Preliminary Report
PEER REVIEW OF THE DURHAM YORK ENERGY CENTRE ESDM REPORT

Prepared for:

The Municipality of Clarington

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EXECUTIVE SUMMARY

SENES Consultants Limited was retained by the Municipality of Clarington to provide a Peer Review of the Emission Summary and Dispersion Modelling (ESDM) Report that was submitted by Golder Associates (on behalf of Covanta Energy) in support of the Basic Comprehensive CofA (Air) for the Durham-York Energy Centre. The purpose of the review was to assess whether the ESDM Report was completed in a reasonably comprehensive manner, using an approach that was consistent with standard practices and protocols, and was consistent with the conditions of the EA Approval.

The information provided in the EA itself, the EA Approval and the ESDM Report (in addition to supporting electronic files) was reviewed in terms of completeness, accuracy and the overall approach of the assessment. This was done in effort to determine whether the assessment was comprehensive, was consistent with what was completed in support of the EA, and if any differences were noted, whether these would fundamentally change the overall conclusions of the report.

The review was completed in three parts, including: (a) the approach used in the Air Quality Assessment completed in support of the EA, and conditions of the EA Approval; (b) the emission inventory; and (c) the air dispersion modelling, including (i) the meteorological data that was used in the assessment, and (ii) the model configuration.

The overall conclusion of the review is that the ESDM Report was reasonably well done, in a manner consistent with industry standard protocols and practices as well as Ontario Ministry of the Environment requirements for emissions inventories and air dispersion modelling assessments. However, some potential issues were identified, which led to the development of various recommendations. These are as follows:

EA Approval and Related Conditions

The EA Approval outlines requirements for the installation of a continuous emissions monitoring system and specifies conditions on how these systems are to be used operationally. It also specifies that the timing and frequency of monitoring is to be outlined in the conditions of the CofA (Air). It is recommended that the Municipality request a copy of the *DRAFT* CofA (Air) for review to ensure that these conditions are acceptable to the Municipality.

In addition, some of the parameters may be monitored via source testing rather than continuous emissions monitors. It is recommended that the facility be required to conduct source testing of the Main Stack on an annual basis, on a waste stream of typical waste composition. It is also recommended that the proponent be required to update the ESDM Report to demonstrate

continued compliance with O.Reg.419 POI (Point of Impingement) limits should the testing indicate that the measured emission rates are higher than those used in the current ESDM Report.

The proposed operational monitoring system will include a dioxins and furans sampling device. The EA indicates that time integrated samples would be collected on approximately a monthly basis, followed by laboratory analysis, which would result in a time lag of one or two weeks before the laboratory results are available. As a result, it is unclear how this will be used as an operational monitor. It is therefore recommended that the frequency/duration of sample collection be shortened if the data is intended to be used for operational control.

In addition, there has been no provision for continuous sampling for mercury, as is encouraged in MOE Guideline A-7. As such, it will likely be sampled as part of the expected annual source testing campaign. However, given that there is no pre-sorting of the waste, it is likely that some mercury will enter the waste stream. It is therefore recommended that a time integrated, continuous mercury sampling system be considered for installation at the facility.

Emissions

The emissions inventory for the Durham York Energy Centre used a combination of emissions testing data provided by the Proponent (Covanta Energy), U.S. EPA AP-42 emission factors and the EPA FIRE database, data from the MOE Peel Human Health Risk Assessment (Peel HHRA), manufacturer's specifications and the York Durham (YD) generic risk assessment.

As mentioned earlier in this report, the DYEC has applied for a Basic Comprehensive CofA. A Basic Comprehensive CofA provides limited operational flexibility, allowing a proponent to operate within a maximum operating envelope which permits changes to be made to a facility (i.e. the addition of a new pieces of equipment, changes to process materials, modifications to air pollution control systems, etc.) without applying for an amendment to the CofA. It is recommended that the limited operational flexibility conditions for the DYECs Basic Comprehensive CofA be reviewed/renewed on a maximum 5 year interval, and that the submission materials be provided to the Municipality of Clarington for review and comment prior to issuance of the renewal.

A discrepancy was identified with the manner in which particulate emissions were estimated in the EA in comparison to the ESDM Report. The ESDM Report addresses filterable and total particulate matter separately, whereas the particulate emission rate used in the EA was noted in the ESDM Report to be "filterable particulate matter" only (i.e., the EA did not account for condensable particulate). However, this distinction was not indicated in the EA documentation. As a result of these differences the $PM_{2.5}$ emission rate used in the EA is lower than would be expected, as only the filterable portion was included. The ESDM Report used a $PM_{2.5}$ emission rate that is based on total $PM_{2.5}$ (filterable + condensable), and as such is more than a factor of 2 times higher than that used in the EA. However, background (non-facility) $PM_{2.5}$ concentrations accounted for a major fraction of the resulting $PM_{2.5}$ concentrations in the EA. The facility related emissions contributed only a very small portion of the overall concentrations. Thus, the inclusion of total $PM_{2.5}$ (filterable + condensable) would not have fundamentally changed the conclusions of the EA. Regardless, this may lead to the perception that the EA was not sufficiently conservative.

The Air Emissions Operational Requirement listed in Schedule 1 of the EA Approval applies to Particulate Matter, and does not specify whether it is for total or filterable particulate matter. The air dispersion modelling and subsequent risk calculations completed in the EA were based on a $PM_{2.5}$ emission rate that is equivalent to the Operational Requirement of 9 mg/Rm^3. It is therefore recommended that the Municipality request that the EA Operational Requirement of 9 mg/Rm^3 be applied to filterable PM (as is typically required) in addition to Total $PM_{2.5}$ (filterable + condensable) if this is technically feasible from an operational perspective. If this is not feasible, it is recommended that the risk calculations related to fine particulate matter ($PM_{2.5}$) that were completed for the EA be revised and submitted as an addendum to the ESDM Report such that the calculations are consistent with the modelled emission rates and predicted concentrations presented in the ESDM Report.

Some potential issues were also identified with the source data and basis of the emission rates for a number of other contaminants that were assessed in the ESDM Report. The emission rates provided in the ESDM Report for many contaminants were based on "engineering calculations", based on data provided by Covanta. The calculations were based on a measured in-stack concentration from another facility, and applied to the Durham York Energy Centre using the expected stack conditions (flow rate, temperature, etc) at the future facility.

It would be expected that these data were collected from a facility of a similar size and similar technology (in terms of process system – firing grate, etc). However, the ESDM Report does not clearly indicate whether the reference facility was similar in nature in terms of the size, basic incineration approach, installed air pollution control equipment and process conditions under which the test data were collected (waste firing rate, etc). Thus it is not clear whether the concentrations are representative of the conditions that would be expected at the Durham York Energy Center. Therefore, it is recommended that the Proponent either provide additional details to demonstrate that the test data are representative and meet criteria for "above average" quality or rerun the analysis using the most conservative emission rates (potentially AP-42 emission factors).

The emission rates for many of the metal compounds were estimated based on information provided by Covanta Energy (with the issues identified above) as well as data from the MOE Peel HHRA (which is presumably the Algonquin Power facility located in Brampton, Ontario).

The Algonquin Power facility is of a similar size to that of the Durham York Energy Centre; however, the ESDM Report does not indicate whether the incineration processes/technologies are similar in nature. It is recommended that the Proponent either provide additional details to demonstrate that the test data is representative or use more conservative emission rates (potentially AP-42 emission factors).

With respect to emissions of Volatile Organic Compounds (VOCs), a comprehensive list of VOCs was considered in the assessment. However, neither the EA nor the ESDM Report included assessments for acetone, acrolein, styrene, and mesitylene (1,3,5-trimethylbenzene), all of which have POI standards in Schedule 3 of O.Reg.419, and are expected to be emitted from the facility as indicated in the EA. The lack of an assessment of acrolein and acetone were similarly identified as an issue by the MOE (Approvals Branch) during the review of the EA documentation. While the EFW facility would likely be a relatively minor source of these contaminants, these contaminants should be included in the assessment of compliance with O.Reg.419. This is particularly true for acrolein, which has a relatively stringent POI limit. It is therefore recommended that the ESDM Report be amended to include an assessment of acetone, acrolein, styrene and mesitylene.

Start Up and Shutdown conditions can be of concern since emission rates are often elevated during these periods. Several different scenarios were used to assess Start Up conditions, including the operation of a single train with auxiliary burner and both trains with auxiliary burner, at different firing rates. However, the Start Up assessment used the same concentration values that were provided by Covanta to represent emission rates from the Main Stack under normal operations. Given that it is unlikely that the testing was completed during a Start Up phase, these concentrations may not be representative of the expected Start Up conditions at the DYEC. As such, it is recommended that the Proponent either provide additional details to demonstrate that the test data is representative, or use more conservative emission rates (potentially AP-42 emission factors).

Air Dispersion Modelling

O.Reg. 419 specifies a list of approved air dispersion models appropriate for use in Ontario, which includes the AERMOD model and soon to be phased out ISC-PRIME model. Proponents may also request use of an alternate model if it can be shown that the use of an alternate model is more appropriate than any of the approved models. Due to the proximity of the proposed facility location to Lake Ontario, the Proponent requested to use the CALPUFF model, which is a non-steady state, Lagrangian puff model. The MOE granted the request, since the CALPUFF model is more appropriate at representing the complex meteorology that exists at a land-water boundary.

As part of the Peer Review, SENES reviewed the input meteorological data, as well as the general inputs to the dispersion modelling portion.

The meteorological data used in both the EA and the ESDM Report was previously reviewed and approved by the MOE. These data were provided to SENES electronically by the MOE. The data files were then reviewed by SENES staff with respect to data inputs and model switches used, in addition to the general approach used in the development of the data.

SENES' review had initially indicated that there were potential issues with the MOE Approved meteorological data. However, based on MOE review and comments, these potential issues are not expected to result in significant differences to the model predicted concentrations.

The general model set up was also reviewed to assess whether the proposed facility layout was accurately represented in the model in terms of source locations and building wake effects. In addition, emission sources were reviewed to ensure that they were represented by the appropriate model source type (i.e. Point source, Volume source). Some issues were identified with the manner in which the building information was entered into the BPIP model. However, the Main Stack is high enough that it is unlikely to experience significant plume downwash. Therefore, any changes to the BPIP inputs are unlikely to have a significant effect on the model predictions.

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1.0 INTRODUCTION AND PURPOSE

The Durham York Energy Centre (DYEC) is a proposed energy from waste facility to be located in Durham Region, within the Municipality of Clarington. The proposed facility was subject to a provincial Environmental Assessment (EA), which received approval from the Ontario Ministry of the Environment in November, 2010. An application for a Basic Comprehensive Certificate of Approval (CofA) (Air) for the facility was submitted to the Ontario Ministry of the Environment in March, 2011.

SENES Consultants Limited was retained by the Municipality of Clarington to provide a Peer Review of the Emission Summary and Dispersion Modelling (ESDM) Report that was submitted in support of the Basic Comprehensive CofA (Air). The purpose of the review was to assess whether the ESDM Report was completed in a reasonably comprehensive manner, using a general approach that was consistent with standard practices and protocols in the general approach, and was consistent with the conditions of the EA Approval.

As part of this process, SENES reviewed the Air Quality Assessment completed in support of the EA, as well as the EA Approval documentation, the ESDM Report, and the air dispersion modelling files (both the meteorological inputs and model configuration and source inputs). An interactive process was followed, which included discussions with staff at the Ontario Ministry of the Environment and Golder Associates (the authors of the ESDM Report, representing the Proponent, Covanta Energy) to apprise them of issues identified during the course of the review. In addition, information on some of these issues was provided to MOE to permit additional discussions and potential resolution in advance of completion of the Peer Review report.

The review findings are outlined in the following sections of this Report.

2.0 ESDM REPORT REVIEW

The information provided in the EA, EA Approval and ESDM Report (in addition to supporting electronic files) was reviewed in terms of completeness, accuracy and the overall approach of the assessment. This was done in effort to determine whether the assessment was comprehensive, was consistent with what was completed in support of the EA, and if any differences were noted, whether these would fundamentally change the overall conclusions of the report.

As outlined earlier, the review was completed in three parts, including: (a) the approach used in the Air Quality Assessment completed in support of the EA, and conditions of the EA Approval; (b) the emission inventory; and (c) the air dispersion modelling, including (i) the meteorological data that was used in the assessment, and (ii) the model configuration. These are discussed in detail in the following sections.

2.1 CONDITIONS OF THE EA APPROVAL

Several conditions placed on the approval of the Environmental Assessment are pertinent to this review. Most of these pertain to the emissions monitoring system that will be installed at the facility. This is discussed in detail in the following section.

2.1.1 Emissions Monitoring and Operational Requirements

Sections 12 and 13 of the EA Approval outline requirements for the installation of a continuous emissions monitoring system and specify conditions on how these systems are to be used operationally. The continuous emissions monitoring system must be installed according to a Plan that is approved by the Director. The Plan must outline the sources and contaminants to be monitored, in addition to details regarding reporting frequency and protocols to be established in the event that the measured concentrations exceed the Air Emissions Operational Requirements that are also specified in the EA Approval. The contaminants outlined in Schedule 1 of the EA Approval are the minimum that must be monitored.

Air Emissions Operational Requirements are specified in Section 13 and Schedule 1 of the EA Approval. These Operational Requirements outline the MOE's requirements that the facility is expected to meet the limits in Schedule 1 at all times with the exception of start up, shut down or malfunctions. The EA Approval specifies that the timing and frequency of monitoring is to be outlined in the conditions of the CofA (Air). It is recommended that the Municipality request a copy of the *DRAFT* CofA (Air) for review to ensure that these conditions are acceptable to the Municipality.

The Air Emissions Operational Requirements are shown in Table 2.2 as follows:

Table 2.1 Air Emissions Operational Requirements

Contaminant	Operational Requirement
Particulate Matter	9 mg/Rm^3
Cadmium	7 ug/Rm^3
Lead	50 ug/Rm^3
Mercury	15 ug/Rm^3
Dioxins and Furans	60 pg/Rm^3
Hydrogen Chloride	9 mg/Rm^3
Sulphur Dioxide	35 mg/Rm^3
Nitrogen Oxides	121 mg/Rm^3
Organic Matter	50 ppmdv = 33 mg/Rm^3
Carbon Monoxide	35 ppmdv = 40 mg/Rm^3
Opacity	5 % (2 hour avg) 10% (6 minute avg)

The EA Approval also specifies that the continuous emissions monitoring system must be operational prior to the receipt of waste at the site. It should be noted that the wording of the condition in Section 12.4 of the EA Approval is such that some of the parameters listed above may be monitored via source testing rather than continuous emissions monitors. The frequency of the source testing is expected to be on an annual basis, and will likely be included as a condition of the CofA as outlined in Ontario Ministry of the Environment Guideline A-7 - *Air Pollution Control, Design and Operation Guidelines for Municipal Waste Thermal Treatment Facilities*. It is recommended that the facility be required to conduct source testing of the Main Stack at a minimum of an annual basis, and that the source testing be carried out on a waste stream that is representative of the typical waste composition that is fed into the facility. Should source testing indicate that the measured emission rates are higher than those used in the current ESDM Report, it is recommended that the proponent be required to update the ESDM Report to demonstrate continued compliance with O.Reg.419 POI limits.

The ESDM Report indicates that the facility will continuously monitor the following:

- Baghouse outlet
  - Opacity,
  - Moisture,
  - Oxygen content (O_2),
  - Nitrogen oxides (NO_x),
  - Sulphur dioxide (SO_2),
  - Hydrogen chloride (HCl),

  - Hydrogen fluoride (HF), and
  - Ammonia (NH_3).
- Economizer outlet
  - Oxygen,
  - Sulphur dioxide, and
  - Carbon monoxide.

In addition to the parameters listed above, the ESDM Report indicates that the system will also include the following "Operational Monitoring Equipment" which will provide feedback on the combustion units'operations:

- Temperature measurements in the combustion zone or a surrogate,
- Long term integrated continuous dioxin sampling device,
- Flue gas stack exit temperature,
- Temperature and pressure of the steam for each boiler, and
- Mass flow rate of steam for each boiler.

It is unclear how the proposed continuous dioxins sampling device will be used as an operational monitor. Based on the information provided in the EA, the time integrated samples would be collected on approximately a monthly basis, followed by laboratory analysis. There would likely be a time lag of one or two weeks before the laboratory results are available. This type of timing would make it very difficult to use the information operationally, as the conditions that may lead to higher monthly results would have long since passed before the data is available. However, the dioxin and furans cartridge samples can be collected more frequently, provided that the laboratory Method Detection Limits (MDLs) can be met. It is recommended that the frequency/duration of sample collection be shortened if the data is intended to be used for operational control.

In addition, there has been no provision for continuous sampling for mercury. As such, it will likely be sampled as part of the expected annual source testing campaign. However, given that there is no pre-sorting of the waste stream, it is likely that some mercury will enter the waste stream. Similar to the proposed dioxin and furans sampler, systems are available to collect time integrated continuous mercury samples. MOE Guideline A-7 encourages proponents to explore the use of such techniques for continuous operational sampling of mercury and dioxins and furans. Use of such a system in the short term (i.e. 1st year of operation) could demonstrate whether the waste stream is adequately segregated or whether a pre-sorting system is should be considered to remove batteries and other mercury containing wastes. It is therefore recommended that a time integrated, continuous mercury sampling system be considered for installation at the facility.

2.2 EMISSIONS INVENTORY

An emissions inventory is an accounting of the expected air pollutant emissions from a facility. Generally, emissions inventories for facilities that do not yet exist are completed using information and data from similar emission sources (e.g., existing Energy from Waste (EFW) facilities) and operations. This can be from actual facility emissions tests from specific facilities that are of a similar size and nature, manufacturer's data or from information in databases of generalized, production-based emission factors (e.g., U.S. EPA AP-42 database).

The emissions inventory for the Durham York Energy Centre used a combination of emissions testing data provided by the Proponent (Covanta Energy), U.S. EPA AP-42 emission factors and the EPA FIRE database, data from the MOE Peel Human Health Risk Assessment (Peel HHRA), manufacturer's specifications and the York Durham (YD) generic risk assessment.

As indicated previously, the DYEC has applied for a Basic Comprehensive Certificate of Approval. This type of approval provides limited operational flexibility to proponents by allowing them to operate within a maximum operating envelope which permits changes to be made to a facility (i.e. the addition of a new pieces of equipment, changes to process materials, modifications to air pollution control systems, etc.) without applying for an amendment to the CofA, provided that they do not exceed the maximum operating envelope. The conditions related to the limited operational flexibility are generally reviewed and renewed every five years. It is recommended that the limited operational flexibility conditions for the DYECs Basic Comprehensive CofA be reviewed/renewed on a maximum 5 year interval, and that the submission materials be provided to the Municipality of Clarington for review and comment prior to issuance of the renewal.

2.2.1 Criteria Air Contaminants

Criteria Air contaminants (CACs) are a suite of air pollutants that cause smog, acid rain and have the potential to affect human and environmental health. CACs include:

- Nitrogen Oxides (NO_x)
- Sulphur Dioxide (SO_2)
- Carbon Monoxide
- Ozone[1]
- Lead
- Particulate Matter

[1] Note that the DYEC is not a significant source of ozone and thus it was not assessed as a primary (emitted) pollutant under O.Reg.419

- Total Particulate Matter (TSP),
- Particulate Matter less than 10 microns (PM_{10}), and
- Particulate Matter less than 2.5 microns ($PM_{2.5}$).

2.2.1.1 Data Quality

The emission rates provided in the ESDM Report for these contaminants were based on "engineering calculations", which indicates that they were provided by Covanta. The calculations were based on a measured in-stack concentration from another facility, and applied to the Durham York Energy Centre using the expected stack conditions (flow rate, temperature, etc) at the future facility.

It would be expected that the data were collected from a facility of a similar size and similar technology (in terms of process system – firing grate, etc). However, the ESDM Report does not clearly indicate whether the reference facility was similar in nature in terms of the size, basic incineration approach, and installed air pollution control equipment. Also, it does not detail the process conditions under which the test data were collected (waste firing rate, etc), which would typically be at maximum firing capacity. Smaller or larger units firing at different rates (i.e. tonnes waste per day) could result in different exhaust concentrations. Thus it is not clear whether the concentrations are representative of the conditions that would be expected at the Durham York Energy Center.

Ontario Regulation 419/05 – Local Air Quality (O.Reg.419) outlines the requirements for the emission rates used in an ESDM Report. Section 11 of O.Reg.419 states that emission rates should be "*The emission rate that, for the relevant averaging period, is at least as high as the maximum emission rate that the source of contaminant is reasonably capable of for the relevant contaminant."* The ESDM Report also indicates that the emission rates provided by Covanta have been assigned a rating of "above average". Section 8.3.2 of MOE Guideline A-10 "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" (the Procedure Document) outlines the types of data sources that would be considered to be of above average quality. Without an indication of the type of unit that was tested (size and firing technology) and the rate at which it was tested, the data does not meet an "above average" quality classification. In the absence of these details data would likely be considered to be of "average" quality, with the highest emission rate from these sources selected, as per O.Reg. 419. Therefore, it is recommended that the Proponent either provide additional details to demonstrate that the test data are representative and meet criteria for "above average" quality or rerun the analysis using the most conservative emission rates (potentially AP-42 emission factors).

2.2.1.2 Filterable Versus Total Particulate

The ESDM Report addresses filterable and total particulate matter separately. Filterable particulate matter is the fraction of particulate matter that is captured on a filter during a source emissions test. The EA was completed using a particulate emission rate that was estimated based on the performance limit of 9 mg/Rm^3. The emission rate used in the EA was noted in the ESDM Report to be "filterable particulate matter" only. However, this distinction was not indicated in the EA, which conservatively assumed that all of the particulate emissions would be in the fine fraction, and thus used the same emission rate for PM_{10} and $PM_{2.5}$ (i.e., the EA did not account for condensable particulate, as discussed below).

A portion of the particulate known as condensibles passes through the filter and is captured in a set of impingers. In terms of $PM_{2.5}$, a significant portion of the total emissions are typically in the condensable fraction.

Most source testing limits and performance guarantees are applied to the filterable portion of particulate emissions only. For example, the MOE Guideline A-7 is silent on whether the limits apply to total or filterable particulate matter. Anne Maria Pennanen, Air Pollution Source Control Engineer at Standards Development Branch, Ontario Ministry of the Environment was consulted on what was required by A-7, since this was not specified in the revised guideline. She indicated that "*the particulate limits in A-7 are specifically for filterable particulate, as is consistent with the Ontario Source Testing Code*".

The Ontario Source Testing Code (OSTC) indicates that the "impinger catch" is not to be included in the total for determination of the particulate emission rate for Method ON-5. In essence, this means that only filterable particulate is included in the reported particulate emissions from source testing. However, Mr. Guillermo Azocar, MOE Source Assessment Specialist was consulted on the requirement to include the condensable fraction in source testing assessments for $PM_{2.5}$. He indicated that the OSTC is currently in the final stages of revision and will include a new method ON-7 for PM_{10} and $PM_{2.5}$ (determination of particle size distribution). This method requires that the measurement include both the filterable and condensable fractions. In his opinion, once the OSTC is posted, both filterable and condensable will be required for assessment of compliance for fine particulate (PM_{10} and $PM_{2.5}$) via source testing.

As a result of the differences noted above, the $PM_{2.5}$ emission rate used in the EA is lower than would be expected, as only the filterable portion was included. The ESDM Report used a $PM_{2.5}$ emission rate that is based on total $PM_{2.5}$ (filterable + condensable), and as such is more than a factor of 2 times higher than that used in the EA. Since $PM_{2.5}$ emissions are related to potential health impacts, the approach used in the EA and the corresponding Human Health Risk Assessment is of concern. However, the magnitude of the resulting $PM_{2.5}$ concentrations in the

EA was primarily driven by the background (non-facility) $PM_{2.5}$ concentrations. The facility related emissions contributed a very small portion of the overall concentrations. As a result, an increase in the facility related concentration of $PM_{2.5}$ by a factor of 2.3 would only increase the concentration ratios presented for normal operations the EA to 0.87 from 0.84. The resulting concentration ratio remains below the threshold of 1. Thus, the inclusion of total $PM_{2.5}$ (filterable + condensable) would not have fundamentally changed the conclusions of the EA. Regardless of the conclusion, this may lead to the perception that the EA was not sufficiently conservative.

The Air Emissions Operational Requirement listed in Schedule 1 of the EA Approval applies to Particulate Matter, and does not specify whether it is for total or filterable particulate matter. Nor does it specify that the concentration is based on the procedures outlined in the OSTC. It is therefore recommended that the Municipality request that the operational requirement of 9 mg/Rm^3 be applied to filterable PM in addition to Total $PM_{2.5}$ (filterable + condensable) if this is technically feasible from an operational perspective. If this is not feasible, it is recommended that the risk calculations related to fine particulate matter (PM_{10} and/or $PM_{2.5}$) completed for the EA be revised and submitted as an addendum to the ESDM Report such that the calculations are consistent with the modelled emission rates and predicted concentrations presented in the ESDM Report.

2.2.2 Metals and Elemental Compounds

The emissions inventory included a number of metals that are typically bound to emitted particulate, or are emitted as a vapour. These include:

- Lead
- Cadmium
- Mercury
- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Boron
- Chromium (hexavalent & total)
- Cobalt
- Nickel
- Phosphorus
- Silver
- Selenium
- Thallium
- Tin
- Vanadium
- Zinc

The emission rates for most of these compounds were estimated based on information provided by Covanta Energy as well as data from the MOE Peel HHRA (which is presumably the Algonquin Power facility located in Brampton, Ontario).

2.2.2.1 Data Quality

As outlined previously, the Covanta data is rated as “above average” in the ESDM report. However, the ESDM Report does not indicate whether the tested facility employs a similar firing technology/process to the DYEC nor does it outline the test conditions at which the data were collected. In the absence of this information, the data are more likely rated as “average” and, it is not clear whether the Covanta data are representative of the expected concentrations at the DYEC. Therefore, it is recommended that the Proponent either provide additional details to demonstrate that the test data are representative and meet criteria for “above average” quality or rerun the analysis using the most conservative emission rates (potentially AP-42 emission factors).

The Algonquin Power facility is of a similar size to that of the Durham York Energy Centre; however, the ESDM Report does not indicate whether the incineration processes/technologies are similar in nature. The quality for this data source is rated as “average” in the ESDM Report. It is recommended that the Proponent either provide additional details to demonstrate that the test data is representative or use more conservative emission rates (potentially AP-42 emission factors).

2.2.3 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of compounds that consist of two or more fused aromatic rings. In some cases several fused rings are connected by hydrocarbon bridges. Differences in the locations of these connection points result in the formation of many structural isomers, which have the same chemical formula but are molecularly different in terms of structure. These compounds are generally of concern as they tend to be persistent in the environment and have the potential to affect human health.

2.2.3.1 Data Quality

The emission rates used in the ESDM Report were based on information provided in the manufacturer’s specifications as well as the Peel HHRA data. The data quality is rated as “average” in the ESDM Report.

For emissions of contaminants that relied on data from the Peel HHRA, it is recommended that the Proponent either provide additional details to demonstrate that the test data are representative or use more conservative emission rates (potentially AP-42 emission factors). The manufacturer’s specifications would generally be regarded as being acceptable as they are specifically related to the unit(s) in question.

2.2.4 Volatile Organic Compounds (VOCs)

The term Volatile Organic Compound (VOC) is typically used to refer to organic chemical compounds which have significant vapour pressures, and which can affect the environment and potentially human health. Health Canada classes VOCs as organic compounds that have boiling points roughly in the range of 50 to 250 °C (122 to 482 °F). VOCs comprise a very large group of compounds which generally consist of hydrocarbon chains or rings with various chemical substitutions. Chlorine, fluorine and bromine tend to be common constituents. While there are a number of naturally occurring VOCs, the bulk of VOCs are man-made and are typically used as solvents used in surface coating (e.g., painting) or cleaning applications.

2.2.4.1 Data Quality

The emission rates used in the ESDM Report were based on information provided in manufacturer's specifications, U.S EPA AP-42 emission factors and U.S. EPA FIRE database as well as the Peel HHRA data and YD generic risk assessment. The data quality from all of these sources is rated as "average" in the ESDM Report.

For emissions of contaminants that relied on data from the Peel HHRA, it is recommended that the Proponent either provide additional details to demonstrate that the test data is representative, or use more conservative emission rates (potentially AP-42 emission factors). Data from the other sources is considered to be acceptable since it is likely sufficiently conservative such that the emissions are not likely to be underestimated.

2.2.4.2 Contaminants Assessed

In general, a comprehensive list of VOCs was considered in the assessment. VOCs were either included in the air dispersion modelling or were assessed but screened out of the air dispersion modelling portion because they were considered to be negligible as per the MOE Procedure Document. However, neither the EA nor the ESDM Report included assessments for acetone, acrolein, styrene, and mesitylene (1,3,5-trimethylbenzene), all of which have POI standards in Schedule 3 of O.Reg.419. The lack of an assessment of acrolein and acetone were similarly identified as an issue by the MOE (Approvals Branch) during the review of the EA documentation.

It is expected that the EFW facility would be a relatively minor source of these contaminants; however, these contaminants should be included in the assessment of compliance with O.Reg.419. This is particularly true for acrolein, which has a relatively stringent POI limit. It is therefore recommended that the ESDM Report be amended to include an assessment of acetone, acrolein, styrene and mesitylene.

2.2.5 Start up Conditions

The emission rates and data quality discussed in the preceding sections apply to emissions from the Main Stack during normal operations. Emission estimates were also developed for Start Up conditions to assess the potential effects associated with these conditions. The emission estimates for the Main Stack during these conditions are generally rated as a lower quality, with a majority of them listed as “marginal”. The emission rates for these conditions were derived based on a combination of the Covanta data and U.S EPA AP-42/FIRE emission rates, as the scenario includes the natural gas auxiliary boiler which must be fired at start up to bring the incinerator unit up to the necessary operating temperature.

Several different scenarios were used to assess Start Up conditions, including the operation of a single train with auxiliary burner and both trains with auxiliary burner, at different firing rates. The assessment used the same concentration values that were provided by Covanta to estimate the start up emission rates from the Main Stack. Given that it is unlikely that the testing was completed during Start Up, these concentrations may not be representative of the expected Start Up conditions at the DYEC. As such, it is recommended that the Proponent either provide additional details to demonstrate that the test data is representative, or use more conservative emission rates (potentially AP-42 emission factors).

2.3 AIR DISPERSION MODELLING

Air dispersion modelling is typically used to assess the potential air pollutant concentrations resulting from the operation of a facility that is not yet built. An air dispersion model is a mathematical representation of how pollutants are dispersed and transported in the atmosphere as they move away from a source. The model uses the estimated air pollutant emission rates along with meteorological data that are representative of the conditions at the site and the mathematical representation of dispersion and transport to predict the air pollutant concentrations at various locations.

O.Reg. 419 specifies a list of approved air dispersion models appropriate for use in Ontario, which includes the AERMOD model and soon to be phased out ISC-PRIME model. O.Reg. 419 also provides a mechanism for Proponents to request use of an alternate model if it can be shown that the use of an alternate model is more appropriate than any of the approved models. Due to the proximity of the proposed facility location to Lake Ontario, the Proponent requested to use the CALPUFF model, which is a non-steady state, Lagrangian puff model. The MOE granted the request, since the CALPUFF model is more appropriate at representing the complex meteorology that exists at a land-water boundary.

CALMET (the meteorological pre-processor) has the ability to generate 3 dimensional meteorology on a grid, such that changes in terrain or surface characteristics (i.e. land to water, or vice versa) are considered in the dispersion calculations. However, this makes it a very complex model to use and/or review.

As part of the Peer Review, SENES reviewed the input meteorological data, as well as the general inputs to the dispersion modelling portion.

2.3.1 Meteorological Data

The meteorological data used in both the EA and the ESDM Report was developed by Stantec (for the EA) and reviewed and approved by the MOE. These data were provided to SENES electronically by the MOE. The data were then reviewed by SENES staff with respect to data inputs and model switches used, in addition to the general approach used in the development of the data.

2.3.1.1 Data Development

The meteorological data file was developed using meteorological observations as the primary data source. For the Application, data from 10 surface stations, 4 upper air stations, 5 precipitation stations and 3 water buoys (sea surface stations) were used for the generation of the CALMET 3-dimensional meteorology. To verify that CALMET generated accurate meteorology, data produced for a single day was analyzed.

The results from this day indicated that there were potential issues with the meteorology, due to unexpected temperature gradients located within Lake Ontario, and the exclusion of the land/lake breeze module in Calpuff.

Since this was an “MOE Approved” meteorological data set, SENES forwarded these issues to the MOE for preview and comment in advance of completion of the Peer Review Report. The MOE provided a response to SENES on 26 May, 2011. The response indicates that the observed temperature gradients were very weak (~0.5 degree centigrade) and were located far enough away from the facility not to have a significant impact. Also, the MOE noted that they cross checked the CALMET data with observations from two lake breeze events that occurred in May 2007, and found that “*the CALMET configuration reproduced these two land/lake breeze cases fairly well.*” Based on the MOEs review, it is not expected that these issues would result in significant changes to the model predicted air concentrations.

2.3.2 Model Source Configurations

The general model set up was reviewed to assess whether the proposed facility layout was accurately represented in the model in terms of source locations and building wake effects. In addition, emission sources were reviewed to ensure that they were represented by the appropriate model source type (i.e. Point source, Volume source).

2.3.2.1 Building Wake Effects

The BPIP (Building Profile Input Program) is used in air dispersion modelling assessments to incorporate the effects of wind flow over and around structures and the corresponding effects on the plume. The program only applies to emissions from stack (point) sources. As inputs, the program requires building dimensions as well as the location of emission sources. The program then produces a matrix of dimensional data that defines the projected effect the structure has on wind flow and emissions based on 10-degree wind directions. For each wind direction, the program produces, per stack emission source, dimensions of:

- Building height
- Projected building width
- Projected building length along the flow
- Along-flow distance from the stack to the center of the upwind face of the projected building
- Across-flow distance from the stack to the center of the upwind face of the projected building

However, BPIP is sensitive to how the structure dimensions are entered into the program. For simple, 1-tiered structures, the program works quite well; however for multi-tiered or complex structures, the format of data entry is critical. The structure layout at the Durham York Energy Centre is complex and hence requires special attention.

Figure 2-1 provides the layout of structures at the Durham York Energy Centre. The numbered buildings align with those presented in the Application, while the red dots indicate the location of the emission sources. As can be seen in Figure 2-3, buildings 1 through 9 are all part of the same structure, and hence wind flow over and around these buildings has to be considered as if it were one entire structure.

Figure 2-2 provides an overview of the main complex and the location of the main stack. For illustrative purposes, Figure 2-4 also indicates the direction of wind flow for a wind coming from 340 degrees. As can be seen, winds coming from 340 degrees are virtually parallel to the length of the structure.

Figure 2-1 - Durham York Energy Centre Building and Stack Layout

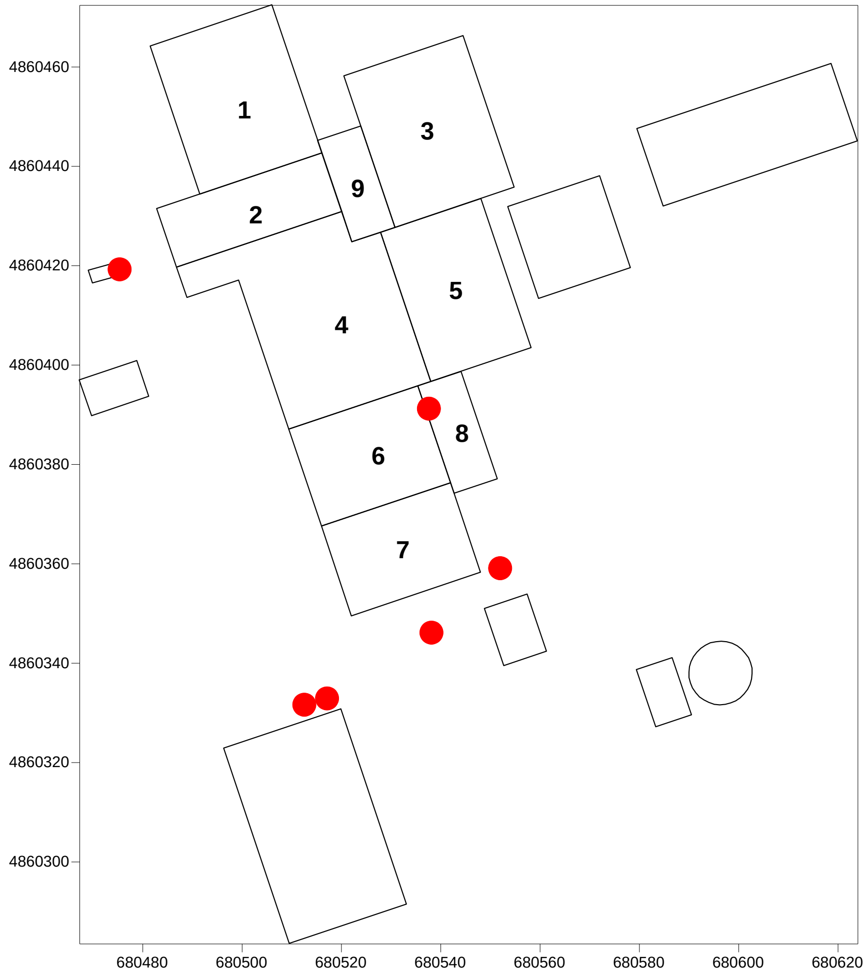

Figure 2-2 - Direction of Winds from 340 Degrees, Durham York Energy Centre

For this illustration, Table 2.2 provides the output from the BPIP model for the main stack as provided in the Application. In particular, the values highlighted represent the values for winds coming from 340 degrees. Thus for winds coming from 340 degrees:

- The building height is 35.1 metres;
- The projected building width is 41.13 metres;
- The projected building length along the flow is 51.58 metres;
- The along-flow distance from the stack to the center of the upwind face of the projected building is 47.41 metres; and
- The across-flow distance from the stack to the center of the upwind face of the projected building is 2.56 metres.

Table 2.2 BPIP output for the Main Stack per Application (m)

SO	BUILDHGT	ST1	35.1	35.1	35.1	35.1	25	25
SO	BUILDHGT	ST1	25	25	25	35.1	35.1	35.1
SO	BUILDHGT	ST1	35.1	35.1	35.1	35.1	35.1	35.1
SO	BUILDHGT	ST1	35.1	35.1	35.1	35.1	25	25
SO	BUILDHGT	ST1	25	25	25	35.1	35.1	35.1
SO	BUILDHGT	ST1	35.1	35.1	35.1	35.1	35.1	35.1
SO	BUILDWID	ST1	60.4	63.77	78.87	80.83	97.98	95.99
SO	BUILDWID	ST1	91.09	92.81	93.2	73.98	70.61	65.09
SO	BUILDWID	ST1	46.9	37.23	36.87	35.4	36.63	55.2
SO	BUILDWID	ST1	60.4	63.77	78.87	80.83	97.98	95.99
SO	BUILDWID	ST1	91.09	92.81	93.2	73.98	70.61	65.09
SO	BUILDWID	ST1	46.9	40.87	40.32	41.13	48.32	55.2
SO	BUILDLEN	ST1	55.92	54.54	65.09	57.59	55.39	43.71
SO	BUILDLEN	ST1	41.13	51.5	65.2	67.89	74.51	78.87
SO	BUILDLEN	ST1	64.65	24.44	19.17	13.32	17.56	55.6
SO	BUILDLEN	ST1	55.92	54.54	65.09	57.59	55.39	43.71
SO	BUILDLEN	ST1	41.13	51.5	65.2	67.89	74.51	78.87
SO	BUILDLEN	ST1	64.65	62.14	57.74	51.58	53.59	55.6
SO	XBADJ	ST1	35.26	28.6	7.48	2.2	-10.18	-12.25
SO	XBADJ	ST1	-23.12	-39.58	-55.22	-69.18	-81.05	-90.45
SO	XBADJ	ST1	-97.1	-100.8	-101.44	-99	-98.79	-96.45
SO	XBADJ	ST1	-91.18	-83.14	-72.57	-59.8	-45.21	-31.46
SO	XBADJ	ST1	-18.01	-11.92	-9.98	1.3	6.54	11.58
SO	XBADJ	ST1	32.44	38.66	43.7	47.41	45.2	40.85
SO	YBADJ	ST1	38.98	49.16	51.01	56.68	51.81	53.44
SO	YBADJ	ST1	53.45	52.39	49.85	54.19	47.83	40.02
SO	YBADJ	ST1	36.35	26.59	10.8	-5.31	-21.26	-27.62
SO	YBADJ	ST1	-38.98	-49.16	-51.01	-56.68	-51.81	-53.44
SO	YBADJ	ST1	-53.45	-52.39	-49.85	-54.19	-47.83	-40.02
SO	YBADJ	ST1	-36.35	-24.77	-11.3	2.56	15.42	27.62

The problem, though, as can been seen in Figure 1B, is the projected building length along the 340 degree flow, for example, should be closer to 120 metres and not 51.58 metres; this is the distance from the north edge of building 1 to the south edge of building 7, and passing through buildings 2, 4 and 6. This discrepancy implies that the building dimensions were not entered into BPIP in the format that is required for complex structures.

Table 2.3 provides the BPIP outputs that SENES believes more accurately represent the flows around the main complex of the facility in respect of the main stack. As can be seen, the projected building length along the 340 degree flow is now calculated to be 122.26 metres.

Table 2.3 - BPIP output for the Main Stack per SENES (m)

SO	BUILDHGT	ST1	35.1	35.1	35.1	35.1	25	25
SO	BUILDHGT	ST1	25	25	25	35.1	35.1	35.1
SO	BUILDHGT	ST1	35.1	35.1	35.1	35.1	35.1	35.1
SO	BUILDHGT	ST1	35.1	35.1	35.1	35.1	25	25
SO	BUILDHGT	ST1	25	25	25	35.1	35.1	35.1
SO	BUILDHGT	ST1	35.1	35.1	35.1	35.1	35.1	35.1
SO	BUILDWID	ST1	86.08	98.71	110.54	119.01	123.87	124.96
SO	BUILDWID	ST1	122.26	123.91	123	118.93	117.45	112.4
SO	BUILDWID	ST1	103.94	92.31	77.89	70.27	71.65	76.7
SO	BUILDWID	ST1	86.08	98.71	110.54	119.01	123.87	124.96
SO	BUILDWID	ST1	122.26	123.91	123	118.93	117.45	112.4
SO	BUILDWID	ST1	103.94	92.31	77.89	70.27	71.65	76.7
SO	BUILDLEN	ST1	118.93	117.45	112.4	103.94	92.31	77.89
SO	BUILDLEN	ST1	70.27	71.65	76.7	86.08	98.71	110.54
SO	BUILDLEN	ST1	119.01	123.87	124.96	122.26	123.91	123
SO	BUILDLEN	ST1	118.93	117.45	112.4	103.94	92.31	77.89
SO	BUILDLEN	ST1	70.27	71.65	76.7	86.08	98.71	110.54
SO	BUILDLEN	ST1	119.01	123.87	124.96	122.26	123.91	123
SO	XBADJ	ST1	0.42	-2.43	-5.2	-7.81	-10.18	-12.25
SO	XBADJ	ST1	-23.12	-39.58	-56.52	-76.14	-93.45	-107.92
SO	XBADJ	ST1	-119.11	-126.69	-130.41	-130.17	-129.89	-126.25
SO	XBADJ	ST1	-119.35	-115.03	-107.21	-96.13	-82.13	-65.64
SO	XBADJ	ST1	-47.15	-32.08	-20.18	-9.93	-5.26	-2.62
SO	XBADJ	ST1	0.1	2.82	5.45	7.91	5.98	3.25
SO	YBADJ	ST1	33.11	44.1	52.65	59.61	64.75	67.93
SO	YBADJ	ST1	69.04	67.94	64.75	59.89	56.3	51.01
SO	YBADJ	ST1	44.16	35.97	26.69	12.01	-3.75	-18.17
SO	YBADJ	ST1	-33.11	-44.1	-52.65	-59.61	-64.75	-67.93
SO	YBADJ	ST1	-69.04	-67.94	-64.75	-59.89	-56.3	-51.01
SO	YBADJ	ST1	-44.16	-35.97	-26.69	-12.01	3.75	18.17

It is noted here that the main stack is being used for illustrative purposes only. Given the height of the main stack in comparison to the height of the buildings, there will likely be no impact from the buildings on the emissions from the main stack. For the remaining stacks, there will be a significant impact from wind flow around buildings on stack emissions.

To test the impact of the difference in BPIP outputs to dispersion modelling results, the CALPUFF model was run for one day of meteorological data, chosen at random, with the only change being the BPIP dimensional data. The CALPUFF results are presented in Table 2.4. It is noted that the results do not represent any particular pollutant, but are rather provided for illustrative purposes only.

Table 2.4 - CALPUFF Results Using Application BPIP Output vs SENES BPIP Output

Meteorological Day = July 5, 2003; Scenario = emissions from 4 silos only				
	Maximum 1-hour concentration (µg/m^3)	Location of Maximum 1-hour concentration	Maximum 24-hour concentration (µg/m^3)	Location of Maximum 24-hour concentration
Application	771.97	680615 E 4860146 N	134.02	680687 E 4860393 N
SENES	567.67	680687 E 4860393 N	139.84	680687 E 4860393 N

As can be seen in Table 2.4, the application of the BPIP is critical to achieving accurate CALPUFF results. Using the SENES BPIP, results in the maximum 1-hour concentration dropping significantly on the day in question, and the location of the maximum also changes, occurring over 250 metres away from the location of the maximum concentration in the Application. On a 24-hour basis, the SENES concentration is higher than the maximum in the Application, though they both occur at the same location.

However, BPIP has little impact on the Main Stack, which is the primary emission source. Therefore, SENES does not believe that any changes to BPIP would significantly affect the maximum predicted concentrations, and thus the conclusions of the report are unlikely to change. In order to demonstrate that this is in fact the case, SENES recommends that the impact of these corrections on the maximum predicted 24-hour concentrations be examined for a few of the key contaminants.

2.3.2.2 Model Source and Emission Rate Inputs

SENES reviewed the model input files to assess whether the source inputs were correctly entered into the files. This included spot checks on the stack parameters (temperature, exit velocity, etc) and contaminant emission rates for the various model scenarios that were assessed. No issues were identified.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

The overall conclusion of the review is that the ESDM Report was reasonably well done, in a manner consistent with industry standard protocols and practices as well as Ontario Ministry of the Environment requirements for emissions inventories and air dispersion modelling assessments. However, some potential issues were identified. These are as follows:

Emissions Monitoring

- Based on the monthly sampling regime outlined in the EA documentation, it is unclear how the proposed continuous dioxins/furans sampling device will be used as an operational monitor.

- Although encouraged by the MOE A-7 Guideline, there has been no provision for continuous sampling for mercury.

Emissions Inventory

- Emission rates for many of the compounds included in the assessment were based on data provided by Covanta, presumably from source testing at other facilities. However, no details were provided related to the source of the data (facility size, nature of the facility/installed operations and air pollution control technologies), waste firing rate, etc. This information is necessary to assess whether the data (and hence estimated emissions) are representative of the expected conditions and concentrations at the DYEC.

- Emission estimates for a number of the compounds were based on data from the Peel HHRA, presumably from the Algonquin Power facility, which is of a similar size to that of the Durham York Energy Centre. However the report does not indicate whether the incineration processes/technologies, installed air pollution controls, etcetera are similar in nature. Therefore it is unclear whether the estimated emissions are representative of what would be expected from the DYEC.

- The Environmental Assessment was completed using a particulate emission rate that was estimated based on “filterable particulate matter” only. As a result, the $PM_{2.5}$ emission rate used in the EA is lower than would be expected. The ESDM Report used a $PM_{2.5}$ emission rate that is based on total $PM_{2.5}$ (filterable + condensable), and as such is more than a factor of 2 times higher than that used in the EA.

- Although the facility is expected to emit acetone, acrolein, styrene, and mesitylene (1,3,5-trimethylbenzene), neither the EA nor the ESDM Report included assessments for these contaminants, which all have POI standards in Schedule 3 of O.Reg.419.

Meteorology

- SENES' review had initially indicated that there were potential issues with the MOE Approved meteorological data. However, based on MOE review and comments, these potential issues are not expected to result in significant differences to the model predicted concentrations.

Model Source Configurations

- There are issues with the manner in which the building information was entered into the BPIP model. However, given the source configuration at the site, and the height of the the primary emission source (Main Stack), any changes to the BPIP inputs are unlikely to have a significant effect on the model predictions.

3.2 RECOMMENDATIONS

As indicated throughout the report and in the preceding section, many of the issues that have been identified are unlikely to result in significant changes to the conclusions of the ESDM Report. However, in many cases this is not clear without actually implementing the changes. SENES therefore makes the following recommendations:

1. The Municipality should request a copy of the *DRAFT* CofA for review and comment prior to issuance of the final CofA to ensure that the Municipality's concerns are adequately addressed within the conditions of the CofA. (section 2.1.1)

2. It is recommended that the facility be required to conduct source testing of the Main Stack on an annual basis at a minimum, and that the source testing be carried out on a waste stream that is representative of the typical waste composition that is fed into the facility. (section 2.1.1)

3. It is recommended that the proponent be required to update the ESDM Report within 3 months to demonstrate continued compliance should source testing indicate that the measured emission rates are higher than those used in the current ESDM Report. (section 2.1.1)

4. With respect to the continuous, time integrated dioxins/furans sampling, it is recommended that the frequency/duration of sample collection be shortened if the data are intended to be used on an operational basis rather than simply a reporting basis. (section 2.1.1)

5. Given that the waste will not be pre-sorted, it is recommended that a time integrated, continuous mercury sampling system be considered to demonstrate that significant quantities of mercury are not entering the incinerator. (section 2.1.1)

6. It is recommended that the limited operational flexibility conditions for the DYECs Basic Comprehensive CofA be reviewed/renewed on a maximum 5 year interval, and that the submission materials be provided to the Municipality of Clarington for review and comment prior to issuance of the renewal. (section 2.2)

7. It is recommended that the Municipality request that operational requirement of 9 mg/Rm^3 be applied to filterable PM in addition to Total $PM_{2.5}$ (filterable + condensable) *if this is technically feasible from an operational perspective*. If the proponent can demonstrate that this is not feasible, it is recommended that the risk calculations related to fine particulate matter (PM_{10} and/or $PM_{2.5}$) completed for the EA be revised and submitted as an addendum to the ESDM Report such that the calculations are consistent with the modelled emission rates and predicted concentrations presented in the ESDM Report. (section 2.2.1.2)

8. With respect to the source emissions inventory data, it is recommended that the Proponent either provide additional details to demonstrate that the test data from Covanta and the Peel HHRA are representative and meet the data quality criteria, or use more conservative emission factors (potentially AP-42 emission factors) in the assessment (2.2.1 – 2.2.4).

9. It is recommended that the assessment be amended to include an assessment of acetone, acrolein, styrene and mesitylene, which were not included but have Point of Impingement Limits in Schedule 3 of O.Reg.419. (section 2.2.4.2)

10. It is recommended that the Proponent examine the effect of the suggested corrections to BPIP for a few of the key contaminants to demonstrate whether there is an impact on the maximum predicted 24-hour concentrations. (section 2.3.2.1)