ARG
AIR RESEARCH GROUP

Air Science Engineering and Consulting

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Emergent Waste Solutions Inc.

2022 Air Emission Test Report

Test Date: August 22, 2022

Prepared For: Emergent Waste Solutions Inc. (EWS)
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August 31, 2022
ARG File #: EMS-0822-22

Emergent Waste Solutions Inc. (EWS)
1337 Townline Road
Abbotsford, BC, V2E 6E1
T: 604.282.7329

Attention: Mr. Kevin Hull
Re: 2022 Air Emission Test Report

Dear Mr. Hull

Please find the enclosed the report on the air emission survey performed at EMS, Abbotsford facility conducted August 22, 2022. Enclosed, detailed information regarding the test results, test methodology, calibration data, and other supporting documentation.

Certification

The field testing for this air emission survey was conducted by certified stack testing technicians as required by the British Columbia Ministry of Environment (BCMOE) Field Sampling Manual Part B2. The field Technicians consisted of Jim Neuman (certified), William Robinson (certified) and Kevin Albrechtsen, B.Sc. (certified). The report was prepared by Kevin Albrechtsen, B.Sc. (certified), in accordance with BC Ministry of Environment (BCMOE) reporting principles and guidelines. The field crew and ARG certify the test methods used were BC Ministry of Environment (BCMOE) approved reference methods for the target parameters investigated.

Should you have any questions regarding our report please contact us at our office 604-560-6346, or by email, kevin@airresearchgroup.com.

Regards
Air Research Group Inc.

Kevin Albrechtsen, B.Sc.
Operations Manager

SUMMARY

Air Research Group Inc. (ARG) performed air emission tests on the EMS facility exhaust gas stack. The purpose of the emissions testing program was to determine the emissions for engineering purposes. The following table summarizes the emission test results.

Table S-1 Summary Table

Test Run		Run 1	Run 2	Average
Date		11-Aug-22	11-Aug-22	
Test Time	(hhmm)	11:50-12:50	13:10-14:10	-
Particulate Matter				
Filterable PM Concentration	(mg/dscm)	6.5	8.6	7.5
Gaseous Emissions				
Carbon Monoxide	(mg/dscm)	5.7	10.3	8.0
	(ppm)	4.9	8.8	6.8
Emission Rate	(Kg/hr)	0.003	0.006	0.005
Nitrogen Oxides	(mg/dscm)	31.5	23.9	27.7
	(ppm)	16.5	12.5	14.5
Emission Rate	(Kg/hr)	0.019	0.015	0.017
Nitrous Oxide	(mg/dscm)	0.7	0.7	0.7
	(ppm)	0.4	0.4	0.4
Emission Rate	(Kg/hr)	0.0004	0.0004	0.0004
Sulphur Dioxide	(mg/dscm)	4.0	2.7	3.4
	(ppm)	1.5	1.0	1.3
Emission Rate	(Kg/hr)	0.002	0.002	0.002
Methane	(mg/dscm)	1.3	1.3	1.3
	(ppm)	2.0	2.0	2.0
Emission Rate	(Kg/hr)	0.0008	0.0008	0.0008
Total Hydrocarbons (as CH4)	(mg/dscm)	3.6	1.0	2.3
	(ppm)	1.8	0.5	1.2
Emission Rate	(Kg/hr)	0.0022	0.0006	0.0014
Stack Gas Parameters				
Flow Rate	(dscm/min)	10.1	10.2	10.1
Temperature	(^{o}C)	96.0	102.8	99.4
O_2	(%vol, dry)	13.3	15.1	14.2
CO_2	(%vol, dry)	6.9	5.3	6.1
Moisture	(%vol, total)	12.3	12.0	12.2
Emission Test Parameters				
Sampling Duration	(minutes)	60	60	-
Gas Sample Volume	(dscm)	1.0192	1.0275	-
Condensate Collected	(g)	107.5	105.2	-
Isokinetic Sampling Rate	(%)	100.5	99.7	100.1

Data is corrected to standard conditions of 20°C, 101325kPa (dry) unless otherwise noted. "<" = Less Than

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APPENDICES

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1.0 INTRODUCTION

Air Research Group Inc. (ARG) was contracted by EMS Inc. (EMS) to conduct the 2021 annual air emission compliance testing to measure Total PM, PM10/2.5 & Condensable PM, Formaldehyde and Phenols, Ammonia, Sulphur Oxides (SO_2), Metals, Carbon Monoxide (CO), Nitrogen Oxides (NO_x), & Total Hydrocarbons (THC). The test methods utilized for this emissions survey are recognized as reference methods used for permit compliance testing purposes in the British Columbia Ministry of Environment (BCMOE) jurisdiction.

2.0 SCOPE OF WORK

The purpose of this source emission survey is to demonstrate compliance with the current air emission permit standards and reporting requirements. The scope of work conducted included testing 6 sources exhaust stacks for the following parameters:

Table 2-1 Scope of Work

Source / I.D.	Parameter	Methodology	Frequency
→ Paint Filtration System	→ Sample/Velocity Traverse points → Velocity / Flow Rate → Dry Gas Molecular Weight (O_2/CO_2) → Moisture Content → Particulate Matter (PM) → VOC's as THC	→ → EPA Method 1 → EPA Method 2 → EPA Method 3/3A → EPA Method 4 → EPA Method 5 → EPA Method 25A →	→ n/a

The concentrations of the contaminants were determined utilizing promulgated methods developed and or approved by the BC Ministry of Environment (BCMOE), Environment Canada (EC), Alberta Environment (AE), and the United States Environmental Protection Agency (USEPA), jurisdictions. For more detailed information on methodology that will was used, please see section 4.0 Test Methodology.

3.0 TEST PLAN

EMS's sources were tested for the parameters specified above following the sampling parameters below:

- Three (3) discrete testing runs were performed on the exhaust Stack.
- Where applicable sampling duration of 60 minutes for each test run.

4.0 TEST METHODOLOGY

4.1 SAMPLING SITE AND TRAVERSE POINTS (EPA METHOD 1)

The sample location, number of traverse points, and location of traverse points were determined using EPA Method 1 “Sample and Velocity Traverses for Stationary Sources”. The sampling site selected in a location with ideally at least eight (8) stack diameters downstream of any local flow disturbances (bends, expansions, etc.) and two (2) diameters upstream of any flow disturbances. Based on the number of traverse points required in the method, the cross-section of the stack will be divided into 8-24 equal areas. Traverse points will be then located within each of these equal areas.

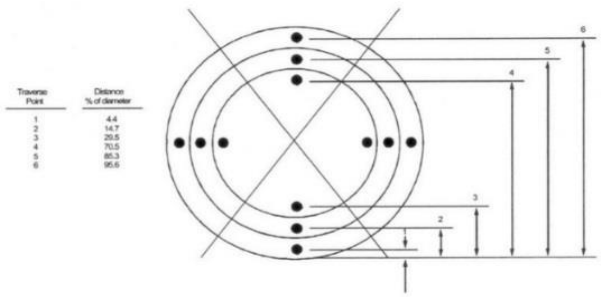

Figure 4-1 Location of Traverse Points for a Circular Stack

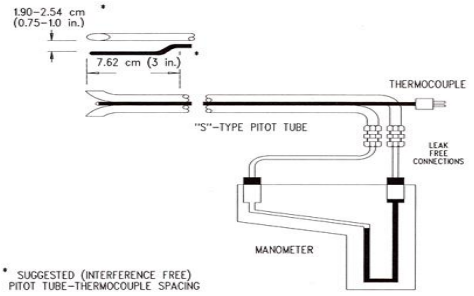

Figure 4-2 S-Type Pitot Diagram

4.2 DISCHARGE FLOW RATE (EPA METHOD 2)

Flow rate measurements were conducted according to US EPA Method 2, “Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)”. The average gas velocity is determined from the gas density and measurements of the velocity pressure with an S-type pitot tube coupled to an inclined manometer. The flow rate of the emission stream was calculated as the product of the average differential pressure.

4.3 DRY MOLECULAR WEIGHT (EPA METHOD 3)

Measurements were conducted in accordance with US EPA Method 3, “Gas Analysis for the Determination of Dry Molecular Weight”. An integrated or grab sample is extracted from a single point in the gas stream and analyzed for its components using a Fyrite analyzer, a gas chromatograph, or calibrated continuous analyzers.

4.4 DRY MOLECULAR WEIGHT (EPA METHOD 3A)

Measurements were conducted in accordance with US EPA Method 3A, “Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)”. A Horiba Model PG350 analyzer was used to measure the concentrations oxygen & carbon dioxide.

Figure 4-3 Horiba PG350 Multicomponent Analyzer EPA Method 3A, 6C, 7E, & 10

4.5 MOISTURE (EPA METHOD 4)

The concentration of moisture in the stack will be determined using US EPA Method 4 “Determination of Moisture Content in Stack Gases”. A gas sample is extracted at a constant rate from a source and sent through a sampling train. The moisture is removed from the sample stream via a series of impingers submerged in an ice bath. The moisture content is then determined both volumetrically and/or gravimetrically.

4.6 PARTICULATE MATTER- TOTAL, PM10 AND PM2.5 (EPA METHOD 201A) & CONDENSABLE PARTICULATE MATTER (CPM, EPA METHOD 202)

Total particulate, PM_{10} and $PM_{2.5}$ were sampled per US EPA Method 201A, “Determination of PM_{10} Emissions (Constant Sampling Rate Procedure)”. Particulate matter captured in the Cascade Impactor is analyzed gravimetrically with the results used to determine the size distribution and the filterable portion of particulate matter of the gas sample. The sampling train used consists of a Cascade Impactor, a heated stainless-steel probe, a standard impinger train, and a control console. A gas sample is extracted isokinetically from a selected point in the stack through the Cascade Impactor, which is a sizing device that fractionates gas-entrained particles per the particle aerodynamic diameters ranging from 25 to 0.3 microns. At the final stage of the Cascade Impactor, the sample gas is filtered through a 0.3-micron glass fiber filter. The filtered gas sample then passed through a series of three impingers containing distilled de-ionized water immersed in an ice bath. Condensable matter of the gas sample is captured in the

impinge, the resulting impinger content is analyzed for condensable organic and inorganic matters according to US EPA Method 202. Methylene chloride is mixed with the impinger solution to extract organic substances from the aqueous solution. Next, the methylene chloride and the aqueous solution will be separated and allowed to evaporate to dryness. The residues will be weighed and determined to be the organic and inorganic portions of condensable PM. As suggested in Method 201A, the PM_{10} measurements included both in-stack (captured by the Cascade Impactor) and condensable emissions.

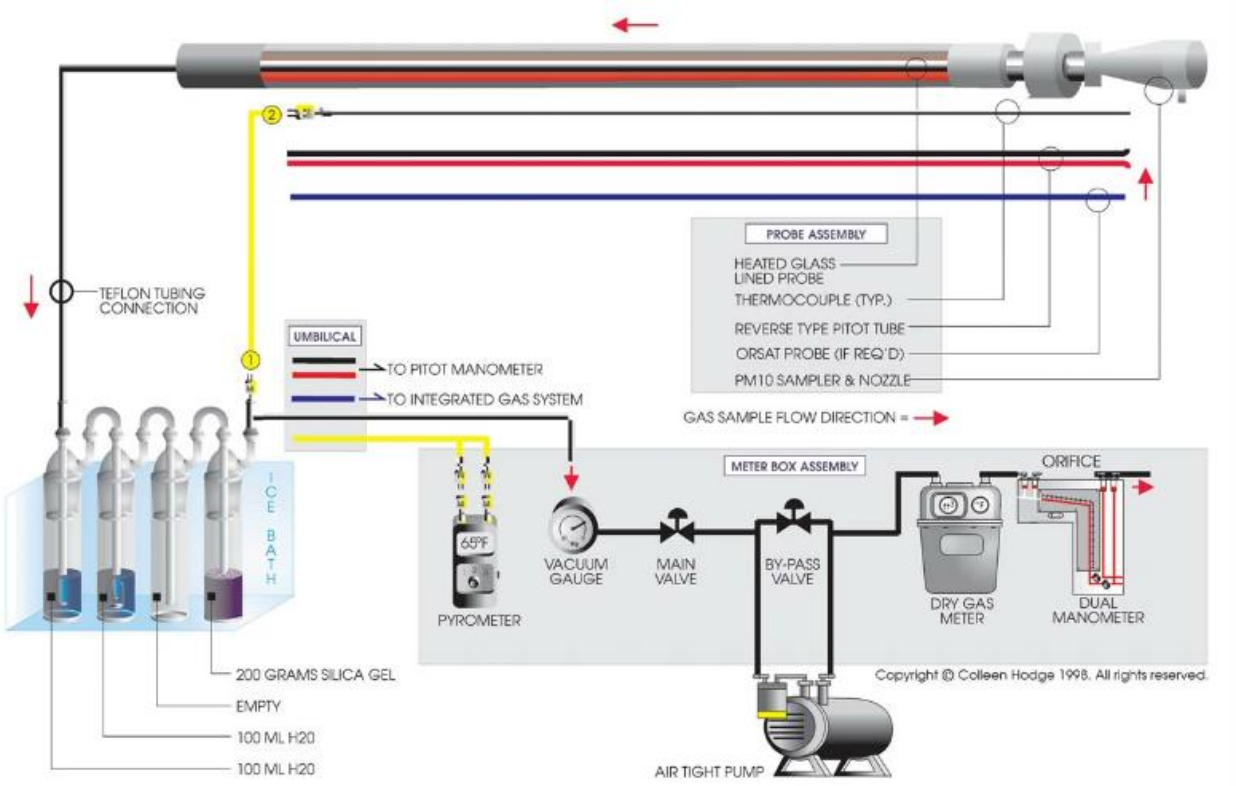

Figure 4-4 Diagram of a Method 201A/202 Sampling Train

4.7 SULPHUR DIOXIDE & NITROGEN OXIDES (EPA METHOD 6C &7E)

Determination of Sulphur Dioxide & Nitrogen Oxides were conducted in accordance with US EPA Method 6C & 7E, "Determination of Sulphur Dioxide & Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)". Measurement of the concentration of nitrogen oxides was conducted by continuously extraction from the stack, and a portion of the sample distributed to an instrumental analyzer. A Horiba Model PG350 analyzer was used to measure the concentrations of sulphur dioxide and nitrogen oxides.

4.8 CARBON MONOXIDE (EPA METHOD 10)

Determination of Carbon Monoxide was conducted in accordance with US EPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources". A Thermo Scientific Model 48i gas filter correlation analyzer was used for the measurements of Carbon Monoxide, whereby a gas sample

was extracted from the source, the moisture is condensed out and the sample transported using a Teflon sample line to the analyzer. A Horiba Model PG350 analyzer was used to measure the concentrations carbon monoxide.

4.9 TOTAL HYDROCARBON (EPA METHOD 25A)

Determination of total hydrocarbons was conducted in accordance with US EPA Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer." A CAI Model 300 HFID, flame ionization analyzer was used for the measurements of Total Hydrocarbons (THC). The analyzer was calibrated with methane standard gas and analyzed a gas sample under hot, wet conditions. Thereby, the measurements are in methane equivalent, wet basis. The test results were converted to dry basis using the moisture content of the stack gas that was determined in the moisture train.

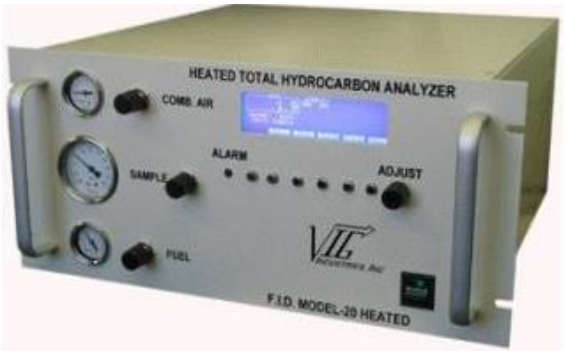

Figure 4-5 VIG Model 20 Total Hydrocarbon Analyzer EPA Method 25A

5.0 QUALITY ASSURANCE / QUALITY CONTROL

Quality assurance/quality control (QA/QC) for each test was accomplished by the following mechanisms:

Administration QA/QC involves aspects such as scheduling, reporting, and general supervision of other QA/QC protocols. Specific details of administration include the following:

- Permit / regulation / test methodology reviews
- Pre-test plans and notifications (as required)
- Delegation of responsibilities to field and office personnel
- Collection and review of all field, process, and analytical data to ensure data integrity and accuracy
- Documentation any irregularities with testing or process conditions
- Duplicate proof of draft and final reports including all data entry

Preparation QA/QC involves aspects such as equipment calibration and cleaning, preparation of reagents, and the site set-up. The preparation QA/QC protocols include:

- Calibration of all test equipment semi-annually
- Cleaning of all glassware.
- A sample of all reagents will be collected prior to the testing of each day.
- During site set-up, all attempts will be made to ensure a clean work area to reduce the possible contamination from the location.

Testing QA/QC involves attention to general sampling techniques as well as items particular to each test method. General sampling QA/QC measures include pre-and post- inspection and leak checks of all test equipment, proper storage of reagents and sample recovery items, collection of all required field data, and the use of experienced and certified test personnel.

Analysis QA/QC is largely through the use of qualified and CALA accredited laboratories. Measures taken by ARG to ensure accurate laboratory results include:

- Blank sample analysis of all reagents
- Proper identification of all collected samples including time and date
- Duplicate / split analysis of selected samples if required
- Chain of custody protocols followed for all samples
- Blind audit or spiked samples if required

6.0 DETAILED TEST RESULTS

Results of the emissions tests are summarized in Table S-1. All gaseous volumes are on a dry basis and corrected to reference conditions of 20°C and 101.32kPa, unless otherwise indicated. Averages are calculated by the arithmetic mean. Field data sheets, computer printouts, laboratory results, calibration certificates and process records are included in the appendices.