD	9	21200	2.3				100
Total-HxCDD	8	31700	5.2				100
Total-HpCDD	2	41800	5.1				100
Total-TCDF	26	81500	1.5				20
Total-PeCDF	22	83300	410				100
Total-HxCDF	14	52300	6.8				100
Total-HpCDF	4	18400	3.4				100

Toxic Equivalency - (WHO 2005)	pg
Lower Bound PCDD/F TEQ (WHO 2005)	6950
Mid Point PCDD/F TEQ (WHO 2005)	6950
Upper Bound PCDD/F TEQ (WHO 2005)	6950

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency

LQL Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

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Sample Analysis Report

Sample Name	SVOC-2 (TS1 THRU TS6)	Sampling Date	16-Sep-19	Approved: T.Patterson --e-signature-- 22-Oct-2019
ALS Sample ID	L2355437-2	Extraction Date	8-Oct-19	
Analysis Method	EPA M23	Sample Size	1 Train	
Analysis Type	Sample	Percent Moisture	n/a	
Sample Matrix	Stack	Split Ratio	2	

Run Information	Run 1
Filename	7-191019A24
Run Date	19-Oct-19 22:17
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS-7 DB5MSUST470134H

Target Analytes	TEF (WHO 2005)	Ret. Time	Conc. pg	EDL pg	Flags	EMPC pg	LQL
2,3,7,8-TCDD	1	27.96	87.0	1.4			20
1,2,3,7,8-PeCDD	1	32.06	289	1.1			100
1,2,3,4,7,8-HxCDD	0.1	34.10	330	3.4			100
1,2,3,6,7,8-HxCDD	0.1	34.15	556	3.1			100
1,2,3,7,8,9-HxCDD	0.1	34.28	422	3.2			100
1,2,3,4,6,7,8-HpCDD	0.01	35.75	6940	3.3			100
OCDD	0.0003	37.24	12400	2.3			200
2,3,7,8-TCDF	0.1	27.04	359	1.1			20
1,2,3,7,8-PeCDF	0.03	31.13	676	3.0			100
2,3,4,7,8-PeCDF	0.3	31.85	1280	2.7			100
1,2,3,4,7,8-HxCDF	0.1	33.61	1220	2.7			100
1,2,3,6,7,8-HxCDF	0.1	33.68	1320	2.5			100
2,3,4,6,7,8-HxCDF	0.1	34.01	2340	2.7			100
1,2,3,7,8,9-HxCDF	0.1	34.44	668	3.1			100
1,2,3,4,6,7,8-HpCDF	0.01	35.19	6480	2.6			100
1,2,3,4,7,8,9-HpCDF	0.01	36.00	1470	3.0			100
OCDF	0.0003	37.33	8370	1.8			200
Field Spike Standards	pg		% Rec	Limits			
37Cl4-2,3,7,8-TCDD	400	27.96	92	70-130			
13C12-1,2,3,4,7,8-HxCDD	4000	34.09	92	70-130			
13C12-2,3,4,7,8-PeCDF	4000	31.84	105	70-130			
13C12-1,2,3,4,7,8-HxCDF	4000	33.60	98	70-130			
13C12-1,2,3,4,7,8,9-HpCDF	4000	35.99	91	70-130			
Extraction Standards							
13C12-2,3,7,8-TCDD	4000	27.93	75	40-130			
13C12-1,2,3,7,8-PeCDD	4000	32.05	80	40-130			
13C12-1,2,3,6,7,8-HxCDD	4000	34.14	79	40-130			
13C12-1,2,3,4,6,7,8-HpCDD	4000	35.75	78	25-130			
13C12-OCDD	8000	37.23	75	25-130			
13C12-2,3,7,8-TCDF	4000	27.02	84	40-130			
13C12-1,2,3,7,8-PeCDF	4000	31.12	83	40-130			
13C12-1,2,3,6,7,8-HxCDF	4000	33.67	87	40-130			
13C12-1,2,3,4,6,7,8-HpCDF	4000	35.19	83	25-130			
Cleanup Standard	pg						
13C12-1,2,3,7,8,9-HxCDF	4000	34.41	71	40-130			
Homologue Group Totals	# peaks		Conc. pg	EDL pg			
Total-TCDD	14	2020	1.4				20
Total-PeCDD	9	3390	1.1				100
Total-HxCDD	7	6670	3.4				100
Total-HpCDD	2	13500	3.3				100
Total-TCDF	25	13000	1.1				20
Total-PeCDF	20	14600	3.0				100
Total-HxCDF	15	16500	3.1				100
Total-HpCDF	4	15100	3.0				100

Toxic Equivalency - (WHO 2005)	pg
Lower Bound PCDD/F TEQ (WHO 2005)	1660
Mid Point PCDD/F TEQ (WHO 2005)	1660
Upper Bound PCDD/F TEQ (WHO 2005)	1660

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency

LQL Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

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Sample Analysis Report

Sample Name	SVOC-3 (TS1 THRU TS6)	Sampling Date	16-Sep-19	Approved: T.Patterson --e-signature-- 22-Oct-2019
ALS Sample ID	L2355437-3	Extraction Date	8-Oct-19	
Analysis Method	EPA M23	Sample Size	1 Train	
Analysis Type	Sample	Percent Moisture	n/a	
Sample Matrix	Stack	Split Ratio	2	

Run Information	Run 1
Filename	7-191019A25
Run Date	19-Oct-19 22:59
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS-7 DB5MSUST470134H

Target Analytes	TEF (WHO 2005)	Ret. Time	Conc. pg	EDL pg	Flags	EMPC pg	LQL
2,3,7,8-TCDD	1	27.98	42.9	1.4			20
1,2,3,7,8-PeCDD	1	32.06	314	2.4			100
1,2,3,4,7,8-HxCDD	0.1	34.10	756	7.6			100
1,2,3,6,7,8-HxCDD	0.1	34.15	2160	6.9			100
1,2,3,7,8,9-HxCDD	0.1	34.28	1360	7.2			100
1,2,3,4,6,7,8-HpCDD	0.01	35.76	37200	12			100
OCDD	0.0003	37.25	95500	5.0			200
2,3,7,8-TCDF	0.1	27.05	249	1.1			20
1,2,3,7,8-PeCDF	0.03	31.13	879	4.5			100
2,3,4,7,8-PeCDF	0.3	31.85	2310	4.1			100
1,2,3,4,7,8-HxCDF	0.1	33.62	2970	12			100
1,2,3,6,7,8-HxCDF	0.1	33.69	4080	11			100
2,3,4,6,7,8-HxCDF	0.1	34.01	11200	12			100
1,2,3,7,8,9-HxCDF	0.1	34.45	3170	14			100
1,2,3,4,6,7,8-HpCDF	0.01	35.20	28300	6.2			100
1,2,3,4,7,8,9-HpCDF	0.01	36.00	10300	7.3			100
OCDF	0.0003	37.34	69700	5.5			200
Field Spike Standards	pg		% Rec	Limits			
37C14-2,3,7,8-TCDD	400	27.98	91	70-130			
13C12-1,2,3,4,7,8-HxCDD	4000	34.10	94	70-130			
13C12-2,3,4,7,8-PeCDF	4000	31.84	97	70-130			
13C12-1,2,3,4,7,8-HxCDF	4000	33.60	94	70-130			
13C12-1,2,3,4,7,8,9-HpCDF	4000	36.00	86	70-130			
Extraction Standards							
13C12-2,3,7,8-TCDD	4000	27.95	63	40-130			
13C12-1,2,3,7,8-PeCDD	4000	32.05	56	40-130			
13C12-1,2,3,6,7,8-HxCDD	4000	34.15	54	40-130			
13C12-1,2,3,4,6,7,8-HpCDD	4000	35.75	61	25-130			
13C12-OCDD	8000	37.24	61	25-130			
13C12-2,3,7,8-TCDF	4000	27.02	63	40-130			
13C12-1,2,3,7,8-PeCDF	4000	31.12	61	40-130			
13C12-1,2,3,6,7,8-HxCDF	4000	33.68	62	40-130			
13C12-1,2,3,4,6,7,8-HpCDF	4000	35.19	63	25-130			
Cleanup Standard	pg						
13C12-1,2,3,7,8,9-HxCDF	4000	34.41	61	40-130			
Homologue Group Totals		# peaks	Conc. pg	EDL pg			
Total-TCDD		15	1350	1.4			20
Total-PeCDD		9	5760	2.4			100
Total-HxCDD		8	24100	7.6			100
Total-HpCDD		2	68800	12			100
Total-TCDF		26	15600	1.1			20
Total-PeCDF		24	30000	4.5			100
Total-HxCDF		15	51700	14			100
Total-HpCDF		4	80400	7.3			100

Toxic Equivalency - (WHO 2005)	pg
Lower Bound PCDD/F TEQ (WHO 2005)	4480
Mid Point PCDD/F TEQ (WHO 2005)	4480
Upper Bound PCDD/F TEQ (WHO 2005)	4480

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency

LQL Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

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Sample Analysis Report

Sample Name	SVOC-BLANK (TS1 THRU TS6)	Sampling Date	17-Sep-19	Approved: T.Patterson --e-signature-- 22-Oct-2019
ALS Sample ID	L2355437-4	Extraction Date	8-Oct-19	
Analysis Method	EPA M23	Sample Size	1 Train	
Analysis Type	Sample	Percent Moisture	n/a	
Sample Matrix	Stack	Split Ratio	2	

Run Information	Run 1
Filename	7-191019A21
Run Date	19-Oct-19 20:10
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS-7 DB5MSUST470134H

Target Analytes	TEF (WHO 2005)	Ret. Time	Conc. pg	EDL pg	Flags	EMPC pg	LQL
2,3,7,8-TCDD	1	NotFnd	<0.83	0.83	U		20
1,2,3,7,8-PeCDD	1	32.07	0.840	0.57	M,J,B		100
1,2,3,4,7,8-HxCDD	0.1	34.10	<2.0	1.3	M,J,R	2.0	100
1,2,3,6,7,8-HxCDD	0.1	34.15	2.73	1.2	M,J		100
1,2,3,7,8,9-HxCDD	0.1	34.27	1.92	1.2	M,J,B		100
1,2,3,4,6,7,8-HpCDD	0.01	35.75	22.1	0.85	J,B		100
OCDD	0.0003	37.24	62.2	0.70	J,B		200
2,3,7,8-TCDF	0.1	26.99	<1.2	0.75	M,J,R	1.2	20
1,2,3,7,8-PeCDF	0.03	31.12	1.97	0.70	M,J,B		100
2,3,4,7,8-PeCDF	0.3	31.84	2.32	0.63	M,J		100
1,2,3,4,7,8-HxCDF	0.1	33.60	2.69	0.72	J		100
1,2,3,6,7,8-HxCDF	0.1	33.68	3.08	0.67	J		100
2,3,4,6,7,8-HxCDF	0.1	34.01	<5.0	0.71	M,J,R	5.0	100
1,2,3,7,8,9-HxCDF	0.1	34.43	3.00	0.82	J		100
1,2,3,4,6,7,8-HpCDF	0.01	35.19	18.2	0.40	J		100
1,2,3,4,7,8,9-HpCDF	0.01	36.00	3.28	0.48	J		100
OCDF	0.0003	37.33	24.1	0.45	J		200
Field Spike Standards	pg		% Rec	Limits			
37Cl4-2,3,7,8-TCDD	400	27.96	92	70-130			
13C12-1,2,3,4,7,8-HxCDD	4000	34.09	92	70-130			
13C12-2,3,4,7,8-PeCDF	4000	31.84	97	70-130			
13C12-1,2,3,4,7,8-HxCDF	4000	33.60	94	70-130			
13C12-1,2,3,4,7,8,9-HpCDF	4000	35.99	91	70-130			
Extraction Standards							
13C12-2,3,7,8-TCDD	4000	27.95	82	40-130			
13C12-1,2,3,7,8-PeCDD	4000	32.05	69	40-130			
13C12-1,2,3,6,7,8-HxCDD	4000	34.14	69	40-130			
13C12-1,2,3,4,6,7,8-HpCDD	4000	35.74	68	25-130			
13C12-OCDD	8000	37.23	70	25-130			
13C12-2,3,7,8-TCDF	4000	27.02	79	40-130			
13C12-1,2,3,7,8-PeCDF	4000	31.12	76	40-130			
13C12-1,2,3,6,7,8-HxCDF	4000	33.67	79	40-130			
13C12-1,2,3,4,6,7,8-HpCDF	4000	35.18	74	25-130			
Cleanup Standard	pg						
13C12-1,2,3,7,8,9-HxCDF	4000	34.41	64	40-130			
Homologue Group Totals	# peaks		Conc. pg	EDL pg			
Total-TCDD	0	<0.83	0.83	U		20	
Total-PeCDD	3	7.84	0.57			100	
Total-HxCDD	3	11.3	1.3			100	
Total-HpCDD	2	43.1	0.85			100	
Total-TCDF	4	8.49	0.75			20	
Total-PeCDF	6	19.0	0.70			100	
Total-HxCDF	6	22.9	0.82			100	
Total-HpCDF	4	35.8	0.48			100	

Toxic Equivalency - (WHO 2005)	pg
Lower Bound PCDD/F TEQ (WHO 2005)	3.40
Mid Point PCDD/F TEQ (WHO 2005)	4.63
Upper Bound PCDD/F TEQ (WHO 2005)	5.05

EDL	Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF	Indicates the Toxic Equivalency Factor
M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the EDL.
J	Indicates that a target analyte was detected below the calibrated range.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
B	Indicates that this target was detected in the blank at greater than 10% of the sample concentration.
LQL	Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC	Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure

ALS Life Sciences

Sample Analysis Report

Sample Name	TRIP BLANK (TS7 THRU TS10)	Sampling Date	17-Sep-19	Approved: T.Patterson --e-signature-- 22-Oct-2019
ALS Sample ID	L2355437-5	Extraction Date	8-Oct-19	
Analysis Method	EPA M23	Sample Size	1	
Analysis Type	Sample	Percent Moisture	n/a	
Sample Matrix	Stack	Split Ratio	2	

Run Information	Run 1
Filename	7-191019A22
Run Date	19-Oct-19 20:52
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS-7 DB5MSUST470134H

Target Analytes	TEF (WHO 2005)	Ret. Time	Conc. pg	EDL pg	Flags	EMPC pg	LQL
2,3,7,8-TCDD	1	NotFnd	<1.6	1.6		U	20
1,2,3,7,8-PeCDD	1	NotFnd	<0.89	0.89		U	100
1,2,3,4,7,8-HxCDD	0.1	NotFnd	<1.2	1.2		U	100
1,2,3,6,7,8-HxCDD	0.1	NotFnd	<1.1	1.1		U	100
1,2,3,7,8,9-HxCDD	0.1	NotFnd	<1.1	1.1		U	100
1,2,3,4,6,7,8-HpCDD	0.01	35.75	<2.6	1.1	M,J,R	2.6	100
OCDD	0.0003	37.23	16.6	0.98	M,J,B		200
2,3,7,8-TCDF	0.1	NotFnd	<1.2	1.2		U	20
1,2,3,7,8-PeCDF	0.03	31.14	<1.1	0.61	M,J,R	1.1	100
2,3,4,7,8-PeCDF	0.3	NotFnd	<0.55	0.55		U	100
1,2,3,4,7,8-HxCDF	0.1	NotFnd	<0.75	0.75		U	100
1,2,3,6,7,8-HxCDF	0.1	NotFnd	<0.70	0.70		U	100
2,3,4,6,7,8-HxCDF	0.1	34.00	<0.75	0.75	M,U	0.60	100
1,2,3,7,8,9-HxCDF	0.1	34.41	<0.94	0.86	M,J,R	0.94	100
1,2,3,4,6,7,8-HpCDF	0.01	NotFnd	<0.77	0.77		U	100
1,2,3,4,7,8,9-HpCDF	0.01	NotFnd	<0.91	0.91		U	100
OCDF	0.0003	37.33	<3.0	0.84	M,J,R	3.0	200
Field Spike Standards			% Rec				
37Cl4-2,3,7,8-TCDD			NS				
13C12-1,2,3,4,7,8-HxCDD			NS				
13C12-2,3,4,7,8-PeCDF			NS				
13C12-1,2,3,4,7,8-HxCDF			NS				
13C12-1,2,3,4,7,8,9-HpCDF			NS				
Extraction Standards							
13C12-2,3,7,8-TCDD	4000	27.96	54	40-130			
13C12-1,2,3,7,8-PeCDD	4000	32.05	64	40-130			
13C12-1,2,3,6,7,8-HxCDD	4000	34.14	60	40-130			
13C12-1,2,3,4,6,7,8-HpCDD	4000	35.74	64	25-130			
13C12-OCDD	8000	37.23	59	25-130			
13C12-2,3,7,8-TCDF	4000	27.04	59	40-130			
13C12-1,2,3,7,8-PeCDF	4000	31.12	62	40-130			
13C12-1,2,3,6,7,8-HxCDF	4000	33.67	62	40-130			
13C12-1,2,3,4,6,7,8-HpCDF	4000	35.18	66	25-130			
Cleanup Standard		pg					
13C12-1,2,3,7,8,9-HxCDF	4000	34.41	64	40-130			
			Conc.	EDL			
Homologue Group Totals		# peaks	pg	pg			
Total-TCDD		0	<1.6	1.6	U		20
Total-PeCDD		0	<0.89	0.89	U		100
Total-HxCDD		0	<1.2	1.2	U		100
Total-HpCDD		0	<1.1	1.1	U		100
Total-TCDF		0	<1.2	1.2	U		20
Total-PeCDF		0	<0.61	0.61	U		100
Total-HxCDF		1	1.08	0.86			100
Total-HpCDF		0	<0.91	0.91	U		100

Toxic Equivalency - (WHO 2005)	pg
Lower Bound PCDD/F TEQ (WHO 2005)	0.00498
Mid Point PCDD/F TEQ (WHO 2005)	1.83
Upper Bound PCDD/F TEQ (WHO 2005)	3.51

EDL	Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF	Indicates the Toxic Equivalency Factor
M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the EDL.
J	Indicates that a target analyte was detected below the calibrated range.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
B	Indicates that this target was detected in the blank at greater than 10% of the sample concentration.
LQL	Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC	Estimated Maximum Possible Concentration - elevated detection limit due to interference or positive id criterion failure
NS	Indicates that this standard was not spiked to sample

ALS Life Sciences

Laboratory Method Blank Analysis Report

Sample Name	Method Blank	Sampling Date	n/a	
ALS Sample ID	WG3174994-1	Extraction Date	8-Oct-19	
Analysis Method	EPA M23	Sample Size	1	Train
Analysis Type	Blank	Percent Moisture	n/a	
Sample Matrix	MEDIA	Split Ratio	2	
				Approved: T.Patterson --e-signature-- 22-Oct-2019

Run Information	Run 1
Filename	7-191019A19
Run Date	19-Oct-19 18:46
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS-7 DB5MSUST470134H

Target Analytes	TEF (WHO 2005)	Ret. Time	Conc. pg	EDL pg	Flags	EMPC pg	LQL
2,3,7,8-TCDD	1	NotFnd	<0.69	0.69	U		20
1,2,3,7,8-PeCDD	1	32.05	1.22	0.60	M,J		100
1,2,3,4,7,8-HxCDD	0.1	NotFnd	<0.73	0.73	U		100
1,2,3,6,7,8-HxCDD	0.1	34.14	<0.72	0.67	M,J,R	0.72	100
1,2,3,7,8,9-HxCDD	0.1	34.26	2.06	0.69	M,J		100
1,2,3,4,6,7,8-HpCDD	0.01	35.74	3.00	1.4	M,J		100
OCDD	0.0003	37.23	17.0	0.63	J		200
2,3,7,8-TCDF	0.1	NotFnd	<0.47	0.47	U		20
1,2,3,7,8-PeCDF	0.03	31.12	1.37	0.33	M,J		100
2,3,4,7,8-PeCDF	0.3	NotFnd	<0.30	0.30	U		100
1,2,3,4,7,8-HxCDF	0.1	33.61	<0.67	0.57	M,J,R	0.67	100
1,2,3,6,7,8-HxCDF	0.1	33.68	<0.55	0.53	M,J,R	0.55	100
2,3,4,6,7,8-HxCDF	0.1	33.99	<0.74	0.57	M,J,R	0.74	100
1,2,3,7,8,9-HxCDF	0.1	34.41	<0.97	0.65	M,J,R	0.97	100
1,2,3,4,6,7,8-HpCDF	0.01	35.18	<1.3	0.32	M,J,R	1.3	100
1,2,3,4,7,8,9-HpCDF	0.01	35.99	<1.9	0.38	M,J,R	1.9	100
OCDF	0.0003	37.32	<3.4	0.44	M,J,R	3.4	200
Field Spike Standards		% Rec					
37Cl4-2,3,7,8-TCDD			NS				
13C12-1,2,3,4,7,8-HxCDD			NS				
13C12-2,3,4,7,8-PeCDF			NS				
13C12-1,2,3,4,7,8-HxCDF			NS				
13C12-1,2,3,4,7,8,9-HpCDF			NS				
Extraction Standards							
13C12-2,3,7,8-TCDD	4000	27.93	75	40-130			
13C12-1,2,3,7,8-PeCDD	4000	32.04	70	40-130			
13C12-1,2,3,6,7,8-HxCDD	4000	34.13	71	40-130			
13C12-1,2,3,4,6,7,8-HpCDD	4000	35.73	73	25-130			
13C12-OCDD	8000	37.22	85	25-130			
13C12-2,3,7,8-TCDF	4000	27.01	77	40-130			
13C12-1,2,3,7,8-PeCDF	4000	31.10	73	40-130			
13C12-1,2,3,6,7,8-HxCDF	4000	33.66	78	40-130			
13C12-1,2,3,4,6,7,8-HpCDF	4000	35.17	82	25-130			
Cleanup Standard		pg					
13C12-1,2,3,7,8,9-HxCDF	4000	34.40	79	40-130			
Homologue Group Totals		# peaks	Conc. pg	EDL pg			
Total-TCDD		0	<0.69	0.69	U		20
Total-PeCDD		1	1.22	0.60			100
Total-HxCDD		1	2.06	0.73			100
Total-HpCDD		2	4.84	1.4			100
Total-TCDF		0	<0.47	0.47	U		20
Total-PeCDF		1	1.37	0.33			100
Total-HxCDF		0	<0.65	0.65	U		100
Total-HpCDF		0	<0.38	0.38	U		100

Toxic Equivalency - (WHO 2005)	pg
Lower Bound PCDD/F TEQ (WHO 2005)	1.50
Mid Point PCDD/F TEQ (WHO 2005)	2.35
Upper Bound PCDD/F TEQ (WHO 2005)	2.80

EDL	Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF	Indicates the Toxic Equivalency Factor
M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the EDL.
J	Indicates that a target analyte was detected below the calibrated range.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
LQL	Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC	Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure
NS	Indicates that this standard was not spiked to sample

ALS Life Sciences

Laboratory Method Blank Analysis Report

Sample Name	Method Blank	Sampling Date	n/a	Approved: T.Patterson --e-signature-- 22-Oct-2019
ALS Sample ID	WG3174994-4	Extraction Date	8-Oct-19	
Analysis Method	EPA M23	Sample Size	1	
Analysis Type	Blank	Percent Moisture	n/a	
Sample Matrix	REAGENT	Split Ratio	2	

Run Information	Run 1
Filename	7-191019A20
Run Date	19-Oct-19 19:28
Final Volume	20 uL
Dilution Factor	1
Analysis Units	pg
Instrument - Column	HRMS-7 DB5MSUST470134H

Target Analytes	TEF (WHO 2005)	Ret. Time	Conc. pg	EDL pg	Flags	EMPC pg	LQL
2,3,7,8-TCDD	1	NotFnd	<0.79	0.79	U		20
1,2,3,7,8-PeCDD	1	NotFnd	<0.42	0.42	U		100
1,2,3,4,7,8-HxCDD	0.1	NotFnd	<0.79	0.79	U		100
1,2,3,6,7,8-HxCDD	0.1	NotFnd	<0.72	0.72	U		100
1,2,3,7,8,9-HxCDD	0.1	NotFnd	<0.75	0.75	U		100
1,2,3,4,6,7,8-HpCDD	0.01	35.75	<1.9	0.74	M,J,R	1.9	100
OCDD	0.0003	37.24	<11	0.50	M,J,R	11	200
2,3,7,8-TCDF	0.1	NotFnd	<0.50	0.50	U		20
1,2,3,7,8-PeCDF	0.03	31.13	<1.1	0.42	M,J,R	1.1	100
2,3,4,7,8-PeCDF	0.3	NotFnd	<0.38	0.38	U		100
1,2,3,4,7,8-HxCDF	0.1	33.60	<0.57	0.57	M,U		100
1,2,3,6,7,8-HxCDF	0.1	NotFnd	<0.53	0.53	U		100
2,3,4,6,7,8-HxCDF	0.1	NotFnd	<0.57	0.57	U		100
1,2,3,7,8,9-HxCDF	0.1	34.43	<1.7	0.65	M,J,R	1.7	100
1,2,3,4,6,7,8-HpCDF	0.01	35.19	1.41	0.39	M,J		100
1,2,3,4,7,8,9-HpCDF	0.01	NotFnd	<0.46	0.46	U		100
OCDF	0.0003	37.33	2.08	0.63	M,J		200

Field Spike Standards % Rec

37Cl4-2,3,7,8-TCDD	NS
13C12-1,2,3,4,7,8-HxCDD	NS
13C12-2,3,4,7,8-PeCDF	NS
13C12-1,2,3,4,7,8-HxCDF	NS
13C12-1,2,3,4,7,8,9-HpCDF	NS

Extraction Standards

13C12-2,3,7,8-TCDD	4000	27.95	66	40-130
13C12-1,2,3,7,8-PeCDD	4000	32.05	69	40-130
13C12-1,2,3,6,7,8-HxCDD	4000	34.15	65	40-130
13C12-1,2,3,4,6,7,8-HpCDD	4000	35.75	69	25-130
13C12-OCDD	8000	37.23	66	25-130
13C12-2,3,7,8-TCDF	4000	27.02	71	40-130
13C12-1,2,3,7,8-PeCDF	4000	31.12	72	40-130
13C12-1,2,3,6,7,8-HxCDF	4000	33.67	72	40-130
13C12-1,2,3,4,6,7,8-HpCDF	4000	35.19	71	25-130

Cleanup Standard

13C12-1,2,3,7,8,9-HxCDF	4000	34.41	74	40-130
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Homologue Group Totals	# peaks	Conc. pg	EDL pg	
Total-TCDD	0	<0.79	0.79	U
Total-PeCDD	0	<0.42	0.42	U
Total-HxCDD	0	<0.79	0.79	U
Total-HpCDD	0	<0.74	0.74	U
Total-TCDF	0	<0.50	0.50	U
Total-PeCDF	0	<0.42	0.42	U
Total-HxCDF	0	<0.65	0.65	U
Total-HpCDF	1	1.41	0.46	

Toxic Equivalency - (WHO 2005) pg

Lower Bound PCDD/F TEQ (WHO 2005)	0.0147
Mid Point PCDD/F TEQ (WHO 2005)	1.13
Upper Bound PCDD/F TEQ (WHO 2005)	2.01

EDL	Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF	Indicates the Toxic Equivalency Factor
M	Indicates that a peak has been manually integrated.
U	Indicates that this compound was not detected above the EDL.
J	Indicates that a target analyte was detected below the calibrated range.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
LQL	Lower Quantification Limit, based on the lowest calibration level corrected for sample size, splits and dilutions.
EMPC	Estimated Maximum Possible Concentration – elevated detection limit due to interference or positive id criterion failure
NS	Indicates that this standard was not spiked to sample

ALS Life Sciences

Laboratory Control Sample Analysis Report

Sample Name	Laboratory Control Sample	Sampling Date	n/a	
ALS Sample ID	WG3174994-2	Extraction Date	8-Oct-19	
Analysis Method	EPA M23	Sample Size	1	n/a
Analysis Type	LCS	Percent Moisture	n/a	
Sample Matrix	QC	Split Ratio	2	
				Approved: T.Patterson --e-signature-- 22-Oct-2019

Run Information	Run 1
Filename	7-191019A16
Run Date	19-Oct-19 16:40
Final Volume	20 uL
Dilution Factor	1
Analysis Units	%
Instrument - Column	HRMS-7 DB5MSUST470134H

Target Analytes	pg	Ret.		Limits	
		Time	% Rec	Flags	
2,3,7,8-TCDD	400	27.95	100	70-130	
1,2,3,7,8-PeCDD	2000	32.05	107	70-130	
1,2,3,4,7,8-HxCDD	2000	34.08	103	70-130	
1,2,3,6,7,8-HxCDD	2000	34.13	103	70-130	
1,2,3,7,8,9-HxCDD	2000	34.26	106	70-130	
1,2,3,4,6,7,8-HpCDD	2000	35.74	102	70-130	
OCDD	4000	37.22	98	70-130	
2,3,7,8-TCDF	400	27.04	98	70-130	
1,2,3,7,8-PeCDF	2000	31.12	110	70-130	
2,3,4,7,8-PeCDF	2000	31.84	96	70-130	
1,2,3,4,7,8-HxCDF	2000	33.60	107	70-130	
1,2,3,6,7,8-HxCDF	2000	33.66	104	70-130	
2,3,4,6,7,8-HxCDF	2000	33.99	102	70-130	
1,2,3,7,8,9-HxCDF	2000	34.41	100	70-130	
1,2,3,4,6,7,8-HpCDF	2000	35.18	102	70-130	
1,2,3,4,7,8,9-HpCDF	2000	35.99	100	70-130	
OCDF	4000	37.31	95	70-130	
Field Spike Standards			% Rec		
37Cl4-2,3,7,8-TCDD			NS		
13C12-1,2,3,4,7,8-HxCDD			NS		
13C12-2,3,4,7,8-PeCDF			NS		
13C12-1,2,3,4,7,8-HxCDF			NS		
13C12-1,2,3,4,7,8,9-HpCDF			NS		
Extraction Standards					
13C12-2,3,7,8-TCDD	4000	27.93	55	40-130	
13C12-1,2,3,7,8-PeCDD	4000	32.04	54	40-130	
13C12-1,2,3,6,7,8-HxCDD	4000	34.13	61	40-130	
13C12-1,2,3,4,6,7,8-HpCDD	4000	35.73	62	25-130	
13C12-OCDD	8000	37.22	60	25-130	
13C12-2,3,7,8-TCDF	4000	27.01	64	40-130	
13C12-1,2,3,7,8-PeCDF	4000	31.10	57	40-130	
13C12-1,2,3,6,7,8-HxCDF	4000	33.66	67	40-130	
13C12-1,2,3,4,6,7,8-HpCDF	4000	35.17	69	25-130	
Cleanup Standard	pg				
13C12-1,2,3,7,8,9-HxCDF	4000	34.40	71	40-130	

NS Indicates that this standard was not spiked to sample

APPENDIX D

Calculated Data

GAS CALCULATIONS

Client: TMAC
 Plant: Incinerator
 Location: Hope Bay Nunavut

	O ₂ (%)	CO ₂ (%)	CO (ppm)	SO ₂ (ppm)	NO _x (ppm)
Gas 1	4.8	19.5	76.4	10.6	167.0
Gas 2	3.7	17.4	518.7	72.3	168.0
Gas 3	9.9	14.2	0.0	0.0	112.5

	O ₂ (%)	CO ₂ (%)	CO (ppm)	SO ₂ (ppm)	NO _x (ppm)
0	1.4	24.2	501	19	200
5	1.7	23.6	9	7	222
10	3.2	20.8	6	8	186
15	7	18.8	6	9	133
20	6	16.6	3	10	145
25	6.7	17.6	5	10	150
30	7.3	15.2	5	11	133

	O ₂ (%)	CO ₂ (%)	CO (ppm)	SO ₂ (ppm)	NO _x (ppm)
0	2.2	18.2	4	6	219
5	2.1	18.3	1	9	230
10	3	18.8	2000	351	159
15	2.5	18.5	1337	33	122
20	3.3	18.8	174	35	188
25	6.4	14.5	69	36	132
30	6.6	14.9	46	36	126

	O ₂ (%)	CO ₂ (%)	CO (ppm)	SO ₂ (ppm)	NO _x (ppm)
0	10.9	14.4	0	0	106
5	10.6	14.7	0	0	111
10	8.5	15.2	0	0	119
15	9.4	13.3	0	0	111
20	8.9	14.4	0	0	112
25	10.9	13.3	0	0	116
30					

GAS CALCULATIONS
TMAC
Incinerator
Hope Bay Nunavut

Variable	Symbol	Units	Calculation	Test 1	Test 2	Test 3	Average
Corresponding PM Test							n/a
Dry Stack Gas Flow Rate	Qs	dscfm dscms	(Entered from PM Test Data) $Qs \text{ (dscms)} = 0.000472 \times Qs \text{ (dscfm)}$	0.00	0.00	0.00	n/a n/a
Stack Gas Oxygen Content	Co2	%	Measurement from Flue Gas Analyzer	4.8	3.7	9.9	6.1
Stack Gas Carbon Dioxide Content	Cco2	%	Measurement from Flue Gas Analyzer	19.5	17.4	14.2	17.1
Sulphur Dioxide - SO2							
SO2 Measured Concentration	Cso2	ppm	Measurement from Flue Gas Analyzer	10.6	72.3	0.0	27.62
Uncorrected @ STP	Cso2	mg/dscm	$Cso2 \text{ (mg/dscm)} = Cso2 \text{ (ppm)} \times 2.62$	27.70	189.39	0.00	72.36
SO2 Emission Rate	ERso2	g/s kg/hr	$ERso2 = Cso2/1000 \times Qs$ $ERso2 \text{ (kg/hr)} = 3.6 \times ERso2 \text{ (g/s)}$	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
SO2 Concentration							
Corrected to 11% O2	Cso2	mg/dscm	$Cso2 \text{ (11\% O2)} = Cso2 \text{ (mg/dscm)} \times (20.9-11) / (20.9-Co2)$	16.99	109.19	0.00	42.06
Corrected to 3% O2	Cso2	mg/dscm	$Cso2 \text{ (3\% O2)} = Cso2 \text{ (mg/dscm)} \times (20.9-3) / (20.9-Co2)$	30.71	197.42	0.00	76.05
Corrected to 12% CO2	Cso2	mg/dscm	$Cso2 \text{ (12\% CO2)} = Cso2 \text{ (mg/dscm)} \times (12/Cco2)$	17.01	130.40	0.00	49.14
Nitrogen Oxides - NOx							
NOx Measured Concentration	Cnox	ppm	Measurement from Flue Gas Analyzer	167.0	168.0	112.5	149.17
Uncorrected @ STP	Cnox	mg/dscm	$Cnox \text{ (mg/dscm)} = Cnox \text{ (ppm)} \times 1.882$	314.29	316.18	211.73	280.73
NOx Emission Rate	ERnox	g/s kg/hr	$ERnox = Cnox/1000 \times Qs$ $ERnox \text{ (kg/hr)} = 3.6 \times ERnox \text{ (g/s)}$	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
NOx Concentration							
Corrected to 11% O2	Cnox	mg/dscm	$Cnox \text{ (11\% O2)} = Cnox \text{ (mg/dscm)} \times (20.9-11) / (20.9-Co2)$	192.75	182.29	189.98	188.34
Corrected to 3% O2	Cnox	mg/dscm	$Cnox \text{ (3\% O2)} = Cnox \text{ (mg/dscm)} \times (20.9-3) / (20.9-Co2)$	348.50	329.59	343.49	340.53
Corrected to 12% CO2	Cnox	mg/dscm	$Cnox \text{ (12\% CO2)} = Cnox \text{ (mg/dscm)} \times (12/Cco2)$	192.99	217.69	178.71	196.47
Carbon Monoxide - CO							
CO Measured Concentration	Cco	ppm	Measurement from Flue Gas Analyzer	76.4	518.7	0.0	198.38
Uncorrected @ STP	Cco	mg/dscm	$Cco \text{ (mg/dscm)} = Cco \text{ (ppm)} \times 1.145$	87.51	593.93	0.00	227.15
CO Emission Rate	ERco	g/s kg/hr	$ERco = Cco/1000 \times Qs$ $ERco \text{ (kg/hr)} = 3.6 \times ERco \text{ (g/s)}$	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
CO Concentration							
Corrected to 11% O2	Cco	mg/dscm	$Cco \text{ (11\% O2)} = Cco \text{ (mg/dscm)} \times (20.9-11) / (20.9-Co2)$	53.67	342.42	0.00	132.03
Corrected to 3% O2	Cco	mg/dscm	$Cco \text{ (3\% O2)} = Cco \text{ (mg/dscm)} \times (20.9-3) / (20.9-Co2)$	97.04	619.13	0.00	238.72
Corrected to 12% CO2	Cco	mg/dscm	$Cco \text{ (12\% CO2)} = Cco \text{ (mg/dscm)} \times (12/Cco2)$	53.73	408.93	0.00	154.22

Legend: sq.ft - square feet
sq.m - square metres
Pi - 3.142
R - degrees Rankin
ppm - parts per million

in.Hg - inches of mercury
cu.ft - cubic feet
cu.m - cubic metres
STP - standard temperature and pressure (25 C and 101.3 kPa)
dscms - dry standard cubic metres per second
dscfm - dry standard cubic feet per minute

mg/dscm - milligrams per dry standard cubic metre
g/s - grams per second
NOx - as NO2
acfm - actual cubic feet per minute

STACK TESTING RESULTS

GAS CALCULATIONS

TMAC

Incinerator

Hope Bay Nunavut

Parameter	Test 1	Test 2	Test 3	Average	Limits
Oxygen - O2 (%)	4.76	3.73	9.87	6.12	-
Carbon Dioxide - CO2 (%)	19.5	17.4	14.2	17.1	-
Sulphur Dioxide - SO2					
SO2 Measured Concentration (ppm)	10.6	72.3	0.0	27.6	-
Uncorrected at STP (mg/dscm)	27.7	189.4	0.0	72.4	-
Emission Rate (kg/hr)	0.00	0.00	0.00	0.00	-
Nitrogen Oxides - NOx					
NOx Measured Concentration (ppm)	167.0	168.0	112.5	149.2	-
Uncorrected at STP (mg/dscm)	314.3	316.2	211.7	280.7	-
Emission Rate (kg/hr)	0.00	0.00	0.00	0.00	-
Carbon Monoxide - CO					
CO Measured Concentration (ppm)	76.4	518.7	0.0	198.4	-
Uncorrected at STP (mg/dscm)	87.5	593.9	0.0	227.1	-
Emission Rate (kg/hr)	0.00	0.00	0.00	0.00	-

Legend:
C - degrees Celsius
m/s - metres per second
dscms - dry standard cubic metres per second
ppm - parts per million

STP - standard temperature and pressure (25 C and 101.3 kPa)
mg/dscm - miligrams per dry standard cubic metre
NOx - as NO2
ND - non-detectable

GAS CALCULATIONS

Client: TMAC
 Plant: Incinerator
 Location: Hope Bay, Nunavut

	O ₂ (%)	CO ₂ (%)	CO (ppm)	SO ₂ (ppm)	NO _x (ppm)
Gas 1	5.9	18.5	0.0	0.0	109.4
Gas 2	9.6	13.9	0.0	0.0	89.1
Gas 3	7.0	17.1	0.0	0.0	66.0

	O ₂ (%)	CO ₂ (%)	CO (ppm)	SO ₂ (ppm)	NO _x (ppm)
0	5	19.2	0	0	115
5	5.5	19.4	0	0	102
10	6.1	18.2	0	0	107
15	6.2	19	0	0	107
20	6.2	18.3	0	0	116
25	6.5	17.3	0	0	109
30	6	18.1	0	0	110

	O ₂ (%)	CO ₂ (%)	CO (ppm)	SO ₂ (ppm)	NO _x (ppm)
0	10.1	12.4	0	0	76
5	9.4	15.9	0	0	85
10	8.2	15.5	0	0	90
15	10.6	12.7	0	0	91
20	11.1	11.6	0	0	94
25	9.9	13.5	0	0	93
30	8.2	15.5	0	0	95

	O ₂ (%)	CO ₂ (%)	CO (ppm)	SO ₂ (ppm)	NO _x (ppm)
0	5.1	19.4	0	0	47
5	5.2	19.3	0	0	58
10	8.8	14.9	0	0	60
15	8.3	15.6	0	0	65
20	6.4	17.8	0	0	72
25	8.2	15.6	0	0	78
30	6.7	17.4	0	0	82

GAS CALCULATIONS
TMAC
Incinerator
Hope Bay, Nunavut

Variable	Symbol	Units	Calculation	Test 1	Test 2	Test 3	Average
Corresponding PM Test							n/a
Dry Stack Gas Flow Rate	Qs	dscfm dscms	(Entered from PM Test Data) $Qs \text{ (dscms)} = 0.000472 \times Qs \text{ (dscfm)}$	0.00	0.00	0.00	n/a n/a
Stack Gas Oxygen Content	Co2	%	Measurement from Flue Gas Analyzer	5.9	9.6	7.0	7.5
Stack Gas Carbon Dioxide Content	Cco2	%	Measurement from Flue Gas Analyzer	18.5	13.9	17.1	16.5
Sulphur Dioxide - SO2							
SO2 Measured Concentration	Cso2	ppm	Measurement from Flue Gas Analyzer	0.0	0.0	0.0	0.00
Uncorrected @ STP	Cso2	mg/dscm	$Cso2 \text{ (mg/dscm)} = Cso2 \text{ (ppm)} \times 2.62$	0.00	0.00	0.00	0.00
SO2 Emission Rate	ERso2	g/s kg/hr	$ERso2 = Cso2/1000 \times Qs$ $ERso2 \text{ (kg/hr)} = 3.6 \times ERso2 \text{ (g/s)}$	0.00	0.00	0.00	0.00
SO2 Concentration							
Corrected to 11% O2	Cso2	mg/dscm	$Cso2 \text{ (11% O2)} = Cso2 \text{ (mg/dscm)} \times (20.9-11) / (20.9-Co2)$	0.00	0.00	0.00	0.00
Corrected to 3% O2	Cso2	mg/dscm	$Cso2 \text{ (3% O2)} = Cso2 \text{ (mg/dscm)} \times (20.9-3) / (20.9-Co2)$	0.00	0.00	0.00	0.00
Corrected to 12% CO2	Cso2	mg/dscm	$Cso2 \text{ (12% CO2)} = Cso2 \text{ (mg/dscm)} \times (12/Cco2)$	0.00	0.00	0.00	0.00
Nitrogen Oxides - NOx							
NOx Measured Concentration	Cnox	ppm	Measurement from Flue Gas Analyzer	109.4	89.1	66.0	88.19
Uncorrected @ STP	Cnox	mg/dscm	$Cnox \text{ (mg/dscm)} = Cnox \text{ (ppm)} \times 1.882$	205.94	167.77	124.21	165.97
NOx Emission Rate	ERnox	g/s kg/hr	$ERnox = Cnox/1000 \times Qs$ $ERnox \text{ (kg/hr)} = 3.6 \times ERnox \text{ (g/s)}$	0.00	0.00	0.00	0.00
NOx Concentration							
Corrected to 11% O2	Cnox	mg/dscm	$Cnox \text{ (11% O2)} = Cnox \text{ (mg/dscm)} \times (20.9-11) / (20.9-Co2)$	136.18	147.54	88.20	123.97
Corrected to 3% O2	Cnox	mg/dscm	$Cnox \text{ (3% O2)} = Cnox \text{ (mg/dscm)} \times (20.9-3) / (20.9-Co2)$	246.23	266.77	159.46	224.15
Corrected to 12% CO2	Cnox	mg/dscm	$Cnox \text{ (12% CO2)} = Cnox \text{ (mg/dscm)} \times (12/Cco2)$	133.59	145.13	86.95	121.89
Carbon Monoxide - CO							
CO Measured Concentration	Cco	ppm	Measurement from Flue Gas Analyzer	0.0	0.0	0.0	0.00
Uncorrected @ STP	Cco	mg/dscm	$Cco \text{ (mg/dscm)} = Cco \text{ (ppm)} \times 1.145$	0.00	0.00	0.00	0.00
CO Emission Rate	ERco	g/s kg/hr	$ERco = Cco/1000 \times Qs$ $ERco \text{ (kg/hr)} = 3.6 \times ERco \text{ (g/s)}$	0.00	0.00	0.00	0.00
CO Concentration							
Corrected to 11% O2	Cco	mg/dscm	$Cco \text{ (11% O2)} = Cco \text{ (mg/dscm)} \times (20.9-11) / (20.9-Co2)$	0.00	0.00	0.00	0.00
Corrected to 3% O2	Cco	mg/dscm	$Cco \text{ (3% O2)} = Cco \text{ (mg/dscm)} \times (20.9-3) / (20.9-Co2)$	0.00	0.00	0.00	0.00
Corrected to 12% CO2	Cco	mg/dscm	$Cco \text{ (12% CO2)} = Cco \text{ (mg/dscm)} \times (12/Cco2)$	0.00	0.00	0.00	0.00

Legend: sq.ft - square feet
sq.m - square metres
Pi - 3.142
R - degrees Rankin
ppm - parts per million

in.Hg - inches of mercury
cu.ft - cubic feet
cu.m - cubic metres
STP - standard temperature and pressure (25 C and 101.3 kPa)
dscms - dry standard cubic metres per second
dscfm - dry standard cubic feet per minute

mg/dscm - milligrams per dry standard cubic metre
g/s - grams per second
NOx - as NO2
acfm - actual cubic feet per minute

STACK TESTING RESULTS

GAS CALCULATIONS

TMAC

Incinerator

Hope Bay, Nunavut

Parameter	Test 1	Test 2	Test 3	Average	Limits
Oxygen - O2 (%)	5.93	9.64	6.96	7.51	-
Carbon Dioxide - CO2 (%)	18.5	13.9	17.1	16.5	-
Sulphur Dioxide - SO2					
SO2 Measured Concentration (ppm)	0.0	0.0	0.0	0.0	-
Uncorrected at STP (mg/dscm)	0.0	0.0	0.0	0.0	-
Emission Rate (kg/hr)	0.00	0.00	0.00	0.00	-
Nitrogen Oxides - NOx					
NOx Measured Concentration (ppm)	109.4	89.1	66.0	88.2	-
Uncorrected at STP (mg/dscm)	205.9	167.8	124.2	166.0	-
Emission Rate (kg/hr)	0.00	0.00	0.00	0.00	-
Carbon Monoxide - CO					
CO Measured Concentration (ppm)	0.0	0.0	0.0	0.0	-
Uncorrected at STP (mg/dscm)	0.0	0.0	0.0	0.0	-
Emission Rate (kg/hr)	0.00	0.00	0.00	0.00	-

Legend:
C - degrees Celsius
m/s - metres per second
dscms - dry standard cubic metres per second
ppm - parts per million

STP - standard temperature and pressure (25 C and 101.3 kPa)
mg/dscm - milligrams per dry standard cubic metre
NOx - as NO2
ND - non-detectable

Raw Data for: **TMAC Resources**

Client:	TMAC
Job Number:	160930343
Plant:	Incinerator
Location:	Hope Bay, NU
Test:	M-1
Date:	17-Sep-19
Personnel:	BC/KW
Test Start:	12:34 PM
Test Finish:	2:34 PM

	Particulate Matter
Collected from Filter (mg):	62.00
Collected from Probe Wash (mg):	35.90
Total Collected (mg):	97.90

Impinger No.	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	862.4	740.6	121.8
2	747.8	722.8	25.0
3	731.6	727.4	4.2
4	607.5	607.0	0.5
5	769.3	760.3	9.0
6	754.2	753.7	0.5
7	956.5	946.0	10.5
Moisture Volume (mL)			171.5

Parameters

Barometric Pressure, Pbar (in. Hg)	29.60
Stack Static Pressure, Pstatic (in. H2O)	0.02
Ambient Temp, (°F)	45
H2O Volume Collected, Vw (mL)	171.5
Total # Sampling Points,	24
Sampling Time per Point, (min)	5
Readings Taken Every __ mins	2.5

O2, (%)	5.9
CO2, (%)	18.5
N2, (%)	75.6

Stack Diameter, (in.)	18
Stack Area, (sq. ft.)	1.77
Probe Length, (in)	24
Nozzle Diameter, (in.)	0.536
Pitot Coefficient, (Cp)	0.821
Gamma, meter constant	0.979

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp (°F)
Traverse 1	1	2.5	1100	0.03	0.71	475.40	
		5	1090	0.03	0.72	477.71	65
	2	7.5	1040	0.03	0.74	478.90	65
		10	1080	0.03	0.72	480.06	65
	3	12.5	1070	0.03	0.73	481.23	65
		15	1050	0.03	0.74	482.43	65
	4	17.5	1090	0.03	0.72	483.57	65
		20	1070	0.03	0.73	484.77	65
	5	22.5	1100	0.03	0.72	485.94	66
		25	1070	0.03	0.73	487.12	66
	6	27.5	1070	0.03	0.73	488.32	66
		30	1070	0.03	0.73	489.49	66
	7	32.5	1060	0.03	0.73	490.67	66
		35	1080	0.03	0.72	491.82	66
	8	37.5	1060	0.03	0.73	493.02	66
		40	1090	0.03	0.72	494.19	66
	9	42.5	1080	0.03	0.72	495.36	66
		45	1110	0.03	0.71	496.54	66
	10	47.5	1100	0.04	0.95	497.85	66
		50	1160	0.04	0.92	499.17	67
	11	52.5	1120	0.04	0.94	500.53	67
		55	1140	0.04	0.93	501.84	67
	12	57.5	1130	0.03	0.70	503.04	67
		60	1130	0.03	0.70	504.19	67
Traverse 2	1	62.5	1120	0.03	0.71	504.19	
		65	1100	0.03	0.72	505.36	67
	2	67.5	1105	0.03	0.71	506.55	67
		70	1120	0.03	0.71	507.70	67
	3	72.5	1120	0.03	0.71	508.85	67
		75	1120	0.03	0.71	510.02	67
	4	77.5	1120	0.03	0.71	511.19	67
		80	1120	0.03	0.71	512.33	67
	5	82.5	1120	0.03	0.71	513.48	67
		85	1130	0.03	0.70	514.65	68
	6	87.5	1130	0.03	0.70	515.80	67
		90	1130	0.03	0.70	516.94	67
	7	92.5	1130	0.03	0.71	518.09	67
		95	1120	0.03	0.71	519.25	68
	8	97.5	1130	0.03	0.70	520.42	68
		100	1170	0.03	0.69	521.56	68
	9	102.5	1140	0.03	0.70	522.70	68
		105	1150	0.03	0.70	523.85	68
	10	107.5	1140	0.03	0.70	525.00	68
		110	1160	0.03	0.69	526.16	68
	11	112.5	1150	0.03	0.70	527.30	69
		115	1150	0.03	0.70	528.45	69
	12	117.5	1160	0.03	0.69	529.60	69
		120	1150	0.03	0.70	530.75	69
			1140	0.03	0.70	531.90	69

Calculations for: **TMAC Resources**
Test #1

Client: TMAC
Job Number: 160930343

Plant: Incinerator
Location: Hope Bay, NU
Test: M-1
Date: 17-Sep-19
Personnel: BC/KW

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	29.60
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	31.20
Volume of Water Vapour Collected, Vwc (cu.ft)	8.232
Stack Gas Moisture Content (% as decimal)	0.128
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	29.50

Isokineticity Checks

Check range	Within Criteria
Check average	Within Criteria

0

	Traverse Point	Time	Stack Gas	S-type Pitot,	Orifice	Stack Gas	Meter Press.,	Gas Meter			Isokinetics I
		(min)	Temp, Ts (R)	delta P (in. H2O)	delta H (in. H2O)	Velocity, Us (ft/s)		Pm (in. Hg)	Avg. Temp, Tm (R)	Volume, Vm (cu. ft.)	
Traverse 1	1	2.5	1560	0.03	0.71	16.22	29.65	525	1.160	1.151	101.76
		5	1550	0.03	0.72	16.17	29.65	525	1.150	1.141	100.56
	2	7.5	1500	0.03	0.74	15.90	29.65	525	1.190	1.181	102.37
		10	1540	0.03	0.72	16.11	29.65	525	1.160	1.151	101.11
	3	12.5	1530	0.03	0.73	16.06	29.65	525	1.170	1.161	101.65
		15	1510	0.03	0.74	15.96	29.65	525	1.200	1.191	103.57
	4	17.5	1550	0.03	0.72	16.17	29.65	525	1.140	1.131	99.68
		20	1530	0.03	0.73	16.06	29.65	525	1.200	1.191	104.25
	5	22.5	1560	0.03	0.72	16.22	29.65	526	1.170	1.159	102.44
		25	1530	0.03	0.73	16.06	29.65	526	1.180	1.169	102.32
	6	27.5	1530	0.03	0.73	16.06	29.65	526	1.200	1.189	104.06
		30	1530	0.03	0.73	16.06	29.65	526	1.170	1.159	101.45
	7	32.5	1520	0.03	0.73	16.01	29.65	526	1.180	1.169	101.99
		35	1540	0.03	0.72	16.11	29.65	526	1.150	1.139	100.04
	8	37.5	1520	0.03	0.73	16.01	29.65	526	1.200	1.189	103.72
		40	1550	0.03	0.72	16.17	29.65	526	1.170	1.159	102.11
	9	42.5	1540	0.03	0.72	16.11	29.65	526	1.170	1.159	101.78
		45	1570	0.03	0.71	16.27	29.65	526	1.180	1.169	103.65
	10	47.5	1560	0.04	0.95	18.73	29.67	526	1.310	1.298	99.39
		50	1620	0.04	0.92	19.08	29.67	527	1.320	1.306	101.86
	11	52.5	1580	0.04	0.94	18.85	29.67	527	1.360	1.345	103.64
		55	1600	0.04	0.93	18.96	29.67	527	1.310	1.296	100.46
	12	57.5	1590	0.03	0.70	16.37	29.65	527	1.200	1.186	105.87
		60	1590	0.03	0.70	16.37	29.65	527	1.150	1.137	101.46
Traverse 2	1	62.5	1580	0.03	0.71	16.32	29.65	527	1.170	1.157	102.90
		65	1560	0.03	0.72	16.22	29.65	527	1.190	1.177	103.99
	2	67.5	1565	0.03	0.71	16.24	29.65	527	1.150	1.137	100.66
		70	1580	0.03	0.71	16.32	29.65	527	1.150	1.137	101.14
	3	72.5	1580	0.03	0.71	16.32	29.65	527	1.170	1.157	102.90
		75	1580	0.03	0.71	16.32	29.65	527	1.170	1.157	102.90
	4	77.5	1580	0.03	0.71	16.32	29.65	527	1.140	1.127	100.26
		80	1580	0.03	0.71	16.32	29.65	527	1.150	1.137	101.14
	5	82.5	1580	0.03	0.71	16.32	29.65	528	1.170	1.155	102.70
		85	1590	0.03	0.70	16.37	29.65	527	1.150	1.137	101.46
	6	87.5	1590	0.03	0.70	16.37	29.65	527	1.140	1.127	100.58
		90	1590	0.03	0.70	16.37	29.65	527	1.150	1.137	101.46
	7	92.5	1580	0.03	0.71	16.32	29.65	528	1.160	1.145	101.83
		95	1590	0.03	0.70	16.37	29.65	528	1.170	1.155	103.03
	8	97.5	1630	0.03	0.69	16.58	29.65	528	1.140	1.125	101.64
		100	1600	0.03	0.70	16.42	29.65	528	1.140	1.125	100.70
	9	102.5	1610	0.03	0.70	16.48	29.65	528	1.150	1.135	101.90
		105	1600	0.03	0.70	16.42	29.65	528	1.150	1.135	101.58
	10	107.5	1620	0.03	0.69	16.53	29.65	528	1.160	1.145	103.10
		110	1610	0.03	0.70	16.48	29.65	529	1.140	1.123	100.82
	11	112.5	1610	0.03	0.70	16.48	29.65	529	1.150	1.133	101.71
		115	1620	0.03	0.69	16.53	29.65	529	1.150	1.133	102.02
	12	117.5	1610	0.03	0.70	16.48	29.65	529	1.150	1.133	101.71
		120	1600	0.03	0.70	16.42	29.65	529	1.150	1.133	101.39
		Total	Average	Average	Average	Average	Average	Average	Total	Total	Average
		120	1,572	0.03	0.73	16.49	29.65	527	56.500	55.883	101.97

Raw Data for: TMAC Resources
Test #2

Client: TMAC
Job Number: 160930343
Incinerator
Plant: Incinerator
Location: Hope Bay, NU
Test: M-2
Date: 17-Sep-19
Personnel: BC / KW

Test Start: 4:06 PM
Test Finish: 6:06 PM

	Particulate
	Matter
Collected from Filter (mg):	68.50
Collected from Probe Wash (mg):	32.60
Total Collected (mg):	101.10

Impinger No.	Final Weight	Tare Weight	Weight of Moisture (g)
1	835.9	741.8	94.1
2	754.7	728.5	26.2
3	735.7	731.3	4.4
4	611.4	611.0	0.4
5	763.9	763.3	0.6
6	757.2	756.5	0.7
7	965.6	956.4	9.2
Moisture Volume (mL)			135.6

Parameters
Barometric Pressure, Pbar (in. Hg)
Stack Static Pressure, Pstatic (in. H2O)
Ambient Temp, (°F)
H2O Volume Collected, Vw (mL)
Total # Sampling Points,
Sampling Time per Point, (min)
Readings Taken Every __ mins

29.40	O2, (%)	9.6
0.02	CO2, (%)	13.9
27	N2, (%)	90.4
135.6		
24		
5		
2.5		

Stack Diameter, (in.) 18
Stack Area, (sq. ft.) 1.76715
Probe Length, (in.) 24
Nozzle Diameter, (in.) 0.536
Pitot Coefficient, (Cp) 0.821
Gamma, meter constant 0.979

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp (°F)
Traverse 1	1	2.5	1200	0.03	0.67	532.30	
		5	1230	0.03	0.66	533.43	66
		7.5	1250	0.03	0.65	534.55	66
	2	10	1240	0.03	0.66	535.66	65
		12.5	1150	0.03	0.66	536.77	66
		15	1150	0.03	0.69	537.91	66
	3	17.5	1150	0.03	0.69	539.03	65
		20	1150	0.03	0.69	540.16	65
		22.5	1150	0.03	0.69	541.29	65
	4	25	1160	0.03	0.69	542.43	66
		27.5	1160	0.03	0.69	543.56	66
		30	1190	0.04	0.90	544.86	66
	5	32.5	1170	0.04	0.91	546.18	66
		35	1190	0.04	0.90	547.47	66
		37.5	1165	0.04	0.92	548.77	66
	6	40	1165	0.04	0.92	550.07	66
		42.5	1170	0.04	0.91	551.36	67
		45	1160	0.04	0.92	552.68	67
	7	47.5	1160	0.04	0.92	553.98	67
		50	1170	0.04	0.91	555.29	67
		52.5	1165	0.04	0.92	556.59	67
	8	55	1180	0.04	0.91	557.91	68
		57.5	1160	0.04	0.92	559.20	68
		60	1190	0.04	0.91	560.51	68
	9		1170	0.04	0.92	561.82	68
Traverse 2	1	62.5	1175	0.04	0.91	561.82	
		65	1175	0.04	0.91	563.13	68
		67.5	1190	0.04	0.91	564.44	68
	2	70	1190	0.04	0.91	565.73	68
		72.5	1210	0.04	0.90	566.05	69
		75	1190	0.04	0.91	568.35	69
	3	77.5	1200	0.04	0.90	569.66	69
		80	1195	0.04	0.90	569.66	69
		82.5	1195	0.04	0.90	570.95	69
	4	85	1200	0.04	0.90	572.26	69
		87.5	1200	0.04	0.90	573.56	69
		90	1190	0.04	0.91	574.88	69
	5	92.5	1200	0.04	0.90	576.19	69
		95	1180	0.05	1.14	577.65	69
		97.5	1230	0.04	0.89	578.94	69
	6	100	1230	0.04	0.89	580.22	69
		102.5	1230	0.04	0.89	581.51	69
		105	1230	0.04	0.89	582.71	70
	7	107.5	1230	0.04	0.89	584.08	70
		110	1250	0.04	0.89	585.38	70
		112.5	1230	0.04	0.89	586.68	70
	8	115	1230	0.04	0.89	587.98	70
		117.5	1230	0.04	0.89	589.28	70
		120	1230	0.04	0.89	590.57	70
	9		1220	0.04	0.89	591.87	70
			1220	0.04	0.89	593.16	70

Calculations for: **TMAC Resources**
Test #2

Client: TMAC
Job Number: 160930343

Plant: Incinerator
Location: Hope Bay, NU
Test: M-2
Date: 17-Sep-19
Personnel: BC / KW

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)
Volume of Water Vapour Collected, Vwc (cu.ft)
Stack Gas Moisture Content (% as decimal)
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)

29.40
34.49
6.509
0.098
32.87

Isokineticity Checks

Check range Within Criteria
Check average Within Criteria

0

	Traverse Point	Time	Stack Gas	S-type Pitot,	Orifice	Stack Gas	Meter Press.,	Gas Meter			Isokinetics I (%)
		(min)	Temp, Ts (R)	delta P (in. H2O)	delta H (in. H2O)	Velocity, Us (ft/s)		Pm (in. Hg)	Avg. Temp, Tm (R)	Volume, Vm (cu. ft.)	
Traverse 1	1	2.5	1660	0.03	0.67	15.90	29.45	526	1.130	1.112	103.77
		5	1690	0.03	0.66	16.05	29.45	526	1.120	1.102	103.77
	2	7.5	1710	0.03	0.65	16.14	29.45	525	1.110	1.094	103.65
		10	1700	0.03	0.66	16.09	29.45	526	1.110	1.092	103.15
	3	12.5	1610	0.03	0.69	15.66	29.45	526	1.140	1.122	103.10
		15	1610	0.03	0.69	15.66	29.45	525	1.120	1.104	101.49
	4	17.5	1610	0.03	0.69	15.66	29.45	525	1.130	1.114	102.39
		20	1610	0.03	0.69	15.66	29.45	525	1.130	1.114	102.39
	5	22.5	1610	0.03	0.69	15.66	29.45	526	1.140	1.122	103.10
		25	1620	0.03	0.69	15.71	29.45	526	1.130	1.112	102.52
	6	27.5	1650	0.04	0.90	18.31	29.47	526	1.300	1.280	103.13
		30	1630	0.04	0.91	18.20	29.47	526	1.320	1.299	104.09
	7	32.5	1650	0.04	0.90	18.31	29.47	526	1.290	1.270	102.34
		35	1625	0.04	0.92	18.17	29.47	526	1.300	1.280	102.35
	8	37.5	1625	0.04	0.92	18.17	29.47	526	1.300	1.280	102.35
		40	1630	0.04	0.91	18.20	29.47	527	1.290	1.267	101.53
	9	42.5	1620	0.04	0.92	18.14	29.47	527	1.320	1.297	103.57
		45	1620	0.04	0.92	18.14	29.47	527	1.300	1.277	102.00
	10	47.5	1630	0.04	0.91	18.20	29.47	527	1.310	1.287	103.10
		50	1625	0.04	0.92	18.17	29.47	527	1.300	1.277	102.16
	11	52.5	1640	0.04	0.91	18.25	29.47	528	1.320	1.294	104.01
		55	1620	0.04	0.92	18.14	29.47	528	1.290	1.265	101.03
	12	57.5	1650	0.04	0.91	18.31	29.47	528	1.310	1.285	103.53
		60	1630	0.04	0.92	18.20	29.47	528	1.310	1.285	102.91
Traverse 2	1	62.5	1635	0.04	0.91	18.22	29.47	528	1.310	1.285	103.06
		65	1650	0.04	0.91	18.31	29.47	528	1.310	1.285	103.53
	2	67.5	1650	0.04	0.91	18.31	29.47	528	1.290	1.265	101.95
		70	1670	0.04	0.90	18.42	29.47	529	1.320	1.292	104.75
	3	72.5	1650	0.04	0.91	18.31	29.47	529	1.300	1.272	102.55
		75	1660	0.04	0.90	18.36	29.47	529	1.310	1.282	103.81
	4	77.5	1655	0.04	0.90	18.34	29.47	529	1.290	1.263	103.49
		80	1660	0.04	0.90	18.36	29.47	529	1.310	1.282	102.07
	5	82.5	1660	0.04	0.90	18.36	29.47	529	1.300	1.272	103.65
		85	1650	0.04	0.91	18.31	29.47	529	1.320	1.292	102.55
	6	87.5	1660	0.04	0.90	18.36	29.47	529	1.310	1.282	104.44
		90	1640	0.05	1.14	20.41	29.48	529	1.460	1.430	92.15
	7	92.5	1690	0.04	0.89	18.53	29.47	529	1.290	1.263	116.63
		95	1690	0.04	0.89	18.53	29.47	529	1.280	1.253	102.98
	8	97.5	1690	0.04	0.89	18.53	29.47	529	1.290	1.263	102.18
		100	1690	0.04	0.89	18.53	29.47	530	1.200	1.172	102.98
	9	102.5	1690	0.04	0.89	18.53	29.47	530	1.370	1.338	95.62
		105	1710	0.04	0.89	18.64	29.47	530	1.300	1.270	109.81
	10	107.5	1690	0.04	0.89	18.53	29.47	530	1.300	1.270	103.59
		110	1690	0.04	0.89	18.53	29.47	530	1.300	1.270	103.58
	11	112.5	1690	0.04	0.89	18.53	29.47	530	1.300	1.270	103.58
		115	1690	0.04	0.89	18.53	29.47	530	1.290	1.260	103.58
	12	117.5	1680	0.04	0.89	18.47	29.47	530	1.300	1.270	102.48
		120	1680	0.04	0.89	18.47	29.47	530	1.290	1.260	103.28
		Total	Average	Average	Average	Average	Average	Average	Total	Total	Average
		120	1,654	0.04	0.86	17.87	29.46	528	60.860	59.688	103.04

Raw Data for: TMAC Resources
Test #3

Client: TMAC
Job Number: 160930343
Incinerator
Plant: Incinerator
Location: Hope Bay, NU
Test: M-3
Date: 18-Sep-19
Personnel: TBH, JJC

Test Start: 10:48 AM
Test Finish: 12:48 PM

	Particulate Matter
Collected from Filter (mg):	57.10
Collected from Probe Wash (mg):	25.60
Total Collected (mg):	82.70

Impinger No.	Final Weight	Tare Weight	Weight of Moisture (g)
1	866.0	736.3	129.7
2	750.9	727.7	23.2
3	733.8	730.8	3.0
4	612.3	612.0	0.3
5	766.8	766.5	0.3
6	755.3	755.3	0.0
7	973.7	964.9	8.8
Moisture Volume (mL)			165.3

Parameters
Barometric Pressure, Pbar (in. Hg)
Stack Static Pressure, Pstatic (in. H2O)
Ambient Temp, (°F)
H2O Volume Collected, Vw (mL)
Total # Sampling Points,
Sampling Time per Point, (min)
Readings Taken Every __ mins

29.50	O2, (%)	7.0
0.02	CO2, (%)	17.1
47	N2, (%)	75.9
165.3		
24		
5		
2.5		

Stack Diameter, (in.) 18
Stack Area, (sq. ft.) 1.77
Probe Length, (in.) 24
Nozzle Diameter, (in.) 0.536
Pitot Coefficient, (Cp) 0.821
Gamma, meter constant 0.979

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp (°F)
Traverse 1	1	2.5	1115	0.03	0.72	593.50	
		5	1160	0.03	0.70	594.66	64
		7.5	1160	0.03	0.70	595.81	64
	2	10	1165	0.03	0.70	596.95	64
		12.5	1100	0.03	0.73	598.09	64
		15	1120	0.03	0.72	599.25	64
	3	17.5	1090	0.03	0.73	600.40	64
		20	1140	0.03	0.71	601.54	64
		22.5	1070	0.03	0.74	602.69	65
	4	25	1080	0.03	0.74	603.86	65
		27.5	1100	0.04	0.97	605.04	65
		30	1140	0.04	0.95	606.41	65
	5	32.5	1130	0.03	0.71	607.72	65
		35	1200	0.03	0.68	608.89	65
		37.5	1200	0.04	0.91	610.05	65
	6	40	1220	0.04	0.90	611.33	65
		42.5	1100	0.04	0.97	612.65	65
		45	1230	0.03	0.67	613.99	65
	7	47.5	1210	0.03	0.68	615.13	65
		50	1220	0.03	0.68	616.26	65
		52.5	1100	0.03	0.73	617.36	65
	8	55	1240	0.03	0.67	618.54	65
		57.5	1200	0.03	0.68	619.67	66
		60	1230	0.03	0.67	620.80	66
	9					621.93	
						623.26	66
						624.55	66
Traverse 2	1	62.5	1160	0.04	0.94	625.84	66
		65	1240	0.04	0.89	627.10	66
		67.5	1130	0.04	0.95	628.16	65
	2	70	1130	0.03	0.71	629.29	65
		72.5	1180	0.03	0.69	630.43	66
		75	1140	0.03	0.71	631.57	66
	3	77.5	1140	0.03	0.71	632.70	66
		80	1160	0.03	0.70	633.85	66
		82.5	1175	0.03	0.70	635.18	66
	4	85	1130	0.03	0.71	636.48	65
		87.5	1180	0.04	0.92	637.80	66
		90	1170	0.04	0.93	639.11	66
	5	92.5	1170	0.04	0.93	640.43	66
		95	1165	0.04	0.93	641.71	66
		97.5	1200	0.04	0.91	643.03	66
	6	100	1200	0.04	0.89	644.31	66
		102.5	1240	0.04	0.89	645.89	66
		105	1240	0.04	0.89	647.33	67
	7	107.5	1210	0.06	1.36	648.78	67
		110	1225	0.05	1.13	650.07	67
		112.5	1210	0.05	1.14	651.36	67
	8	115	1250	0.04	0.89	652.68	67
		117.5	1270	0.04	0.88		
		120	1200	0.04	0.91		

T (deg C)	T (deg F)	
10:00	8.7	47.7
11:00	7.9	46.2
12:00	8.4	47.1

Calculations for: **TMAC Resources**
Test #3

Client: TMAC
Job Number: 160930343

Plant: Incinerator
Location: Hope Bay, NU
Test: M-3
Date: 18-Sep-19
Personnel: TBH, JJC

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	29.50
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	31.02
Volume of Water Vapour Collected, Vwc (cu.ft)	7.934
Stack Gas Moisture Content (% as decimal)	0.119
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	29.47

Isokineticity Checks

Check range	Within Criteria
Check average	Within Criteria

0

	Traverse Point	Time	Stack Gas	S-type Pitot,	Orifice	Stack Gas	Meter Press.,	Gas Meter			Isokinetics
		(min)	Temp, Ts (R)	delta P (in. H2O)	delta H (in. H2O)	Velocity, Us (ft/s)		Pm (in. Hg)	Avg. Temp, Tm (R)	Volume, Vm (cu. ft.)	
Traverse 1	1	2.5	1575	0.03	0.72	16.33	29.55	524	1.160	1.150	101.17
		5	1620	0.03	0.70	16.56	29.55	524	1.150	1.140	101.71
	2	7.5	1620	0.03	0.70	16.56	29.55	524	1.140	1.130	100.83
		10	1625	0.03	0.70	16.59	29.55	524	1.140	1.130	100.98
	3	12.5	1560	0.03	0.73	16.25	29.55	524	1.160	1.150	100.69
		15	1580	0.03	0.72	16.36	29.55	524	1.150	1.140	100.45
	4	17.5	1550	0.03	0.73	16.20	29.55	524	1.140	1.130	98.63
		20	1600	0.03	0.71	16.46	29.55	525	1.150	1.137	100.89
	5	22.5	1530	0.03	0.74	16.10	29.55	525	1.170	1.157	100.38
		25	1540	0.03	0.74	16.15	29.55	524	1.180	1.169	101.76
	6	27.5	1560	0.04	0.97	18.77	29.57	525	1.370	1.356	102.85
		30	1600	0.04	0.95	19.01	29.57	525	1.310	1.296	99.59
	7	32.5	1590	0.03	0.71	16.41	29.55	525	1.170	1.157	102.33
		35	1660	0.03	0.68	16.77	29.55	525	1.160	1.147	103.65
	8	37.5	1660	0.04	0.91	19.36	29.57	525	1.280	1.267	99.11
		40	1680	0.04	0.90	19.48	29.57	525	1.320	1.306	102.82
	9	42.5	1560	0.04	0.97	18.77	29.57	525	1.340	1.326	100.60
		45	1690	0.03	0.67	16.92	29.55	525	1.140	1.127	102.78
	10	47.5	1670	0.03	0.68	16.82	29.55	525	1.130	1.118	101.28
		50	1680	0.03	0.68	16.87	29.55	525	1.100	1.088	98.88
	11	52.5	1560	0.03	0.73	16.25	29.55	525	1.180	1.167	102.23
		55	1700	0.03	0.67	16.97	29.55	526	1.130	1.115	101.98
	12	57.5	1660	0.03	0.68	16.77	29.55	526	1.130	1.115	100.78
		60	1690	0.03	0.67	16.92	29.55	526	1.130	1.115	101.68
Traverse 2	1	62.5	1620	0.04	0.94	19.13	29.57	526	1.330	1.314	101.54
		65	1700	0.04	0.89	19.59	29.57	526	1.290	1.274	100.88
	2	67.5	1590	0.04	0.95	18.95	29.57	526	1.290	1.274	97.58
		70	1590	0.03	0.71	16.41	29.55	525	1.260	1.246	110.20
	3	72.5	1640	0.03	0.69	16.67	29.55	525	1.060	1.048	94.15
		75	1600	0.03	0.71	16.46	29.55	525	1.130	1.118	99.14
	4	77.5	1600	0.03	0.71	16.46	29.55	526	1.140	1.125	99.82
		80	1620	0.03	0.70	16.56	29.55	526	1.140	1.125	100.44
	5	82.5	1635	0.03	0.70	16.64	29.55	526	1.130	1.115	100.02
		85	1590	0.03	0.71	16.41	29.55	526	1.150	1.135	100.39
	6	87.5	1640	0.04	0.92	19.24	29.57	526	1.330	1.314	102.17
		90	1630	0.04	0.93	19.19	29.57	525	1.300	1.286	99.75
	7	92.5	1630	0.04	0.93	19.19	29.57	526	1.320	1.304	101.09
		95	1625	0.04	0.93	19.16	29.57	526	1.310	1.294	100.17
	8	97.5	1660	0.04	0.91	19.36	29.57	526	1.320	1.304	102.01
		100	1660	0.04	0.91	19.36	29.57	526	1.280	1.264	98.92
	9	102.5	1700	0.04	0.89	19.59	29.57	526	1.320	1.304	103.23
		105	1700	0.04	0.89	19.59	29.57	526	1.280	1.264	100.10
	10	107.5	1670	0.06	1.36	23.78	29.60	526	1.580	1.562	100.11
		110	1685	0.05	1.13	21.81	29.58	527	1.440	1.420	100.15
	11	112.5	1670	0.05	1.14	21.71	29.58	527	1.450	1.430	100.39
		115	1710	0.04	0.89	19.65	29.57	527	1.290	1.272	100.99
	12	117.5	1730	0.04	0.88	19.77	29.56	527	1.290	1.272	101.57
		120	1660	0.04	0.91	19.36	29.57	527	1.320	1.301	101.82
		Total	Average	Average	Average	Average	Average	Average	Total	Total	Average
		120	1,632	0.04	0.82	17.99	29.56	525	59.180	58.500	100.93

Stack: Hope Bay, NU
Operating Conditions: Normal
Stack Height above Grade: X.xx m
Stack Diameter: 0.46 m

Reference Temperature, Tref (F): 77
(R): 537
(K): 298
Reference Pressure, Pref (in.Hg): 29.92
(Bar): 1.0

Parameter	Symbol	Units	Test 1	Test 2	Test 3	Average
Test ID	-	-	M-1	M-2	M-3	-
Date	-	-	17-Sep-19	17-Sep-19	18-Sep-19	n/a
Start Time	-	-	12:34 PM	4:06 PM	10:48 AM	n/a
End Time	-	-	2:34 PM	6:06 PM	12:48 PM	n/a
Total Sampling Time	-	min	120	120	120	120
Stack Diameter	D	in.	18	18	18	18
Average Stack Gas Temperature	Ts	F	1112	1194	1172	1159
Average Dry Gas Meter Temperature	Tm	F	67	68	65	67
Barometric Pressure	Pbar	in.Hg	29.60	29.40	29.50	29.50
Stack Static Pressure	Pstatic	in.H2O	0.02	0.02	0.02	0.02
Avgerage Pressure Drop (Head)	dP	in.H2O	0.03	0.04	0.04	0.03
Average deltaH Orifice	dH	in.H2O	0.73	0.86	0.82	0.80
Average Meter Temperature	Tm	F	67	68	65	67
Gas Sample Volume	Vm	cu.ft	56.500	60.860	59.180	58.85
Average Isokinetics	I	%	102.0	103.0	100.9	102.0
Nozzle Diameter	Dn	in.	0.536	0.536	0.536	0.536
Pitot Coefficient	Cp	-	0.821	0.821	0.821	0.821
Gamma, meter constant	y	-	0.979	0.979	0.979	0.979
Reference Temperature	Tref	R	537	537	537	537
Reference Pressure	Pref	in.Hg	29.92	29.92	29.92	29.92
Stack Gas Oxygen Content	Co2	%	5.9	9.6	7.0	7.5
Stack Gas Carbon Dioxide Content	Cco2	%	18.5	13.9	17.1	16.5
Stack Gas Nitrogen Content	Cn2	%	75.6	90.4	75.9	80.6
Volume of Water Collected	Vw	mL	171.5	135.6	165.3	157.5
Particulate Collected from Filter	-	mg	62	69	57	63
Particulate Collected from Probe Wash	-	mg	36	33	26	31
Total Particulate Collected	Mp	mg	98	101	83	94

Legend: F - degrees Fahrenheit
K - degrees Kelvin
Bar - bars
in.Hg - inches of mercury
in. - inches

in.H2O - inches of water
cu.ft - cubic feet
R - degrees Rankin
NOx - as NO2

CALCULATIONS
TMAC
Incinerator
Stack: Hope Bay, NU
Operating Conditions: Normal
Stack Height above Grade: X.xx m
Stack Diameter: 0.46 m

Variable	Symbol	Units	Calculation	Test 1	Test 2	Test 3	Average
Stack Area	As	sq.ft sq.m	As = Pi x ((D/12)^2)/ 4 As (sq.m) = As (sq.ft) x 0.0929	1.77 0.16	1.77 0.16	1.77 0.16	1.77 0.16
Barometric Pressure Stack Static Pressure Avg. Stack Temperature Avg. Meter Temperature Nozzle Diameter	Pbar Pstatic Ts Tm Dn	kPa kPa R R mm	Pbar (kPa) = Pbar (in.Hg) x 3.386 Pstatic (kPa) = Pstatic (in.H2O) x 0.249 Ts (R) = Ts (F) + 460 Tm (R) = Tm (F) + 460 Dn (mm) = Dn (in.) x 25.4	100.2 0.005 1572 527 14	99.5 0.005 1654 528 14	99.9 0.005 1632 525 14	99.9 0.005 1619 527 14
Gas Meter Pressure Sample Volume at STP Volume of Water Vapour Water Fraction	Pm Vmc Vwc Bwo	in.Hg cu.ft cu.m cu.ft -	Pm = Pbar + (dH / 13.6) Vmc = Tref / Pref x (Vm x Pm x y) / Tm Vmc (cu.m) = 0.02832 x Vmc (cu.ft) Vwc = 0.0480 x Vw Bwo = Vwc / (Vwc + Vmc)	29.65 55.881 1.58 8.232 0.128	29.46 59.694 1.69 6.509 0.098	29.56 58.503 1.66 7.934 0.119	29.56 58.026 1.64 7.558 0.115
Molecular Weight, Dry Molecular Weight, Wet	Md Ms	lb/lb-mol lb/lb-mol	Md = 0.44 (Cco2) + 0.32 (Co2) + 0.28 (Cn2) Ms = Md (1 - Bwo) + (18 x Bwo)	31.20 29.50	34.49 32.87	31.02 29.47	32.24 30.61
Stack Pressure Stack Gas Velocity Actual Stack Gas Flow Rate Dry Stack Gas Flow Rate	Ps Us Q Qs	in.Hg ft/s m/s acfm dscfm dscms	Ps = Pbar + (Pstatic / 13.6) Us = 85.33 x Cp x ((dP x Ts)/(Ps x Ms))^0.5 Us (m/s) = 0.3048 x Us (ft/s) Q = 60 x Us x As Qs = Q x (1-Bwo) x (Tref/Ts) x (Ps/Pref) Qs (dscms) = 0.000472 x Qs (dscfm)	29.60 16.49 5.03 1,748 515 0.24	29.40 17.87 5.45 1,894 545 0.26	29.50 17.99 5.48 1,908 545 0.26	29.50 17.45 5.32 1,850 535 0.25
Particulate Concentration Particulate Emission Rate Particulate Concentration Corrected to 11% O2 Corrected to 3% O2 Corrected to 12% CO2	Cs ERp Cs Cs Cs	mg/dscm g/s kg/hr mg/dscm mg/dscm mg/dscm	Cs = Mp / Vmc ERp = Cs/1000 x Qs ERp (kg/hr) = 3.6 x ERp (g/s) Correction factor to 11% O2 Cs (11% O2) = Cs x (20.9-11) / (20.9-Co2) Cs (3% O2) = Cs x (20.9-3) / (20.9-Co2) Cs (12% CO2) = Cs x (12/Cco2)	61.862 0.015 0.05 0.661 41 74 40	59.804 0.015 0.06 0.879 53 95 52	49.916 0.013 0.05 0.710 35 64 35	57.194 0.014 0.05 43 78 42

Legend: sq.ft - square feet
sq.m - square metres
Pi - 3.142
R - degrees Rankin
in.Hg - inches of mercury

acfm - actual cubic feet per minute
dscfm - dry standard cubic feet per minute
dscms - dry standard cubic metres per second
ppm - parts per million
mg/dscm - miligrams per dry standard cubic metre
g/s - grams per second
NOx - as NO2

cu.ft - cubic feet
cu.m - cubic metres
STP - standard temperature and pressure
(25 C and 101.s kPa)

SUMMARY OF METAL EMISSIONS- TMAC Incinerator Exhaust Stack 2017

	TEST1	TEST2	TEST3
vol dry gas meter dscm	1.58	1.69	1.66
volumetric flow dry stack gas dscm/s	0.24	0.26	0.26
O2 correction factor	0.66	0.88	0.71

	Test 1			Test 2			Test 3			Average		
	mg/dscm at STP	mg/dscm at 11% O2	emission rate (kg/hr)	mg/dscm at STP	mg/dscm at 11% O2	emission rate (kg/hr)	mg/dscm at STP	mg/dscm at 11% O2	emission rate (kg/hr)	mg/dscm at STP	mg/dscm at 11% O2	emission rate (kg/hr)
Total Mercury (Hg)	3.34E-04	2.21E-04	2.92E-07	3.14E-04	2.76E-04	2.91E-07	3.90E-04	2.77E-04	3.61E-07	3.46E-04	2.58E-04	3.15E-07

PRELIMINARY STACK TESTING RESULTS

TMAC

Incinerator

Stack: Hope Bay, NU

Operating Conditions: Normal

Stack Height above Grade: X.xx m

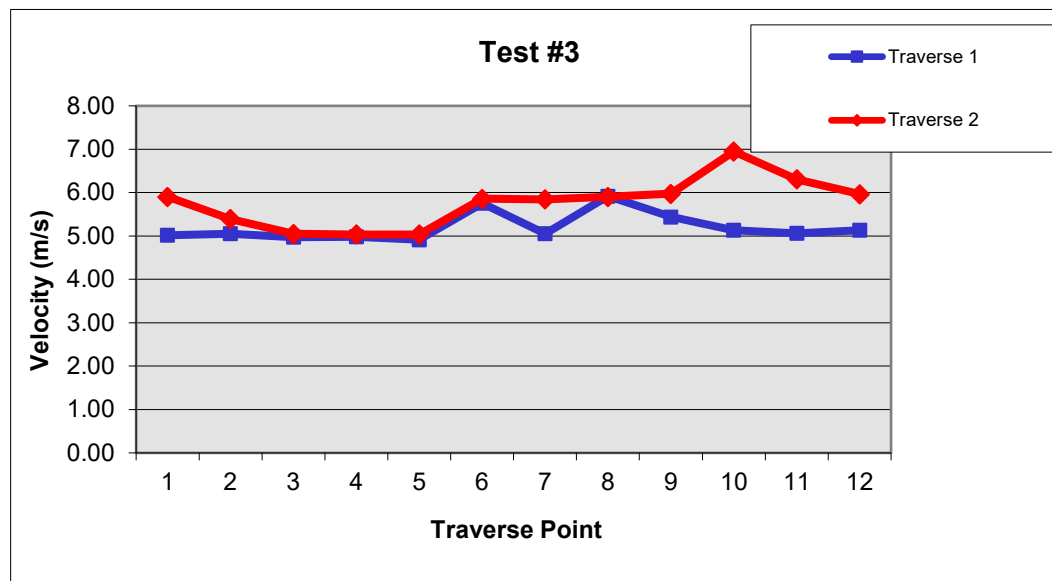
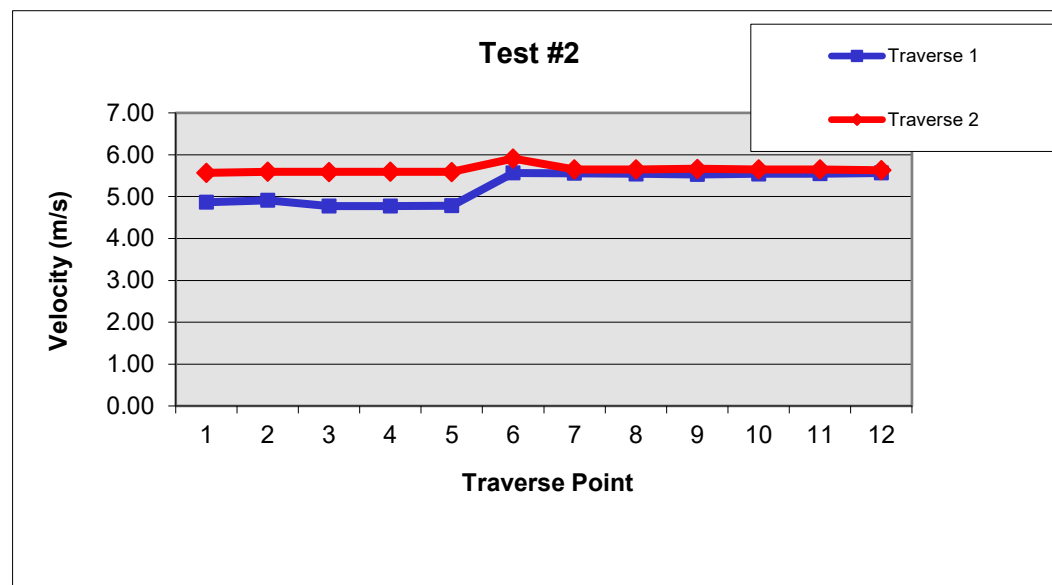
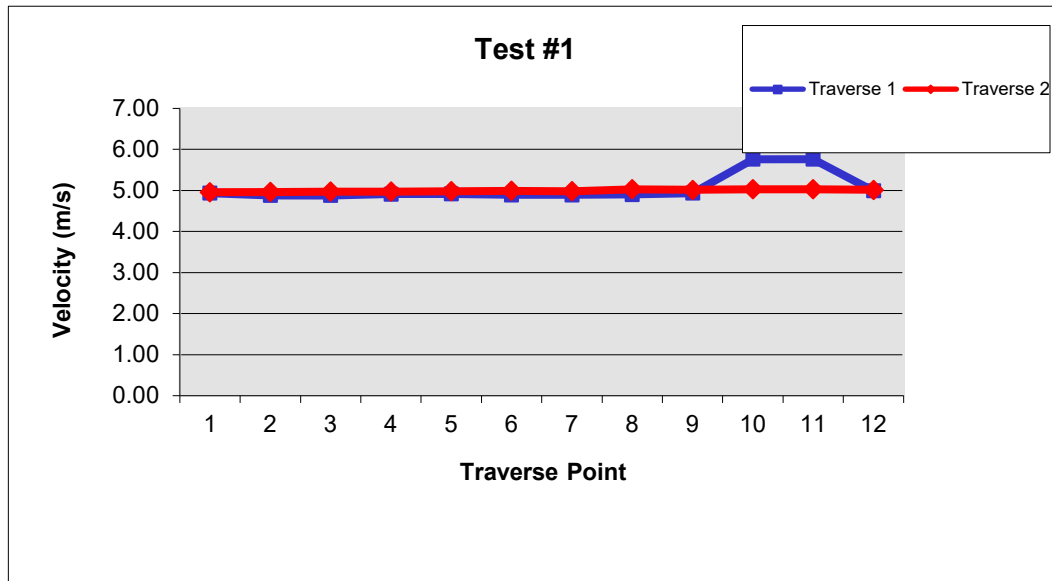
Stack Diameter: 0.46 m

Parameter	Test 1	Test 2	Test 3	Average
Test ID	M-1	M-2	M-3	
Test Date	17-Sep-19	17-Sep-19	18-Sep-19	
Stack Gas Temperature (C)	600	646	633	626
Moisture Content (%)	12.84	9.8	11.9	11.5
Velocity (m/s)	5.03	5.45	5.48	5.32
Volumetric Flow (dscms)	0.24	0.26	0.26	0.25
Oxygen - O2 (%)	5.93	9.64	6.96	7.51
Carbon Dioxide - CO2 (%)	18.50	13.87	17.14	16.50
Particulate Matter - PM				
Particulate Concentration (mg/dscm)	62	60	50	57
Corrected to 11% O2 (mg/dscm)	40.9	52.6	35.4	43.0
Corrected to 11% O2 (ug/dscm)	0.04	0.05	0.04	0.04
Emission Rate (g/s)	0.02	0.02	0.01	0.01

Legend: C - degrees Celsius
m/s - metres per second
dscms - dry standard cubic metres per second
ppm - parts per million
STP - standard temperature and pressure (25 C and 101.3 kPa)
mg/dscm - miligrams per dry standard cubic metre
NOx - as NO2

Parameter	Test 1	Test 2	Test 3	Average
Test Duration (min)	120	120	120	120
Stack Gas Static Pressure (kPa)	0.005	0.005	0.005	0.005
Volume of Gas Sampled (Rm ³)	1.58	1.69	1.66	1.64
Average Isokineticity (%)	102.0	103.0	100.9	102.0
Total Particulate Matter not including Impingers (mg)	97.90	101.10	82.70	93.90
Exhaust Gas Parameters				
Stack Gas Temperature (°C)	600	646	633	626
Stack Gas Moisture Content (%)	12.84	9.83	11.94	11.54
Stack Gas Velocity (m/s)	5.03	5.45	5.48	5.32
Stack Gas Flow Rate (Rm ³ /s)	0.24	0.26	0.26	0.25
Oxygen - O ₂ Concentration (%)	5.93	9.64	6.96	7.51
Carbon Dioxide - CO ₂ Concentration (%)	18.5	13.9	17.1	16.5
Particulate Matter (PM) ⁺ Concentration (mg/Rm ³)	61.9	59.8	49.9	57.2
Emission Rate (kg/hr)	0.05	0.06	0.05	0.05
Mercury (Hg) Concentration (ug/Rm ³)	0.33	0.31	0.39	0.35
Concentration (ug/Rm ³) @ 11%	0.22	0.28	0.28	0.26
Emission Rate (kg/hr)	2.92E-07	2.91E-07	3.61E-07	3.15E-07

Stack Gas Velocity Profiles
Hope Bay, NU
Particulate and Metals Testing



Raw Data for: New Incinerator DF Testing

Client:	TMAC
Job Number:	160930343
Plant:	incinerator
Location:	Hope Bay
Test:	SVOC-1
Date:	15-Sep-19
Personnel:	BC
Test Start:	10:55 AM
Test Finish:	2:05 PM

Dioxins and Furans			
Collected from Front Half Rinse (pg TEQ):			
Collected from Back half rinse (pg TEQ):			
Total Collected (pg TEQ):		6945.010	

Parameters	
Barometric Pressure, Pbar (in. Hg)	29.50
Stack Static Pressure, Pstatic (in. H2O)	0.02
Ambient Temp, (°F)	41
H2O Volume Collected, Vw (mL)	356.7
Total # Sampling Points,	24
Sampling Time per Point, (min)	8
Readings Taken Every __ mins	4

O2, (%)	3.7
CO2, (%)	18.5
N2, (%)	77.8

Impinger No.	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
Condenser	306.4	304.7	1.7
Resin Trap	350.6	347.9	2.7
Condensate trap	817.5	490.1	327.4
1	770.2	752.8	17.4
2	647.1	646.5	0.6
3	918.5	911.6	6.9

Moisture Volume (mL)	356.7
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Stack Diameter, (in.)	18
Stack Area, (sq. ft.)	1.77
Probe Length, (in.)	24
Nozzle Diameter, (in.)	0.536
Pitot Coefficient, (Cp)	0.821
Gamma, meter constant	0.979

T (deg C)	T	P (kPa)	P
11:00	7.5		100.12
12:00	7.6		100.1
1:00	7.3		100.07
2:00	7.5		100.06

Gas Meter Temp						
	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)
Traverse 1	1	4	1355	0.02	0.42	230.45
		8	1382	0.02	0.42	231.92
		12	1418	0.02	0.41	233.26
	2	16	1430	0.03	0.61	234.66
		20	1462	0.04	0.80	236.35
		24	1488	0.04	0.79	238.29
	3	28	1493	0.04	0.79	240.20
		32	1515	0.05	0.97	242.14
		36	1533	0.05	0.96	244.25
	4	40	1550	0.06	1.15	246.42
		44	1562	0.06	1.14	248.80
		48	1561	0.06	1.14	251.17
	5	52	1575	0.05	0.95	253.54
		56	1580	0.05	0.94	255.68
		60	1591	0.04	0.75	257.76
	6	64	1591	0.04	0.75	259.65
		68	1608	0.04	0.74	261.55
		72	1540	0.03	0.58	263.20
	7	76	1547	0.03	0.57	264.82
		80	1561	0.03	0.57	266.48
		84	1512	0.03	0.58	268.15
	8	88	1531	0.03	0.58	269.82
		92	1524	0.03	0.58	271.48
		96	1519	0.04	0.77	273.41
Traverse 2	1	100	1530	0.04	0.77	275.34
		104	1518	0.04	0.77	277.29
		108	1517	0.04	0.78	279.22
	2	112	1530	0.04	0.77	281.17
		116	1515	0.05	0.97	283.41
		120	1508	0.05	0.98	285.56
	3	124	1518	0.05	0.97	287.69
		128	1504	0.05	0.98	289.87
		132	1507	0.05	0.98	292.05
	4	136	1520	0.05	0.97	294.20
		140	1507	0.05	0.98	296.34
		144	1515	0.05	0.97	298.54
	5	148	1508	0.05	0.98	300.71
		152	1514	0.05	0.97	302.93
		156	1580	0.05	0.94	305.10
	6	160	1565	0.05	0.95	307.23
		164	1547	0.06	1.15	309.69
		168	1545	0.06	1.15	312.05
	7	172	1538	0.06	1.16	314.42
		176	1535	0.06	1.16	316.80
		180	1540	0.06	1.16	319.15
	8	184	1535	0.06	1.16	321.52
		188	1532	0.06	1.16	323.91
			1535	0.06	1.16	326.26

Raw Data for: New Incinerator DF Testing Test #2

Client:	TMAC
Job Number:	160930343
Plant:	incinerator
Location:	Hope Bay
Test:	SVOC-2
Date:	16-Sep-19
Personnel:	BC
Test Start:	10:00 AM
Test Finish:	12:00 PM

Parameters

Barometric Pressure, Pbar (in. Hg)	29.60
Stack Static Pressure, Pstatic (in. H2O)	0.02
Ambient Temp, (°F)	35
H2O Volume Collected, Vw (mL)	196.3
Total # Sampling Points,	24
Sampling Time per Point, (min)	8
Readings Taken Every __ mins	4.0

Dioxins and Furans	
Collected from Front Half Rinse (pg TEQ):	
Collected from Back half rinse (pg TEQ):	
Total Collected (pg TEQ):	1656.91

O2, (%)	4.76
CO2, (%)	19.54
N2, (%)	75.70

Impinger No.	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
Condenser	229.6	227.1	2.5
Resin Trap	342.2	339.4	2.8
Condensate trap	763.4	540.9	222.5
1	742.5	778.3	-35.8
2	620.0	619.8	0.2
3	922.2	918.1	4.1
Moisture Volume (mL)			196.3

Stack Diameter, (in.)	18
Stack Area, (sq. ft.)	1.77
Probe Length, (in.)	24
Nozzle Diameter, (in.)	0.536
Pitot Coefficient, (Cp)	0.821
Gamma, meter constant	0.979

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp (°F)
Traverse 1	1	4	1420	0.03	0.57	326.60	
		8	1427	0.03	0.57	328.31	73
	2	12	1464	0.03	0.56	329.91	73
		16	1480	0.03	0.55	331.56	73
	3	20	1474	0.02	0.37	333.19	73
		24	1480	0.02	0.37	334.55	72
	4	28	1475	0.02	0.37	335.87	73
		32	1478	0.02	0.37	337.20	72
	5	36	1478	0.02	0.37	338.55	73
		40	1455	0.03	0.56	340.19	72
	6	44	1447	0.03	0.56	341.87	72
		48	1455	0.02	0.37	341.87	72
	7	52	1455	0.02	0.37	343.32	72
		56	1430	0.02	0.38	346.22	72
	8	60	1508	0.03	0.54	347.82	72
		64	1580	0.03	0.52	349.42	72
	9	68	1584	0.03	0.52	350.77	72
		72	1536	0.02	0.36	352.08	72
	10	76	1507	0.02	0.36	353.42	71
		80	1505	0.02	0.36	354.78	72
	11	84	1520	0.02	0.36	356.12	72
		88	1510	0.02	0.36	357.44	72
	12	92	1499	0.02	0.36	358.79	71
		96	1503	0.02	0.36	360.17	71
			1506	0.02	0.36	361.51	71
Traverse 2	1	100.0	1499	0.02	0.36	361.51	70
		104.0	1470	0.02	0.37	362.85	70
	2	108.0	1470	0.02	0.37	364.21	70
		112.0	1499	0.02	0.36	365.56	70
	3	116.0	1485	0.02	0.36	366.91	69
		120.0	1475	0.02	0.37	368.25	68
	4	124.0	1488	0.02	0.36	369.60	68
		128.0	1482	0.02	0.36	370.95	68
	5	132.0	1490	0.02	0.36	372.28	67
		136.0	1480	0.02	0.36	373.60	67
	6	140.0	1498	0.02	0.36	374.94	67
		144.0	1490	0.02	0.36	376.27	67
	7	148.0	1504	0.02	0.36	377.60	67
		152.0	1495	0.02	0.36	378.94	67
	8	156.0	1502	0.02	0.36	380.28	67
		160.0	1480	0.02	0.36	381.60	66
	9	164.0	1494	0.02	0.36	382.94	66
		168.0	1505	0.02	0.36	384.27	66
	10	172.0	1500	0.02	0.36	385.59	66
		176.0	1500	0.02	0.36	386.92	66
	11	180.0	1490	0.02	0.36	388.26	66
		184.0	1510	0.02	0.36	389.58	66
	12	188.0	1500	0.02	0.36	390.91	66
			1500	0.02	0.36	392.25	66

Calculations for: New Incinerator DF Testing Test #2

Client: TMAC
Job Number: 160930343

Plant: incinerator
Location: Hope Bay
Test: SVOC-2
Date: 16-Sep-19
Personnel: BC

Calculated Parameters	
Stack Gas Pressure, Ps (in.Hg)	29.60
Stack Gas Pressure, Ps (KPa)	100.24
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	31.32
Volume of Water Vapour Collected, Vwc (cu.ft)	9.422
Stack Gas Moisture Content (% as decimal)	0.127
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	29.62

	Traverse Point	Time	Stack Gas	S-type Pitot,	Orifice	Stack Gas	Meter Press.,	Gas Meter			Isokinetics
		(min)	Temp, Ts (R)	delta P (in. H2O)	delta H (in. H2O)	Velocity, Us (ft/s)		Pm (in. Hg)	Avg. Temp, Tm (R)	Volume, Vm (cu. ft.)	
Traverse 1	1	4	1880	0.03	0.57	17.77	29.64	533	1.710	1.671	101.43
		8	1887	0.03	0.57	17.80	29.64	533	1.600	1.563	95.08
	2	12	1924	0.03	0.56	17.97	29.64	533	1.650	1.612	99.01
		16	1940	0.03	0.55	18.05	29.64	533	1.630	1.593	98.21
	3	20	1934	0.02	0.37	14.71	29.63	532	1.360	1.331	100.35
		24	1940	0.02	0.37	14.74	29.63	533	1.320	1.289	97.36
	4	28	1935	0.02	0.37	14.72	29.63	532	1.330	1.301	98.16
		32	1938	0.02	0.37	14.73	29.63	533	1.350	1.319	99.53
	5	36	1915	0.03	0.56	17.93	29.64	532	1.640	1.606	98.36
		40	1907	0.03	0.56	17.90	29.64	532	1.680	1.645	100.55
	6	44	1915	0.02	0.37	14.64	29.63	532	1.450	1.419	106.46
		48	1890	0.02	0.38	14.55	29.63	532	1.320	1.292	96.28
	7	52	1968	0.03	0.54	18.18	29.64	532	1.580	1.547	96.06
		56	2040	0.03	0.52	18.51	29.64	532	1.600	1.566	99.04
	8	60	2044	0.03	0.52	18.53	29.64	532	1.600	1.566	99.13
		64	1996	0.02	0.36	14.95	29.63	532	1.350	1.321	101.19
	9	68	1967	0.02	0.36	14.84	29.63	532	1.310	1.282	97.48
		72	1965	0.02	0.36	14.83	29.63	531	1.340	1.314	99.85
	10	76	1954	0.02	0.37	14.79	29.63	532	1.360	1.331	100.86
		80	1980	0.02	0.36	14.89	29.63	532	1.340	1.311	100.04
	11	84	1970	0.02	0.36	14.85	29.63	532	1.320	1.292	98.30
		88	1959	0.02	0.36	14.81	29.63	531	1.350	1.323	100.44
	12	92	1963	0.02	0.36	14.82	29.63	531	1.380	1.353	102.78
		96	1966	0.02	0.36	14.84	29.63	531	1.340	1.314	99.87
Traverse 2	1	100	1959	0.02	0.36	14.81	29.63	530	1.340	1.316	99.88
		104	1930	0.02	0.37	14.70	29.63	530	1.360	1.336	100.62
	2	108	1959	0.02	0.36	14.81	29.63	530	1.350	1.326	100.63
		112	1945	0.02	0.36	14.76	29.63	529	1.350	1.328	100.46
	3	116	1935	0.02	0.37	14.72	29.63	528	1.340	1.321	99.65
		120	1948	0.02	0.36	14.77	29.63	528	1.350	1.331	100.73
	4	124	1942	0.02	0.36	14.74	29.63	528	1.350	1.331	100.57
		128	1950	0.02	0.36	14.78	29.63	527	1.330	1.314	99.47
	5	132	1940	0.02	0.36	14.74	29.63	527	1.320	1.304	98.47
		136	1958	0.02	0.36	14.81	29.63	527	1.340	1.324	100.43
	6	140	1950	0.02	0.36	14.78	29.63	527	1.330	1.314	99.47
		144	1964	0.02	0.36	14.83	29.63	527	1.330	1.314	99.83
	7	148	1955	0.02	0.36	14.79	29.63	527	1.340	1.324	100.35
		152	1962	0.02	0.36	14.82	29.63	527	1.340	1.324	100.53
	8	156	1940	0.02	0.36	14.74	29.63	526	1.320	1.306	98.66
		160	1954	0.02	0.36	14.79	29.63	526	1.340	1.326	100.51
	9	164	1965	0.02	0.36	14.83	29.63	526	1.330	1.316	100.04
		168	1960	0.02	0.36	14.81	29.63	526	1.320	1.306	99.16
	10	172	1960	0.02	0.36	14.81	29.63	526	1.330	1.316	99.92
		176	1950	0.02	0.36	14.78	29.63	526	1.340	1.326	100.41
	11	180	1960	0.02	0.36	14.81	29.63	526	1.320	1.306	99.16
		184	1970	0.02	0.36	14.85	29.63	526	1.330	1.316	100.17
	12	188	1960	0.02	0.36	14.81	29.63	526	1.340	1.326	100.67
			Total 188	Average 1,951	Average 0.02	Average 0.40	Average 15.41	Average 29.63	Average 530	Total 65.650	Total 64.512

Raw Data for: New Incinerator DF Testing Test #3

Client: TMAC	
Job Number: 160930343	
Plant: incinerator	
Location: Hope Bay	
Test: SVOC-3	
Date: 16-Sep-19	
Personnel: BC	
Test Start:	2:18 PM
Test Finish:	4:18 PM

Parameters

Barometric Pressure, Pbar (in. Hg)	29.80
Stack Static Pressure, Pstatic (in. H2O)	0.02
Ambient Temp, (°F)	40
H2O Volume Collected, Vw (mL)	204.0
Total # Sampling Points,	24
Sampling Time per Point, (min)	8
Readings Taken Every __ mins	4

Dioxins and Furans	
Collected from Front Half Rinse (pg TEQ):	
Collected from Back half rinse (pg TEQ):	
Total Collected (pg TEQ):	4478.330

Impinger No.	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
Condenser	264.1	262.1	2.0
Resin Trap	338.6	341.4	-2.8
Condensate trap	692.8	504.8	188.0
1	741.1	727.4	13.7
2	634.3	634.3	0.0
3	925.3	922.2	3.1
Moisture Volume (mL)			204.0

Stack Diameter, (in.)	18
Stack Area, (sq. ft.)	1.77
Probe Length, (in.)	24
Nozzle Diameter, (in.)	0.536
Pitot Coefficient, (Cp)	0.821
Gamma, meter constant	0.979

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp (°F)
Traverse 1	1	4	1650	0.04	0.70	392.78	59
		8	1560	0.04	0.73	394.57	60
	2	12	1538	0.04	0.74	396.44	60
		16	1480	0.04	0.76	398.30	61
	3	20	1430	0.04	0.78	400.20	61
		24	1460	0.04	0.77	402.14	62
	4	28	1400	0.03	0.60	404.06	62
		32	1480	0.03	0.57	405.77	62
	5	36	1495	0.03	0.57	407.44	62
		40	1495	0.03	0.57	409.08	63
	6	44	1450	0.03	0.58	410.71	64
		48	1495	0.03	0.57	412.41	64
	7	52	1480	0.03	0.57	414.07	64
		56	1510	0.02	0.38	415.45	63
	8	60	1520	0.02	0.37	416.81	63
		64	1460	0.03	0.58	418.42	64
	9	68	1520	0.03	0.56	420.05	64
		72	1470	0.03	0.58	421.69	65
	10	76	1520	0.02	0.37	423.14	65
		80	1500	0.03	0.57	424.79	65
	11	84	1590	0.03	0.54	426.40	65
		88	1470	0.02	0.38	427.82	65
	12	92	1510	0.02	0.38	429.19	65
		96	1515	0.02	0.38	430.56	65
			1510	0.02	0.38	431.89	65
Traverse 2	1	100	1490	0.03	0.57	433.51	65
		104	1450	0.03	0.58	435.20	66
	2	108	1520	0.03	0.56	436.86	65
		112	1535	0.03	0.56	438.53	66
	3	116	1530	0.03	0.56	440.17	66
		120	1530	0.03	0.56	441.83	66
	4	124	1520	0.03	0.56	443.47	66
		128	1505	0.03	0.57	445.15	66
	5	132	1500	0.03	0.57	446.82	66
		136	1460	0.03	0.58	448.53	66
	6	140	1400	0.03	0.60	450.18	66
		144	1475	0.03	0.58	451.81	66
	7	148	1400	0.04	0.80	453.68	66
		152	1440	0.04	0.78	455.58	66
	8	156	1460	0.03	0.58	457.29	66
		160	1390	0.04	0.80	459.20	66
	9	164	1300	0.04	0.85	461.21	66
		168	1370	0.04	0.81	463.22	67
	10	172	1420	0.04	0.79	465.20	66
		176	1375	0.04	0.81	467.20	67
	11	180	1470	0.04	0.77	469.17	67
		184	1480	0.04	0.77	471.10	67
	12	188	1515	0.04	0.75	473.00	67

T (deg C)	T (deg F)	P (kPa)	P (inHg)	
2:00	8.7	47.7	101.01	29.8
3:00	9.3	48.7	101.04	29.83
4:00	9.2	48.6	101.05	29.84

Calculations for: New Incinerator DF Testing Test #3

Test #3

Client: TMAC
Job Number: 160930343

Plant: incinerator
Location: Hope Bay
Test: SVOC-3
Date: 43724
Personnel: BC

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg) 29.80
Stack Gas Pressure, Ps (KPa) 100.92
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole) 30.67
Volume of Water Vapour Collected, Vwc (cu.ft) 9.792
Stack Gas Moisture Content (% as decimal) 0.109
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole) 29.29

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Meter Press., Pm (in. Hg)	Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	1	4	2110	0.04	0.70	21.78	29.85	519	1.790	1.809	97.76
		8	2020	0.04	0.73	21.31	29.85	520	1.870	1.886	99.75
	2	12	1998	0.04	0.74	21.20	29.85	520	1.860	1.876	98.67
		16	1940	0.04	0.76	20.89	29.86	521	1.900	1.913	99.14
	3	20	1890	0.04	0.78	20.62	29.86	521	1.940	1.953	99.92
		24	1920	0.04	0.77	20.78	29.86	522	1.920	1.930	99.47
	4	28	1860	0.03	0.60	17.71	29.84	522	1.710	1.718	100.64
		32	1940	0.03	0.57	18.09	29.84	522	1.670	1.678	100.38
	5	36	1955	0.03	0.57	18.16	29.84	523	1.640	1.644	98.76
		40	1910	0.03	0.58	17.95	29.84	524	1.630	1.631	96.84
	6	44	1955	0.03	0.57	18.16	29.84	524	1.700	1.701	102.18
		48	1940	0.03	0.57	18.09	29.84	524	1.660	1.661	99.39
	7	52	1970	0.02	0.38	14.88	29.83	523	1.380	1.383	102.12
		56	1980	0.02	0.37	14.92	29.83	523	1.360	1.363	100.90
	8	60	1920	0.03	0.58	18.00	29.84	524	1.610	1.611	95.90
		64	1980	0.03	0.56	18.27	29.84	524	1.630	1.631	98.60
	9	68	1930	0.03	0.58	18.04	29.84	525	1.640	1.638	97.76
		72	1980	0.02	0.37	14.92	29.83	525	1.450	1.448	107.17
	10	76	1960	0.03	0.57	18.18	29.84	525	1.650	1.648	99.11
		80	2050	0.03	0.54	18.60	29.84	525	1.610	1.608	98.90
	11	84	1930	0.02	0.38	14.73	29.83	525	1.420	1.418	103.62
		88	1970	0.02	0.38	14.88	29.83	525	1.370	1.368	101.00
	12	92	1975	0.02	0.38	14.90	29.83	525	1.370	1.368	101.13
		96	1970	0.02	0.38	14.88	29.83	525	1.330	1.328	98.05
Traverse 2	1	100	1950	0.03	0.57	18.14	29.84	525	1.620	1.618	97.06
		104	1910	0.03	0.58	17.95	29.84	526	1.690	1.685	100.03
	2	108	1980	0.03	0.56	18.27	29.84	525	1.660	1.658	100.22
		112	1995	0.03	0.56	18.34	29.84	526	1.670	1.665	101.01
	3	116	1990	0.03	0.56	18.32	29.84	526	1.640	1.635	99.07
		120	1990	0.03	0.56	18.32	29.84	526	1.660	1.655	100.28
	4	124	1980	0.03	0.56	18.27	29.84	526	1.640	1.635	98.82
		128	1965	0.03	0.57	18.21	29.84	526	1.680	1.675	100.85
	5	132	1960	0.03	0.57	18.18	29.84	526	1.670	1.665	100.12
		136	1920	0.03	0.58	18.00	29.84	526	1.710	1.705	101.47
	6	140	1860	0.03	0.60	17.71	29.84	526	1.650	1.645	96.38
		144	1935	0.03	0.58	18.07	29.84	526	1.630	1.625	97.10
	7	148	1860	0.04	0.80	20.45	29.86	526	1.870	1.865	94.64
		152	1900	0.04	0.78	20.67	29.86	526	1.900	1.895	97.18
	8	156	1920	0.03	0.58	18.00	29.84	526	1.710	1.705	101.47
		160	1850	0.04	0.80	20.40	29.86	526	1.910	1.905	96.40
	9	164	1760	0.04	0.85	19.90	29.86	526	2.010	2.005	98.96
		168	1830	0.04	0.81	20.29	29.86	527	2.010	2.001	100.71
	10	172	1880	0.04	0.79	20.56	29.86	526	1.980	1.975	100.74
		176	1835	0.04	0.81	20.31	29.86	527	2.000	1.991	100.35
	11	180	1930	0.04	0.77	20.83	29.86	527	1.970	1.961	101.36
		184	1940	0.04	0.77	20.89	29.86	527	1.930	1.921	99.56
	12	188	1975	0.04	0.75	21.08	29.86	527	1.900	1.891	98.89
		Total	Average	Average	Average	Average	Average	Average	Total	Total	Average
		188	1,940	0.03	0.61	18.53	29.85	525	80.220	80.190	99.57

DATA ENTRY
TMAC
incinerator
Fuel: municipal waste
Operating Conditions: Normal
Emission Control: dual chamber incinerator
Stack Height above Grade: XXX m
Stack Diameter: 0.46 m

Reference Temperature, Tref (F): 77
(R): 537
(K): 298
Reference Pressure, Pref (in.Hg): 29.92
(Bar): 1.0

Parameter	Symbol	Units	Test 1	Test 2	Test 3	Average
Test ID	-	-	SVOC-1	SVOC-2	SVOC-3	-
Date	-	-	15-Sep-19	16-Sep-19	16-Sep-19	n/a
Start Time	-	-	10:55 AM	10:00 AM	2:18 PM	n/a
End Time	-	-	2:05 PM	12:00 PM	4:18 PM	n/a
Total Sampling Time	-	min	188	188	188	188
Stack Diameter	D	in.	18	18	18	18
Average Stack Gas Temperature	Ts	F	1521	1491	1480	1497
Average Dry Gas Meter Temperature	Tm	F	58	70	65	64
Barometric Pressure	Pbar	in.Hg	29.50	29.60	29.80	29.63
Stack Static Pressure	Pstatic	in.H2O	0.02	0.02	0.02	0.02
Avgerage Pressure Drop (Head)	dP	in.H2O	0.05	0.02	0.03	0.03
Avgerage deltaH Orifice	dH	in.H2O	0.88	0.40	0.61	0.63
Average Meter Temperature	Tm	F	58	70	65	64
Gas Sample Volume	Vm	cu.ft	95.810	65.650	80.220	80.56
Average Isokinetics	I	%	106.8	99.7	99.6	102.0
Nozzle Diameter	Dn	in.	0.536	0.536	0.536	0.536
Pitot Coefficient	Cp	-	0.821	0.821	0.821	0.821
Gamma, meter constant	y	-	0.979	0.979	0.979	0.979
Reference Temperature	Tref	R	537	537	537	537
Reference Pressure	Pref	in.Hg	29.92	29.92	29.92	29.92
Stack Gas Oxygen Content	Co2	%	3.7	4.8	9.9	6.1
Stack Gas Carbon Dioxide Content	Cco2	%	18.5	19.5	14.2	17.4
Stack Gas Nitrogen Content	Cn2	%	77.8	75.7	75.9	76.5
Volume of Water Collected	Vw	mL	356.7	196.3	204.0	252.3
Dioxins and Furans Collected In Front Half	-	pg TEQ	0.000	0.000	0.000	0.0000
Doxins and Furans Collected In Back Half	-	pg TEQ	0.000	0.000	0.000	0.0000
Total Dioxins and Furans Collected	Mhg	pg TEQ	6945.010	1656.911	4478.330	4360.0837

Legend: F - degrees Fahrenheit
K - degrees Kelvin
Bar - bars
in.Hg - inches of mercury
in. - inches
in.H2O - inches of water
cu.ft - cubic feet
R - degrees Rankin
NOx - as NO2

CALCULATIONS
TMAC
incinerator
Fuel: municipal waste
Operating Conditions: Normal
Emission Control: dual chamber incinerator
Stack Height above Grade: XXX m
Stack Diameter: 0.46 m

Variable	Symbol	Units	Calculation	Test 1	Test 2	Test 3	Average
Stack Area	As	sq.ft sq.m	As = Pi x ((D/12)^2)/ 4 As (sq.m) = As (sq.ft) x 0.0929	1.77 0.16	1.77 0.16	1.77 0.16	1.77 0.16
Barometric Pressure	Pbar	kPa	Pbar (kPa) = Pbar (in.Hg) x 3.386	99.9	100.2	100.9	100.3
Stack Static Pressure	Pstatic	kPa	Pstatic (kPa) = Pstatic (in.H2O) x 0.249	0.00	0.00	0.00	0.00
Avg. Stack Temperature	Ts	R	Ts (R) = Ts (F) + 460	1981	1951	1940	1957
Avg. Stack Temperature	Ts	R	Ts (C) = (Ts (R) - 492) x 5/9	827	811	804	814
Avg. Meter Temperature	Tm	R	Tm (R) = Tm (F) + 460	518	530	525	524
Nozzle Diameter	Dn	mm	Dn (mm) = Dn (in.) x 25.4	14	14	14	14
Gas Meter Pressure	Pm	in.Hg	Pm = Pbar + (dH / 13.6)	29.56	29.63	29.85	29.68
Sample Volume at STP	Vmc	cu.ft cu.m	Vmc = Tref / Pref x (Vm x Pm x y) / Tm Vmc (cu.m) = 0.02832 x Vmc (cu.ft)	96.039 2.720	64.524 1.827	80.188 2.271	80.250 2.273
Volume of Water Vapour	Vwc	cu.ft	Vwc = 0.0480 x Vw	17.122	9.422	9.792	12.112
Water Fraction	Bwo	-	Bwo = Vwc / (Vwc + Vmc)	0.151	0.127	0.109	0.129
Molecular Weight, Dry	Md	lb/lb-mol	Md = 0.44 (Cco2) + 0.32 (Co2) + 0.28 (Cn2)	31.11	31.32	30.67	31.03
Molecular Weight, Wet	Ms	lb/lb-mol	Ms = Md (1 - Bwo) + (18 x Bwo)	29.13	29.62	29.29	29.35
Stack Pressure	Ps	in.Hg	Ps = Pbar + (Pstatic / 13.6)	29.50	29.60	29.80	29.63
Stack Gas Velocity	Us	ft/s m/s	Us = 85.33 x Cp x ((dP x Ts)/(Ps x Ms))^0.5 Us (m/s) = 0.3048 x Us (ft/s)	22.45 6.84	15.41 4.70	18.53 5.65	18.80 5.73
Actual Stack Gas Flow Rate	Q	acfm	Q = 60 x Us x As	2,380	1,634	1,965	1,993
Dry Stack Gas Flow Rate	Qs	dscfm dscms	Qs = Q x (1-Bwo) x (Tref/Ts) x (Ps/Pref) Qs (dscms) = 0.000472 x Qs (dscfm)	540 0.25	388 0.18	483 0.23	470 0.22
Dioxin and Furan Concentration Uncorrected @ STP	Chg	pg/dscm	Chg = Mhg / Vmc	2553.47	906.74	1972.04	1810.75
Dioxin and Furan Emission Rate	ERhg	pg/s kg/hr	ERhg = Chg/1x10 ⁹ x Qs ERhg(kg/hr) = 3.6x10 ⁻⁹ x ERh (g/s)	650.64 0.00	166.20 0.00	449.50 0.00	422.11 0.00
Dioxin and Furan Concentration Corrected to 11% O2	Chg	pg/dscm	Correction factor to 11% O2 Chg (11% O2) = Chg (mg/dscm) x (20.9-11) / (20.9-Co2)	0.58 1472.17	0.61 556.08	0.90 1769.47	1265.91
Corrected to 3% O2	Chg	pg/dscm	Chg (3% O2) = Chg (mg/dscm) x (20.9-3) / (20.9-Co2)	2661.81	1005.44	3199.35	2288.87
Corrected to 12% CO2	Chg	pg/dscm	Chg (12% CO2) = Chg (mg/dscm) x (12/Cco2)	1656.30	556.77	1664.56	1292.54

Legend:

sq.ft - square feet
sq.m - square metres
Pi - 3.142
R - degrees Rankin
in.Hg - inches of mercury
g/s - grams per second

acfm - actual cubic feet per minute
dscfm - dry standard cubic feet per minute
dscms - dry standard cubic metres per second
ppm - parts per million
mg/dscm - miligrams per dry standard cubic metre
ug - mircograms

cu.ft - cubic feet
cu.m - cubic metres
STP - standard temperature and pressure
(25 C and 101. kPa)
NOx - as NO2
pg - picograms

OFFICIAL STACK TESTING RESULTS

TMAC

incinerator

Fuel: municipal waste

Operating Conditions: Normal

Emission Control: dual chamber incinerator

Stack Height above Grade: XXX m

Stack Diameter: 0.46 m

Parameter	Test 1	Test 2	Test 3	Average
Test ID Test Date	SVOC-1 15-Sep-19	SVOC-2 16-Sep-19	SVOC-3 16-Sep-19	
Stack Gas Temperature (C)	827	811	804	814
Moisture Content (%)	15.1	12.7	10.9	12.9
Velocity (m/s)	6.84	4.70	5.65	5.73
Volumetric Flow (dscms)	0.25	0.18	0.23	0.22
Oxygen - O2 (%)	3.73	4.76	9.87	6.12
Carbon Dioxide - CO2 (%)	18.5	19.5	14.2	17.4
Dioxins and Furans (TCDD Equivalent)				
Dioxin and Furan Concentration (pg TEQ/dscm)	2,553	907	1,972	1,811
Corrected to 11% O2 (pg TEQ/dscm)	1,472	556	1,769	1,266
Corrected to 11% O2 (ng TEQ/dscm)	1.47	0.56	1.77	1.27
Emission Rate (pg TEQ/s)	651	166	449	422
Emission Rate (ng Teq/s)	0.65	0.17	0.45	0.42

0.08

Legend: C - degrees Celsius
m/s - metres per second
dscms - dry standard cubic metres per second
ppm - parts per million
STP - standard temperature and pressure (25 C and 101.3 kPa)
mg/dscm - miligrams per dry standard cubic metre
NOx - as NO2

Stack Gas Velocity Profiles
Hope Bay
SVOCs / Dioxins & Furans Testing

