February 2016

Addendum to Technical Support Document #3

AIR QUALITY & ODOUR ASSESSMENT

TAGGART
GROUP OF COMPANIES

THE MILLER GROUP

1.0 BACKGROUND

An Air Quality and Odour Assessment report for the proposed Capital Region Resource Recovery Centre (CRRRC) was previously prepared, as reported in Technical Support Document (TSD) #3, and is a component of the December 2014 Environmental Assessment (EA) report. The findings of TSD #3 were summarized in the EA report. The air quality and odour assessment characterizes and assesses the effects of the proposed CRRRC on this component of the environment and also includes an assessment of greenhouse gas (GHG) emissions.

The Ministry of Environment and Climate Change (MOECC) air reviewers provided comments on air quality and odour modelling aspects of the EA report and on TSD #3. This Addendum was prepared in response to comments received March 6, 2015 from the MOECC air technical review and subsequent meeting in June 2015, conference calls in November 2015 and a face to face meeting on December 10, 2015 and was subsequently revised in February 2016 in response to comments received on January 28, 2016.

This Addendum addresses the following MOECC numbered comments of the March 6, 2015 memo:

- Comment 3: The landfill modelling release height of 45.8 metres used in the assessment.
- Comment 4: The use of a regional meteorological data set in the odour modelling and the odour modelling results provided as a frequency analysis at the 99.5th percentile.
- Comments 6-9 & 19: Additional information with respect to potential odourous sources related to the loading and unloading of the organics processing primary reactor cells and overall material handling of potentially odourous organic material.
- Comment 12: The use of an estimated control efficiency of 85% for paved roads.
- Comment 13: The proposed infrequent outdoor wood grinding and chipping operations in the compost storage and processing pad area.
- Comment 14: The use of an outlet loading of 10 mg/m^3 to estimate particulate emissions from baghouse dust collectors.
- Comment 15: The use of 30-year averaged landfill gas generation rates and a request for revised significance assessment and compliance assessment. All dispersion modelling was carried out at the highest predicted gas generation rate.
- Comment 17: The use of contaminated soil as daily cover and potentially higher levels of NMOCs observed from landfills where contaminated soil is used as daily cover.

For ease of review, the following sections are divided as per the headings of the comments received.

2.0 ASSESSMENT OF AIR QUALITY AND ODOUR EFFECTS

2.1 Identification of Emission Sources

In response to comment 13, Table 4-1 of TSD #3 (Table 11.2.2-1 of the EASR) has been updated to include the proposed infrequent wood grinding and chipping operation and is provided on the following page.

In response to comment 6, the pumping of the organics slurry from the exterior, closed storage tank into tankers for haulage off-Site to off-Site anaerobic digestion facilities was not included as an emissions source as the process takes place within piping from the storage tank to the tanker. There is little opportunity for odour generation from this process. Air discharged as a result of the filling of the tanker has potential odours reduced by passing through carbon filters attached to the tanker.

Comments 7, 8, 9 & 19 are mainly addressed in the updated odour management plan memo contained in Appendix A of this addendum. To complete the response to comment 19, a primary reactor odour source was added at the organics processing facility location. For odour modelling purposes, 5% of the size of the landfill odour source area was used as the primary reactor odour source area. The rationale for the use of 5% is described below.

The organics processing is to take in 50,000 tonnes per year; at 312 operating days/year, this equates to 160 tonnes/day. The organics mixed with bulking agent will be moved and placed in the primary reactor cell during the latter part of each operating day at a rate of about 70 tonnes/hr. It has been assumed that the "latter part of the day" is 3 to 4 hours out of the 12 hour day, which means that 210 to 280 tonnes/working day of organics mixed with bulking agent is moved and placed in the primary reactor. This is the material that represents the odour source for the modelling. It was also assumed that the weight of wet food waste is approximately 1 tonne/cubic metre, which corresponds to 210 to 280 cubic metres per day of airspace in the primary reactor. Each primary reactor cell is 70 metres wide x 300 metres long in plan area.

The primary reactors have been designed with a triangular cross-section, as per Appendix G Figure 2 in Volume IV, of 70 metres across with 5.25H:1V slopes to a peak height of 7 metres. Every 1 metre length of the reactor corresponds to a volume of 245 cubic metres, or about 1 day's placement. Because it would be impractical to build the cell in 1 metre strips, it was assumed the mixed organics would be placed over roughly half the cell width (35 metres) to the final shape (volume of approximately 123 cubic metres/metre): this would require a cell length of about 1.7 to 2.3 metres, which is something that could be built with a loader, but more likely would be approximately 3 metres wide. As such, the available daily quantity would not enable the cell to be built to its final shape in a single day. At 3 metres wide, the corresponding footprint area (odour source area) would be about 90 square metres. Compared to the landfill working area odour source area of 1,500 square metres, this is about 6% of the landfill source area.

Table 4-1: Summary of Sources Assessed as Part of the Air Quality & Odour Assessment

Source Information		Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
General Location	**Source**			
Flare and/or Electrical Generation Plant	Enclosed LFG and biogas flare and/or engines	Yes	Yes	—
Construction and Demolition Facility	Dust collector	Yes	Yes	—
Material Recovery Facility	Dust collector	Yes	Yes	—
Organics Processing Facility	Biofilter	Yes	Yes	—
	Organics processing operations (material handling)	Yes	Yes	—
	Organics processing operations (tailpipe emissions)	Yes	Yes	—
Composting	Composting, curing, and post processing (material handling)	Yes	Yes	—
	Composting, curing, and post processing (tailpipe emissions)	Yes	Yes	—
PHC Impacted Soil Treatment Area	Biofilter	Yes	Yes	—
	PHC soil treatment operations (material handling)	Yes	Yes	—
	PHC soil treatment operations (tailpipe emissions)	Yes	Yes	—
Landfill	Landfill Cap	Yes	Yes	—
	Landfill operations (material handling)	Yes	Yes	—
	Landfill operations (tailpipe exhaust emissions)	Yes	Yes	—
Leachate Pre-Treatment	Leachate pre-treatment	Yes	Yes	—
	Leachate ponds	Yes	Yes	—
Paved Roads	Vehicle exhaust and fugitive road dust	Yes	Yes	—
Unpaved Roads	Vehicle exhaust and fugitive road dust	Yes	Yes	—
Emergency Generator	Diesel emergency power generator used to provide electricity during power outages	Yes	No	The emergency power equipment only operates periodically (rather than continuously) and therefore produces emissions that are negligible relative to the overall emissions from the CRRRC. Additionally, the emergency power generator will not be operating at the same time as any other equipment and therefore is not a part of the worst-case scenario.
Support Activities	Operational support activities, such as maintenance activities (including welding, compressor, diesel fire pump, lights)	No	No	These activities are considered to be negligible in comparison to the other activities occurring on- Site.
	Stationary fuel combustion for comfort heating	Yes	Yes	Emissions from these sources occur seasonally (i.e., do not occur at all times during a year) and are very small compared to mobile combustion sources. For this assessment, only nitrogen oxide emissions were modelled.
Wood Grinding and Chipping	Outdoor wood grinding and chipping operation in the compost storage and processing pad area	No	No	Wood grinding will only occur periodically, and the frequency will depend on the rate and amount of material received. The material to be chipped will have relatively high moisture content and is expected to result in negligible particulate emissions in any event. Given the moisture content of the material, the relatively small processing capacity of the chipper and grinder (estimated at 1 metric tonne per hour), the infrequent nature of the operation and the location on-Site, inclusion of particulate emissions from this source was considered insignificant.

2.2 Assessment of Atmospheric Effects

In response to comment 12, a dust control efficiency of 85% is listed for paved roads in Appendix A of TSD # 3, sections 4.1.3 and 4.1.4. The control efficiency of 85% is based on the site's proposed best management practices to be implemented to mitigate fugitive dust as described in the Design and Operations Report. The control efficiency selected is within the range described in the Western Regional Air Partnership's (WARP) Fugitive Dust Handbook (www.wrapair.org/forums/dejf/fdh). In addition to control methods listed in the D&O report, visible dust deposits will be removed from the roads as soon as reasonably possible.

In response to comment 14, an outlet loading of 10 mg/m^3 was used to estimate the particulate emissions; this emission factor is appropriate for newer baghouse dust collectors. This outlet loading is based on the current recommended outlet values emissions factor of 10 mg/m^3 for dust collectors as reflected in the MOECC Procedure Document (Guideline A-10) (Draft Version 4.0). Should the MOECC Procedure Document (Guideline A-10) (Draft Version 4.0) not be finalized at the time of submittal of the ECA, additional supporting information from the manufacturer will be provided.

2.3 Landfill Gas (NMOC) Assessment

The CRRRC will include a hydrocarbon contaminated soils treatment facility. Heavily impacted soils will be treated prior to application as daily cover. Considering the total soil required for daily cover both daily and annually, and the processed soil available for use as daily cover annually and daily, it is estimated that only 10-15% of the processed contaminated soil capable of generating NMOC's will be used as daily cover. Therefore, no revision to the assessment is necessary as a result of comment 17.

2.4 Compliance with Ontario Regulation 419/05

In response to comments 3, 4, 15 & 19, Table 4-4 of TSD #3 (Table 11.2.2-4 of the EASR) has been revised. Revised concentrations at POI based on an updated landfill modelled release height of 10 m (half the maximum peak height of the landfill) are presented in the table below; and an updated Table B.6-2 Dispersion Modelling Inputs from TSD #3 is provided in Appendix B to this addendum. A revised contaminant significance assessment has been provided in Appendix C to this addendum.

The results of the odour assessment are presented in the table below as a maximum concentration at the nearest residential receptor. The odour assessment also includes an additional primary reactor odour source as discussed above in response to comment 19. The input parameters for this source are presented in Appendix B. As reported in the EASR, the revised assessment also indicates that the proposed CRRRC facility will be in compliance with O. Reg. 419/05 (MOE, 2013a). As the odour concentrations, are below 1 odour unit (OU) a frequency distribution analysis is not required with a local meteorological data set (i.e., comment 4).

Table 4-4: Predicted Compliance Air Quality Concentrations at POI (February 2016 revisions shown in italic)

Indicator	Averaging Period	Air Quality Criteria (µg/m³)	Maximum Concentration at POI (µg/m³) (1)	Percentage of Limit (%)
SPM (24-hr)	24-hour	120	98.23	82%
PM_{10} (24-hr)	24-hour	50	23.30	47%
$PM_{2.5}$ (24-hr)	24-hour	25	20.16	81%
NO_X (1-hr)	1-hour	400	112.36	28%
NO_X (24-hr)	24-hour	200	37.67	19%
NO_2 (1-hr)(2)	1-hour	400	112.36	28%
NO_2 (24-hr)(2)	24-hour	200	37.67	19%
SO_2 (1-hr)	1-hour	690	15.91	2%
SO_2 (24-hr)	24-hour	275	8.54	3%
CO (1/2-hr)	½-hour	6000	872.44	15%
H_2S (24-hr)	24-hour	7	0.34	5%
H_2S (10-min)	10-min	13	2.67	21%
C_2H_3Cl (24-hr)	24-hour	1	0.021	2%
Odour (10-min) (3)	10-min	1(3)	0.95	95%

Notes:
µg/m³ – micrograms per cubic metre
(1) Represents the maximum predicted concentrations at POI locations within the lands within the Site-vicinity.
(2) A conservative concentration conversion value of 100% of NO_x was applied to NO_2.
(3) The maximum predicted concentration in OU at discrete receptors.

3.0 CONCLUSIONS

This Addendum has been prepared to address the remaining comments of the Ministry of Environment and Climate Change (MOECC). With the revisions incorporated into the predictive modelling, there were no changes to the outcome of the assessment in terms of air quality and odour. The following is a summary of the responses to the numbered MOECC remaining comments.

MOECC Comment Number	Summary of Response
3	The landfill has been remodelled with a modelled release height of 10m (half the maximum peak height) and a revised Table 4-4 (Section 2.4) and Table B.6-2 (Appendix B) are included as part of this addendum.
4	Table 4-4 has been revised to include both the predicted maximum concentration and the 99.5^{th} percentile in Section 2.4 of this addendum.
6	Additional information on the odour is provided in Section 2.1 of this addendum.
7	Please refer to the Final Odour Management Plan provided in Appendix A of this addendum.
8	Please refer to the Final Odour Management Plan provided in Appendix A of this addendum.
9	Please refer to the Final Odour Management Plan provided in Appendix A of this addendum. Additional details are provided in response to comment 19 in Section 2.1 of this addendum.
12	Additional information on the 85% control efficiency is provided in Section 2.2 of this addendum.
13	Infrequent wood grinding and chipping operation information is provided in Section 2.1 of this addendum.
14	No changes were made to the assessment; additional information is provided in Section 2.2 of this addendum.
15	A revised Table 4-4 (Section 2.4) and significance assessment (Appendix C) have been provided in this addendum. Updated emission rate calculations and other tables from TSD#3 have been provided in Appendix D.
17	Additional information on the amount of treated contaminated soil that will be used as daily cover is provided in Section 2.3 of this addendum.
19	An additional primary reactor odour source with an area of 5% of the total landfill size has been added to the odour assessment and results of the assessment are provided in in the revised Table 4-4 in Section 2.4 of this addendum. Additional details on the odour management are provided in the Final Odour Management Plan in Appendix A of this addendum.

APPENDIX A

Final Odour Management Plan

CRRRC Organics Processing Facility – Final Odour Management Plan

For the proposed CRRRC, odour emissions have been assessed for all components of the waste management facility (including organics processing) and have been predicted to be in compliance with pertinent MOECC guidelines (i.e., not cause an adverse impact). The results of this assessment are provided in Section 11.2.2 of the Volume I main EA Report.

A summary of the operations of the organics processing facility is provided in Sections 9.2.2 and 10.5 of the Volume I main EA report. Additional detail is provided in Appendix F of the Volume IV D&O Report. As described in these documents, organics receiving and pre-processing will be carried out within an enclosed building that will be kept under negative pressure and the exhaust air will be treated with a biofilter. This will effectively control potential fugitive odour emissions associated with this initial step in the organics diversion process.

To reduce the potential for odour emissions in subsequent steps in this process, the following best management and operational practices and controls will be implemented for the organics processing facility:

- Filling of an area of the primary reactor with pre-blended organic materials to initiate the digestion process will not be carried out at the same time as the opening and removal of digested organic material (digestate) from another area of the primary reactor where digestion is complete.
- Odour control for primary reactor filling operations will be accomplished by pre-blending organic materials with the bulking agent (which is carbon-rich and which, as discussed at the meeting at the University of Toronto on July 14, 2015, will suppress potential odours) within the pre-processing building, placing the materials into the primary reactor during a short period of time (daily filling cycle), and covering the placed material at the end of the daily filling cycle.
- The gases from the enclosed primary reactor cells will be extracted from the reactor and used as combustion air in the flare or energy recovery facility, or treated in the biofilter.
- Prior to opening the primary reactor for removal of digestate, the primary reactor will be operated under aerobic conditions to stabilize the digestate and reduce the potential for odour emissions. Conversion from anaerobic to aerobic operations in the primary reactor is expected to take place over a period of weeks to months. The decision to convert from anaerobic to aerobic conditions will be based on the following observations using information obtained from the process instrumentation:

  1. Reduction in the rate of biogas production in the primary reactor.
  2. Reduction of temperature in the primary reactor.
  3. Reduction of the ratio of Biochemical Oxygen Demand (BOD) to Chemical Oxygen Demand (COD) in liquor drained from the primary reactor.
  4. Reduction in rate of liquor production in the primary reactor.
  5. Reduction of volume of the organic/bulking agent mass contained in the primary reactor.

Collectively, these observations will indicate that the rate of conversion of organics has decreased and that the organic mass has been significantly stabilized in the anaerobic treatment phase. Numeric limits have not been established for each of these criteria; instead, the decision to convert operation from anaerobic to aerobic will be made based on the collective information from all of these measurements.

- However, in the event that significant odours are encountered during excavation of the digestate, odour control options will include:

  1. Application of odour control compounds to the odourous material;
  2. Blending with finished compost to reduce odour levels to within acceptable limits;
  3. Placement of cover materials (membranes or bulk materials) over odourous material compost to reduce odour levels to within acceptable limits; and,
  4. Placing the odourous material back into the primary reactor for continued treatment.

- Odours from outdoors curing/aeration on the compost pad will be controlled by blending digestate with appropriate materials to attain a minimum carbon: nitrogen ratio of 20:1, by ensuring a minimum porosity of 20% and by maintaining the material at a moisture content of less than 60% to reduce the potential for anaerobic conditions. Material will be turned at a frequency that prevents development of anaerobic conditions. Material will be turned only when wind direction and atmospheric pressure conditions are suitable. Any material in an advanced anaerobic state that cannot be returned to aerobic conditions will be landfilled.

APPENDIX B

Revised Dispersion Modelling Inputs

Table B 6-2: Area Source Summary

Source Description (and ID #)	Release Height Above Grade (m)	Area (m^2)	UTM Northing (m)	UTM Easting (m)	Indicator Compound	Emission Rate During Operations ($g/s\text{-}m^2$)
Composting Area (S7)	4	22,739	466669.10 466493.20 466646.10 466741.30	5021094.40 5021317.40 5021374.00 5021122.10	Odour	1.36E-02
Organics Processing Facility, Composting Facility, and the PHC Soil Treatment Area (S6, S7 & S9)	4	99,595	466376.5 466328.6 466340.6 466302.4 466209.7 466441.6 466473.7 466535.8 466493.2 466647.3 466741.5 466588.9 466566.5 466354.0 466365.3	5020973.9 5020955.9 5020926.0 5020911.0 5021160.1 5021249.9 5021169.8 5021196.0 5021317.2 5021374.8 5021122.7 5021062.9 5021117.5 5021039.7 5021009.8	SPM PM_{10} $PM_{2.5}$ NOx SO2 CO	1.06E-06 9.82E-07 9.04E-07 1.65E-05 2.79E-10 1.51E-05
Landfill (including landfill working face and cap) (S10)	10	839,407	465806.10 465988.00 466023.00 466065.00 466100.00 466148.90 466204.90 466216.60 466482.40 466608.30 467100.40 466818.20 466421.80 466489.40 466284.20 466139.60	5020284.20 5019792.20 5019726.90 5019705.90 5019687.20 5019682.50 5019687.20 5019694.20 5019794.50 5019869.10 5020058.00 5020850.90 5020708.60 5020519.70 5020440.40 5020410.10	NO_X SO_2 CO SPM PM_{10} $PM_{2.5}$ C_2H_3Cl H_2S Odour	1.29E-06 2.45E-11 1.28E-06 9.34E-08 8.30E-08 7.51E-08 1.52E-09 1.86E-08 5.78E-03

Source Description (and ID #)	Release Height Above Grade (m)	Area (m^2)	UTM Northing (m)	UTM Easting (m)	Indicator Compound	Emission Rate During Operations ($g/s\text{-}m^2$)
Leachate equalization pond (S21)	0.6	19,688	466456.2 466432.2 466622.8 466656.6	5020853.8 5020940.2 5021016.3 5020930.4	Odour	4.70E-05
Leachate effluent ponds (S22)	0.6	6,629	466674.6 466655.4 466765.4 466785.8	5020980.5 5021030.2 5021075.4 5021023.3	Odour	1.40E-04
Primary Reactor (Organics material handling)	4	60	466425.26	5021239.14	Odour	8.98E-01

APPENDIX C

Revised Significance Assessment

Table 1
Significance Assessment

Contaminant	CAS No.	Total Facility Emission Rate [g/s]	Air Dispersion Model Used	Averaging Period [hours]	MOE POI Limit [µg/m³]	Emission Threshold [g/s]	Negligibility Assessment
Sulphur Dioxide	7446-09-5	2.04E-01	AERMOD	24	275	6.56E-02	Indicator Compound
Sulphur Dioxide	7446-09-5	2.04E-01	AERMOD	1	690	6.76E-02	Indicator Compound
Hydrogen Sulfide	7783-06-4	1.88E-02	AERMOD	24	7	1.67E-03	Indicator Compound
Hydrogen Sulfide	7783-06-4	1.88E-02	AERMOD	10-min	13	1.05E-03	Indicator Compound
Ethylbenzene	100-41-4	8.14E-03	AERMOD	24	1000	2.39E-01	Negligible
Ethylbenzene	100-41-4	8.14E-03	AERMOD	10-min	1900	1.53E-01	Negligible
Nitrogen Oxides	10102-44-0	8.60E-01	AERMOD	24	200	4.77E-02	Indicator Compound
Nitrogen Oxides	10102-44-0	8.60E-01	AERMOD	1	400	3.92E-02	Indicator Compound
Ethylene Dibromide	106-93-4	1.05E-05	AERMOD	24	3	7.16E-04	Negligible
Butane	106-97-8	5.21E-04	AERMOD	24	7600	1.81E+00	Negligible
Acrylonitrile	107-13-1	1.53E-06	AERMOD	24	0.6	1.43E-04	Negligible
Methyl isobutyl ketone	108-10-1	1.40E-03	AERMOD	24	1200	2.86E-01	Negligible
Toluene	108-88-3	4.29E-02	AERMOD	24	2000	4.77E-01	Negligible
Chlorobenzene	108-90-7	9.77E-04	AERMOD	1	3500	3.43E-01	Negligible
Chlorobenzene	108-90-7	9.77E-04	AERMOD	10-min	4500	3.63E-01	Negligible
Pentane	109-66-0	5.08E-03	AERMOD	24	4200	1.00E+00	Negligible
Hexane	110-54-3	4.21E-03	AERMOD	24	7500	1.79E+00	Negligible
Perchloroethylene (tetrachloroethylene)	127-18-4	6.04E-03	AERMOD	24	360	8.59E-02	Negligible
Xylene	1330-20-7	1.55E-02	AERMOD	24	730	1.74E-01	Negligible
Xylene	1330-20-7	1.55E-02	AERMOD	10-min	3000	2.42E-01	Negligible
t-1,2-dichloroethene	156-60-5	4.99E-05	AERMOD	24	105	2.51E-02	Negligible
Carbonyl sulfide	463-58-1	1.31E-04	AERMOD	24	3.2	7.64E-04	Negligible
Carbon tetrachloride	56-23-5	2.20E-05	AERMOD	24	2.4	5.73E-04	Negligible
Carbon Monoxide	630-08-0	5.07E+00	AERMOD	½	6000	4.84E-01	Indicator Compound
Ethanol	64-17-5	1.67E-04	AERMOD	1	19000	1.86E+00	Negligible
Isopropanol (Isopropyl Alcohol)	67-63-0	1.56E-04	AERMOD	24	7300	1.74E+00	Negligible
Acetone	67-64-1	5.60E-04	AERMOD	24	11880	2.84E+00	Negligible
Chloroform	67-66-3	6.42E-05	AERMOD	24	1	2.39E-04	Negligible
Benzene	71-43-2	2.96E-03	AERMOD	24	100	2.39E-02	Negligible
Benzene	71-43-2	2.96E-03	AERMOD	Annual	0.45	5.60E-04	See attached table
Methyl chloroform (1,1,1-Trichloroethane)	71-55-6	1.17E-04	AERMOD	24	115000	2.75E+01	Negligible
Mercury (total)	7439-97-6	2.31E-06	AERMOD	24	2	4.77E-04	Negligible
Ethane	74-84-0	4.29E-03	AERMOD	24	4800	1.15E+00	Negligible
Chloromethane	74-87-3	2.21E-04	AERMOD	24	320	7.64E-02	Negligible
Methyl mercaptan	74-93-1	1.04E-03	AERMOD	24	0.1	2.39E-05	See attached table
Propane	74-98-6	1.08E-02	AERMOD	24	7200	1.72E+00	Negligible
Chloroethane	75-00-3	4.57E-03	AERMOD	24	5600	1.34E+00	Negligible
Vinyl chloride	75-01-4	1.59E-03	AERMOD	24	1	2.39E-04	Indicator Compound
Ethyl mercaptan (ethanethiol)	75-08-1	1.94E-04	AERMOD	24	0.1	2.39E-05	See attached table
Methylene chloride	75-09-2	9.37E-03	AERMOD	24	220	5.25E-02	Negligible
Carbon disulfide	75-15-0	3.65E-05	AERMOD	24	330	7.88E-02	Negligible
Dimethyl sulfide	75-18-3	5.55E-03	AERMOD	10-min	30	2.42E-03	See attached table
Bromodichloromethane	75-27-4	5.18E-06	AERMOD	24	0.1	2.39E-05	Negligible
1,1-Dichloroethane	75-34-3	8.48E-04	AERMOD	24	165	3.94E-02	Negligible
Vinylidene chloride (1,1-Dichloroethene)	75-35-4	5.58E-05	AERMOD	24	10	2.39E-03	Negligible
Chlorodifluoromethane	75-45-6	1.23E-03	AERMOD	24	350000	8.35E+01	Negligible
Fluorotrichloromethane	75-69-4	1.87E-03	AERMOD	24	6000	1.43E+00	Negligible
Dichlorodifluoromethane	75-71-8	2.56E-03	AERMOD	24	500000	1.19E+02	Negligible
Hydrogen Chloride	7647-01-0	1.49E-01	AERMOD	24	20	4.77E-03	See attached table
Propylene dichloride (1,2-Dichloropropane)	78-87-5	2.12E-05	AERMOD	24	2400	5.73E-01	Negligible
Methyl ethyl ketone	78-93-3	4.56E-03	AERMOD	24	1000	2.39E-01	Negligible
Trichloroethylene (TCE)	79-01-6	1.95E-03	AERMOD	24	12	2.86E-03	Negligible
1,1,2,2-Tetrachloroethane	79-34-5	3.23E-04	AERMOD	24	0.1	2.39E-05	See attached table
Dichlorobenzene	106-46-7	2.48E-03	AERMOD	1	30500	2.99E+00	Negligible
Suspended particulate matter (< 44 µm Diameter)	N/A	1.51E+00	AERMOD	24	0.1	2.39E-05	Indicator Compound
PM10	N/A	7.68E-01	AERMOD	24	0.1	2.39E-05	Indicator Compound
PM2.5	N/A	5.91E-01	AERMOD	24	0.1	2.39E-05	Indicator Compound
Odour	N/A	2.42E+04	AERMOD	24	0.1	2.39E-05	Indicator Compound
Nitrogen Oxides (EPG)	10102-44-0	1.45E-01	AERMOD	1/2	1880	1.52E-01	Negligible

MOECC Dispersion Factor

Averaging Period	Dispersion Factor [µg/m³ per g/s]*
1	5100
10-min	8423
½	6192
24	2095
Annual	401
30-day	808

Table 2
Emission Summary Table

Contaminant	CAS No.	Total Facility Emission Rate [g/s]	Air Dispersion Model Used	Maximum POI Concentration [µg/m³]	Averaging Period [hours]	MOE POI Limit [µg/m³]	Limiting Effect	Regulation Schedule No.	Percentage of MOE Limit [%]
Sulphur Dioxide	7446-09-5	0.20	AERMOD	0.00	24	275	Health & Vegetation	Schedule 3	<1%
Sulphur Dioxide	7446-09-5	0.20	AERMOD	0.00	1	690	Health & Vegetation	Schedule 3	<1%
Hydrogen Sulfide	7783-06-4	0.0188	AERMOD	0.26	24	7	Health	Schedule 3	3.7%
Hydrogen Sulfide	7783-06-4	0.0188	AERMOD	0.80	10-min	13	Odour	Schedule 3	6.2%
Nitrogen Oxides	10102-44-0	0.86	AERMOD	37.67	24	200	Health	Schedule 3	18.8%
Nitrogen Oxides	10102-44-0	0.86	AERMOD	112.36	1	400	Health	Schedule 3	28.1%
Carbon Dioxide	124-38-9	228.56	AERMOD		24	21000	—	JSL	Below JSL
Carbon Monoxide	630-08-0	5.07	AERMOD	872.44	½	6000	Health	Schedule 3	14.5%
Mercury	7439-97-6	0.00	AERMOD		24	2	Health	Schedule 3	<1%
Methane	74-82-8	34.32	AERMOD		24	0.1	—	De Minimus	Below De Minimus
Methyl mercaptan	74-93-1	0.00	AERMOD		24	0.1	—	De Minimus	Below De Minimus
Propane	74-98-6	0.01	AERMOD		24	7200	—	JSL	Below JSL
Vinyl chloride	75-01-4	0.0016	AERMOD	0.021	24	1	Health	Schedule 3	2.1%
Methylene chloride	75-09-2	0.01	AERMOD		24	220	Health	Schedule 3	<1%
Methyl ethyl ketone	78-93-3	0.00	AERMOD		24	1000	Health	Schedule 3	<1%
Suspended particulate matter (< 44 µm Diameter)	N/A	1.51	AERMOD	0.00	24	120	Visibility	Schedule 3	<1%
PM10	N/A	0.77	AERMOD	0.00	24	50	—	AAQC	<1%
PM2.5	N/A	0.59	AERMOD	0.00	24	25	—	AAQC	<1%
Odour	N/A	24194	AERMOD	0.59	10-min	1	Odour	Guideline	59.5%

Made By: AVW
Checked By: CST

APPENDIX D

Additional Revised Calculations and Tables from TSD #3

Revised section 4.1.9 (TSD#3 Appendix A)

LFG not collected and distributed to the flare or the electrical generation plant may result in fugitive LFG emissions from the landfill cap. These fugitive emissions were estimated, including odour emissions. LFG constituents and their estimated respective concentrations in the LFG were obtained from the U.S. EPA AP 42 Chapter 2.4 (Table 2.4-1). Maximum LFG emissions per year were estimated using results from the LandGEM model (provided in Appendix C) based on a 75% capture efficiency.

The following is a sample calculation for the emission rate of vinyl chloride from the landfill cap:

$$\mathrm{ER} = \mathrm{conc.}\frac{\mu\mathrm{g}}{\mathrm{m}^3} \times \mathrm{LGF}\ \frac{\mathrm{m}^3}{\mathrm{yr}} \times \frac{1\ \mathrm{yr}}{365\ \mathrm{days}} \times \frac{1\ \mathrm{day}}{24\ \mathrm{hrs}} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times \frac{1\ \mathrm{g}}{1{,}000{,}000\ \mu\mathrm{g}} \times (1 - \mathrm{collection\ efficiency\ (\%)})$$

Where:
ER = emission rate (m^3/s),
conc. = concentration of the contaminant in the landfill gas (g/m^3) obtained from US EPA AP 42 Chapter 2.4
LFG = maximum landfill gas emissions per yr (m^3/yr) (obtained from LandGEM), and
collection efficiency = collection efficiency of landfill gas.

$$\mathrm{ER} = 3627.21\ \frac{\mu\mathrm{g}}{\mathrm{m}^3} \times 44{,}250{,}000\frac{\mathrm{m}^3}{\mathrm{yr}} \times \frac{1\ \mathrm{yr}}{365\ \mathrm{days}} \times \frac{1\ \mathrm{day}}{24\ \mathrm{hrs}} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times \frac{1\ \mathrm{g}}{1{,}000{,}000\ \mu\mathrm{g}} \times (1 - 75\%)$$

$$\mathrm{ER} = 0.00127\frac{\mathrm{g}}{\mathrm{s}}$$

Emissions of the remaining LFG constituents were calculated in the same manner presented above.

To calculate the odour emissions, the flow rate of the landfill cap is needed. The following is a sample calculation to determine the flow rate from the landfill cap:

$$\mathrm{FR} = \mathrm{LFG}\ \frac{\mathrm{m}^3}{\mathrm{yr}} \times \frac{1\ \mathrm{yr}}{365\ \mathrm{days}} \times \frac{1\ \mathrm{day}}{24\ \mathrm{hrs}} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times (1 - 75\%)$$

Where:
FR = flow Rate (m^3/s),
LFG = maximum landfill gas emissions per year (m^3/yr) (obtained from LandGEM), and
75% = collection efficiency of landfill gas.

$$\mathrm{FR} = 44{,}250{,}000\frac{\mathrm{m}^3}{\mathrm{yr}} \times \frac{1\ \mathrm{yr}}{365\ \mathrm{days}} \times \frac{1\ \mathrm{day}}{24\ \mathrm{hrs}} \times \frac{1\ \mathrm{hr}}{3{,}600\ \mathrm{s}} \times (1 - 75\%)$$

$$\mathrm{FR} = 0.351\ \frac{\mathrm{m}^3}{\mathrm{s}}$$

The following is a sample calculation for the emission rate of odour from the landfill cap. The odour concentration of the LFG was estimated to be 10,000 OU/m^3 based on the upper range from the MOECC's *Interim Guide to Estimate and Assessing Landfill Air Impacts* (MOE, 1992).

$$\mathrm{ER} = \text{odour concentration}\ \frac{\mathrm{OU}}{\mathrm{m^3}} \times \text{flow rate}\,\frac{\mathrm{m^3}}{\mathrm{s}}$$

$$\mathrm{ER} = 10{,}000\ \frac{\mathrm{OU}}{\mathrm{m^3}} \times 0.351\,\frac{\mathrm{m^3}}{\mathrm{s}}$$

$$\mathrm{ER} = 3{,}510\ \mathrm{OU/s}$$

Table 4-2: Revised Summary of Worst Case Assumed Emissions during Operation of the CRRRC (Table A5-1)

Facility	Activity	Contaminant (g/s)								
		SPM	PM_{10}	$PM_{2.5}$	NO_x/ NO_2 [(1)]	SO_2	CO	H_2S	C_2H_3Cl	Odour (OU/s)
Flare and/or Electrical Generation Plant	Enclosed LFG flare and/or LFG and biogas to energy engines	0.1309	0.1309	0.1309	0.4404	0.1018	4.6546	0.0031	0.0002	—
Construction and Demolition Facility	Dust collector	0.0708	0.0708	0.0708	—	—	—	—	—	—
Materials Recovery Facility	Dust collector	0.0708	0.0708	0.0708	—	—	—	—	—	—
Organics Processing Facility	Biofilter	—	—	—	—	—	—	—	—	10,000
	Organics processing operations (material handling)	0.0043	0.0021	0.0003	—	—	—	—	—	—
	Organics processing operations (tailpipe emissions)	0.0278	0.0278	0.0278	0.4472	0.00001	0.4777	—	—	—
Composting	Composting, curing, and post processing (material handling)	0.0046	0.0022	0.0003	—	—	—	—	—	309
	Composting, curing, and post processing (tailpipe emissions)	0.0559	0.0584	0.0584	1.1572	0.00002	0.9882	—	—	—
PHC Impacted Soil Treatment	Biofilter	—	—	—	—	—	—	—	—	2,083
	PHC impacted soil treatment operations (material handling)	0.0104	0.0049	0.0007	—	—	—	—	—	—
	PHC impacted soil treatment operations (tailpipe emissions)	0.0025	0.0025	0.0025	0.0433	0.000001	0.0429	—	—	—
Landfill	Landfill cap	—	—	—	—	—	—	0.0156	0.0013	3,510
	Landfill operations (material handling)	0.0161	0.0076	0.0012	—	—	—	—	—	1,347
	Landfill operations (tailpipe emissions)	0.0618	0.0618	0.0618	1.0799	0.00002	1.0717	—	—	—
Leachate Pre-treatment	Leachate pre-treatment	—	—	—	—	—	—	—	—	6,944
	Leachate equalization pond	—	—	—	—	—	—	—	—	0.9250
	Leachate effluent ponds	—	—	—	—	—	—	—	—	0.9250

Facility	Activity	Contaminant (g/s)								
		SPM	PM_{10}	$PM_{2.5}$	NO_x/ NO_2 [(1)]	SO_2	CO	H_2S	C_2H_3Cl	Odour (OU/s)
Paved Roads	Fugitive road dust	0.6332	0.1215	0.0294	—	—	—	—	—	—
	Vehicle exhaust	0.0013	0.0013	0.0011	0.0315	0.0001	0.0073	—	—	—
Unpaved Roads	Fugitive road dust	0.2880	0.0778	0.0078	—	—	—	—	—	—
	Vehicle exhaust	0.0001	0.0001	0.0001	0.0025	0.0000	0.0006	—	—	—
Emergency Generator[(2)]	Diesel emergency power generator	0.0004	0.0004	0.0004	0.1446	0.0708	0.0152	—	—	—
Support Activities	Operational support activities, such as maintenance activities (including welding, compressor, diesel fire pump, lights)	These activities are considered to be negligible in comparison to the other activities occurring on-Site.								
	Stationary Fuel Combustion	— [(3)]	— [(3)]	— [(3)]	0.0387	— [(3)]	— [(3)]	—	—	—
Primary Reactor	Organics Material Handling	—	—	—	—	—	—	—	—	53.88

Table 4-3: Concentrations at Discrete Receptors for the Proposed CRRRC Facility

Indicator	Averaging Period	Existing Conditions Ottawa (µg/m³)[1]	Maximum Predicted Concentration at Discrete Receptors (µg/m³)[2]	Cumulative effect (µg/m³)
SPM (24-hr)	24-hour	49.04	14.07	63.11
PM_{10} (24-hr)	24-hour	24.52	3.78	28.30
$PM_{2.5}$ (24-hr)	24-hour	12.26	2.28	14.54
NO_X (1-hr)	1-hour	62.07	13.72	75.79
NO_X (24-hr)	24-hour	57.12	2.38	59.50
NO_2 (1-hr) [3]	1-hour	45.14	13.72	58.86
NO_2 (24-hr)[3]	24-hour	38.83	2.38	41.21
SO_2 (1-hr)	1-hour	7.86	1.92	9.78
SO_2 (24-hr)	24-hour	7.64	0.54	8.18
CO (1/2-hr)	½-hour	867.18	106.59	973.77
CO (1-hr)	1-hour	722.65	87.78	810.43
CO (8-hr)	8-hour	827.44	43.99	871.43
H_2S (24-hr)	24-hour	—	0.016	0.0161
H_2S (10-min)	10-min	—	0.10	0.100
C_2H_3Cl (24-hr)	24-hour	—	0.0221	0.0221
Odour (10-min)[4]	10-min	—	0.59	0.5949

Notes:

[1] The 90th percentile predicted existing concentrations; values for SPM and PM_{10} are calculated from the $PM_{2.5}$ as described in Section 2.3.1.1

[2] Represents the maximum predicted concentrations at discrete receptors within the Site- vicinity.

[3] A conservative concentration conversion value of 100% of NO_x was applied to NO_2.

[4] The 99.5th percentile predicted concentration at discrete receptors.

"—" indicates that there is no data available for existing conditions.