AirZOne
Comprehensive Air Quality Services

Report on the Final Review of Assessment Methods for the Durham York Energy Centre Fall 2018 Compliance Emissions Testing

Project J18030

Prepared for:
Gioseph Anello
Manager of Waste Planning & Technical Services
Region of Durham, Works Department
605 Rossland Road East
Whitby, Ontario
L1N 6A3

Prepared by:
Airzone One Ltd.
222 Matheson Boulevard East
Mississauga, Ontario
L4Z 1X1

&

Adomait Environmental Solutions Inc.
160 Cyprus Drive
Kitchener, Ontario
N2M 4R5

February 2019

Contents

LIST OF FIGURES

Introduction

This project was commissioned by the Regional Municipality of Durham to provide independent audits of procedures related to source sampling and assessment of the Durham York Energy Centre (DYEC) during the Fall 2018 Compliance Source Testing campaign. The source testing was undertaken by ORTECH Consulting Inc. (Ortech), using source sampling methods described below and generally following the Ontario Source Testing Code. Media and materials for the sampling were provided by ALS Environmental (ALS) and samples were processed at the ALS laboratories in Burlington. ALS has various accreditations, including the Canadian Association for Laboratory Accreditation Inc. (CALA) accreditation in Canada, which follows the ISO 17025 operational protocols for the laboratory and the methods of processing. This level of accreditation requires validation of methods, evidence for the training and proficiency of analysts and includes producing evidence that procedures are followed as documented at every stage of processing including tracking of samples, tracking of batches of sampling materials, standard reference compounds, surrogate materials and procedures. Levels of documentation include the methods for processing samples and their validation in the laboratory and the data processing and quality assurance/quality control (QA/QC) procedures used to qualify the data. The compliance modelling was conducted by Golder Associates Ltd. (Golder) using methods and guidance outlined in Ontario Regulation 419/05 (O. Reg. 419/05), as well as the facility's Environmental Compliance Approval (ECA No. 7306-8FDKNX).

The field sampling audits were undertaken by Adomait Environmental Solutions Inc. (Adomait). Adomait has over 20 years of experience in undertaking source testing and has conducted hundreds of source testing projects in various environments since 1996. The laboratory results were reviewed by Airzone One Ltd. (Airzone). Airzone and predecessor companies have specialized in air monitoring and analysis and modeling of atmospheric processes since 1979. Airzone has a CALA-certified laboratory headed by Phil Fellin, M.Sc. (45 years of experience with Ontario Ministry of the Environment, Conservation and Parks (MECP), Environment Canada, Airzone and predecessor companies). The review of laboratory results was undertaken by Dr. Lucas Neil, who has 15 years of experience in air monitoring and analysis of environmental samples and proficiency in the modeling of airborne compounds required for this project. The modeling audit was conducted by Airzone and was headed by Dr. Neil, with assistance from Dr. Franco DiGiovanni (20 years of experience with Environment Canada, Airzone and predecessor companies).

Source Sampling Audit

Adomait Environmental Solutions Inc. (Adomait) observed the sampling of two stack trains at the Durham York Energy Centre, focusing specifically on the sampling of semi-volatile organic compounds (SVOC) that was conducted on September 13th and 14th, 2018. Mr. Martin Adomait of Adomait was responsible for observing the stack samplers throughout the process. Mr. Adomait's observations focused primarily on the stack sampling methods and implementation procedures. The observations

included the pre-sampling preparation, sampling, and post-sampling activities. Mr. Andrew Lanesmith observed the instrumentation in the process control room during the sample collection periods.

Process Control Room Operations Review

In the Process Operations Centre, observations were made on one-minute readings as they appeared on the system monitors. Readings were manually recorded every 10 minutes, although deviations were identified when they occurred. As a general observation, parameters being recorded for this review maintained stable readings throughout the observation period. A few deviations were observed and are discussed below; however, these did not persist and quickly returned to stable levels.

1. The sampling of Unit 1 was delayed on September 13th until a starting time of 10:17 am. Maintenance staff noted that a pressure gauge associated with the air pollution control (APC) system did not return to zero following air pulsing. The cause was traced to a blocked check-valve. Replacement of the valve eliminated the problem, thereby allowing the test to proceed.
2. The sampling of Unit 1 was also delayed on September 14th until a starting time of 9:36 am. The HCl analyzer, which normally reads between 2 to 4 mg/m^3 (one-minute average), started showing slight instability. At the same time, samples of recirculated fly ash indicated lower than typical alkalinity, indicating potentially elevated levels of acid gases. Covanta staff increased the lime feed rate to 300 kg/hour until it was determined that HCl concentrations were at appropriate levels, at which point testing began. The lime feed rate was returned to normal levels by 11:30 am. All the HCl spikes were short lived; at no time did the average HCl data exceed the regulatory stack limit (9 mg/m^3 with a 24-hour rolling average).
3. Oxygen concentrations were maintained > 6% (one-hour average) at all times and were generally between 6.6 to 9.3%. The ECA compliance limit is > 6%.
4. CO concentrations were stable throughout the tests with only two spikes observed over the two-day period. The CO spikes did not last beyond the 10-minute observation interval.
5. The quench tower inlet and outlet temperatures showed consistent control of the rising temperatures on both monitoring days during sample collection. The inlet temperatures rose moderately from 168°C to approximately 176°C. The outlet temperatures remained consistent throughout at 149°C to 154°C. Based on previous source testing observations, the quench tower inlet temperatures could be expected to increase during the day (within allowable limits).
6. As a result of consistent outlet temperatures from the Quench tower, the baghouse inlet temperatures remained ~140°C to 146°C. This is approximately the midpoint of the ECA performance requirement. The ECA performance requirement is 120°C to 185°C (Section 6(2)(h)). These readings were consistent with observations from previous stack tests. Consistent temperatures in the baghouse allow comparison between data sets at different times. It is also important when considering the volatilization of various dioxins and furans that may be in particle-bound form in the baghouse. Increased temperatures could volatilize dioxins and furans that are already captured by the baghouse in particle-bound form.
7. Production at the plant is often evaluated in terms of steam flow. Steam flow was typically in the range of 32 to 34 tonne/hour, although readings between 30.1 and 35.2 tonne/hour were

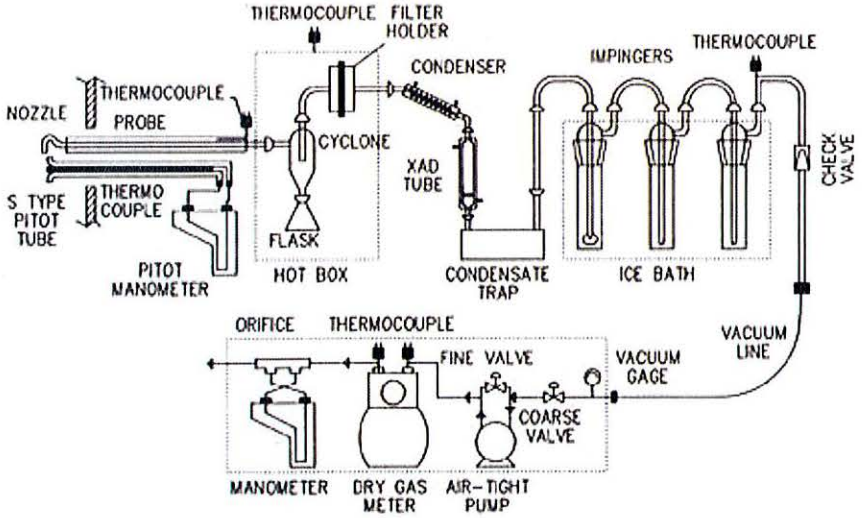
recorded. This was similar to levels observed during other stack testing campaigns at this plant. Similar production also makes the comparison between different stack tests possible.

8. Carbon and lime dosage were consistent with the previous testing campaigns. Carbon doses of ~5 kg/hour are necessary to keep the dioxins in check. As noted in item 2 above, the lime feed rate was increased above normal operating range on the morning of September 14th.
9. Occasional anomalies in the one-minute data were observed in the flowrate and moisture numbers. The calculated moisture typically ranged from 15 to 20% although readings as high as 25% were observed and on one occasion the reading momentarily dropped to 1.8%. Similar to other testing campaigns, it is speculated that this is related to the problems that occur during the reading of dry verses wet oxygen analyzers.

Source Sampling Methods

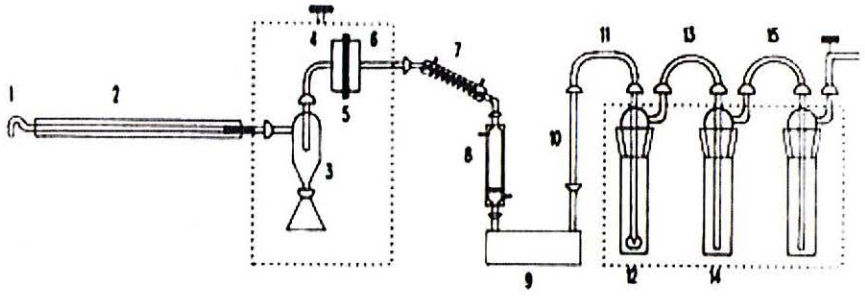
SVOC samples were collected following the procedures in EPS 1/RM/2. Figure 1 shows a diagram of the sampling train required for sampling the stack gas at isokinetic flows. The gas was drawn through a filter, followed by a condenser and XAD trap, then through an impinger condensate trap, and finally a set of three impingers; the first filled with ethylene glycol, the second empty, and the final impinger charged with silica gel. Upon completion of each test, the sampling train is recovered as per the Environment Canada protocol, as shown in Figure 2. Any moisture collected in the U-tubes behind the condenser/XAD filter was transferred to the first impinger before moving the glassware to the recovery area. Pre-cleaned amber jars were used to store the liquid samples and cleaned tinfoil was used to store the filter. Ortech's sampling train differs from that shown in Figure 1 since the condenser and XAD tube are fused into one continuous piece to minimize leaks. Therefore, the condenser could not be soaked for five minutes with acetone and hexane, as recommended in the method. The condenser/XAD trap instead had both ends capped and wrapped in tin foil and the soaking and sample recovery was conducted by the laboratory. This change does not compromise the performance of the method for collection of SVOCs.

Figure 1: SVOC Sampling Train



The sampling and recovery procedures followed the protocols specified by the methods to maintain the integrity of the samples. Ortech had adequate staff to collect samples and transfer the sampling media to the on-site lab for recovery and clean-up. Communications with the control room were maintained continuously to ensure that samples were collected during representative operating conditions.

Figure 2: SVOC Sampling Train Recovery



Container or Sample	Component(s)	Recovery Procedure
1	1, 2, 3, 4	Wash and brush 3 times each with hexane (H) and acetone (A). Rinse 3 times each with H and A.
2	5	Remove carefully from holder. Place on pre-cleaned foil. Fold in half. Place in pre-cleaned glass petri dish.
3	6, 7	Soak 5 minutes each with H and A. Rinse 3 times each with H and A.
4	8	Cap ends and wrap in foil.
5	9, 12	Empty contents into container and rinse each 3 times with HPLC water.
6	6 to 15 except 8	Rinse 3 times each with H and A.

Mark liquid levels on all bottles.
All sample containers are pre-cleaned amber glass bottles with pre-cleaned Teflon lid liners.

Observations During Sample Collection

In general, the procedures detailed in the Environment Canada methods were followed. Since not all procedures are clearly described in the method, some practices may differ slightly. These minor changes do not impact the integrity of the samples, and have been discussed previously. The following are some of the procedures that were observed:

- Clean Up/Recovery:
  - Capped all open connections on the probe and impingers using Teflon tape.
  - All personnel used Tyvek gloves during sampling set-up and recoveries.

  - The sampling team used cleaned amber glass jars for recovery of liquids, cleaned tinfoil for filters and followed Method 23 for sample recovery.
- All leak checks of the dioxin and furan sampling runs were observed at both the start and at the end of all SVOC tests conducted. When the leak checks were successful (i.e., all leak checks were below 0.02 cfm) and thus, the tests could be considered as valid. Leak checks were always performed in a systematic and non-rushed manner to ensure good QA/QC. All trains were leaked checked at ~15 in Hg, which is prescribed by the method. All trains were checked before starting the first traverse and after the first traverse. Following movement of the train to the second traverse, the leak check was repeated, and following the test, it was performed again. In all the testing, only one train developed a leak problem after the movement. However, since the leak check before the move was acceptable, the problem was corrected prior to conducting the second traverse. It is common that leaks can develop during movement of the train due to the multiple glassware joints. All leak checks were recorded at levels less than 0.02 cfm at 15 in. Hg for sampling runs completed on September 13th and 14th.
- The sampling trains typically operated at vacuums less than 7-9 in. Hg. Therefore, when the leak checks were performed, the vacuum of 15 in. Hg was adequate to ensure leak free operation during sampling.
- Stack temperatures reported by the stack testing crew were checked with the auditor in the control room to verify that the temperature was accurate. Verification was completed on both days of dioxin and furan testing (September 13th and 14th). On September 13th, Covanta's control system reported the temperature of the baghouses at 141.6°C and 145.0°C for Units 1 and 2, respectively. The stack gas temperatures reported by Ortech around the same time (+/- 5 minutes) were 142.2°C (288°F) and 143.8°C (291°F). The procedure was performed the following day, as one of the control boxes was changed. Covanta's control system reported the temperature of the baghouses at 141.0°C and 143.0°C for Units 1 and 2, respectively. Ortech reported the stack gas temperatures at values 140°C (284°F) and 143.0°C (289°F) for Units 1 and 2, respectively. This level of variance between the control room and the stack testers is expected and acceptable.
- The sealing of the ports was changed in this sampling round. Probes with an insulated sheathing were used and port covers fitting the opening were manufactured and implemented. Towels were no longer used for sealing the ports, as a rubber gasket was fitted around the slight opening.
- Impinger/XAD temperatures were checked approximately every half hour at each sampling train. Ortech supplied plenty of ice to the crews. The temperatures were maintained in the 5.5°C to 12.7°C (42°F to 55°F). These temperatures improve adsorption of dioxins/furans on the sampling media.
- Adomait recorded dry gas meter correction and pitot factors for comparison with the final report to be issued by Ortech.
- All trains operating at the baghouse outlet locations were inserted into 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 the start of sampling. This also limits loss of any sample from the train.

- Auditing was only conducted on the sampling trains at the Boiler 1 and 2 outlets. The quench tower inlet locations were not monitored in this sampling round, as source sampling was not conducted at these locations.

All samples were handled appropriately and in accordance with the procedures outlined in the method.

Laboratory Processing Audit

At the request of the Regional Municipality of Durham, the processing, handling and analysis of laboratory samples was not audited for the Fall 2018 Compliance Source Testing campaign.

Laboratory Results

As previously commented, the ALS method for condensable particulate matter analysis differs from US EPA Method 202 in one regard: ALS conducts a titration of the aqueous portion of the samples prior to final evaporation and drying to neutralize acid in the sample; whereas the US EPA method only calls for this titration if the dried aqueous fraction cannot reach a constant final weight upon drying. The potential biases and complications from this deviation have been discussed in the Spring 2017 Voluntary Emissions Testing report (dated October 2017). Airzone has reviewed the laboratory results provided by Ortech in Report No. 21840. Based on this review, it is not expected that the deviation from US EPA Method 202 has caused any significant question about the data quality for the condensable particulate matter determination.

As previously reported, the ALS method for dioxins and furans analysis differed from US EPA Method 23 in two regards: (i) the lab used DCM for both Soxhlet extraction steps, and (ii) the use of a Florisil column for clean-up of the samples. The potential biases and complications from this deviation have been discussed in the Spring 2017 Voluntary Emissions Testing report (dated October 2017). As indicated on the laboratory reports for dioxins and furans provided in Ortech Report No. 21840, all standard recoveries for compliance samples were within acceptable limits for US EPA Method 23. Consequently, we are not concerned that either deviation from US EPA Method 23 should cause concerns about the validity of the results.

It should be noted, however, that for the Method Blank sample, all of the dioxin and furan extraction standards were outside the allowable recovery range. When the calculations for concentration are performed the results are corrected for the recovery of the extraction standards. As long as there is sufficient signal to get an accurate concentration in the sample, it is assumed that the behavior of the extraction standard is the same as the target compounds. Since much of the data for dioxins and furans

is low in concentrations, the accuracy in these readings is relatively low, in part due to the uncertainty in the blank level extraction standard recoveries. If the blank level extraction standard recoveries were better controlled (i.e., within allowable range) the low level dioxin and furan data would be more certain. However, since the emission data is very low and below levels of concern (e.g., significantly below in-stack limits and Point of Impingement (POI) standards), we are not concerned with this issue. Furthermore, the dioxin and furan sample concentrations were not blank corrected, in order to be conservative with respect to the modeling of POI concentrations; therefore, the blank sample results have no impact on the in-stack and POI concentrations reported. However, this deviation from allowable method controls should have been commented on by Ortech in Section 6.5.4 of the report, as well as the impact these deviations may have on the final reported results.

Modelling Results

The peer review included an assessment of the dispersion modelling conducted by Golder Associates as outlined in Ortech Report No. 21880 (Appendix 27). Airzone's review was based on the understanding that, as part of the source testing program, a modelling assessment is required as outlined in Schedule "E" of the DYEC's ECA (ECA No. 7306-8FDKNX). As indicated in Schedule "E", the dispersion modelling must be in accordance with O. Reg. 419/05. Furthermore, the facility's approved Emission Summary and Dispersion Modelling (ESDM) report, dated March 2011, was used as guidance regarding all modelling options that were approved by the Ministry of the Environment, Conservation and Parks (MECP) during the review process of the facility's ECA.

An initial review of the emission rates for individual Polycyclic Aromatic Hydrocarbons (PAHs) found a discrepancy between the emission rates provided in Table 78 of Appendices 1 & 2 (Ortech Report No. 21880) and the emission rates provided in the Site-Wide Emission Inventory in the Golder Technical Memorandum (Appendix 27, Ortech Report No. 21880). This discrepancy was highlighted, via email, to Golder, Ortech, the Region of Durham and the DYEC. After Golder and Ortech conducted a review of the data, it was found that the actual PAH concentration results were used in place of the PAH emission rate data for Boiler No. 1. Consequently, a revised spreadsheet was provided to Golder, who subsequently updated the modelling and re-issued their Technical Memorandum with the revised data. The revised Technical Memorandum (dated January 29, 2019) was reviewed and it was determined that the new PAH emission rates were correct and matched the emission rates provided in Table 78 of Appendices 1 & 2 (Ortech Report No. 21880). All other emission rates in the Golder Technical Memorandum (Appendix 27, Ortech Report No. 21880) matched the values provided by Ortech in Table 78 of Appendices 1 & 2 (Ortech Report No. 21880).

With regards to the dispersion model, Airzone was able to confirm that, for DYEC sources, it was implemented in accordance with the requirements set out in O. Reg. 419/05, as required by the facility's ECA. To confirm these requirements, Airzone reviewed the modelling input files provided by Golder and verified that the appropriate default and MECP approved model switches were selected. This was done

by comparing the modelling input files with the facility's ESDM report, and associated modelling input files, as well as consultation with the MECP.

We were also able to confirm the results of the modelling by reviewing the model output files provided by Golder and the emission rates provided by Ortech. Airzone also ran the dispersion model separately and compared our model output results to those provided by Golder. Via this exercise, we were able to reproduce the results provided by Golder, further confirming their results. Our review verifies that the facility's POI values, as a result of the facility's emissions, are within MECP POI standards, guidelines and other reference values.

Conclusions

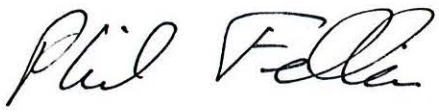
Based on the observations made, both during field sampling and laboratory analysis, Adomait and Airzone are satisfied that both Ortech and ALS collected and analyzed all samples according to standard operating procedures and approved methods. Therefore, at this time, there are no concerns about the validity of the source testing data reported by Ortech.

With regards to the dispersion modelling, Airzone is satisfied that Golder conducted the modelling in accordance with O. Reg. 419/05 and the facility's ECA. The assessment confirms that the facility's Point of Impingement (POI) values are within the specified MECP standards as utilized under O. Reg. 419/05.

Prepared by:

Lucas Neil, Ph.D.
Air Quality Scientist
Airzone One Ltd.

Reviewed by:



Phil Fellin, M.Sc.
Manager, Air Monitoring & Analysis
Airzone One Ltd.

Franco DiGiovanni, Ph.D.
Senior Air Quality Modeller
Airzone One Ltd.