AMESA Long Term Sampling System Work Plan

Revised April 11, 2017

1.0 Introduction

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. Dioxins and furans 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. The objective of this Work Plan is to set forth an outline of a revised strategy to improve the consistency of data and complete the performance evaluation of the LTSS. This proposed revised evaluation strategy is based on the data collected to date. The complete set of data will be evaluated to determine if the AMESA provides an accurate estimate of the emissions of dioxins and furans from the DYEC.

2.0 Historical Operation and Proposed Test Methodology Summary

The LTSS was started up and maintained in accordance with guidance from the AMESA manufacturer, Environnement S.A. Deutschland (ESAD, the European manufacturer of the AMESA system), the North America vendor Altech and the AMESA Technical Manual (June 2010). An - AMESA Trap Replacement Standard Operating Procedure (SOP) (DYEC ENV 001) was initially developed and implemented based upon Altech guidance. This SOP was subsequently updated, once to include revised Altech Guidance which was implemented following the initial DYEC source test in October 2015, and subsequently to include ESAD cleaning procedures by rinsing with water, acetone and toluene and later changed to water, acetone and hexane in conformance with EPS 1 RM/2.

Initial AMESA sampling operation was done with blank traps to ensure the system was able to withdraw a sample iso-kinetically. Subsequently, the AMESA probe was removed from the duct during refractory cure of the boiler when oil was combusted. The AMESA LTSS probe was put back into service just prior to the conduct of initial Relative Accuracy (RA) testing of the Continuous Emission Monitoring System (CEMS).

The AMESA probe was initially managed in accordance with the original Altech procedures that stated:

1. LTSS probes are to be cleaned utilizing instrument air only by back flowing instrument air through the nozzle and into the duct,
2. LTSS is “purged” of any contamination buildup followed by sampling with a blank trap for a period up to 48 hours.
3. No chemical or physical cleaning of LTSS probes was recommended.

Using the above procedures and in conformance with the Source Test Plan submitted to the MOECC, the initial evaluation of the AMESA LTSS on October 27th and 28th consisted of three (3) paired tests utilizing a minimum sampling period of four hours. Each paired set included a single point AMESA sampling result with multi-point source testing in accordance with EPS 1 RM/2. The term “multi-point” means that an EPS 1 RM/2 nozzle was used to extract flue gas and moved to various points across the duct diameter

during the test program, as is done for conventional stack tests. The AMESA system uses a single fixed point in the center of the duct to sample the flue gas.

As recommended by ESAD, subsequent validation testing of the AMESA system in 2016 continued to utilize a RA approach, as utilized in the initial validation program which is also consistent with the procedures ESAD has utilized in European installations. These subsequent paired sets, completed in May 2016 and November 2016, however, also extended the sampling period to six (6) hours in accordance with discussions with ESAD, the Regions and the MOECC. The extended sampling period provided additional AMESA sample volume consistent with the total sample volume collected with EPS 1/ RM2. At this time, nine (9) valid AMESA samples have been collected concurrently with EPS 1/ RM2 samples for each DYEC unit, in accordance with the initial Source Test Plan. In addition to the extended sampling time, new ESAD system cleaning procedures were implemented which included a rinsing process of the nozzle and inner tube with distilled water, acetone and toluene. During the conduct of the compliance testing program in 2016, representatives of ESAD were present to train Covanta personnel on this procedure and to thoroughly review and make any adjustments to ensure the proper operation of the AMESA system. Probe/inner tube rinse samples were collected and analyzed separately from the XAD resin trap from the AMESA system.

The following table compares the methodology used in past test events to the current proposed methodology. In previous AMESA tests, Covanta obtained paired sets of data where a manual method test is conducted at the same time, for the same duration and at the same proximate location as the AMESA system. The results of the manual method tests were compared to the corresponding AMESA tests to assess AMESA's accuracy.

Test Date	**October 2015**	**May 2016**	**November 2016**	**Proposed May 2017**
Reference Method	**EPS 1/RM 2**	**EPS 1/ RM 2**	**EPS 1/RM 2**	**EPS 1/RM 2 (Modified)[(1)]**
Number of Reference test runs	3	3	3	5
Manual method sample period (hours)	4	6	6	8
Single point or traverse	Traverse	Traverse	Traverse	Single Point
AMESA Parameters				
Single point or traverse	Single	Single	Single	Single
Number of AMESA Runs	3	3	3	1
AMESA Sampling Period (hours)	4	6	6	40
Source Testing Contractor	Ortech	Ortech	Ortech	Ortech
XAD trap preparation	ALS	Maxxam	Maxxam	ALS
Probe cleaning before installation	No	Water, Acetone, Toluene Rinse	Water, Acetone, Toluene Rinse	Laboratory procedure used for EPS 1/RM 2
Probe rinse after sampling event	No	No	Yes	Yes

Notes: (1) Fixed sampling point

In the proposed methodology, five manual method tests of eight hours duration each are conducted sequentially and compared to a single AMESA test spanning the entire 40 hour period covered by the manual tests. Unlike the standard reference testing method, the proposed validation tests will use a fixed sampling point in the centre of the duct to mirror the behavior of the AMESA system.

3.0 Isokinetic Flow Evaluation Conclusions

The evaluation of the LTSS was conducted in two steps: first, the evaluation of the sampling rate of the DYEC system was conducted to determine if the flue gas sample system met isokinetic standards; subsequently; an initial evaluation of the capability to monitor dioxins and furans was initiated. The specified range for the sampling system evaluation is 95 – 115% isokinetic flow pursuant to the AMESA vendor. 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 long term dioxin sampling system to generate representative data of long term DYEC operation. This includes the ability of the system to automatically adjust to changes in flow due to changes in the steam generation rate and resultant flue gas flow rate. The continuation of demonstrating isokinetic flow will be made from subsequent AMESA LTSS operational records matched against reference method test flows to verify the operation of the AMESA system.

4.0 Summary of AMESA RA Validation Data

Validation data available for evaluation is limited to nine (9) paired sets of samples taken on October 28th – 29th, 2015, May 9th – 11th, and October 27th – 31st, 2016. Data files for these test runs are available and presented in the associated Ortech Source Test Report No. 21546-1 dated November 25, 2015, Ortech Source Test Report No. 21656 dated June 13, 2016, and Ortech Source Stack Test Report 21698 dated December 22, 2016. Tables 1 and 2 summarize the testing results and RA results.

The relative accuracy of the AMESA data as compared to the reference method, is significantly greater than the RA criteria (10%) suggested to be utilized by the ECA, i.e. Performance Specification 4. Relative accuracy also does not seem dependent on whether probe rinse contributions are included in the evaluation. TEQ results appear to decline as the initial run of each 3 run test program is typically the highest result. ESAD has commented that such data trends are typical of results in which the sampling system is plagued with insufficient cleaning. As a result, Covanta began to rinse the AMESA sampling system between monthly sampling events. As single rinses appeared to be insufficient from validation testing results, the sampling system was subsequently double and triple rinsed. These data suggest improvement in reducing the contribution of the rinse, however, as much as 8% was still being contributed from the third rinse. Validation test results also appear to suggest that process variability has declined over time for all data.

The evolution of AMESA procedures from October 2015 through and including May 2017 was based on information provided by ESAD and Altech. A comparison of the paired sets of reference method and AMESA results from the May 2015 program do not indicate a correlation. Covanta in consultation with the Regions implemented discussion with ESAD in an effort to understand the reason for the poor correlation and to improve that correlation during subsequent efforts.

Table 1: Summary of Unit 1 AMESA RA Validation Data [(1)]

RUN #	DATE	AMESA Probe Rinse as a % of Total	AMESA with Probe Rinse	AMESA without Probe Rinse	Reference Method
1	28-Oct-15	N/A	N/A	843	25.9
2	29-Oct-15	N/A	N/A	273	29.6
3	29-Oct-15	N/A	N/A	121	25.5
4	9-May-16	51%	869	430	1169
5	10-May-16	77%	265	61.3	678
6	11-May-16	61%	62	24.3	606
7	27-Oct-16	91%	279	26.2	7.6
8	28-Oct-16	90%	159	15.7	5.9
9	31-Oct-16	79%	60	12.9	14.8
		Relative Accuracy (%)	116	162	

Notes: (1) All results presented as pg TEQ/RM^3 corrected to 25^{o}C and 1 atmosphere, adjusted to 11% O_2, using NATO/CCMS (1989) toxicity equivalency factors with full detection limit.

Table 2: Summary of Unit 2 AMESA RA Validation Data [(1)]

	DATE	AMESA Probe Rinse as a % of Total	AMESA With Probe Rinse	AMESA Without Probe Rinse	Reference Method
1	28-Oct-15	N/A	N/A	559	19.5
2	29-Oct-15	N/A	N/A	258	23.8
3	29-Oct-15	N/A	N/A	182	23.2
4	6-May-16	92%	150	12.4	14
5	9-May-16	83%	45	7.5	9
6	10-May-16	91%	99	8.9	12
7	1-Nov-16	91%	397	34.1	6.8
8	2-Nov-16	90%	324	31.3	6.5
9	3-Nov-16	90%	193	20	6.0
		Relative Accuracy (%)	3718	1862	

Notes: (1) All results presented as pg TEQ/RM^3 corrected to 25°C and 1 atmosphere, adjusted to 11% O_2, using NATO/CCMS (1989) toxicity equivalency factors with full detection limit.

5.0 Proposed AMESA Work Plan

Throughout the evaluation program of the AMESA LTSS, Covanta has utilized the recommendations of ESAD. Both ESAD and Altech have been onsite to verify the installation of the AMESA system. As such, both companies were present either before and/or during the validation test programs conducted in 2016.

Covanta, following consultation with the Regions and ESAD, proposes to modify the AMESA Work Plan to: (1) incorporate AMESA sampling system cleaning procedures that more fully replicate reference method procedures, specifically EPS 1/RM 2; (2) substitute the paired RA approach with the validation protocol included within the proposed Technical Specifications for long term sampling systems for PCDD/PCDF as published by the British Standards Institution (BSI) in April 2015; and (3) modify the reference method to replicate the AMESA sampling approach.

In conformance with ALS procedures developed specifically for sampling SVOCs, the AMESA sampling system will be removed and sent to ALS prior to the conduct of the validation testing program. The AMESA sampling sections, probe, elbow and inner tube assembly will go through a multistep cleaning process, much like all of Ortech's reference method testing glassware following ALS documentation ID: *BU-WI-3000, Organic Glassware/Equipment Cleaning, Proofing and Maintenance*. Covanta maintains duplicate sampling components such that monthly AMESA sampling can continue in operation while the spare sampling components are laboratory cleaned and proofed to be subsequently reinstalled prior to the conduct of the Validation Test program. ALS will utilize hexane in substitution for toluene in conformance with reference method procedures.

Although BSI specifications remain to be independently verified, the variability of RA results collected to date warrants a new approach to evaluate the LTSS. Notably, in recognition of the variability of emission results for the range of TEQ expected, BSI specifications referenced as CEN/TS 1948-5, incorporate a sliding scale for the maximum deviation in relation to the TEQ concentration as enumerated in Table I.1 in Annex I of the BSI specifications and is provided below. We propose to apply this standard to DYEC results.

Concentration ng I-TEQ/m^3 (at standard conditions, dry)	Maxim. deviation %
0,02	100
0,03	60
0,04	45
0,06	40
0,08	37
0,1	35

AMESA sampling is proposed to be conducted in parallel with EPS 1/ RM2 for a minimum continuous period of 40 hours. Each reference method test period will be conducted for eight hours upon which the sampling train will be replaced until a total test period of 40 hours over two days is achieved. This results in one sample for the AMESA system and a mean value of five samples for the standard reference method. This validation testing will be conducted following the completion of the Voluntary Source Testing Program. Both Unit 1 and Unit 2 will be tested simultaneously as described above. In

this manner, sampling interruptions should be minimized to avoid any contamination during the program.

Lastly, it is proposed that the reference method sampling probe will not traverse the flue gas duct during the entire validation sampling period but rather remain stationary in the duct close to the AMESA sampling port. While it is recognized that due to limited vertical space between the baghouse outlet and the induced draft fan, sampling ports are located in a "non-ideal" location as defined by the Ontario Source Testing Code. An "ideal" location is defined as being at least eight stack diameters downstream and at least two stack diameters upstream of flow disturbances. The sampling ports which are utilized are 4.4 duct diameters downstream and 0.7 duct diameters upstream from the nearest flow disturbances. In an effort to reduce any potential issue which could increase variability, especially at the minimal levels of TEQ measured to date, validation testing will occur with both the AMESA probe and the reference method probe being held in a stationary position.

The proposed modifications to the AMESA Work Plan are considered to be a continuation of a best efforts approach to evaluate the performance of the AMESA long term sampling system. ESAD has noted that while the BSI approach remains to be validated they concur on utilizing this approach at this time for the DYEC following consideration of the RA test data collected to date.

ESAD previously noted that long-term sampling AMESA operation (28 +/- day sample periods) do not require the additional solvent cleaning procedure prior to new sample traps being put into operation. ESAD does recommend the use of the solvent cleaning procedure at least every six (6) months. Covanta is planning to continue to utilize solvent cleaning each time a new monthly trap is introduced into the AMESA system for the remaining months of 2017 in accordance to the revised SOP DYEC ENV 001. Ongoing performance of the AMESA system will also include evaluation of long term data collected (28 +/- day sample periods).