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The Regional Municipality of Durham
Information Report

From:	Commissioner of Works
Report:	#2024-INFO-55
Date:	September 13, 2024

Subject:

Durham York Energy Centre 2024 Compliance Source Test Update

Recommendation:

Receive for information.

Report:

1. Purpose

1.1 The purpose of this report is to provide an update on the 2024 Compliance Source Test results at the Durham York Energy Centre (DYEC).

2. Background

2.1 As required by the DYEC Environmental Compliance Approval (ECA), the Owners are to perform an annual Compliance Source Test in accordance with the procedures and schedules outlined in Schedule “E” of the ECA. The Compliance Source Test measures the rate of emission of the test contaminants from the stack.

3. Compliance Source Test

3.1 The Compliance Source Test was conducted between March 18, 2024, to March 21, 2024, for all test contaminants on Boiler 1 and Boiler 2.

3.2 The results summary of the Compliance Source Test demonstrated that all emissions were within the limits detailed in the ECA (Attachment #1).

3.3 The full Compliance Source Test Report was sent to the Ministry of Environment, Conservation and Parks (MECP) and subsequently posted to the project website.

3.4 The DYEC emissions dispersion was modeled utilizing the Compliance Source Test data and the MECP approved CALPUFF model. The results of the contaminant concentrations at the maximum point of impingement were then compared to the limits within the Ontario Regulation 419/05 Air Pollution – Local Air Quality which are set to be protective of human health and the environment.

3.5 All of the calculated impingement concentrations were well below the regulatory limits.

4. Owners' Consultant Reviews

4.1 Stantec, the Source Test peer reviewer, provided their Final Report (Attachment #2) to the Region on August 15, 2024. Stantec's report concluded:

> "Stantec is satisfied that the conduct of the source testing, the analytical analysis, and the analytical calculations were carried out in a professional manner and followed all relevant guidelines, protocols, and best practices."
>
> "Stantec is satisfied that the modelling was completed in accordance with the facility's ECA (Condition 6.1 and Schedule B), as well as O. Reg. 419/05."

4.2 HDR personnel were also present during the Source Tests. In their report (Attachment #3) HDR provided the following conclusion:

"HDR observed ORTECH following the approved stack sampling procedures and test methods. HDR also observed ReWorld's plant personnel operating the DYEC under normal operating conditions and in accordance with acceptable industry operating standards. Based on the results summarized in ORTECH's test report (dated May 16, 2024), the air emission results of the Spring 2024 Compliance Test demonstrated that the DYEC operated below the ECA's Schedule "C" limits."

5. Continued Demonstrated Performance

5.1 DYEC demonstrates consistent performance with the appropriate controls and monitoring in place which provide a level of safety and protection to human health and the environment.

5.2 The results of testing completed from 2019-2024 are presented in Attachment 4. The data presented indicates that the DYEC has consistently demonstrated that it operates safely and effectively within the ECA Schedule “C” limits.

5.3 A table comparison of the latest source testing results against the ECA limits and A-7 guideline is presented in Attachment #5 which shows DYEC consistently operates and performs below regulatory limits.

6. Conclusion

6.1 The Owners’ technical consultants and peer reviewers have confirmed that the Compliance Source Test was conducted in accordance with the Ministry of the Environment, Conservation and Parks’ guidelines.

6.2 All results of the Compliance Source Test were below the concentration limits prescribed in Schedule C of the Environmental Compliance Approval.

6.3 Using CALPUFF dispersion modeling techniques, the predicted maximum point of impingement concentrations, based on the average test results for both boilers, show Durham York Energy Centre to be operating well below all current standards in Regulation 419/05 under the Environmental Protection Act and other Ministry of the Environment, Conservation and Parks criteria including guidelines and upper-risk thresholds.

7. Attachments

Attachment 1: Compliance Source Test Results Summary

Attachment 2: Stantec 2024 Compliance Source Test Final Report

Attachment 3: HDR Inc. 2024 Compliance Source Test Technical Memorandum

Attachment 4: Source Test Results 2019-2024

Attachment 5: Comparison Table: 2024 Compliance Source Test Results Compared to ECA limits and Ontario A-7 Guideline

Respectfully submitted,

Original signed by:

Ramesh Jagannathan, MBA, M.Eng., P.Eng., PTOE
Commissioner of Works

EXECUTIVE SUMMARY

ORTECH Consulting Alliance Inc. (ORTECH) completed the annual compliance emission testing program at the Durham York Energy Centre (DYEC) located in Courtice, Ontario between March 18 and March 21, 2024. The emission testing program was performed to satisfy the requirements of the Ontario Ministry of the Environment, Conservation and Parks (MECP) Amended Environmental Compliance Approval (ECA) No. 7306-8FDKNX. Section 7(1) of the ECA states that "the owner shall perform annual source testing, in accordance with the procedures and schedule outlined in the attached Schedule E, to determine the rates of emissions of the test contaminants from the stack. The program shall be conducted not later than six months after the commencement date of operation of the facility/equipment and subsequent source testing programs shall be conducted once every calendar year thereafter". A list of the test programs conducted by ORTECH to date is provided below:

Test Program	Test Date	ORTECH Report No.
2015 Compliance	September/October 2015	21546
2016 Voluntary	May 2016	21656
2016 Compliance	October/November 2016	21698
2017 Voluntary	May 2017	21754
2017 Compliance	October 2017	21800
2018 Voluntary	May/June 2018	21840
2018 Compliance	September 2018	21880
2019 Voluntary	June 2019	21936
2019 Compliance	September 2019	21960
2020 Voluntary	June 2020	22001
2020 Compliance	November 2020	22050
2021 Voluntary	June 2021	22081
2021 Compliance	November/December 2021	22085
2022 Voluntary	May 2022	22158
2022 Compliance	November/December 2022	22160
2023 Voluntary	April 2023	22230
2023 Compliance	September/October 2023	22235
2024 Compliance	March 2024	22327

Source testing was performed on the Baghouse (BH) Outlet of Boiler No. 1 and BH Outlet of Boiler No. 2 for the test contaminants listed in Schedule D of the ECA.

Triplicate emission tests were completed for particulate matter, metals, semi-volatile organic compounds, acid gases, volatile organic compounds, aldehydes and combustion gases at the BH Outlet of each Boiler. Triplicate emission tests were also completed for total hydrocarbons at the Quench Inlet of each Boiler. The contaminant groups included in the emission test program and the reference test methods used are summarized below:

Test Groups	Reference Method
Particulate and Metals	US EPA Method 29
$PM_{2.5}$/PM_{10} and Condensable Particulate	US EPA Methods 201A and 202
Semi-Volatile Organic Compounds	Environment Canada Method EPS 1/RM/2
Volatile Organic Compounds	US EPA SW-846 Method 0030 (SLO VOST modification)
Aldehydes	NCASI Method ISS/FP-A105.01
Halides and Ammonia	US EPA Method 26A
Combustion Gases: Oxygen and Carbon Dioxide Carbon Monoxide Sulphur Dioxide Nitrogen Oxides Total Hydrocarbons	 Facility CEM Facility CEM Facility CEM Facility CEM ORTECH per US EPA Method 25A

Schedule C of ECA No. 7306-8FDKNX lists in-stack limits for the emissions of various compounds. In- stack emissions limits are given for particulate matter, mercury, cadmium, lead, dioxins and furans and organic matter for comparison with the results from compliance source testing. In-stack emission limits are also given for hydrochloric acid, sulphur dioxide, nitrogen oxides and carbon monoxide calculated as the rolling arithmetic average of data measured by a continuous emission monitoring system (CEMS).

Since relative accuracy and system bias testing was conducted in August 2023, the data recorded by the DYEC CEMS was used to assess against the in-stack emissions limits detailed in Schedule C of the ECA for hydrochloric acid, sulphur dioxide, nitrogen oxides and carbon monoxide. Note the DYEC CEMS data for the days when isokinetic testing was performed at each unit (March 18 to March 21, 2024) was used to determine the minimum, average and maximum concentrations of the combustion gases listed in the ECA. Concentration data measured by ORTECH on March 19, 2024 was used to assess against the total hydrocarbons (organic matter) in-stack emissions limit detailed in Schedule C of the ECA.

Consistent with the approach commonly required by the MECP for compliance emission testing programs, the following results are conservative in the sense that when the analytical result is reported to be below the detection limit, the full detection limit is used to calculate emission data and is shown by a "<" symbol. Also, when one or both Boiler results are reported to be below the detection limit, the detection limit was used to conservatively estimate the total emission rate for the Main Stack.

The MECP "Summary of Standards and Guidelines to Support Ontario Regulation 419/05 – Air Pollution – Local Air Quality", dated April 2012, provides an updated framework for calculating dioxin and furan toxicity equivalent concentrations which includes emission data for 12 dioxin-like PCBs. This document was replaced by "Air Contaminants Benchmarks List: standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants", however the dioxin and furan toxicity equivalent calculation methodology remains the same. The dioxins, furans and dioxin-like PCBs toxicity equivalent emission data was also calculated using half the detection limit for those compounds not detected. The half detection limit data was used to assess against the dispersion modelling Point of Impingement limit. The toxicity equivalent concentrations calculated using the full detection limit, for those compounds less than the reportable detection limit, were used to assess against the in-stack limit detailed in Schedule C of the ECA.

The average results for the tests conducted at Boiler No. 1, along with the respective in-stack emission limits, are summarized in the following table:

Parameter	Test No. 1	Test No. 2	Test No. 3	Average	In-Stack Limit
Total Power Output (MWh/day)*	-	-	-	388	-
Average Combustion Zone Temp. (□C)*	-	-	-	1222	-
Steam (tonnes/day)*	-	-	-	794	-
MSW Combusted (tonnes/day)*	-	-	-	223	-
NO_X Reagent Injection Rate (liters/day)*	-	-	-	1362	-
Carbon Injection (kg/day)*	-	-	-	128	-
Lime Injection (kg/day)*	-	-	-	3550	-
Filterable Particulate (mg/Rm^3) (1)	1.58	0.84	1.52	1.31	9
PM_{10} with Condensable (mg/Rm^3) (1)	6.06	<6.26	<6.30	<6.21	-
$PM_{2.5}$ with Condensable (mg/Rm^3) (1)	5.99	<5.98	<6.10	<6.02	-
Hydrogen Fluoride (mg/Rm^3) (1)	<0.090	<0.089	<0.10	<0.093	-
Ammonia (mg/Rm^3) (1)	0.47	0.69	0.58	0.58	-
Cadmium (µg/Rm^3) (1)	0.088	0.16	<0.019	<0.090	7
Lead (µg/Rm^3) (1)	0.51	0.26	0.15	0.31	50
Mercury (µg/Rm^3) (1)	<0.098	0.067	0.32	<0.16	15
Antimony (µg/Rm^3) (1)	0.069	<0.044	<0.039	<0.051	-
Arsenic (µg/Rm^3) (1)	<0.044	<0.044	<0.039	<0.042	-
Barium (µg/Rm^3) (1)	10.6	10.5	9.33	10.1	-
Beryllium (µg/Rm^3) (1)	<0.044	<0.044	<0.039	<0.042	-
Chromium (µg/Rm^3) (1)	0.96	1.03	0.70	0.90	-
Cobalt (µg/Rm^3) (1)	0.032	<0.044	<0.039	<0.038	-
Copper (µg/Rm^3) (1)	2.72	1.64	1.19	1.85	-
Molybdenum (µg/Rm^3) (1)	4.01	4.25	3.39	3.88	-
Nickel (µg/Rm^3) (1)	0.68	0.77	0.44	0.63	-
Selenium (µg/Rm^3) (1)	<0.22	<0.22	<0.19	<0.21	-
Silver (µg/Rm^3) (1)	<0.044	<0.044	<0.039	<0.042	-
Thallium (µg/Rm^3) (1)	<0.044	<0.044	<0.039	<0.042	-
Vanadium (µg/Rm^3) (1)	<0.022	<0.022	<0.019	<0.021	-
Zinc (µg/Rm^3) (1)	14.3	10.3	8.26	11.0	-
Dioxins and Furans (pg TEQ/Rm^3) (3)	<1.97	<3.06	<1.88	<2.30	60
Total Chlorobenzenes (ng/Rm^3) (1)	<113	<99.6	<127	<113	-
Total Chlorophenols (ng/Rm^3) (5)	<521	<1828	NQ	<1163	-
Total PAHs (ng/Rm^3) (1)	<222	<399	<343	<321	-
VOCs (µg/Rm^3) (1)	<117	<62.4	<73.4	<84.3	-
Aldehydes (µg/Rm^3) (1)	<82.1	<15.5	<52.3	<50.0	-
Total VOCs (µg/Rm^3) (1) (4)	<199	<77.9	<126	<134	-
Quench Inlet Organic Matter (THC) (ppm, dry) (2)	0.1	0.1	0	0.1	50

* based on process data provided by Covanta

(1) dry at 25□C and 1 atmosphere, adjusted to 11% oxygen by volume.

(2) dry basis as equivalent methane (average of each 60 minute test with data recorded in 1-minute intervals).

(3) calculated using the NATO/CCMS (1989) toxicity equivalence factors and the full detection limit for those isomers below the analytical detection limit, dry at 25□C and 1 atmosphere, adjusted to 11% oxygen by volume.

(4) Includes all components from the volatile organic compounds test list in the ECA (i.e. Volatile Organic Sampling Train and Aldehyde Sampling train components).

(5) Total chlorophenols were not quantifiable (NQ) due to spike recovery loses during the extraction of the samples by the analytical laboratory.

The average results for the tests conducted at Boiler No. 2, along with the respective in-stack emission limits, are summarized in the following table:

Parameter	Test No. 1	Test No. 2	Test No. 3	Average	In-Stack Limit
Total Power Output (MWh/day)*	-	-	-	388	-
Average Combustion Zone Temp. (□C)*	-	-	-	1280	-
Steam (tonnes/day)*	-	-	-	800	-
MSW Combusted (tonnes/day)*	-	-	-	218	-
NO_X Reagent Injection Rate (liters/day)*	-	-	-	522	-
Carbon Injection (kg/day)*	-	-	-	124	-
Lime Injection (kg/day)*	-	-	-	3539	-
Filterable Particulate (mg/Rm^3) (1)	1.73	1.44	1.28	1.48	9
PM_{10} with Condensable (mg/Rm^3) (1)	<5.39	<6.55	<5.19	<5.71	-
$PM_{2.5}$ with Condensable (mg/Rm^3) (1)	<4.98	<6.48	<5.00	<5.49	-
Hydrogen Fluoride (mg/Rm^3) (1)	<0.11	<0.098	<0.097	<0.10	-
Ammonia (mg/Rm^3) (1)	0.37	0.30	0.28	0.32	-
Cadmium (µg/Rm^3) (1)	0.014	0.055	0.10	0.057	7
Lead (µg/Rm^3) (1)	0.22	0.21	0.33	0.26	50
Mercury (µg/Rm^3) (1)	0.44	1.21	<0.089	<0.58	15
Antimony (µg/Rm^3) (1)	<0.044	<0.046	<0.045	<0.045	-
Arsenic (µg/Rm^3) (1)	<0.044	<0.046	<0.045	<0.045	-
Barium (µg/Rm^3) (1)	10.6	11.1	11.6	11.1	-
Beryllium (µg/Rm^3) (1)	<0.044	<0.046	<0.045	<0.045	-
Chromium (µg/Rm^3) (1)	0.90	0.88	0.95	0.91	-
Cobalt (µg/Rm^3) (1)	0.042	<0.023	<0.023	<0.029	-
Copper (µg/Rm^3) (1)	1.34	1.51	1.13	1.33	-
Molybdenum (µg/Rm^3) (1)	4.04	4.20	4.09	4.11	-
Nickel (µg/Rm^3) (1)	0.50	0.59	0.58	0.56	-
Selenium (µg/Rm^3) (1)	<0.22	<0.23	<0.23	<0.23	-
Silver (µg/Rm^3) (1)	<0.044	<0.046	<0.045	<0.045	-
Thallium (µg/Rm^3) (1)	<0.044	<0.046	<0.045	<0.045	-
Vanadium (µg/Rm^3) (1)	<0.022	<0.023	<0.023	<0.023	-
Zinc (µg/Rm^3) (1)	9.95	10.9	10.1	10.3	-
Dioxins and Furans (pg TEQ/Rm^3) (3)	<1.81	<2.00	<1.83	<1.88	60
Total Chlorobenzenes (ng/Rm^3) (1)	<156	<59.3	<152	<122	-
Total Chlorophenols (ng/Rm^3) (5)	NQ	NQ	<1471	<1380	-
Total PAHs (ng/Rm^3) (1)	<142	<315	<167	<208	-
VOCs (µg/Rm^3) (1)	<338	<279	<227	<281	-
Aldehydes (µg/Rm^3) (1)	<211	<188	<199	<199	-
Total VOCs (µg/Rm^3) (1) (4)	<549	<467	<426	<480	-
Quench Inlet Organic Matter (THC) (ppm, dry) (2)	0.6	0.1	0	0.2	50

* based on process data provided by Covanta

(1) dry at 25□C and 1 atmosphere, adjusted to 11% oxygen by volume.

(2) dry basis as equivalent methane (average of each 60 minute test with data recorded in 1-minute intervals).

(3) calculated using the NATO/CCMS (1989) toxicity equivalence factors and the full detection limit for those isomers below the analytical detection limit, dry at 25□C and 1 atmosphere, adjusted to 11% oxygen by volume.

(4) Includes all components from the volatile organic compounds test list in the ECA (i.e. Volatile Organic Sampling Train and Aldehyde Sampling train components).

(5) Total chlorophenols were not quantifiable (NQ) due to spike recovery loses during the extraction of the samples by the analytical laboratory.

A summary of the minimum, average and maximum concentrations for the combustion gases measured by the DYEC CEMS with in-stack limits listed in the ECA is provided below for the two units.

Boiler No.	Parameter	Minimum	Average	Maximum	In-Stack Limit
Boiler No. 1	Carbon Monoxide (mg/Rm^3) (1)	4.0	6.1	9.5	40
	Hydrogen Chloride (mg/Rm^3) (2)	0.2	0.3	0.5	9
	Nitrogen Oxides (mg/Rm^3) (2)	110	111	113	121
	Sulphur Dioxide (mg/Rm^3) (2)	0	0.2	1.8	35
Boiler No. 2	Carbon Monoxide (mg/Rm^3) (1)	5.5	8.0	12.4	40
	Hydrogen Chloride (mg/Rm^3) (2)	2.1	2.2	2.4	9
	Nitrogen Oxides (mg/Rm^3) (2)	106	108	109	121
	Sulphur Dioxide (mg/Rm^3) (2)	0	0.39	2.4	35

(1) 4-hour average measured by DYEC CEMS, dry at 25□C and 1 atmosphere adjusted to 11% oxygen by volume
(2) 24-hour average measured by DYEC CEMS, dry at 25□C and 1 atmosphere adjusted to 11% oxygen by volume

The emission data measured at each Boiler BH Outlet during the testing program was combined and used to assess the emissions from the Main Stack against the current point of impingement criteria detailed in Ontario Regulation 419/05.

Dispersion modelling was completed using the CALPUFF model (using Version 7.2.1 level 150618 as approved by the MECP in May 2021) by WSP Canada Inc. A summary of the results are provided in the tables appended to this report (Appendix 27) based on calculated ground level Point of Impingement (POI) concentrations for the average total Main Stack emissions. As shown in the tables, the calculated impingement concentrations for all the contaminants were well below the relevant MECP standards.

In summary, the key results of the emission testing program are:

- The facility was maintained within the operational parameters defined by the amended ECA that constitutes normal operation during the stack test periods. Testing was conducted at a steam production rate of greater than 766 tonnes of steam per day for each Boiler (approximately 94.9% of maximum continuous rating). The maximum continuous rating for the facility is 1614.7 tonnes of steam per day for the two Boilers combined (33.64 tonnes of steam per hour or 807.4 tonnes per day for each Boiler).
- The in-stack concentrations of the components listed in the ECA were all below the concentration limits provided in Schedule C of the ECA.
- Using CALPUFF dispersion modelling techniques, the predicted maximum point of impingement concentrations, based on the average test results for both boilers, show DYEC to be operating well below all current standards in Regulation 419/05 under the Ontario Environmental Protection Act and other MECP criteria including guidelines and upper risk thresholds.

Tables referenced in this report for the tests conducted at Boiler No. 1 and Boiler No. 2 are provided in Appendix 1 and Appendix 2, respectively.

OVERSIGHT OF AIR EMISSIONS SOURCE TESTING AT THE DURHAM YORK ENERGY CENTRE (SPRING 2024)

August 15, 2024

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The conclusions in the Report titled Oversight of Air Emissions Source Testing at the Durham York Energy Centre (Spring 2024) are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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Acronyms / Abbreviations

ADMP	Air Dispersion Modelling Plan
Adomait	Adomait Environmental Services
CARB	California Air Resources Board
CB	chlorobenzenes
CEM	Continuous Emissions Monitoring
CO	carbon monoxide
CP	chlorophenols
D/F	dioxins and furans
DYEC	Durham York Energy Centre
ECA	Environmental Compliance Approval
LCS	laboratory control sample
MECP	Ministry of the Environment, Conservation and Parks
MSW	municipal solid waste
NOx	nitrogen oxides
O_2	molecular oxygen
O. Reg. 419/05	Ontario Regulation 419/05
ORTECH	ORTECH Consulting Inc.
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
POI	Point of Impingement
QA/QC	Quality Assurance/Quality Control
Region	Regional Municipality of Durham
SO_2	sulphur dioxide
Stantec	Stantec Consulting Ltd.
SVOCs	semi-volatile organic compounds
TEQ	Toxic Equivalents
THC	Total Hydrocarbons
US EPA	United States Environmental Protection Agency

List of Symbols and Units of Measure

dscm/h	dry standard cubic metre per hour
g/s	gram per second
hr	hour
kg/hr	kilogram per hour
m^3/hour	cubic metre per hour
min	minutes
mg/m^3	milligram per cubic metre
ppm	parts per million
tonnes/hr	tonnes per hour
µg/s	microgram per second
ng/s	nanogram per second
ng TEQ/s	nanogram of toxic equivalents per second
pg TEQ/Rm^3	picogram of toxic equivalents per reference cubic metre
°F	degrees Fahrenheit
°C	degrees Celsius
%	percent

1 Introduction

The Durham York Energy Centre (DYEC) is a thermal treatment facility with a maximum thermal treatment rate of 140,000 tonnes/year of municipal solid waste (MSW). The facility was built to operate 24 hours/day, seven days/weeks, 365 days/year. MSW may be delivered to the facility six days per week between 7:00 am to 7:00 pm.

The facility performs annual source testing as required per the facility's Amended Environmental Compliance Approval (ECA) (No. 7306-8FDKNX). Section 7(1) of the ECA states that "the owner shall perform annual source testing, in accordance with the procedures and schedule outlined in the attached Schedule E, to determine the rates of emissions of the test contaminants from the stack".

Stantec Consulting Ltd. (Stantec) was retained by The Regional Municipality of Durham (the Region) to provide oversight services of the air emission source testing campaign conducted at the DYEC between March 18 and March 21, 2024 by ORTECH Consulting Inc. (ORTECH).

2 On-Site Source Testing Observations

Stantec sub-contracted the on-site auditing of the testing to Adomait Environmental Solutions Inc. (Adomait). Adomait staff, led by Martin Adomait, M.Sc., P.Eng., were on on-site March 20th and 21st to observe the sampling for semi-volatile organic compounds (SVOCs), including dioxins and furans (D/F). The on-site review of the Stack Sampling Protocol was conducted to check that the testing follows sampling methods described in the Ontario Source Testing Code, and includes a review of:

1. On-site observations of testing,
2. Sampling locations,
3. Sampling procedures,
4. Sample recovery and analysis, and
5. Process parameter review.

The following sections were provided to the Region in a memorandum dated April 5th, 2024. They are replicated here for completeness and to provide the Region with a single document summarizing the entirety of the peer review.

2.1 Observations of Process Operations Centre

The auditor was stationed in a conference room equipped with a screen to display real-time and recent data related to parameters being monitored. Occasional visits to the control room also took place when necessary. In addition, Excel files containing one-minute data were provided to the auditor daily. The one-minute data summarized the various system parameters for Boiler 1 and Boiler 2 lines discussed below,

except for the quench-tower inlet/outlet temperatures and moisture levels. The inlet/outlet temperatures were provided separately, while moisture data could only be accessed directly from the system monitors in the control room.

The dioxin and furan emission sampling process and the incineration operations were generally stable throughout. Two dioxin/furan sampling runs were completed on March 20th at both boilers without issues. A third sampling run on Boiler 1 on March 21st was also completed without issues. Half-way through the third sampling event on Boiler 2 on March 21st, after the completion of the first traverse, the dioxin/furan sampling train failed its leak check. A leak check was completed on each sampling train prior to and after each sampling run to ensure that no leakage of outside air into the sample air flow affects the integrity of the sample. The leak test failure required the ORTECH personnel to abandon the test, reassemble the sampling equipment with new glassware and repeat the procedure. A second issue developed during the repeat test as steam production on Boiler 2 started to decline. After approximately 20 minutes of prolonged low steam levels, the sampling was halted at 11:52 AM. Feedstock with a high moisture content was suspected to be the cause of the declining steam production. Sampling resumed at 12:08 PM when steam production achieved approximately 90% of the target (33.6 thousand kilograms per hour (kg/h)).

Table 1: Summary of System Monitoring Parameters (March 20 – 21, 8:00 AM to 6:00 PM)

	Oxygen (%)	**CO (mg/m^3)**	**NO_x (mg/m^3)**	**SO_2 (mg/m^3)**	**Moisture (%)**	**Combustion Temp (°C)**	**Steam Production (10^3 kg/hr)**
	1 min average	**4-hr average**	**1 min range (24-hr average)**	**1 min range (24-hr average)**	**1 min range (average)**	**1 min range**	**1 min range (average)**
Boiler 1 March 20 (Test 1 & 2)	6.3 – 9.7	6 – 10	40.3 – 153.5 (102.1)	0 – 2.7 (0.0)	-5.0 – 26.0 (17.7)	989 – 1,154	30.1 – 35.5 (33.3)
Boiler 1 March 21 (Test 3)	6.9 – 10.4	5 – 7	28.9 – 158.4 (102.2)	0 – 251 (3.9)	0.7 – 26.0 (16.4)	996 – 1,176	28.4 – 35.0 (32.8)
Boiler 2 March 20 (Test 1 & 2)	6.3 – 10.1	6 – 11	55.7 – 161.9 (99.0)	0 – 0 (0.0)	-4.8 – 26.5 (17.7)	1,039 – 1,222	27.4 – 34.6 (34.6)
Boiler 2 March 21 (Test 3)	6.6 – 12.0	7 – 21	66.3 – 153.8 (103.3)	0 – 8.0 (0.1)	-0.6 – 31.1 (21.1)	1,024 – 1,234	28.2 – 34.9 (32.5)
Criteria	>6.0	40 (4 hr)	121 (24 hr)	35 (24 hr)	-	1,000	33.6

The auditing process involved monitoring the real-time display of trending data, taking note of anomalies and discussing the deviations, and any corrective measures taken, with facility staff. After the monitoring periods, the recorded data in Excel files was further reviewed. Various monitoring parameters in the Excel files were more closely examined, eliminating data that may have been influenced by calibration or purging events that took place during this time. These parameters are summarized in **Table 1**. The parameters included oxygen (O_2) one-minute average, carbon monoxide (CO) 4-hour rolling average,

nitrogen oxides (NOx) 24-hour rolling average (for the portion of day that data was collected), sulphur dioxide (SO_2) 24-hour rolling average, moisture content, combustion temperatures, and steam production. **Table 1** also provides the criteria for these parameters, as provided in the facility's Environmental Compliance Approval (ECA).

The following conclusions of the Process Operations Centre observations and review of the monitoring parameters were made for the stack testing period.

1. Oxygen concentrations, ranged from 6.3% to 10.4% at Boiler 1, and 6.3% to 12.0% at Boiler 2 on March 20 and 21, 2024. The ECA specifies that the oxygen concentration shall not be less than 6% as recorded by the continuous emission monitoring system. The operation complied with this requirement during the testing period.

2. Carbon monoxide (CO) concentrations at Boiler 1 were generally stable throughout the tests, ranging between 0.0 and 46.8 milligram per cubic metre (mg/m^3). The calculated 4-hour average ranged from 5 to 10 mg/m^3. CO concentrations at Boiler 2 were also generally stable throughout the tests, ranging between 0.0 and 134 mg/m^3. The calculated 4-hour average ranged from 6 to 21 mg/m^3. Occasional spikes in CO concentration were likely due to cold CO spikes that may be attributed to incomplete combustion. The spikes were less than 1 minute in duration and similar to observations in previous stack testing regimes. The occurrence of CO spikes is common, and the quick suppression of spikes indicates that the systems are operating effectively. The 4-hour averages of CO were less than the in-stack emission limit of 40 mg/m^3.

3. The average NOx concentrations over two days during testing ranged between 40 and 158 mg/m^3, averaging 102 mg/m^3 at Boiler 1 over the testing period. The average NOx concentrations over two days during testing at Boiler 2 ranged between 56 and 161 mg/m^3, averaging between 99 and 103 mg/m^3 over the testing period. Both units, if operated in a similar manner, outside of the monitoring period would have been below the in-stack emission limit of 121 mg/m^3, calculated as a 24-hour rolling arithmetic average.

4. The SO_2 concentrations were stable throughout the monitoring period with 1-min values between 0.0 and 0.1 mg/m^3 for both units, with one anomalous short-term trend on Boiler 1 that lasted a few minutes. This pattern was generally consistent given the constant lime injection of 135 – 150 kg/h for Boiler 1 on March 20th. Lime feed rates at Boiler 2 were consistent at 135 – 166 kg/h for March 20th and 21st. There was one anomaly on March 21st at Boiler 1 between 3:57 PM to 4:18 PM. During this time, the SO_2 concentrations rose to a level 251 mg/m^3. The lime injection rate correspondingly increased to a high of 300 kg/h. After this short period, the SO_2 concentrations declined as did the lime injection rate (~145 kg/h). The system responded effectively to SO_2 spikes by increasing the lime injection rate. Both units, if operated in a similar manner, outside of the monitoring period would have been below the in-stack emission limit of 35 mg/m^3 calculated as a 24-hour rolling arithmetic average.

5. The moisture content in the stack was determined via a mathematical relationship utilizing continuous monitoring and the dry and wet oxygen readings. The range and average moisture content from both Boiler 1 and Boiler 2 process lines are summarized in **Table 1**. The range from both lines can report erroneous negative or low moisture levels (e.g. -5% or 0.7%). This can be a typical artifact of an unstable wet oxygen analyzer. The negative or low levels, however, appeared infrequently and were isolated. Since the discrepancies were isolated, these values do

not greatly affect the average moisture levels. The moisture levels were generally consistent for Boiler 1, but Boiler 2 showed increased moisture levels for the sampling run on March 21st.

6. The combustion zone temperatures for each boiler were, for the most part, maintained above the minimum temperature of 1,000°C. As shown in the table above, Boiler 1 did deviate below 1,000°C; however, the lower number was recorded for only a single one-minute reading. At the following minute reading, the combustion temperature was again greater than 1,000°C. The deviation was so small that it would not lead to any significant impacts. The combustion temperatures at Boiler 2 were above 1,000°C at all times during the sampling program.

7. The quench tower inlet and outlet temperatures showed consistent control, reducing inlet temperatures by 9.4 to 14.4°C (17 to 26°F) on average on both monitoring days during sample collection. The inlet temperatures have been known to increase gradually each day, but on this occasion, there was practically no change. The outlet temperatures generally remained consistent at ~66.7°C (~152°F). As a result of consistent outlet temperatures from the quench towers, Boiler 1 baghouse inlet temperatures remained steady between 134°C and 143°C (273.2 and 289.4°F). Similarly, Boiler 2 temperatures were recorded from 136 to 144°C (276.8 to 291.2°F). Both baghouse temperatures were near the midpoint of the performance requirement of 120°C to 185°C set out in the ECA (Section 6(2)(h)). Good temperature control is important to limit the volatilization of various dioxins and furans that may be particle-bound in the baghouse.

8. The real-time display of carbon dosing for Boiler 1 indicated small periods of erratic fluctuations. However, the average feed rate remained stable at 5.33 and 5.32 kg/h for the two monitoring days. Similarly, average carbon dosage at Boiler 2 had rates of 5.17 and 5.17 kg/h for the same two days.

9. Production at the plant is often evaluated in terms of steam flow. The target was 33.6 thousand kg/h. Steam flow for Boiler 1 averaged 33.3 and 32.8 thousand kg/h for March 20th and 21st, respectively. Steam flow for Boiler 2 averaged 34.6 and 32.5 thousand kg/h for March 20th and 21st, respectively, with the exception as cited above on the 21st. All averages were within 90% of the target. The range of the nominal total steam generation is within the 72 tonnes per hour of steam production rate listed in the ECA. The production was similar to levels observed during previous stack testing campaigns at this facility.

10. Airflow remained stable throughout the stack tests. Airflow for Boiler 1 generally ranged between 75,510 to 75,940 dry standard cubic metre per hour (dscm/h), and Boiler 2 ranged between 70,090 to 72,550 dscm/h.

2.2 Observations of the Stack Testing Operations

Observations of the stack testing procedures were undertaken during the SVOC sampling part of the program. The field observations are provided in a series of tables in Appendix A.

1. Where possible, leak checks were observed at both the start, traverse change, and at the conclusion of all SVOC tests conducted. When the leak checks were successful, the tests could be regarded as valid. Leak checks were always performed in a systematic and non-rushed manner to ensure good Quality Assurance/Quality Control (QA/QC). The summary of Adomait field observations is provided in Appendix A.

2. Previous aberrations in the stack velocity measurements were reduced by using metal plates and rubber sealer plates to eliminate these problems. This set-up was similar to previous stack testing regimes.

3. Impinger/adsorbent temperatures were checked repeatedly at each sampling train. ORTECH supplied plenty of ice to the crews. The temperatures were maintained in the range of 5.0°C to 13.9°C (41°F to 57°F). Maintaining low adsorbent temperatures improves adsorption of dioxins/furans on the sampling media. The temperatures were maintained at reasonably low levels and were deemed acceptable.

4. The audit team also recorded dry gas meter corrections and pitot factors for comparison with the final report.

5. All trains operating at the baghouse outlet locations were inserted and withdrawn from the stack while the sampling train was running. Given the high negative pressure at these locations, it was important to ensure that the filter was not displaced prior to commencement of sampling. It also limits loss of any sample from the train.

6. No review of the sample recovery procedures conducted by ORTECH staff were performed.

Based on audit staff observations, ORTECH staff followed all appropriate sampling and recovery procedures as noted by the sampling methods (EPS 1/RM/2 and US EPA Method 23).

3 Report Review

ORTECH's draft source sampling report (the "Report") was provided to Stantec on May 27th, 2024. Stantec and Adomait conducted a review of the Report, with focus given to a detailed review of all SVOC-related sections.

3.1 Review of Source Testing Protocols

Adomait has conducted a thorough review of the source testing report as it relates to the dioxins and furans and has found no discrepancies between the methods described in the report compared to the observations made during testing. A further review of the dioxin/furan emission results at Boiler 1 compared to that of Boiler 2 was also undertaken. A comparison of the speciated dioxins and furans concentrations showed similar characteristics between the two boilers with minor exceptions (see **Table 2**). This is inline with expectations given that both boilers are processing a similar waste stream, and both boilers used similar combustion practices. Furthermore, the concentrations and patterns of the dioxins and furans suggested a consistent pattern when compared to the historical testing record from 2017 to 2024, except for the tests conducted during the period of 2020-2021. A plugged baghouse in 2020 posed problems for Boiler 1 in 2020. Given the consistency of the results between boilers, and the historical record, it was concluded that the boilers are operating as intended. Furthermore, given the consistency of the results with the historical record, Adomait was satisfied that all sampling/analytical protocols were followed according to appropriate methodologies. Consequently, Adomait has no concerns over the validity of collected samples, and the dioxin and furan results.

Table 2: Summary of Historical the Dioxin and Furan Concentrations (pg TEQ/Rm^3)

		Test 1	Test 2	Test 3	Average	Difference
2017a	Boiler 1	<6.89	<6.44	<7.79	<7.04	1.77
	Boiler 2	<5.19	<4.88	<5.72	<5.27	
2017b	Boiler 1	<5.87	<7.15	<5.70	<6.24	-3.54
	Boiler 2	<10.3	<9.16	<9.93	<9.78	
2018	Boiler 1	<5.52	<4.70	<4.81	<5.01	1.79
	Boiler 2	<3.28	<3.46	<2.93	<3.22	
2019	Boiler 1	<1.52	<1.33	<1.77	<1.54	-1.62
	Boiler 2	<3.80	<3.73	<1.94	<3.16	
2020a	Boiler 1	<1.82	<1.67	<2.04	<1.84	-0.67
	Boiler 2	<2.23	<3.10	<2.19	<2.51	
2020b	Boiler 1	<31.1	<30.9	<24.4	<28.8	21.69
	Boiler 2	<6.82	<7.94	<6.56	<7.11	
2021a	Boiler 1	<3.84	<5.13	<3.40	<4.12	-3.38
	Boiler 2	<6.82	<8.45	<7.22	<7.50	
2021b	Boiler 1	<13.0	<18.0	<12.8	<14.6	12.08
	Boiler 2	<2.22	<3.21	<2.13	<2.52	
2022a	Boiler 1	<8.88	<9.42	<5.82	<8.04	3.89
	Boiler 2	<4.09	<3.95	<4.42	<4.15	
2022b	Boiler 1	<4.03	<3.82	<3.40	<3.75	-0.55
	Boiler 2	<2.19	<8.70	<2.01	<4.30	
2023a	Boiler 1	<2.90	<4.79	<14.0	<7.23	-1.96
	Boiler 2	<8.91	<8.75	<9.90	<9.19	
2023b	Boiler 1	<10.9	<11.7	<9.53	<10.7	6.53
	Boiler 2	<3.18	<2.37	<6.96	<4.17	
2024a	Boiler 1	<2.04	<2.88	<1.99	<2.30	0.46
	Boiler 2	<1.82	<1.87	<1.83	<1.84	

Notes: All data was calculated using WHO toxicity equivalence factors and full detection limit for those isomers below the analytical detection limit, dry at 25°C, and 1 atmosphere, adjusted to 11% oxygen. Test 2017a was conducted early in 2017, while 2017b was completed later in the year. The same applies for all other years. Reference ORTECH Tables 46 for Boilers 1 and 2, respectively.

3.2 Review of Analytical Reporting

Stantec has conducted a thorough review of the source testing report. While the source testing report was reviewed in its entirety, focus was given to a detailed review of all SVOC-related sections. As per the contract with the Region, the project did not include the oversight and audit review of actual laboratory work. Therefore, no statement of efficacy is provided regarding the processing, handling, and analysis of laboratory samples.

Based on this review, Stantec provides the following comments:

1. Dioxins and Furans

    a. The recoveries of Field Spike Standards of all D/F samples were within the acceptable range of recoveries provided in Environment Canada Reference Method EPS 1/RM/2 (EPS 1/RM/2) (70% – 130%), for all but one sample (TEST #3 APC OUTLET #1).

    b. The recoveries of Extraction Standards for all D/F samples are within the acceptable range of recoveries provided in EPS 1/RM/2, which is either 40% – 130% or 25 – 130%, depending on the specific D/F.

    c. The recoveries of Cleanup Standards of all D/F samples were within the acceptable range of recoveries provided in EPS 1/RM/2 (40% – 130%).

    d. Stantec was able to trace and confirm the D/F congener group emission rate calculations presented by ORTECH provided in Section 7.9.1 (Page 45).

    e. Stantec was able to trace and confirm the D/F and dioxin-like PCB toxic equivalents (TEQ's) emission rate calculations (ng TEQ/s) presented by ORTECH provided in Section 7.9.1 (Page 46).

    f. Stantec was able to trace and confirm the in-stack TEQ concentration calculations presented by ORTECH (see Section 7.9.1, Page 47) and confirm that the D/F TEQ concentrations are below the maximum in-stack limit of 60 pgTEQ/Rm^3.

2. PCBs

    a. The recoveries of the Extraction Standards for PCBs are within the acceptable range of recoveries provided in US EPA Method 1668C (10% – 145%).

    b. The recoveries of Field Spike Standards of all PCB samples were within the acceptable range of recoveries provided in US EPA Method 1668C (70% – 130%).

    c. The recoveries of Cleanup Standards of all PCB samples were within the acceptable range of recoveries provided in US EPA Method 1668C (5% – 145%, or 10% – 145%).

    d. PCB samples were not blank corrected based on the blank sampling train and laboratory blank results. This is an acceptable methodology and will provide an over-estimate of the true concentrations within the samples.

3. Chlorobenzenes

    a. The analytical reports indicate that the recoveries of select labelled extraction standards were below the method control limit. However, no significant bias to the sample results is expected given that the target analyte recoveries are all in control for the laboratory control sample (LCS). This is a valid assumption; therefore, the poor recoveries of labelled standards in these samples will not impact the conclusions of the report.

    b. Chlorobenzene samples were not blank corrected based on the blank sampling train and laboratory blank results. This is an acceptable methodology and will provide an over-estimate of the true concentrations within the samples.

c. Stantec was able to trace and confirm the chlorobenzene emission rate calculations (µg/s) presented by ORTECH provided in Section 7.9.2 (Page 48).

4. Chlorophenols

a. All CP samples experienced low Extraction Standard recoveries (i.e., outside the accepted window of 50 – 150%) for at least one standard, which indicates a potential low bias on the samples. As per previous testing campaigns, CP sample concentrations were not corrected for this low bias. Furthermore, most CP sample concentrations were found to be below the detection limit. Therefore, as has been noted before, correction for this bias would not have been statistically meaningful. While the reduced recoveries may result in increased error in the determined concentrations, there is currently no concern that the error may lead to values over and above relevant ambient air quality standards.

b. The Report notes (page 35) that "chlorophenol detection limits reported are significantly higher than the detection limits typically reported by the analytical laboratory (<1000 ng vs <60 ng)." However, the modelling results indicated that all CP values are well below the corresponding standards. Consequently, there is no concern that CP POI values may be over and above relevant ambient air quality standards.

c. Stantec was able to trace and confirm the chlorophenol emission rate calculations (µg/s) presented by ORTECH provided in Section 7.9.2 (Page 48).

5. Polycyclic Aromatic Hydrocarbons

a. The recoveries of Field Sampling Standards for PAHs are within the acceptable range of recoveries provided in CARB Method 429 (50% – 150%).

b. The recoveries of the Extraction Standards for multiple PAHs were outside the acceptable range of recoveries provided in CARB Method 429, which is 50% – 150%. In all cases the recoveries were biased low, which indicates a potential low bias on the sample results. PAH sample concentrations were not corrected for this low bias. This may result in an underestimation of facility emission rates for PAHs. However, the target analyte recoveries are all in control for the LCS. Therefore, as discussed above, no significant bias to the sample results is expected. Furthermore, based on modelling results all PAH values are well below the corresponding standards. Therefore, a correction factor for the decreased recoveries would still indicate PAH levels well below the standard. Consequently, there is currently no concern that the error may lead to values that would have approached or exceeded the relevant in-stack or ambient standards.

c. PAH samples were not blank corrected based on the blank sampling train and laboratory blank results. This is an acceptable methodology and will provide an estimate of worst-case concentrations within the samples.

d. Stantec was able to trace and confirm the PAH emission rate calculations (µg/s) presented by ORTECH provided in Section 7.9.3 (Page 49).

3.3 Review of Dispersion Modelling

Appendix 27 of the Report presents the results of dispersion modelling based on results of the source testing program. The dispersion modelling provided in the appendix was completed by WSP, who provided Stantec with all relevant modelling files (e.g., input files, output files, etc.) for review.

Based on this review, Stantec provides the following comments:

1. Stantec confirmed that the CALPUFF and CALPOST version numbers and level numbers used in the model (as indicated in the corresponding input file) matched those provided in WSP's memorandum.
2. Stantec reviewed the CALPUFF options outlined in Table 2 of WSP's memorandum. These options match those in the supplied input files for modelling years 2014, 2017, and 2018. Note that the model was run for meteorological years 2014 to 2018.
3. Stantec reviewed the source parameters provided in Table 3 of WSP's memorandum and confirmed that the parameters match those determined from the source testing. These source parameters also match those in the supplied input files for modelling years 2014, 2017, and 2018. For the 2014 modelled year, the CALPUFF input file had an Exit Velocity of 23.43 m/s, which is 0.35 m/s lower than the value listed in Appendix 27, and an Exit Temperature of 415.96 K, which is 4.46 K higher than the value listed in Appendix 27. WSP reviewed their modelling and have confirmed that the files were run with the correct velocity and temperature. However, when providing files to the Region, the 2014 model files representative of 2023 source testing data were transferred by mistake.
4. Stantec reviewed the Dispersion Factors (without meteorological anomaly removed) provided in Table 4 of WSP's memorandum to confirm that they matched the maximum value provided in the CALPOST output files for all five years modelled. The values provided in the report equalled those in the output files. Minor discrepancies are expected to be the result of number rounding.

Averaging Period	10-min	½-hr	1-hr	24-hr	30-day	Annual
WSP Dispersion Factor before meteorological anomaly removal [µg/m³ per g/s]	45.73	33.26	27.72	1.23	0.17	0.06
Output File Dispersion Factor without meteorological anomaly removal [µg/m³ per g/s]	45.78	33.65	27.72	1.23	0.17	0.06

5. Stantec reviewed the Site-Wide Emission Inventory provided in Appendix A of WSP's memorandum. The following SVOCs were reviewed, and emission rates were found to match those calculated in ORTECH's report, which also equalled those calculated by Stantec.
    a. Dioxins, Furans and Dioxin-like PCBs
    b. Monochlorobenzene
    c. Pentachlorophenol
    d. Benzo(a)Pyrene
6. Stantec reviewed key SVOCs from the Emission Summary Table (Appendix B of WSP's memorandum) to ensure that emission rates were estimated appropriately from the Dispersion Factors shown in Table 4. The list of substances reviewed were:
    a. Benzo(a)pyrene

b. Monochlorobenzene
c. Dioxins, Furans, and Dioxin-like PCBs

Based on the above review, there are no concerns with the conduct of the modelling. POI values presented in Appendix 27 of the Report provide a conservative estimate of potential impacts and are well below MECP criteria.

4 Conclusions

Based on a review of the Source Testing Report, and the on-site observations, there are no concerns about the validity of the source testing data reported by ORTECH. Stantec is satisfied that the conduct of the source testing, the analytical analysis, and the analytical calculations were carried out in a professional manner and followed all relevant guidelines, protocols, and best practices.

Based on a review of the CALPUFF Modelling (Appendix 27), Stantec is satisfied that the modelling was completed in accordance with the facility's ECA (Condition 6.1 and Schedule B), as well as O. Reg. 419/05.

Appendix A Adomait Field Notes

Reference: Oversight of Air Emission Source Testing at the Durham York Energy Centre (Spring 2024)

	Semi-Volatiles-1		**Semi-Volatiles-1**	
Date	March 20, 2024		March 20, 2024	
Observation	Boiler #1		Boiler #2	
Nozzle Size/Type	0.2586		0.2498	
Meter Cal/ID	1.018		0.986	
Pitot cal	0.844		0.843	
Calc Moisture	16		16	
Static	-11.9		-11.71	
Pitot Leak Check	Pass		Pass	
Pre-traverse Leak Check	0.002 @16 inches H_2O	0.003 @18 inches H_2O	0.003 @16 inches H_2O	0.003 @15 inches H_2O
SVOC Test Start Time	8:10	10:23	8:13	10:28
Running On Insertion	Yes	Yes	Yes	Yes
Stack temperature ºF	280, 281, 280	281, 282, 280	283, 284, 285	285, 286, 288, 289
Trap temperature ºF	48, 49, 48, 47, 47, 47,49, 48, 54	53, 56, 57, 55, 51, 49, 54, 49, 50	46, 46, 46, 47, 47, 46, 46, 45, 45	42, 43, 43, 43, 43, 42, 41, 42, 43
Running on removal	Yes	Yes	Yes	Yes
Traverse Completed	10:10	12:23	10:13	12:28
Post-traverse Leak Check	0.002 @18 inches H_2O	0.002 @16 inches H_2O	0.002 @15 inches H_2O	0.002 @15 inches H_2O

Reference: Oversight of Air Emission Source Testing at the Durham York Energy Centre (Spring 2024)

	Semi-Volatiles-2		**Semi-Volatiles-2**	
Date	March 20, 2024		March 20, 2024	
Observation	Boiler #1		Boiler #2	
Nozzle Size/Type	0.2586		0.2498	
Meter Cal/ID	1.018 Team 4		0.986 Team 3	
Pitot cal	0.844		0.843	
Calc Moisture	16		16	
Static	-11.9		-11.71	
Pitot Leak Check	Pass		Pass	
Pre-traverse Leak Check	0.002 @16 inches H_2O	0.002 @16 inches H_2O	0.001 @15 inches H_2O	0.001 @15 inches H_2O
SVOC Test Start Time	13:18	15:30	13:13	15:26
Running On Insertion	Yes	Yes	Yes	Yes
Stack temperature ºF	282, 280, 280	279, 281, 280	288, 288, 280	287, 285, 280
Trap temperature ºF	47, 49, 48, 49, 49, 50	50, 53, 51, 51, 51, 48, 48, 49,	47, 47, 47, 46, 44, 44	47, 47, 47, 47, 44, 45, 45, 47, 48
Running on removal	Yes	Yes	Yes	Yes
Traverse Completed	15:18	17:30	15:13	17:26
Post-traverse Leak Check	0.001 @16 inches H_2O	0.002 @16 inches H_2O	0.002 @18 inches H_2O	0.002 @16 inches H_2O

Reference: Oversight of Air Emission Source Testing at the Durham York Energy Centre (Spring 2024)

	Semi-Volatiles-3		**Semi-Volatiles-3***	
Date	March 21, 2024		March 21, 2024	
Observation	Boiler #1		Boiler #2	
Nozzle Size/Type	0.2586		0.2498	
Meter Cal/ID	1.018		0.986	
Pitot cal	0.844		0.843	
Calc Moisture	16		16	
Static	-11.9		-11.71	
Pitot Leak Check	Pass		Pass	
Pre-traverse Leak Check	0.002 @15 inches H_2O	0.002 @17 inches H_2O	0.002 @15 inches H_2O	0.002 @15 inches H_2O
SVOC Test Start Time	8:07	10:15	11:31	13:54
Running On Insertion	Yes	Yes	Yes	Yes
Stack temperature ºF	280, 281, 280	280, 281, 280	284, 288, 288	283, 285, 285, 286
Trap temperature ºF	53, 56, 57, 55, 54, 52, 43, 44, 45	43, 46, 47, 46, 45, 47, 44	45, 46, 45, 47, 48, 47, 46	47, 45, 45, 47, 47, 46, 45, 46 48, 50
Running on removal	Yes	Yes	Yes	Yes
Traverse Completed	10:07	12:15	13:46	15:54
Post-traverse Leak Check	0.002 @17 inches H_2O	0.002 @17 inches H_2O	0.002 @15 inches H_2O	0.001 @15 inches H_2O

Notes: *Leak check failure after first half of Boiler #2 test 3. Data reflects the repeat testing.
*Test stopped at 11:53 started again at 12:08 (Running on insertion)

Technical Memorandum

To: Andrew Evans, PEng, Region of Durham

Cc: Lipika Saha, PEng (Region of Durham)

Muneeb Farid, PEng (Region of York)

John Clark, Alan Cremen, Kirk Dunbar, Abigail Fleming, Annette Scotto (HDR)

From: Bruce Howie, PE

Date: June 24, 2024

Re: **Durham York Energy Centre: Spring 2024 Compliance Stack Test HDR Observations During Testing and Summary of Results**

Introduction

During the period from March 18 through March 21, 2024, ORTECH Consulting, Inc. (ORTECH) conducted the Compliance Source Test at the Durham York Energy Center (DYEC) for the Regions of Durham and York. This Compliance testing has been performed annually since the start of Commercial Operation in 2016. Testing was performed in accordance with the reference methods required under Section 7(1) of the Amended Environmental Compliance Approval (ECA) No. 7306-8FDKNX, originally issued by the Ontario Ministry of Environment, Conservation and Parks (MECP) on June 29, 2011. HDR personnel were on-site to observe DYEC operations and stack sampling procedures during the testing on March 19th to March 21st. The purpose of this technical memorandum is to summarize the observations made by HDR personnel during the testing as well as to summarize our review of the results for the Source Test based on the information provided in the ORTECH Test Report dated May 16, 2024.

HDR Observations during the Compliance Source Test

The tentative testing schedule for the March 2024 Compliance Source Test is included in Attachment A to this Technical Memorandum. Also included in Attachment A is a summary of the testing observed by HDR. HDR's role on-site was to observe Covanta's operations of the DYEC during test sampling, and to observe ORTECH's sampling procedures and activities. HDR personnel were on-site during the air emission testing on March 19th to March 21st to observe the source test sampling activities with particular focus on the Method 23 tests for Dioxins/Furans on both Units 1 and 2. HDR observed the operations of the boiler and air pollution control systems to verify the DYEC was being operated under normal operating conditions during the test periods. The following is a

summary of the key events and observations made by HDR during the sampling days that we were at the DYEC. Attachment A shows the start and stop times of each test.

Day 1: Tuesday, March 19th

Stack testing commenced at 08:12 and was completed at 18:46. Tests for both Units were completed as scheduled without any observed or reported upsets.
The parameters below (data collected at 14:12) were observed to be within the normal range.

Parameter	Normal Range	Unit 1	Unit 2
Steam Load (kg/hr)	32,000-35,000	32,718	31,855
Carbon (kg/hr)	4.5-5.5	5.3	5.2
Steam Outlet Temp (°C)	495-510	502	503
Steam Pressure (bar)	86-90	89.9	89.9
Combustion Temps (°C)	>1,000	1,232	1,291
Baghouse dp (mBar)	10-20	18.9	14.5

Day 2: Wednesday, March 20th

Stack testing commenced at 07:57 and was completed at 17:30. Tests for both Units were completed as scheduled (Dioxin/Furans, VOST, Aldehydes).

HDR observed a leak test of the sampling train on both units on March 20th and noted that it passed.

- Unit 1 at 15:18 during the Dioxins/Furans Run 2 port switch.
- Unit 2 at 10:13 during the Dioxins/Furans Run 1 port switch.

The parameters below (data collected at 11:00) were observed to be within the normal range. Unit 1 baghouse differential pressure (dp) was slightly higher than typical but still within acceptable range throughout testing.

Parameter	Normal Range	Unit 1	Unit 2
Steam Load (kg/hr)	32,000-35,000	33,537	34,019
Carbon (kg/hr)	4.5-5.5	5.29	5.16
Steam Outlet Temp (°C)	495-510	506	510
Steam Pressure (bar)	86-90	89.8	89.9
Combustion Temps (°C)	>1,000	1,241	1,291
Baghouse dp (mBar)	10-20	21.0	16.8

*Although Unit 1 baghouse dp was slightly higher than the normal range throughout testing, values did not present any levels of concern.

Day 3: Thursday, March 21st

Stack testing commenced on Unit 1 at 08:07 and was completed at 12:15. Unit 2 Dioxins/Furans testing initially commenced at 07:49 but failed the leak check during the port switch. A new sampling train was assembled, and another Unit 2 test commenced at 11:31. At 11:53 the run was paused due to a drop in the steam flow to below 30,000 kg/hr, likely due to a wet load of waste. Based on HDR's understanding, the low-level steam flow target is 30,300 kg/hr, which is 90% of the design MCR steam flow (33,600 kg/hr). Steam flows returned to design levels and the boiler was stable by 12:08 and the Unit 2 Dioxins/Furans test was restarted at 12:08. The Dioxins/Furans test was successfully completed at 15:54.

HDR observed three leak tests on March 21st. One test on Unit 2 failed, noted in the following.

- Unit 1 at 10:06 during the Dioxins/Furans Run 3 port switch.
- Unit 2 at 09:48 during the Dioxins/Furans Run 3 port switch, leak test failed and the run was aborted.
- Unit 2 at 13:45 during the Dioxins/Furans Run 3 port switch.

The parameters below (data collected at 11:01) were observed to be within the normal range. Unit 2 continued to be slightly higher than typical, but remained acceptable through all testing.

Parameter	Normal Range	Unit 1	Unit 2
Steam Load (kg/hr)	32,000-35,000	33,730	33,097
Carbon (kg/hr)	4.5-5.5	5.3	5.1
Steam Outlet Temp (°C)	495-510	507	506
Steam Pressure (bar)	86-90	89.9	90.0
Combustion Temps (°C)	>1,000	1,233	1,304
Baghouse dp (mBar)	10-20	21.0	16.8

HDR noted that Covanta's Rick Koehler was on-site throughout the testing period to assist in the coordination and to observe the Compliance Source Testing.

Based on HDR's observations of the Source Testing, ORTECH conducted the testing in accordance with the applicable standards and procedures. ORTECH was careful during each port change to ensure that the probe was not scraped inside the port during insertion and removal of the probe. In addition, sampling equipment was assembled properly, the ice used in the sample box was replenished in a timely manner, and all required leak checks were conducted. After each completed test, the sampling trains were transported to a trailer located outside the boiler building for recovery and clean up to avoid potential contamination at the test location. It should be noted that the actual clock times associated

with each run, are slightly longer than the run lengths indicated in the test plan. This difference is due to the time required for ORTECH to pull the probe out of the first port, leak check the sampling equipment, and insert the probe into the second port. This is typical of stack sampling practices and is done in accordance with the test plan and approved procedures.

Attachment B provides a summary of the DYEC operating data recorded by Covanta's distributive control system (or DCS) during the Dioxins/Furans tests. One set of operating parameters that appeared to deviate from the expected ranges are the variables associated wit the LN and SNCR controls for NOx reduction. Unit 1 was observed to be operating with a higher tertiary air flow and a higher percentage of tertiary air (percent of total combustion air) while at the same time requiring higher ammonia injection rates. Typically, higher LN flow will result in lower NOx formation and a reduction in the demand for ammonia in the SNCR system. Covanta should verify tertiary air flow meter calibration and investigate the boiler operating conditions that may have contributed to this deviation. As previously noted, HDR did not observe any deviations from the approved test protocol or applicable stack test procedures and based on the operational data and HDR's observations, the boilers and APC equipment were generally operated under normal conditions during the testing.

Summary of Results

The results of the testing program, based on ORTECH's May 16, 2024, report, are summarized in Table 1 and Figures 1 and 2. As shown, emissions of all pollutants are corrected to Reference conditions (25° C, 101.3 kP, dry basis, 11% oxygen) and were below the ECA's Schedule "C" limits. As a part of HDR's review of the ORTECH report, we completed a review of the data presented and calculations. There were no errors in calculations found during this review.

Table 1 – Summary of March 2024 Compliance Source Test Results

Parameter	Units[1]	ECA Limit	Unit 1		Unit 2	
			Result	% of Limit	Result	% of Limit
Particulate Matter (PM)[2]	mg/Rm^3	9	1.31	15%	1.48	16%
Mercury (Hg)[2]	µg/Rm^3	15	<0.16	1%	<0.58	4%
Cadmium (Cd)[2]	µg/Rm^3	7	<0.090	1%	0.057	1%
Lead (Pb)[2]	µg/Rm^3	50	0.31	1%	0.26	1%
Hydrochloric Acid (HCl)[3][4]	mg/Rm^3	9	0.5	6%	2.4	27%
Sulphur Dioxide (SO_2)[3][4]	mg/Rm^3	35	1.8	5%	2.4	7%
Nitrogen Oxides (NO_x)[3][4]	mg/Rm^3	121	113	93%	109	90%
Carbon Monoxide (CO)[3][5]	mg/Rm^3	40	9.5	24%	12.4	31%
Total Hydrocarbons (THC)[6]	ppm	50	0.1	0%	0.2	0%
Dioxins and Furans[7]	pg TEQ/Rm^3	60	<2.30	4%	<1.88	3%

(1) R means the values are adjusted to reference conditions (i.e., dry basis, 25°C, 101.3 kPa, 11% O_2)

(2) average of three runs

(3) based on CEM data provided by Covanta

(4) maximum calculated 24-hour rolling arithmetic average measured by the DYEC CEMS during the period from 08:00 on March 18, 2024 until 16:00 on March 21, 2024

(5) maximum calculated 4-hour rolling arithmetic average measured by the DYEC CEMS during the period from 08:00 on March 18, 2024 until 16:00 on March 21, 2024

(6) average of three one hour tests measured at an undiluted location, reported on a dry basis expressed as equivalent methane

(7) average of three test runs calculated using the NATO/CCMS (1989) toxicity equivalence factors and the full detection limit for those isomers below the analytical detection limit

Figure 1 - DYEC Test Results as a Percent of ECA Limit

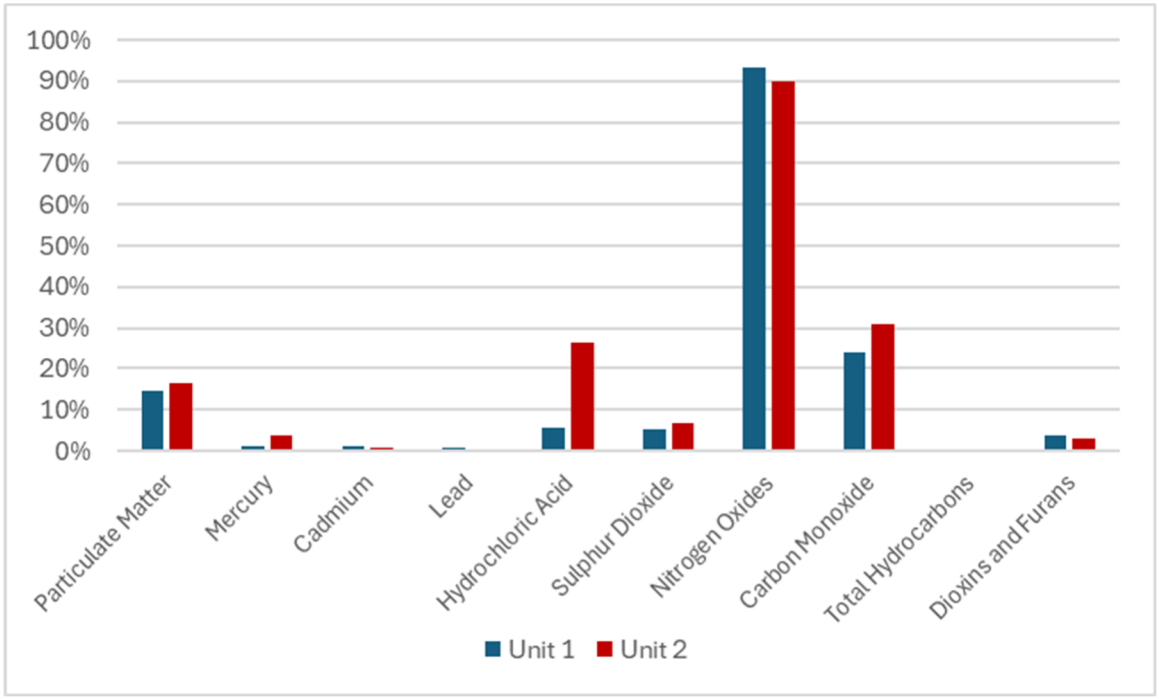
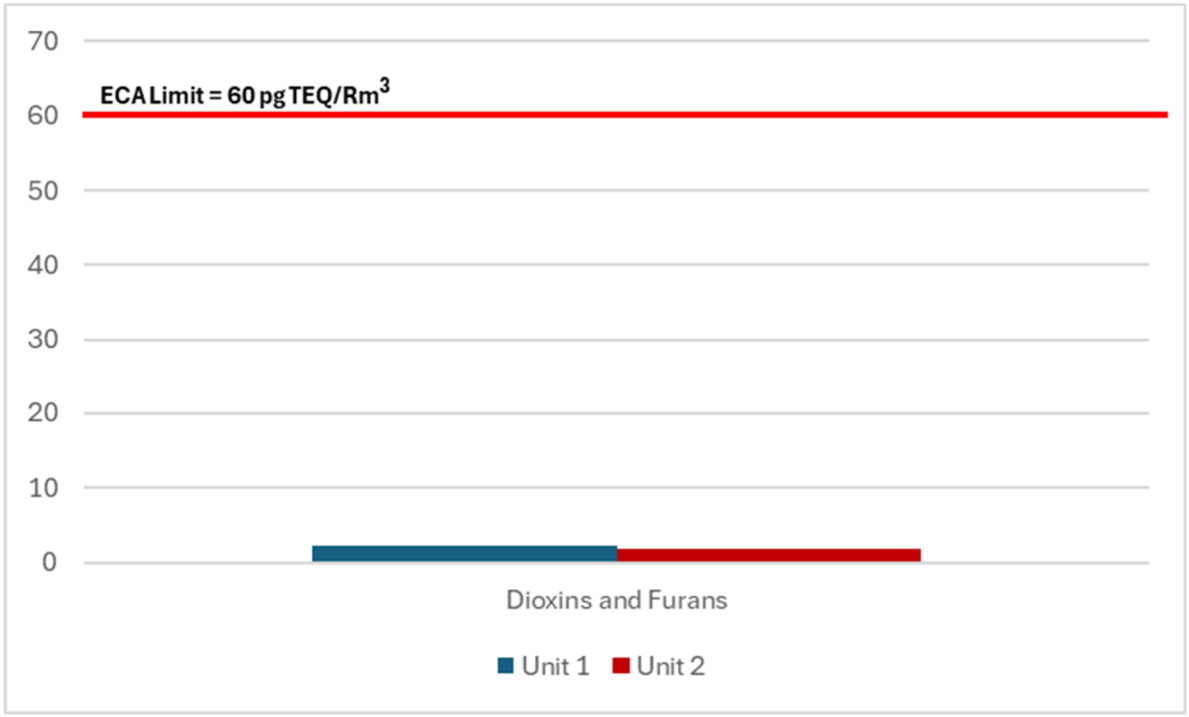


Figure 2 – Test Results for Dioxins and Furans



Conclusions and Recommendations

HDR has completed our review of the preliminary results of the air emissions testing performed during the DYEC Spring 2024 Compliance Test. Representatives from HDR were present at the DYEC to observe the sampling procedures and facility operations throughout the majority of the testing period that occurred between March 18th through March 21st, 2024. HDR observed ORTECH following the approved stack sampling procedures and test methods. HDR also observed Covanta's plant personnel operating the DYEC under normal operating conditions and in accordance with acceptable industry operating standards. Based on the results summarized in ORTECH's test report (dated May 16, 2024), the air emission results of the Spring 2024 Compliance Test demonstrated that the DYEC operated below the ECA's Schedule "C" limits.

Attachments:

Attachment A – Tentative Stack Test Schedule and Summary of Testing Observed by HDR

Attachment B – Summary of Operating Data during Dioxins/Furans Tests

Attachment A: Final Stack Test Schedule & Summary of Testing Observed by HDR.

Tentative Test Schedule

Day/Location		Parameter	Method	# of Runs	Duration
Fri. March 15	#1 & #2 APC	Setup and Prelim. Particulate	Ontario M5	2	60
Mon. March 18	#1 APC Outlet	Particulate/Metals	Ontario M5/EPA M29	2	180
		Hydrogen Fluoride	EPA M26A	3	60
	#2 APC Outlet	Particulate/Metals	Ontario M5/EPA M29	1	180
		PM_{10}, $PM_{2.5}$ & Condensables	EPA Method 201A/202	3	120
Tues. March 19	#1 APC Outlet	PM_{10}, $PM_{2.5}$ & Condensables	EPA Method 201A/202	3	120
		Particulate/Metals	Ontario M5/EPA M29	1	180
	#2 APC Outlet	Particulate/Metals	Ontario M5/EPA M29	2	180
		Hydrogen Fluoride	EPA M26A	3	60
Wed. March 20	#1 APC Outlet	Dioxin/Furan	EPS 1/RM/2	2	240
		VOST	SW846-0030	3	40
		Aldehydes	NCASI Method ISS/FP-A105.01	3	60
	#2 APC Outlet	Dioxin/Furan	EPS 1/RM/2	2	240
		VOST	SW846-0030	3	40
		Aldehydes	NCASI Method ISS/FP-A105.01	3	60
Thurs. March 21	#1 APC Outlet	Dioxin/Furan	EPS 1/RM/3	1	240
	#2 APC Outlet	Dioxin/Furan	EPS 1/RM/2	1	240

Note: Friday March 22 is reserved as a contingency test day.

Summary of Testing Observed by HDR.

Day 1: Tuesday, March 19th

Unit	Test	Run 1		Run 2		Run 3	
		Start	Stop	Start	Stop	Start	Stop
Unit 1	PM10/2.5	08:24	10:26	11:02	13:04	13:50	15:53
	PM/Metals	-	-	-	-	15:26	18:35
	Acid Gases	-	-	-	-	-	-
Unit 2	PM10/2.5	-	-	-	-	-	-
	PM/Metals	08:12	11:25	11:59	15:07	15:38	18:46
	Acid Gases	08:13	09:13	09:56	10:56	11:07	12:07

Day 2: Wednesday, March 20th

Unit	Test	Run 1		Run 2		Run 3		Run 4	
		Start	Stop	Start	Stop	Start	Stop	Start	Stop
Unit 1	Dioxin/Furan	08:10	12:23	13:18	17:30				
	VOST	07:57	08:37	08:43	09:23	09:29	10:09	10:15	10:55
	Aldehyde	11:30	12:30	12:47	13:47	14:05	15:05		
Unit 2	Dioxin/Furan	08:13	12:28	13:13	17:26				
	VOST	07:59	08:39	08:48	09:28	09:39	10:19	10:32	11:12
	Aldehyde	12:00	13:00	13:17	14:17	14:36	15:36		

Day 3: Thursday, March 21st

Unit	Test	Run 3	
		Start	Stop
Unit 1	Dioxin/Furan	08:07	12:15
Unit 2*	Dioxin/Furan	11:31	15:54

* The test run was paused at 11:53 due to a drop in the steam flow. The set point is 90% of the standard flow (33,600 kg/hr). During this time, the steam flow fell below 30,000 kg/hr, likely due to a wet load. The test continued at 12:08 and was successfully completed at 15:54.

Attachment B: Summary of Operating Data during the Dioxins/Furans Tests

March 2024 Compliance Dioxins Testing
Operations Data and Results

Operating Parameter	Boiler 1			Boiler 2		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
	20-Mar	20-Mar	21-Mar	20-Mar	20-Mar	21-Mar
MSW Combusted (tonnes/day)						
Steam (kg/hr)	33,432	33,263	33,481	33,029	33,358	33,092
Steam temp	507	507	506	508	515	509
Primary Air Flow	30,159	30,464	29,629	32,709	33,294	32,714
Overfire Air Flow	5,911	5,935	5,893	5,819	7,193	5,318
Tertiary Air (Fresh LN Air)	9,908	9,892	9,820	8,502	8,599	8,458
Tertiary air temperature ^{o}C	40.8	39.1	38.3	40.9	36.8	37.1
Lime Injection (kg/hr)	144.5	144.4	144.5	144.2	144.1	144.3
Ammonia Injection Rate (liters/hr)	1.1	0.8	0.8	0.2	0.3	0.5
Carbon Injection (kg/hr)	5.3	5.3	5.3	5.1	5.2	5.2
Combustion air preheat temp	110.6	115.0	117.4	111.5	104.9	118.0
Average Combustion Zone Temp ^{o}C	1,099	1,089	1,090	1,141	1,155	1,164
Superheater #3 Flue gas inlet Temp ^{o}C	573	576	568	577	593	588
Economizer Inlet Temp ^{o}C	343	345	343	343	350	345
Economize Outlet Temp ^{o}C	170	176	170	170	178	173
Quench Outlet Temp ^{o}C	153	153	152	153	153	152
Reactor Outlet (BH Inlet) Temp ^{o}C	140	139	140	141	140	141
Baghouse Outlet Temp ^{o}C	137	136	137	138	138	137
Tertiary Air Header Pressure mbar	60	60	60	64	65	68
Tertiary Air Left mbar	33	33	31	28	29	28
Tertiary air Right mbar	34	34	35	28	28	28
Baghouse Differential Pressure mbar	20	20	21	16	16	17
Oxygen (%) - Boiler Outlet	7.2	7.1	7.3	7.1	7.1	7.5
Oxygen (%) - Baghouse Outlet	8.0	8.2	8.2	8.2	8.2	9.6
CO -Boiler Outlet - mg/Rm3	8.4	6.6	6.3	13.7	7.7	9.9
CO - Baghouse Outlet - mg/Rm3	6.1	4.4	4.1	9.8	4.7	6.9
NOx - mg/Rm3	105.5	109.4	108.4	100.6	109.4	107.6
NH3 mg/Rm3	8.2	10.7	8.1	11.1	10.9	11.3
Flue gas moisture	16.8%	18.2%	16.6%	19.9%	21.3%	21.3%
Outlet/Stack Dioxin - NATO - (pg TEQ/Rm^{3})	**<1.97**	**<3.06**	**<1.88**	**<1.81**	**<2.00**	**<1.83**

[1]Average Unit data for the periods corresponding to the test run times.

Attachment 4

Table 1: DYEC Source Test Emission Results 2019-2024

Parameter	Emission limit	Spring 2019 Voluntary		Fall 2019 Compliance		Spring 2020 Voluntary		Fall 2020 Compliance		Spring 2021 Voluntary		Fall 2021 Compliance		Spring 2022 Voluntary		Fall 2022 Compliance		Spring 2023 Voluntary		Fall 2023 Compliance		Spring 2024 Compliance	
		Boiler 1	Boiler 2	Boiler 1	Boiler 2	Boiler 1	Boiler 2	Boiler 1	Boiler 2	Boiler 1	Boiler 2	Boiler 1	Boiler 2	Boiler 1	Boiler 2	Boiler 1	Boiler 2	Boiler 1	Boiler 2	Boiler 1	Boiler 2	Boiler 1	Boiler 2
Cadmium	7 µg/Rm^3	0.1	0.08	0.18	0.08	0.056	0.11	0.075	0.056	0.068	0.045	0.064	0.02	0.023	0.39	0.063	0.03	0.12	0.08	0.83	0.37	0.09	0.057
Carbon Monoxide	40 mg/Rm^3	13.1	12.2	11.2	12.1	15.2	11.4	11.4	14.1	12.6	12.7	9.7	11.7	10.7	15.3	9.1	9.4	9.0	16.10	8.1	9.9	6.1	8.0
Dioxins and Furans	60 pgTEQ/Rm^3	4.55	4.58	1.51	3.24	1.82	2.53	28.7	7.26	4.10	7.35	14.7	2.56	7.28	4.10	3.68	3.91	6.61	9.18	10.9	4.43	2.3	1.88
Hydrogen Chloride	9 mg/Rm^3	1.9	4.2	3	5.1	4.5	5.1	3.8	3.2	3.1	2.9	2.2	1.8	1.0	3.6	0.4	3.8	0.8	3.1	1	3.1	0.3	2.2
Lead	50 µg/Rm^3	0.59	0.46	0.54	0.57	0.55	0.61	0.37	0.34	0.44	0.32	0.46	0.17	0.55	0.28	0.23	0.15	0.28	0.15	0.56	0.25	0.31	0.26
Mercury	15 µg/Rm^3	0.35	0.1	0.29	0.1	0.13	0.1	0.34	0.045	0.086	0.081	0.053	0.05	0.089	0.09	0.093	0.09	0.09	0.09	0.09	0.08	0.16	0.58
Nitrogen Oxides	121 mg/Rm^3	110	110	111	110	109	109	110	110	109	110	111	110	110	110	112	111	110	110	109	111	111	108
Organic Matter	50 ppmdv	1.8	0.5	0.8	0.3	0.2	1.7	0.5	1.1	1.0	0.4	0	0	0.7	1.5	0.1	0.3	0.03	0.4	0.5	0.4	0.1	0.2
Sulphur Dioxide	35 mg/Rm^3	0.03	0.02	0	0.01	0	0	0.1	0.1	0.3	0.7	0.3	0.2	0.02	0.9	0.5	0.6	0.02	0.13	0	0.03	0.2	0.39
Total Suspended Particulate Matter	9 mg/Rm^3	0.62	0.38	0.61	0.54	1.14	1.04	2.6	2	0.78	0.25	0.48	0.31	0.87	1.58	0.27	0.2	0.20	0.24	0.57	0.43	1.31	1.48

Attachment 5

Table 2: Comparison Table: 2024 Compliance Source Test Results Compared to ECA limits and Ontario A-7 Guideline

Parameter	Units	Boiler #1	Boiler #2	DYEC Average	DYEC ECA limit	% below ECA limit	Ontario A-7 Guideline	EU (2010/75/EU)	% below EU limit
Nitrogen Oxides	mg/ Rm^3	111	108	110	**121**	9%	**198**	**183**	39.9%
Total Suspended Particulate Matter	mg/ Rm^3	1.31	1.48	1.4	**9**	84.4%	**14**	**9**	84.4%
Sulphur Dioxide	mg/ Rm^3	0.2	0.39	0.3	**35**	99.1%	**56**	**46**	99.3%
Hydrogen Chloride	mg/ Rm^3	0.3	2.2	1.3	**9**	85.6%	**27**	**9**	85.6%
Carbon Monoxide	mg/ Rm^3	6.1	8.0	7.1	**40**	82.3%	**40**	**46**	84.6%
Mercury	µg/Rm^3	0.16	0.58	0.4	**15**	97.3%	**20**	**46**	99.1%
Cadmium	µg/Rm^3	0.09	0.057	0.07	**7**	99%	**7**	**n/a**	n/a
Lead	µg/Rm^3	0.31	0.26	0.29	**50**	99.4%	**60**	**n/a**	n/a
Dioxin/Furans	pg TEQ/Rm^3	2.3	1.88	2.1	**60**	96.5%	**80**	**92**	97.7%