Durham York Energy Centre - AMESA Report

Background

The AMESA (Adsorption MEthod for SAmpling Dioxins and Furans) Long Term Sampling System (LTSS or AMESA), installed on each of the two units at the Durham York Energy Centre (DYEC), is a dioxin and furan continuous sampling system designed to meet the requirements of Environmental Compliance Approval (ECA) Condition 7(3). It is designed to extract a sample of flue gas from the outlet of the air pollution control system on a continuous and isokinetic basis for the duration of the sampling period. The sample is drawn from the flue gas duct and cooled. Dioxins and furans in the flue gas sample stream are adsorbed on a replaceable trap filled with adsorbent resin (XAD-2) which is spiked with an internal standard by the laboratory that will complete the analyses following the designated sampling period. It is important to note that while the AMESA samples on a continuous basis, it does not produce results in real time. The trap is removed on an approximately monthly basis and sent to a certified Ontario laboratory to test for Dioxins and Furans. Results are available approximately 3 weeks after receipt.

Operation of the LTSS was initiated in 2015 and the system has been maintained in accordance with current guidance from the AMESA manufacturer, Environnement S.A. Deutschland (ESAD, the European manufacturer of the AMESA system), the North America vendor ENVEA and the AMESA Technical Manual (June 2010).

The AMESA systems are used only for the purpose stated in the ECA evaluation of the LTSS *and* trend analysis and evaluation of Air Pollution Control (APC) equipment performance as documented by ECA Condition 7 (3). Testing, Monitoring and Auditing:

> *Long-Term Sampling for Dioxins and Furans*
>
> *(3) (a) The Owner shall develop, install, maintain and update as necessary a long-term sampling system, with a minimum monthly sampling frequency, to measure the concentration of Dioxins and Furans in the Undiluted Gases leaving the APC Equipment associated with each Boiler. The performance of this sampling system will be evaluated during the annual Source Testing programs in accordance with the principles outlined by 40 CFR 60, Appendix B, Specification 4.*
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> *(b) The Owner shall evaluate the performance of the long-term sampling system in determining Dioxins and Furans emission trends and/or fluctuations as well as demonstrating the ongoing performance of the APC Equipment associated with the Boilers.*

All measurements obtained from the AMESA sampler, whether short term or long-term sampling periods, are not meant to be used for verifying compliance with the regulatory limits for dioxins and furans.

Prior to the implementation of the 2018 AMESA workplan strategy, evaluation of the LTSS identified inconsistent monthly data prevented determining trends of dioxins and furans. As a result, the 2018 AMESA Work Plan was developed to set forth an outline of a revised strategy as summarized in the Table below to improve the consistency of monthly data while continuing the performance evaluation of

the LTSS. The sequence of tasks undertaken below (1) through (6) successfully resulted in the generation of more consistent data.

AMESA Workplan Task Status		
Task	Completion Date(s)	Evaluation Period
1. Improved routine maintenance of the AMESA system using a checklist provided by Environnement S.A. Deutschland (ESAD).	U1 Feb 3, 2018 U2 Mar 21, 2018 U1 Sep 27, 2018 U2 Oct 11, 2018 U1/U2 Mar 21, 2019 U1/U2 Sep 2019 U1/U2 Mar 2020 U1/U2 October 2020	March 2018 – December 2020
2. Swap AMESA Sampling Probes between units.	April 23, 2018	April 2018 – December 2019
3. Isokinetic Flow demonstration for AMESA sample collection	May 29-Jun 1, 2018 September 2018 September 2019 November 11-12, 2020	May 2018 – December 2020
4. Install new gas meters	May 2018	May 2018 - December 2019
5. Conduct 12 (twelve) hour AMESA validation tests concurrently with EPS 1/ RM2 compliance samples for each unit.	September 13-14, 2018 September 11-13, 2019 June 17-18, 2020 November 11-12, 2020	September 2018 – December 2020
6. Adjust long term sampling procedures to allow for additional cleaning and proofing of the AMESA sampling assembly in conformance with outlier data generation	October 2018 First proofed pieces installed April 9, 2019 First pieces with proof analysis delivered November 18, 2019	October 2018 – December 2019
7. If significant deviations in AMESA results between the two units remain following completion of the sampling probe swap, new gas meter installation and two annual maintenance periods, swap the entire AMESA sampling system between units.	March 2020 (After one year of data from Task (6), review result deviations to determine if entire AMESA system needs to be swapped between units) After completing Tasks (1) to (4) and (6), bias between systems diminished to an extent that Task (7) is no longer required and therefore was not implemented.	September 2019 – September 2020 (without equipment swap)

As noted for Task 6 above, and in conformance with ALS Environmental-Burlington (ALS) analytical testing laboratory procedures developed specifically for sampling SVOCs (semi-volatile organics compounds), the AMESA sampling system is removed and sent to ALS prior to the conduct of monthly and validation testing programs. The AMESA sampling sections, titanium bend, union, gooseneck and inner glass tube ("sampling probe equipment") are subjected to a multistep cleaning process, much like all of Ortech's (stack testing company) reference method testing glassware following ALS documentation ID: BU-WI-3000, Organic Glassware/Equipment Cleaning, Proofing and Maintenance. Covanta maintains additional sampling probe equipment such that monthly AMESA sampling can continue in operation while the spare sampling probe equipment is laboratory cleaned and proofed to be subsequently reinstalled prior to the conduct of the Validation Test program. Covanta has also purchased additional sampling probe equipment to improve operational flexibility while proofing in preparation for the annual calibration task. ALS utilizes hexane in substitution for toluene (suggested by the AMESA equipment manufacturer) in conformance with reference method procedures.

Current System Status

1. **Isokinetic Flow Evaluations**

   An initial evaluation of the LTSS was conducted to determine if the flue gas sample system met isokinetic standards. The specified range for the sampling system evaluation is 95 – 115% isokinetic flow pursuant to the AMESA equipment manufacturer. A minimum of nine flow measurements were taken on each unit. This evaluation concluded that the AMESA system is capable of sampling at an isokinetic rate from a single point at 108% and 106% for Unit 1 and Unit 2 respectively. The ability to maintain this isokinetic flow successfully is understood to be a key parameter for any dioxin sampling system to generate representative data of long term DYEC operation. The AMESA probe tip has a flue gas flow sensor and a VFD driven sampling pump. This allows the system to automatically adjust sampling rates to changes in flue gas flow rate. Flow mismatches result in both alarms at the AMESA control panel and alarm codes on the AMESA sampling period flow summary document.

   Evaluations to determine if the flue gas sample system continues to meet isokinetic standards were repeated during the 2018 spring voluntary source test, and the 2018, 2019 and 2020 fall compliance source testing programs. The average velocity measured by the AMESA for several coincident particulate, metals and SVOC test periods were compared. The testing demonstrated successful isokinetic sampling during each of these testing campaigns. (Unit 1 ranged from 102.7% to 108.8% and Unit 2 ranged from 99.0% to 106.3%.)

2. **Results and Discussion of Correlation Testing**

   During voluntary and compliance source testing conducted in fall 2018, spring and fall 2019 and spring and fall 2020, the DYEC sampled for Dioxin and Furans using the *Reference Method for Source Testing: Measurement of Releases of Selected Semi-volatile Organic Compounds from Stationary Sources* (Environment Canada Method EPS 1/RM/2). In order to continue the evaluation of the AMESA, the LTSS was operated concurrently during the above noted reference

method sampling. One AMESA sampling run was completed concurrently during the full duration of performing three reference method sampling runs on each unit. This allows for the comparison of the average of the three-reference method run results to the single AMESA sampling run result for each unit.

Dioxin and furan compliance source test results, representative of normal operations, since 2018, have not only been fairly consistent between test runs, results have also been consistently below the level of quantification (LOQ) of 32 pg/Rm^3 TEQ as established by Environment and Climate Change Canada (compliance tests ranged between 1.51 and 7.27 pg/Rm^3 TEQ @ 11%O_2). This superior level of compliance demonstrated by the operation of the DYEC, below the LOQ, contributes significantly to the difficulty of establishing a correlation between compliance test results and those results measured by the AMESA system.

A summary of annual correlation tests is presented below:

UNIT 1, Sept 13-14, 2018		
REFERENCE METHOD		
RUN 1	< 5.66	pg TEQ/Rm3 (NATO)
RUN 2	< 4.74	pg TEQ/Rm3 (NATO)
RUN 3	< 4.75	pg TEQ/Rm3 (NATO)
AVERAGE	< 5.05	pg TEQ/Rm3 (NATO)
AMESA SAMPLER		
AMESA	< 16.90	pg TEQ/Rm3 (NATO)
% vs RM	235	
	100	Max Allowed

UNIT 2, Sept 13-14, 2018		
REFERENCE METHOD		
RUN 1	< 3.33	pg TEQ/Rm3 (NATO)
RUN 2	< 3.43	pg TEQ/Rm3 (NATO)
RUN 3	< 2.89	pg TEQ/Rm3 (NATO)
AVERAGE	< 3.22	pg TEQ/Rm3 (NATO)
AMESA SAMPLER		
AMESA	< 5.00	pg TEQ/Rm3 (NATO)
% vs RM	55	
	100	Max Allowed

UNIT 1, Sept 12-13, 2019		
REFERENCE METHOD		
RUN 1	< 1.53	pg TEQ/Rm^3 (NATO)
RUN 2	< 1.33	pg TEQ/Rm^3 (NATO)
RUN 3	< 1.67	pg TEQ/Rm^3 (NATO)
AVERAGE	< 1.51	pg TEQ/Rm^3 (NATO)
AMESA SAMPLER		
AMESA	< 6.33	pg TEQ/Rm^3 (NATO)
% vs RM	319	
	100	Max Allowed

UNIT 2, Sept 11-12, 2019		
REFERENCE METHOD		
RUN 1	< 3.92	pg TEQ/Rm^3 (NATO)
RUN 2	< 3.74	pg TEQ/Rm^3 (NATO)
RUN 3	< 2.06	pg TEQ/Rm^3 (NATO)
AVERAGE	< 3.24	pg TEQ/Rm^3 (NATO)
AMESA SAMPLER		
AMESA	< 30.10	pg TEQ/Rm^3 (NATO)
% vs RM	829	
	100	Max Allowed

UNIT 1, June 17-18, 2020		
REFERENCE METHOD		
RUN 1	< 1.77	pg TEQ/Rm^3 (NATO)
RUN 2	< 1.70	pg TEQ/Rm^3 (NATO)
RUN 3	< 1.99	pg TEQ/Rm^3 (NATO)
AVERAGE	< 1.82	pg TEQ/Rm^3 (NATO)
AMESA SAMPLER		
AMESA	< 4.48	pg TEQ/Rm^3 (NATO)
% vs RM	146	
	100	Max Allowed

UNIT 2, June 17-18, 2020		
REFERENCE METHOD		
RUN 1	< 2.14	pg TEQ/Rm^3 (NATO)
RUN 2	< 3.26	pg TEQ/Rm^3 (NATO)
RUN 3	< 2.19	pg TEQ/Rm^3 (NATO)
AVERAGE	< 2.53	pg TEQ/Rm^3 (NATO)
AMESA SAMPLER		
AMESA	< 3.13	pg TEQ/Rm^3 (NATO)
% vs RM	24	
	100	Max Allowed

UNIT 1, Nov 11-12, 2020		
REFERENCE METHOD		
RUN 1	< 31.2	pg TEQ/Rm^3 (NATO)
RUN 2	< 31.0	pg TEQ/Rm^3 (NATO)
RUN 3	< 23.8	pg TEQ/Rm^3 (NATO)
AVERAGE	< 28.7	pg TEQ/Rm^3 (NATO)
AMESA SAMPLER		
AMESA	6.51	pg TEQ/Rm^3 (NATO)
% vs RM	340	
	100	Max Allowed

UNIT 2, Nov 11-12, 2020		
REFERENCE METHOD		
RUN 1	< 6.90	pg TEQ/Rm^3 (NATO)
RUN 2	< 8.31	pg TEQ/Rm^3 (NATO)
RUN 3	< 6.59	pg TEQ/Rm^3 (NATO)
AVERAGE	< 7.27	pg TEQ/Rm^3 (NATO)
AMESA SAMPLER		
AMESA	4.83	pg TEQ/Rm^3 (NATO)
% vs RM	50	
	100	Max Allowed

Notes:

1. NATO/CCMS (1989) toxicity equivalency factors with full detection limit.
2. % vs RM calculated using the Dry Adjusted TEQ Concentration data (% vs RM = [(RM - AMESA)/RM]*100); RM = reference method.
3. % vs RM performed referencing BSI CEN/TS 1948 5 standard (+/- 100%)
4. Subsequent evaluation conducted pursuant to the AMESA Checklist identified Unit 1 carbon feed rate during the 2020 compliance testing was below the setpoint of normal operation.

3. Identification of SOPs

An AMESA Trap Replacement Standard Operating Procedure (SOP) (DYEC ENV 001) was initially developed and implemented based upon ENVEA (formerly Altech) guidance. This SOP was subsequently updated, to include revised guidance, an ESAD cleaning procedure in conformance with EPS 1 RM/2, addition of purges, the requirement to send the system pieces to the analytical laboratory for proofing before installation.

An "AMESA Investigation Checklist" has been developed to be implemented whenever a monthly AMESA result exceeds the Target Range threshold, defined as 100% of the LOQ.

Intended Path Forward

As a result of successfully completing the 2018 AMESA Workplan, specifically Tasks (1) through (6), Covanta will implement the following activities as the intended path forward:

a. Continuation of the AMESA monthly sampling program identified herein with Record Retention
b. LTSS data validation will continue in conformance with the AMESA checklist.
c. Validated LTSS data shall be utilized to evaluate trends in the performance of the facility's APC equipment.
d. Annual AMESA correlation tests will be discontinued following the November 2020 Source Test. Correlation testing will be re-implemented if the AMESA results exhibit an erratic trend.
e. All AMESA records required by ECA conditions 14(3) through 14(8) will be stored at the Facility and will be available for MECP inspection. Monthly data shall be summarized and presented in the annual ECA report.

Data Validation

Ensuring valid data points are used in the calculation of a rolling average is necessary to ensure the system can track trends in APC equipment performance, as opposed to issues with specific sampling periods. As such a review of sample results to assess if a point could be considered an outlier by establishing a Target Range threshold of greater than 100% of the LOQ, i.e. 32 pg/Rm^3 TEQ + 32 = 64 pg/Rm^3 TEQ @ 11% O_2.

As part of the review, the following actions will be taken:

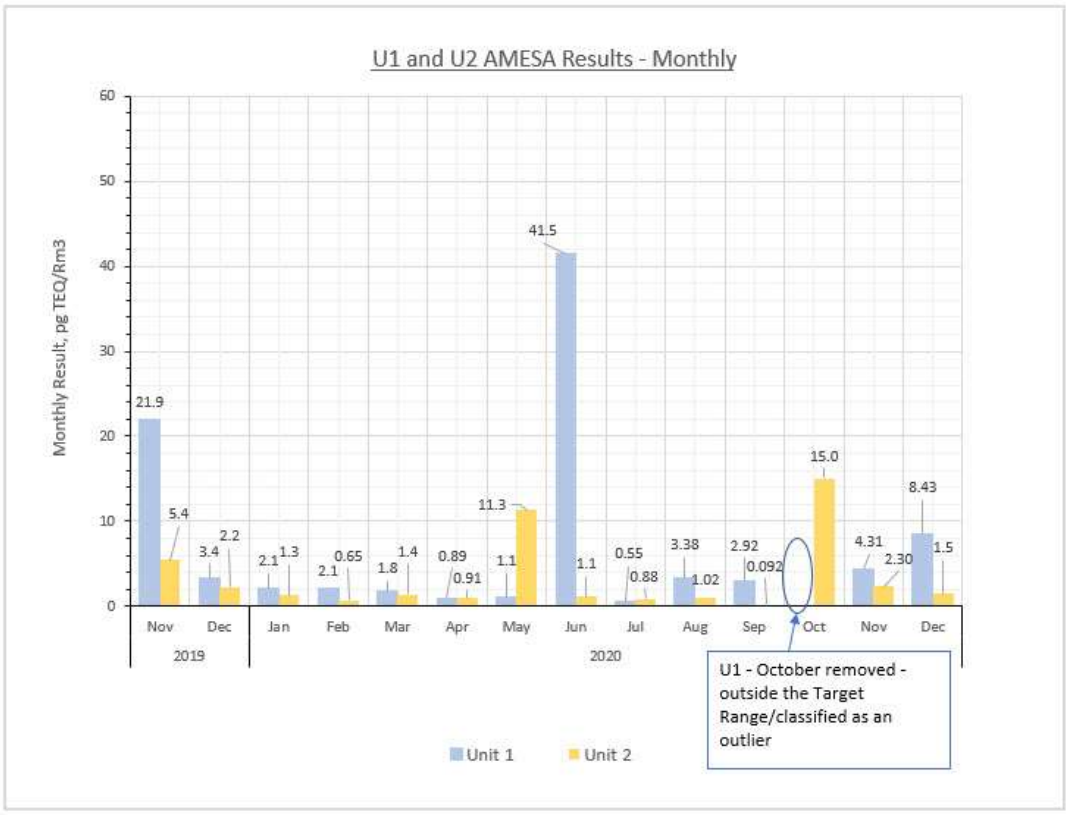
a. An analysis of boiler and APC equipment operating performance will be conducted for the sampling period that generated the potential outlier. Results of the analysis ("the AMESA Investigation Checklist") will be presented in the ECA annual report. Any sample result which exceeds the Targe Range threshold will be evaluated and may not be incorporated into the rolling average. Any sample result exceeding the Target Range threshold will also trigger a due diligence investigation and appropriate corrective action that will be documented in the annual ECA report.
b. Regional Ambient Air Quality (AAQ) monitoring station dioxin and furan data will be analysed for the same period.
c. If three sequential, unexplainably elevated AMESA results ("a trend") occur on the same boiler train and are greater than 100% of the LOQ (64 pg/Rm^3 TEQ, a determination will be made on whether to conduct a new AMESA correlation test during the next scheduled source test.

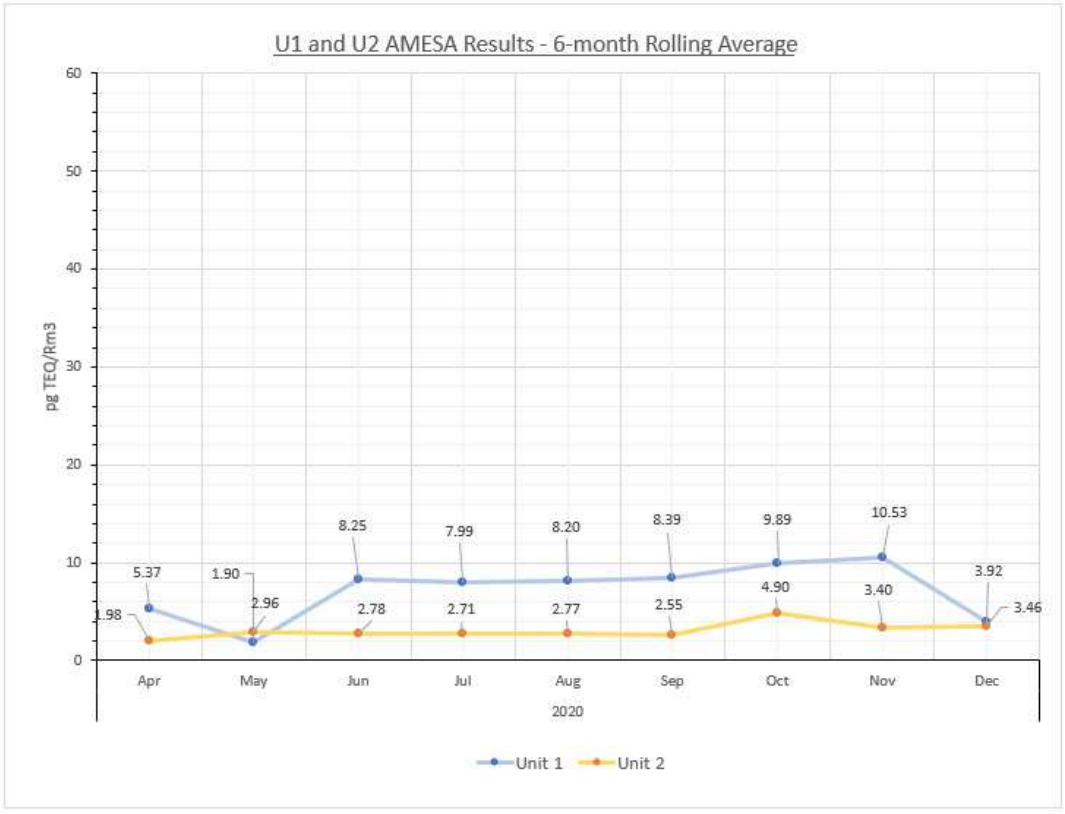
In the event a 12-month rolling average exceeds 100% of the LOQ (64 pg/Rm^3 TEQ @ 11% O_2), operation of the Boiler and APC Equipment shall be verified in conformance with the principles of the 2016 Abatement Plan. This includes completion of the Phase II Inspection Checklist.

a. Regional Ambient Air Quality (AAQ) monitoring station dioxin and furan data will be analysed for the same period
b. If three (3) twelve (12) month rolling averages within a year exceed 64 pg/Rm^3 TEQ, the need to conduct an additional dioxin compliance test to verify APC performance and AMESA calibration shall be discussed with the MECP.

Current AMESA Monthly Results and Rolling Average

The monthly and six (6) month rolling averages are presented below. Twelve (12) month rolling averages will be presented when sufficient data is available.


U1 and U2 AMESA Results - Monthly
Monthly Result, pg TEQ/Rm3
60
50
40
30
20
10
0
21.9
5.4
3.4
2.2
2.1
1.3
2.1
0.65
1.8
1.4
0.89
0.91
1.1
11.3
41.5
1.1
0.55
0.88
3.38
1.02
2.92
0.092
15.0
4.31
2.30
8.43
1.5
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2019
2020
U1 - October removed - outside the Target Range/classified as an outlier
Unit 1
Unit 2


U1 and U2 AMESA Results - 6-month Rolling Average
pg TEQ/Rm3
60
50
40
30
20
10
0
5.37
1.90
8.25
7.99
8.20
8.39
9.89
10.53
3.92
1.98
2.96
2.78
2.71
2.77
2.55
4.90
3.40
3.46
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2020
Unit 1
Unit 2

While AMESA precision has not improved to the point that correlations to BSI CEN/TS 1948-5 are achieved, the work plan activities have resulted in sufficient improvement to demonstrate some confidence in the AMESA to produce data that is appropriate for trending purposes, knowing that outliers will present themselves on occasion.

Boiler #1 AMESA results for October 2020 exceeded the Target Range threshold (64 pg/Rm^3 TEQ) which triggered the completion of the AMESA checklist. Three issues were found:

1. Boiler #1 AMESA incorrectly resumed operation as soon as waste was re-introduced to the boiler on Oct 26 following a day long full plant outage to replace a steam line rupture disk. The Facility was not in steady state operation; therefore, the LTSS may not have met isokinetic flow standards during this time.
2. Boiler #1 AMESA chiller was out of service from October 14-15 due to a malfunction. The AMESA continued to sample flue gas and was not paused during this period of malfunction.
3. When the feed rate was calculated using day bin weight and time required to empty the bin contents ("bin level method"), the true carbon feed to Unit #1 APC equipment was found to be lower than the indicated (normal operating) value of 5.2 kg/hr. This issue was discovered on December 18, 2020 and corrected on the same day. A flexible connection from the carbon silo to carbon feeder was found to be incorrectly adjusted and may have affected the feed rate, contributing to unstable conditions. Moving forward, carbon feed will be verified on a daily basis by bin level method to ensure the normal operation 5.2 kg/hr carbon feed rate is maintained at all times.

Reporting of AMESA Results

AMESA results for the previous year will be reported as part of the annual ECA report. This will commence with the data collected during the 2020 calendar year. In addition, all AMESA records required by ECA conditions 14(3) through 14(8) will be stored at the Facility and will be available for MECP inspection.

AMESA trends of validated data will be presented as a 12-month rolling average together with an analysis to demonstrate the ongoing performance of the APC Equipment.

A summary of non-routine maintenance completed on the AMESA system will be presented as part of the annual ECA report.