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Scientific and technical advice

Proposed GasPlasma Energy-From-Waste Facility in Hamilton

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The following has been prepared at the request of the Hamilton Public Health Services to assist with the review and interpretation of the human health risk assessment conducted in support of the Environmental Screening Process for the proposed Port Fuels & Material Services, Inc. Energy-From-Waste (EFW) facility.

Specifically, the following questions were posed:

- Was the HHRA completed using an appropriate and complete methodology, whereby the results of the assessment can be considered reasonable and valid? If not, what were the gaps identified in the HHRA methodology?
- When considering the pilot EFW plant that is operational in Swindon, U.K., please provide comments regarding the expected validity of the data that was extrapolated from the small-scale plant. Will the extrapolated data be valid and representative of the full-scale operation?
- Given that the Completed Screening Criteria Checklist (Table 3.1) identifies that the project might cause negative effects on air quality, why hasn't ozone (O_3) been accounted for? Although not direct emission from the facility, should ozone be included in the impact assessment?
- Given that the wind rose (FIGURE 3 LOCALIZED WIND ROSE FOR PFMSI (LGE) HAMILTON, pg. 381) identifies that winds from the proposed facility will blow toward the south west into the

Keith Neighbourhood which is an area of high respiratory and cardiovascular-related emergency room visits (CODE RED, 2010 http://media.metroland.com/thespec.com/statistics_flash/) and the Summary of Chronic Risks for COCs Industrial Site (Table 6.11) identifies that baseline (background concentrations) of chronic risk exceeds target risk of 1.0E-06 for Benzene, Bromodichloromethane, Ethylene Dibromide, has the HHRA clearly analyzed, characterized and quantified the combined risks to health from these stressors for this population?

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

The methodology of the human health risk assessment (HHRA) prepared by Conestoga-Rovers & Associates for the proposed GasPlasma facility in Hamilton was reviewed by Public Health Ontario (PHO), to determine if the assessment followed generally best acceptable practices (as described by regulatory guidance from the Ministry of Environment and Climate Change (MOECC), Health Canada and the United States Environmental Protection Agency (US EPA)) to describe and estimate potential human health risks from the proposed facility.

The report prepared by Conestoga-Rovers & Associates follows the framework for an HHRA and is in general accordance with guidance from the MOECC, Health Canada and the US EPA. The inputs and fate and transport modelling were not reviewed by PHO, and therefore the results of the HHRA have not been validated. Upon review of the HHRA methodology, the following are a list of limitations/and or gaps in the assessment:

- Baseline conditions only accounted for ambient air; baseline soil and vegetation conditions were not measured or qualitatively assessed in the HHRA. Information about the baseline conditions in these media is needed for an understanding of the potential health risks discussed for all the given scenarios and receptors evaluated in the HHRA.

- The HHRA does not quantitatively or qualitatively discuss emissions from the waste delivery trucks to and from the proposed facility, and other traffic that may be related to the operations of the proposed facility.

- The HHRA does not discuss or evaluate the following scenarios:

    - An operation upset scenario, where the facility may malfunction or not work as intended ;

    - Future case scenario, where the facility emissions and future and existing facilities are assessed to illustrate the overall impact to the local air shed.

- It would be useful to provide a plain language summary of the HHRA, so that the assessment objectives, methodology and results can be understood and interpreted by a wider audience (i.e., members of the community).

EXTRAPOLATING FROM THE SWINDON PILOT

Pilot studies may be used to meet several objectives including site-specific optimization of operations, trouble shooting, experimenting with new processes, estimating costs, efficiency and efficacy of operations. The full scale plant will process up to 200 times more waste than the pilot (the pilot consumed up to 100 kg per hour of solid waste). The pilot has operated for a limited amount of time: over 3000 hours. The proposed facility is the first full scale system to combine gasification and plasma conversion. It is not clear what the longest continuous operational period was during the pilot, nor how this may effect predictions of the costs of operation, operational stability and efficiency, including estimates of emissions quality. Emissions from the Swindon pilot exceeded Ontario's Guideline A7. As a result, the design proposed for Hamilton includes additional pollution abatement technology such as scrubbers and catalytic oxidizers that were not specifically evaluated with the pilot.

The proponent discusses emission calculations and both the data sources and data quality in Appendix A: Supporting Calculations, of the Emission Summary and Dispersion Modelling of Appendix F: Air Quality Assessment Report.

When considering the issue of the validity of the use of pilot results to forecast expected concentrations of chemicals at the full scale, several factors are relevant:

1. Two modes of operation were weighted differently for the HHRA: 95 % of time in "Normal" and 5% of time in"Bypass" modes, each with an array of emission sources. The various sources considered include the waste and fuel preparation exhaust, the Refuse Derived Fuel (RDF) Drier exhaust, the GasPlasma local exhaust hood, the GasPlasma maintenance local exhaust hood, exhaust from the bypass thermal oxidizer, in hot standby mode as well as in syngas combustion mode, the power generation exhaust, and the direct plasma exhaust.

2. The data quality for emissions modelling is described variously as "Marginal," "Uncertain data quality," "Average," "Un-validated Source Testing," and "Highest." The methods of deriving data vary through "un-validated source testing," "engineering calculation," "emission factors," and "engineering estimates."

3. Where emission data from the Swindon pilot plant is employed, it is based on the average of the results from three groups of pilot results labelled July 2011, July 2012, and December 2013.

4. Some data from measurements of pilot chemical concentrations in emissions were adjusted downward before use in the dispersion models. The adjustments are intended to forecast or estimate the performance of pollution abatement technologies: "Emissions of carbon monoxide (CO), nitrogen oxides (NOx), polycyclic aromatic hydrocarbons (PAHs), and particulate matter (PM) were estimated assuming control efficiency obtained from the installation of oxidative catalysts on the gas engines at the PFMSI facility. There is no control installed on the engine at the Swindon plant. Control efficiencies of 90 percent for CO and total organic carbon, and PAHs, and 95 percent for NOx and PM were assumed. The control efficiencies are based on information provided to PFMSI from prominent local catalyst suppliers and are considered to be

readily achievable for catalytic controls." The engines are expected to run leaner and at higher temperatures.

5. Certain compounds typically included in assessments of emissions from thermal treatment facilities in Ontario, were not analysed during the pilot. Here the proponent used data from other thermal solid waste treatment facilities in Ontario that are expected to have higher emissions.

6. Emission estimates for combustion gases, as well as some heavy metals and polycyclic aromatic hydrocarbons (PAHs) are based on the pilot.

Overall the quality of the data does not provide a reliable basis for an assessment of public health impact. A more reliable basis for an assessment could be done with a facility in which the proponent is willing to be accountable for enforceable emission concentrations. This could be accomplished through conditions in legal instruments, such as a certificate of approval, in which in-stack standards match the dispersion model inputs.

OZONE

Cycles of ozone formation and destruction, accumulation transportation are complex. The precursors for ground level ozone formation, VOCs and NOx, are emitted from a broad range of sources, dispersed and carried in the atmosphere until conditions are right for the photo-chemical reactions to produce ozone. For this reason, the geographic areas of assessment for ground level ozone are broad. Any ozone formation resulting from NOx and VOC emissions from the facility is likely to occur some distance from the source; 10 to 100 km away from the source, dependant on climactic conditions, outside of the range of the HHRA. Mitigation of ground level ozone requires cooperation over large areas on reducing emissions of precursors, NOx and VOCs, both of which are typically monitored in-stack under Guideline A-7. The proponent's position articulates these points in Appendix F of the Environmental Screening Report (section 3 of the HHRA, "Identification of Chemicals of Concern").

KEITH NEIGHBOURHOOD

The HHRA evaluated the potential health risks from background concentrations of contaminants of concern using applicable human health benchmarks at each sensitive receptor location. The following volatile organic compounds: benzene, bromodichloromethane, ethylene dibromide, and chloroform were identified above the target risk level of 1E-06; however, the HHRA did not specifically take into account any underlying disease pattern in the population surrounding the proposed facility.

The Keith Neighbourhood has been identified as an area with higher levels of emergency rooms visits per 1,000 residents per year compared to the rest of the city [(1)] and has high rates of respiratory and cardiovascular related emergency room visits. [(2)] However, it is unclear what symptoms and diagnoses are included in the terms "respiratory" and "cardiovascular" related emergency room visits. In addition, the contribution of behavioural and occupational risk factors relating to the number of emergency room visits by residents of Keith Neighbourhood has not been identified. Ambient air concentrations of VOCs

in other areas of the city (where rates of respiratory and cardiovascular related emergency room visits are lower than observed in the Keith Neighbourhood) have not been measured.

The health effects of benzene, bromodichloromethane, ethylene dibromide, and chloroform were reviewed to determine if elevated ambient air concentrations of these VOCs, are adversely affecting the residents of the Keith Neighbourhood, who are presumed to be vulnerable to respiratory and cardiovascular symptoms as indicated by higher rates of emergency room visits. Chronic exposure via inhalation to benzene, bromodichloromethane, ethylene dibromide, and chloroform at the proposed background concentrations have not been linked to respiratory or cardiovascular effects. [3,4,5,6] Detailed information about the health effects associated with these chemicals are documented in the HHRA's toxicology profiles (Attachment E).

We hope this write-up has been helpful for you. If you have any questions or require clarification, please do not hesitate to contact us.

REFERENCES

(1) Social Planning and Research Council of Hamilton. Neighbourhood Profiles: Beasley, Crown Point, Jamesville, Keith, Landsdale, Mcquesten, Quigley Road, Riverdale, Rolston, South Sherman and Stinson. http://www.sprc.hamilton.on.ca/wp-content/uploads/2012/03/2012-Report-Neighbourhood_Profiles_March.pdf. March 2012.

(2) Code Red: Mapping the Health of Hamilton. http://media.metroland.com/thespec.com/statistics_flash/. 2010.

(3) ATSDR. Toxicological Profile for Benzene. http://www.atsdr.cdc.gov/toxprofiles/tp3.pdf. August 2007.

(4) ATSDR. Toxicological Profile for Bromodichloromethane. http://www.atsdr.cdc.gov/toxprofiles/tp129.pdf. December 1989.

(5) ATSDR. Toxicological Profile for Ethylene Dibromide http://www.atsdr.cdc.gov/toxprofiles/tp37.pdf. July 1992.

(6) ATSDR. Toxicological Profile for Chloroform. http://www.atsdr.cdc.gov/toxprofiles/tp6.pdf. September 1997.