AirZOne
Comprehensive Air Quality Services

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

Project J18030

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October 2018

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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 Spring 2018 Voluntary 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 May 31st and June 1st, 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. Ms. Janice Tessman observed the instrumentation in the process control room during the sample collection periods.

Process Control Room Operations Review

In the Control Room, 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.

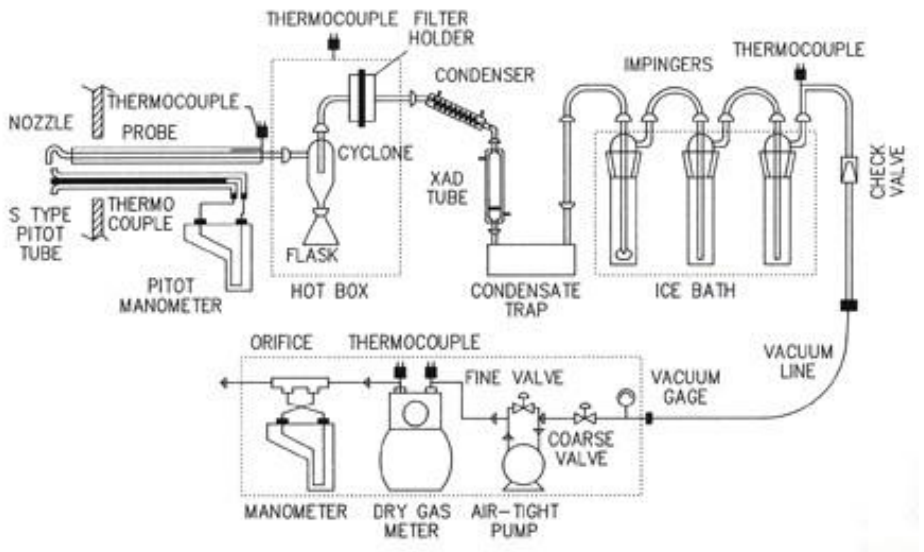
1. Oxygen concentrations were maintained > 6% at all times and were generally 6.9 to 9.1%. The ECA compliance limit is > 6%.
2. CO spikes occurred more frequently when compared to the Fall 2017 Compliance Test. Most of the CO spikes did not last beyond the 10 minute interval. The CO spikes started to cause issues on May 31st due to their frequency. Consequently, the SVOC test on Unit 2 was halted and the Auxiliary Burner was started. However, after one hour, the system had not stabilized and the SVOC test on Unit 2 was abandoned. This decision was reached by Covanta staff. The extended delay of the test would have made the test unrepresentative.
3. CO spikes were less frequent on June 1st and the operation was far more stable. It was surmised, by Covanta staff, that the waste processed on May 31st was much wetter and inconsistent than the waste processed on June 1st.
4. The sampling of Unit 1 was delayed on June 1st until a starting time of 12:46 due to temperature irregularities in two of the Unit's fly ash recirculation streams. The feed from two of the streams had different temperatures suggesting that one of the streams had been blocked. The maintenance crew tried to unclog the recycle pathways, as well as replacing temperature and level sensors. After the repair, the streams again had similar temperatures and the system seemed to function well.
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 167°C to approximately 171°C. The outlet temperatures remained consistent throughout at 149 to 153°C. Based on previous source testing observations, the quench tower inlet temperatures could be expected to increase during the day (within allowable limits); however, this time only moderate increases were observed. In any case, the outlet temperatures remained steady regardless of the inlet temperatures.
6. As a result of consistent outlet temperatures from the Quench tower, the baghouse inlet temperatures remained ~140 to 144°C. This is approximately the midpoint of the ECA performance requirement. The ECA performance requirement is 120 to 185°C (Section 6(2)(h)). These readings were consistent with observations from previous stack tests (~144°C (2017 Compliance Test); 138 to 140°C (Spring 2016); and 142 to 145°C (Fall 2016)). 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 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 in the range of 32 to 34 thousand kg/hour. 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 were utilized. A dose value of 5 kg/hr has been chosen by Covanta, in discussion with MECP, as an operational parameter to ensure exceptional pollution control performance.
9. Occasional anomalies in the one minute data were observed in the flowrate and moisture numbers. The calculated moisture at times were reduced to zero. Similar to other testing campaigns when this was observed, it is speculated that this is related to the problems that occur during the reading of dry versus wet oxygen monitors. Typically, this anomaly would only last for one minute.

Source Sampling Methods

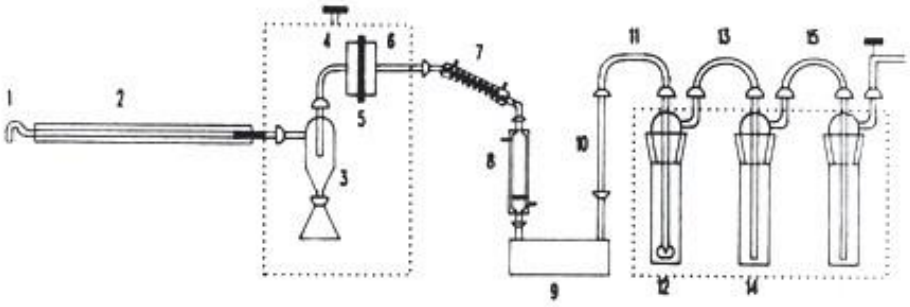
SVOC samples were collected following the procedures in EPS 1/RM/3 and US EPA Method 23. Figure 1 shows a diagram of the sampling train required for sampling the stack gas at isokinetic flows. The gas was drawn through a filter, followed by a condenser and XAD trap, then through an impinger condensate 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.

- Where possible, leak checks were observed at both the start and conclusion of all SVOC tests. Leak checks were always performed at the conclusion of tests. When the leak checks are successful, the source sampling tests are considered valid. Leak checks were always performed in a systematic manner to ensure good QA/QC.
- Stack temperatures reported by the stack testing crew were checked by Adomait's auditor in the control room to verify that the temperature was consistent with the in-stack readings. In all cases, temperatures varied by +/- 2°C. This level of variance is consistent with expected bias between different temperature probes.
- Occasionally, minor aberrations were noted in the velocities of the Method 5 Meter Box control panels. Due to the large vacuum at these sampling locations, the seal on the sampling port would become dislodged at times and interfere with the pitot tubes. The crew members responded quickly and efficiently to repair the seal.
- Impinger/XAD temperatures were checked periodically at each sampling train. Ortech supplied plenty of ice to the crews. The temperatures were maintained in the 7 to 13°C (45 to 55°F). These temperatures are critical as it improves 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 Spring 2018 Voluntary 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 Laboratory Control Sample, one dioxin was outside the allowable range while one furan is at the borderline of the range. Nevertheless, this is not expected to impact the results for the compliance samples.

Modelling Results

The peer review included an assessment of the dispersion modelling conducted by Golder Associates as outlined in Ortech Report No. 21840 (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.

In future reports, Golder needs to correct their referencing with regards to the chemical transformation mechanism they are using for the assessment and formation of Secondary Particulate Matter. Within the body of their report, Section 3.8, they indicate that CALPUFF's RIVAD/ARM3 mechanism is used; however, they indicate that the flag setting within CALPUFF (MCHEM) for this mechanism is 1, when it is, in fact, 3. Furthermore, in Table 2 of the report, they again list the flag setting as 1, which is listed as the MESOPUFF II scheme in the "Comments" column of the table. This inconsistency in reporting the chemical transformation mechanism may cause confusion to readers of the report and should, therefore, be corrected. The correct mechanism, as per the facility's ESDM, is the RIVAD/ARM3 mechanism, which was used in all modelling scenarios for the formation of Secondary Particulate Matter.

When estimating emission rates for metals, Ortech has indicated the following:

> "In instances where all analyses were reported to be below the detection limit for a given metal, the value of the detection limit for the fraction most likely to contain that metal was used to

calculate emission data, and the remaining fraction was assigned a value of zero. In instances where any given fraction was detected that value was used to calculate emission data, and the remaining undetected fraction were assigned a value of zero." – Section 7.7 (pg. 40)

As we have indicated in our previous report for the Fall 2017 Compliance Emissions Testing report (dated February 2018), this runs contrary to both MECP (as provided to Airzone) and US EPA guidance, as communicated to Airzone. We understand, however, that Ortech has been directed in the past to conduct the assessment as they indicate in their report. Consequently, at our request, Ortech has consulted with the MECP and confirmed that their method, as written in the report, is acceptable to the MECP. This communication has been provided to Airzone and will be kept on file for future reference.

On July 1, 2018, the MECP made amendments to section 10 of O. Reg. 419/05, which specifies the operating conditions that must be considered as part of an application for an ECA. One amendment that may specifically impact the DYEC is the addition of subsection (1.9), which states:

(1.9) Despite subsection (1.5), the Director may, by written notice, require a person making a determination for the purposes of paragraph 1 of subsection (1) to consider a scenario specified in the notice that is not of a type mentioned in subsection (1.5) for an averaging period specified in the notice, if the Director is of the opinion that at least one of the following criteria is met:

1. There may be an acute effect associated with a contaminant discharged during the scenario.
2. The scenario may occur too frequently and permit discharges of a contaminant that may,
    i. result in a contravention of section 19 or 20 if the scenario were considered in making a determination for the purposes of paragraph 1 of subsection (1), or
    ii. in the case of a contaminant in respect of which neither section 19 nor 20 applies, cause an adverse effect. O. Reg. 109/18, s. 3 (2).

While this testing, and subsequent modelling, is not part of an ECA application, it is not clear at this time how the MECP will apply these amendments to source testing campaigns and corresponding modelling, which must follow O. Reg. 419/05 guidance. Consequently, we would recommend that the Region of Durham direct Ortech to consult with the MECP to confirm how this amendment may impact the required modelling as part of future source testing and if it needs to be considered for future reports. This correspondence should then be forwarded to Airzone for our files for future reference.

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

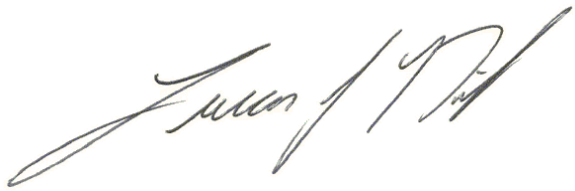
facility's Point of Impingement (POI) values, as a result of the facility's emissions, are within MECP POI standards, guidelines and other reference values.

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:



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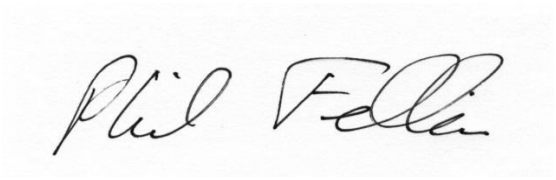

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