Ministry of the Environment
Standards Development Branch
40 St. Clair Avenue West
Toronto ON M4V 1M2
www.ene.gov.on.ca

Ministère de l'Environnement
Direction de l'élaboration des normes
40, avenue St. Clair ouest
Toronto, ON M4V 1M2
www.ene.gov.on.ca

Ontario

Via email: celeste.dugas@ontario.ca
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December 14, 2015

MEMORANDUM

TO: Celeste Dugas, District Manager
York-Durham District Office
Central Region

FROM: Guillermo Azocar, Source Assessment Specialist
Technology Standards Section
Standards Development Branch

SUBJECT: Comments on the 2015 source testing program conducted at Durham-York Energy Centre E.F.W. facility (Clarington). Amended Environmental Compliance Approval No. 7306-8FDKNX.

Please find enclosed the evaluation of the source testing program report, ORTECH Project No. 21546, dated 2015/11/25, prepared on behalf of Covanta Durham-York Renewable Energy Limited Partnership, and referring to source testing conducted at Durham-York Energy Centre's Energy-From-Waste facility (Clarington, Ontario).

The testing was required by Condition 7 of the Environmental Compliance Approval No. 7306-8FDKNX, issued on 2011/06/28, and the Notice No. 1 of ECA amendment, issued on 2014/08/12.

The objective of this source testing program was to validate that the facility's two thermal treatment trains are capable of meeting their individual performance parameters and their combined emission limits when operating at maximum continuous rating, as required by the source testing definition and conditions listed in the above mentioned ECA.

***Sources tested*:**

- Municipal Solid Waste Energy-From-Waste Incinerator – Thermal Treatment Unit 1
- Municipal Solid Waste Energy-From-Waste Incinerator – Thermal Treatment Unit 2

Combustion Trains
Common Stack

Combustion Trains
Exhaust Duct

***Target contaminants*:**

- Total Suspended Particulate Matter (TSP),
- PM_{10} (filterable and condensable fractions),
- $PM_{2.5}$, (filterable and condensable fractions),
- Metals (18 selected metals, as listed in the ECA's Schedule "D", plus hexavalent chromium),
- Semi-volatile Organic Compounds (7 dioxins and 10 furans isomers, 12 dioxin-like PCBs, 39 selected PAHs, 13 chlorobenzenes, and19 chlorophenols) – as listed in ECA's Schedule "D",
- Volatile Organic Compounds (29 selected VOCs, including 5 aldehydes/ketones, as listed in the ECA's Schedule "D"),
- Hydrogen fluoride (HF),
- Hydrogen chloride (HCl),
- Nitrogen oxides (NO_X),
- Sulphur dioxide (SO_2),
- Combustion gases (oxygen, CO, and CO_2),
- Total organic matter (THC), and
- Odour.

***Reference methods used*:**

- TSP: OSTC Method ON-5,
- $PM_{2.5}/PM_{10}$: OSTC Method ON-7,
- PM condensable: US EPA 40CFR60 Method 202,
- Metals: US EPA 40CFR60 Method 29,
- Hexavalent chromium: US EPA SW-846, Method 0061,
- SVOCs: Environment Canada's Report EPS 1/RM/2,
- VOCs: US EPA SW-846 Method 0030,

- Aldehydes/ketones: State of California Method CARB 430
- HF: US EPA 40CFR60 Method 13B,
- HCl: US EPA 40CFR60 Method 26 (for RATA), and DYEC CEMS (for compliance),
- NOx: US EPA 40CFR60 Method 7E (for RATA), and DYEC CEMS (for compliance),
- SO_2: US EPA 40CFR60 Method 6C (for RATA), and DYEC CEMS (for compliance),
- CO_2: US EPA 40CFR60 Method 3A,
- O_2: US EPA 40CFR60 Method 3A (for emissions normalization at the stack, and RATA undiluted at outlet of combustor), and DYEC CEMS (for compliance – undiluted at outlet of combustor),
- CO: US EPA 40CFR60 Method 10 (for RATA), and DYEC CEMS (for compliance),
- THC: US EPA 40CFR60 Method 25A,
- Odour: OSTC Method ON-6, and
- Stack Gas Parameters: Ontario Source Testing Code's Method ON-1 to ON-4.

***Brief Process Description*:**

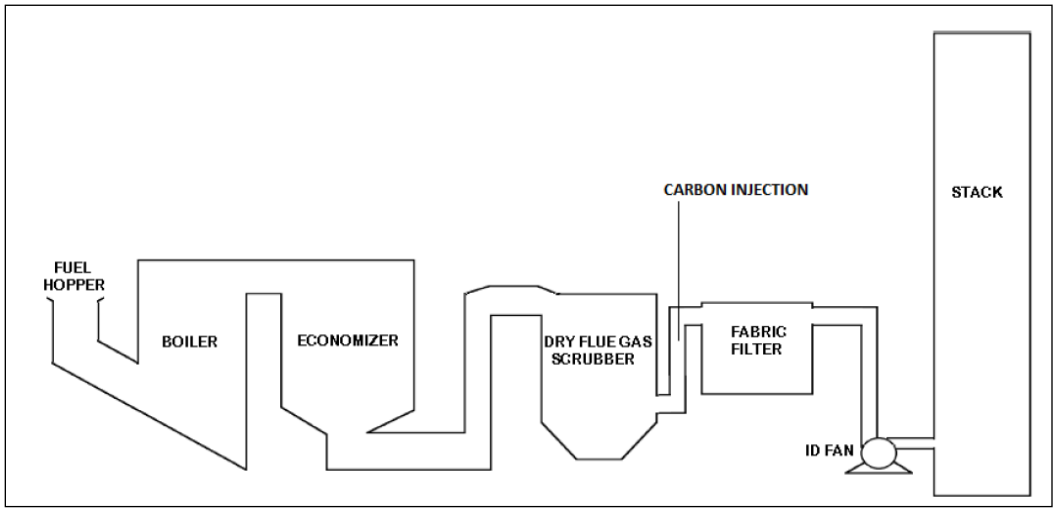
The Durham-York Energy Centre (DYEC) is an energy-from-waste facility built with the aim of processing solid waste from the Regions of Durham and York. The maximum thermal processing rate stated in the ECA is 140,000 tonnes of waste per year. The facility is expected to operate on a continuous basis, 24 hours/day, 7 days/week, 365 days/year, with the waste delivered initially set at 6 days per week between 07:00 and 19:00 hours.

The facility consists of two thermal treatment lines, with each having a MSW processing nominal capacity of 218 t/d of MSW, with a heat content of 13 MJ/kg, to generate 20 MWh of electricity (nominal capacity) and 33,640 kilograms per hour of steam (nominal capacity).

Each thermal treatment line is equipped with independent air pollution control equipment; consisting of a Selective Non-Catalytic Reduction System with ammonia injection (for NOx control), an activated carbon injection system (to reduce mercury and dioxins in flue gas), a dry recirculation lime injection scrubber (to control acid gases), and a pulse jet type baghouse (to control particulate emissions).

The treated exhaust gases from both lines are vented to the atmosphere via a common exhaust stack, having an exit diameter of 1.71 metres, extending 87.6 metres above grade.

Process Diagram:



***Testing Strategy*:**

ORTECH (on behalf of Covanta) conducted the emission testing program at the two thermal treatment lines. Triplicate emission tests were completed for particulate matter, particle size distribution (PM_{10} and $_{PM2.5}$ filterable fraction determination, plus condensables), selected metals, semivolatile organic compounds, aldehydes, acid gases, ammonia, volatile organic compounds and combustion gases.

ZORIX Environmental (on behalf of Covanta) conducted the odour emission testing portion of this source testing program.

During the pre-test plan preparation, it was anticipated that the average hourly non-hazardous waste processing rate for each thermal treatment unit would be 218 t/d, plus or minus 10% (based on the ECA stated maximum nominal capacity of 140,000 t/y); for each unit to produce 33,800 kg/h of steam, to generate 20MWh (~410 MW/d) of electricity.

***Process Information during the source testing*:**

Based on the source testing program conducted from 2015/09/29 to 2015/10/02 the facility's waste throughput averaged 225 t/d for Boiler 1 and 222 t/d for Boiler 2. The steam production was 837 t/d for Boiler 1, and 838 t/d for Boiler 2. The gross power throughput of the facility during that period averaged at 412 MW/d. These process conditions represent ~100% of the thermal treatment lines waste throughput, steam production and power throughput.

Due to integrity concerns with the semi-volatile organic compound samples collected on 2015/09/30 and 2015/10/01; this set of samples were rejected. Two additional triplicate set of samples were collected. The first additional set of samples was collected on 2015/10/21 and 2015/10/22; with the second set on 2015/10/28 and 2015/10/29. During these two additional periods of testing, the facility's waste throughput averaged 222 t/d for Boiler 1 and 220 t/d for

Boiler 2 during the collection of the first set of additional samples; and 222 t/d for Boiler 1 and 227 t/d for Boiler 2 during the collection of the second set of samples.

For Boiler #1, and based on 96 hours of combustion temperature monitoring between 2015/09/29 and 2015/10/02; only 62% of the combustion temperature 1-minute readings were at or above the ECA's 1000^{o}C±1.5% set limit (ECA's Condition 6(2)(a)(ii)); with 91% of those readings at or above the ECA's 1000^{o}C±1.5% limit, when 1-hour averages were calculated (the ECA's Condition 14(4)(c)(viii) requires temperature to be recorded at a minimum on a 1-hour basis).

For Boiler #2, and based on 96 hours of temperature monitoring between 2015/09/29 and 2015/10/02; 83% of the combustion temperature 1-minute readings were at or above the ECA's 1000^{o}C±1.5% set limit (ECA's Condition 6(2)(a)(ii)); with 91% of those readings at or above the ECA's 1000^{o}C±1.5% limit, when 1-hour averages were calculated (the ECA's Condition 14(4)(c)(viii) requires temperature to be recorded at a minimum on a 1-hour basis).

For Boiler #1, and based on 88 hours of residual oxygen monitoring between 2015/09/29 and 2015/10/02; 99% of the residual oxygen 1-minute readings were at or above the ECA's 6$^{\%}$ set limit (ECA's Condition 6(2)(b)).

For Boiler #2, and based on 78.7 hours of residual oxygen monitoring between 2015/09/29 and 2015/10/02; 96.3% of the residual oxygen 1-minute readings were at or above the ECA's 6$^{\%}$ set limit (ECA's Condition 6(2)(b)).

For the thermal treatment units #1 and #2, the inlet temperature into each baghouse was consistently between 120^{o}C and 185^{o}C, as required by the ECA's Condition 6(2)(h)

The following table summarizes the process conditions during the test periods:

DYEC Energy-From-Waste Facility

ORTECH Report (2015/11/25)

Measurement Parameter		Units	2015-09-29	2015-09-30	2015-10-01	2015-10-02	2015-10-21	2015-10-22	2015-10-21	2015-10-21	Average	Total	Max Allowable
Date													
MSW Usage Rate	Boiler 1	t/d	225	230	227	217	230	223	224	230	226	448	436
	Boiler 2	t/d	213	234	225	216	220	220	225	224	222		
Steam Production	Boiler 1	t/d	841	839	842	827	810	819	824	818	828	1656	1728
	Boiler 2	t/d	841	841	840	828	815	822	822	820	829		
Power Thorughput (gross)	----	MW/d	409	420	417	403	311	405	406	398	396	---	480
Combustion Zone Outlet Temperature	Boiler 1	°C	995	1006	1015	1006					1006	---	1000
	Boiler 2	°C	1031	1037	1030	1010					1027	---	
Baghouse Inlet Temperature	Unit 1	°C	142	142	141	141					142	---	185
	Unit 2	°C	137	138	136	135					137	---	
Combustion Residual Oxygen	Unit 1	%	7.7	7.7	7.6	7.4					7.6	---	≥ 6
	Unit 2	%	8.2	8.3	7.7	7.2					7.8	---	
CO_2 Produced	Unit 1	%	11.3	11.4	11.6	11.7					11.5	---	---
	Unit 2	%	10.9	11.0	11.9	12.2					11.5	---	
Carbon Injection Rate	Boiler 1	kg/d	96	95	95	95	123	124	119	118	108	---	---
	Boiler 2	kg/d	95	91	90	90	123	123	120	118	106	---	
Lime Injection Rate	Boiler 1	kg/d	3968	3973	3940	4417	5653	5644	4140	4090	4478	---	---
	Boiler 2	kg/d	3833	3762	3931	3935	5748	5749	4154	4153	4408	---	
Ammonia Injection Rate	Unit 1	L/d	1212	1315	1438	1368	1180	1218	983	968	1210	---	---
	Unit 2	L/d	1109	1411	1399	1177	1387	1618	1523	1474	1387	---	

***Compliance Summary*:**

The facility met the twelve (12) emission limits set in the ECA's Schedule "C".

The following table summarizes the compliance of the facility during the days when source testing was conducted:

DYEC Energy-From-Waste Facility								
ORTECH Report (2015/11/25)								ECA No. 7306-8FDKNX
Contaminant	THERMAL TREATMENT	Units	Test #1	Test #2	Test #3	Average	Total	Maximum Limit
IN STACK CONCENTRATIONS								
Total Suspended Particulate Matter	Line 1	mg/Rm^3	0.39	0.49	0.69	0.52	0.47	9
	Line 2		0.46	0.28	0.49	0.41		
Cadmium	Line 1	ug/Rm^3	0.263	0.056	0.080	0.13	0.14	7
	Line 2		0.18	0.09	0.18	0.15		
Lead	Line 1	ug/Rm^3	0.279	0.293	1.13	0.57	0.54	50
	Line 2		0.65	0.43	0.46	0.51		
Mercury	Line 1	ug/Rm^3	1.20	0.976	1.38	1.19	0.95	15
	Line 2		0.90	0.61	0.64	0.72		
Organic Matter (10-minute rolling average)*	Line 1	mg/Rm^3	2.1	1.8	1.7	1.9	----	33
	Line 2		0.0	0.0	4.5	1.5	----	
Dioxins, Furans and Dioxin-Like PCBs**	Line 1	pgTEQ/Rm^3	27.1	26.5	20.1	24.6	24.7	60
	Line 2		24.1	27.6	22.9	24.9		
Hydrochloric Acid (24 hour average)	Line 1	mg/Rm^3	1.69	2.19	3.12	2.33	2.7	9
	Line 2		2.88	3.27	3.12	3.09		
Nitrogen Oxides (24 hour average)	Line 1	mg/Rm^3	112	111	107	110	109	121
	Line 2		112	111	104	109		
Sulphur Dioxide (24 hour average)	Line 1	mg/Rm^3	2.97	6.72	2.90	4.20	2.60	35
	Line 2		1.54	0.61	0.87	1.01		
Carbon Monoxide (4 hour average)	Line 1	mg/Rm^3	15.8	14.8	13.9	14.8	15.3	40
	Line 2		18.3	13.4	15.8	15.8		
Opacity (6 minute average)	Line 1	%	0.0	0.0	0.0	0.0	0.00	10
	Line 2		0.0	0.0	0.0	0.0		
Opacity (2 hour average)	Line 1	%	0.0	0.0	0.0	0.0	0.00	5
	Line 2	%	0.0	0.0	0.0	0.0		

R means that concentrations of the contaminants listed are reported dry basis, and have been normalized to 11% oxygen at a reference temperature of 25^{0}C, and a reference pressure of 101.3 kPa.

* Organic matter as monitor by CEMs, based on 10-minute average.

** Based on WHO 2005 Toxic Equivalent Factors, and on 2015/10/28 and 2015/10/29 testing results.

***Emissions Summary*:**

The source testing was a requirement specified in the amended Environmental Compliance Approval No. 7306-8FDKNX, Condition 7.

Testing was conducted at both thermal treatment lines. No testing was undertaken at the common stack.

An organic matter analysis was conducted to determine the suitability of moving the analyser from the outlet of the combustion chamber to the outlet of the pollution control equipment. Cursory review of the information provided shows some variability; but based on the marginal concentrations reported, the variability is not significant. Further assessment of the data will be undertaken.

A relative accuracy test audit (RATA) was conducted at DYEC CEM systems at both thermal treatment lines. The CEM system for both of the lines passed the audit and it is considered certified to provide traceable and reliable emissions information. No flow stratification or disturbances were reported at the location where the CEM systems' probes were located.

A Pre-test plan for this source testing program was submitted by ORTECH (on behalf of Covanta) and approved by the Technology Standards Section on 2014/10/31, complying with the ECA's Schedule "E".

E-mail notice was received from Covanta on 2015/09/11, indicating that emission testing was scheduled to start on 2015/09/28, complying with the ECA's Schedule "E".

The source testing was conducted from 2015/09/29 to 2015/10/02, complying with the ECA's Schedule "E" stipulated timelines for the conduction of the source testing program.

Staff from the MOECC's Technology Standards Section witnessed (in parts) the source testing program at the thermal treatment units on 2015/09/29, and the odour testing on 2015/10/08.

Due to integrity concerns with the semi-volatile organic compound samples collected on 2015/09/30 and 2015/10/01; this set of samples were rejected. Two additional triplicate set of samples were collected. The first additional set of samples was collected on 2015/10/21 and 2015/10/22; with the second set on 2015/10/28 and 2015/10/29.

The digital version of the source testing report was received on 2015/11/25, complying with the ECA's Schedule "E" condition for submission of the source testing report.

Based on the source testing program conducted from 2015/09/29 to 2015/10/02 the facility's waste throughput averaged 225 t/d for Boiler 1 and 222 t/d for Boiler 2. The steam production was 837 t/d for Boiler 1, and 838 t/d for Boiler 2. The gross power throughput of the facility during that period averaged at 412 MW/d. These process conditions represent ~100% of the thermal treatment lines waste throughput, steam production and power throughput.

During the two additional set of semi-volatile organic compounds samples collected on 2015/10/21 and 2015/10/22; the facility's waste throughput averaged 222 t/d for Boiler 1 and 220 t/d for Boiler 2 during the collection of the first set of additional samples; and 222 t/d for Boiler 1 and 227 t/d for Boiler 2 during the collection of the second set of samples.

At each of the thermal treatment lines, one hundred and sixty-seven (167) contaminants were monitored during the source testing program; including, total suspended particulate matter, PM_{10}, $PM_{2.5}$, condensable particulate matter (inorganic and organic), metals (19), dioxins/furans (17 isomers), dioxin like PCBs (12), polycyclic organic matter compounds (39), chlorophenols (19), chlorobenzenes (12), volatile organic compounds (29), aldehydes and ketones (5), acid gases (3), combustion gases (3), ammonia, organic matter, and odour.

In-stack concentrations at one-minute intervals were monitored by Covanta's CEM systems to validate compliance of the facility based on specified average time (24-hour, 4-hour, 2-hour, 10-

minutes, 6-minute, and 1-minute): twenty-four (24) hour average monitoring reporting for NOx, SO_2, and HCl; four (4) hour average monitoring reporting for CO; two (2) hour and 6-minute average monitoring reporting for opacity; ten-minute average reporting for organic matter; and 1-minute average monitoring reporting for combustion residual oxygen, and carbon dioxide.

The sampling/monitoring equipment calibration was acceptable.

Due to time constraints, a more detailed assessment of emission were conducted only for the thermal treatment line 1.

No issues were reported on the TSP and metals lab analysis report appended. Concentrations above the metals' detection limit were observed for 8 of the 19 target metals for at least one of the test-runs for unit 1.

Particle size distribution conducted successfully for determination of the filterable fraction of PM_{10} and $PM_{2.5}$. The particle size distribution results indicated that particles sizes with an aerodynamic diameter of 10 microns (PM_{10}) and lower represented 79.2% by weight of the sample collected; while particles with an aerodynamic diameter of 2.5 microns ($PM_{2.5}$) and lower represented 44.4% by weight of the sample collected.

Inorganic particulate matter condensable fraction was lost due to analytical mismanagement. This missing fraction is not considered significant as to invalidate the PM_{10} and $PM_{2.5}$ reported emissions. Part of the inorganic condensable particle fraction can be obtained from the metals train, if considered relevant.

Semi-volatile organic compound samples were collected on 2015/09/30 and 2015/10/01. This set of samples was rejected. Two additional triplicate set of samples were collected. The first additional set of samples was collected on 2015/10/21 and 2015/10/22; with the second set on 2015/10/28 and 2015/10/29. For compliance determination the second set of tests was used for this assessment.

Recoveries of the samples were within the reference method specifications. Ionic interference was observed for the tetra furan as well as the tetra dioxin. All the other dioxin and furan isomers were detected during at least one of the test-runs.

Six (6) out of the 12 dioxin- like PCBs were detected during at least one of the test-runs.

No issues were found with the PAHs' lab analysis report. Manual integration of the peaks was performed probably due to ionic background interferences. From the 39 PAHs monitored, 18 were detected during at least one of the test-runs.

No issues were found with the chlorophenols and chlorobenzenes' lab analysis report. From the 13 chlorobenzenes monitored, eight were detected during at least one of the test-runs. Only one of the 19 chlorophenols monitored were detected (4-monochlorophenol).

No issues were found with the VOCs' lab analysis report. Fourteen of the 29 VOCs monitored were detected at least during one of the nine test-runs conducted.

No issues were found with the HCl, HF and ammonia lab analysis' report. HCl and ammonia were detected during the three test-runs conducted. HF was not detected.

No issues were reported for the aldehydes' lab analysis. Acetone, acetaldehyde, formaldehyde and methyl ethyl ketone were detected during at least one of the test-runs. Acrolein was not detected in any of the three test-runs conducted.

Odour emissions were monitored at the tipping floor. It is considered the best location, as it will reflect the worst case scenario odour emissions that can be expected if the emissions are not treated through the boilers. Concerns were identified with the flow rate used for calculating the odour impact. ZORIX used 11 m^3/s; while each line is showing processing flow at a rate of 17 m^3/s. The flow rate to be used in the dispersion modelling should be the aggregate of the wet standard flow handled by the two thermal treatment lines, if the intention is to indicate worst scenario based on all the odorous emissions being treated by the boilers before exhausting to the atmosphere.

The other indicated source of potential fugitives was identified as the trucks transporting the waste to the facility. It is believed that the Covanta odour management plan addresses the potential concerns from the trucks.

Zero opacity was reported during most of the time the source testing program was being conducted.

The emission measurements were conducted satisfactorily according to the Ontario Source Testing Code (OSTC), reference methods used, and following the pre-test plan prepared by ORTECH (ORTECH Project 21546), approved by the Technology Standards Section on 2014/10/31.

ORTECH's stack gas parameters and emissions reported were not significantly different from the one calculated by the MOECC's TSS for the Thermal Treatment Line 1. Consistency with MOECC's TSS calculations was not assessed for Line 2 results.

Combustion temperature analysis was undertaken by Covanta in order to set up the temperature sensor in a less harsh environmental location. A cursory review indicated suitable correlation. Based on the data, a bias factor was incorporated to reflect actual temperatures at the combustion chamber, when displayed at the control room. Further assessment of this information will be conducted.

Combustion temperature was monitored by Covanta's temperature monitoring system, at 1-minute intervals.

Initial phase of the assessment of the AMESA long term dioxins monitoring system was undertaken during this source testing program. Information is considered inconclusive. More information is required to be gathered when the next source testing program takes place. Covanta and the MOECC TSS are required to harmonize the strategy that will be used to assess

the reliability of this monitoring system. This strategy should be in place by the time the 2016 source testing campaign takes place.

Point of Impingement (POI) concentrations were reported but not assessed in this review; therefore, the compliance of the facility with O.Reg419/05 set limits was not validated.

Sincerely yours,

cc: P. Dunn – MOECC York-Durham D.O. (via email: philip.dunn@ontario.ca)
S. Thomas – MOECC York-Durham D.O. (via email: Sandra.thomas@ontario.ca)
L. Hussain - MOECC SDB TSS (via email: lubna.i.hussain@ontario.ca)
C. Ruddy – MOECC SDB TSS (via email: caitlyn.ruddy@ontario.ca)
File AQ-02 (Durham-York Energy Centre)