
**Emission Characterization Program
PARCON 125, Plasma Waste Destruction Unit**

Prepared for:

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Table of Contents

SUMMARY	1
1. INTRODUCTION	3
2. TEST PROGRAM RESPONSIBILITIES	3
3. TEST MATRIX.....	4
4. TEST SCHEDULE.....	4
5. SAMPLING LOCATIONS.....	5
6. SAMPLING AND ANALYTICAL METHODOLOGIES	5
6.1 GROUP A COMPOUNDS (PARTICULATE/METALS)	6
6.2 GROUP B COMPOUNDS (SEMI-VOLATILE ORGANICS)	7
6.3 GROUP C COMPOUNDS (VOLATILE ORGANIC COMPOUNDS)	7
6.4 GROUP D COMPOUNDS (HYDROGEN CHLORIDE, HYDROGEN FLUORIDE)	8
6.5 GROUP E COMPOUNDS (ALDEHYDES AND KETONES).....	8
6.6 GROUP F COMPOUNDS (COMBUSTION GASES & THC).....	9
7. QA/QC PROGRAM.....	9
8. RESULTS	10
8.1 GROUP A COMPOUNDS (PARTICULATE/METALS)	10
8.1.1 TOTAL SUSPENDED PARTICULATE	10
8.1.2 METALS	11
8.2 GROUP B COMPOUNDS (SEMI-VOLATILE ORGANICS)	12
8.2.1 CHLOROBENZENES (CBS).....	12
8.2.2 CHLOROPHENOLS (CPS).....	13
8.2.3 POLYAROMATIC HYDROCARBONS (PAHS)	13
8.2.4 POLYCHLORINATED BIPHENYLS (PCBS).....	14
8.2.5 PCDDs/PCDFs	15
8.3 VOLATILE ORGANIC COMPOUNDS (VOCs)	16
8.4 HYDROGEN CHLORIDE/HYDROGEN FLUORIDE (HCl/HF)	17
8.5 ALDEHYDES AND KETONES (A&K).....	17
8.6 COMBUSTION GASES AND TOTAL HYDROCARBONS	17
9. DRE DETERMINATIONS	18
10. DISPERSION MODELING	18
11. SCRUBBER SAMPLES.....	19

Appendices

- Appendix 1. Tables**
- Appendix 2. Certificate of Approval**
- Appendix 3. Project Description, Operations Summary**
- Appendix 4. TSP/Metals Field Data Sheets**
- Appendix 5. TSP/Metals Recovery Sheets**
- Appendix 6. SVOCs Field Data Sheets**
- Appendix 7. SVOCs Recovery Sheets**
- Appendix 8. VOCs Field Data Sheets**
- Appendix 9. HCl/HF Field Data Sheets**
- Appendix 10. A&K Field Data Sheets**
- Appendix 11. Complete sample Log**
- Appendix 12. Calibration Data**
- Appendix 13. TSP/Metals Stack Gas Calculations**
- Appendix 14. TSP Analytical Reports**
- Appendix 15. Metals Analytical Report**
- Appendix 16. SVOCs Stack Gas Calculations**
- Appendix 17. SVOCs Analytical Reports**
- Appendix 18. VOCs Analytical Report**
- Appendix 19. HCl/HF Analytical Report**
- Appendix 20. A&K Analytical Report**
- Appendix 21. CEM Calibration Data**
- Appendix 22. Combustion Gas/THC Data**
- Appendix 23. PCBs Feed Rates**
- Appendix 24. REG346 Dispersion Model**
- Appendix 25. REG346 Results**

SUMMARY

At the request of Kinectrics Inc. (Kinectrics), Envirosolve completed an emission characterization program of a PARCON 125 plasma arc, waste destruction unit at Kinectrics' Kipling Avenue facility.

The purpose of the program was to measure the emissions of several classes of selected contaminants to demonstrate the unit's ability to destroy various waste feeds and to satisfy the requirements of Certificate of Approval (C of A), Air, No. 6135-4UTKDE issued by the Ontario Ministry of the Environment (MOE). The test was also used to demonstrate the plasma arc's ability to destroy polychlorinated biphenyls (PCBs).

The contaminants were divided into groups defined by the sampling train required for collection of each group as follows:

Group	Contaminants
Group A	Particulate/Metals
Group B	Semi-Volatile Organic Compounds (SVOCs) – PCDDs/PCDFs, PCBs, PAHs, CBs, CPs
Group C	Volatile Organics (VOCs)
Group D	Hydrogen Chloride (HCl), Hydrogen Fluoride (HF)
Group E	Aldehyde & Ketones (A&K)
Group F	Combustion Gases, Total Hydrocarbons (O ₂ , CO ₂ , CO, NO _x , SO ₂ , THC)

The proposed sampling methodologies for the contaminants to be characterized are summarized as follows:

Group	Sampling Methodology	Instrumentation/Equipment
Group A	EPA Modified Method 29(40 CFR 60)	Modified Method 5 Sampling Train
Group B	Environment Canada EPS 1/RM/2	Modified Method 5 Sampling Train
Group C	SW846 VOST Method 0030	VOST Sampling Train
Group D	EPA Modified Method 26(40 CFR 60)	Midget Impinger Sampling Train
Group E	SW846 Modified Method 0011	Midget Impinger Sampling Train (non-isokinetic)
Group F	O ₂ EPA Method 3A (40 CFR 60) CO EPA Method 10 (40 CFR 60) CO ₂ EPA Method 3A (40 CFR 60) THC EPA Method 25A (40 CFR 60) NO _x EPA Method 7E (40 CFR 60) SO ₂ EPA Method 6C (40 CFR 60)	CAI Model 100-P (Paramagnetic) Analyser Teco Model 48H (GFC) Analyzer CAI Model ZRH (NDIR) Analyzer CAI Model 300 (FID) Analyser CAI Model 300CLD (chemiluminescent) Analyzer Western Research Model 721 ATM (NDUV) Analyzer

40 CFR 60 – Code of Federal Regulations, Protection of Environment, Title 40, Part 60.

Report EPS 1/RM/2, June 1989, Measurement of Releases of Selected Semi-volatile Organic Compounds from Stationary Sources. SW846-Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.

PCB destruction removal efficiencies (DREs) were determined for the plasma arc furnace based on calculated PCB feed rates during the PCB feed burn(s) and measured PCB concentrations at the stack. The results are summarized as follows:

Test Identification	PCB Input	PCB Output	PCB DRE
SVOC Test No. 1	2225900000 µg	70.3 µg	99.999997 %
SVOC Test No. 2	2173400000 µg	887 µg	99.999959 %
SVOC Test No. 3	2217600000 µg	117 µg	99.999995 %

The PARCON 125 plasma arc, waste destruction unit was effective in achieving “six nines” efficiency in PCB destruction.

Dispersion modeling (Ontario MOE REG346 Model) was performed on contaminant emission rates as required in the C of A and compared with Ontario Environmental Protection Act, Regulation 346 standards, interim standards, interim guidelines and Approvals Screening Levels based on ground level point of impingement concentrations. A hypothetical model was constructed from building and property line dimensions suggested by Kinectrics. The resulting factor based on an emission rate of 1 g/sec was used to model analyte emission rates into maximum ground level impingement concentrations.

The average results of the emission testing program completed indicated that the plasma waste destruction unit was operating within compliance for all current Ontario Environmental Protection Act, Regulation 346 Standards, Interim Standards, Interim Guidelines and Approvals Screening Levels based on ground level point of impingement concentrations.

Included in the data is a column determining the percentage of criteria, which compares the calculated contaminant levels with the applicable criteria level. The tables indicate that all contaminant levels are below the applicable criteria levels. Point of impingement results are to be found overleaf.

1. Introduction

At the request of Kinectrics Inc. (Kinectrics), Envirosolve completed an emission characterization program of a PARCON 125 plasma arc, waste destruction unit at Kinectrics' Kipling Avenue facility.

The purpose of the program was to validate the PARCON plasma waste destruction unit as a suitable technology to destroy high level PCBs, and to measure the emissions of several classes of selected contaminants as required in Certificate of Approval (C of A), Air, No. 6135-4UTKDE issued by the Ontario Ministry of the Environment (MOE). The C of A is provided in Appendix 2.

A "Project Description" and "Executive Summary" of the PARCON 125 plasma arc furnace is provided in Appendix 3.

2. Test Program Responsibilities

The program involved several groups and/or agencies including; Kinectrics, Envirosolve, local MOE District Office and MOE Air Resources Branch. The organization/agency and their respective representatives are listed as follows:

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Kinectrics/Plasma Environment was responsible for:

- providing safe and reasonable access to the sampling location (scaffolding or platforms) as required
- providing sampling port(s) as required by the reference method
- providing reasonably accessible power supply (eight separate 120v, 15a circuits)
- providing a dilution system for flue gas measurements with the combustion gas analysers
- providing a technician to aid in sampling for the duration of the program
- providing a complete Method 5 system for metals sampling
- operating the processes as desired for the test program and supplying relevant process data for inclusion in the report as required in the C of A
- any deviations from the C of A protocol

Envirosolve was responsible for:

- supplying all equipment, supplies and analytical services required to complete the program
- data reduction of all tests
- final report

3. Test Matrix

The test matrix was proposed by Kinectrics upon consultation with Mr. Vlado Ozvacic of the MOE. The original test matrix was changed upon further consultation with the MOE. A commissioning phase was followed by a plasma gas and feed rate optimization phase was followed by triplicate testing (all contaminants) on PCB waste feed.

4. Test Schedule

The test program was completed between May 16 to May 18, 2001. A detailed schedule for the main test program is presented in tabular form as follows:

<i>Test Identification</i>	<i>Date</i>	<i>Time</i>	<i>Test Duration</i>
SVOCs Test No. 1	May 16	13:40-17:05	210 minutes
TSP/Metals Test No. 1	May 16	13:43-17:18	215 minutes
VOCs Test No. 1	May 16	14:30-15:30	60 minutes
HCl/HF Test No. 1	May 16	16:10-17:10	60 minutes
SVOCs Test No. 2	May 18	08:55-12:25	210 minutes
TSP/Metals Test No. 2	May 18	08:55-12:25	210 minutes
HCl/HF Test No. 2	May 18	09:00-10:00	60 minutes
A&K Test No. 1	May 18	10:10-10:40	30 minutes
A&K Test No. 2	May 18	10:49-11:19	30 minutes
VOCs Test No. 2	May 18	11:27-11:57	30 minutes
SVOCs Test No. 3	May 18	14:41-18:12	190 minutes
TSP/Metals Test No. 3	May 18	14:41-18:12	210 minutes
VOCs Test No. 3	May 18	14:43-15:43	60 minutes
A&K Test No. 3	May 18	16:10-17:10	50 minutes
HCl/HF Test No. 3	May 18	17:07-18:07	60 minutes

5. Sampling Locations

Sampling was conducted through several holes (ports) cut into a six inch exhaust pipe exiting the plasma arc furnace. Isokinetic sampling was completed through two separate three-inch holes cut at different sections of the exhaust. Each sampling “port” is defined as “ideal” by the MOE Ontario Source Testing Code (OSTC).

The CEMs, VOST, HCl/HF and A&K sampling was conducted through ¼ inch ports cut in the exhaust as not to interfere with the isokinetic sampling.

6. Sampling and Analytical Methodologies

The contaminants were divided into groups defined by the sampling train required for collection of each group as follows:

Group	Contaminants
Group A	Particulate/Metals
Group B	Semi-Volatile Organic Compounds (SVOCs) – PCDDs/PCDFs, PCBs, PAHs, CBs, CPs
Group C	Volatile Organics (VOCs)
Group D	Hydrogen Chloride (HCl), Hydrogen Fluoride (HF)
Group E	Aldehyde & Ketones (A&K)
Group F	Combustion Gases, Total Hydrocarbons (O ₂ , CO ₂ , CO, NO _x , SO ₂ , THC)

The sampling methodologies followed for the contaminants characterized are summarized as follows:

Group	Sampling Methodology	Instrumentation/Equipment
Group A	EPA Modified Method 29(40 CFR 60)	Modified Method 5 Sampling Train
Group B	Environment Canada EPS 1/RM/2	Modified Method 5 Sampling Train
Group C	SW846/ VOST Method 0030	VOST Sampling Train
Group D	EPA Modified Method 26(40 CFR 60)	Midget Impinger Sampling Train
Group E	SW846 Modified Method 0011	Midget Impinger Sampling Train (non-isokinetic)
Group F	O ₂ EPA Method 3A (40 CFR 60) CO EPA Method 10 (40 CFR 60) CO ₂ EPA Method 3A (40 CFR 60) THC EPA Method 25A (40 CFR 60) NO _x EPA Method 7E (40 CFR 60) SO ₂ EPA Method 6C (40 CFR 60)	CAI Model 100-P (Paramagnetic) Analyser Teco Model 48H (GFC) Analyser CAI Model ZRH (NDIR) Analyser CAI Model 300 (FID) Analyser CAI Model 300CLD (chemiluminescent) Analyser Western Research Model 721 ATM (NDUV) Analyser

40 CFR 60 – Code of Federal Regulations, Protection of Environment, Title 40, Part 60.

Report EPS 1/RM/2, June 1989, Measurement of Releases of Selected Semi-volatile Organic Compounds from Stationary Sources. SW846-Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

The common sampling methodologies that were used to operate the modified method 5 trains (Group A & Group B compounds) are summarized as follows:

Parameter	Sampling Methodology	Instrumentation/Equipment
Location of Sampling Site & Sampling Points	OSTC Method 1	NA
Determination of Stack Gas Velocity & Volumetric Flow Rate	OSTC Method 2	Method 5 Train
Determination of Molecular Weight of Dry Stack Gas	OSTC Method 3	Portable Combustion Gas Analyser
Determination of Moisture Content of Stack Gases	OSTC Method 4	Modified Method 5 Train
Isokinetic Sampling For Particulate/Metals & SVOCs	OSTC Method 5	Modified Method 5 Train

OSTC - Ontario Source Testing Code, (Version #2), Report # ARB-66-80, November 1980

The analytical methodologies for the Group A to Group D compounds to be characterized are summarized as follows:

<i>Contaminant</i>	<i>Analytical Reference Method</i>	<i>Instrumentation</i>
Total Suspended Particulate	OSTC Method 5	Gravimetric
Metals	EPA Method 6010	Inductively Coupled Plasma Atomic Spectroscopy (Hg-GFAAS)
PCDDs, PCDFs	Env. Canada EPS 1/RM/3	High Resolution Gas Chromatography High Resolution Mass Spectrometry
CBs, PCBs	Env. Canada EPS 1/RM/3	High Resolution Gas Chromatography High Resolution Mass Spectrometry
PAHs	NITEP/Mid-Connecticut	High Resolution Gas Chromatography High Resolution Mass Spectrometry
Volatile Organics (VOST)	EPA Method 5040	Low Resolution Gas Chromatography Low Resolution Mass Spectrometry
Hydrogen Chloride/Fluoride	EPA Method 300	Ion Chromatography

Note: PCB analyses of test train samples were analysed by high-resolution mass spectrometry due to DRE requirement.

6.1 Group A Compounds (Particulate/Metals)

A summary of the Modified Method 29 sampling train and sample recovery components is presented in tabular form as follows:

Train Configuration

Nozzle	Glass
Probe Liner	Glass
Filter	Quartz Fibre Filter
Heated Line	Teflon
Impinger Solutions	<ol style="list-style-type: none"> 1. Empty (condensate knock-out) 2. 100 ml 5% HNO₃/10% H₂O₂ 3. 100 ml 5% HNO₃/10% H₂O₂ 4. Empty 5. 100 ml 4% KMnO₄/10% H₂SO₄ 6. 100 ml 4% KMnO₄/10% H₂SO₄ 7. Silica Gel

Sample Recovery Components

1	Quartz Fibre Filter	Particulate, Metals
2	Acetone Front-Half Rinse	Particulate, Metals
3	0.1N HNO ₃ Front-Half Rinse	Metals
4	Imp. 1-3 Contents & Rinses (0.1N HNO ₃)	Metals
5A	Imp. 4 Contents & Rinses (0.1N HNO ₃)	Metals
5B	Imp. 5-6 Contents & Rinses (4% KMnO ₄ /10% H ₂ SO ₄)	Mercury
5C	Imp. 5-6 Rinses (8N HCl)	Mercury

A Teflon heated line connecting the sample probe to the heated oven was used to facilitate sampling due to the presence of structural interference's which would not allow for the use of a monorail system.

Triplicate tests were completed for 21% chlorine, concentrated PCB waste feed. Each train sampled flue gas at a single point in the six-inch port.. Each test was approximately 210 minutes in duration. Relevant test parameters were recorded every 5 minutes. Field data sheets for each test are provided in Appendix 4.

Upon completion of each test, the sample train was disassembled, sealed and transported to the recovery laboratory at Kinectrics. Recovery sheets for each test train and the blank train are provided in Appendix 6.

6.2 Group B Compounds (Semi-Volatile Organics)

A summary of the Environment Canada Method EPS 1/RM/2 sampling train and sample recovery components is presented in tabular form as follows:

Train Configuration

Nozzle	Glass
Probe Liner	Glass
Filter	Quartz Fibre Filter
Resin	Amberlite XAD-2 (20-40 grams)
Impinger Solutions	1. Empty (condensate knockout) 2. 100 ml Ethylene Glycol 3. Empty 4. Silica Gel

Sample Recovery Components

1	Quartz Fibre Filter	Trace Organics
2	Hexane/Acetone Front-Half Rinse	Trace Organics
3	Hexane/Acetone Condenser/Trap Rinse	Trace Organics
4	Amberlite XAD-2 Resin	Trace Organics
5	Impinger 1 to 4 Contents & H ₂ O _{RODI} Rinse	Trace Organics
6	Hexane/Acetone Back-Half Rinse	Trace Organics

The sample train condenser coil and XAD-2 resin trap was not be soaked for five minutes as per the reference method since such a procedure is difficult to negotiate without spillage. The components were generously rinsed three times with the required solvents as a substitute procedure.

Triplicate tests were completed for 21% chlorine, concentrated PCB waste feed. Each train sampled flue gas at a single point in the six-inch port.. Each test was approximately 210 minutes in duration. Relevant test parameters were recorded every 5 minutes. Field data sheets for each test are provided in Appendix 6.

Upon completion of each test, the sample train was disassembled, sealed and transported to the recovery laboratory at Kinectrics. Recovery sheets for each test train and the blank train are provided in Appendix 7.

6.3 Group C Compounds (Volatile Organic Compounds)

A summary of the Volatile Organic Compound (VOC) sampling train and sample recovery components is presented in tabular form as follows:

Train Configuration

Nozzle	NA
Probe Liner	Teflon
Filter	Glass Wool in Probe
Collection Media	Tenax Tube Tenax/Charcoal Tube Condensate Trap

Sample Recovery Components

TS1	Tenax, Tenax/Charcoal Tube	VOCs
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A single pair of VOST tubes was used as a single test run. Each pair of VOST tubes collected sample for 60 minutes at approximately 0.33 litres per minute. Relevant test parameters were recorded every five minutes.

VOC emission rates were calculated using the average volumetric flow rate from the modified Method 5 trains ran on each respective day. Field data sheets for each test are provided in Appendix 8.

A single field blank was analyzed for the complete test program.

6.4 Group D Compounds (Hydrogen Chloride, Hydrogen Fluoride)

A summary of the EPA Method 26 sampling train and sample recovery components is presented in tabular form as follows:

Train Configuration

Probe Liner	Teflon
Filter	NA
Impinger Solutions	<ol style="list-style-type: none"> 1. Empty (condensate knock-out) 2. 15 ml H₂O_{RODI} 3. 15 ml H₂O_{RODI} 4. Empty 5. Silica Gel

Sample Recovery Components

1	Imp. 1-4 & H ₂ O _{RODI} Rinses	Chloride, Fluoride Anions
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Triplicate tests were completed for 21% chlorine, concentrated PCB waste feed. Each train sampled flue gas at a single point. Each test was approximately 60 minutes in duration. Relevant test parameters were recorded every 5 minutes. Field data sheets for each test are provided in Appendix 9.

Upon completion of each test, the sample train was disassembled, and recovered on-site. Recovery sheets for each test train were not required as the impinger contents and rinses were “topped-up” to the same volume for each test.

A single blank HCl/HF test train was recovered for the complete test program.

6.5 Group E Compounds (Aldehydes and Ketones)

A summary of the SW846 Method 0011 sampling train and sample recovery components is presented in tabular form as follows:

Train Configuration

Probe Liner	Teflon
Filter	NA
Impinger Solutions	<ol style="list-style-type: none"> 1. Empty (condensate knock-out) 2. 15 ml DNPH 3. 15 ml DNPH 4. Empty 5. Silica Gel

Sample Recovery Components

1	Imp. 1-4 & H ₂ O _{RODI} Rinses	Aldehydes & Ketones
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Triplicate tests were completed for 21% chlorine, concentrated PCB waste feed. Each train sampled flue gas at a single point. Each test was approximately 60 minutes in duration. Relevant test parameters were recorded every 5 minutes. Field data sheets for each test are provided in Appendix 10.

Upon completion of each test, the sample train was disassembled, and recovered on-site. Recovery sheets for each test train were not required as the impinger contents and rinses were “topped-up” to the same volume for each test.

A single blank A&K test train was recovered for the complete test program.

6.6 Group F Compounds (Combustion Gases & THC)

Compliance continuous emission analysers (CEMs) were used for measuring gaseous contaminants in the flue gas.

Calibrations were performed at the start and finish of each test day, as required. One or more of the analyzers were periodically calibrated throughout each test day dependent upon each analyzer’s performance. Individual analyser linearity was completed prior to the start of the test program.

Due to the high carbon dioxide concentrations present in the flue gas, a dilution system was required to measure carbon dioxide. Kinectrics used mass flow controllers to dilute flue gas with nitrogen to a concentration below 20% (the analyser’s limit).

7. QA/QC Program

Envirosolve used several tools to ensure that the sampling and recovery procedures used in the test program followed the approved reference methods including, but not limited to:

- Holding pre-test meeting(s) to familiarize personnel with their respective role(s).
- Reviewing all sampling and recovery procedures with respective individuals.
- Customizing step by step Recovery Data Sheets and Recovery Summary Checklist sheets to ensure proper recovery of each respective test.
- Creating Field Sampling Test Data Sheets to ensure all pertinent data is recorded.
- Reviewing the calibration and maintenance schedule of all equipment needed for each test.
- Creating custom log sheets and chain of custody sheets for all contaminants.

All field sampling and recovery sheets were completed before the start of the test program. Sample logs and labels were cross-referenced with one another and the respective methodology to ensure proper labeling of all the samples. Each sample was given a unique sample number, which was traceable to the sample log. The complete sample log is provided in Appendix 11.

All Envirosolve equipment used in the program was calibrated as required by the Ontario Source Testing Code and/or approved sampling methodology requirements. Calibration data is provided in Appendix 12.

8. Results

All tables are provided in Appendix 1. Analyses reported as less than detection limit (<DL) were reported (entered) as the detection limit with the “less than” (<) symbol preceding the value. The “less than” (<) symbol precedes each subsequent calculation to indicate that the calculated value was a direct result of a "non-detect" value, partial summation or average which includes a "non-detect" value.

Psychometric charts were used to determine flue gas moisture content for each test, based on saturation at the average flue gas temperature. Test recovery sheet, moisture data was not used.

8.1 Group A Compounds (Particulate/Metals)

Stack gas calculations for each Particulate/Metals test are provided in Appendix 13. A summary of the stack gas physical parameters and stack gas sampling parameters for each test are provided in Table 1.

The average stack gas physical parameters measured by the PM trains are summarized as follows:

<i>Stack Gas Physical Parameter</i>	<i>Averages</i>
Stack Gas Temperature	51 °C
Moisture Content (v/v)	13.2 %
Absolute Pressure	101.3 kPa
Velocity	2.64 m/s
Actual Volumetric Flow Rate	0.048 m ³ /s
Wet Reference Volumetric Flow Rate	0.044 m ³ /s
Dry Reference Volumetric Flow Rate	0.038 m ³ /s

8.1.1 Total Suspended Particulate

Particulate concentrations, corrected concentrations and emission rates are provided in Table 2 and test averages are summarized as follows:

<i>Analyte</i>	<i>Dry Reference Conc.</i>	<i>O₂ Corrected Conc.</i>	<i>Emission Rate</i>
Total Suspended Particulate	299 mg/Rm ³	225 mg/Rm ³	11.5 mg/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

The Blank train did not produce significant filter or probe rinse particulate weight gains or losses. The TSP analytical report is provided in Appendix 14.

8.1.2 Metals

Metal concentrations, corrected concentrations and emission rates for Test No. 1, Test No. 2 and Test No. 3 are provided in Table 3, 4 and 5, respectively.. The summary of average concentration and emission data is presented in table 6 and summarized as follows:

<i>Analyte</i>	<i>Dry Reference Conc.</i>	<i>O₂ Corrected Conc.</i>	<i>Emission Rate</i>
Aluminum	17.4 µg/Rm ³	12.9 µg/Rm ³	0.666 µg/s
Chromium	1.93 µg/Rm ³	1.43 µg/Rm ³	0.074 µg/s
Cobalt	<0.299 µg/Rm ³	<0.223 µg/Rm ³	<0.012 µg/s
Copper	314 µg/Rm ³	233 µg/Rm ³	12.1 µg/s
Iron	28.5 µg/Rm ³	21.0 µg/Rm ³	1.09 µg/s
Lead	2.07 µg/Rm ³	1.54 µg/Rm ³	0.079 µg/s
Lithium	2.11 µg/Rm ³	1.56 µg/Rm ³	0.081 µg/s
Magnesium	5.31 µg/Rm ³	3.93 µg/Rm ³	0.204 µg/s
Manganese	95.0 µg/Rm ³	70.7 µg/Rm ³	3.65 µg/s
Antimony	<2.86 µg/Rm ³	<2.11 µg/Rm ³	<0.109 µg/s
Molybdenum	3.29 µg/Rm ³	2.44 µg/Rm ³	0.126 µg/s
Nickel	3.36 µg/Rm ³	2.49 µg/Rm ³	0.129 µg/s
Phosphorous (Total)	<1.27 µg/Rm ³	<0.936 µg/Rm ³	<0.048 µg/s
Selenium	<2.11 µg/Rm ³	<1.55 µg/Rm ³	<0.080 µg/s
Silicon	15742 µg/Rm ³	11582 µg/Rm ³	602 µg/s
Silver	9.17 µg/Rm ³	6.75 µg/Rm ³	0.350 µg/s
Sodium	4037 µg/Rm ³	3023 µg/Rm ³	156 µg/s
Strontium	0.200 µg/Rm ³	0.149 µg/Rm ³	0.008 µg/s
Arsenic	<1.42 µg/Rm ³	<1.05 µg/Rm ³	<0.054 µg/s
Tin	121 µg/Rm ³	89.9 µg/Rm ³	4.65 µg/s
Titanium	0.395 µg/Rm ³	0.291 µg/Rm ³	0.015 µg/s
Vanadium	<0.344 µg/Rm ³	<0.256 µg/Rm ³	<0.013 µg/s
Zinc	12.3 µg/Rm ³	9.10 µg/Rm ³	0.472 µg/s
Barium	0.437 µg/Rm ³	0.326 µg/Rm ³	0.017 µg/s
Beryllium	<0.030 µg/Rm ³	<0.022 µg/Rm ³	<0.001 µg/s
Boron	3.08 µg/Rm ³	2.28 µg/Rm ³	0.118 µg/s
Cadmium	<0.063 µg/Rm ³	<0.047 µg/Rm ³	<0.002 µg/s
Calcium	23.3 µg/Rm ³	17.3 µg/Rm ³	0.895 µg/s
Mercury	<0.077 µg/Rm ³	<0.057 µg/Rm ³	<0.003 µg/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

"<" indicates analyte not detected in one or more test(s) (substitute detection limit)

Certain analytes were analysed in the elemental form and converted to the equivalent amount of compounds regulated in REG346. These conversions are listed below the REG346 table for metals results.

The Blank train contained significant amounts of contamination for several metal analytes, which is common due to the digestion of the quartz filter during the analysis of the front-half of the train. The presence of silicon from the digestive process contributes to the large amounts of calculated equivalent respirable silica.

The metals analytical report including detection limits and spike recoveries is presented in Appendix 15. The Blank train analysis is also provided indicating the compounds normally present due to contamination from the filter media itself.

8.2 Group B Compounds (Semi-Volatile Organics)

Prior to the start of the program, all SVOCs glassware, collection media and materials were rinsed and proofed as per the reference method. The proof analyses for all SVOCs are provided at the beginning of the SVOCs analytical report.

Stack gas calculations for each SVOC test are provided in Appendix 16. A summary of the stack gas physical parameters and stack gas sampling parameters for each test are provided in Table 1.

The average stack gas physical parameters measured by the SVOCs trains are summarized as follows:

<i>Stack Gas Physical Parameter</i>	<i>Averages</i>
Stack Gas Temperature	51 °C
Moisture Content (v/v)	13.0 %
Absolute Pressure	101.3 kPa
Velocity	2.62 m/s
Actual Volumetric Flow Rate	0.048 m ³ /s
Wet Reference Volumetric Flow Rate	0.044 m ³ /s
Dry Reference Volumetric Flow Rate	0.038 m ³ /s

8.2.1 Chlorobenzenes (CBs)

Chlorobenzene concentrations, corrected concentrations and emission rates for Test No. 1, Test No. 2 and Test No. 3 are provided in Tables 7, 8 and 9 respectively.

The summary of average concentration and emission rate data is presented in table 10 and summarized as follows:

<i>Analyte</i>	<i>Dry Reference Conc.</i>	<i>O₂ Corrected Conc.</i>	<i>Emission Rate</i>
1,2-Dichlorobenzene	<0.418 µg/Rm ³	<0.308 µg/Rm ³	<0.016 µg/s
1,3-Dichlorobenzene	<0.210 µg/Rm ³	<0.153 µg/Rm ³	<0.008 µg/s
1,4-Dichlorobenzene	1.21 µg/Rm ³	0.898 µg/Rm ³	0.046 µg/s
1,2,3-Trichlorobenzene	<0.145 µg/Rm ³	<0.107 µg/Rm ³	<0.006 µg/s
1,2,4-Trichlorobenzene	0.502 µg/Rm ³	0.367 µg/Rm ³	0.019 µg/s
1,3,5-Trichlorobenzene	<0.101 µg/Rm ³	<0.074 µg/Rm ³	<0.004 µg/s
1,2,3,4-Tetrachlorobenzene	<0.135 µg/Rm ³	<0.099 µg/Rm ³	<0.005 µg/s
1,2,3,5-Tetrachlorobenzene	<0.101 µg/Rm ³	<0.074 µg/Rm ³	<0.004 µg/s
1,2,4,5-Tetrachlorobenzene			
Hexachlorobenzene	<0.101 µg/Rm ³	<0.074 µg/Rm ³	<0.004 µg/s
Pentachlorobenzene	<0.100 µg/Rm ³	<0.073 µg/Rm ³	<0.004 µg/s
Hexachloroethane	<0.068 µg/Rm ³	<0.050 µg/Rm ³	<0.003 µg/s
Hexachlorobutadiene	<0.100 µg/Rm ³	<0.073 µg/Rm ³	<0.004 µg/s
Octachlorostyrene	<0.068 µg/Rm ³	<0.050 µg/Rm ³	<0.003 µg/s
2,6,A-Trichlorotoluene	<0.068 µg/Rm ³	<0.050 µg/Rm ³	<0.003 µg/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

"<" indicates analyte not detected in one or more test(s) (substitute detection limit

The Blank train did not contain contamination. The chlorobenzene analytical results, including detection limits and surrogate recoveries are contained in the SVOC analytical report provided in Appendix 17.

8.2.2 Chlorophenols (CPs)

Chlorophenol concentrations, corrected concentrations and emission rates for Test No. 1, Test No. 2 and Test No. 3 are provided in Tables 11, 12 and 13 respectively. The summary of average concentration and emission rate data is presented in table 14 and summarized as follows:

Analyte	Dry Reference Conc.	O ₂ Corrected Conc.	Emission Rate
2-Chlorophenol	<0.166 µg/Rm ³	<0.121 µg/Rm ³	<0.006 µg/s
3-Chlorophenol & 4-Chlorophenol	<0.178 µg/Rm ³	<0.130 µg/Rm ³	<0.007 µg/s
2,3,5,6-Tetrachlorophenol	<0.079 µg/Rm ³	<0.059 µg/Rm ³	<0.003 µg/s
2,4-Dichlorophenol	<0.277 µg/Rm ³	<0.202 µg/Rm ³	<0.011 µg/s
2,6-Dichlorophenol	<0.079 µg/Rm ³	<0.059 µg/Rm ³	<0.003 µg/s
2,3,4-Trichlorophenol	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
2,3,5-Trichlorophenol	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
2,3,4,5-Tetrachlorophenol	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
2,3,4,6-Tetrachlorophenol	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
2,4,5-Trichlorophenol	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
2,4,6-Trichlorophenol	<5.59 µg/Rm ³	<4.04 µg/Rm ³	<0.213 µg/s
Pentachlorophenol	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Total Dichlorophenols	<0.545 µg/Rm ³	<0.398 µg/Rm ³	<0.021 µg/s
Total Trichlorophenols	<5.10 µg/Rm ³	<3.69 µg/Rm ³	<0.194 µg/s
Total Tetrachlorophenols	<0.103 µg/Rm ³	<0.076 µg/Rm ³	<0.004 µg/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

"<" indicates analyte not detected in one or more test(s) (substitute detection limit)

The Blank train did not contain contamination. The chlorophenol analytical results, including detection limits and surrogate recoveries are contained in the SVOC analytical report provided in Appendix 17.

8.2.3 Polyaromatic Hydrocarbons (PAHs)

PAH concentrations, corrected concentrations and emission rates for Test No. 1, Test No. 2 and Test No. 3 are provided in Tables 15, 16 and 17 respectively. The summary of average concentration and emission rate data is presented in table 18 and summarized as follows:

Analyte	Dry Reference Conc.	O ₂ Corrected Conc.	Emission Rate
Acenaphthene	1.78 µg/Rm ³	1.32 µg/Rm ³	0.068 µg/s
Acenaphthylene	0.114 µg/Rm ³	0.085 µg/Rm ³	0.004 µg/s
Anthracene	<0.113 µg/Rm ³	<0.083 µg/Rm ³	<0.004 µg/s
Benzo(a)anthracene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Benzo(a)fluorene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Benzo(a)pyrene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Benzo(b)anthracene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Benzo(b)fluorene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Benzo(b/j)fluoranthene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Benzo(e)pyrene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Benzo(ghi)perylene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Benzo(k)fluoranthene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Biphenyl	2.56 µg/Rm ³	1.86 µg/Rm ³	0.098 µg/s
Camphene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Chrysene & Triphenylene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Coronene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Dibenzo(a,e)pyrene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Dibenzo(ac,ah)anthracene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s

Dibenzo(a,l)pyrene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Dibenzo(a,j)acridine	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Fluoranthene	3.95 µg/Rm ³	2.89 µg/Rm ³	0.151 µg/s
Fluorene	6.92 µg/Rm ³	5.02 µg/Rm ³	0.263 µg/s
Indeno(1,2,3-cd)pyrene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
m-Terphenyl	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Naphthalene	9.62 µg/Rm ³	7.00 µg/Rm ³	0.366 µg/s
o-Terphenyl	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Perylene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Phenanthrene	22.7 µg/Rm ³	16.5 µg/Rm ³	0.865 µg/s
Picene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
p-Terphenyl	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Pyrene	<0.245 µg/Rm ³	<0.179 µg/Rm ³	<0.009 µg/s
Quinoline	<0.343 µg/Rm ³	<0.254 µg/Rm ³	<0.013 µg/s
1-Chloronaphthalene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
1-Methylnaphthalene	3.18 µg/Rm ³	2.32 µg/Rm ³	0.121 µg/s
1-Methylphenanthrene	<0.137 µg/Rm ³	<0.101 µg/Rm ³	<0.005 µg/s
2-Chloronaphthalene	<0.209 µg/Rm ³	<0.152 µg/Rm ³	<0.008 µg/s
2-Methylantracene	<0.420 µg/Rm ³	<0.311 µg/Rm ³	<0.016 µg/s
2-Methylnaphthalene	3.76 µg/Rm ³	2.75 µg/Rm ³	0.143 µg/s
3-Methylcholanthrene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
5-Nitroacenaphthalene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
7H-Dibenzo(c,g) Carbazole	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
7,12-Dimethylbenzo(a)anthracene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
9,10-Dimethylantracene	<0.069 µg/Rm ³	<0.051 µg/Rm ³	<0.003 µg/s
Tetralin	<0.217 µg/Rm ³	<0.161 µg/Rm ³	<0.008 µg/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

"<" indicates analyte not detected in one or more test(s) (substitute detection limit)

The Blank train did not contain contamination. The PAH analytical results, including detection limits and surrogate recoveries are contained in the SVOC analytical report provided in Appendix 17.

8.2.4 Polychlorinated Biphenyls (PCBs)

PCB concentrations, corrected concentrations and emission rates for Test No. 1, Test No. 2 and Test No. 3 are provided in Tables 19, 20 and 21 respectively. The summary of average concentration and emission data is presented in Table 22 and summarized as follows:

Analyte	Dry Reference Conc.	O ₂ Corrected Conc.	Emission Rate
Monochlorobiphenyls	3.85 ng/Rm ³	2.88 ng/Rm ³	0.148 ng/s
Dichlorobiphenyls	5.99 ng/Rm ³	4.36 ng/Rm ³	0.228 ng/s
Trichlorobiphenyls	19.9 ng/Rm ³	14.5 ng/Rm ³	0.759 ng/s
Tetrachlorobiphenyls	31.0 ng/Rm ³	22.7 ng/Rm ³	1.18 ng/s
Pentachlorobiphenyls	60.6 ng/Rm ³	44.7 ng/Rm ³	2.31 ng/s
Hexachlorobiphenyls	273 ng/Rm ³	202 ng/Rm ³	10.4 ng/s
Heptachlorobiphenyls	317 ng/Rm ³	234 ng/Rm ³	12.1 ng/s
Octachlorobiphenyls	33.9 ng/Rm ³	25.0 ng/Rm ³	1.29 ng/s
Nonachlorobiphenyls	1.65 ng/Rm ³	1.22 ng/Rm ³	0.063 ng/s
Decachlorobiphenyls	<0.610 ng/Rm ³	<0.450 ng/Rm ³	<0.023 ng/s
Total PCB Congeners	752 ng/Rm³	555 ng/Rm³	28.7 ng/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

"<" indicates analyte not detected in one or more test(s) (substitute detection limit)

The Blank train did not contain contamination. The PCB analytical results, including detection limits and surrogate recoveries are contained in the SVOC analytical report provided in Appendix 17.

8.2.5 PCDDs/PCDFs

PCDD/PCDF concentrations, corrected concentrations and emission rates for Test No. 1, Test No. 2 and Test No. 3 are provided in Tables 23, 24 and 25 respectively. The summary of average concentration and emission data is presented in Table 26 and summarized as follows:

Analyte	Dry Reference Conc.	O ₂ Corrected Conc.	Emission Rate
2,3,7,8-Tetra CDD	<0.0021 ng/Rm ³	<0.0015 ng/Rm ³	<0.0001 ng/s
1,2,3,7,8-Penta CDD	0.0108 ng/Rm ³	0.0080 ng/Rm ³	<0.0004 ng/s
1,2,3,4,7,8-Hexa CDD	0.0060 ng/Rm ³	0.0044 ng/Rm ³	0.0002 ng/s
1,2,3,6,7,8-Hexa CDD	0.0054 ng/Rm ³	0.0040 ng/Rm ³	0.0002 ng/s
1,2,3,7,8,9-Hexa CDD	<0.0039 ng/Rm ³	<0.0029 ng/Rm ³	<0.0002 ng/s
1,2,3,4,6,7,8-Hepta CDD	<0.0137 ng/Rm ³	<0.0102 ng/Rm ³	<0.0005 ng/s
Octa CDD	<0.0411 ng/Rm ³	<0.0305 ng/Rm ³	<0.0016 ng/s
Total Tetra CDD	0.4005 ng/Rm ³	0.2940 ng/Rm ³	0.0153 ng/s
Total Penta CDD	1.1199 ng/Rm ³	0.8559 ng/Rm ³	0.0436 ng/s
Total Hexa CDD	0.0508 ng/Rm ³	0.0385 ng/Rm ³	0.0020 ng/s
Total Hepta CDD	<0.0137 ng/Rm ³	<0.0102 ng/Rm ³	<0.0005 ng/s
2,3,7,8-Tetra CDF	0.3739 ng/Rm ³	0.2752 ng/Rm ³	0.0143 ng/s
1,2,3,7,8-Penta CDF	0.0858 ng/Rm ³	0.0633 ng/Rm ³	0.0033 ng/s
2,3,4,7,8-Penta CDF	0.2116 ng/Rm ³	0.1566 ng/Rm ³	0.0081 ng/s
1,2,3,4,7,8-Hexa CDF	0.1280 ng/Rm ³	0.0945 ng/Rm ³	0.0049 ng/s
1,2,3,6,7,8-Hexa CDF	0.0460 ng/Rm ³	0.0339 ng/Rm ³	0.0018 ng/s
2,3,4,6,7,8-Hexa CDF	0.0425 ng/Rm ³	0.0315 ng/Rm ³	0.0016 ng/s
1,2,3,7,8,9-Hexa CDF	0.0028 ng/Rm ³	0.0021 ng/Rm ³	0.0001 ng/s
1,2,3,4,6,7,8-Hepta CDF	0.0471 ng/Rm ³	0.0346 ng/Rm ³	0.0018 ng/s
1,2,3,4,7,8,9-Hepta CDF	<0.0137 ng/Rm ³	<0.0102 ng/Rm ³	<0.0005 ng/s
Octa CDF	<0.0411 ng/Rm ³	<0.0305 ng/Rm ³	<0.0016 ng/s
Total Tetra CDF	0.9932 ng/Rm ³	0.7288 ng/Rm ³	0.0378 ng/s
Total Penta CDF	0.8054 ng/Rm ³	0.5951 ng/Rm ³	0.0308 ng/s
Total Hexa CDF	0.4040 ng/Rm ³	0.2981 ng/Rm ³	0.0154 ng/s
Total Hepta CDF	0.0819 ng/Rm ³	0.0601 ng/Rm ³	0.0031 ng/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

"<" indicates analyte not detected in one or more test(s) (substitute detection limit)

PCDD/PCDF international Toxic Equivalent Factor (TEQ) concentrations, corrected concentrations and emission rates for Test No. 1, Test No. 2 and Test No. 3 are provided in Tables 27, 28, and 29 respectively. The summary of average TEQ concentration and emission data is presented in Table 30, and is summarized as follows:

Analyte	Dry Reference Conc.	O ₂ Corrected Conc.	Emission Rate
Dioxin Total	0.0092 ng/Rm ³	0.0068 ng/Rm ³	0.0004 ng/s
Furan Total	0.1701 ng/Rm ³	0.1257 ng/Rm ³	0.0065 ng/s
Dioxin/Furan Total	0.1792 ng/Rm ³	0.1325 ng/Rm ³	0.0068 ng/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

The Blank train did not contain contamination. The PCDD/PCDF analytical results, including detection limits and surrogate recoveries are contained in the SVOC analytical report provided in Appendix 17.

8.3 Volatile Organic Compounds (VOCs)

Reference volumes sampled for each test are provided in Table 30.

VOC concentrations, corrected concentrations and emission rates for Test No. 1, Test No. 2 and Test No. 3 are provided in Tables 31, 32, and 33 respectively. The summary of average concentration and emission data is presented in Table 34 and summarized as follows:

Analyte	Dry Reference Conc.	O ₂ Corrected Conc.	Emission Rate
Dichlorodifluoromethane	34.8 µg/Rm ³	24.9 µg/Rm ³	1.34 µg/s
Chloromethane	25.0 µg/Rm ³	18.0 µg/Rm ³	0.964 µg/s
Vinyl Chloride	<3.78 µg/Rm ³	<2.71 µg/Rm ³	<0.145 µg/s
Chloroethane	16.5 µg/Rm ³	11.8 µg/Rm ³	0.635 µg/s
Trichlorofluoromethane	281 µg/Rm ³	202 µg/Rm ³	10.8 µg/s
Trichlorofluoroethane	25.9 µg/Rm ³	18.6 µg/Rm ³	0.996 µg/s
Acetone	216 µg/Rm ³	155 µg/Rm ³	8.32 µg/s
1,1-Dichloroethane	18.8 µg/Rm ³	13.5 µg/Rm ³	0.723 µg/s
trans-1,2-Dichloroethane	<2.33 µg/Rm ³	<1.67 µg/Rm ³	<0.090 µg/s
Dichloromethane	31.1 µg/Rm ³	22.3 µg/Rm ³	1.20 µg/s
Chloroform	600 µg/Rm ³	430 µg/Rm ³	23.1 µg/s
Carbon Tetrachloride	263 µg/Rm ³	189 µg/Rm ³	10.1 µg/s
1,1-Dichloroethane	<3.51 µg/Rm ³	<2.52 µg/Rm ³	<0.135 µg/s
1,2-Dichloroethane	18.3 µg/Rm ³	13.2 µg/Rm ³	0.706 µg/s
1,2-Dibromoethane	<2.33 µg/Rm ³	<1.67 µg/Rm ³	<0.090 µg/s
1,2-Dichloropropane	<2.86 µg/Rm ³	<2.05 µg/Rm ³	<0.110 µg/s
1,3-Dichloropropane	<0.932 µg/Rm ³	<0.669 µg/Rm ³	<0.036 µg/s
1,1,1-Trichloroethane	<28.7 µg/Rm ³	<20.6 µg/Rm ³	<1.10 µg/s
1,1,2-Trichloroethane	<0.932 µg/Rm ³	<0.669 µg/Rm ³	<0.036 µg/s
1,1,2,2-Tetrachloroethane	<0.932 µg/Rm ³	<0.669 µg/Rm ³	<0.036 µg/s
cis-1,3-Dichloropropene	<3.46 µg/Rm ³	<2.49 µg/Rm ³	<0.133 µg/s
trans-1,3-Dichloropropene	<3.31 µg/Rm ³	<2.37 µg/Rm ³	<0.127 µg/s
Chlorobenzene	11.3 µg/Rm ³	8.12 µg/Rm ³	0.436 µg/s
Bromomethane	19.0 µg/Rm ³	13.7 µg/Rm ³	0.733 µg/s
Dibromomethane	1.88 µg/Rm ³	1.35 µg/Rm ³	0.072 µg/s
Bromoform	96.2 µg/Rm ³	69.0 µg/Rm ³	3.70 µg/s
Bromodichloromethane	442 µg/Rm ³	317 µg/Rm ³	17.0 µg/s
Dibromochloromethane	374 µg/Rm ³	268 µg/Rm ³	14.4 µg/s
Trichloroethylene	23.9 µg/Rm ³	17.1 µg/Rm ³	0.920 µg/s
Tetrachloroethylene	153 µg/Rm ³	110 µg/Rm ³	5.89 µg/s
Benzene	22.4 µg/Rm ³	16.1 µg/Rm ³	0.862 µg/s
Toluene	33.9 µg/Rm ³	24.3 µg/Rm ³	1.30 µg/s
Ethylbenzene	10.1 µg/Rm ³	7.26 µg/Rm ³	0.389 µg/s
m/p-Xylene	28.6 µg/Rm ³	20.6 µg/Rm ³	1.10 µg/s
O-Xylene	11.0 µg/Rm ³	7.91 µg/Rm ³	0.425 µg/s
Styrene	13.0 µg/Rm ³	9.32 µg/Rm ³	0.500 µg/s
Isopropylbenzene	<1.97 µg/Rm ³	<1.42 µg/Rm ³	<0.076 µg/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

"<" indicates analyte not detected in one or more test(s) (substitute detection limit)

The various Blanks did not contain significant contamination for most compounds. There were a few compounds found in the trip blank which is not that uncommon for this sampling media. The VOC analytical report including the various blanks, detection limits and surrogate recoveries is presented in Appendix 18.

8.4 Hydrogen Chloride/Hydrogen Fluoride (HCl/HF)

Reference volumes sampled for each test are provided in Table 36. The summary of average concentration and emission data is presented in Table 37, and are summarized as follows:

<i>Analyte</i>	<i>Dry Reference Conc.</i>	<i>O₂ Corrected Conc.</i>	<i>Emission Rate</i>
Hydrogen Chloride	23.4 mg/Rm ³	17.3 mg/m ³	0.900 mg/s
Hydrogen Fluoride	5.97 mg/Rm ³	4.43 mg/m ³	0.230 mg/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

The hydrogen chloride/fluoride analytical report is provided in Appendix 19. The results are very consistent however, the blank sample contained chloride and fluoride ions in the same amount found in the test samples. All analyses were repeated and found similar to the original results. Since the blank sample was high in chloride content, the test samples are suspect.

8.5 Aldehydes and Ketones (A&K)

Reference volumes sampled for each aldehyde and acetone test are provided in Table 38 and Table 40, respectively.. The summary of average concentration and emission data is presented in Table 39 and Table 41, respectively, and are summarized as follows:

<i>Analyte</i>	<i>Dry Reference Conc.</i>	<i>O₂ Corrected Conc.</i>	<i>Emission Rate</i>
Acetaldehyde	46.9 µg/Rm ³	31.1 µg/m ³	1.79 µg/s
Formaldehyde	127 µg/Rm ³	94.5 µg/m ³	4.88 µg/s
Acetone	214 µg/Rm ³	160 µg/m ³	8.23 µg/s

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

The aldehyde and ketone analytical report is provided in Appendix 20

8.6 Combustion Gases and Total Hydrocarbons

CEM calibration data for all analysers is provided in Appendix 21. Combustion gas and total hydrocarbon tabulated data for each test is provided in Appendix 22.

A dilution system was used to measure carbon dioxide concentrations in the flu gas due to the extremely high CO₂ content. This dilution system was operational for only a short period of time prior to the first tests. An assumed CO₂ concentration of 85% (approximate concentration measured when dilution system was operational) was used for flue gas molecular weight determinations.

Combustion gas and total hydrocarbon concentrations, corrected concentrations and emission data are provided in Table 42. The summary of average concentration and emission data is presented in Table 43, and are summarized as follows:

<i>Gas</i>	<i>Conc.</i>	<i>Dry Reference Conc.</i>	<i>O₂ Corrected Conc.</i>	<i>Emission Rate</i>
Oxygen	75133 ppm	53.8 mg/Rm ³	39.8 mg/Rm ³	2.08 mg/s
Carbon Dioxide	850000 ppm	1529743 mg/Rm ³	1132186 mg/Rm ³	59150 mg/s
Carbon Monoxide	30.1 ppm	42.1 mg/Rm ³	31.3 mg/Rm ³	1.62 mg/s
Nitrogen Oxides	29.0 ppm	53.8 mg/Rm ³	39.8 mg/Rm ³	2.08 mg/s
Sulphur Dioxide	0.6 ppm	1.35 mg/Rm ³	0.969 mg/Rm ³	0.052 mg/s
THC	2.0 ppm		1.4 ppm*	

Reference Conditions: 77°F, 29.92 in. Hg – 25°C, 101.3 kPa

Oxygen Correction – Corrected to 11% oxygen

*THC – Wet Basis as Methane

9. DRE Determinations

PCB destruction removal efficiencies (DREs) were determined for the plasma arc furnace based on calculated PCB feed rates during the PCB feed burn(s) and measured PCB concentrations at the stack. Kinectrics was responsible for determining PCB feed rates as supplied in Appendix 23.

The results are summarized as follows:

<i>Test Identification</i>	<i>PCB Input</i>	<i>PCB Output</i>	<i>PCB DRE</i>
SVOC Test No. 1	2225900000 µg	70.3 µg	99.999997 %
SVOC Test No. 2	2173400000 µg	887 µg	99.999959 %
SVOC Test No. 3	2217600000 µg	117 µg	99.999995 %

10. Dispersion Modeling

Dispersion modeling (Ontario MOE REG346 Model) was performed on contaminant emission rates as required in the C of A and compared with Ontario Environmental Protection Act, Regulation 346 standards, interim standards, interim guidelines and Approvals Screening Levels based on ground level point of impingement concentrations. A hypothetical model was constructed from building and property line dimensions suggested by Kinectrics. The resulting factor based on an emission rate of 1 g/sec was used to model analyte emission rates into maximum ground level impingement concentrations.

The hypothetical model assumed the following parameters:

- building dimensions ~ 60 ft x 60 ft x 20 ft (L, W, H)
- building centered within property line measuring ~ 100 square yards
- stack height ~ 10 ft above roof

The REG346 model is provided in Appendix 24. The POI results are provided in Appendix 25.

The average results of the emission testing program completed indicated that the plasma waste destruction unit was operating within compliance for all current Ontario Environmental Protection Act, Regulation 346 Standards, Interim Standards, Interim Guidelines and Approvals Screening Levels based on ground level point of impingement concentrations.

Included in the data is a column determining the percentage of criteria, which compares the calculated contaminant levels with the applicable criteria level. The tables indicate that all contaminant levels are below the applicable criteria levels.

11. Scrubber Samples

During the main test program, four scrubber solution samples were taken by Kinectrics staff. Two of the four samples (1st and 4th sample) were submitted for SVOCs analyses. The samples were logged as E01011-66-SAMPLE 1 and E01011-69-SAMPLE 4, respectively. The results are provided next to each blank analysis in the SVOCs reports.

Both scrubber solution samples did not contain significant amounts of analytes. Most compounds were below detection limits with the exception of PCBs and some of the furan congeners. These compounds were found in very small quantities.

ENVIROSOLVE

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