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West Carleton Environmental Centre Landfill

Ottawa, Ontario

Final Report

Emission Summary & Dispersion Modelling Report

RWDI # 1302177
July 30, 2014

SUBMITTED TO

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Ministry of the Environment | Ministère de l'Environnement

Ontario

EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

Company Name: Waste Management of Canada Corporation

Company Address: 117 Wentworth Court
Brampton, Ontario L6T 5L4

Location of Facility: West Carleton Environmental Centre, 2301 Carp Rd
Ottawa, Ontario K0A 1L0

The attached Emission Summary and Dispersion Modeling Report was prepared in accordance with s.26 of O. Reg. 419/05 and the guidance in the MOE document "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" dated July, 2005 and "Air Dispersion Modelling Guideline for Ontario" dated July 2005 and the minimum required information identified in the check-list on the reverse of this sheet has been submitted.

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EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

		Required Information		
			Submitted	Explanation/Reference
	Executive Summary and Emission Summary Table			
	1.1	Overview of ESDM Report	☒ Yes	Executive Summary
	1.2	Emission Summary Table	☒ Yes	ESDM Table 7.1
1.0	**Introduction and Facility Description**			
	1.1	Purpose and Scope of ESDM Report (when report only represents a portion of facility)	☒ Yes	ESDM Section 1.1
	1.2	Description of Processes and NAICS code(s)	☒ Yes	ESDM Section 1.2
	1.3	Description of Products and Raw Materials	☒ Yes	ESDM Section 1.3
	1.4	Process Flow Diagram	☒ Yes	ESDM Section 1.4
	1.5	Operating Schedule	☒ Yes	ESDM Section 1.5
2.0	**Initial Identification of Sources and Contaminants**			
	2.1	Sources and Contaminants Identification Table	☒ Yes	ESDM Table 2.1
3.0	**Assessment of the Significance of Contaminants and Sources**		☒ Yes	
	3.1	Identification of Negligible Contaminants and Sources	☒ Yes	ESDM Section 3.1
	3.2	Rationale for Assessment	☒ Yes	ESDM Section 3.2
4.0	**Operating Conditions, Emission Estimating and Data Quality**			
	4.1	Description of operating conditions, for each significant contaminant that results in the maximum POI concentration for that contaminant	☒ Yes	ESDM Section 4.1
	4.2	Explanation of Method used to calculate the emission rate for each contaminant	☒ Yes	ESDM Section 4.2
	4.3	Sample calculation for each method	☒ Yes	Appendices B, C and D
	4.4	Assessment of Data Quality for each emission rate	☒ Yes	ESDM Section 4.3
5.0	**Source Summary Table and Property Plan**			
	5.1	Source Summary Table	☒ Yes	Table 5.1
	5.2	Site Plan (scalable)	☒ Yes	Figure 5.2
6.0	**Dispersion Modelling**			
	6.1	Dispersion Modelling Input Summary Table	☒ Yes	ESDM Section 6.1
	6.2	Land Use Zoning Designation Plan	☒ Yes	ESDM Section 6.2
	6.3	Dispersion Modelling Input and Output Files	☒ Yes	ESDM Section 6.3
7.0	**Emission Summary Table and Conclusions**			
	7.1	Emission Summary Table	☒ Yes	Table 7.1
	7.2	Assessment of Contaminants with no MOE POI Limits	☒ Yes	ESDM Section 7.2
	7.3	Conclusions	☒ Yes	ESDM Section 7.4
	Appendices (Provide supporting information or details such as...)			
	Appendix A: Dispersion Modelling Input & Output Files		☒ Yes	
	Appendix B: Combustion By-Product and Dust Emissions		☒ Yes	
	Appendix C: Landfill Gas Emissions		☒ Yes	
	Appendix D: Odour Emissions		☒ Yes	
	Appendix E: Odour Frequency Analysis		☒ Yes	
			☐ Yes	
			☐ Yes	

 * This checklist is taken from the document titled "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" dated July, 2005

EXECUTIVE SUMMARY

This Emission Summary and Dispersion Modelling (ESDM) report was prepared in support of an application to amend the following existing Environmental Compliance Approvals (ECA):

- ECA #4117-8EHQE7;
- ECA #7025-7F4PN5; and
- ECA #7816-7C9JMR.

The application for ECA amendment reflects the expansion of the applicant's West Carleton Environmental Centre (WCEC) facility located at 2301 Carp Road, Ottawa, Ontario. This application is being submitted to achieve compliance of Waste Management of Canada Corporation's (WM) operations with the requirements of Section 9 of the Environmental Protection Act (EPA), R.S.O. 1990.

The purpose of the application for amendment is to include the new and/or modified operations and sources associated with the proposed landfill expansion as follows:

- Five (5) 1,600 kW landfill gas-fired engine-generator sets;
- Two (2) enclosed flare systems;
- One (1) candlestick flare system;
- One (1) existing closed landfill mound;
- One (1) proposed landfill mound;
- Four (4) sources associated with the landfilling activities including the active stage, working face, interim cover and contaminated soil stockpile;
- One (1) leachate treatment system including one (1) raw leachate equalization tank, one (1) SBR tank, one (1) effluent equalization tank, and one (1) sludge holding tank;
- Material loading at contaminated soil stockpile;
- Material loading at overburden stockpile;
- Material loading the construction working face;
- Material loading at the landfill working face;
- Material unloading at the contaminated soil stockpile;
- Material unloading at the construction working face;
- Material unloading at the landfill working face;
- Bulldozing at the overburden stockpile;
- Bulldozing at the construction working face;
- Crushing of aggregate material at the Impact Crusher near the Waste Transfer Facility; and
- One (1) 300 hp diesel-fired engine supplying power to the impact crusher.

Sources and activities subject to the Environmental Activity and Sector Registry are included in this application for amendment to ECA #4117-8EHQE7, in accordance with a request made under s. 20.18 of the Environmental Protection Act.

WM's WCEC is a waste disposal facility receiving municipal, industrial, commercial, and institutional wastes. The North American Industry Classification Scheme (NAICS) code that best applies to WM's WCEC landfill is 562210 – "Waste Disposal and Treatment". This facility is part of Schedule 5 identified by a NAICS code listed in Schedule 5 and shall comply with Schedule 3 standards using an approved dispersion model (AERMOD), effective February 1, 2013.

A total of seventy-five contaminants were identified with respect to WCEC landfill operation. These contaminants were emitted from a total of thirty-two sources at the WCEC landfill facility. Of the identified contaminants, forty-six contaminants were discharged in negligible amounts and four of the significant contaminants do not have Schedule 3 Standard or guideline under O. Reg. 419/05. Of all the sources on site, thirty were determined to be significant.

For the purposes of estimating emissions from the facility, a maximum operating scenario was considered. This scenario consists of simultaneous operation of all on-site sources at a maximum capacity, including the LGTE facility engine-generator sets, the landfill gas flares, the leachate treatment system and generators. The assessment also considered the concurrent maximum level of fugitive releases from the existing and proposed landfill mounds as well as material handling and processing emissions. This scenario was used as the basis for the dispersion modelling analysis, which was conducted for 10-minute, 30-minute, 1-hour, 24-hour and annual averaging times. Emission rates were determined through the following estimation techniques; mass balance, emission factors, source testing, and engineering calculations.

The facility is located at 2301 Carp Road, Ottawa, Ontario, and is zoned as a rural heavy industrial area. The facility is surrounded by mineral extraction, rural general industrial, rural commercial, and environmental protection areas. The local terrain is relatively flat; however, source and receptor base heights were considered in the dispersion modelling analysis through the use of terrain data files available from the MOE.

Concentrations at points of impingement were predicted using the AERMOD. Modelling input and output files have been provided on a compact disc included in Appendix A.

The maximum predicted 10-minute odour concentration is higher than the criterion of 1 OU, with a value of 2.6 at one of the twenty-three assessed discrete receptors. However, the modelling shows that the criterion of 1 OU is exceeded less than 0.5% annual at the discrete receptor, which is considered acceptable by the suggested MOE guidance in terms of odour emissions (Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines).

Predicted concentrations for all of the contaminants of significance were found to be less than their respective Standards or guidelines under O. Reg. 419/05 at all receptors in the area. The contaminant with the greatest percentage of the O. Reg. 419/05 Standard was predicted to be vinyl chloride with a value of 73%. Therefore, WCEC landfill facility is expected to be in compliance with the requirements of O. Reg. 419/05.

Emission Summary Table

RWDI Project #1302177

Receptor	Contaminant	CAS Number	Total Facility Emission Rate (g/s)	Air Dispersion Model Used	Maximum POI Concentration (µg/m³)	Averaging Period (hours)	MOE POI Limit [1] (µg/m³)	Limiting Effect	Regulation Schedule #	Percentage of MOE POI Limit (%)
Property Line	Methyl chloroform (1,1,1-Trichloroethane)	71-55-6	6.00E-05	AERMOD	0.003	24 Hour	115000	Health	Schedule 3	< 1%
Property Line	1,1,2-Trichloroethane	79-00-5	7.72E-06	AERMOD	0.0004	24 Hour	0.31	N/A	JSL	< 1%
Property Line	Dichloroethane, 1,1-	75-34-3	1.54E-03	AERMOD	0.07	24 Hour	165	Health	Schedule 3	< 1%
Property Line	Vinylidene chloride (1,1-Dichloroethene)	75-35-4	5.09E-03	AERMOD	0.61	24 Hour	10	Health	Schedule 3	6%
Property Line	Ethylene dichloride	107-06-2	1.30E-03	AERMOD	0.2	24 Hour	2	Health	Schedule 3	8%
Property Line	Dichloroethylene, cis-1,2-	156-59-2	1.05E-01	AERMOD	12.2	24 Hour	105	Health	Guideline	12%
Property Line	Dichloroethylene, trans-1,2-	156-60-5	1.71E-04	AERMOD	0.008	24 Hour	105	Health	Guideline	< 1%
Property Line	Ammonia	7664-41-7	1.05E-01	AERMOD	12.8	24 Hour	100	Health	Schedule 3	13%
Property Line	Benzene	71-43-2	6.29E-03	AERMOD	0.05	Annual	0.45	Health	Schedule 3	11%
Property Line	Carbon tetrachloride	56-23-5	9.94E-06	AERMOD	0.0005	24 Hour	2.4	Health	Schedule 3	< 1%
Property Line	Chloroethane	75-00-3	2.48E-03	AERMOD	0.24	24 Hour	5600	Health	Schedule 3	< 1%
Property Line	Chloroform	67-66-3	1.08E-04	AERMOD	0.005	24 Hour	1	Health	Schedule 3	< 1%
Property Line	Methylene chloride	75-09-2	4.85E-01	AERMOD	58.9	24 Hour	220	Health	Schedule 3	27%
Property Line	Dimethyl sulphide	75-18-3	8.81E-04	AERMOD	0.37	10 Minute	30	Odour	Guideline	1%
Property Line	Ethylene dibromide	106-93-4	2.02E-06	AERMOD	0.00009	24 Hour	3	Health	Guideline	< 1%
R3	Hydrogen sulphide [2]	7783-06-4	1.08E-01	AERMOD	6	10 Minute	13	Odour	Schedule 3	49%
Property Line	Hydrogen sulphide [2]	7783-06-4	1.08E-01	AERMOD	2	24 Hour	7	Health	Schedule 3	24%
Property Line	Methane	74-82-8	3.94E-01	AERMOD	48	24 Hour	n/a	n/a	n/a	n/a
Property Line	Mercaptans [3]	74-93-1	4.71E-06	AERMOD	0.002	10 Minute	13	Odour	Schedule 3	< 1%
Property Line	Octane	111-65-9	3.33E-03	AERMOD	1.4	10 Minute	61800	Odour	Guideline	< 1%
Property Line	Butyl alcohol, sec-	78-92-2	1.72E-02	AERMOD	0.80	24 Hour	496	N/A	JSL	< 1%
Property Line	Tetrachloroethylene	127-18-4	7.67E-03	AERMOD	0.58	24 Hour	360	Health	Schedule 3	< 1%
Property Line	Trichloroethylene (TCE)	79-01-6	1.25E-02	AERMOD	1.4	24 Hour	12	Health	Schedule 3	12%
Property Line	Vinyl chloride	75-01-4	7.87E-03	AERMOD	0.7	24 Hour	1	Health	Schedule 3	73%
Property Line	Carbon monoxide (single source)	630-08-0	1.61E+01	AERMOD	899	1/2 Hour	6000	Health	Schedule 3	15%
Property Line	Nitrogen oxides	10102-44-0	3.60E+00	AERMOD	229	1 Hour	400	Health	Schedule 3	57%
Property Line	Nitrogen oxides	10102-44-0	3.60E+00	AERMOD	84	24 Hour	200	Health	Schedule 3	42%
Property Line	Suspended particulate matter (< 44 µm diameter)	n/a - 1	2.33E+00	AERMOD	41	24 Hour	120	Visibility	Schedule 3	34%
Property Line	Sulphur dioxide	7446-09-5	2.13E+00	AERMOD	80	1 Hour	690	Health & Vegetation	Schedule 3	12%
Property Line	Sulphur dioxide	7446-09-5	2.13E+00	AERMOD	60	24 Hour	275	Health & Vegetation	Schedule 3	22%
Property Line	Dioxins, Furans and Dioxin-like PCBs	n/a - 2	4.05E-10	AERMOD	8.50E-09	24 Hour	1.00E-07	Health	Schedule 3	8%
R8	Odour	n/a - 3	7.69E+03	AERMOD	2.6	10 Minute	n/a	I	n/a	n/a

Notes:

[1] The term "MOE POI Limit" identified in Table D-4 refers to the following information (there may be more than one relevant MOE POI Limit for each contaminant):

- air quality standards in Schedules 1, 2 and 3 of the Regulation; and

- the guidelines for contaminants set out the MOE publication, "Summary of Standards and Guidelines to Support Ontario Regulation 419: Air Pollution – Local Air Quality"

- an acceptable concentration for contaminants with no standards or guidelines.

[2] A calibration factor of 3 was applied to all hydrogen sulphide concentrations.

[3] For the purposes of the Regulation, mercaptans are expressed as methyl mercaptan; an amount (or concentration of total mercaptans shall be calculated in accordance with the following formula:

$A = \Sigma((B \times 48) / C)$, where,

A = the amount (or concentration) of total mercaptans, expressed as methyl mercaptan

B = the amount (or concentration) of each mercaptans

C = the molecular weight of each mercaptan

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1. INTRODUCTION AND FACILITY DESCRIPTION

1.1 Purpose and Scope of ESDM Report

This Emission Summary and Dispersion Modelling (ESDM) report was prepared in support of an application to amend the following existing Environmental Compliance Approvals (ECA):

- ECA #4117-8EHQE7;
- ECA #7025-7F4PN5; and
- ECA #7816-7C9JMR.

The application for ECA amendment reflects the expansion of the applicant's West Carleton Environmental Centre (WCEC) facility located at 2301 Carp Road, Ottawa, Ontario. This application is being submitted to achieve compliance of Waste Management of Canada Corporation's (WM) operations with the requirements of Section 9 of the Environmental Protection Act (EPA), R.S.O. 1990.

Sources and activities subject to the Environmental Activity and Sector Registry are included in this application for amendment to ECA #4117-8EHQE7, in accordance with a request made under s. 20.18 of the Environmental Protection Act.

1.2 Description of Process & NAICS Code(S)

WM's WCEC is a waste disposal facility receiving municipal, industrial, commercial, and institutional wastes. The North American Industry Classification Scheme (NAICS) code that best applies to WM's WCEC landfill is 562210 – "Waste Disposal and Treatment". This facility is part of Schedule 5 identified by a NAICS code listed in Schedule 5 and shall comply with Schedule 3 standards using an approved dispersion model (AERMOD), effective February 1, 2013.

1.3 Description of Products and Raw Materials

The raw material for the landfilling operations consists of various municipal, industrial, commercial and institutional wastes. The landfill operations do not produce any products; instead landfill gases and leachate are generated as by-products of the landfill operations.

Detailed descriptions for the existing, modified or new operations at the WCEC landfill facility are provided in the following sections.

1.3.1 Fugitive Landfill Emissions from Existing Landfill Mound

The existing landfill mound under final cover is the portion of the WCEC landfill where waste is no longer being deposited. The existing landfill is closed and the entire landfill mound is under final cover. This area is characterized by the presence of a clay landfill cap and LFG collection system. The top portion of the landfill is covered with a heavy polymer membrane (beanie). The total landfill final cover area is estimated to be approximately 34.46 ha (344,600 m^2) with a final peak height of 174 m above sea level.

Fugitive emissions of LFG compounds may occur from the final cover area, due to the release of LFG through the surface of the landfill. The LFG collection system in the final cover area of the landfill serves to extract the LFG from the mound, thus reducing the amount of LFG available to escape through the surface of the mound. In addition, the cover material filters and limits the ability of the LFG to be released through the surface of the landfill. However, even with the LFG collection system and cap in place, some LFG is released through the atmosphere through the final cover.

The existing landfill mound, with a final cover in place and extraction wells installed, has an overall LFG collection efficiency of 85%.

1.3.2 Fugitive Landfill Emissions from Proposed Landfill Mound

The proposed landfill area is the portion of the landfill where accepted waste will be deposited at an estimated rate of 400,000 tonnes per year, equivalent to a total waste tonnage of 4,000,000 tonnes. The material accepted will consist primarily of institutional, commercial and industrial waste, as well as residential waste and “special” waste. “Special” waste consists primarily of contaminated soils that may be used for daily or interim covers. The composition of the waste stream is expected to vary based on actual waste sources.

The rate of LFG generation within the proposed landfill mound will be dependent on the quantity of waste placed. Fugitive emissions through the surface of the daily cover, interim cover and final cover of LFG compounds may occur. The proposed LFG collection system will serve to extract LFG from the mound, thus reducing the amount of LFG available to escape through the surface of the mound. In addition, the cover material filters and limits the ability of the LFG to be released through the surface of the landfill. However, even with the LFG collection system and covers in place, some LFG is released through the atmosphere through the daily cover, interim cover, final cover.

The LFG collection system serving the proposed landfill mound will be designed and constructed to have the capability of achieving an overall collection efficiency of 85%.

1.3.3 Landfill Collection System, Landfill Gas-Fired Generators and Flares

Currently, a landfill gas (LFG) collection system is serving the existing landfill mound. A similar system is to be implemented to serve the proposed landfill mound. These LFG collection systems supply the LFG to the on-site electricity generation system at the landfill-gas-to-energy (LGTE) facility and to on-site flares. The LGTE facility consists of five reciprocating engine-generator sets, all located inside a building near the southeast corner of the property boundary, along Carp Road. The engine-generators are used to combust the landfill gases and the energy generated through the combustion reaction is used to supply up to 8 MW of electricity to the municipal grid.

Currently, two types of engine-generator sets are in place at the landfill gas-to-energy (LGTE) facility. Due to the proposed landfill expansion, the smaller engine-generator sets with a power rating of 800 kilowatts (kW) may be replaced with the larger engine-generator sets with a power rating of 1,600 kW. In effort to conservatively assess emissions from the landfill gas-fired engine-generators and in anticipation of the increased LFG generation, this assessment is based on the installation of the larger 1,600 kW engine-generator sets. This configuration of generators (in combination with the flare configuration, the recommended LFG collection efficiency, and potential LFG generation) is expected to have the capacity to handle the LFG collected by the LFG collections systems from both the existing and proposed landfills.

In addition to supplying LFG to the landfill gas-fired engine-generator sets, the LFG collection systems also supply LFG generated from the existing landfill and the preferred landfill to three flares. The flares are utilized to combust and destroy the LFG that was not sent to the generators.

1.3.4 Contaminated Soil Stockpile

The WCEC landfill will receive contaminated soil or 'special' waste from off-site locations for use as daily cover. The majority of this soil is likely to be petroleum fuel-contaminated and to contain fuel-related VOCs such as benzene and other light aromatics. The contaminated soil will be stockpiled near the haul routes for daily access, located in the adjacent cell south of the active stage of the proposed landfill. The contaminated soil stockpile is expected to not exceed a surface area of approximately 4,000 m^2.

1.3.5 Leachate Treatment System

WM has proposed to collect the leachate generated at the closed existing landfill mound and send it to an-site leachate treatment system. Similarly, the leachate generated at the proposed landfill will also be collected and sent to the proposed leachate treatment system. The leachate will be treated on-site using a sequencing batch reactor (SBR) system. The SBR leachate treatment system is a single train. The tanks associated with the SBR system operation will include the raw leachate equalization tank, the SBR tank, the effluent equalization tank, and the sludge tank. Raw leachate from the leachate collection wells will be pumped to an equalization tank for storage. From the equalization tank, raw leachate will be pumped using leachate transfer pumps to the SBR tank.

The SBR system operates on a batch cycle which includes the following steps:

- Fill cycle – in the fill cycle the raw leachate is pumped into the SBR tank to fill the tank to a preset level;
- React cycle – in the react cycle the SBR tank contents are aerated and the biological decomposition of the leachate occurs;
- Settle phase – after the reaction phase, the aeration and mixing of the SBR is stopped and the mixed liquor suspended solids are allowed to settle;
- Decant phase – in the decant phase the clarified effluent is decanted from the top of the SBR tank to the treated leachate effluent tank; and
- On a periodic basis, waste activated sludge is pumped from the SBR tank to the sludge storage tank.

1.3.6 Material Handling and Processing Sources

Handling of particulate matter-generating materials, such as overburden materials and contaminated soil, will occur daily during construction operations and normal landfilling operations. These operations include:

- Material loading at contaminated soil stockpile, overburden stockpile, construction working face, and landfill working face;
- Material unloading at the contaminated soil stockpile, construction working face, and landfill working face;
- Bulldozing at the overburden stockpile and construction working face; and
- Crushing of aggregate material at the Impact Crusher near the WTFP.

1.3.6.1 Material Handling Operations

Both material loading and unloading generate particulate matter emissions. Material loading into haul trucks is completed using loader bucket at the contaminated soil stockpile, the overburden stockpile, the construction working face and the landfill working face. Material unloading is completed when the haul truck bed is lifted up to dump its material at the construction working face and the landfill working face.

1.3.6.2 Bulldozing Operations

Bulldozing is also a particulate matter emission generating activity, which occurs at the landfill overburden stockpile in the southwest corner of the proposed landfill and at the construction working face. Bulldozing will be limited to the approximate surface areas of 4,000 m^2 and 900 m^2 for the overburden stockpile and construction working face, respectively.

1.3.6.3 Crushing Operation

WM has proposed to operate an impact crusher to allow for on-site crushing of aggregate material, a process with the potential to also generate particulate matter emissions. At the time of the assessment, data for the crushing operations was not available and therefore a typical impact crusher processing capacity was taken from an impact crusher unit used by WM at another facility, previously evaluated by RWDI. The crushing process consists of one impact crusher, having a processing rate of 200 tonnes per hour. One 300 hp diesel engine is used to power the crushing plant.

1.4 Process Flow Diagram

Figure 1.4 in the Figures Section provides the process flow diagram(s) for the facility.

1.5 Operating Schedule

The landfill operates from 6:00 to 20:00 with waste receipt and the Waste Transfer and Processing Facility (WTPF) operating from 7:00 to 19:00. The landfill and the WTPF facility are assumed to operate year-round.

Landfill construction activities such as bulldozing at the overburden pile and at the construction working face are not assumed to be continuous and these activities are limited to occur during the landfill hours of operation. Similarly, the diesel-fired impact crusher operation is not assumed to be continuous and will only occur during the hours of operation for the WTPF.

All other equipment such as the landfill gas flares, the landfill gas-fired generators, the leachate treatment system, and the emergency diesel-fired generator (providing back-up power for the leachate treatment facility) are assumed to operate continuously.

2. INITIAL IDENTIFICATION OF SOURCES & CONTAMINANTS

Table 2.1 in the Tables Section provides the Source and Contaminants Identification Table. A list of the sources included in this ESDM Report is provided below:

2.1 New, Modified or Updated Sources Requiring Approval

- One (1) existing capped landfill mound (Source ID: LM_EX), previously used for the landfilling of solid waste materials. The landfill mound produces landfill gas, the majority of which is collected and sent to the LGTE facility or to the flares for destruction. The landfill gas not collected is released from the landfill mound in a fugitive manner;
- One (1) landfill mound (Source ID: LM_PP), used for the landfilling of solid waste materials. The landfill mound produces landfill gas, the majority of which is collected and sent to the LGTE facility or to the flares for destruction. The landfill gas not collected is released from the landfill mound in a fugitive manner;
- Five (5) 1,600 kW landfill gas-fired engine-generator sets (Source ID: E1, E2, E3, E4 and E5) for a total power rating of 8.0 kW and a maximum LFG firing rate of 0.28 m^3 per second;
- One (1) enclosed flare system (Source ID: F1), used to incinerate the landfill gases from a landfill gas collection system at a maximum volumetric gas flow rate of 0.57 cubic metres per second based on a methane content of 50 percent by volume. The landfill flare has a maximum heat input of 41.7 gigajoules per hour;
- One (1) enclosed flare system (Source ID: F2), used to incinerate the landfill gases from an expanded landfill gas collection system at a maximum volumetric gas flow rate of 1.04 cubic metres per second based on a methane content of 50 percent by volume. The landfill flare has a maximum heat input of 70.7 gigajoules per hour;

- One (1) candlestick flare system (Source ID: F3), used to incinerate the landfill gases from a landfill gas collection system at a maximum volumetric gas flow rate of 1.0 standard m^3 per second based on a methane content of 50 percent by volume;
- One (1) raw leachate equalization tank (Source ID: RAWLEACH), which is an outdoor above-ground storage tank;
- One (1) SBR tank (Source ID: SBR), which is an outdoor above-ground storage tank, exhausting through a passive vent;
- One (1) effluent equalization tank (Source ID: EFFLUENT), which is an outdoor above-ground storage tank, exhausting through a passive vent;
- One (1) sludge holding tank (Source ID: SLUDGE), which is an outdoor above-ground storage tank, exhausting through a passive vent;
- One (1) 300 hp diesel-fired engine (Source ID: CR_ENG) used to provide power to the impact crusher;
- Crushing of aggregate material at the Impact Crusher (Source ID: CR) near the Waste Transfer Facility;
- Material loading and unloading at contaminated soil stockpile (Source ID: CSS_MH);
- Material loading at overburden stockpile (Source ID: OB_MH);
- Material loading the construction working face (Source ID: CWS_MH);
- Material loading at the landfill working face (Source ID: ACTFCE);
- Material unloading at the construction working face (Source ID: CF_UNL);
- Material unloading at the landfill working face (Source ID: ACT_UNL);
- Bulldozing at the overburden stockpile (Source ID: OB_BD); and
- Bulldozing at the construction working face (Source ID: CF_BD).

2.2 Existing Approved Sources

- One (1) 320 kW emergency diesel-fired generator (Source ID: LEACHGEN) used to provide back-up power for the leachate treatment facility.

2.3 Previously Approved Insignificant Sources not Included in The Modelling

- One (1) exhaust (Source ID: B3), to serve the gas stripper in the Blower Building used to remove methane and non-methane organic compounds from the wastewater before its discharge to sanitary sewer; and
- One (1) landfill gas-fired boiler (Source ID: BOILER), used at the leachate facility to provide heating for the SBR process, with a maximum heat input of 2 111 000 kilojoules per hour.

3. SIGNIFICANCE OF SOURCES AND CONTAMINANTS

3.1 Identification of Negligible Sources

3.1.1 Insignificant Sources

The following sources were determined to be insignificant:

- One (1) exhaust (Source ID: B3), to serve the gas stripper in the Blower building; and,
- One (1) landfill gas-fired boiler (Source ID: Boiler), used at the leachate treatment facility to provide heating for the SBR process.

3.1.2 Rationale for Assessment

The gas stripper exhaust (B3) and landfill gas-fired boiler (BOILER) were both deemed to be insignificant based on MOE guidance. The MOE states that: sources which, in combination, represent less than 5% of total property–wide emissions of a contaminant can, in many cases, be considered insignificant sources.

Emissions for the gas stripper exhaust (B3) were calculated in the 2008 ESDM and found to be less than 1% of the site-wide totals for all contaminants, previous to adding emissions from proposed landfill.

The significance of the landfill gas-fired boiler (BOILER) was assessed based on its maximum landfill gas consumption. This source can consume up to 0.032 m³/s of landfill gas. The total landfill gas consumed by combustion equipment at the WCEC Landfill facility (including the flares, LFG engines, and the boiler) is 4.04 m³/s. Since the BOILER consumes less than 1% of the landfill gas, it would be expected to release less than 1% of the total site-wide emissions from landfill gas combustion.

3.2 Identification of Insignificant Contaminants

3.2.1 Insignificant Contaminants

The following contaminants were determined to be insignificant:

- 1,1,2,2-Tetrachloroethan (CAS# 79-34-5);
- 1,3,5 Trimethylbenzene (CAS# 108-67-8);
- 1,4 Dichlorobenzene(-p) (CAS#106-46-7);
- 1-Methylnaphthalene (CAS# 90-12-0);
- 1-Methylphenanthrene (CAS# 832-69-9);
- 2-Methylnaphthalene (CAS# 91-57-6);
- Acenaphthylene (CAS# 120-12-7);
- Acetone (2-Propanone) (CAS# 67-64-1);
- Aluminum (CAS# 7429-90-5);
- Fluorene (CAS# 86-73-7);
- Lead (CAS# 7439-92-1);
- Magnesium (CAS# 7439-95-4);
- Manganese (CAS# 7439-96-5);
- Mercury (CAS# 7439-97-6);
- Methyl Ethyl Ketone (2-Butanone) (CAS# 78-93-3);
- Molybdenum (CAS# 7439-98-7);
- Naphthalene (CAS# 91-20-3);
- Nickel (CAS# 7440-02-0);

- Antimony (CAS# 7440-36-0);
- Arsenic (CAS# 7440-38-2);
- Biphenyl (CAS# 92-52-4);
- Bis(2-Ethylhexyl)Phthalate (CAS# 117-81-7);
- Boron (CAS# 7440-42-8);
- Bromodichloromethane (CAS# 75-27-4);
- Cadmium (CAS# 7440-43-9);
- Calcium (CAS# 7440-70-2);
- Chlorobenzene (CAS#108-90-7);
- Chloromethane (methylchloride) (CAS# 74-87-3);
- Chromium (total) (CAS #7440-47-3);
- Cobalt (CAS# 7440-48-4);
- Copper (CAS# 7440-50-8);
- Ethylbenzene (CAS# 100-41-4);
- Phenanthrene (CAS# 85-01-8);
- Phenol (CAS# 108-95-2);
- Phosphorus (CAS# 7723-14-0);
- Potassium (CAS# 7440-09-7);
- Quinoline (CAS# 91-22-5);
- Selenium (CAS# 7782-49-2);
- Sodium (CAS #7440-23-5);
- Styrene (CAS# 100-42-5);
- Sulphate (CAS# 18785-72-3);
- Tin (CAS #7440-31-5);
- Titanium (CAS# 7440-32-6);
- Toluene (CAS# 108-88-3);
- Xylene (CAS# 1330-20-7); and
- Zinc (CAS# 7440-66-6).

3.2.2 Insignificant Contaminants

Contaminants that were measured in the source testing for the landfill gas engines but were not present in detectable quantities in the laboratory analysis were deemed to be insignificant.

The leachate treatment facility (which includes the SBR system) portion of the assessment deals with volatile compounds as identified from sampling of raw leachate from the existing WCEC landfill and projected leachate quality parameters from WM's Twin Creeks landfill. The sampling results and list of projected leachate quality parameters can be found in **Appendix H1 and H2**. Compounds that were not detected (i.e., below sampling detection limits) were deemed to be insignificant. Non-volatile compounds, such as metals, were assumed to remain in the liquid leachate and were also deemed to be insignificant.

Contaminant emissions unique to the leachate management system were compared to a calculated site-specific emission threshold to evaluate whether the contaminant is significant. The Emission Threshold is calculated using a MOE conservative dispersion factor (µg/m³ per g/s emission) and the relevant standard or guideline under O. Reg. 419/05. For chemicals without standards or guidelines under O. Reg. 419/05, the MOE *de minimus* POI concentrations (24-hour average basis) presented in Appendix B of the MOE's Procedure for Preparing an ESDM Report, Version 3.0, March 2009, can be applied. The dispersion factor used to calculate the emission threshold is based on the separation distance between the leachate treatment system sources and the nearest POI. Detailed calculations can be found in **Appendix B**.

4. OPERATING CONDITIONS, EMISSIONS ESTIMATING & DATA QUALITY

Section 10 of O. Reg. 419/05 states that, for the purposes of an ESDM report, an acceptable operating scenario to consider is one that would result, for a given contaminant, in the highest concentration of that contaminant at Points of Impingement (POI's) that the facility is capable of causing. To satisfy this requirement, a maximum production scenario was developed in consultation with WM. This scenario examined the maximum processing rate that the facility could be expected to achieve. This consists of simultaneous operation of all on-site sources at a maximum capacity, including the LGTE facility engine-generator sets, the landfill gas flares, the leachate treatment system and generators. The assessment also considered the concurrent maximum level of fugitive releases from the existing and proposed landfill mounds as well as material handling and processing emissions.

In the Detailed Impact Assessment prepared as part of the Environmental Assessment Application, the potential air quality impacts that would results from the construction and operation of the proposed landfill were assessed at two worst case future build stages and phases of development. The scenarios assessed were:

- An intermediate operation scenario; and
- A final operating scenario.

Based on the results outlined in the Detailed Impact Assessment, the maximum predicted concentrations for the vast majority of the contaminants assessed were observed as a result of the intermediate operation scenario. The intermediate operation scenario was therefore chosen as the worst-case scenario evaluated as part of this assessment.

4.1 Description of Operating Conditions

4.1.1 Existing Landfill Mound, LFG Engines and LFG Flares

All five 1,600 kW engine-generators and all three flares were assumed to be operating at a maximum capacity for 24 hours per day, 365 days per year, concurrent with the maximum fugitive landfill gas releases through the existing landfill mound. The existing landfill mound has a LFG collection system in place, with 85% collection efficiency.

4.1.2 Proposed Landfill Mound

For the intermediate operation scenario, it was assumed that Phase 1 was completed and therefore half of the total waste, approximately 2,000,000 tonnes, had been deposited in all eight stages of the landfill. It was assumed that this area will be characterized by the presence of a LFG collection system with a collection efficiency of 85%. Phase 2 was also assumed to have commenced, and approximately 250,000 tonnes of waste was deposited in Stage 1.

As a conservative approach, it was assumed that the entire surface area (47,250 m^2) of Stage 1 was considered the "active stage". The active stage was defined as the area where waste was deposited during the year in which the intermediate operation scenario takes place. The active stage is also assumed to contain an interim cover area, which includes a 900 m^2 working face where landfilling would actively occur. The active stage would not have a completely installed LFG collection system, therefore the LFG collection efficiency for the active stage area would only be 50%.

In addition to the active stage occurring in Stage 1, it was assumed that construction operations occur simultaneously in Stage 3. Both the landfill and construction working faces were assumed to be placed in the northeast corner of Stage 1 and Stage 3, respectively, as this represents a worst case location due to the close proximity of the property boundary and sensitive receptors.

4.1.3 Contaminated Soil Stockpiling

The contaminated soil stockpile was assumed to have a surface area of 4,000 m^2, based on the size of the contaminated soil stockpile at the existing landfill mound during its peak operation (in 2004). The contaminated soil stockpile was modelled in a worst-case location near the southwest corner of the proposed landfill. As a conservative estimate the contaminant soil stockpile was modelled at a height of zero metres above grade.

4.1.4 Leachate Treatment System

The WCEC leachate treatment systems (SBR system) will treat leachate collected from the existing and proposed landfills. Although the SBR is a batch system, the sources were conservatively assumed to be emitting continuously.

All four leachate treatment tanks (equalization tank, SBR, effluent tank and sludge tank) were assumed to be emitting contaminants simultaneously and at a maximum capacity, for 24 hours per day, 365 days per year.

The emergency diesel generator serving the leachate treatment system was also assumed to be operating at maximum capacity, as part of a routine scheduled testing. As a conservative estimate, it was assumed that the emergency diesel generator was operating 24 hours per day, 365 days per year.

4.1.5 Material Handling and Processing

Material handling activities, bulldozing activities and crushing operations are assumed to take place at the WCEC landfill all year-round.

Landfill construction activities such as bulldozing at the overburden pile and at the construction working face are not assumed to be continuous and these activities are limited to occur during the landfill hours of operation (from 7:00 to 17:00). Similarly, the diesel-fired impact crusher operation is not assumed to be continuous and will only occur during the hours of operation for the WTPF (from 7:00 to 19:00).

The crushing operations assume that the impact crusher has a maximum processing rate of 200 tonnes per hour.

4.2 Explanation of Method Used to Calculate the Emission Rate

4.2.1 Existing Landfill Mound

4.2.1.1 Existing Landfill Mound

The United States Environmental Protection Agency's (U.S. EPA) Landfill Gas Emissions Model (LANDGEM) was used to calculate LFG generation rates and estimate the emission rates for the LFG compounds from the existing closed landfill mound.

The key inputs in the LANDGEM program are the methane generation rate (k) and the methane generation capacity (L_0). The LFG generation of 0.72 m^3/s was based on the recommended k and L_0 values for Ontario landfills from Environment Canada's GHG Quantification Guidance - Emission Factors from Canada's GHG Inventory – Waste obtained in May 2011 (k=0.045, L0=83). These values were selected as they represent the most recent guidance for landfills in Ontario.

When comparing to the available metered LFG consumption data from the LGTE facility in 2010 and the LFG flares, the actual amount of gas combusted exceeded the LANDGEM predicted amount of gas generated. The reason for this discrepancy is likely attributed to the unknown and estimated historical waste acceptance rate at the existing landfill. Therefore, the metered consumption data was used in combination with the estimated collection efficiency of the LFG collection system to back calculate the amount of LFG generated by the landfill 2010 and determine a correction factor that can be applied to determine future year LFG generation from the existing landfill.

The LANDGEM model and correction factor were used to calculate LFG generation for the existing WCEC landfill for the intermediate operation scenario (which approximately corresponds to the 2018 calendar year). For the existing landfill, it was assumed that the LFG collection system is installed serving the entirety the mound, and operating with an estimated LFG collection efficiency 85%.

Please refer to **Appendix D** for additional details and sample calculations.

4.2.1.2 Landfill Gas Compound Emissions

To ensure the use of conservative LFG emission rates, a comparison of the calculated emission rates and source testing results was completed.

Emission rates are calculated using the concentration of compounds in LFG in combination with the maximum LFG consumption rate for each piece of equipment. To determine the concentration of compounds in the LFG, on-site measurement of LFG compounds were taken on June 10, 2004 and April 4, 2011. The two datasets (2004 and 2011) were reviewed against each other to note any changes in the LFG composition due to the improvements to the LFG collection system. The average concentration for each individual compound was calculated separately for the 2004 samples and the 2011 samples. The 2004 and 2011 average concentrations were compared to one another, and the higher of the two was used to develop the emission rate for the LFG compounds in this ECA assessment.

Between the calculated emission rates and source testing results, the maximum emission rate for each contaminant was selected for use in the dispersion modelling. For all compounds, the calculated emission rates based on the equipment maximum LFG consumption rate and the highest concentration measures in LFG yielded the more conservative emission rate with the exception of benzene. The emission rate for benzene was based on the source testing results.

The emission rates for each of the LFG compounds from the existing landfill mound were calculated by using the measured concentration (in milligrams per cubic metres) taken on June 10, 2004 or April 4, 2011 in combination with the amount of LFG released fugitively from the landfill (in cubic metres per year) (refer to methodology described in Section 4.2.1).

Please refer to **Appendix D** for additional details and sample calculations.

4.2.1.3 Odour Emissions

The odour emission rates were estimated through the use of emission factors based on LFG generation rates and collection efficiencies described previously in Section 4.2.2 and the Ministry of Environment recommended odour concentration of 10,000 OU/m^3 of LFG, outlined in the MOE's "Interim Guide to Estimate and Assess Landfill Air Impacts", 1992.

Please refer to **Appendix D** for additional details and sample calculations.

4.2.2 Proposed Landfill Mound and Active Stage

4.2.2.1 Proposed Landfill Mound

The United States Environmental Protection Agency's (U.S. EPA) Landfill Gas Emissions Model (LANDGEM) was used to calculate LFG generation rates and estimate the emission rates for the LFG compounds from the proposed landfill mound.

The key inputs in the LANDGEM program are the methane generation rate (k) and the methane generation capacity (L_0). The LFG generation of 0.72 m^3/s was based on the recommended k and L_0 values for Ontario landfills from Environment Canada's GHG Quantification Guidance - Emission Factors from Canada's GHG Inventory – Waste obtained in May 2011 (k=0.045, L0=83). These values were selected as they represent the most recent guidance for landfills in Ontario.

In contrast to determining the LFG generated from the existing landfill, a correction factor was not applied in determining the LFG generated from the proposed landfill. The reason a correction factor was not applied was due to WM plans to execute diversion efforts and accept less organic material at the proposed landfill, resulting in lower LFG generation rates. Also, unlike the historical waste acceptance at the existing landfill, the waste acceptance at the proposed landfill will be well documented. For these reasons, it is thought that the LFG generation estimated using the LANDGEM model will be more accurate and little discrepancy will occur when compared to the future metered consumption data.

For the proposed landfill footprint, the estimated gas collection efficiency of the LFG collection system varies between the portions of the landfill with final cover (85% collection) and the active stage of the landfill (50% collection).

4.2.2.2 Landfill Gas Compound Emissions

The emission rates for the LFG compounds from the proposed landfill mound were calculated by assuming that the concentration in the raw LFG produced by the proposed landfill would be the same as the measured concentrations found in the raw LFG of the existing landfill (refer to methodology described in Section 4.2.1.1) in combination with the LFG generation rates and LFG collection efficiencies described in the previous section.

Please refer to **Appendix E** for additional details and sample calculations.

4.2.2.3 Odour Emissions

The odour emission rates from the proposed landfill mound were estimated using the LFG generation rates and the collection efficiency described in Section 4.2.3 as well as the Ministry of Environment recommended odour concentration of 10,000 OU/m^3 of LFG, outlined in the MOE's "Interim Guide to Estimate and Assess Landfill Air Impacts", 1992.

Odour emission rates from the working face area of the active stage were determined through flux chamber measurements taken at various representative landfill sites in Ontario such as Ridge Landfill, Britannia Road Sanitary Landfill, Trail Road Landfill and Walker Landfill. Flux chamber measurements are used to directly measure the odour emission rate originating from the surface of interest.

The odour emission samples were collected using a stainless flux chamber. The flux chamber was placed on the surface of the working face and the bottom edge of the chamber was forced a short depth down into the surface to create a seal. The flux chamber was operated under a slight positive pressure to further prevent outside air from entering underneath the walls and into the chamber.

Samples were collected and submitted for analysis by an odour panel, a representative group of the population that smell and characterize diluted odour samples to quantitatively determine the strength of the odour source in odour units. The 90th percentile concentration from the samples collected on each source was used in determining the emission rate for the source.

Please refer to **Appendix E** for additional details and sample calculations.

4.2.3 Landfill Gas-Fired Generators and Flares

Source testing was conducted for both the landfill gas-fired engine-generator sets and flares to measure concentrations of LFG compounds as well as combustion by-products. The source testing conducted on the landfill gas-fired engine-generators were completed and summarized in RWDI Report #0925116: "Stack Sampling Program", dated November, 2010. The source testing conducted on the flares were completed and summarized in RWDI Memo Report #W07-5143A: "Results of Stack testing on the Flare Stack, Carp Road Landfill, March Testing Program", dated June, 2007.

The destruction efficiency of the landfill gas-fired generators was estimated to be 97% and the destruction efficiency of the landfill gas-fired flares was estimated to be 98%. This is based on guidance in the final version of the U.S. EPA AP-42 Emission Factor Document (AP-42), Chapter 2.4 Municipal Solid Waste Landfills, dated November 1998,

4.2.3.1 Landfill Gas Compound Emissions

The emission rates for each of the LFG compounds from the existing landfill and proposed landfill mounds were calculated by using the measured concentration (in milligrams per cubic metres) taken on June 10, 2004 or April 4, 2011 (refer to methodology described in Section 4.2.1.1) in combination with the total amount of LFG released fugitively from the landfills (in cubic metres per year).

Please refer to **Appendix F** for additional details and sample calculations.

4.2.3.2 Combustion By-Product Emissions

Emissions from the landfill gas-fired engine-generators and flares also include combustion by-products such as total suspended particulate, carbon monoxide, nitrogen oxides and dioxins and furans.

LFG-fired engine-generators' particulate matter emission rates were calculated using information provided in Chapter 2.4 of AP-42. The LFG-fired generators' nitrogen oxides, carbon monoxide and dioxins and furans emission rates are based on the source testing results.

Most flares' nitrogen oxides, carbon monoxide and particulate matter emission rates were calculated based on Chapter 2.4 of AP-42, with the exception of the nitrogen oxides emission rate from Flare 2, which was based on source testing results. The dioxins and furans emission rates for all three flares are also based on the source testing, as it is the best available data.

Please refer to Appendices F for additional details and sample calculations.

4.2.4 Contaminated Soil Stockpile

4.2.4.1 Volatile Organic Compound Emissions

The contaminated soil accepted and utilized at the proposed landfill is expected to be similar in nature to the soil previously accepted at the existing landfill. The majority of soil used at the existing landfill was petroleum fuel-contaminated and contained fuel-related VOCs such as benzene and other light aromatic compounds. The results from a flux chamber measurement program for the existing landfill contaminated soil stockpiles were the most appropriate method to estimate the emissions for this source.

In 2004, a flux chamber measurement program, as presented in RWDI Report #041491: "Landfill Gas Assessment Ottawa Landfill Baseline Conditions", dated March, 2005 was used to determine the emission rate originating from the contaminated soil stockpiles. The composition of the contaminated soil stockpiles is expected to vary based on actual soil accepted, therefore a total of six samples were collected over the course of two days; July 7 and 8, 2004, to determine "typical" concentrations of contaminants in the contaminated soil stockpiles. As emissions of VOCs from the soil will generally decrease with increasing surface exposure time, the majority of the samples were taken from piles that had been deposited less than one hour prior to the commencement of sampling. The remaining samples were collected from piles that were less than 24 hours old. In addition, the emissions are expected to be highest during the summer months, since the volatilization of VOCs will be greater at higher temperatures. The emission rates determined from the July sampling results were applied to the contaminated soil stockpiles on an annual basis.

The soil emission samples were collected using a flux chamber. This flux chamber was 71 cm in diameter, 31 cm high constructed of 14 gauge stainless steel, as per the designer specifications (Reinhart, Cooper and Walker, 1992). The flux chamber was placed on the surface of the contaminated soil pile and the bottom edge of the chamber was forced a short depth down into the surface to create a seal. The flux chamber was operated under a slight positive pressure (0.045 inches H2O) to further prevent outside air from entering underneath the walls and into the chamber, as recommended by the designer (Reinhart, Cooper and Walker, 1992).

The flux chamber was first purged with a sweep gas of nitrogen to minimize biasing of gas emission rates and produce accurate measurements. After the flux chamber had been purged, a VOC sample was drawn from the chamber using a four-phase stainless steel absorbent tube. The sample was collected using the VOC sample train, in accordance with the U.S. EPA Method TO-17. An average flow rate of 406 mL/min was maintained for approximately 25 minutes, resulting in sample volumes ranging from 8.8 to 11.1 liters. The sample tubes were sent to OSB Laboratories in Brampton to be analyzed for all of 24 LFG species.

The sample results indicate that the most of the contaminants were not emitted from the contaminated soil stockpile in concentrations above the laboratory detection limit. Emission flux rates (in grams per square metre per second) were determined for the following eight compounds, which were found to be emitted from the contaminated soil stockpiles:

- 1,1,1-Trichloroethane;
- 1,2-Dichloroethane;
- Benzene;
- Dichloromethane;
- Octane;
- 2-Butanol;
- Tetrachloroethylene; and
- Trichloroethylene.

Please refer to **Appendix G** for additional details and sample calculations.

4.2.5 Leachate Treatment Facility

4.2.5.1 Volatile Organic Compound and Odour Emissions

The U.S. EPA's wastewater treatment model WATER9 was used to estimate potential air emissions from the SBR leachate treatment system. WATER9 outputs emission rates (in gram per second) to air by contaminant for each source. WATER9 allows the user of the model to select component equipment configurations within the plant and arrange the flows and process inputs to approximate the facility configuration, therefore allowing the user to simulate the plant virtually within the modelling program. Certain parameters were inputted to the program (i.e., temperatures, flows, influent concentrations), based on the Ottawa Landfill Leachate Treatment System Conceptual Design Report document, prepared by AECOM, as well as additional information provided by AECOM and Waste Management. Where required information was not available from either of these sources, parameters were based on the WATER9 defaults. In cases where a specific equipment configuration did not exist within the program, the most reasonably representative equipment type or configuration was chosen.

For the WCEC landfill's leachate treatment system or the sequencing batch reactor (SBR) system was represented by the "diffused air biotreatment" equipment type in the WATER9 model. This equipment type considers biological degradation of the compounds in the leachate and aeration/agitation of the leachate in the containment tank. The Equalization Tank and Effluent Equalization Tank were represented by the "storage tank" equipment type in the WATER9 model and the Sludge Tank was represented by the "mix tank" equipment type.

The water quality data for all sources at the leachate treatment facility were based on the water quality data for raw leachate. Incoming leachate quality data was based on two sources of information – sampling data from raw leachate at the existing landfill and maximum design leachate concentrations for a SBR system at another WM facility, the Twin Creeks landfill. The raw leachate sampling data were assessed and any contaminants that were detected above their corresponding method detection limit were carried forward in the assessment. Contaminants that were measured but not found in concentrations above the method detection limit were not assessed. The WCEC existing landfill sampling data and the Twin Creeks design concentrations were compared, and the highest concentration for each contaminant (with exception of ammonia) was used to develop emission rates for the detected contaminants. This is a conservative approach, as no degradation or removal of the contaminants in the leachate was accounted for as the leachate is treated through the process. The one exception to the above statement is when calculating ammonia emission rates, where AECOM provided inlet ammonia concentration data separately for the raw leachate (Equalization Tank and SBR), the effluent (Effluent Tank), as well as the sludge (Sludge Tank).

The initial proposed design for the SBR system was to treat leachate collected from the existing landfill. In anticipation of the increased leachate generation due to the construction and filling of the proposed landfill, the SBR system was assumed to double in equipment and capacity; therefore, as a conservative approach, the initial estimated emission rates for the raw leachate equalization tank, the effluent equalization tank, and the sludge holding tank were doubled. The emissions from the SBR tank were not doubled, since the SBR is a batch process and maximum emissions would not occur from two SBR tanks simultaneously.

For the purposes of this assessment and to obtain the most conservative emissions release estimate, the following was assumed:

- The SBR system is operating at its maximum flow rate;
- The leachate inlet concentration for each parameter identified is at its highest;
- The leachate generated from the proposed landfill and the existing landfill are similar in quality; and
- The SBR tank, although a batch process, is discharging emission continuously, 24 hours per day, 7 days a week.

Having one SBR system operating 24-hours per day at the worst-case conditions is a conservative assumption intended to address any potential additional capacity that may be required in the future.

Please refer to **Appendix H** for additional details and sample calculations.

4.2.5.2 Combustion By-Product Emissions

A 320 kW emergency diesel-fired generator supports the leachate treatment system or SBR system. Emissions associated with the emergency diesel-fired generator include combustion by-products such as total suspended particulate, carbon monoxide and nitrogen oxides.

PM, CO and NO_x emission rates were calculated based on emission factors provided in manufacturer specifications.

Please refer to **Appendix I** for additional details and sample calculations.

4.2.6 Material Handling and Processing Emissions

4.2.6.1 Fugitive Dust (Particulate Matter) Emissions

Estimates of the particulate matter emission rates from landfilling and construction operations were obtained using the relevant chapters from AP-42. These documents provide a reasonable general estimate of emission rates in dry conditions. Formulae and emission factors for calculating particulate matter emission rates are presented below.

4.2.6.2 Material Handling Emission Rates

Estimates for particulate matter emission rates for material handling operations are based on the equation from Section 13.2.4 of AP-42 summarized below:

$$E = k * 0.0016 * \left[\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right] \quad \text{Equation 1}$$

Where: E = emission factor in kg/Mg (kilogram of particulate matter emitted per megagram of material processed);

K = particle size multiplier (TSP = 0.74, PM_{10} = 0.35 and $PM_{2.5}$ = 0.11);

U = mean wind speed in m/s (metres/second); and,

M = material moisture content (%).

The required inputs into the above equation are mean wind speed and moisture content of the material handled. An hourly emission rate file was generated using the hourly wind speed recorded in the Ottawa Airport meteorological data file used, corresponding to the years of meteorological data modelled. Material handling was assumed to occur only during the landfill's hours of operation; therefore, material handling emissions were only calculated for hours between 6:00 and 20:00 and were set to zero off for all other hour. Hourly emission rates were also set to zero if the Ottawa Airport meteorological data for the corresponding hour was recorded to have medium to high precipitation.

The typical mean moisture content of 12 % for cover material at municipal solid waste landfills, as listed in Section 13.2.4 of AP-42, was used to calculate the emission rates for all material handling sources.

At the proposed landfill footprint, the material handling sources include:

- Material loading and unloading at the contaminated soil stockpile;
- Material loading at the overburden stockpile;
- Material loading and unloading at the construction working face; and
- Material loading and unloading at the landfill working face.

Emissions were based on material handling rates developed by using the truck traffic for each location and a truck capacity of 10 m^3 of soil/granular material. A material density of 1.61 tonnes/m^3 was calculated based on the average density of clay (dry excavated and wet excavated) and sand (wet and dry) from the Mass, Weight, Density or Specific Gravity of Bulk Material website. Material handling rates for each source are summarized in **Table 4.2.7**

Excerpts of the hourly emission rate files can be found in **Appendix J**.

4.2.6.3 Bulldozing Emission Rates

Particulate matter emission estimates from the bulldozing operations at the overburden stockpile and the construction working face were obtained using the equation used for the bulldozing overburden material from Section 11.9.2 of AP-42 as summarized below:

$$E\ (TSP) = \frac{2.6(s)^{1.2}}{(M)^{1.3}} \qquad \text{Equation 2}$$

$$E\ (PM15) = \frac{0.45(s)^{1.5}}{(M)^{1.4}} \qquad \text{Equation 3}$$

$$E\ (PM10) = E(PM15) \times 0.75 \qquad \text{Equation 4}$$

$$E\ (PM2.5) = E(TSP) \times 0.105 \qquad \text{Equation 5}$$

Where: E = emission factor in kg/hr;

s = material silt loading (%); and

M = material moisture content.

Bulldozing was assumed to occur on a continuous basis for the landfill hours of operations. No controls were applied to the particulate matter emission created by the bulldozing operations.

The bulldozing operations at the overburden stockpile and the construction working face are considered area sources and to determine the emission flux rate, the approximated surface areas of 4000 m^2 and 900 m^2 for the overburden stockpile and construction working face, respectively, were used.

To be consistent with the material handling emission rates developed, the typical mean moisture content of 12% and mean silt content of 9% for cover material at municipal solid waste landfills, as listed in Section 13.2.4 of the AP-42, was used to calculate the emission rates for all the bulldozing sources. Based on the silt and moisture content used, the calculated $PM_{2.5}$ emission rates were higher than the calculated PM_{10} emission rates. Therefore, as a conservative approach, the $PM_{2.5}$ emission rates were used for both the $PM_{2.5}$ and PM_{10} assessments.

Please refer to **Appendix K** for additional details and sample calculations.

4.2.7 Impact Crusher and Engine

4.2.7.1 Particulate Matter Emissions

Particulate matter emissions from the crushing and screening processes were determined using the AP-42 Chapter 11.19.2 “Crushed Stone Processing and Pulverized Mineral Processing”. Since this chapter does not include emission factors from primary and secondary crushing, the tertiary crushing emission factor of 6.0E-04 kg/Mg was conservatively used for the crushing process. Controlled emission factors were used as it was assumed that water spray bars have been installed on the processing equipment to control fugitive particulate matter emissions from the crushing process.

As no data on the proposed crusher system was available at the time of this assessment, the amount of material handled the processing operations was determined by using the processing capacity of 200 Mg/hour based on another typical impact crusher previously evaluated by RWDI.

Please refer to **Appendix L** for additional details and sample calculations.

4.2.7.2 Combustion By-Products

One 300 horsepower diesel engine powers the impact crusher. Specifications for the specific unit to be used at the WCEC were not available, since the equipment has not yet been selected. Emission rates for the engine was based on emission factors from AP-42 Chapter 3.3, Gasoline and Diesel Industrial Engines, with exhaust parameters assumed based on typical units.

Please refer to **Appendix L** for additional details and sample calculations.

4.3 Sample Calculation for each Method

Sample calculations are provided in the appendix associated with each source.

4.4 Assessment of Data Quality for Each Emission Rate

The assessment of data quality for each emission rate is provided in the Source Summary Table.

The emission rates for the landfill gas-fired engines were based on engineering calculations, AP-42 emission factors and validated source testing program; therefore, depending on the contaminant, they were assigned an “above-average” or “marginal” data quality rating. The emission rates for the landfill gas flares were based on LANDGEM calculations, source testing and AP-42 emission factors; therefore, dependant on the contaminant, they were assigned an “above-average” or “average” data quality rating.

The emission rates for the landfill mounds were based on LANDGEM calculations and source testing; therefore, they were assigned “above-average” data quality ratings. The fugitive emissions from the contaminated soil stockpile were based on validated source testing program; therefore, they were assigned “above-average” data quality ratings.

The leachate treatment emission rates estimated using WATER9 were assigned “average” data quality ratings. The emission rates for the leachate treatment system emergency diesel generator are based on AP-42 emission factors with “A” ratings; therefore, they were assigned “above-average” data quality ratings.

The emission rates for the material loading activities are based on an AP-42 emission factor equation with an “A” rating; therefore, they were assigned “above-average” data quality ratings. The emission rates for the bulldozing activities are based on an AP-42 emission factor with a “C” rating; therefore, they were assigned “average” data quality ratings. The emission rates for the crushing activities and diesel generator are based on an AP-42 emission factor with an “E” rating; therefore, they were assigned “marginal” data quality ratings.

5. SOURCE SUMMARY TABLE & PROPERTY PLAN

5.1 Source Summary Table

Table 5.1 in the Tables Section provides the Source Summary Table for the facility.

5.2 Site Plan (Scaleable)

Figure 5.2 in the Figures Section provides the site plan for the facility.

6. DISPERSION MODELLING

6.1 Dispersion Modelling Input Summary Table

Table 6.1 in the Tables Section provides the Dispersion Modelling Input Summary Table for the facility. Additional information on specific elements of the modelling analysis is provided in the following sections.

The U.S. EPA's AERMOD dispersion model was used to predict maximum concentrations resulting from emissions from the WCEC facility. AERMOD is a steady-state Gaussian model that is capable of handling multiple emission sources. Within the model, receptor grids as well as discrete receptor locations of interest can be considered.

Separate model runs were conducted for each of the thirty-three (33) significant contaminants emitted from the WCEC landfill facility. All sources in the assessment were modelled either as a point, area or volume sources.

6.1.1 Meteorological Conditions

Five years of local meteorological data (2006-2010) were used in the AERMOD dispersion model. The meteorological data set for the WCEC was developed by the MOE's Environmental Monitoring and Reporting Branch (EMRB). This dataset, however, was based on the MOE's regional meteorological data for Eastern Ontario, which considers surface data from the Ottawa International Airport. The Ottawa Airport, which is located approximately 25 km away from the landfill, is the nearest weather station providing the desired meteorological parameters on an hourly basis. The EMRB adjusted the regional meteorological dataset to account for local land uses surrounding the WCEC facility. The data set provided by the EMBR was used directly in the dispersion model, with no changes or alterations conducted by RWDI.

Consultation on the meteorological dataset was conducted with Jinliang (John) Liu from the EMRB. A request for approval under Section 13(1) of O. Reg. 419/05 for the use of site-specific meteorological data is included in the ECA application.

6.1.2 Area of Modelling Coverage

The area of modelling coverage was designed to meet the requirements outlined in Section 14 of O. Reg. 419/05. A multi-tiered receptor grid was developed with reference to Section 7.2 of the Air Dispersion Modelling Guideline for Ontario, Version 2.0, March 2009; therefore, interval spacing was dependent on the receptor distance from on-site sources.

Typically when modelling odour (or any contaminant with a 10-minute averaging standard), impacts are assessed only at odour sensitive receptor locations and not at the property line. In the MOE's "Methodology for Modelling Assessments of Contaminants with 10-minute Average Standards and Guidelines under O. Reg. 419/05", April 2008, odour sensitive receptors are defined as "any locations where and when human activities regularly occur". Receptors were positioned at 1.5 metres above grade, which is considered to be a typical breathing zone height. Twenty-two (22) discrete (residential) receptors were considered in this assessment. The receptor locations are shown in **Figure 6.1.2.**

R1and R3, which were assessed in the Detailed Impact Assessment, are not assessed as part of this ECA assessment, as WM has purchased the lands on which R1and R3 are located, no longer making them sensitive receptors.

6.1.3 Stack Height for Certain New Sources of Contaminant

All stack heights are less than the allowable stack height obtained using the stack height formula defined under Section 15 of O. Reg. 419/05. As such, building downwash effects have been considered in the dispersion modelling by using the US-EPA's Building Profile Input Program (BPIP) associated with the AERMOD model.

The Building Profile Input Program (BPIP) was used to calculate the effects of building downwash on point sources, such as stacks. The landfill-gas-to-energy building and the flare building were included in the modelling, as these structures have the potential to affect emissions from the engines and flares. The SBR system tanks were also included in the modelling as buildings, as the tanks have the potential to affect emission from the tank vent sources. The BPIP model was run prior to running the AERMOD model to incorporate the potential building downwash effects.

The potential building downwash effects were only evaluated for the point sources within the dispersion model. Although the existing and proposed landfill mounds may be considered "structures", dispersion modelling tests were completed including these landfill mound "structures" and it was found that the effects of mound downwash have insignificant impacts on the maximum off-site concentrations. The effects of the mound downwash are insignificant as the sloping features of the mound do not act as a solid block building.

6.1.4 Terrain Data

Terrain information for the area surrounding the WCEC landfill facility was obtained from the MOE Ontario Digital Elevation Model Data web site. The terrain data are based on the North American Datum 1983 (NAD83) horizontal reference datum. These data were run through the AERMAP terrain pre-processor to estimate base elevations for receptors and to help the model account for changes in elevation of the surrounding terrain.

6.1.5 Averaging Periods Used

10-minute, ½-hour, 1-hour and 24-hour averaging times were used with the AERMOD model to compare to Schedule 3 Standards and other guidelines listed in the Ministry document "Summary of O. Reg. 419/05 Standards and Point Of Impingement Guidelines and Ambient Air Quality Criteria (AAQC's)" dated April 2012. 10-minute average values were calculated from the 1-hour predicted concentrations using a factor of 1.65, as given in Table 4.1 of the Ministry document "Guideline A11: Air Dispersion Modelling Guideline for Ontario" dated March 2009. ½-hour average values were calculated from the 1-hour predicted concentrations using a factor of 1.2, as given in Table 4.1 of Guideline A11.

6.2 Land Use Designation Plan

Figure 6.2 in the Figures Section provides the zoning documentation. The WCEC landfill facility is located adjacent to Highway 417. It is bounded by Carp Road on the east and William Mooney Road on the west. An active quarry is situated immediately east of the site across Carp Road. The land within 1 km of the landfill is largely industrial and agricultural. The landfill itself is zoned as "rural heavy industrial" and is bordered by "mineral extraction" areas to the east and north, "rural general industrial" areas to the north and south, "rural commercial" areas to the south, and "environmental protection" areas to the west.

6.3 Dispersion Modelling Input and Output Files

Modelling input and output files have been provided on a compact disc included in **Appendix A**

CONSULTING ENGINEERS & SCIENTISTS

7. EMISSION SUMMARY TABLE & CONCLUSIONS

7.1 Emission Summary Table

Table 7.1 in the Tables Section provides the Emission Summary Table for the facility.

7.2 Contaminants without Standards or Guidelines under O. Reg. 419/05

The following contaminants do not have standards or guidelines under O. Reg. 419/05, but have Jurisdictional Screening Levels (JSL):

- 1,1,2-Trichloroethane (CAS# 79-00-5); and
- Butyl alcohol, sec- (CAS# 78-92-2).

The predicted concentrations of these contaminants are below their respective JSL, and therefore do not require a maximum ground-level concentration acceptability request.

The following contaminants do not have Standards or guidelines under O. Reg. 419/05, nor do they have relevant JSL values, and will also require a maximum ground-level concentration acceptability request:

- 1,1,2,2-Tetrachloroethane (CAS# 79-34-5);
- Bromodichloromethane (CAS# 75-27-4); and
- Methane (CAS# 74-82-8).

7.3 Odour Criteria

In March, 2005, the Ontario Ministry of the Environment published a position paper in which it proposed to develop an odour policy framework. As part of this position paper, the Ministry recognized the need to review odour-based limits. Historically, the odour threshold most commonly reported was the detection threshold, which is defined as the level at which 50% of a group of normal observers say they detect the odour. The Ministry recognized that complaint thresholds are typically 3 to 5 times the detection threshold. Odour levels are expressed in terms of odour units (OU), where a value of 1 OU corresponds to the 50% detection threshold. Expressed in these units, the complaint threshold for an odour is typically 3 to 5 OU.

Historically, the Ministry's requirements with respect to odours have varied from one facility to another.

The Ministry had no requirement in cases where there was no history of odour complaints or no other evidence of potential concerns. When there was evidence of a legitimate concern, the Ministry sometimes required the facility to stay within 1 OU at sensitive impact locations at all times. In other cases, a frequency of values above 1 OU was permitted if it was below 0.5% annually and, in other cases, a higher odour threshold was adopted (e.g., 5 OU).

In the case of the WCEC odour emissions, concentrations exceed the 1 OU criterion at several of the twenty-three discrete receptors locations evaluated. The frequency of exceedance was conducted. The modeled frequency of exceedance is 0.33%, below the acceptable 0.5% annual frequency of exceedance. Frequency analysis results are shown in **Appendix M**.

7.4 Landfill Gas Calibration Factor

The LANDGEM Model has been developed as a LFG generation model and is not a LFG emission model. The approaches taken in this assessment also produce an estimate of LFG generation rather than LFG emission. This is a very critical distinction when assessing air quality. The effect of LFG passing through several feet of moistened soil, full of microbes and reactive minerals, greatly reduces the amount of many LFG compounds. This is particularly true for reduced sulphur compounds such as hydrogen sulphide.

As referred to in the Amended LFG (VOC) Baseline Assessment Report, dated November 2011, a Combined Assessment of Modelled and Monitored (CAMM) results indicated that it is reasonable that the hydrogen sulphide emission rate be adjusted using a calibration factor. The emission factors for the hydrogen sulphide sources (only LFG related sources) in this assessment were divided by a value of 3, the reduction factor used to obtain an adjusted emission rate. The CAMM study has been reviewed and accepted by the MOE, with the documentation included in **Appendix N**.

None of the other contaminant emission rates were adjusted through the use of a calibration factor.

7.5 Conclusions

Concentrations at points of impingement were predicted using the AERMOD. Modelling input and output files have been provided on a compact disc included in **Appendix A**.

The maximum predicted 10-minute odour concentration is higher than the criterion of 1 OU, with a value of 2.6 at one of the twenty-three assessed discrete receptors. However, the modelling shows that the criterion of 1 OU is exceeded less than 0.5% annual at the discrete receptor, which is considered acceptable by the suggested MOE guidance in terms of odour emissions (Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines).

Predicted concentrations for all of the contaminants of significance were found to be less than their respective Standards or guidelines under O. Reg. 419/05 at all receptors in the area. The contaminant with the greatest percentage of the O. Reg. 419/05 Standard was predicted to be vinyl chloride with a value of 73%. Therefore, WCEC landfill facility is expected to be in compliance with the requirements of O. Reg. 419/05.

TABLES

2.1 Sources and Contaminant Identification Table

RWDI Project #1302177

Source Information			Expected Contaminants	Included in Modelling? (yes / no)	Significant? (yes / no)	Reference (optional)
Source ID (optional)	Source Description or Title	General Location				
E1	LFG Engine #1 - CAT 3520	LFG Engine Building - East Corner of Facility near Carp Road	By-Products of Combustion & Residual VOCs	yes	yes	
E2	LFG Engine #2 - CAT 3520	LFG Engine Building - East Corner of Facility near Carp Road	By-Products of Combustion & Residual VOCs	yes	yes	
E3	LFG Engine #3 - CAT 3520	LFG Engine Building - East Corner of Facility near Carp Road	By-Products of Combustion & Residual VOCs	yes	yes	
E4	LFG Engine #4 - CAT 3520	LFG Engine Building - East Corner of Facility near Carp Road	By-Products of Combustion & Residual VOCs	yes	yes	
E5	LFG Engine #5 - CAT 3520	LFG Engine Building - East Corner of Facility near Carp Road	By-Products of Combustion & Residual VOCs	yes	yes	
F1	LFG Flare #1	Adjacent to LFG Blower Building - North side of Facility next to Carp Road	By-Products of Combustion & Residual VOCs	yes	yes	
F2	LFG Flare #2	Adjacent to LFG Blower Building - North side of Facility next to Carp Road	By-Products of Combustion & Residual VOCs	yes	yes	
F3	Candlestick LFG Flare	Adjacent to LFG Blower Building - North side of Facility next to Carp Road	By-Products of Combustion & Residual VOCs	yes	yes	
LM_EX	Existing Landfill Mound	South Centre of Site	VOCs and Odour	yes	yes	
LM_PP	Proposed Landfill Mound	North Centre of Site	VOCs and Odour	yes	yes	
ACTSTG	Active Stage of Proposed Landfill Mound	North East of Proposed Landfill Mound	VOCs	yes	yes	
WRKFCE	Working Face of Proposed Landfill Mound	North East of Proposed Landfill Mound	Odour	yes	yes	
INTERIM	Interim Cover Area of Proposed Landfill Mound	North East of Proposed Landfill Mound	Odour	yes	yes	
CSS	Contaminated Soil Stockpile	West of Proposed Landfill Mound	VOCs	yes	yes	
RAWLEACH	Raw Leachate Equalization Tank	Leachate Treatment Facility - South of Existing Landfill Mound	Ammonia, Odour and VOCs	yes	yes	
SBR	Sequencing Batch Reactor Tank	Leachate Treatment Facility - South of Existing Landfill Mound	Ammonia, Odour and VOCs	yes	yes	
EFFLUENT	Effluent Equalization Tank	Leachate Treatment Facility - South of Existing Landfill Mound	Ammonia, Odour and VOCs	yes	yes	
SLUDGE	Sludge Tank	Leachate Treatment Facility - South of Existing Landfill Mound	Ammonia, Odour and VOCs	yes	yes	
LEACHGEN	Emergency Diesel-Fired Generator for SBR	Leachate Treatment Facility - South of Existing Landfill Mound	By-Products of Combustion	yes	yes	
CR_ENG	Impact Crusher Diesel Engine	Waste Transfer Facility - South West of Existing Landfill Mound	By-Products of Combustion	yes	yes	
CR	Impact Crusher	Waste Transfer Facility - South West of Existing Landfill Mound	TSP	yes	yes	
ACTFCE	Material Loading at the Working Face of the Active Stage	North East of Proposed Landfill Mound	TSP	yes	yes	
ACT_UNL	Material Unloading at the Working Face of the Active Stage	North East of Proposed Landfill Mound	TSP	yes	yes	
CF_BD	Bulldozing at the Construction Working Face	North East of Proposed Landfill Mound	TSP	yes	yes	
CF_UNL	Material Unloading at the Construction Working Face	North East of Proposed Landfill Mound	TSP	yes	yes	
CWS_MH	Material Loading at the Construction Working Face	North East of Proposed Landfill Mound	TSP	yes	yes	
CSS_MH	Material loading and unloading at the Contaminated Soil Stockpile	West of Proposed Landfill Mound	TSP	yes	yes	
OB_BD	Bulldozing at the Overburden Pile	West of Proposed Landfill Mound	TSP	yes	yes	
OB_MH	Material Loading at the Overburden Pile	West of Proposed Landfill Mound	TSP	yes	yes	
BOILER	Leachate Plant Boiler	Leachate Treatment Facility - South of Existing Landfill Mound	By-Products of Combustion & Residual VOCs	no	no	[1]
B3	GS Blower	South East of Existing Landfill Mound	VOCs	no	no	[1]

Notes:

[1] the Leachate plant boiler and GS blower were deemed to be insignificant since these source contributed less than 5% of the overall site-wide emissions.

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											1,1,1-Trichloroethane	71-55-6	1.33E-06	1	EC	Above-Average	2%
											1,1,2,2-Tetrachloroethane	79-34-5	1.39E-07	1	EC	Above-Average	2%
											1,1,2-Trichloroethane	79-00-5	1.73E-07	1	EC	Above-Average	2%
											1,1-Dichloroethane	75-34-3	3.45E-05	1	EC	Above-Average	2%
											1,1-Dichloroethylene	75-35-4	1.41E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	1.36E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	8.09E-05	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	3.82E-06	1	EC	Above-Average	2%
											Benzene	71-43-2	3.07E-04	1	EC	Above-Average	5%
											Bromodichloromethane	75-27-4	1.29E-08	1	EC	Above-Average	2%
											Carbon Tetrachloride	56-23-5	2.22E-07	1	EC	Above-Average	2%
											Chloroethane	75-00-3	1.12E-05	1	EC	Above-Average	<1%
											Chloroform/Trichloromethane	67-66-3	2.41E-06	1	EC	Above-Average	2%
											Dichloromethane	75-09-2	2.04E-05	1	EC	Above-Average	<1%
E1	Point	LFG Engine #1 - CAT 3520	6.48	445	0.4	51.57	13.4	5.5	424756	5014676	Dimethyl sulfide	75-18-3	1.97E-05	1	EC	Above-Average	2%
											Ethyl Mercaptan	75-08-1	6.51E-08	1	EC	Above-Average	2%
											Ethylene Dibromide	106-93-4	4.51E-08	1	EC	Above-Average	2%
											Hydrogen sulfide	7783-06-4	2.42E-03	1	EC	Above-Average	2%
											Methyl Mercaptan	74-93-1	4.04E-08	1	EC	Above-Average	2%
											Octane	111-65-9	7.31E-05	1	EC	Above-Average	2%
											sec-Butyl Alcohol/2-Butanol	78-92-2	3.84E-04	1	EC	Above-Average	2%
											Tetrachloroethylene	127-18-4	7.02E-05	1	EC	Above-Average	<1%
											Trichloroethylene	79-01-6	2.32E-05	1	EC	Above-Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	4.30E-05	1	EC	Above-Average	<1%
											Total Suspended Particulate	n/a - 1	1.08E-01	1	EF	Marginal	5%
											Carbon Monoxide	630-08-0	3.00E-02	1	V-ST	Above-Average	<1%
											Nitrogen Oxides	10102-44-0	2.20E-01	1	V-ST	Above-Average	6%
											Sulphur Dioxide	7446-09-5	1.00E-01	1	V-ST	Above-Average	5%
											Dioxins, Furans and Dioxin-like PCBs [2]	n/a - 2	2.12E-11	1	V-ST	Above-Average	5%
											1,1,1-Trichloroethane	71-55-6	1.33E-06	1	EC	Above-Average	2%
											1,1,2,2-Tetrachloroethane	79-34-5	1.39E-07	1	EC	Above-Average	2%
											1,1,2-Trichloroethane	79-00-5	1.73E-07	1	EC	Above-Average	2%
											1,1-Dichloroethane	75-34-3	3.45E-05	1	EC	Above-Average	2%
											1,1-Dichloroethylene	75-35-4	1.41E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	1.36E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	8.09E-05	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	3.82E-06	1	EC	Above-Average	2%
											Benzene	71-43-2	3.07E-04	1	EC	Above-Average	5%
											Bromodichloromethane	75-27-4	1.29E-08	1	EC	Above-Average	2%
											Carbon Tetrachloride	56-23-5	2.22E-07	1	EC	Above-Average	2%
											Chloroethane	75-00-3	1.12E-05	1	EC	Above-Average	<1%
											Chloroform/Trichloromethane	67-66-3	2.41E-06	1	EC	Above-Average	2%
											Dichloromethane	75-09-2	2.04E-05	1	EC	Above-Average	<1%
E2	Point	LFG Engine #2 - CAT 3520	6.48	445	0.4	51.57	13.4	5.5	424760	5014671	Dimethyl sulfide	75-18-3	1.97E-05	1	EC	Above-Average	2%
											Ethyl Mercaptan	75-08-1	6.51E-08	1	EC	Above-Average	2%
											Ethylene Dibromide	106-93-4	4.51E-08	1	EC	Above-Average	2%
											Hydrogen sulfide	7783-06-4	2.42E-03	1	EC	Above-Average	2%
											Methyl Mercaptan	74-93-1	4.04E-08	1	EC	Above-Average	2%
											Octane	111-65-9	7.31E-05	1	EC	Above-Average	2%
											sec-Butyl Alcohol/2-Butanol	78-92-2	3.84E-04	1	EC	Above-Average	2%
											Tetrachloroethylene	127-18-4	7.02E-05	1	EC	Above-Average	<1%
											Trichloroethylene	79-01-6	2.32E-05	1	EC	Above-Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	4.30E-05	1	EC	Above-Average	<1%
											Total Suspended Particulate	n/a - 1	1.08E-01	1	EF	Marginal	5%
											Carbon Monoxide	630-08-0	3.00E-02	1	V-ST	Above-Average	<1%
											Nitrogen Oxides	10102-44-0	2.20E-01	1	V-ST	Above-Average	6%
											Sulphur Dioxide	7446-09-5	1.00E-01	1	V-ST	Above-Average	5%
											Dioxins, Furans and Dioxin-like PCBs [2]	n/a - 2	2.12E-11	1	V-ST	Above-Average	5%
											1,1,1-Trichloroethane	71-55-6	1.33E-06	1	EC	Above-Average	2%
											1,1,2,2-Tetrachloroethane	79-34-5	1.39E-07	1	EC	Above-Average	2%
											1,1,2-Trichloroethane	79-00-5	1.73E-07	1	EC	Above-Average	2%
											1,1-Dichloroethane	75-34-3	3.45E-05	1	EC	Above-Average	2%
											1,1-Dichloroethylene	75-35-4	1.41E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	1.36E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	8.09E-05	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	3.82E-06	1	EC	Above-Average	2%
											Benzene	71-43-2	3.07E-04	1	EC	Above-Average	5%
											Bromodichloromethane	75-27-4	1.29E-08	1	EC	Above-Average	2%
											Carbon Tetrachloride	56-23-5	2.22E-07	1	EC	Above-Average	2%
											Chloroethane	75-00-3	1.12E-05	1	EC	Above-Average	<1%
											Chloroform/Trichloromethane	67-66-3	2.41E-06	1	EC	Above-Average	2%
											Dichloromethane	75-09-2	2.04E-05	1	EC	Above-Average	<1%
E3	Point	LFG Engine #3 - CAT 3520	6.48	445	0.4	51.57	13.4	5.5	424764	5014667	Dimethyl sulfide	75-18-3	1.97E-05	1	EC	Above-Average	2%
											Ethyl Mercaptan	75-08-1	6.51E-08	1	EC	Above-Average	2%
											Ethylene Dibromide	106-93-4	4.51E-08	1	EC	Above-Average	2%
											Hydrogen sulfide	7783-06-4	2.42E-03	1	EC	Above-Average	2%
											Methyl Mercaptan	74-93-1	4.04E-08	1	EC	Above-Average	2%
											Octane	111-65-9	7.31E-05	1	EC	Above-Average	2%
											sec-Butyl Alcohol/2-Butanol	78-92-2	3.84E-04	1	EC	Above-Average	2%
											Tetrachloroethylene	127-18-4	7.02E-05	1	EC	Above-Average	<1%
											Trichloroethylene	79-01-6	2.32E-05	1	EC	Above-Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	4.30E-05	1	EC	Above-Average	<1%
											Total Suspended Particulate	n/a - 1	1.08E-01	1	EF	Marginal	5%
											Carbon Monoxide	630-08-0	3.00E-02	1	V-ST	Above-Average	<1%
											Nitrogen Oxides	10102-44-0	2.20E-01	1	V-ST	Above-Average	6%
											Sulphur Dioxide	7446-09-5	1.00E-01	1	V-ST	Above-Average	5%
											Dioxins, Furans and Dioxin-like PCBs [2]	n/a - 2	2.12E-11	1	V-ST	Above-Average	5%
											1,1,1-Trichloroethane	71-55-6	1.33E-06	1	EC	Above-Average	2%
											1,1,2,2-Tetrachloroethane	79-34-5	1.39E-07	1	EC	Above-Average	2%
											1,1,2-Trichloroethane	79-00-5	1.73E-07	1	EC	Above-Average	2%
											1,1-Dichloroethane	75-34-3	3.45E-05	1	EC	Above-Average	2%
											1,1-Dichloroethylene	75-35-4	1.41E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	1.36E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	8.09E-05	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	3.82E-06	1	EC	Above-Average	2%
											Benzene	71-43-2	3.07E-04	1	EC	Above-Average	5%
											Bromodichloromethane	75-27-4	1.29E-08	1	EC	Above-Average	2%
											Carbon Tetrachloride	56-23-5	2.22E-07	1	EC	Above-Average	2%
											Chloroethane	75-00-3	1.12E-05	1	EC	Above-Average	<1%
											Chloroform/Trichloromethane	67-66-3	2.41E-06	1	EC	Above-Average	2%
											Dichloromethane	75-09-2	2.04E-05	1	EC	Above-Average	<1%
E4	Point	LFG Engine #4 - CAT 3520	6.48	445	0.4	51.57	13.4	5.5	424768	5014663	Dimethyl sulfide	75-18-3	1.97E-05	1	EC	Above-Average	2%
											Ethyl Mercaptan	75-08-1	6.51E-08	1	EC	Above-Average	2%
											Ethylene Dibromide	106-93-4	4.51E-08	1	EC	Above-Average	2%
											Hydrogen sulfide	7783-06-4	2.42E-03	1	EC	Above-Average	2%
											Methyl Mercaptan	74-93-1	4.04E-08	1	EC	Above-Average	2%
											Octane	111-65-9	7.31E-05	1	EC	Above-Average	2%
											sec-Butyl Alcohol/2-Butanol	78-92-2	3.84E-04	1	EC	Above-Average	2%
											Tetrachloroethylene	127-18-4	7.02E-05	1	EC	Above-Average	<1%
											Trichloroethylene	79-01-6	2.32E-05	1	EC	Above-Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	4.30E-05	1	EC	Above-Average	<1%
											Total Suspended Particulate	n/a - 1	1.08E-01	1	EF	Marginal	5%
											Carbon Monoxide	630-08-0	3.00E-02	1	V-ST	Above-Average	<1%
											Nitrogen Oxides	10102-44-0	2.20E-01	1	V-ST	Above-Average	6%
											Sulphur Dioxide	7446-09-5	1.00E-01	1	V-ST	Above-Average	5%
											Dioxins, Furans and Dioxin-like PCBs [2]	n/a - 2	2.12E-11	1	V-ST	Above-Average	5%

5.1 Source Summary Table (by source)

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
E5	Point	LFG Engine #5 - CAT 3520	6.48	445	0.4	51.57	13.4	5.5	424772	5014660	1,1,1-Trichloroethane	71-55-6	1.33E-06	1	EC	Above-Average	2%
											1,1,2,2-Tetrachloroethane	79-34-5	1.39E-07	1	EC	Above-Average	2%
											1,1,2-Trichloroethane	79-00-5	1.73E-07	1	EC	Above-Average	2%
											1,1-Dichloroethane	75-34-3	3.45E-05	1	EC	Above-Average	2%
											1,1-Dichloroethylene	75-35-4	1.41E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	1.36E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	8.09E-05	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	3.82E-06	1	EC	Above-Average	2%
											Benzene	71-43-2	3.07E-04	1	EC	Above-Average	5%
											Bromodichloromethane	75-27-4	1.29E-08	1	EC	Above-Average	2%
											Carbon Tetrachloride	56-23-5	2.22E-07	1	EC	Above-Average	2%
											Chloroethane	75-00-3	1.12E-05	1	EC	Above-Average	<1%
											Chloroform/Trichloromethane	67-66-3	2.41E-06	1	EC	Above-Average	2%
											Dichloromethane	75-09-2	2.04E-05	1	EC	Above-Average	<1%
											Dimethyl sulfide	75-18-3	1.97E-05	1	EC	Above-Average	2%
											Ethyl Mercaptan	75-08-1	6.51E-08	1	EC	Above-Average	2%
											Ethylene Dibromide	106-93-4	4.51E-08	1	EC	Above-Average	2%
											Hydrogen sulfide	7783-06-4	2.42E-03	1	EC	Above-Average	2%
											Methyl Mercaptan	74-93-1	4.04E-08	1	EC	Above-Average	2%
											Octane	111-65-9	7.31E-05	1	EC	Above-Average	2%
											sec-Butyl Alcohol/2-Butanol	78-92-2	3.84E-04	1	EC	Above-Average	2%
											Tetrachloroethylene	127-18-4	7.02E-05	1	EC	Above-Average	<1%
											Trichloroethylene	79-01-6	2.32E-05	1	EC	Above-Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	4.30E-05	1	EC	Above-Average	<1%
											Total Suspended Particulate	n/a - 1	1.08E-01	1	EF	Marginal	5%
											Carbon Monoxide	630-08-0	3.00E-02	1	V-ST	Above-Average	<1%
											Nitrogen Oxides	10102-44-0	2.20E-01	1	V-ST	Above-Average	6%
											Sulphur Dioxide	7446-09-5	1.00E-01	1	V-ST	Above-Average	5%
											Dioxins, Furans and Dioxin-like PCBs [2]	n/a - 2	2.12E-11	1	V-ST	Above-Average	5%
F1	Point	LFG Flare #1	31.3	871	2.1	9.0	12.2	n/a	424557	5014950	1,1,1-Trichloroethane	71-55-6	1.80E-06	1	EC	Above-Average	3%
											1,1,2,2-Tetrachloroethane	79-34-5	1.89E-07	1	EC	Above-Average	3%
											1,1,2-Trichloroethane	79-00-5	2.34E-07	1	EC	Above-Average	3%
											1,1-Dichloroethane	75-34-3	4.68E-05	1	EC	Above-Average	3%
											1,1-Dichloroethylene	75-35-4	1.91E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	1.84E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	1.10E-04	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	5.18E-06	1	EC	Above-Average	3%
											Benzene	71-43-2	4.12E-05	1	EC	Above-Average	<1%
											Bromodichloromethane	75-27-4	1.75E-08	1	EC	Above-Average	3%
											Carbon Tetrachloride	56-23-5	3.02E-07	1	EC	Above-Average	3%
											Chloroethane	75-00-3	1.52E-05	1	EC	Above-Average	<1%
											Chloroform/Trichloromethane	67-66-3	3.26E-06	1	EC	Above-Average	3%
											Dichloromethane	75-09-2	2.77E-05	1	EC	Above-Average	<1%
											Dimethyl sulfide	75-18-3	2.67E-05	1	EC	Above-Average	3%
											Ethyl Mercaptan	75-08-1	8.83E-08	1	EC	Above-Average	3%
											Ethylene Dibromide	106-93-4	6.13E-08	1	EC	Above-Average	3%
											Hydrogen sulfide	7783-06-4	3.28E-03	1	EC	Above-Average	3%
											Methyl Mercaptan	74-93-1	5.48E-08	1	EC	Above-Average	3%
											Octane	111-65-9	9.91E-05	1	EC	Above-Average	3%
											sec-Butyl Alcohol/2-Butanol	78-92-2	5.21E-04	1	EC	Above-Average	3%
											Tetrachloroethylene	127-18-4	9.53E-05	1	EC	Above-Average	1%
											Trichloroethylene	79-01-6	3.15E-05	1	EC	Above-Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	5.83E-05	1	EC	Above-Average	<1%
											Total Suspended Particulate	n/a - 1	7.70E-02	1	EF	Average	3%
											Carbon Monoxide	630-08-0	3.42E+00	1	EF	Average	21%
											Nitrogen Oxides	10102-44-0	1.85E-01	1	EF	Average	5%
											Sulphur Dioxide	7446-09-5	7.11E-01	1	V-ST	Above-Average	33%
											Dioxins, Furans and Dioxin-like PCBs [2]	n/a - 2	9.96E-11	1	V-ST	Above-Average	25%
F2	Point	LFG Flare #2	57.3	900	2.7	10.01	12.2	n/a	424551	5014946	1,1,1-Trichloroethane	71-55-6	3.29E-06	1	EC	Above-Average	5%
											1,1,2,2-Tetrachloroethane	79-34-5	3.45E-07	1	EC	Above-Average	6%
											1,1,2-Trichloroethane	79-00-5	4.28E-07	1	EC	Above-Average	6%
											1,1-Dichloroethane	75-34-3	8.53E-05	1	EC	Above-Average	6%
											1,1-Dichloroethylene	75-35-4	3.49E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	3.36E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	2.00E-04	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	9.46E-06	1	EC	Above-Average	6%
											Benzene	71-43-2	7.52E-05	1	EC	Above-Average	1%
											Bromodichloromethane	75-27-4	3.20E-08	1	EC	Above-Average	6%
											Carbon Tetrachloride	56-23-5	5.50E-07	1	EC	Above-Average	6%
											Chloroethane	75-00-3	2.78E-05	1	EC	Above-Average	1%
											Chloroform/Trichloromethane	67-66-3	5.96E-06	1	EC	Above-Average	6%
											Dichloromethane	75-09-2	5.06E-05	1	EC	Above-Average	<1%
											Dimethyl sulfide	75-18-3	4.88E-05	1	EC	Above-Average	6%
											Ethyl Mercaptan	75-08-1	1.61E-07	1	EC	Above-Average	6%
											Ethylene Dibromide	106-93-4	1.12E-07	1	EC	Above-Average	6%
											Hydrogen sulfide	7783-06-4	5.99E-03	1	EC	Above-Average	6%
											Methyl Mercaptan	74-93-1	9.99E-08	1	EC	Above-Average	6%
											Octane	111-65-9	1.81E-04	1	EC	Above-Average	5%
											sec-Butyl Alcohol/2-Butanol	78-92-2	9.51E-04	1	EC	Above-Average	6%
											Tetrachloroethylene	127-18-4	1.74E-04	1	EC	Above-Average	2%
											Trichloroethylene	79-01-6	5.74E-05	1	EC	Above-Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	1.06E-04	1	EC	Above-Average	1%
											Total Suspended Particulate	n/a - 1	1.40E-01	1	EF	Average	6%
											Carbon Monoxide	630-08-0	6.24E+00	1	EF	Average	39%
											Nitrogen Oxides	10102-44-0	1.86E-01	1	V-ST	Average	5%
											Dioxins, Furans and Dioxin-like PCBs [2]	n/a - 2	9.96E-11	1	V-ST	Above-Average	25%
F3	Point	Candlestick LFG Flare	1	900	0.2	31.8	10.4	n/a	424551	5014952	1,1,1-Trichloroethane	71-55-6	3.17E-06	1	EC	Above-Average	5%
											1,1,2,2-Tetrachloroethane	79-34-5	3.32E-07	1	EC	Above-Average	5%
											1,1,2-Trichloroethane	79-00-5	4.11E-07	1	EC	Above-Average	5%
											1,1-Dichloroethane	75-34-3	8.21E-05	1	EC	Above-Average	5%
											1,1-Dichloroethylene	75-35-4	3.36E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	3.23E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	1.93E-04	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	9.09E-06	1	EC	Above-Average	5%
											Benzene	71-43-2	7.23E-05	1	EC	Above-Average	1%
											Bromodichloromethane	75-27-4	3.08E-08	1	EC	Above-Average	5%
											Carbon Tetrachloride	56-23-5	5.29E-07	1	EC	Above-Average	5%
											Chloroethane	75-00-3	2.67E-05	1	EC	Above-Average	1%
											Chloroform/Trichloromethane	67-66-3	5.73E-06	1	EC	Above-Average	5%
											Dichloromethane	75-09-2	4.87E-05	1	EC	Above-Average	<1%
											Dimethyl sulfide	75-18-3	4.69E-05	1	EC	Above-Average	5%
											Ethyl Mercaptan	75-08-1	1.55E-07	1	EC	Above-Average	5%
											Ethylene Dibromide	106-93-4	1.07E-07	1	EC	Above-Average	5%
											Hydrogen sulfide	7783-06-4	5.76E-03	1	EC	Above-Average	5%
											Methyl Mercaptan	74-93-1	9.61E-08	1	EC	Above-Average	5%
											Octane	111-65-9	1.74E-04	1	EC	Above-Average	5%
											sec-Butyl Alcohol/2-Butanol	78-92-2	9.14E-04	1	EC	Above-Average	5%
											Tetrachloroethylene	127-18-4	1.67E-04	1	EC	Above-Average	2%
											Trichloroethylene	79-01-6	5.52E-05	1	EC	Above-Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	1.02E-04	1	EC	Above-Average	1%
											Total Suspended Particulate	n/a - 1	1.35E-01	1	EF	Marginal	6%
											Carbon Monoxide	630-08-0	6.00E+00	1	EF	Average	37%
											Nitrogen Oxides	10102-44-0	3.25E-01	1	EF	Average	9%
											Sulphur Dioxide	7446-09-5	7.11E-01	1	V-ST	Above-Average	33%
											Dioxins, Furans and Dioxin-like PCBs [2]	n/a - 2	9.96E-11	1	V-ST	Above-Average	25%
LM_EX	Area	Existing Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423418	5014454	Odour [in OU/s]	n/a - 3	1.94E+03	1	EC	Above-Average	25%
											1,1,1-Trichloroethane	71-55-6	3.07E-05	1	EC	Above-Average	51%
											1,1,2,2-Tetrachloroethane	79-34-5	3.22E-06	1	EC	Above-Average	52%
											1,1,2-Trichloroethane	79-00-5	3.99E-06	1	EC	Above-Average	52%
											1,1-Dichloroethane	75-34-3	7.95E-04	1	EC	Above-Average	52%
											1,1-Dichloroethylene	75-35-4	3.25E-05	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	3.13E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	1.87E-03	1	EC	Above-Average	2%
											1,2-Dichloroethene (Trans)	156-60-5	8.81E-05	1	EC	Above-Average	52%
											Benzene	71-43-2	7.01E-04	1	EC	Above-Average	11%
											Bromodichloromethane	75-27-4	2.98E-07	1	EC	Above-Average	52%
											Carbon Tetrachloride	56-23-5	5.13E-06	1	EC	Above-Average	52%
											Chloroethane	75-00-3	2.59E-04	1	EC	Above-Average	10%
											Chloroform/Trichloromethane	67-66-3	5.55E-05	1	EC	Above-Average	52%
											Dichloromethane	75-09-2	4.72E-04	1	EC	Above-Average	<1%
											Dimethyl sulfide	75-18-3	4.55E-04	1	EC	Above-Average	52%
											Ethyl Mercaptan	75-08-1	1.50E-06	1	EC	Above-Average	52%
											Ethylene Dibromide	106-93-4	1.04E-06	1	EC	Above-Average	52%
											Hydrogen sulfide	7783-06-4	5.59E-02	1	EC	Above-Average	52%
											Methyl Mercaptan	74-93-1	9.31E-07	1	EC	Above-Average	52%
											Octane	111-65-9	1.69E-03	1	EC	Above-Average	51%
											sec-Butyl Alcohol/2-Butanol	78-92-2	8.86E-03	1	EC	Above-Average	52%
											Tetrachloroethylene	127-18-4	1.62E-03	1	EC	Above-Average	21%
											Trichloroethylene	79-01-6	5.35E-04	1	EC	Above-Average	4%
											Vinyl Chloride/Chloroethene	75-01-4	9.91E-04	1	EC	Above-Average	13%

5.1 Source Summary Table (by source)

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
LM_PP	Area	Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423131	5014859	Odour [in OU/s)	n/a - 3	6.02E+02	1	EC	Above-Average	8%
											1,1,1-Trichloroethane	71-55-6	9.52E-06	1	EC	Above-Average	16%
											1,1,2,2-Tetrachloroethane	79-34-5	9.98E-07	1	EC	Above-Average	16%
											1,1,2-Trichloroethane	79-00-5	1.24E-06	1	EC	Above-Average	16%
											1,1-Dichloroethane	75-34-3	2.47E-04	1	EC	Above-Average	16%
											1,1-Dichloroethylene	75-35-4	1.01E-05	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	9.72E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	5.79E-04	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	2.74E-05	1	EC	Above-Average	16%
											Benzene	71-43-2	2.18E-04	1	EC	Above-Average	3%
											Bromodichloromethane	75-27-4	9.25E-08	1	EC	Above-Average	16%
											Carbon Tetrachloride	56-23-5	1.59E-06	1	EC	Above-Average	16%
											Chloroethane	75-00-3	8.03E-05	1	EC	Above-Average	3%
											Chloroform/Trichloromethane	67-66-3	1.72E-05	1	EC	Above-Average	16%
											Dichloromethane	75-09-2	1.46E-04	1	EC	Above-Average	<1%
											Dimethyl sulfide	75-18-3	1.41E-04	1	EC	Above-Average	16%
											Ethyl Mercaptan	75-08-1	4.66E-07	1	EC	Above-Average	16%
											Ethylene Dibromide	106-93-4	3.23E-07	1	EC	Above-Average	16%
											Hydrogen sulfide	7783-06-4	1.73E-02	1	EC	Above-Average	16%
											Methyl Mercaptan	74-93-1	2.89E-07	1	EC	Above-Average	16%
											Octane	111-65-9	5.23E-04	1	EC	Above-Average	16%
											sec-Butyl Alcohol/2-Butanol	78-92-2	2.75E-03	1	EC	Above-Average	16%
											Tetrachloroethylene	127-18-4	5.03E-04	1	EC	Above-Average	7%
											Trichloroethylene	79-01-6	1.66E-04	1	EC	Above-Average	1%
											Vinyl Chloride/Chloroethene	75-01-4	3.08E-04	1	EC	Above-Average	4%
ACTSTG	Area	Active Stage of Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423748	5015094	1,1,1-Trichloroethane	71-55-6	4.33E-06	1	EC	Above-Average	7%
											1,1,2,2-Tetrachloroethane	79-34-5	4.54E-07	1	EC	Above-Average	7%
											1,1,2-Trichloroethane	79-00-5	5.63E-07	1	EC	Above-Average	7%
											1,1-Dichloroethane	75-34-3	1.12E-04	1	EC	Above-Average	7%
											1,1-Dichloroethylene	75-35-4	4.59E-06	1	EC	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	4.42E-07	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Cis)	156-59-2	2.64E-04	1	EC	Above-Average	<1%
											1,2-Dichloroethene (Trans)	156-60-5	1.24E-05	1	EC	Above-Average	7%
											Benzene	71-43-2	9.90E-05	1	EC	Above-Average	2%
											Bromodichloromethane	75-27-4	4.21E-08	1	EC	Above-Average	7%
											Carbon Tetrachloride	56-23-5	7.24E-07	1	EC	Above-Average	7%
											Chloroethane	75-00-3	3.66E-05	1	EC	Above-Average	1%
											Chloroform/Trichloromethane	67-66-3	7.84E-06	1	EC	Above-Average	7%
											Dichloromethane	75-09-2	6.66E-05	1	EC	Above-Average	<1%
											Dimethyl sulfide	75-18-3	6.42E-05	1	EC	Above-Average	7%
											Ethyl Mercaptan	75-08-1	2.12E-07	1	EC	Above-Average	7%
											Ethylene Dibromide	106-93-4	1.47E-07	1	EC	Above-Average	7%
											Hydrogen sulfide	7783-06-4	7.89E-03	1	EC	Above-Average	7%
											Methyl Mercaptan	74-93-1	1.32E-07	1	EC	Above-Average	7%
											Octane	111-65-9	2.38E-04	1	EC	Above-Average	7%
											sec-Butyl Alcohol/2-Butanol	78-92-2	1.25E-03	1	EC	Above-Average	7%
											Tetrachloroethylene	127-18-4	2.29E-04	1	EC	Above-Average	3%
											Trichloroethylene	79-01-6	7.56E-05	1	EC	Above-Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	1.40E-04	1	EC	Above-Average	2%
WRKFCE	Area	Working Face of Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423762	5015357	Odour [in OU/s)	n/a - 3	8.08E+02	1	EC	Average	11%
INTERIM	Area	Interim Cover Area of Proposed Landfill Mound	n/a	n/a	n/a	n/a	n/a	n/a	423743	5015381	Odour [in OU/s)	n/a - 3	2.90E+01	1	EC	Average	<1%
CSS	Area	Contaminated Soil Stockpile	n/a	n/a	n/a	n/a	n/a	n/a	423886	5015024	1,1,1-Trichloroethane	71-55-6	5.13E-07	1	V-ST	Above-Average	<1%
											1,2-Dichloroethane	107-06-2	3.19E-06	1	V-ST	Above-Average	<1%
											Benzene	71-43-2	1.35E-04	1	V-ST	Above-Average	2%
											Dichloromethane	75-09-2	2.70E-05	1	V-ST	Above-Average	<1%
											Octane	111-65-9	6.38E-05	1	V-ST	Above-Average	2%
											sec-Butyl Alcohol/2-Butanol	78-92-2	6.40E-07	1	V-ST	Above-Average	<1%
											Tetrachloroethylene	127-18-4	5.38E-06	1	V-ST	Above-Average	<1%
											Trichloroethylene	79-01-6	5.87E-06	1	V-ST	Above-Average	<1%
RAWLEACH	Point	Raw Leachate Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424269	5014684	Odour [in OU/s)	n/a - 3	2.00E+01	1	EF	Average	<1%
											1,1-Dichloroethylene	75-35-4	1.29E-04	1	EF	Average	3%
											1,2-Dichloroethane	107-06-2	1.64E-05	1	EF	Average	1%
											Ammonia	7664-41-7	3.06E-04	1	EF	Average	<1%
											Benzene	71-43-2	5.48E-05	1	EF	Average	<1%
											Chloroethane	75-00-3	3.96E-05	1	EF	Average	2%
											Vinyl Chloride/Chloroethene	75-01-4	1.25E-04	1	EF	Average	2%
											1,2-Dichloroethene (Cis)	156-59-2	6.80E-04	1	EF	Average	<1%
											Methane	74-82-8	1.66E-02	1	EF	Average	4%
											Dichloromethane	75-09-2	2.76E-03	1	EF	Average	<1%
											Tetrachloroethylene	127-18-4	1.04E-04	1	EF	Average	1%
											Trichloroethylene	79-01-6	2.04E-04	1	EF	Average	2%
SBR	Point	Sequencing Batch Reactor Tank	0.0001	32	0.2	0.003	6.6	0.6	424317	5014732	Odour [in OU/s)	n/a - 3	3.47E+03	1	EF	Average	45%
											1,1-Dichloroethylene	75-35-4	5.95E-04	1	EF	Average	12%
											1,2-Dichloroethane	107-06-2	3.63E-05	1	EF	Average	3%
											Ammonia	7664-41-7	1.03E-01	1	EF	Average	98%
											Benzene	71-43-2	1.45E-04	1	EF	Average	2%
											Chloroethane	75-00-3	2.27E-04	1	EF	Average	9%
											Vinyl Chloride/Chloroethene	75-01-4	1.12E-03	1	EF	Average	14%
											1,2-Dichloroethene (Cis)	156-59-2	2.59E-02	1	EF	Average	25%
											Dichloromethane	75-09-2	3.78E-02	1	EF	Average	8%
											Tetrachloroethylene	127-18-4	5.31E-04	1	EF	Average	7%
											Trichloroethylene	79-01-6	9.65E-04	1	EF	Average	8%
EFFLUENT	Point	Effluent Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424290	5014662	Odour [in OU/s)	n/a - 3	6.00E+00	1	EF	Average	<1%
											1,1-Dichloroethylene	75-35-4	8.78E-05	1	EF	Average	2%
											1,2-Dichloroethane	107-06-2	8.50E-06	1	EF	Average	<1%
											Ammonia	7664-41-7	5.08E-06	1	EF	Average	<1%
											Benzene	71-43-2	3.12E-05	1	EF	Average	<1%
											Chloroethane	75-00-3	2.44E-05	1	EF	Average	<1%
											Vinyl Chloride/Chloroethene	75-01-4	8.24E-05	1	EF	Average	1%
											1,2-Dichloroethene (Cis)	156-59-2	3.92E-04	1	EF	Average	<1%
											Methane	74-82-8	1.53E-02	1	EF	Average	4%
											Dichloromethane	75-09-2	1.62E-03	1	EF	Average	<1%
											Tetrachloroethylene	127-18-4	6.62E-05	1	EF	Average	<1%
											Trichloroethylene	79-01-6	1.22E-04	1	EF	Average	<1%
SLUDGE	Point	Sludge Tank	0.0001	25	0.2	0.003	6.6	0.6	424340	5014708	Odour [in OU/s)	n/a - 3	8.09E+02	1	EF	Average	11%
											1,1-Dichloroethylene	75-35-4	4.22E-03	1	EF	Average	83%
											1,2-Dichloroethane	107-06-2	1.23E-03	1	EF	Average	95%
											Ammonia	7664-41-7	1.64E-03	1	EF	Average	2%
											Benzene	71-43-2	3.18E-03	1	EF	Average	51%
											Chloroethane	75-00-3	1.69E-03	1	EF	Average	68%
											Vinyl Chloride/Chloroethene	75-01-4	4.62E-03	1	EF	Average	59%
											1,2-Dichloroethene (Cis)	156-59-2	7.48E-02	1	EF	Average	71%
											Methane	74-82-8	3.62E-01	1	EF	Average	92%
											Dichloromethane	75-09-2	4.42E-01	1	EF	Average	91%
											Tetrachloroethylene	127-18-4	3.82E-03	1	EF	Average	50%
											Trichloroethylene	79-01-6	1.01E-02	1	EF	Average	81%
LEACHGEN	Point	Emergency Diesel-Fired Generator for SBR	1.23	432	0.2	39.2	3.1	0.1	424298	5014726	Total Suspended Particulate	n/a - 1	7.22E-03	1	EF	Above-Average	<1%
											Carbon Monoxide	630-08-0	7.80E-02	1	EF	Above-Average	<1%
											Sulphur Dioxide	7446-09-5	1.34E-01	1	EF	Marginal	6%
											Nitrogen Oxides	10102-44-0	6.30E-01	1	EF	Above-Average	18%
CR_ENG	Point	Impact Crusher Diesel Engine	0.555	600	0.12	49.100	2	N/A	423800	5014110	Total Suspended Particulate	n/a - 1	8.32E-02	1	EF	Marginal	4%
											Carbon Monoxide	630-08-0	2.52E-01	1	EF	Marginal	2%
											Sulphur Dioxide	7446-09-5	7.75E-02	1	EF	Marginal	4%
											Nitrogen Oxides	10102-44-0	1.17E+00	1	EF	Marginal	33%
CR	Volume	Impact Crusher	n/a	n/a	n/a	n/a	n/a	n/a	423790	5014099	Total Suspended Particulate	n/a - 1	3.33E-02	1	EF	Marginal	1%
ACTFCE [4]	Volume	Material Loading at the Working Face of the Active Stage	N/A	N/A	N/A	N/A	N/A	N/A	423763	5015382	Total Suspended Particulate	n/a - 1	3.36E-03	1	EF	Above-Average	<1%
ACT_UNL [4]	Volume	Material Unloading at the Working Face of the Active Stage	N/A	N/A	N/A	N/A	N/A	N/A	423763	5015382	Total Suspended Particulate	n/a - 1	3.36E-03	1	EF	Above-Average	<1%
CF_BD	Area	Bulldozing at the Construction Working Face	N/A	N/A	N/A	N/A	N/A	N/A	423623	5015244	Total Suspended Particulate	n/a - 1	6.30E-01	1	EF	Average	27%
CF_UNL [4]	Volume	Material Unloading at the Construction Working Face	N/A	N/A	N/A	N/A	N/A	N/A	423625	5015266	Total Suspended Particulate	n/a - 1	2.85E-02	1	EF	Above-Average	1%
CWS_MH [4]	Volume	Material Loading at the Construction Working Face	N/A	N/A	N/A	N/A	N/A	N/A	423626	5015265	Total Suspended Particulate	n/a - 1	1.68E-03	1	EF	Above-Average	<1%
CSS_MH [4]	Volume	Material loading and unloading at the Contaminated Soil Stockpile	N/A	N/A	N/A	N/A	N/A	N/A	423939	5015041	Total Suspended Particulate	n/a - 1	1.34E-02	1	EC	Above-Average	<1%
OB_BD	Area	Bulldozing at the Overburden Pile	N/A	N/A	N/A	N/A	N/A	N/A	423790	5014937	Total Suspended Particulate	n/a - 1	6.30E-01	1	EF	Average	27%
OB_MH [4]	Volume	Material Loading at the Overburden Pile	N/A	N/A	N/A	N/A	N/A	N/A	423840	5014956	Total Suspended Particulate	n/a - 1	1.68E-03	1	EC	Above-Average	<1%

5.1 Source Summary Table (by source)

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Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data						
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temp. (ºC)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
Total	- -	Total of all Listed Sources	- -	- -	- -	- -	- -	- -	- -	- -	1,1,1-Trichloroethane	71-55-6	6.00E-05	- -	- -	- -	100%
											1,1,2,2-Tetrachloroethane	79-34-5	6.23E-06	- -	- -	- -	100%
											1,1,2-Trichloroethane	79-00-5	7.72E-06	- -	- -	- -	100%
											1,1-Dichloroethane	75-34-3	1.54E-03	- -	- -	- -	100%
											1,1-Dichloroethylene	75-35-4	5.09E-03	- -	- -	- -	100%
											1,2-Dichloroethane	107-06-2	1.30E-03	- -	- -	- -	100%
											1,2-Dichloroethene (Cis)	156-59-2	1.05E-01	- -	- -	- -	100%
											1,2-Dichloroethene (Trans)	156-60-5	1.71E-04	- -	- -	- -	100%
											Ammonia	7664-41-7	1.05E-01	- -			100%
											Benzene	71-43-2	6.29E-03	- -	- -	- -	100%
											Bromodichloromethane	75-27-4	5.77E-07	- -	- -	- -	100%
											Carbon Tetrachloride	56-23-5	9.94E-06	- -	- -	- -	100%
											Chloroethane	75-00-3	2.48E-03	- -	- -	- -	100%
											Chloroform/Trichloromethane	67-66-3	1.08E-04	- -	- -	- -	100%
											Dichloromethane	75-09-2	4.85E-01	- -	- -	- -	100%
											Dimethyl sulfide	75-18-3	8.81E-04	- -	- -	- -	100%
											Ethyl Mercaptan	75-08-1	2.91E-06	- -	- -	- -	100%
											Ethylene Dibromide	106-93-4	2.02E-06	- -	- -	- -	100%
											Hydrogen sulfide	7783-06-4	1.08E-01	- -	- -	- -	100%
											Methane	74-82-8	3.94E-01	- -	- -	- -	100%
											Methyl Mercaptan	74-93-1	1.80E-06	- -	- -	- -	100%
											Octane	111-65-9	3.33E-03	- -	- -	- -	100%
											sec-Butyl Alcohol/2-Butanol	78-92-2	1.72E-02	- -	- -	- -	100%
											Tetrachloroethylene	127-18-4	7.67E-03	- -	- -	- -	100%
											Trichloroethylene	79-01-6	1.25E-02	- -	- -	- -	100%
											Vinyl Chloride/Chloroethene	75-01-4	7.87E-03	- -	- -	- -	100%
											Total Suspended Particulate	n/a - 1	2.33E+00	- -	- -	- -	100%
											Carbon Monoxide	630-08-0	1.61E+01	- -	- -	- -	100%
											Nitrogen Oxides	10102-44-0	3.60E+00	- -	- -	- -	100%
											Sulphur Dioxide	7446-09-5	2.13E+00	- -	- -	- -	100%
											Dioxins, Furans and Dioxin-like PCBs [2]	n/a - 2	4.05E-10	- -	- -	- -	100%
											Odour [in OU/s)	n/a - 3	7.69E+03	- -	- -	- -	100%

Notes:
[1] Source ID, Source Type: should provide information on the modelling source type (e.g., Point, Area or Volume Source); the process source or sources within the modelling source (e.g., Process Line #1); and the stack or stacks within each process source.
[2] Emission Estimating Technique Short-Forms are V-ST (Validated Source Test), "ST" (Source Test), EF (Emission Factor), MB (Mass Balance), and EC (Engineering Calculation).
[3] Data Quality Categories: Highest; Above-Average; Average; and Marginal.
[4] Emission rate shown for material handling sources and wind erosion sources are calculated using the threshold wind speed of 6.2 m/s

6.1 Dispersion Modelling Input Summary Table

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Relevant Section of the Regulation	Section Title	Description of How the Approved Dispersion Model was Used
Section 8	Negligible Sources	The following souces were determined to be insignificant - one exhaust serving the gas stripper (B3) in the Blower building and one landfill gas-fired boiler (BOILER), used at the leachate treatment facility. The gas stripper exhaust (B3) and landfill gas-fired boiler (BOILER) were both deemed to be insignificant based on MOE guidance. The MOE states that: sources which, in combination, represent less than 5% of total property–wide emissions of a contaminant can, in many cases, be considered insignificant sources. These sources were not included in the dispersion modelling assessment.
Section 9	Same Structure Contamination	Same structure contamination was not considered a part of this assessment.
Section 10	Operating Conditions	Please refer to Section 4.1 in the ESDM report. For the purposes of estimating emissions from the facility, a maximum operating scenario was considered. This scenario consists of simultaneous operation of all on-site sources at a maximum capacity, including the LGTE facility engine-generator sets, the landfill gas flares, the leachate treatment system and generators. The assessment also considered the concurrent maximum level of fugitive releases from the existing and proposed landfill mounds as well as material handling and processing emissions.
Section 11	Source of Contaminant Emission Rates	Please refer to Section 4.2 in the ESDM report. Emission rates were determined through the following estimation techniques; mass balance, emission factors, source testing, and engineering calculations.
Section 12	Combined Effect of Assumptions for Operating Conditions and Emission Rates	The operating conditions and emission rates (as decribed in the preceeding sections) were used in an approved dispersion model. The model predicted results that were less than the applicable POI Standards and MOE guidelines, therefore, no further refinments were made to either the operating conditions or emissions
Section 13	Meteorological Conditions	Please refer to Section 6.1.1 in the ESDM report. Five years of local meteorological data (2006-2010) were used in the AERMOD dispersion model. The meteorological data set for the WCEC was developed by the MOE's Environmental Monitoring and Reporting Branch (EMRB). This dataset, however, was based on the MOE's regional meteorological data for Eastern Ontario, which considers surface data from the Ottawa International Airport. The Ottawa Airport, which is located approximately 25 km away from the landfill, is the nearest weather station providing the desired meteorological parameters on an hourly basis. The EMRB adjusted the regional meteorological dataset to account for local land uses surrounding the WCEC facility. The data set provided by the EMBR was used directly in the dispersion model, with no changes or alterations conducted by RWDI.
Section 14	Area of Modelling Coverage	Please refer to Section 6.1.2 in the ESDM report. For AERMOD, the area of modelling coverage was designed to meet the requirements outlined in O.Reg. 419/05, s.14. A multi-tiered grid was designed to extend a minimum of 5 km from all sources located on-site. All receptors in the grid were positioned at ground level. The internal spacing was dependant on the receptor distance from the on-site sources. Twenty-two (22) discrete (residential) receptors were considered in this assessment. Receptors were positioned at 1.5 metres above grade, which is considered to be a typical breathing zone height.
Section 15	Stack Height for Certain New Sources of Contaminant	Please refer to Section 6.1.3 in the report. All stack heights are less than the allowable stack height obtained using the stack height formula defined under Section 15 of O. Reg. 419/05
Section 16	Terrain Data	Please refer to Section 6.1.4 in the report. Terrain information for the area surrounding the WCEC landfill facility was obtained from the MOE Ontario Digital Elevation Model Data web site. The terrain data are based on the North American Datum 1983 (NAD83) horizontal reference datum. These data were run through the AERMAP terrain pre-processor to estimate base elevations for receptors and to help the model account for changes in elevation of the surrounding terrain.
Section 17	Averaging Periods	Please refer to Section 6.1.5 in the report. Emissions were modelled for 10-minute, 1-hour, 24-hour and annual averaging times, to correspond with the POI Standards and MOE guidelines for the various contaminants. Odour emissions were modelled for a 10-minute averaging time, using the AERMOD dispersion model to compare to the MOE's 10 minute average criteria of 1 OU.

7.1 Emission Summary Table

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Receptor	Contaminant	CAS Number	Total Facility Emission Rate (g/s)	Air Dispersion Model Used	Maximum POI Concentration (µg/m³)	Averaging Period (hours)	MOE POI Limit [1] (µg/m³)	Limiting Effect	Regulation Schedule #	Percentage of MOE POI Limit (%)
Property Line	Methyl chloroform (1,1,1-Trichloroethane)	71-55-6	6.00E-05	AERMOD	0.003	24 Hour	115000	Health	Schedule 3	< 1%
Property Line	1,1,2,2-Tetrachloroethane	79-34-5	6.23E-06	AERMOD	0.0003	24 Hour	0.1	n/a	n/a	< 1%
Property Line	1,1,2-Trichloroethane	79-00-5	7.72E-06	AERMOD	0.0004	24 Hour	0.31	N/A	JSL	< 1%
Property Line	Dichloroethane, 1,1-	75-34-3	1.54E-03	AERMOD	0.07	24 Hour	165	Health	Schedule 3	< 1%
Property Line	Vinylidene chloride (1,1-Dichloroethene)	75-35-4	5.09E-03	AERMOD	0.61	24 Hour	10	Health	Schedule 3	6%
Property Line	Ethylene dichloride	107-06-2	1.30E-03	AERMOD	0.2	24 Hour	2	Health	Schedule 3	8%
Property Line	Dichloroethylene, cis-1,2-	156-59-2	1.05E-01	AERMOD	12.2	24 Hour	105	Health	Guideline	12%
Property Line	Dichloroethylene, trans-1,2-	156-60-5	1.71E-04	AERMOD	0.008	24 Hour	105	Health	Guideline	< 1%
Property Line	Ammonia	7664-41-7	1.05E-01	AERMOD	12.8	24 Hour	100	Health	Schedule 3	13%
Property Line	Benzene	71-43-2	6.29E-03	AERMOD	0.05	Annual	0.45	Health	Schedule 3	11%
Property Line	Bromodichloromethane	75-27-4	5.77E-07	AERMOD	0.00003	24 Hour	0.1	n/a	n/a	< 1%
Property Line	Carbon tetrachloride	56-23-5	9.94E-06	AERMOD	0.0005	24 Hour	2.4	Health	Schedule 3	< 1%
Property Line	Chloroethane	75-00-3	2.48E-03	AERMOD	0.24	24 Hour	5600	Health	Schedule 3	< 1%
Property Line	Chloroform	67-66-3	1.08E-04	AERMOD	0.005	24 Hour	1	Health	Schedule 3	< 1%
Property Line	Methylene chloride	75-09-2	4.85E-01	AERMOD	58.9	24 Hour	220	Health	Schedule 3	27%
Property Line	Dimethyl sulphide	75-18-3	8.81E-04	AERMOD	0.37	10 Minute	30	Odour	Guideline	1%
Property Line	Ethylene dibromide	106-93-4	2.02E-06	AERMOD	0.00009	24 Hour	3	Health	Guideline	< 1%
R3	Hydrogen sulphide [2]	7783-06-4	1.08E-01	AERMOD	6	10 Minute	13	Odour	Schedule 3	49%
Property Line	Hydrogen sulphide [2]	7783-06-4	1.08E-01	AERMOD	2	24 Hour	7	Health	Schedule 3	24%
Property Line	Methane	74-82-8	3.94E-01	AERMOD	48	24 Hour	n/a	n/a	n/a	n/a
Property Line	Mercaptans [3]	74-93-1	4.71E-06	AERMOD	0.002	10 Minute	13	Odour	Schedule 3	< 1%
Property Line	Octane	111-65-9	3.33E-03	AERMOD	1.4	10 Minute	61800	Odour	Guideline	< 1%
Property Line	Butyl alcohol, sec-	78-92-2	1.72E-02	AERMOD	0.80	24 Hour	496	N/A	JSL	< 1%
Property Line	Tetrachloroethylene	127-18-4	7.67E-03	AERMOD	0.58	24 Hour	360	Health	Schedule 3	< 1%
Property Line	Trichloroethylene (TCE)	79-01-6	1.25E-02	AERMOD	1.4	24 Hour	12	Health	Schedule 3	12%
Property Line	Vinyl chloride	75-01-4	7.87E-03	AERMOD	0.7	24 Hour	1	Health	Schedule 3	73%
Property Line	Carbon monoxide (single source)	630-08-0	1.61E+01	AERMOD	899	1/2 Hour	6000	Health	Schedule 3	15%
Property Line	Nitrogen oxides	10102-44-0	3.60E+00	AERMOD	229	1 Hour	400	Health	Schedule 3	57%
Property Line	Nitrogen oxides	10102-44-0	3.60E+00	AERMOD	84	24 Hour	200	Health	Schedule 3	42%
Property Line	Suspended particulate matter (< 44 µm diameter)	n/a - 1	2.33E+00	AERMOD	41	24 Hour	120	Visibility	Schedule 3	34%
Property Line	Sulphur dioxide	7446-09-5	2.13E+00	AERMOD	80	1 Hour	690	Health & Vegetation	Schedule 3	12%
Property Line	Sulphur dioxide	7446-09-5	2.13E+00	AERMOD	60	24 Hour	275	Health & Vegetation	Schedule 3	22%
Property Line	Dioxins, Furans and Dioxin-like PCBs	n/a - 2	4.05E-10	AERMOD	8.50E-09	24 Hour	1.00E-07	Health	Schedule 3	8%
R8	Odour	n/a - 3	7.69E+03	AERMOD	2.6	10 Minute	n/a	I	n/a	n/a

Notes:

[1] The term "MOE POI Limit" identified in Table D-4 refers to the following information (there may be more than one relevant MOE POI Limit for each contaminant):

- air quality standards in Schedules 1, 2 and 3 of the Regulation; and
- the guidelines for contaminants set out the MOE publication, "Summary of Standards and Guidelines to Support Ontario Regulation 419: Air Pollution – Local Air Quality"
- an acceptable concentration for contaminants with no standards or guidelines.

[2] A calibration factor of 3 was applied to all hydrogen sulphide concentrations.

[3] For the purposes of the Regulation, mercaptans are expressed as methyl mercaptan; an amount (or concentration of total mercaptans shall be calculated in accordance with the following formula:

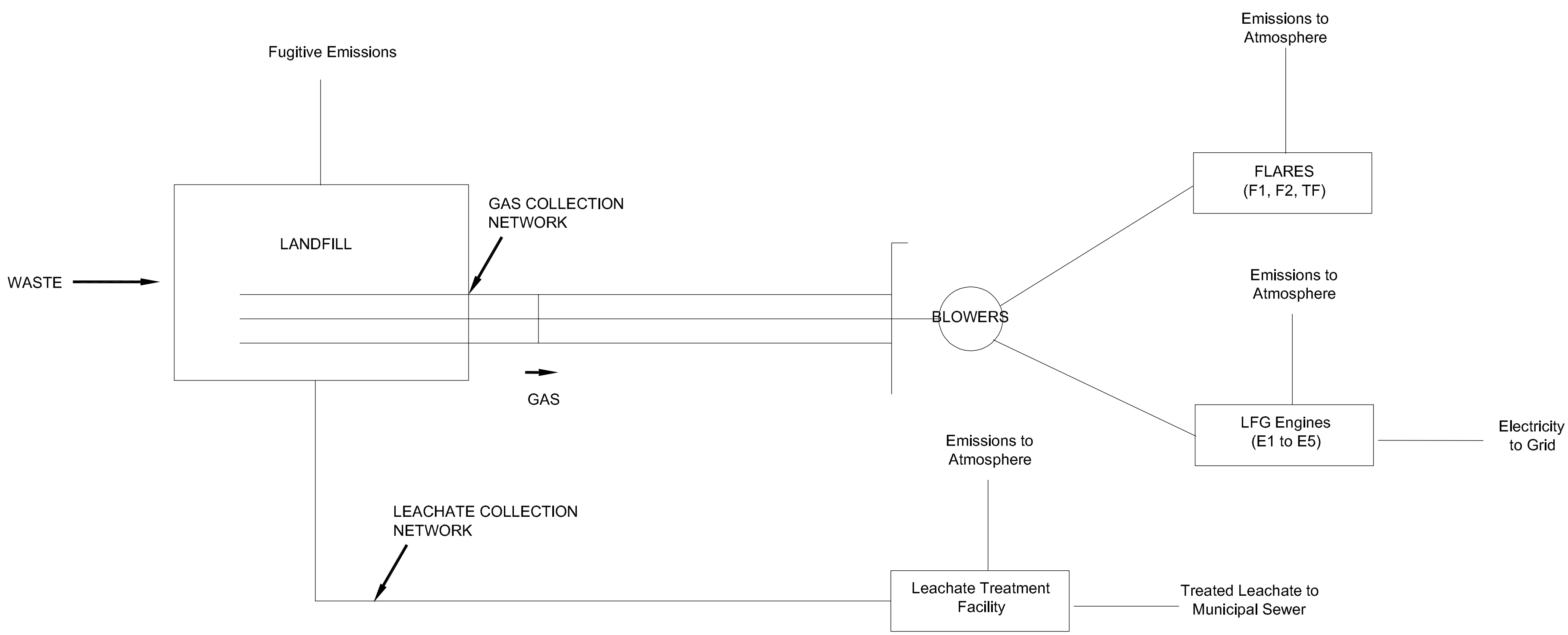
$A = \Sigma((B \times 48) / C)$, where,

A = the amount (or concentration) of total mercaptans, expressed as methyl mercaptan

B = the amount (or concentration) of each mercaptans

C = the molecular weight of each mercaptan

FIGURES



Process Flow Diagram - Landfill Gas Sources

Waste Management of Canada Corporation,
Ottawa Landfill - Ottawa, Ontario

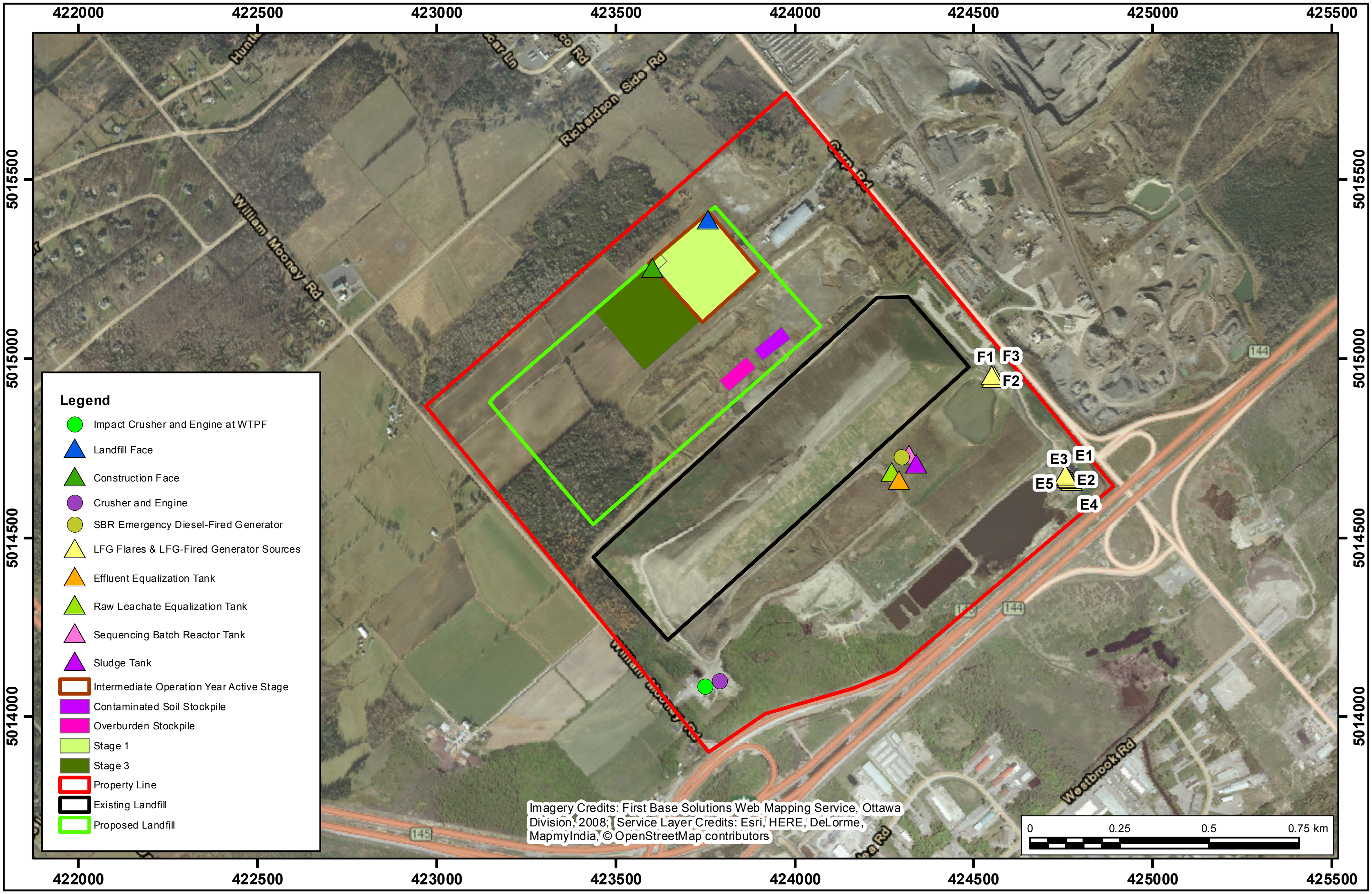
Project #1100721

Drawn by: SJP | Figure: **1.4**

Approx. Scale: N.T.S.

Date Revised: Jan. 18, 2011

RWDI



WCEC Landfill Site Plan

Map Projection: NAD 83 UTM 18N.

West Carleton Environmental Centre - Ottawa, Ontario

True North

Project #1302177

Drawn by: NBN	Figure: 5.2
Approx. Scale:	1:15,000
Date Revised:	May 28, 2014

RWDI

WCEC Landfill Discrete Receptor Locations

Map Projection: NAD 83 UTM 18N.

West Carleton Environmental Centre - Ottawa, Ontario

True North

Project #1302177

Drawn by: NBN	Figure:6.1.2
Approx. Scale:	1:40,000
Date Revised:	Mar. 12, 2014

RWDI

Figure 6.2 – Zoning Definitions

TABLE 35(B)- LIST OF PRIMARY ZONES AND CODES

(I) Zone Name	(II) Zone Code
RESIDENTIAL ZONES	
(1) Residential First Density Zone	R1
(2) Residential Second Density Zone	R2
(3) Residential Third Density Zone	R3
(4) Residential Fourth Density Zone	R4
(5) Residential Fifth Density Zone	R5
(6) Mobile Home Park Zone	RM
INSTITUTIONAL ZONES	
(7) Minor Institutional Zone	I1
(8) Major Institutional Zone	I2
OPEN SPACE AND LEISURE ZONES	
(9) Parks and Open Space Zone	O1
(10) Community Leisure Facility Zone	L1
(11) Major Leisure Facility Zone	L2
(12) Central Experimental Farm Zone	L3
ENVIRONMENTAL ZONE	
(13) Environmental Protection Zone	EP
COMMERCIAL/MIXED USE ZONES	
(14) Local Commercial Zone	LC
(15) General Mixed Use Zone	GM
(16) Traditional Mainstreet Zone	TM
(17) Arterial Mainstreet Zone	AM
(18) Mixed Use Centre Zone	MC
(19) Mixed Use Downtown Zone	MD

INDUSTRIAL ZONES	
(20) Business Park Industrial Zone	IP
(21) Light Industrial Zone	IL
(22) General Industrial Zone	IG
(23) Heavy Industrial Zone	IH
TRANSPORTATION ZONES	
(24) Air Transportation Facility Zone	T1
(25) Ground Transportation Facility Zone	T2
RURAL ZONES	
(26) Agricultural Zone	AG
(27) Mineral Extraction Zone	ME
(28) Mineral Aggregate Reserve Zone	MR
(29) Rural Commercial Zone	RC
(30) Rural General Industrial Zone	RG
(31) Rural Heavy Industrial Zone	RH
(32) Rural Institutional Zone	RI
(33) Rural Residential Zone	RR
(34) Rural Countryside Zone	RU
(35) Village Mixed Use Zone	VM
(36) Village Residential First Density Zone	V1
(37) Village Residential Second Density Zone	V2
(38) Village Residential Third Density Zone	V3
OTHER ZONES	
(39) Development Reserve Zone	DR

Figure 6.2a - Zoning Map for Ottawa Landfill
Showing Lands South and West of the Landfill

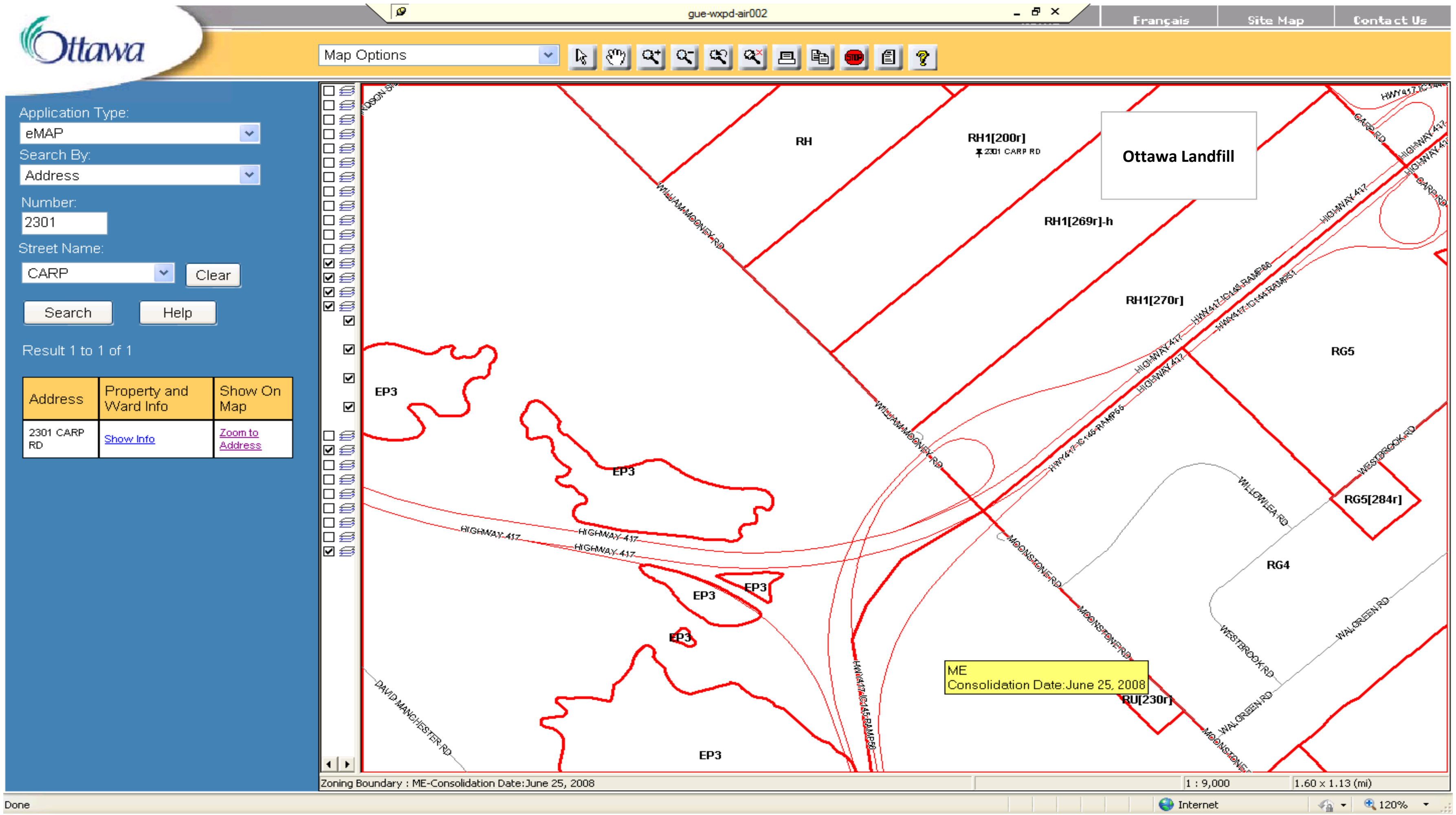
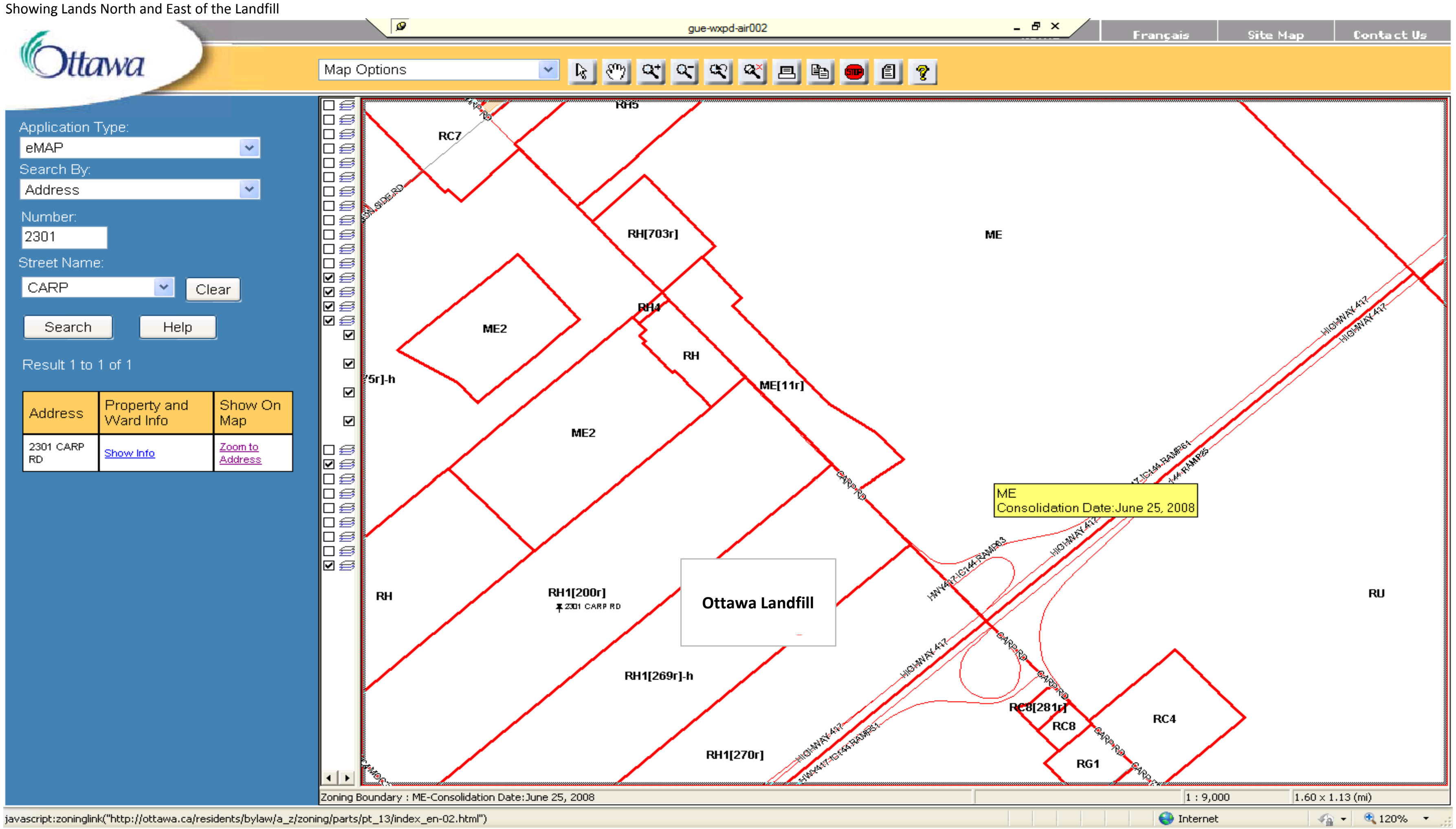


Figure 6.2b - Zoning Map for Ottawa Landfill

Showing Lands North and East of the Landfill



APPENDIX A

Please See Attached CD

APPENDIX B

Appendix B: Supporting Information for Assessment of Negligibility Based on Leachate Management System

Contaminant Name	Contaminant CAS Number	Source ID	Source Description	Contaminant Emission Rate (by source) (g/s)	Distance to Property Line [2] (m)	Reg. 419 Standard or Guideline (µg/m³)	Criteria [1] 50% of Standard or de minimus (µg/m³)	Regulation Schedule #	Criteria Averaging Time (hours)	Limiting Effect	Table B-1 1-hour Dispersion Factor for Shortest Distance to Property Line [2] (µg/m³ / g/s)	Table B-1 Dispersion Factor Converted to Criteria Averaging Time (µg/m³ / g/s)	Predicted Concentration (µg/m³)	Contaminant Negligible?
1,1 Dichloroethene (vinylidene chloride)	75-35-4		total leachate management plant	5.03E-03	380	10	5	3	24	health	1700	680	3.42E+00	yes
1,2 Dichloroethane	107-06-2		total leachate management plant	1.29E-03	380	2	1	3	24	health	1700	680	8.75E-01	yes
1,3,5 Trimethylbenzene	108-67-8		total leachate management plant	2.67E-04	380	220	110	3	24	heath	1700	680	1.82E-01	yes
1,4 Dichlorobenzene (-p)	106-46-7		total leachate management plant	9.70E-04	380	95	47.5	3	24	health	1700	680	6.60E-01	yes
1-Methylnaphthalene	90-12-0		total leachate management plant	6.24E-06	380	12	6	JSL	24	--	1700	680	4.24E-03	yes
1-Methylphenanthrene	832-69-9		total leachate management plant	1.15E-06	380	0.1	0.05	de minimus	24	--	1700	680	7.82E-04	yes
2-Methylnaphthalene	91-57-6		total leachate management plant	3.90E-06	380	10	5	JSL	24	--	1700	680	2.65E-03	yes
Acenaphthylene	120-12-7		total leachate management plant	1.42E-06	380	0.2	0.1	JSL	24	--	1700	680	9.66E-04	yes
Acetone (2-Propanone)	67-64-1		total leachate management plant	2.40E-01	380	11800	5900	3	24	health	1700	680	1.63E+02	yes
Ammonia	7664-41-7		total leachate management plant	1.45E+00	380	100	50	3	24	health	1700	680	9.89E+02	no
Benzene	71-43-2		total leachate management plant	2.43E-01	380	2.3	1.15	(annual equivalen	24	health	1700	680	1.66E+02	no
Biphenyl	92-52-4		total leachate management plant	2.25E-06	380	60	30	24-hr guideline	1	odour	1700	680	1.53E-03	yes
Bis(2-Ethylhexyl)Phthalate	117-81-7		total leachate management plant	5.41E-06	380	50	25	3	24	health	1700	680	3.68E-03	yes
Chlorobenzene	108-90-7		total leachate management plant	4.14E-04	380	3500	1750	3	1	health	1700	1700	7.04E-01	yes
Chlorobenzene	108-90-7		total leachate management plant	4.14E-04	380	4500	2250	3	10-min	odour	1700	2805	1.16E+00	yes
Chloroethane (ethyl chloride)	75-00-3		total leachate management plant	1.98E-03	380	5600	2800	3	24	health	1700	680	1.35E+00	yes
Chloroethylene (vinyl chloride)	75-01-4		total leachate management plant	5.95E-03	380	1	0.5	3	24	health	1700	680	4.04E+00	no
Chloromethane (methylchloride)	74-87-3		total leachate management plant	4.58E-03	380	320	160	3	24	health	1700	680	3.11E+00	yes
cis-1,2 Dichloroethylene	156-59-2		total leachate management plant	1.02E-01	380	105	52.5	24-hr guideline	24	health	1700	680	6.92E+01	no
Ethylbenzene	100-41-4		total leachate management plant	2.70E-02	380	1000	500	3	24	health	1700	680	1.83E+01	yes
Fluorene	86-73-7		total leachate management plant	5.87E-07	380	0.1	0.05	de minimus	24	--	1700	680	3.99E-04	yes
Methyl Ethyl Ketone (2-Butanone)	78-93-3		total leachate management plant	1.10E-01	380	1000	500	3	24	health	1700	680	7.48E+01	yes
Methane	74-82-8		total leachate management plant	4.95E-01	380	0.1	0.05	de minimus	24	--	1700	680	3.37E+02	no
Methylene Chloride (dichloromethane)	75-09-2		total leachate management plant	5.22E-01	380	220	110	3	24	health	1700	680	3.55E+02	no
Naphthalene	91-20-3		total leachate management plant	8.50E-04	380	22.5	11.25	24-hr guideline	24	health	1700	680	5.78E-01	yes
Naphthalene	91-20-3		total leachate management plant	8.50E-04	380	50	25	24-hr guideline	10-min	odour	1700	2805	2.38E+00	yes
Phenanthrene	85-01-8		total leachate management plant	2.93E-06	380	0.1	0.05	de minimus	24	--	1700	680	1.99E-03	yes
Phenol	108-95-2		total leachate management plant	3.37E-05	380	30	15	3	24	health	1700	680	2.29E-02	yes
Quinoline	91-22-5		total leachate management plant	5.60E-06	380	0.1	0.05	de minimus	24	--	1700	680	3.81E-03	yes
Styrene	100-42-5		total leachate management plant	6.00E-02	380	400	200	3	24	health	1700	680	4.08E+01	yes
Sulphate	18785-72-3		total leachate management plant	2.25E-15	380	0.1	0.05	de minimus	24	--	1700	680	1.53E-12	yes
Tetrachloroethene	127-18-4		total leachate management plant	4.52E-03	380	360	180	3	24	health	1700	680	3.07E+00	yes
Toluene	108-88-3		total leachate management plant	1.14E+00	380	2000	1000	24-hr guideline	24	odour	1700	680	7.72E+02	yes
Trichloroethylene	79-01-6		total leachate management plant	1.14E-02	380	12	6	3	24	health	1700	680	7.76E+00	no
Xylene	1330-20-7		total leachate management plant	1.99E-01	380	730	365	3	24	health	1700	680	1.36E+02	yes

Notes:

[1] 50% of MOE Schedule 1, 2 or 3 Standard, or de-minimus values as per Appendix B of the Guide to Preparing an ESDM Report.

[2] Use dispersion factor associated with shortest distance to property line for all sources emitting the contaminant. For the Ottawa Landfill leachate plant, the closest source to the property line has a separation distance of 680m.

APPENDIX C

Appendix C: Comparison of Results from Scenarios Evaluated as part of the EA

Summary of Maximum Predicted 24-Hour Concentrations Off-site for Each Future Build Scenario

CAS #	Compounds	Average Sample Concentration (mg/m³)	Averaging Period (hours)	MOE POI Limit (µg/m³)	2018 – Future Build		2023 – Future Build	
					Maximum Predicted Concentration (µg/m³)	Percentage of MOE POI Limit (%)	Maximum Predicted Concentration (µg/m³)	Percentage of MOE POI Limit (%)
71-55-6	1,1,1-Trichloroethane	0.16	24 Hour	115,000	2.77E-03	<0.1%	2.53E-03	<0.1%
79-34-5	1,1,2,2-Tetrachloroethane	0.017	n/a	n/a	2.91E-04	n/a	2.65E-04	n/a
79-00-5	1,1,2-Trichloroethane	0.02	24 Hour	0.31	3.61E-04	0%	3.29E-04	0%
75-34-3	1,1-Dichloroethane	4.1	24 Hour	165	7.20E-02	<0.1%	6.56E-02	<0.1%
75-35-4	1,1-Dichloroethylene	0.17	24 Hour	10	6.06E-01	6%	6.06E-01	6%
107-06-2	1,2-Dichloroethane	0.02	24 Hour	2	1.58E-01	8%	1.58E-01	8%
156-59-2	1,2-Dichloroethene (Cis)	9.63	24 Hour	105	1.22E+01	12%	1.22E+01	12%
156-60-5	1,2-Dichloroethene (Trans)	0.45	24 Hour	105	7.97E-03	<0.1%	7.27E-03	<0.1%
71-43-2	**Benzene**	**3.62**	**24 Hour**	**2.3**	**4.31E-01**	**19%**	**4.29E-01**	**19%**
75-27-4	Bromodichloromethane	0.002	n/a	n/a	2.70E-05	n/a	2.46E-05	n/a
56-23-5	Carbon Tetrachloride	0.03	24 Hour	2.4	4.64E-04	<0.1%	4.23E-04	<0.1%
75-00-3	Chloroethane	1.34	24 Hour	5600	2.44E-01	<0.1%	2.44E-01	<0.1%
67-66-3	Chloroform/Trichloromethane	0.29	24 Hour	1	5.02E-03	1%	4.58E-03	0%
75-09-2	Dichloromethane	2.43	24 Hour	220	5.89E+01	27%	5.89E+01	27%
106-93-4	Ethylene Dibromide	0.01	24 Hour	3	9.42E-05	<0.1%	8.59E-05	<0.1%
04/06/7783	**Hydrogen sulphide**	**288**	**24 Hour**	**7**	**1.68E+00**	**24%**	**1.53E+00**	**22%**
78-92-2	sec-Butyl Alcohol/2-Butanol (as n-Butanol)	45.7	24 Hour	920	8.23E-01	<0.1%	8.39E-01	<0.1%
127-18-4	Tetrachloroethylene	8.36	24 Hour	360	5.80E-01	0%	5.75E-01	0%
79-01-6	Trichloroethylene	2.76	24 Hour	12	1.39E+00	12%	1.39E+00	12%
75-01-4	**Vinyl Chloride/Chloroethene**	**5.11**	**24 Hour**	**1**	**7.35E-01**	**73%**	**7.32E-01**	**73%**
7664-41-7	Ammonia	n/a	24 Hour	100	1.28E+01	13%	1.28E+01	13%

Summary of Maximum Predicted 10-Minute Results at Discrete Receptors for Each Future Build Scenario – Contingency Leachate Management System

Receptor	2018 - Future Build			2023 - Future Build		
No.	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU	Maximum 10-Minute Average Concentration (OU/m³)	Frequency >1 OU	Frequency >3 OU
2	2.5	0.36%	--	2.5	0.33%	--
3	1.4	0.10%	--	**2.7**	**0.18%**	**--**
4	2.5	0.16%	--	2.4	0.19%	--
5	0.5	--	--	0.5	--	--
6	1	0.01%	--	0.8	--	--
7	0.8	--	--	0.6	--	--
8	**2.6**	**0.15%**	--	2.6	0.13%	--
9	2.1	**0.48%**	--	1	--	--
10	0.5	--	--	0.7	--	--
11	0.7	--	--	1	--	--
12	0.8	--	--	1.3	0.02%	--
13	1	--	--	1	--	--
14	1.5	0.08%	--	1.6	**0.35%**	**--**
15	1.1	0.01%	--	1.1	0.04%	--
16	0.8	--	--	0.6	--	--
17	0.6	--	--	0.5	--	--
18	1.9	0.14%	--	1.8	0.09%	--
19	1.1	0.02%	--	0.9	--	--
20	0.7	--	--	0.5	--	--
21	0.6	--	--	0.7	--	--
22	0.4	--	--	0.6	--	--
23	0.4	--	--	0.5	--	--
24	0.3	--	--	0.3	--	--

The worst-case concentration occurs in the 2023 Future Build Year, however it is less than 4% higher than the worst case concentration in the 2018 Future Build Year. The worst-case frequency of exceedences (0.48%) occurs in the 2018 Future Build Year, and it if far exceeds the worst case frequency of exceedences in the 2023 Future Build Year. Therefore, the 2018 Future Build Year, or as referred to in the ECA the mid year operation scenario, was the evaluated worst-case scenario.

APPENDIX D

Appendix D1 - Existing Landfill Mound LFG Emission Rates - Based on Scaling 2010 Flow Data

Landfill Gas Consumed (2010)	48,911,689	m³/year (from flowmeter data as provided in 2010 NPRI Info)
% of LM_EX with Gas Collection System in Place	100%	
Estimated Efficiency of LFG Collection System	85%	
Overall Gas Collection	85%	
Total Landfill Gas Generated	57,543,164	m³/year (based on gas consumed & overall gas collection)
Total Landfill Gas Released	8,631,475	m³/year (based on gas generated & overall gas collection)
Continuous Emission Rate	0.27	m³/s

Emission Flux Rate from Landfill

Landfill Area	355,013	m² (actual area)
Landfill Area	365,726	m² (modelled area)

Notes:

[1] Using flowmeter data provided in 2010 NPRI Info and Landgem LFG Output, a ratio was calculated and applied to other years to predict actual LFG generation rates

Ratio Gas Generated/LANDGEM Prediction = 1.64

Scenario	Year	LANDGEM Emissions (m^3/year)	Total Landfill Gas Generated (m^3)	Collection Efficiencies	Total Landfill Gas Released (m^3)	Continuous Emission Rate (m^3/s)
Intermediate Operation Year	2018	24,834,505	40,751,168	0.85	6,112,675	0.194

			Collection Efficiency		2018	
					0.850	
			Flow Rate (m³/s)		0.194	
	DESCRIPTION	Average Concentration [1]		Emission Rate	Emission Flux Rate
CAS #	COMPOUND	mg/m^3	g/m^3	g/s	g/m^2/s
71-55-6	1,1,1-Trichloroethane	0.158	1.58E-04	3.07E-05	8.39E-11
79-34-5	1,1,2,2-Tetrachloroethane	0.017	1.66E-05	3.22E-06	8.79E-12
79-00-5	1,1,2-Trichloroethane	0.021	2.06E-05	3.99E-06	1.09E-11
75-34-3	1,1-Dichloroethane	4.10	4.10E-03	7.95E-04	2.17E-09
75-35-4	1,1-Dichloroethylene	0.17	1.68E-04	3.25E-05	8.89E-11
107-06-2	1,2-Dichloroethane	0.016	1.62E-05	3.13E-06	8.57E-12
156-59-2	1,2-Dichloroethene (Cis)	9.63	9.63E-03	1.87E-03	5.10E-09
156-60-5	1,2-Dichloroethene (Trans)	0.45	4.55E-04	8.81E-05	2.41E-10
71-43-2	Benzene	3.62	3.62E-03	7.01E-04	1.92E-09
75-27-4	Bromodichloromethane	0.002	1.54E-06	2.98E-07	8.15E-13
56-23-5	Carbon Tetrachloride	0.026	2.65E-05	5.13E-06	1.40E-11
75-00-3	Chloroethane	1.34	1.34E-03	2.59E-04	7.08E-10
67-66-3	Chloroform/Trichloromethane	0.29	2.86E-04	5.55E-05	1.52E-10
75-09-2	Dichloromethane	2.43	2.43E-03	4.72E-04	1.29E-09
75-18-3	Dimethyl sulfide [2]	2.35	2.35E-03	4.55E-04	1.24E-09
75-08-1	Ethyl Mercaptan	0.008	7.75E-06	1.50E-06	4.11E-12
106-93-4	Ethylene Dibromide	0.01	5.37E-06	1.04E-06	2.85E-12
04-06-7783	Hydrogen sulfide [2]	288.15	2.88E-01	5.59E-02	1.53E-07
74-93-1	Methyl Mercaptan	0.005	4.80E-06	9.31E-07	2.55E-12
111-65-9	Octane	8.70	8.70E-03	1.69E-03	4.61E-09
78-92-2	sec-Butyl Alcohol/2-Butanol	45.70	4.57E-02	8.86E-03	2.42E-08
127-18-4	Tetrachloroethylene	8.36	8.36E-03	1.62E-03	4.43E-09
79-01-6	Trichloroethylene	2.76	2.76E-03	5.35E-04	1.46E-09
75-01-4	Vinyl Chloride/Chloroethene	5.11	5.11E-03	9.91E-04	2.71E-09

Notes:

[1] Average Concentrations are based on the LFG Analysis results of measurements taken in 2004 and in 2011.
The resulting concentrations were averaged for the 2004 and 2011 period.
The highest average concentration was used to estimate the emission rates and emission flux rate.

[2] Sulphur Compounds concentrations were highest in 2011 and are an average of six sample concentration results

Sample Calculations

Total Landfill Gas Generated (m^3) = $\frac{24,834,505\ m^3}{year} \times \frac{1.64\ (Gas\ Generated)}{Landgem\ Prediction}$

Total Landfill Gas Generated (m^3) = 40,751,168

Total Landfill Gas Released (m^3) = 40,751,168 m^3 | 1-0.85 (Collection Efficiency)

Total Landfill Gas Released (m^3) = 6,112,675

Continuous LFG Emission Rate (m^3/s) = $\frac{6,112,675\ m^3}{year} \times \frac{1\ year}{365\ days} \times \frac{1\ day}{24\ hours} \times \frac{1\ hour}{3600s}$

Continuous LFG Emission Rate (m^3/s) = 0.194

Benzene Emission Rate (g/s) = $\frac{0.003617\ g}{m^3} \times \frac{0.194\ m^3}{s}$

Benzene Emission Rate (g/s) = 0.000701

Benzene Emission Flux Rate (g/s/m^2) = $\frac{0.000701\ g}{s} \times \frac{1}{365,726\ m^2}$

Benzene Emission Flux Rate (g/s/m^2) = 1.92E-09

REPORT OF ANALYSIS: EPA624/TO-14 Target Compounds in mg/m³

REPORT: 11017 (Method - SCAN ATD-GC-MSD Cryogenic Oven Control)

	DESCRIPTION	11042003	11042004	11042005	11042006	
CAS #	**COMPOUND**	**No.1-VOC 4/19/11 V=5.0mL**	**No.1-VOC 4/19/11 V=15mL**	**No.2-VOC 4/19/11 V=15mL**	**No.3-VOC 4/19/11 V=15mL**	**POI (Ontario) (ug/m³)**
	Target Compounds					
74-93-1	Methyl Mercaptan	**0.011**	**0.003**	**0.003**	**0.003**	-
75-01-4	Vinyl Chloride	4.53	4.25	5.88	5.80	3
75-08-1	Ethyl Mercaptan	**0.017**	**0.005**	**0.005**	**0.004**	-
75-00-3	Chloroethane	**0.083**	0.153	0.200	0.198	-
75-18-3	Dimethyl Sulfide	**0.014**	**0.004**	**0.004**	**0.003**	30
75-35-4	1,1-Dichloroethylene	0.047	0.049	0.072	0.066	30
75-09-2	Dichloromethane	0.592	0.592	0.831	0.797	5300
156-60-5	1,2-Dichloroethene (trans)	0.274	0.348	0.531	0.505	315
75-34-3	1,1-Dichloroethane	0.992	1.015	1.451	1.378	600
78-92-2	2-Butanol	**0.025**	**0.007**	**0.006**	**0.006**	-
156-59-2	1,2-Dichloroethene (cis)	7.75	8.15	11.58	11.04	315
67-66-3	Chloroform	0.056	0.072	0.103	0.100	300
56-23-5	Carbon Tetrachloride	**0.059**	**0.017**	**0.016**	**0.014**	1800
71-55-6	1,1,1-Trichloroethane	0.093	0.143	0.206	0.191	350000
71-43-2	Benzene	2.33	2.45	3.68	3.44	1
107-06-2	1,2-Dichloroethane	**0.036**	**0.010**	**0.010**	**0.009**	6
79-01-6	Trichloroethylene	1.37	1.45	2.23	2.10	3500
75-27-4	Bromodichloromethane	**0.003**	**0.001**	**0.001**	**0.001**	-
111-65-9	Octane	4.67	4.53	6.60	6.07	45400
79-00-5	1,1,2-Trichloroethane	**0.046**	**0.013**	**0.012**	**0.011**	-
127-18-4	Tetrachloroethylene	3.90	4.39	6.72	6.31	10000
106-93-4	1,2-Dibromoethane	**0.012**	**0.003**	**0.003**	**0.003**	-
79-34-5	1,1,2,2-Tetrachloroethane	**0.037**	**0.011**	**0.010**	**0.009**	-
	TVOCs (Toluene)	552	381	661		

POI = Half Hour Point of Impingement (Ontario Ministry of Environment)

V = Volume of air sampled

NB - Values in bold represent "Less Thans"

REPORT OF ANALYSIS: Selected and Target Compounds in mg/m³

REPORT: 04024 (Methods 1c, 3a, 5b, 6b)

	DESCRIPTION	04061105	04061106	04061107	0
CAS #	COMPOUND	VOC1 V=5mL	VOC2 V=5mL	VOC3 V=5mL	POI (Ontario) (mg/m³)
	Target Compounds				
74-93-1	Methyl Mercaptan	ND	ND	ND	0.02
75-08-1	Ethyl Mercaptan	ND	ND	ND	0.02
75-01-4	Vinyl Chloride/Chloroethene	3.74	3.65	3.88	0.003
75-00-3	Chloroethane	1.218	1.361	1.427	-
75-35-4	1,1-Dichloroethylene	0.1704	0.1632	0.1698	0.03
75-18-3	Dimethyl Sulphide	2.27	2.34	2.46	0.03
75-09-2	Dichloromethane	2.61	2.29	2.40	5.3
156-60-5	1,2-Dichloroethene (Trans)	0.448	0.453	0.463	0.315
75-34-3	1,1-Dichloroethane	4.09	4.00	4.22	0.6
156-59-2	1,2-Dichloroethene (Cis)	8.00	7.70	8.11	0.315
78-92-2	sec-Butyl Alcohol/2-Butanol	45.3	43.9	47.9	-
67-66-3	Chloroform/Trichloromethane	0.307	0.281	0.271	0.3
71-55-6	1,1,1-Trichloroethane	0.1231	0.1053	0.1199	350
56-23-5	Carbon Tetrachloride	ND	ND	ND	0.0072
71-43-2	Benzene	3.67	3.51	3.67	
107-06-2	1,2-Dichloroethane	ND	ND	ND	0.006
79-01-6	Trichloroethylene	2.83	2.66	2.79	3.5
75-27-4	Bromodichloromethane	ND	ND	ND	-
111-65-9	Octane	8.88	8.26	8.95	45.4
79-00-5	1,1,2-Trichloroethane	ND	ND	ND	-
127-18-4	Tetrachloroethylene	8.36	8.16	8.56	10
106-93-4	Ethylene Dibromide	ND	ND	ND	0.009
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	ND	-
	Selected Compounds				
15-07-1/74-98	1-Propene/Propane	48.2	49.3	49.4	-
75-28-5	2-Methyl Propane/Isobutane	17.80	16.83	17.87	-
115-11-7	Isobutene/2-Methyl-1-Propene	7.69	7.53	8.24	-
67-56-1	Methanol	2.58	2.31	3.73	12
78-78-4	2-Methyl Butane	5.82	5.74	6.57	-
75-69-4	Trichlorofluoromethane(11)	0.995	1.033	1.155	18
9-67-1/1191-9	1-Pentene/Ethyl Cyclopropane	0.323	0.279	0.298	-
109-66-0	Pentane	5.15	4.73	5.28	-
64-17-5	Ethanol	76.3	77.7	81.6	19
123-38-6	Propanal	1.270	1.272	1.414	0.007
67-64-1	Acetone	17.66	17.73	18.26	48
75-15-0	Carbon Disulphide	0.814	U	0.473	0.33
67-63-0	Isopropyl Alcohol	25.7	25.6	26.8	24
75-05-8	Acetonitrile	0.1199	0.209	0.1349	-
79-29-8	2,3-Dimethyl Butane	0.512	0.573	0.649	-
79-20-9	Methyl Acetate	1.041	1.361	1.400	-
107-83-5	2-Methyl Pentane	4.16	4.08	4.24	-
96-14-0	3-Methyl Pentane	3.51	3.35	3.57	-
2-41-6/763-29	1-Hexene/2-Methyl-1-Pentene	0.416	0.355	0.370	-
110-54-3	Hexane	7.85	7.78	8.17	35
71-23-8	n-Propanol	38.1	38.2	39.8	48
534-22-5	2-Methyl Furan	1.188	1.149	1.062	-
123-72-8	n-Butanal	4.94	4.91	4.68	-
96-37-7	Methyl Cyclopentane	3.63	3.37	3.22	-
78-93-3	MEK/2-Butanone	41.0	39.7	41.1	30
141-78-6	Ethyl Acetate	14.33	13.39	13.88	19
109-99-9	Tetrahydrofuran	6.36	5.95	5.75	93
591-76-4	2-Methyl Hexane	5.8	5.82	5.72	-
589-34-4	3-Methyl Hexane	9.78	9.80	9.87	-
565-59-3	2,3-Dimethyl Pentane	2.95	2.81	2.75	-

REPORT OF ANALYSIS: Selected and Target Compounds in mg/m³

REPORT: 04024 (Methods 1c, 3a, 5b, 6b)

	DESCRIPTION	04061105	04061106	04061107	0
CAS #	COMPOUND	VOC1 V=5mL	VOC2 V=5mL	VOC3 V=5mL	POI (Ontario) (mg/m³)
78-83-1	Isobutyl Alcohol/2-Methyl-1-Pr	5.92	5.61	5.23	-
142-82-5	Heptane	13.47	13.78	14.12	33
71-36-3	n-Butanol	41.2	41.4	44.7	2.278
108-87-2	Methyl Cyclohexane	19.60	19.43	19.92	-
592-27-8	2-Methyl Heptane	6.18	5.92	6.12	-
589-53-7	4-Methyl Heptane	2.11	2.01	6.17	-
589-81-1	3-Methyl Heptane	5.27	5.13	5.11	-
108-10-1	4-Methyl-2-Pentanone/MIBK	8.30	8.00	8.61	1.2
108-88-3	Toluene	65.4	61.9	62.3	2
123-86-4	Butyl Acetate	16.01	15.49	16.57	0.735
108-90-7	Chlorobenzene	3.45	3.36	3.45	4.2
100-41-4	Ethyl Benzene	31.9	29.3	29.2	3
)8-38-3/106-42	m/p-Xylene	73.7	65.9	67.1	2.3*
95-47-6	o-Xylene	26.5	24.0	24.8	2.3*
1678-92-8	Propyl Cyclohexane	41.1	42.2	43.6	-
98-82-8	Cumene/Isopropyl Benzene	6.36	5.87	6.13	0.1
79-92-5	Camphene	41.6	40.9	42.2	-
103-65-1	Propyl Benzene	7.36	6.64	7.10	-
20-14-4/622-96	m/p-Ethyl Toluene	25.1	22.7	23.9	-
124-18-5	Decane	70.1	63.5	66.2	-
611-14-3	o-Ethyl Toluene	14.14	12.70	13.40	-
95-63-6	1,2,4-Trimethyl Benzene	20.9	18.83	19.88	0.5
13466-78-9	3-Carene	3.54	3.64	4.01	-
3-86-3/5989-2	Limonene/D-Limonene	64.5	58.1	59.7	-
99-87-6	p-Cymene	36.1	32.6	33.4	-
106-46-7	1,4-Dichlorobenzene	14.04	12.18	13.02	-
1120-21-4	Undecane	23.9	21.4	23.1	-
541-02-6	Decamethyl Cyclopentasiloxar	11.91	11.69	14.13	-
112-40-3	Dodecane	2.59	2.31	2.70	-
540-97-6	Dodecamethyl Cyclohexasilox	6.61	6.25	6.16	-
-	Aromatics	76.4	58.3	70.6	
-	Aliphatics	244	228	243	
-	Cycloaliphatics	109.0	101.0	116.7	
-	Oxygenates	403	406	324	
-	Complex	176.4	129.8	209	
	TVOCs (Toluene)	1408	1315	1379	

POI = Half Hour Point of Impingement (Ontario Ministry of Environment)
U = Unresolved due to co-elution
< (ND) = Characteristic ions are not present therefore Not Detected
* & ** = Sum of all isomers
V = Volume of air sampled

Maxxam Job #: B153692
Report Date: 2011/04/21

RWDI West Inc
Client Project #: WM OTTAWA
Project name:
Your P.O. #: 1100798
Sampler Initials:

COMPRESSED GAS PARAMETERS (AIR)

Maxxam ID		JG2672	JG2672	JG2673		JG2674	JG2674		
Sampling Date		19/04/2011	19/04/2011	19/04/2011		19/04/2011	19/04/2011		
COC Number		na	na	na		na	na		
	Units	**SAMPLE1**	**SAMPLE1 Lab-Dup**	**SAMPLE 2**	**RDL**	**SAMPLE 3**	**SAMPLE 3 Lab-Dup**	**RDL**	**QC Batch**
Oxygen	% v/v	5.2	N/A	2.9	0.1	2.9	2.9	0.1	2464878
Nitrogen	% v/v	19.5	N/A	12.0	0.1	11.9	12.0	0.1	2464878
Methane	% v/v	45.0	N/A	50.7	0.1	50.6	51.1	0.1	2464878
Carbon Dioxide	% v/v	30.8	N/A	34.8	0.1	34.9	35.2	0.1	2464878
Carbon Monoxide	% v/v	ND	N/A	ND	0.1	ND	ND	0.1	2464878
Hydrogen sulfide	ppmv	170	180	180	1.5	290	N/A	2.5	2464828
Carbonyl sulfide	ppmv	ND	ND	ND	0.40	ND	N/A	0.40	2464828
Methyl mercaptan	ppmv	0.96	0.90	0.90	0.80	1.1	N/A	0.80	2464828
Ethyl mercaptan	ppmv	0.55	0.43	ND	0.40	0.47	N/A	0.40	2464828
Dimethyl sulfide	ppmv	1.4	1.6	1.6	0.80	1.7	N/A	0.80	2464828
Dimethyl disulfide	ppmv	ND	ND	ND	0.80	ND	N/A	0.80	2464828

ND = Not detected
N/A = Not Applicable
RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch

AirZOne
Comprehensive Air Quality Services

RWDI Air
Att: Brad Bergeron
650 Woodlawn Road
Guelph ON, N1K 1B8

Sample Analysis Report

Project Number:	J11061
Client #	1100798
Report Date:	30-Apr-11
Analysis Date:	29-Apr-11
Receipt Date	29-Apr-11
Analytical Method:	Gas Chromatography/Flame Photometric Detection/ (GC/FPD)
Unit:	All results reported in mole ppm by volume
Sample Type:	Tedlar Bag

Results	Detection Limit	TRS-1	TRS-2	TRS-3
Marix gases				
CO	100	<100	<100	<100
O2	100	31439	22240	20985
CO2	100	415403	446814	427069
CH4	100	428771	440616	465959
N2	100	124213	90146	85803
Sulfur Compounds				
Hydrogensulfide	0.01	173	183	182
Methyl mercaptan	0.01	0.55	0.58	0.56
Ethyl Mercaptan	0.01	0.26	0.29	0.26
Dimethyl Sulfide	0.01	0.18	0.20	0.18
Dimethyl Disulfide	0.01	0.05	0.06	0.05
Carbonyl Sulfide	0.01	<0.01	<0.01	<0.01

Analyst	Quang Tran, M. Sc.
Manager Air Monitoring	Philip Fellin, M.Sc.

MaxXam Analytics Inc

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www.maxxamanalytics.com

:owan Williams Davies & Irwin Inc
RWDI)
;50 Woodlawn Rd W
Guelph, ON
N1K 1B8

Report Date: 2004/06/18

Attention: John Devoe

ANALYTICAL REPORT

MAXXAM JOB #: A426911
Received: 2004/06/11, 09:43

Sample Matrix: GASES
Samples Received: 3

Analyses	Number of Tests	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Matrix Gases	3	2004/06/18	2004/06/11	Ont SOP 0289	GC/TCD
Sulphur Compounds In Gaseous Samples (1)	3	2004/06/18	2004/06/11	Ont SOP 0598, 288	GC/FPD Direct Inject

MAXXAM ANALYTICS INC.

Tom Mitchell

TOM MITCHELL, B.Sc
Air Quality Services
(1) GC/FPD (Gas Chromatography/Flame Photometric Detection)

Total pages: 1

Maxxam Analytics Inc

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www.maxxamanalytics.com

REPORT DATE: 2004/06/18

MAXXAM JOB #: A426911

RESULTS OF CHEMICAL ANALYSES OF GASES

Maxxam ID		C92810	C92811	C92812	
Parameter	Units	#1	#2	#3	MDL
Oxygen	%	0.7	0.7	0.6	0.1
Nitrogen	%	6.2	5.9	5.7	0.1
Methane	%	54.3	54.7	54.4	0.1
Carbon Dioxide	%	38.9	38.9	38.8	0.1
Carbon Monoxide	%	ND	ND	ND	0.1
Hydrogen Sulfide/Carbonyl Sulfide	ppmv	36.3	41.1	44.2	2.0
Methyl Mercaptan	ppmv	1.00	1.10	1.20	0.10
Ethyl Mercaptan/Dimethyl Sulfide	ppmv	0.60	0.60	0.70	0.10
Dimethyl Disulfide	ppmv	ND	ND	ND	0.10
Carbon Disulfide	ppmv	ND	ND	ND	0.040

ND = Not detected
MDL = METHOD DETECTION LIMIT

CATHY LI, Air Quality Services

5540 McAdam Road, Mississauga, Ontario, Canada L4Z 1P1 Tel: (905) 890-2555 Toll Free: (800) 563-6266 Fax: (905) 890-0370

Appendix D7 - Existing Landfill Mound Odour Emission Rates - Based on Scaling 2010 Flow Data

Odour Concentration of Landfil Gas	10,000	OU/m³	"upper range" estimate of odour concentrationfrom the MOE's Interim Guide to Estimate and Assess Landfill Air Impacts
Landfill Gas Consumed (2010)	48,911,689	m³/year (from flowmeter data as provided in 2010 NPRI Info)	
% of LM_EX with Gas Collection System in Place	100%		
Estimated Efficiency of LFG Collection System	85%		
Overall Gas Collection	85%		
Total Landfill Gas Generated	57,543,164	m³/year (based on gas consumed & overall gas collection)	
Total Landfill Gas Released	8,631,475	m³/year (based on gas generated & overall gas collection)	
Continuous Emission Rate	0.27	m³/s	

Emission Flux Rate from Landfill

Landfill Area	355,013	m² (actual area)
Landfill Area	365,726	m² (modelled area)

Notes:

[1] Using flowmeter data provided in 2010 NPRI Info and Landgem LFG Output, a ratio was calculated and applied to other years to predict actual LFG generation rates

Ratio Gas Generated/LANDGEM Prediction = 1.64

Year	LANDGEM Emissions (m^3/year)	Total Landfill Gas Generated (m^3/year)	Collection Efficiencies	Total Landfill Gas Released (m^3/year)	Continuous Emission Rate (m^3/s)	Odour Emission Rate (OU/s)	Odour Emission Flux Rate (OU/m^2/s)
Intermediate Operation Year (2018)	24,834,505	40,751,168	0.85	6,112,675	0.194	1938	5.30E-03

Sample Calculations

Total Landfill Gas Generated (m^3) = $\frac{24{,}834{,}505 \text{ m}^3}{\text{year}} \left| \frac{1.64 \text{ (Gas Generated)}}{\text{Landgem Prediction}} \right.$

Total Landfill Gas Generated (m^3) = 40,751,168

Total Landfill Gas Released (m^3) = $40{,}751{,}168 \text{ m}^3$ | 1-0.85 (Collection Efficiency)

Total Landfill Gas Released (m^3) = 6,112,675

Continuous LFG Emission Rate (m^3/s) = $\frac{6{,}112{,}675 \text{ m}^3}{\text{year}} \left| \frac{1 \text{ year}}{365 \text{ days}} \right| \frac{1 \text{ day}}{24 \text{ hours}} \left| \frac{1 \text{ hour}}{3600\text{s}} \right.$

Continuous LFG Emission Rate (m^3/s) = 0.194

Odour Emission Rate (OU/s) = $\frac{10{,}000 \text{ OU}}{\text{m}^3} \left| \frac{0.194 \text{ m}^3}{\text{s}} \right.$

Odour Emission Rate (g/s) = 1938

Odour Emission Flux Rate (g/s/m^2) = $\frac{1938 \text{ OU}}{\text{s}} \left| \frac{}{365{,}726 \text{ m}^2} \right.$

Odour Emission Flux Rate (OU/s/m^2) = 5.30E-03

APPENDIX E

Appendix E1 - Proposed Landfill Mound and Active Stage LFG Emission Rates - Based on LANDGEM Data

Modelled Landfill Area (m^2)	Proposed Landfill Footprint	Active Stage
Intermediate Operation Year (2018)	321198	47,250

Notes:

No actual change in landfill area, change is due to adjustments made to the preferred alternative landfill polygon source to accommodate the change of the active stage placement

Proposed Landfill

Scenario	Year	LANDGEM Emissions (m^3/year)	Collection Efficiencies	Total Landfill Gas Released (m^3/s)	Continuous Emission Rate (m^3/s)
Intermediate Operation Year	2018	12,649,667	0.85	1,897,450	0.060

Active Stage

Scenario	Year	LANDGEM Emissions (m^3/year)	Collection Efficiencies	Total Landfill Gas Released (m^3/s)	Continuous Emission Rate (m^3/s)
Intermediate Operation Year	2018	1,726,619	0.5	863,310	0.027

Notes:

The waste deposit in each stages (8) and for both phases is assumed to be placed in 16 equal portions.

Total waste placed (400,000 Mg per year, 4,000,000 Mg total).

Approximately 250,000 Mg waste per portion.

LANDGEM Emission for the active stage is based on the placement of 250,000 Mg of waste, with no historic cumulation from previous waste deposited.

This is the maximum amount of gas that would be emitted from that waste (i.e. 1 year after its placement).

PROPOSED LANDFILL EMISSION RATES

				2018	
		Collection Efficiency		0.850	
		Flow Rate (m³/s)		0.060	
CAS #	DESCRIPTION	Average Concentration [1]		Emission Rate	Emission Flux Rate
	COMPOUND	mg/m^3	g/m^3	g/s	g/m^2/s
71-55-6	1,1,1-Trichloroethane	0.158	1.58E-04	9.52E-06	2.96E-11
79-34-5	1,1,2,2-Tetrachloroethane	0.017	1.66E-05	9.98E-07	3.11E-12
79-00-5	1,1,2-Trichloroethane	0.021	2.06E-05	1.24E-06	3.85E-12
75-34-3	1,1-Dichloroethane	4.10	4.10E-03	2.47E-04	7.69E-10
75-35-4	1,1-Dichloroethylene	0.17	1.68E-04	1.01E-05	3.14E-11
107-06-2	1,2-Dichloroethane	0.016	1.62E-05	9.72E-07	3.03E-12
156-59-2	1,2-Dichloroethene (Cis)	9.63	9.63E-03	5.79E-04	1.80E-09
156-60-5	1,2-Dichloroethene (Trans)	0.45	4.55E-04	2.74E-05	8.52E-11
71-43-2	Benzene	3.62	3.62E-03	2.18E-04	6.77E-10
75-27-4	Bromodichloromethane	0.002	1.54E-06	9.25E-08	2.88E-13
56-23-5	Carbon Tetrachloride	0.026	2.65E-05	1.59E-06	4.96E-12
75-00-3	Chloroethane	1.34	1.34E-03	8.03E-05	2.50E-10
67-66-3	Chloroform/Trichloromethane	0.29	2.86E-04	1.72E-05	5.36E-11
75-09-2	Dichloromethane	2.43	2.43E-03	1.46E-04	4.56E-10
75-18-3	Dimethyl sulfide [2]	2.35	2.35E-03	1.41E-04	4.40E-10
75-08-1	Ethyl Mercaptan	0.008	7.75E-06	4.66E-07	1.45E-12
106-93-4	Ethylene Dibromide	0.01	5.37E-06	3.23E-07	1.01E-12
04-06-7783	Hydrogen sulfide [2]	288.15	2.88E-01	1.73E-02	5.40E-08
74-93-1	Methyl Mercaptan	0.005	4.80E-06	2.89E-07	9.00E-13
111-65-9	Octane	8.70	8.70E-03	5.23E-04	1.63E-09
78-92-2	sec-Butyl Alcohol/2-Butanol	45.70	4.57E-02	2.75E-03	8.56E-09
127-18-4	Tetrachloroethylene	8.36	8.36E-03	5.03E-04	1.57E-09
79-01-6	Trichloroethylene	2.76	2.76E-03	1.66E-04	5.17E-10
75-01-4	Vinyl Chloride/Chloroethene	5.11	5.11E-03	3.08E-04	9.58E-10

Notes:

[1] Average Concentrations are based on the LFG Analysis results of measurements taken in 2004 and in 2011.

The resulting concentrations were averaged for the 2004 and 2011 period.

The highest average concentration was used to estimate the emission rates and emission flux rate

[2] Sulphur Compounds concentrations were highest in 2011 and are an average of six sample concentration results

ACTIVE STAGE EMISSION RATES

				2018	
		Collection Efficiency		0.500	
		Flow Rate (m³/s)		0.027	
	DESCRIPTION	Average Concentration [1]		Emission Rate	Emission Flux Rate
CAS #	COMPOUND	mg/m^3	g/m^3	g/s	g/m^2/s
71-55-6	1,1,1-Trichloroethane	0.158	1.58E-04	4.33E-06	9.17E-11
79-34-5	1,1,2,2-Tetrachloroethane	0.017	1.66E-05	4.54E-07	9.61E-12
79-00-5	1,1,2-Trichloroethane	0.021	2.06E-05	5.63E-07	1.19E-11
75-34-3	1,1-Dichloroethane	4.10	4.10E-03	1.12E-04	2.38E-09
75-35-4	1,1-Dichloroethylene	0.17	1.68E-04	4.59E-06	9.72E-11
107-06-2	1,2-Dichloroethane	0.016	1.62E-05	4.42E-07	9.36E-12
156-59-2	1,2-Dichloroethene (Cis)	9.63	9.63E-03	2.64E-04	5.58E-09
156-60-5	1,2-Dichloroethene (Trans)	0.45	4.55E-04	1.24E-05	2.63E-10
71-43-2	Benzene	3.62	3.62E-03	9.90E-05	2.10E-09
75-27-4	Bromodichloromethane	0.002	1.54E-06	4.21E-08	8.91E-13
56-23-5	Carbon Tetrachloride	0.026	2.65E-05	7.24E-07	1.53E-11
75-00-3	Chloroethane	1.34	1.34E-03	3.66E-05	7.74E-10
67-66-3	Chloroform/Trichloromethane	0.29	2.86E-04	7.84E-06	1.66E-10
75-09-2	Dichloromethane	2.43	2.43E-03	6.66E-05	1.41E-09
75-18-3	Dimethyl sulfide [2]	2.35	2.35E-03	6.42E-05	1.36E-09
75-08-1	Ethyl Mercaptan	0.008	7.75E-06	2.12E-07	4.49E-12
106-93-4	Ethylene Dibromide	0.01	5.37E-06	1.47E-07	3.11E-12
04-06-7783	Hydrogen sulfide [2]	288.15	2.88E-01	7.89E-03	1.67E-07
74-93-1	Methyl Mercaptan	0.005	4.80E-06	1.32E-07	2.78E-12
111-65-9	Octane	8.70	8.70E-03	2.38E-04	5.04E-09
78-92-2	sec-Butyl Alcohol/2-Butanol	45.70	4.57E-02	1.25E-03	2.65E-08
127-18-4	Tetrachloroethylene	8.36	8.36E-03	2.29E-04	4.84E-09
79-01-6	Trichloroethylene	2.76	2.76E-03	7.56E-05	1.60E-09
75-01-4	Vinyl Chloride/Chloroethene	5.11	5.11E-03	1.40E-04	2.96E-09

Notes:

[1] Average Concentrations are based on the LFG Analysis results of measurements taken in 2004 and in 2011.

The resulting concentrations were averaged for the 2004 and 2011 period.

The highest average concentration was used to estimate the emission rates and emission flux rate

[2] Sulphur Compounds concentrations were highest in 2011 and are an average of six sample concentration results

Sample Calculations - Active Stage

Total Landfill Gas Released (m^3) = 1,726,619 m^3 | 1-0.05 (Collection Efficiency)

Total Landfill Gas Released (m^3) = 863,310

Continuous LFG Emission Rate (m^3/s) = $\frac{863{,}310}{\text{year}} \cdot \frac{1\text{ year}}{365\text{ days}} \cdot \frac{1\text{ day}}{24\text{ hours}} \cdot \frac{1\text{ hour}}{3600\text{s}}$

Continuous LFG Emission Rate (m^3/s) = 0.027

Benzene Emission Rate (g/s) = $\frac{0.003617\text{ g}}{m^3} \cdot \frac{0.027\ m^3}{s}$

Benzene Emission Rate (g/s) = 9.90E-05

Benzene Emission Flux Rate (g/s/m^2) = $\frac{9.90\text{E-05 g}}{s} \cdot \frac{1}{47{,}250\ m^2}$

Benzene Emission Flux Rate (g/s/m^2) = 2.10E-09

Appendix E2 - Proposed Landfill Mound Odour Emission Rates - Based on LANDGEM

Odour Concentration of Landfil Gas 10,000 OU/m³

"upper range" estimate of odour concentrationfrom the MOE's Interim Guide to Estimate and Assess Landfill Air Impacts

Year	Modelled Preferred Alternative Landfill Area (m^2)
Intermediate Operation Year (2018)	321198

Notes:

No actual change in landfill area, change is due to change of the active stage placement and therefore slight adjustments made to the preferred alternatice landfill mound polygon source in the modelling

Proposed Landfill

Year	LANDGEM Emissions (m^3/year)	Collection Efficiencies	Total Landfill Gas Released	Continuous Emission Rate (m^3/s)	Odour Emission Rate (OU/s)	Odour Emission Flux Rate (OU/m^2/s)
Intermediate Operation Year (2018)	12,649,667	0.85	1,897,450	0.060	602	1.87E-03

Sample Calculations

Total Landfill Gas Released (m^3) = 12,679,667 m^3 | 1-0.85 (Collection Efficiency)

Total Landfill Gas Released (m^3) = 1,897,450

Continuous LFG Emission Rate (m^3/s) = $\frac{1,897,450}{\text{year}} \cdot \frac{1 \text{ year}}{365 \text{ days}} \cdot \frac{1 \text{ day}}{24 \text{ hours}} \cdot \frac{1 \text{ hour}}{3600s}$

Continuous LFG Emission Rate (m^3/s) = 0.060

Odour Emission Rate (g/s) = $\frac{10,000 \text{ OU}}{m^3} \cdot \frac{0.060 \ m^3}{s}$

Odour Emission Rate (g/s) = 602

Odour Emission Flux Rate (g/s/m^2) = $\frac{602 \text{ OU}}{s} \cdot \frac{1}{321,198 \ m^2}$

Odour Emission Flux Rate (g/s/m^2) = 1.84E-03

Appendix E3: Working Face Odour Emission Rates based on Representative Facilities in Ontario

Sample ID	Odour Concentration (OU/m^3)	Odour Emission Flux Rate Concentration (OU/m^2/s)	Source
WF1-O26	512	0.37	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
WF2-O26	868	0.62	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
WF1-LT	163	0.12	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
WF2-LT	161	0.12	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
WF3-LT	178	0.13	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
WF1-J21	793	0.58	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
WF2-J21	841	0.61	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
Aug23-F3	742	0.54	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
Aug23-F4	917	0.67	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
Aug23-F5	1149	0.83	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
Aug23-F6	1149	0.83	RWDI (W05-5271A); Trail Road Landfill Composting Dispersion Modelling Study; June, 2006
BFC-5	2272	1.63	RWDI (00-144); Odour Impact Management Plan for the Britannia Road Sanitary Landfill; November, 1999
BFC-6	1262	0.91	RWDI (00-144); Odour Impact Management Plan for the Britannia Road Sanitary Landfill; November, 1999
BFC-7	1035	0.74	RWDI (00-144); Odour Impact Management Plan for the Britannia Road Sanitary Landfill; November, 1999
BFC-8	1230	0.88	RWDI (00-144); Odour Impact Management Plan for the Britannia Road Sanitary Landfill; November, 1999
BFC-9	985	0.71	RWDI (00-144); Odour Impact Management Plan for the Britannia Road Sanitary Landfill; November, 1999
BFC-10	861	0.62	RWDI (00-144); Odour Impact Management Plan for the Britannia Road Sanitary Landfill; November, 1999
Working Face	4350	1.1	RWDI (95-302); BFI Ridge Landfill Expansion EA Impact Assessment Appendix M - Landfill Atmospheric Studies; September 1996 CBJ Air Quality Management (CJB); City of Guelph Eastview Road Sanitary Landfill Application for Continued and Closure Technical Appendix: Air (Updated Analysis of Odour Impacts), May 1993
Working Face	1100	0.0124	RWDI (92-218); Britannia Landfill Expansion Study, Volume 2B, Section G, Air Quality and Odour; May 1992
Working Face	1100	0.0105	RWDI (92-218); Britannia Landfill Expansion Study, Volume 2B, Section G, Air Quality and Odour; May 1992
Working Face	1100	0.01027	RWDI (92-218); Britannia Landfill Expansion Study, Volume 2B, Section G, Air Quality and Odour; May 1992
Working Face	1100	0.0379	RWDI (92-218); Britannia Landfill Expansion Study, Volume 2B, Section G, Air Quality and Odour; May 1992
Active Face - T1	390	0.280	RWDI (W05-5113C); Walker Environmental Assessment Odour Impact Assessment, Appendix C3a; February 2006
Active Face - T2	302	0.217	RWDI (W05-5113C); Walker Environmental Assessment Odour Impact Assessment, Appendix C3a; February 2006
Active Face - T3	329	0.236	RWDI (W05-5113C); Walker Environmental Assessment Odour Impact Assessment, Appendix C3a; February 2006

90th Percentile Odour Emission Flux Rate **0.898** (OU/m2/s)

Year	Working Face Surface Area (m^2)	Odour Emission Flux Rate (OU/m^2/s)
Intermediate Operation Year (2018)	900	0.898

Appendix E4 - Preferred Alternative Landfill Interim Cover Area Odour Emission Rates

Based on LANDGEM

Year	Modelled Interim Cover Area (m2)
Intermediate Operation Year (2018)	45666

Notes:

No actual change in landfill area, change is due to change of the working face placement and therefore slight adjustments made to the interim face polygon source

Interim Face

Year	Collection Efficiencies	Odour Emission Rate (OU/s)	Odour Emission Flux Rate (OU/m²/s)
Intermediate Operation Year (2018)	0%	1142	0.025

Notes:

LANDGEM Emission is based on the placement of 250,000 Mg of waste, with no historic cumulation

This is the maximum amount of gas that would be emitted from that waste (i.e. 1 year after its placement)

Sample Calculations

$$\text{Odour Emission Flux Rate (OU/s)} = \frac{0.025\ \text{OU}}{m^2 \cdot s} \times 45666\ m^2$$

Odour Emission Flux Rate (OU/s) = 1141.66

APPENDIX F

Appendix F1 - Engine-Generators and Flares LFG Emission Rates

				Point Sources							
		Max Equipment Capacity (m^3/s)		0.57	1.04	1	0.28	0.28	0.28	0.28	0.28
		Destruction Efficiency		0.98	0.98	0.98	0.97	0.97	0.97	0.97	0.97
		Equipment ID		F1	F2	F3	E1	E2	E3	E4	E5
	DESCRIPTION	Average Concentration [1]		Emission Rate	Emission Rate	Emission Rate	Emission Rate	Emission Rate	Emission Rate	Emission Rate	Emission Rate
CAS #	COMPOUND	mg/m^3	g/m^3	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s
71-55-6	1,1,1-Trichloroethane	0.158	1.58E-04	1.80E-06	3.29E-06	3.17E-06	1.33E-06	1.33E-06	1.33E-06	1.33E-06	1.33E-06
79-34-5	1,1,2,2-Tetrachloroethane	0.017	1.66E-05	1.89E-07	3.45E-07	3.32E-07	1.39E-07	1.39E-07	1.39E-07	1.39E-07	1.39E-07
79-00-5	1,1,2-Trichloroethane	0.021	2.06E-05	2.34E-07	4.28E-07	4.11E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07	1.73E-07
75-34-3	1,1-Dichloroethane	4.10	4.10E-03	4.68E-05	8.53E-05	8.21E-05	3.45E-05	3.45E-05	3.45E-05	3.45E-05	3.45E-05
75-35-4	1,1-Dichloroethylene	0.17	1.68E-04	1.91E-06	3.49E-06	3.36E-06	1.41E-06	1.41E-06	1.41E-06	1.41E-06	1.41E-06
107-06-2	1,2-Dichloroethane	0.016	1.62E-05	1.84E-07	3.36E-07	3.23E-07	1.36E-07	1.36E-07	1.36E-07	1.36E-07	1.36E-07
156-59-2	1,2-Dichloroethene (Cis)	9.63	9.63E-03	1.10E-04	2.00E-04	1.93E-04	8.09E-05	8.09E-05	8.09E-05	8.09E-05	8.09E-05
156-60-5	1,2-Dichloroethene (Trans)	0.45	4.55E-04	5.18E-06	9.46E-06	9.09E-06	3.82E-06	3.82E-06	3.82E-06	3.82E-06	3.82E-06
71-43-2	Benzene [1]	3.62	3.62E-03	4.12E-05	7.52E-05	7.23E-05	3.07E-04	3.07E-04	3.07E-04	3.07E-04	3.07E-04
75-27-4	Bromodichloromethane	0.002	1.54E-06	1.75E-08	3.20E-08	3.08E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08	1.29E-08
56-23-5	Carbon Tetrachloride	0.026	2.65E-05	3.02E-07	5.50E-07	5.29E-07	2.22E-07	2.22E-07	2.22E-07	2.22E-07	2.22E-07
75-00-3	Chloroethane	1.34	1.34E-03	1.52E-05	2.78E-05	2.67E-05	1.12E-05	1.12E-05	1.12E-05	1.12E-05	1.12E-05
67-66-3	Chloroform/Trichloromethane	0.29	2.86E-04	3.26E-06	5.96E-06	5.73E-06	2.41E-06	2.41E-06	2.41E-06	2.41E-06	2.41E-06
75-09-2	Dichloromethane	2.43	2.43E-03	2.77E-05	5.06E-05	4.87E-05	2.04E-05	2.04E-05	2.04E-05	2.04E-05	2.04E-05
75-18-3	Dimethyl sulfide [2]	2.35	2.35E-03	2.67E-05	4.88E-05	4.69E-05	1.97E-05	1.97E-05	1.97E-05	1.97E-05	1.97E-05
75-08-1	Ethyl Mercaptan	0.008	7.75E-06	8.83E-08	1.61E-07	1.55E-07	6.51E-08	6.51E-08	6.51E-08	6.51E-08	6.51E-08
106-93-4	Ethylene Dibromide	0.01	5.37E-06	6.13E-08	1.12E-07	1.07E-07	4.51E-08	4.51E-08	4.51E-08	4.51E-08	4.51E-08
04-06-7783	Hydrogen sulfide	288.15	2.88E-01	3.28E-03	5.99E-03	5.76E-03	2.42E-03	2.42E-03	2.42E-03	2.42E-03	2.42E-03
74-93-1	Methyl Mercaptan	0.005	4.80E-06	5.48E-08	9.99E-08	9.61E-08	4.04E-08	4.04E-08	4.04E-08	4.04E-08	4.04E-08
111-65-9	Octane	8.70	8.70E-03	9.91E-05	1.81E-04	1.74E-04	7.31E-05	7.31E-05	7.31E-05	7.31E-05	7.31E-05
78-92-2	sec-Butyl Alcohol/2-Butanol	45.70	4.57E-02	5.21E-04	9.51E-04	9.14E-04	3.84E-04	3.84E-04	3.84E-04	3.84E-04	3.84E-04
127-18-4	Tetrachloroethylene	8.36	8.36E-03	9.53E-05	1.74E-04	1.67E-04	7.02E-05	7.02E-05	7.02E-05	7.02E-05	7.02E-05
79-01-6	Trichloroethylene	2.76	2.76E-03	3.15E-05	5.74E-05	5.52E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05
75-01-4	Vinyl Chloride/Chloroethene	5.11	5.11E-03	5.83E-05	1.06E-04	1.02E-04	4.30E-05	4.30E-05	4.30E-05	4.30E-05	4.30E-05

Notes:

[1] Benzene emission rates for the generators are taken from 2010 Source Testing Results, as they are more conservative than the LANDGEM results

Sample Calculations

$$\text{Flare 1 Emission Rate (1,1,1-Trichloroethane in g/s)} = \frac{0.57\ m^3}{s} \times \text{1-0.98 (destruction efficiency)} \times \frac{1.58E\text{-}04\ g}{m^3}$$

Flare 1 Emission Rate (1,1,1-Trichloroethane in g/s) = 1.80E-06

Appendix F2a: Combustion Emission Calculations - Landfill Gas Flare

Based on AP-42 Chapter 2.4 "Municipal Solid Waste Landfills"

from final section (Nov. 1998)

Pollutant	Emission Factor ($kg/10^6$ dscm Methane)	Rating
Nitrogen Dioxide	650	C
Carbon Monoxide	12000	C
Particulate Matter	270	D

Note: dscm = dry standard cubic meter

Equipment	Total Gas Volumetric Flow Rate (standard) m^3/s	Methane Volumetric Flow Rate (standard) m^3/s	Emission Rate (g/s)			
			NOx	SO_2	CO	PM
Flare 1	0.57	0.285	0.185	0.711	3.42	0.077
Flare 2	1.04	0.52	0.186	N/A[3]	6.24	0.140
Candlestick Flare	1.0	0.5	0.325	0.71	6.00	0.135

Notes:

[1] The assumed Methane content in the LFG is: 50%

[2] The NOx emission rate (for Flare 2 only) and Dioxins and Furans emission rates for all flares are based on source testing results.

[3] Flare 2 source testing results showed that sulphur dioxide was not detected (i.e., below sampling detection limits) and therefore was not included.

Sample Calculation:

Flare 1 Emission Rate (NOx in g/s) = $\frac{0.57\ dsm^3}{s} \times 50\%\ methane \times \frac{650\ kg}{10^6\ dsm^3} \times \frac{1000g}{1\ kg}$

Flare 1 Emission Rate (NOx in g/s) = 0.185

Sample Calculation - SO2 emissions:

Site Specific Data for total reduced sulphur compounds as sulphur

Sulphur Compounds	ppmv	# of Sulphur
Sulphur	198	-
Methyl Mercaptan	0.002	1
Ethyl Mercaptan	0.003	1
Dimethyl Sulphide	0.88	1
Hydrogen Sulphide	196	1

Q_{CH4} = 27,922,952.92 m^3/year

C_S = 198 ppmv

Q_S = 10056 m^3/year

MW_p = 32.06 g/mol

T = 25 ^oC (recommended assumption)

UM_p = 13186 kg/year

CM_{SO2} = 22416 kg/year

CM_{SO2} = 0.71 g/s

Appendix F2b: Combustion Emission Calculations - Landfill Gas Flare

Based on AP-42 Chapter 2.4 "Municipal Solid Waste Landfills"

$$C_S = \sum_{i=1}^{n} C_P * S_P \quad (8)$$

where:

C_S = Concentration of total reduced sulfur compounds, ppmv as S (for use in equation 3);
C_P = Concentration of each reduced sulfur compound, ppmv;
S_P = Number of moles of S produced from the combustion of each reduced sulfur compound (i.e., 1 for sulfides, 2 for disulfides); and
n = Number of reduced sulfur compounds available for summation.

To estimate emissions of NMOC or other landfill gas constituents, the following equation should be used:

$$Q_P = 1.82\ Q_{CH_4} * \frac{C_P}{(1 \times 10^6)} \quad (3)$$

where:

Q_P = Emission rate of pollutant P (i.e. NMOC), m^3/yr;
Q_{CH_4} = CH_4 generation rate, m^3/yr (from the Landfill Air Emissions Estimation model);
C_P = Concentration of P in landfill gas, ppmv; and
1.82 = Multiplication factor (assumes that approximately 55 percent of landfill gas is CH_4 and 45 percent is CO_2, N_2, and other constituents).

Uncontrolled mass emissions per year of total NMOC (as hexane), CO_2, CH_4, and speciated organic and inorganic compounds can be estimated by the following equation:

$$UM_P = Q_P * \left[\frac{MW_P * 1\ \text{atm}}{(8.205 \times 10^{-5}\ m^3\text{-atm/gmol-}^\circ K)(1000 g/kg)(273 + T\ ^\circ K)} \right] \quad (4)$$

where:

UM_P = Uncontrolled mass emissions of pollutant P (i.e., NMOC), kg/yr;
MW_P = Molecular weight of P, g/gmol (i.e., 86.18 for NMOC as hexane);
Q_P = NMOC emission rate of P, m^3/yr; and
T = Temperature of landfill gas, °C.

This equation assumes that the operating pressure of the system is approximately 1 atmosphere. If the temperature of the landfill gas is not known, a temperature of 25°C (77°F) is recommended.

To prepare estimates of SO_2 emissions, data on the concentration of reduced sulfur compounds within the landfill gas are needed. The best way to prepare this estimate is with site-specific information on the total reduced sulfur content of the landfill gas. Often these data are expressed in ppmv as sulfur (S). Equations 3 and 4 should be used first to determine the uncontrolled mass emission rate of reduced sulfur compounds as sulfur. Then, the following equation can be used to estimate SO_2 emissions:

$$CM_{SO_2} = UM_S * \frac{\eta_{col}}{100} * 2.0 \quad (7)$$

where:

CM_{SO_2} = Controlled mass emissions of SO_2, kg/yr;
UM_S = Uncontrolled mass emissions of reduced sulfur compounds as sulfur, kg/yr (from equations 3 and 4);
η_{col} = Efficiency of the landfill gas collection system, percent; and
2.0 = Ratio of the molecular weight of SO_2 to the molecular weight of S.

Appendix F2a: Combustion Emission Calculations (Updated Dioxins and Furans Emissions) - Landfill Gas Flare

Sampling Results - Dioxins and Furans

Test :	Blank	Test No. 1						Test No. 2							
Sample ID :	Blank	M23-Flare-T1						M23-Flare-T2							
Sample Volume (m^3) [1] :	-	2.37						3.22							
Stack Flow Rate (m^3/s) [1] :	-	7.79						8.7						AVERAGE	
		Lab Data	**TEQ**		**Concentation**		**Emission Rate**	**Lab Data**	**TEQ**		**Concentration**		**Emission Rate**	**Concentration**	**Emission Rate**
	(pg)	(pg)	**Factor**		(pg TEQ/m^3)	**(pg/s)**	(pg TEQ/s)	(pg)	**Factor**		(pg TEQ/m^3)	**(pg/s)**	(pg TEQ/s)	(pg/m^3)	(pg/s)
2,3,7,8-Tetra CDD	<1.6	< 28	1	11.8209	12	92.08459	92	< 13	1	4.03395	4	35.1760753	35	8	63.5
1,2,3,7,8-Penta CDD	<1.1	< 8.5	1	3.58848	3.6	27.95425	28	< 9.5	1	2.94789	2.9	25.7055935	26	3.25	27
1,2,3,4,7,8-Hexa CDD	<1.3	< 2.5	0.1	0.10554	0.11	0.822184	0.82	< 2.9	0.1	0.08999	0.09	0.78469707	0.78	0.10	0.8
1,2,3,6,7,8-Hexa CDD	<1.1	< 2.1	0.1	0.08866	0.089	0.690634	0.69	< 2.5	0.1	0.07758	0.078	0.67646299	0.68	0.084	0.685
1,2,3,7,8,9-Hexa CDD	<1.2	< 2.3	0.1	0.0971	0.097	0.756409	0.76	< 2.7	0.1	0.08378	0.084	0.73058003	0.73	0.0905	0.745
1,2,3,4,6,7,8-Hepta CDD	<3.8	< 5.1	0.01	0.02153	0.022	0.167725	0.17	3.1	0.01	0.00962	0.0096	0.08388141	0.084	0.016	0.13
1,2,3,4,6,7,8,9-Octa CDD	28.3	39.7	0.000	0.00503	0.005	0.039169	0.039	22.7	0.000	0.00211	0.0021	0.01842685	0.018	0.0036	0.029
2,3,7,8-Terta CDF	<1.2	< 2.3	0.1	0.0971	0.097	0.756409	0.76	< 3.1	0.1	0.09619	0.096	0.8388141	0.84	0.10	0.8
1,2,3,7,8-Penta CDF	<1.2	< 3.3	0.03	0.0418	0.042	0.325585	0.33	< 3.0	0.03	0.02793	0.028	0.24352668	0.24	0.035	0.29
2,3,4,7,8-Penta CDF	<1.2	< 3.2	0.3	0.40529	0.41	3.157186	3.2	< 2.9	0.3	0.26996	0.27	2.3540912	2.4	0.34	2.8
1,2,3,4,7,8-Hexa CDF	<2.2	< 2.5	0.1	0.10554	0.11	0.822184	0.82	< 1.8	0.1	0.05585	0.056	0.48705335	0.49	0.083	0.66
1,2,3,6,7,8-Hexa CDF	<0.95	< 2.2	0.1	0.09288	0.093	0.723522	0.72	< 1.6	0.1	0.04965	0.05	0.43293631	0.43	0.072	0.575
2,3,4,6,7,8-Hexa CDF	<1.1	< 2.6	0.1	0.10977	0.11	0.855071	0.86	< 1.9	0.1	0.05896	0.059	0.51411187	0.51	0.085	0.685
1,2,3,7,8,9-Hexa CDF	<1.2	< 2.8	0.1	0.11821	0.12	0.920846	0.92	< 2.0	0.1	0.06206	0.062	0.54117039	0.54	0.091	0.73
1,2,3,4,6,7,8-Hepta CDF	<2.9	< 5.4	0.01	0.0228	0.023	0.177592	0.18	< 3.7	0.01	0.01148	0.011	0.10011652	0.1	0.017	0.14
1,2,3,4,7,8,9-Hepta CDF	<1.2	< 2	0.01	0.00844	0.0084	0.065775	0.066	< 2.1	0.01	0.00652	0.0065	0.05682289	0.057	0.00745	0.06
1,2,3,4,6,7,8,9-Octa CDF	<7.4	6.6	0.000	0.00084	0.00084	0.006512	0.0065	< 7.2	0.000	0.00067	0.00067	0.00584464	0.0058	0.000755	0.0062
Total Toxicity Equivalency (TEQ) →					16.9		130				7.8		69	12.4	100

Notes:

[1] Sample volume and volumetric flow rate based on dry referenced conditions (101.3kPa, and 25 °C)

*'**<**' indicates that the laboratory results were less than the Method Detection Limit (MDL). This MDL was used to calculate the concentration and emission rate.*

Appendix F3a: Combustion Emission Calculations - Landfill Gas-Fired Engine-Generators

Based on AP-42 Chapter 2.4 "Municipal Solid Waste Landfills"

from final section (Nov. 1998)

Pollutant	Emission Factor ($kg/10^6$ dscm Methane)	Rating
Particulate Matter	770	E

Equipment	Total Gas Volumetric Flow Rate (standard) m^3/s	Methane Volumetric Flow Rate (standard) m^3/s	Emission Rate (g/s)		
			NOx	CO	PM
CAT3520 Engine	0.28	0.14	- -	- -	0.108

Notes:

[1] The assumed Methane content in the LFG is: 50%

[2] The NOx, CO, SO2 and Dioxins and Furans emission rates for both engine types are based on source testing results.

Sample Calculation:

CAT3520 Engine Emission Rate (PM in g/s) = $\frac{0.14\ dsm^3}{s} \times 50\%\ methane \times \frac{770\ kg}{10^6\ dsm^3} \times \frac{1000g}{1\ kg}$

CAT3520 Engine Emission Rate (PM in g/s) = 0.054

Appendix F3b: Combustion Emission Calculations (Updated Dioxins and Furans) - Landfill Gas-Fired Engine-Generators

With original TEF

CAT 3520

Parameter	Concentration @ 11% O_2 (pg/m3)	International TEQ Factor	Toxicity Equivalent (TEQ) (pg TEQ/m3)	TEQ Emission Rate (pg/s)
2,3,7,8-Tetra CDD *	1.0	1	1	3
1,2,3,7,8-Penta CDD	1.7	0.5	0.84	2.6
1,2,3,4,7,8-Hexa CDD	0.7	0.1	0.073	0.22
1,2,3,6,7,8-Hexa CDD	1.0	0.1	0.1	0.29
1,2,3,7,8,9-Hexa CDD	1.0	0.1	0.1	0.29
1,2,3,4,6,7,8-Hepta CDD	2.4	0.01	0.024	0.072
1,2,3,4,6,7,8,9-Octa CDD	6.6	0.001	0.0066	0.02
2,3,7,8-Tetra CDF **	27.6	0.1	2.8	8.5
1,2,3,7,8-Penta CDF	5.0	0.5	2.5	7.5
2,3,4,7,8-Penta CDF	7.0	0.05	0.35	1.1
1,2,3,4,7,8-Hexa CDF	3.7	0.1	0.37	1.1
1,2,3,6,7,8-Hexa CDF	4.0	0.1	0.4	1.2
2,3,4,6,7,8-Hexa CDF	3.2	0.1	0.32	0.99
1,2,3,7,8,9-Hexa CDF	0.7	0.1	0.068	0.21
1,2,3,4,6,7,8-Hepta CDF	5.9	0.01	0.059	0.18
1,2,3,4,7,8,9-Hepta CDF	1.2	0.01	0.012	0.038
1,2,3,4,6,7,8,9-Octa CDF	2.5	0.001	0.0025	0.0073
TEQ			9.0	27

Notes:

Updated Emissions with WHO_{2005} TEF

Reference Flow Rate 2.30 m^3/s

Parameter	Concentration @ 11% O_2 pg/m^3	WHO_{2005} TEFs	Toxicity Equivalent (TEQ) pg TEQ/m^3	TEQ Emission Rate pg/s
2,3,7,8-Tetra CDD	1	1	1	2.3
1,2,3,7,8-Penta CDD	1.7	1	1.7	3.9
1,2,3,4,7,8-Hexa CDD	0.7	0.1	0.07	0.2
1,2,3,6,7,8-Hexa CDD	1	0.1	0.1	0.2
1,2,3,7,8,9-Hexa CDD	1	0.1	0.1	0.2
1,2,3,4,6,7,8-Hepta CDD	2.4	0.01	0.024	0.1
1,2,3,4,6,7,8,9-Octa CDD	6.6	0.0003	0.00198	0.0
2,3,7,8-Tetra CDF	27.6	0.1	2.76	6.3
1,2,3,7,8-Penta CDF	5	0.03	0.15	0.3
2,3,4,7,8-Penta CFD	7	0.3	2.1	4.8
1,2,3,4,7,8-Hexa CDF	3.7	0.1	0.37	0.9
1,2,3,6,7,8-Hexa CDF	4	0.1	0.4	0.9
2,3,4,6,7,8-Hexa CDF	3.2	0.1	0.32	0.7
1,2,3,7,8,9-Hexa CDF	0.7	0.1	0.07	0.2
1,2,3,4,6,7,8-Hepta CDF	5.9	0.01	0.059	0.1
1,2,3,4,7,8,9-Hepta CDF	1.2	0.01	0.012	0.0
1,2,3,4,6,7,8,9-Octa CDF	2.5	0.0003	0.00075	0.0

Results from Ottawa Landfill · Landfill Gas-to-Energy Engines - as sent to client

(from RWDI Job # 0925116
spreadsheet "Tables at 20100929 by CTW.xls"

Table 1: Sampling Summary - Flow Characteristics

CAT 3516

Stack Gas Parameter		Test No. 2 SVOC	Test No. 3 SVOC	Test No. 4 SVOC	TOTAL AVERAGE	
Testing Date		15-Jun-10	16-Jun-10	16-Jun-10	-	
Stack Temperature	°F	671	671	674	672	
	°C	355	355	357	356	
Moisture	%	12.4	14.4	13.7	13.5	
Velocity	ft/s	75.75	77.67	78.4	77.3	
	m/s	23.1	23.67	23.9	23.6	
Actual Flow Rate	CFM	6,149	6,305	6,362	6,272	= 2.96 m³/s
Referenced Flow Rate	CFM	2,547	2,543	2,559	2,550	
	m^3/s	1.2	1.2	1.2	1.2	
Sampling Isokinetic Rate	%	99	103	101	101	

CAT 3520

Stack Gas Parameter		Test No. 5 SVOC	Test No. 6 SVOC	Test No. 7 SVOC	TOTAL AVERAGE	
Testing Date		17-Jun-10	17-Jun-10	18-Jun-10	-	
Stack Temperature	°F	834	829	835	833	
	°C	446	443	446	445	
Moisture	%	13.2	13.3	13.2	13.2	
Velocity	ft/s	168.3	167.7	167.9	167.9	
	m/s	51.3	51.1	51.2	51.2	
Actual Flow Rate	CFM	13,749	13,699	13,713	13,720	= 6.48 m³/s
Referenced Flow Rate	CFM	4,929	4,923	4,931	4,928	
	m^3/s	2.3	2.3	2.3	2.3	
Sampling Isokinetic Rate	%	98	98	99	98	

Notes:
SVOC = Sampling for PAH's, Dioxins, and Furans
-All referenced values are expressed at 101.3kPa, 25°C
-Average of three tests
SVOC Test 1 was discarded due to insufficient process data
Detailed sampling results including individual test results can be found in Appendix B

Table 2: Polycyclic Aromatic Hydrocarbons (PAH) - Averaged Results

Parameter	CAT 3516 Concentration (ug/m^3)	CAT 3516 Emission Rate (ug/s)	CAT 3520 Concentration (ug/m^3)	CAT 3520 Emission Rate (ug/s)
1-Methylnaphthalene	2.6	3.1	3.1	7.2
1-Methylphenanthrene	< 0.2	< 0.28	< 0.4	< 0.921
2-Chloronaphthalene	< 0.1	< 0.1	< 0.3	< 0.731
2-Methylanthracene	< 0.1	< 0.1	< 0.3	< 0.731
2-Methylnaphthalene	3.5	4.2	3.9	9.0
3-Methylcholanthrene	< 0.2	< 0.20	< 0.6	< 1.46
7,12-Dimethylbenzo(a)anthracene	< 0.2	< 0.21	< 0.6	< 1.46
9,10-Dimethylanthracene	< 0.2	< 0.20	< 0.6	< 1.46
Acenaphthene	0.1	0.13	< 0.2	< 0.37
Acenaphthylene	< 0.1	< 0.15	< 0.2	< 0.53
Anthracene	< 0.04	< 0.05	< 0.24	< 0.55
Benzo(a)anthracene	< 0.04	< 0.05	0.20	0.46
Benzo(a)fluorene	< 0.2	< 0.21	< 0.6	< 1.46
Benzo(a)pyrene	< 0.04	< 0.05	< 0.16	< 0.365
Benzo(b)fluoranthene	< 0.04	< 0.05	0.37	0.86
Benzo(b)fluorene	< 0.1	< 0.10	< 0.3	< 0.73
Benzo(e)pyrene	< 0.1	< 0.1	< 0.3	< 0.731
Benzo(g,h,i)perylene	< 0.04	< 0.05	< 0.16	< 0.37
Benzo(k)fluoranthene	< 0.04	< 0.05	< 0.16	< 0.37
Biphenyl	109.0	131	1190	2770
Chrysene	89.4	107	90.3	210
Coronene	< 0.2	< 0.21	< 0.6	< 1.46
Dibenz(a,h)anthracene	< 0.04	< 0.05	< 0.16	< 0.37
Dibenzo(a,e)pyrene	< 0.2	< 0.21	< 0.6	< 1.46
Fluoranthene	0.3	0.34	0.8	1.97
Fluorene	0.2	0.23	10.3	24.0
Indeno(1,2,3-cd)pyrene	< 0.04	< 0.05	< 0.16	< 0.37
m-Terphenyl	1.8	2.1	37.3	86.8
Naphthalene	15.2	18	23.6	55
o-Terphenyl	2.3	2.8	10.2	23.7
Perylene	< 0.2	< 0.21	< 0.6	< 1.46
Phenanthrene	1.1	1.32	3.7	8.65
p-Terphenyl	1.3	1.6	20.8	48.5
Pyrene	0.1	0.17	0.3	0.635
Quinoline	< 0.2	< 0.2	< 0.6	< 1.5
Tetralin	0.6	0.76	< 0.4	< 0.90

Notes:
-Sampling followed Environment Canada Method RM/2
-All referenced concentration values are expressed at 101.3kPa and 25°C
-Average of three tests
-When laboratory analysis was below the detection limit, this detection limit was used to calculate the concentration and emission rate.

Detailed sampling results including individual test results can be found in Appendix B

(green) : detected contaminants, in common with leachate treatment plant

(pink) = other detected contaminants

Table 3: Dioxins and Furans - Average Results

CAT 3516

Parameter	Concentration @ 11% O_2	International TEQ Factor	Toxicity Equivalent (TEQ)	TEQ Emission Rate
	(pg/m3)		(pg TEQ/m3)	(pg/s)
2,3,7,8-Tetra CDD *	28.3	1	28	46.0
1,2,3,7,8-Penta CDD	47.1	0.5	24	39.0
1,2,3,4,7,8-Hexa CDD	12.3	0.1	1.2	2.10
1,2,3,6,7,8-Hexa CDD	15.9	0.1	1.6	2.60
1,2,3,7,8,9-Hexa CDD	14.5	0.1	1.4	2.40
1,2,3,4,6,7,8-Hepta CDD	18.8	0.01	0.19	0.31
1,2,3,4,6,7,8,9-Octa CDD	15.2	0.001	0.02	0.03
2,3,7,8-Tetra CDF **	1376	0.1	140	220.0
1,2,3,7,8-Penta CDF	144.9	0.5	72	120.0
2,3,4,7,8-Penta CDF	268.0	0.05	13.0	22.00
1,2,3,4,7,8-Hexa CDF	94.2	0.1	9.4	15.0
1,2,3,6,7,8-Hexa CDF	86.9	0.1	8.7	14.00
2,3,4,6,7,8-Hexa CDF	79.7	0.1	8.0	13.00
1,2,3,7,8,9-Hexa CDF	4.2	0.1	0.4	0.69
1,2,3,4,6,7,8-Hepta CDF	79.7	0.01	0.8	1.30
1,2,3,4,7,8,9-Hepta CDF	7.0	0.01	0.07	0.120
1,2,3,4,6,7,8,9-Octa CDF	9.4	0.001	0.0094	0.016
TEQ			310	500

CAT 3520

Parameter	Concentration @ 11% O_2	International TEQ Factor	Toxicity Equivalent (TEQ)	TEQ Emission Rate
	(pg/m3)		(pg TEQ/m3)	(pg/s)
2,3,7,8-Tetra CDD *	1.0	1	1	3
1,2,3,7,8-Penta CDD	1.7	0.5	0.84	2.6
1,2,3,4,7,8-Hexa CDD	0.7	0.1	0.073	0.22
1,2,3,6,7,8-Hexa CDD	1.0	0.1	0.1	0.29
1,2,3,7,8,9-Hexa CDD	1.0	0.1	0.1	0.29
1,2,3,4,6,7,8-Hepta CDD	2.4	0.01	0.024	0.072
1,2,3,4,6,7,8,9-Octa CDD	6.6	0.001	0.0066	0.02
2,3,7,8-Tetra CDF **	27.6	0.1	2.8	8.5
1,2,3,7,8-Penta CDF	5.0	0.5	2.5	7.5
2,3,4,7,8-Penta CDF	7.0	0.05	0.35	1.1
1,2,3,4,7,8-Hexa CDF	3.7	0.1	0.37	1.1
1,2,3,6,7,8-Hexa CDF	4.0	0.1	0.4	1.2
2,3,4,6,7,8-Hexa CDF	3.2	0.1	0.32	0.99
1,2,3,7,8,9-Hexa CDF	0.7	0.1	0.068	0.21
1,2,3,4,6,7,8-Hepta CDF	5.9	0.01	0.059	0.18
1,2,3,4,7,8,9-Hepta CDF	1.2	0.01	0.012	0.038
1,2,3,4,6,7,8,9-Octa CDF	2.5	0.001	0.0025	0.0073
TEQ			9.0	27

Notes:

[1] Sample volume and volumetric flow rate based on dry referenced conditions (101.3kPa, and 25° C)

'<' indicates that the laboratory results were less than the Estimated Detection Limit (EDL). This EDL was used to calculate the concentration and emission rate.

* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan, **CDF = Chloro Dibenzo-p-Furan

(J) Estimated concentration between the Estimated Detection Limit (EDL) and the Reportable Detection Limit (RDL)

- Refer to the lab report for EDL and RDL values

Detailed sampling results including individual test results can be found in Appendix B

= detected contaminants, in common with leachate treatment plant

= other detected contaminants

7446-09-5 5.00E-01 Regulation 346 4.4E+01 0.5 830 Health Schedule 2 5%

Table 4: Volatile Organic Compounds - Average Results

Parameter	CAT 3516 Concentration (ug/m^3)	CAT 3516 Emission Rate (mg/s)	CAT 3520 Concentration (ug/m^3)	CAT 3520 Emission Rate (mg/s)	
Dichlorodifluoromethane (FREON 12)	< 11.8	< 0.01	< 11.4	< 0.026	
Chloromethane	< 9.1	< 0.01	< 10.5	< 0.024	
Vinyl Chloride	11.7	0.01	< 8.7	< 0.02	
Bromomethane	< 9.0	< 0.01	< 10.5	< 0.024	
Chloroethane	< 4.0	< 0.005	< 4.7	< 0.011	non-detected
Trichlorofluoromethane (FREON 11)	< 4.5	< 0.01	< 5.3	< 0.01	
Acetone (2-Propanone)	< 26.4	< 0.03	< 27.1	< 0.062	
1,1-Dichloroethylene	< 4.5	< 0.01	< 5.3	< 0.01	
Iodomethane	< 9.0	< 0.01	< 10.5	< 0.024	
Carbon Disulfide	< 13.6	< 0.02	< 15.8	< 0.036	
Methylene Chloride(Dichloromethane)	< 9.0	< 0.01	< 10.5	< 0.024	non-detected
1,1-Dichloroethane	< 4.5	< 0.005	< 5.3	< 0.012	
trans-1,2-Dichloroethylene	< 4.7	< 0.006	< 5.3	< 0.012	
cis-1,2-Dichloroethylene	12.4	0.01	< 7.9	< 0.018	
Chloroform	< 4.5	< 0.01	< 5.3	< 0.012	
1,2-Dichloroethane	< 3.1	< 0.000	< 3.7	< 0.008	
Methyl Ethyl Ketone (2-Butanone)	< 22.6	< 0.03	< 21.0	< 0.048	
1,1,1-Trichloroethane	< 4.5	< 0.005	< 5.3	< 0.012	
Carbon Tetrachloride	< 9.0	< 0.010	< 10.5	< 0.024	
Benzene	165.9	0.2	133.4	0.307	
1,1,2-Trichloroethane	< 9.0	< 0.01	< 10.5	< 0.024	
1,2-Dichloropropane	< 4.5	< 0.005	< 5.3	< 0.012	
Trichloroethylene	< 5.4	< 0.01	< 5.3	< 0.012	
Dibromomethane	< 4.5	< 0.005	< 5.3	< 0.012	
Bromodichloromethane	< 4.5	< 0.005	< 5.3	< 0.012	
cis-1,3-Dichloropropene	< 4.5	< 0.005	< 5.3	< 0.012	
trans-1,3-Dichloropropene	< 3.1	< 0.004	< 3.7	< 0.008	
Dibromochloromethane	< 4.0	< 0.005	< 4.7	< 0.011	
Methyl Isobutyl Ketone	< 9.1	< 0.01	< 10.5	< 0.024	
Methyl Butyl Ketone (2-Hexanone)	< 14.2	< 0.02	< 15.8	< 0.036	
Toluene	176.0	0.21	136.2	0.313	
Ethylene Dibromide	< 4.5	< 0.005	< 5.3	< 0.012	
Tetrachloroethylene	24.6	0.03	< 18.3	< 0.042	
Chlorobenzene	< 5.1	< 0.01	< 5.3	< 0.012	non-detected
1,1,1,2-Tetrachloroethane	< 4.5	< 0.01	< 5.3	< 0.01	
Ethylbenzene	49.5	0.06	25.3	0.06	
m / p-Xylene (combine for total Xylene)	94.8	0.11	50.6	0.12	
Styrene	< 4.5	< 0.01	< 5.3	< 0.01	
o-Xylene (combine for total Xylene)	26.2	0.03	< 14.9	< 0.03	
Bromoform	< 4.5	< 0.01	< 5.3	< 0.01	
1,1,2,2-Tetrachloroethane	< 4.5	< 0.01	< 5.3	< 0.01	
1,2,3-Trichloropropane	< 9.0	< 0.01	< 10.5	< 0.02	
1,3-Dichlorobenzene	< 9.0	< 0.01	< 10.5	< 0.02	
1,4-Dichlorobenzene	< 13.6	< 0.02	< 12.3	< 0.03	non-detected
1,2-Dichlorobenzene	< 9.0	< 0.01	< 10.5	< 0.02	

Notes:

-Sampling followed U.S. EPA SW846 Method 0030-VOST

-All referenced concentration values are expressed at 101.3kPa and 25°C

-Average of six tests

-When laboratory analysis was below the detection limit, this detection limit was used to calculate the concentration and emission rate.

Detailed sampling results including individual test results can be found in Appendix C

(light green) = detected contaminants, in common with leachate treatment plant

(blue-green) = not detected in Engine testing but detected in leachate analysis

(pink) = other detected contaminants.

Table 5: Gaseous Pollutants - Average Results

CAT 3516

Parameter	Concentration		Emission Rate
		Actual O_2	
	(ppm)	(mg/m^3)	(g/s)
Nitrogen Oxides, expressed as NO_2 (NO_X)	103.1	193.9	0.23
Sulphur Dioxide (SO_2)	24.5	64	0.1
Total Hydrocarbons (expressed as Methane)	1130	739	0.89
Total Hydrocarbons (10 min.)	1200	-	-
Total Hydrocarbons (30 min.)	3.0	-	-
Carbon Monoxide (CO)	2.2	2.5	0.02
	(%)		
Oxygen (O_2)	7.4	-	-

CAT 3520

Parameter	Concentration		Emission Rate
		Actual O_2	
	(ppm)	(mg/m^3)	(g/s)
Nitrogen Oxides, expressed as NO_2 (NO_X)	50.4	94.8	0.22
Sulphur Dioxide (SO_2)	22	57.5	0.1
Total Hydrocarbons (expressed as Methane)	1331	871	2.00
Total Hydrocarbons (10 min.)	1530.0	-	-
Total Hydrocarbons (30 min.)	11.7	-	-
Carbon Monoxide (CO)	3.5	4.0	0.03
	(%)		
Oxygen (O_2)	8.0	-	-

Notes:

-Sampling followed U.S. EPA Method 3 (O_2 and CO_2), Method 10 (CO), Method 6C (SO_2), and Method 7E (NO_X)

-All referenced concentration values are expressed at 101.3kPa and 25°C

-Average all tests

-Emission rate for CAT 3516 calculated based on average volumetric flow rate of 1.2 Rm^3/sec

-Emission rate for CAT 3520 calculated based on average volumetric flow rate of 2.3 Rm^3/sec

Detailed sampling results including individual test results can be found in Appendix D

[green highlight] = detected contaminants, in common with leachate treatment plant

CONSULTING ENGINEERS
& SCIENTISTS

June 13, 2007

Remi Godin
Waste Management of Canada
2301 Carp Road
Ottawa, ON K0A 1L0

RWDI AIR Inc.
650 Woodlawn Road West
Guelph, ON
Canada N1K 1B8

A member of the RWDI Group of Companies

Re: Results of Stack Testing on the Flare Stack
Carp Road Landfill, March Testing Program
RWDI Reference No. W07-5143A

Email: rgodin@wm.com

Dear Remi:

RWDI AIR Inc. (RWDI) has been retained by Carp Road Landfill to conduct emission sampling of one of their flare stacks at their Landfill located in Kanata, Ontario. The purpose of this testing was to determine the emissions of dioxins and furans, along with volatile organic compounds being emitted from the landfill gas flare stack #2 (F-2).

Two tests on the flare stack were conducted on March 22nd, and March 23rd, 2007 while the landfill was operating under typical process conditions. The emissions for the key parameters are provided below, and more detailed results are presented in the appendices.

Sampling Location

Due to sampling logistics (i.e. safety and scaffolding) only one of the two flare stacks were tested. Also for these reasons only one of the sampling ports on the flare could be accessed.

The flare stack was tested for dioxins and furans, volatile organic compounds (VOC), oxygen, carbon dioxide, oxides of nitrogen, and sulphur dioxide. In addition to these parameters, stack gas characteristics including stack gas velocity and volumetric flow rate were determined.

Sampling Methodologies

Stack Velocity, Temperature, and Volumetric Flow Rate Determination

The exhaust velocities and flow rates were determined following the Ontario Source Testing Code (OSTC) Method 2, "Determination of Stack Gas Velocity and Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer. Volumetric flow rates were determined following the equal area method as outlined in OSTC Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a digital temperature indicator.

The diameter of the stack at the sample location was taken from the engineering drawings and C of A documentation and was determined to be 2.7m.

The dry molecular weight of the stack gas was determined following calculations outlined in OSTC Method 3, "Determination of Molecular Weight of Dry Stack Gas". Stack moisture content was determined through direct condensation and according to OSTC Method 4, "Determination of Moisture Content of Stack Gas".

Sampling Dioxin and Furan Isomers

Sampling for dioxins and furans (PCDD/F) was performed in accordance with Environment Canada's method RM/2, "Reference Method for Source Testing of Releases of Selected Semi-Volatile Organic Compounds from Stationary Sources". Triplicate sampling runs were conducted.

Due to the safety conditions regarding the high temperature and sampling infrastructure, sampling was conducted isokinetically at a single point. The sample was drawn through a glass lined sample probe and proofed glass fibre filter. Both of these were maintained at a temperature of 120 ± 14°C (248 ± 25°F). The sample then passed through a water cooled condenser and an XAD-2 absorbent module. The temperature of the XAD-2 module was kept below 20°C. The stack gas sample was then introduced into the impinger train. The impinger train was configured as specified in the reference method.

Upon completion of the test, the samples were kept cool and delivered to Maxxam Analytical Services in Burlington, Ontario. The filter, XAD-2 module, impinger catch, and all rinses were analysed for the target compounds using high resolution mass spectrometry.

Sampling for Volatile Organic Compounds

Sampling for volatile organic compounds (VOC) was conducted by collecting the stack gas sample in a Tedlar Bag. The sample was then transported the same day to the laboratory and was analysed for VOC's.

Paracel Laboratory's Ltd. Located in Ottawa, Ontario, conducted laboratory analysis.

Monitoring for NO_X, SO_2

Nitrogen oxides (NOx) and sulphur dioxide (SO_2) was monitored using an electro-chemical cell combustion gas analyser. Sampling was conducted over a 1-hour duration and the average concentration was obtained from these readings.

Please note that this method is considered non-compliance level testing and should be seen as screening values only.

Results

The results to the sampling program are provided in the tables below. The average stack gas flow characteristics are presented in Table 1, the average results from the emissions monitoring are presented in Table 2.

Table 1 – Average Stack Gas Characteristics

Parameter	Units	Average Value
Diameter	m	2.7
Temperature	^oC	937
Moisture	%	12.7
Velocity	m/s	6.8
Oxygen	%	13.5
Carbon Dioxide	%	6.1
Volumetric Flow Rate (actual)	ACFM	81,950
Volumetric Flow Rate (Referenced to dry, 25oC and 101.3kPa)	Rm^3/s	8.25

Table 2 – Average Sampling Results

Parameter	Concentration	Emission Rate
	(pg/m^3)	(pg/s)
Dioxins and Furans (TEQ)	11	88
	(mg/m^3)	(mg/s)
Oxides of Nitrogen	23	186
Sulphur Dioxide	<13	< 108
	(mg/m^3)	(mg/s)
TVOC	< 5	< 41
Benzene	< 0.5	< 4
Bromodichloromethane	< 0.4	< 3
Bromoform	< 0.8	< 7
Bromomethane	< 0.7	< 6
Carbon Tetrachloride	< 0.5	< 4
Chlorobenzene	< 0.4	< 3
Chloroethane	< 1	< 8
Chloroform	< 0.5	< 4
Chloromethane	< 3	< 25
Dibromochloromethane	< 0.5	< 4
1,2-Dibromoethane	< 1	< 8
m-Dichlorobenzene	< 0.4	< 3
o-Dichlorobenzene	< 0.4	< 3
p-Dichlorobenzene	< 0.4	< 3
1,1-Dichloroethane	< 0.6	< 5
1,2-Dichloroethane	< 0.5	< 4
1,1-Dichloroethylene	< 0.6	< 5
c-1,2-Dichloroethylene	< 0.4	< 3
t-1,2-Dichloroethylene	< 0.4	< 3
1,2-Dichloropropane	< 0.7	< 6
c-1,3-Dichloropropene	< 0.4	< 3
t-1,3-Dichloropropene	< 0.5	< 4
Ethylbenzene	< 0.5	< 4
Methylene Chloride	< 4	< 33
Styrene	< 0.4	< 3
1,1,2,2-Tetrachloroethane	< 0.6	< 5
Tetrachloroethylene	< 0.5	< 4
Toluene	< 0.5	< 4
1,1,1-Trichloroethane	< 0.5	< 4
1,1,2-Trichloroethane	< 0.6	< 5
Trichloroethylene	< 0.5	< 4
Trichlorofluoromethane	< 1	< 8
1,3,5-Trimethylbenzene	< 0.5	< 4
Vinyl Chloride	< 0.5	< 4
m/p-Xylene	< 1	< 8
o-Xylene	< 0.5	< 4

As expected, the landfill gas flare (F-2) showed no significant levels of emissions for the parameters tested. The majority of the PCDD/F and VOC parameters were below the laboratory's method detection limit.

Detailed results from the testing are presented in the appendices. Appendix A includes the laboratory results, and Appendix B contains the detailed calculations from the testing.

If you have any questions regarding these results, please do not hesitate to contact us.

Yours very truly,

RWDI AIR Inc.

Colin Welburn

Colin Welburn, P.Eng.
Project Manager Specialist

APPENDIX A

Stack Gas Characteristics

Stack Gas Velocity and Volumetric Flow Rate

Client:	Carp Road Landfill
Project #:	W07-5143
Locations:	Flare Stack - Test #1
Date:	22-Mar-07
Time:	AM
stack diameter (inches):	106
Stack Area, (ft2):	61.3
Barometric Press, Pb (" Hg):	29.60
Stack Pressure, Ps (" Hg):	29.56

Pitot Coefficient, Cp:	0.84
Molar Weight Stack Gas:	28.20
Moisture, Bws (%):	12.2%
Static Pressure, Pg (" H2O):	-0.5

Dry Molecular Weight

O_2	13.2	%
CO_2	6.1	%
CO	0	ppm
N_2	79.8	%
Ar	0.9	%
Md	**29.62**	

		Traverse 1				Traverse 2			
Point	**Position** (in)	**delta P** (" H_2O)	**Temp (Ts)** (°F)	**Velocity** (ft/s)	**Cyclonic** Angle	**delta P** (" H_2O)	**Temp (Ts)** (°F)	**Velocity** (ft/s)	**Cyclonic** Angle
1		0.02	1758	16.5	< 5				
2		0.03	1758	20.3	< 5				
3		0.03	1758	20.3	< 5				
4		0.04	1758	23.4	< 5				
5		0.03	1758	20.3	< 5				
6		0.04	1758	23.4	< 5				
7		0.04	1758	23.4	< 5				
8		0.04	1758	23.4	< 5				
9									
10									
Average		**0.03**	**1758**	**21.4**					

Average velocity	(ft/s)	21.4
	(m/s)	6.5
Flow Rate, Qs (actual)	(cfm)	78,527
	(m3/min)	2,223.6
	(m3/sec)	37.06
Flow Rate, Qs (ref,dry)	(cf/sec)	275
	(m3/sec)	**7.79**

BWS

Moisture (B_{ws}) **0.122**

Stack Gas Velocity and Volumetric Flow Rate

Client:	Carp Road Landfill
Project #:	W07-5143
Locations:	Flare Stack - Test #2
Date:	23-Mar-07
Time:	AM
stack diameter (inches):	106
Stack Area, (ft2):	61.3
Barometric Press, Pb (" Hg):	29.70
Stack Pressure, Ps (" Hg):	29.66

Pitot Coefficient, Cp:	0.84
Molar Weight Stack Gas:	28.10
Moisture, Bws (%):	13.1%
Static Pressure, Pg (" H2O):	-0.5

Dry Molecular Weight		
O_2	13.2	%
CO_2	6.1	%
CO	0	ppm
N_2	79.8	%
Ar	0.9	%
Md	**29.62**	

		Traverse 1				Traverse 2			
Point	**Position** (in)	**delta P** (" H_2O)	**Temp (Ts)** (°F)	**Velocity** (ft/s)	**Cyclonic** Angle	**delta P** (" H_2O)	**Temp (Ts)** (°F)	**Velocity** (ft/s)	**Cyclonic** Angle
1		0.03	1679	19.9	< 5				
2		0.03	1679	19.9	< 5				
3		0.05	1679	25.7	< 5				
4		0.05	1679	25.7	< 5				
5		0.05	1679	25.7	< 5				
6		0.04	1679	23.0	< 5				
7		0.04	1679	23.0	< 5				
8		0.04	1679	23.0	< 5				
9									
10									
Average		**0.04**	**1679**	**23.2**					

Average velocity	(ft/s)	23.2
	(m/s)	7.1
Flow Rate, Qs (actual)	(cfm)	85,375
	(m3/min)	2,417.5
	(m3/sec)	40.29
Flow Rate, Qs (ref,dry)	(cf/sec)	308
	(m3/sec)	**8.72**

BWS	
Moisture (B_{ws})	**0.131**

Semi-Volatile Organic Compounds
(Dioxins and Furans)

Semi-Volatile Organic Compounds Sampling

Facility:	Carp. Rd Landfill	**Operator:**	AWA / ELS
City:	Ottawa, Ontario	**Entered by:**	ELS
Source:	Flare	**Checked by:**	AWA
Reference Method:	RM/2 E.C.		

	Symbol	**Units**	**Test #1** SVOC	**Test #2** SVOC
Date			March 22,07	March 23,07
Start Time			8:19 AM	9:35 AM
End Time			11:13am	1:00 PM
Round Stack, Diameter (Inside)	d_s	in	106	106
Standard Temperature	T_s	^oF	77	77
Standard Pressure	P_s	" Hg	29.92	29.92
Nozzle Diameter	D_n	in	0.569	0.569
Average Stack Temperature	T_s	^oF	1757	1679
Average Meter Temperature	T_m	^oF	48	60
Barometric Pressure	P_{bar}	" Hg	29.6	29.7
Stack Static Pressure	P_g	" H_2O	-0.5	-0.5
Average Delta H	dH	" H_2O	0.74	0.97
Average Velocity Head (root mean square)	dP_{rms}	" H_2O	0.03	0.04
Pitot Coefficient	C_p	-	0.84	0.84
		Pitot ID ->	S-Type	S-Type
Gas Sample Volume	V_m	ft^3	79.62	110.41
DGM Calibration Factor	Y	-	1.0040	1.0040
		DGM ID ->	Console C	Console C
Total Sampling Time	min	min	170	205
Stack Gas Oxygen Concentration	O_2	%	13.5	13.5
Stack Gas Carbon Dioxide Concentration	CO_2	%	6.1	6.1
Impinger Gain	W_w	g	241.2	357.6

Semi-Volatile Organic Compounds Sampling

Facility: Carp. Rd Landfill
City: Ottawa, Ontario
Source: Flare
Reference Method: RM/2 E.C.
Operator: AWA / ELS
Entered by: ELS
Checked by: AWA

Emissions Calculations	Symbol	Units	Test #1 SVOC	Test #2 SVOC	AVERAGE
Nozzle Area	A_n	ft^2	0.00176	0.00176	
Stack Area	A_s	ft^2	61.28	61.28	
Average Stack Temperature	T_s	^oR	2217	2139	2178
Average DGM Temperature	T_m	^oR	508	520	
Sample Volume at Reference Conditions	V_{mStd}	ft^3	83.70	113.87	
	V_{mmstd}	**m^3**	**2.37**	**3.22**	
Vol. of Water Vapour	V_{wStd}	ft^3	11.5776	17.1648	
Water Fraction	B_{ws}		0.122	0.131	12.6%
Molecular Weight, dry	M_d	lb/lbmole	29.63	29.63	29.63
Molecular Weight, wet	M_w	lb/lbmole	28.22	28.11	28.16
Absolute Stack Pressure	P_s	" Hg	29.56	29.66	29.61
Isokinetic Rate	I	%	105	104	104

Semi-Volatile Organic Compounds Sampling

Facility: Carp rd. Landfill
City: Ottawa, Ontario
Source: Flare
Reference Method: RM/2 E.C.
Run: Test 1

Operator: AWA / ELS
Entered by: ELS
Checked by: AWA
Test Date: March 22,07

Point	Time (min)	Velocity Pressure (" H_2O)	Orifice Pressure (" H_2O)	Meter Volume (ft^3)	Stack Temp (^oF)	Condenser Temp (^oF)	Imp Temp (^oF)	Meter Temp (^oF)	Vacuum Pressure (" Hg)	Percentage Isokinetic **(%)**
test Leak Check =		<0.00 at 10" Hg								
1	0	0.03	0.82	912.38	1652	41	40	41	0.0	110
	5	0.03	0.81	914.75	1652	37	38	41	0.0	97
	10	0.03	0.81	916.86	1652	36	37	41	0.0	101
	15	0.03	0.72	919.05	1742	36	37	41	0.0	104
	20	0.03	0.72	921.25	1742	36	37	42	0.0	104
	25	0.03	0.72	923.46	1742	36	37	42	5.0	105
	30	0.03	0.72	925.69	1742	37	37	43	5.0	106
	35	0.03	0.72	927.95	1742	37	38	43	3.0	115
	40	0.03	0.72	930.40	1742	38	38	44	0.0	105
	45	0.03	0.72	932.65	1742	38	39	45	0.0	105
	50	0.03	0.72	934.90	1742	38	39	45	0.0	106
	55	0.03	0.72	937.17	1742	38	39	46	0.0	101
	60	0.03	0.72	939.33	1742	39	39	46	0.0	110
	65	0.03	0.72	941.69	1742	38	39	47	0.0	105
	70	0.03	0.72	943.95	1760	39	40	47	0.0	106
	75	0.03	0.72	946.22	1760	39	40	47	0.0	102
	80	0.03	0.69	948.39	1760	40	40	48	0.0	104
	85	0.03	0.69	950.61	1760	41	41	48	0.0	103
	90	0.03	0.69	952.82	1760	40	42	49	0.0	103
	95	0.03	0.69	955.04	1760	42	42	49	0.0	103
	100	0.03	0.69	957.26	1760	43	43	45	0.0	105
	105	0.03	0.69	959.50	1760	44	44	51	0.0	103
	110	0.03	0.69	961.73	1796	45	44	51	0.0	104
	115	0.03	0.69	963.95	1796	47	46	52	0.0	104
	120	0.03	0.69	966.18	1796	48	46	52	0.0	103
	125	0.03	0.69	968.39	1796	50	47	53	0.0	104
	130	0.03	0.69	970.62	1796	50	47	54	0.0	103
	135	0.03	0.69	972.84	1796	50	49	54	0.0	104
	140	0.03	0.69	975.07	1796	49	48	55	0.0	99
	145	0.04	0.91	977.21	1796	45	46	55	0.0	102
	150	0.04	0.91	979.74	1796	46	47	56	1.0	107
	155	0.04	0.91	982.40	1796	47	48	56	1.0	107
	160	0.04	0.91	985.07	1796	48	48	57	2.0	101
	165	0.04	0.91	987.59	1796	48	48	58	2.0	110
	173			991.99						
		0.03	0.74	79.62	1757	42	42	48	-	105

Note: Stopped test short due to power outage at the landfill.

Semi-Volatile Organic Compounds Sampling

Facility: Carp. Rd Landfill — AWA / ELS
City: Ottawa, Ontario — ELS
Source: Flare — AWA
Reference Method: RM/2 E.C. — March 23,07
Run: Test 2

Point	Time (min)	Velocity Pressure (" H_2O)	Orifice Pressure (" H_2O)	Meter Volume (ft^3)	Stack Temp (^oF)	Condenser Temp (^oF)	Imp Temp (^oF)	Meter Temp (^oF)	Vacuum Pressure (" Hg)	Percentage Isokinetic **(%)**
Traverse 1										
1	0	0.04	0.96	992.02	1666	48	59	43	0.0	99
	5	0.04	0.96	994.55	1666	45	57	43	0.0	101
	10	0.04	0.96	997.15	1666	45	56	44	0.0	102
	15	0.04	0.96	999.76	1666	45	53	46	0.0	101
	20	0.04	0.96	1002.37	1666	44	53	48	0.0	101
	25	0.04	0.96	1004.98	1666	45	53	50	0.0	101
	30	0.04	0.96	1007.62	1666	45	54	52	0.0	101
	35	0.04	0.96	1010.27	1666	46	54	54	0.0	101
	40	0.04	0.96	1012.91	1666	46	54	55	1.0	109
	45	0.04	0.96	1015.77	1666	41	52	57	1.0	93
	50	0.04	0.96	1018.21	1666	43	52	60	1.0	100
	55	0.04	0.96		1666	43	52	60	1.0	
	60	0.04	0.96	1023.53	1684	43	52	60	1.0	101
	65	0.04	0.96		1684	44	52	60	1.0	
	70	0.04	0.98	1028.84	1684	45	52	59	1.0	101
	75	0.04	0.98	1031.50	1684	44	52	59	1.0	101
	80	0.04	0.98	1034.15	1684	45	51	60	1.0	103
	85	0.04	0.98	1036.78	1684	46	51	60	1.0	104
	90	0.04	0.98	1039.43	1684	47	52	60	1.0	105
	95	0.04	0.98	1042.10	1684	52	51	62	1.0	106
	100	0.04	0.98	1044.81	1684	47	49	63	1.0	106
	105	0.04	0.98	1047.53	1684	48	49	65	1.0	105
	110	0.04	0.98	1050.23	1684	48	51	68	1.0	106
	115	0.04	0.98	1052.98	1684	48	51	70	1.0	105
	120	0.04	0.98	1055.71	1684	49	51	72	1.0	106
	125	0.04	0.98	1058.48	1684	50	53	72	1.0	104
	130	0.04	0.98	1061.20	1684	49	54	71	1.0	104
	135	0.04	0.98	1063.90	1684	50	51	69	1.0	107
	140	0.04	0.98	1066.66	1684	56	56	68	1.0	105
	145	0.04	0.98	1069.38	1684	47	53	67	1.0	102
	150	0.04	0.98	1072.01	1684	44	49	66	1.0	111
	155	0.04	0.98	1074.87	1684	48	49	65	1.0	102
	160	0.04	0.98	1077.50	1684	49	50	64	1.0	107
	165	0.04	0.98	1080.24	1684	46	50	63	0.5	106
	170	0.04	0.98	1082.95	1684	53	51	63	0.5	106
	175	0.04	0.98	1085.66	1684	52	50	62	0.5	105
	180	0.04	0.98	1088.34	1684	49	51	62	0.5	106
	185	0.04	0.98	1091.04	1684	50	52	62	0.5	105
	190	0.04	0.98	1093.72	1684	50	53	62	0.5	105
	195	0.04	0.98	1096.41	1684	53	55	61	0.5	104
	200	0.04	0.98	1099.07	1684	58	51	61	0.5	110
	206	0.04	0.98	1102.43	1684	59	59	61	0.5	
	Average	0.04	0.97	110.41	1679	48	52	60	-	104

Sampling Results - Dioxins and Furans

Test :	Blank	Test No. 1				Test No. 2					
Sample ID :	Blank	M23-Flare-T1				M23-Flare-T2					
Sample Volume (m^3) [1] :	-	2.37				3.22					
Stack Flow Rate (m^3/s) [1] :	-	7.79				8.7				**AVERAGE**	
	(pg)	**Lab Data** (pg)	**TEQ Factor**	**Concentation** (pg TEQ/m^3)	**Emission Rate** (pg TEQ/s)	**Lab Data** (pg)	**TEQ Factor**	**Concentation** (pg TEQ/m^3)	**Emission Rate** (pg TEQ/s)	**Concentration** (pg/m^3)	**Emission Rate** (pg/s)
2,3,7,8-Tetra CDD	<1.6	< 28	1	12	92	< 13	1	4	35	8	63.5
1,2,3,7,8-Penta CDD	<1.1	< 8.5	0.5	1.8	14	< 9.5	0.5	1.5	13	1.65	14
1,2,3,4,7,8-Hexa CDD	<1.3	< 2.5	0.1	0.11	0.82	< 2.9	0.1	0.09	0.78	0.10	0.8
1,2,3,6,7,8-Hexa CDD	<1.1	< 2.1	0.1	0.089	0.69	< 2.5	0.1	0.078	0.68	0.084	0.685
1,2,3,7,8,9-Hexa CDD	<1.2	< 2.3	0.1	0.097	0.76	< 2.7	0.1	0.084	0.73	0.0905	0.745
1,2,3,4,6,7,8-Hepta CDD	<3.8	< 5.1	0.01	0.022	0.17	3.1	0.01	0.0096	0.084	0.016	0.13
1,2,3,4,6,7,8,9-Octa CDD	28.3	39.7	0.001	0.017	0.13	22.7	0.001	0.007	0.061	0.0120	0.096
2,3,7,8-Terta CDF	<1.2	< 2.3	0.1	0.097	0.76	< 3.1	0.1	0.096	0.84	0.10	0.8
1,2,3,7,8-Penta CDF	<1.2	< 3.3	0.01	0.014	0.11	< 3.0	0.01	0.0093	0.081	0.012	0.10
2,3,4,7,8-Penta CDF	<1.2	< 3.2	0.5	0.68	5.3	< 2.9	0.5	0.45	3.9	0.565	4.6
1,2,3,4,7,8-Hexa CDF	<2.2	< 2.5	0.1	0.11	0.82	< 1.8	0.1	0.056	0.49	0.083	0.66
1,2,3,6,7,8-Hexa CDF	<0.95	< 2.2	0.1	0.093	0.72	< 1.6	0.1	0.05	0.43	0.072	0.575
2,3,4,6,7,8-Hexa CDF	<1.1	< 2.6	0.1	0.11	0.86	< 1.9	0.1	0.059	0.51	0.085	0.685
1,2,3,7,8,9-Hexa CDF	<1.2	< 2.8	0.1	0.12	0.92	< 2.0	0.1	0.062	0.54	0.091	0.73
1,2,3,4,6,7,8-Hepta CDF	<2.9	< 5.4	0.01	0.023	0.18	< 3.7	0.01	0.011	0.1	0.017	0.14
1,2,3,4,7,8,9-Hepta CDF	<1.2	< 2	0.01	0.0084	0.066	< 2.1	0.01	0.0065	0.057	0.00745	0.06
1,2,3,4,6,7,8,9-Octa CDF	<7.4	6.6	0.001	0.0028	0.022	< 7.2	0.001	0.0022	0.019	0.0025	0.0205
Total Toxicity Equivalency (TEQ) →				15.4	118			6.6	57	11.0	88

<u>Notes:</u>

[1] Sample volume and volumetric flow rate based on dry referenced conditions (101.3kPa, and 25° C)

*'**<**' indicates that the laboratory results were less than the Method Detection Limit (MDL). This MDL was used to calculate the concentration and emission rate.*

Volatile Organic Compounds

Volatile Organic Compounds Sampling Results

Parameter	MDL mg/m^3	Concentration mg/m^3	Emission Rate (mg/s)
TVOC	5	< 5	< 41
Benzene	0.5	< 0.5	< 4
Bromodichloromethane	0.4	< 0.4	< 3
Bromoform	0.8	< 0.8	< 7
Bromomethane	0.7	< 0.7	< 6
Carbon Tetrachloride	0.5	< 0.5	< 4
Chlorobenzene	0.4	< 0.4	< 3
Chloroethane	1	< 1	< 8
Chloroform	0.5	< 0.5	< 4
Chloromethane	3	< 3	< 25
Dibromochloromethane	0.5	< 0.5	< 4
1,2-Dibromoethane	1	< 1	< 8
m-Dichlorobenzene	0.4	< 0.4	< 3
o-Dichlorobenzene	0.4	< 0.4	< 3
p-Dichlorobenzene	0.4	< 0.4	< 3
1,1-Dichloroethane	0.6	< 0.6	< 5
1,2-Dichloroethane	0.5	< 0.5	< 4
1,1-Dichloroethylene	0.6	< 0.6	< 5
c-1,2-Dichloroethylene	0.4	< 0.4	< 3
t-1,2-Dichloroethylene	0.4	< 0.4	< 3
1,2-Dichloropropane	0.7	< 0.7	< 6
c-1,3-Dichloropropene	0.4	< 0.4	< 3
t-1,3-Dichloropropene	0.5	< 0.5	< 4
Ethylbenzene	0.5	< 0.5	< 4
Methylene Chloride	4	< 4	< 33
Styrene	0.4	< 0.4	< 3
1,1,2,2-Tetrachloroethane	0.6	< 0.6	< 5
Tetrachloroethylene	0.5	< 0.5	< 4
Toluene	0.5	< 0.5	< 4
1,1,1-Trichloroethane	0.5	< 0.5	< 4
1,1,2-Trichloroethane	0.6	< 0.6	< 5
Trichloroethylene	0.5	< 0.5	< 4
Trichlorofluoromethane	1	< 1	< 8
1,3,5-Trimethylbenzene	0.5	< 0.5	< 4
Vinyl Chloride	0.5	< 0.5	< 4
m/p-Xylene	1	< 1	< 8
o-Xylene	0.5	< 0.5	< 4

Notes:

- *MDL = Method Detection Limit*
- *TVOC = Total Volatile Organic Compounds*
- Emission rate was calculated using 8.25 m^3/s (Dry, referenced flow rate)
- *For all parameters the concentration of the sample was below the MDL Therefore this MDL was used to calculate the concentration and the emission rate for each parameter.*

NO_x and SO_2 Monitoring

NOx / SO2 / CO Monitoring
(Electrochemical Cell Detection)

Date Mar 23 / 07

Time	NOx	SO2
1029	11	0
1036	12	0
1048	12	0
1056	12	0
1101	12	0
1105	11	0
1110	12	0
AVG	12	<5
ppm	12	5
mg/m3	23	13
m3/s	8.3	8.3
mg/s	186	108

APPENDIX B

Your Project #: OTTAWA LANDFILL
Site#: MEDIA PREP

RWDI Received	
FEB 2 6 2007	
ORIG To AWA	XC To

Attention: Andy Abra
RWDI West Inc
650 Woodlawn Rd W
Guelph, ON
N1K 1B8

Report Date: 2007/02/05

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A709372
Received: 2007/01/30, 12:13

Sample Matrix: Impinger Solution
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Dioxins/Furans in Air by HRMS-Method 23	1	2007/02/02	2007/02/02	BRL SOP-00404	EPA M23/23A

MAXXAM ANALYTICS INC.

A Sebastian
ANCY SEBASTIAN, C.Tech.
Senior Project Manager, Air Toxics

AMS/ams
encl.

Total cover pages: 1

5555 North Service Road, Burlington, Ontario, Canada L7L 5H7 Tel: (905) 332-8788 Toll Free: (800) 668-0639 Fax: (905) 332-9169

Maxxam Job #: A709372
Report Date: 2007/02/05

RWDI West Inc
Client Project #: OTTAWA LANDFILL
Project name:
Sampler Initials:

DIOXINS AND FURANS BY HRMS (IMPINGER SOLUTION)

Maxxam ID		Q72930					
Sampling Date		2007/01/30 12:17		TOXIC EQUIVALENCY		# of	
	Units	TRAIN PROOF #1-4	RDL	TEF (WHO)	TEQ(DL)	Isomers	QC Batch
2,3,7,8-Tetra CDD *	pg	<1.1	1.1	1.00	1.10	N/A	1158026
1,2,3,7,8-Penta CDD	pg	<2.3	2.3	1.00	2.30	N/A	1158026
1,2,3,4,7,8-Hexa CDD	pg	<1.4	1.4	0.100	0.140	N/A	1158026
1,2,3,6,7,8-Hexa CDD	pg	<1.1	1.1	0.100	0.110	N/A	1158026
1,2,3,7,8,9-Hexa CDD	pg	<1.3	1.3	0.100	0.130	N/A	1158026
1,2,3,4,6,7,8-Hepta CDD	pg	7.9	1.3	0.0100	0.0790	N/A	1158026
1,2,3,4,6,7,8,9-Octa CDD	pg	56.8	1.5	0.000100	0.00568	N/A	1158026
Total Tetra CDD	pg	<1.1	1.1	N/A	N/A	0	1158026
Total Penta CDD	pg	<2.3	2.3	N/A	N/A	0	1158026
Total Hexa CDD	pg	<1.3	1.3	N/A	N/A	0	1158026
Total Hepta CDD	pg	14.2	1.3	N/A	N/A	2	1158026
2,3,7,8-Tetra CDF **	pg	<1.5	1.5	0.100	0.150	N/A	1158026
1,2,3,7,8-Penta CDF	pg	<1.7	1.7	0.0500	0.0850	N/A	1158026
2,3,4,7,8-Penta CDF	pg	<1.7	1.7	0.500	0.850	N/A	1158026
1,2,3,4,7,8-Hexa CDF	pg	<1.7	1.7	0.100	0.170	N/A	1158026
1,2,3,6,7,8-Hexa CDF	pg	<1.4	1.4	0.100	0.140	N/A	1158026
2,3,4,6,7,8-Hexa CDF	pg	<1.9	1.9	0.100	0.190	N/A	1158026
1,2,3,7,8,9-Hexa CDF	pg	<2.5	2.5	0.100	0.250	N/A	1158026
1,2,3,4,6,7,8-Hepta CDF	pg	<3.5 (1)	3.5	0.0100	0.0350	N/A	1158026
1,2,3,4,7,8,9-Hepta CDF	pg	<1.3	1.3	0.0100	0.0130	N/A	1158026
1,2,3,4,6,7,8,9-Octa CDF	pg	10.7	2.0	0.000100	0.00107	N/A	1158026
Total Tetra CDF	pg	<1.5	1.5	N/A	N/A	0	1158026
Total Penta CDF	pg	<1.7	1.7	N/A	N/A	0	1158026
Total Hexa CDF	pg	1.9	1.8	N/A	N/A	1	1158026
Total Hepta CDF	pg	<6.4 (1)	6.4	N/A	N/A	0	1158026
Toxic Equivalency	pg	0.147	N/A	N/A	N/A	N/A	1158026
TOTAL TOXIC EQUIVALENCY	pg	N/A	N/A	N/A	5.75	N/A	N/A
Surrogate Recovery (%)							
C13-1234678 HeptaCDD	%	103	N/A	N/A	N/A	N/A	1158026

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient, Total Toxic Equivalency = The sum of all TEQs
(1) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.

5555 North Service Road, Burlington, Ontario, Canada L7L 5H7 Tel: (905) 332-8788 Toll Free: (800) 668-0639 Fax: (905) 332-9169

Maxxam Job #: A709372
Report Date: 2007/02/05

RWDI West Inc
Client Project #: OTTAWA LANDFILL
Project name:
Sampler Initials:

DIOXINS AND FURANS BY HRMS (IMPINGER SOLUTION)

Maxxam ID		Q72930					
Sampling Date		2007/01/30 12:17		TOXIC EQUIVALENCY		# of	
	Units	TRAIN PROOF #1-4	RDL	TEF (WHO)	TEQ(DL)	Isomers	QC Batch
C13-1234678 HeptaCDF	%	93	N/A	N/A	N/A	N/A	1158026
C13-123678 HexaCDD	%	71	N/A	N/A	N/A	N/A	1158026
C13-123678 HexaCDF	%	75	N/A	N/A	N/A	N/A	1158026
C13-12378 PentaCDD	%	102	N/A	N/A	N/A	N/A	1158026
C13-12378 PentaCDF	%	102	N/A	N/A	N/A	N/A	1158026
C13-123789 HexaCDF	%	100	N/A	N/A	N/A	N/A	1158026
C13-2378 TetraCDD	%	87	N/A	N/A	N/A	N/A	1158026
C13-2378 TetraCDF	%	86	N/A	N/A	N/A	N/A	1158026
C13-Octachlorodibenzo-p-Dioxin	%	105	N/A	N/A	N/A	N/A	1158026

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

5555 North Service Road, Burlington, Ontario, Canada L7L 5H7 Tel: (905) 332-8788 Toll Free: (800) 668-0639 Fax: (905) 332-9169

Maxxam Job #: A709372
Report Date: 2007/02/05

RWDI West Inc
Client Project #: OTTAWA LANDFILL
Project name:
Sampler Initials:

Test Summary

Maxxam ID	Q72930	**Collected**	2007/01/30
Sample ID	TRAIN PROOF #1-4	**Shipped**	
Matrix	Impinger Solution	**Received**	2007/01/30

Test Description	Instrumentation	Batch	Prepared	Analyzed	Analyst
Dioxins/Furans in Air by HRMS-Method 23	HRMS/MS	1158026	2007/02/02	2007/02/02	OBC

5555 North Service Road, Burlington, Ontario, Canada L7L 5H7 Tel: (905) 332-8788 Toll Free: (800) 668-0639 Fax: (905) 332-9169

Maxxam Job #: A709372
Report Date: 2007/02/05

RWDI West Inc
Client Project #: OTTAWA LANDFILL
Project name:
Sampler Initials:

GENERAL COMMENTS

Results relate only to the items tested.

5555 North Service Road, Burlington, Ontario, Canada L7L 5H7 Tel: (905) 332-8788 Toll Free: (800) 668-0639 Fax: (905) 332-9169

PARACEL Laboratories Ltd.
Environmental & Indoor Air Quality

Fax Cover Page

To:	Colin Welburn
Company:	
Fax number:	+1 (519) 823-1316
From:	Heather Mcgregor
Fax number:	613-731-9064
Business phone:	613-731-9577
Date & Time:	5/7/2007 4:59:47 PM
Pages:	7
Re:	M0029

5/7/2007 4:59 PM FROM: Paracel Laboratories Paracel Laboratories TO: +1 (519) 823-1316 PAGE: 002 OF 007

PARACEL Laboratories Ltd.
Environmental & Indoor Air Quality

300-2319 St. Laurent Blvd.
Ottawa ON K1G 4J8
Phone: (613) 731-9577
Fax: (613) 731-9064
Toll Free: 800-7491947
email: paracel@paracellabs.com

Order #: M0029

Certificate of Analysis

RWDI

222 Somerset St. W
Ottawa, ON K2P 2G3
Attn: Mr. Colin Welburn

Phone: (613) 730-7608
Fax: (519) 823-1316

Client PO:
Project: **W07-5143**
Custody #:

Report Date: 27-Mar-2007
Order Date: 23-Mar-2007

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
M0029.1	Flare Stack

Approved By: ____________________ Dale Robertson, B.Sc.
Laboratory Director

Paracel Laboratories Ltd. **Order #: M0029**

Certificate of Analysis

Report Date: 27-Mar-2007
Order Date: 23-Mar-2007

Client: **RWDI**
Client PO: Project: **W07-5143**

Analysis Summary Table

Analysis	Method Reference/Description
TVOC's	P&T GC-FID
VOCs, tedlar bag	EPA 624 - P&T GC-MS

n/a: not applicable
MDL: Method Detection Limit
CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

Paracel Laboratories Ltd. **Order #: M0029**

Certificate of Analysis

Report Date: 27-Mar-2007
Order Date: 23-Mar-2007

Client: **RWDI**
Client PO: Project: **W07-5143**

Matrix: Air

Parameter	MDL/Units	
	Sample ID:	Flare Stack
	Sample Date:	23/03/2007
		M0029.1
TVOC	5 mg/m3	< 5
Benzene	0.5 mg/m3	< 0.5
Bromodichloromethane	0.4 mg/m3	< 0.4
Bromoform	0.8 mg/m3	< 0.8
Bromomethane	0.7 mg/m3	< 0.7
Carbon Tetrachloride	0.5 mg/m3	< 0.5
Chlorobenzene	0.4 mg/m3	< 0.4
Chloroethane	1 mg/m3	< 1
Chloroform	0.5 mg/m3	< 0.5
Chloromethane	3 mg/m3	< 3
Dibromochloromethane	0.5 mg/m3	< 0.5
1,2-Dibromoethane	1 mg/m3	< 1
m-Dichlorobenzene	0.4 mg/m3	< 0.4
o-Dichlorobenzene	0.4 mg/m3	< 0.4
p-Dichlorobenzene	0.4 mg/m3	< 0.4
1,1-Dichloroethane	0.6 mg/m3	< 0.6
1,2-Dichloroethane	0.5 mg/m3	< 0.5
1,1-Dichloroethylene	0.6 mg/m3	< 0.6
c-1,2-Dichloroethylene	0.4 mg/m3	< 0.4
t-1,2-Dichloroethylene	0.4 mg/m3	< 0.4
1,2-Dichloropropane	0.7 mg/m3	< 0.7
c-1,3-Dichloropropene	0.4 mg/m3	< 0.4
t-1,3-Dichloropropene	0.5 mg/m3	< 0.5
Ethylbenzene	0.5 mg/m3	< 0.5
Methylene Chloride	4 mg/m3	< 4
Styrene	0.4 mg/m3	< 0.4
1,1,2,2-Tetrachloroethane	0.6 mg/m3	< 0.6
Tetrachloroethylene	0.5 mg/m3	< 0.5
Toluene	0.5 mg/m3	< 0.5

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Paracel Laboratories Ltd.

Order #: M0029

Certificate of Analysis

Report Date: 27-Mar-2007
Order Date: 23-Mar-2007

Client: **RWDI**
Client PO:
Project: **W07-5143**

		Flare Stack
		23/03/2007
		M0029.1
1,1,1-Trichloroethane	0.5 mg/m3	< 0.5
1,1,2-Trichloroethane	0.6 mg/m3	< 0.6
Trichloroethylene	0.5 mg/m3	< 0.5
Trichlorofluoromethane	1 mg/m3	< 1
1,3,5-Trimethylbenzene	0.5 mg/m3	< 0.5
Vinyl Chloride	0.5 mg/m3	< 0.5
m/p-Xylene	1 mg/m3	< 1
o-Xylene	0.5 mg/m3	< 0.5
1,4-Bromofluorobenzene	surrogate	104%
Dibromofluoromethane	surrogate	108%
Toluene-d8	surrogate	96%

Paracel Laboratories Ltd. **Order #: M0029**

Certificate of Analysis

Report Date: 27-Mar-2007
Order Date: 23-Mar-2007

Client: **RWDI**
Client PO:
Project: **W07-5143**

QA/QC Results

	Blank	Spike (QC Limits)	Duplicate	
Benzene	< 0.5 mg/m3	0% (61 - 135%)	< 0.5	< 0.5
Bromodichloromethane	< 0.4 mg/m3	0% (48 - 164%)	< 0.4	< 0.4
Bromoform	< 0.8 mg/m3	0% (3 - 182%)	< 0.8	< 0.8
Carbon Tetrachloride	< 0.5 mg/m3	0% (19 - 155%)	< 0.5	< 0.5
Chlorobenzene	< 0.4 mg/m3	0% (61 - 139%)	< 0.4	< 0.4
Chloroform	< 0.5 mg/m3	0% (52 - 134%)	< 0.5	< 0.5
Chloromethane	< 3 mg/m3	0% (50 - 193%)	< 3	< 3
Dibromochloromethane	< 0.5 mg/m3	0% (33 - 175%)	< 0.5	< 0.5
1,2-Dibromoethane	< 1 mg/m3	0% (33 - 173%)	< 1	< 1
m-Dichlorobenzene	< 0.4 mg/m3	0% (63 - 133%)	< 0.4	< 0.4
o-Dichlorobenzene	< 0.4 mg/m3	0% (55 - 141%)	< 0.4	< 0.4
p-Dichlorobenzene	< 0.4 mg/m3	0% (64 - 134%)	< 0.4	< 0.4
1,1-Dichloroethane	< 0.6 mg/m3	0% (51 - 134%)	< 0.6	< 0.6
1,2-Dichloroethane	< 0.5 mg/m3	0% (38 - 164%)	< 0.5	< 0.5
1,1-Dichloroethylene	< 0.6 mg/m3	0% (47 - 150%)	< 0.6	< 0.6
c-1,2-Dichloroethylene	< 0.4 mg/m3	0% (62 - 139%)	< 0.4	< 0.4
t-1,2-Dichloroethylene	< 0.4 mg/m3	0% (48 - 153%)	< 0.4	< 0.4
1,2-Dichloropropane	< 0.7 mg/m3	0% (45 - 155%)	< 0.7	< 0.7
c-1,3-Dichloropropene	< 0.4 mg/m3	0% (27 - 178%)	< 0.4	< 0.4
t-1,3-Dichloropropene	< 0.5 mg/m3	0% (40 - 167%)	< 0.5	< 0.5
Ethylbenzene	< 0.5 mg/m3	0% (58 - 147%)	< 0.5	< 0.5
Styrene	< 0.4 mg/m3	0% (48 - 146%)	< 0.4	< 0.4
1,1,2,2-Tetrachloroethane	< 0.6 mg/m3	0% (24 - 171%)	< 0.6	< 0.6
Tetrachloroethylene	< 0.5 mg/m3	0% (33 - 153%)	< 0.5	< 0.5
Toluene	< 0.5 mg/m3	0% (55 - 148%)	< 0.5	< 0.5
1,1,1-Trichloroethane	< 0.5 mg/m3	0% (44 - 133%)	< 0.5	< 0.5
1,1,2-Trichloroethane	< 0.6 mg/m3	0% (38 - 163%)	< 0.6	< 0.6
Trichloroethylene	< 0.5 mg/m3	0% (55 - 152%)	< 0.5	< 0.5
Trichlorofluoromethane	< 1 mg/m3	0% (60 - 163%)	< 1	< 1
1,3,5-Trimethylbenzene	< 0.5 mg/m3	0% (57 - 135%)	< 0.5	< 0.5

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Paracel Laboratories Ltd. **Order #: M0029**

Certificate of Analysis

Report Date: 27-Mar-2007
Order Date: 23-Mar-2007

Client: **RWDI**
Client PO:
Project: **W07-5143**

	Blank	Spike (QC Limits)	Duplicate	
Vinyl Chloride	< 0.5 mg/m3	0% (51 - 168%)	< 0.5	< 0.5
m/p-Xylene	< 1 mg/m3	0% (45 - 168%)	< 1	< 1
o-Xylene	< 0.5 mg/m3	0% (28 - 183%)	< 0.5	< 0.5

APPENDIX G

Appendix G1 - Contaminated Soil Stockpile VOC Emission Rates

Contaminated Soil Stockpile Surface Area: 4000 m^2

CAS #	DESCRIPTION	Emission Flux Rate [1]	Emission Rate
	COMPOUND	$g/m^2/s$	g/s
71-55-6	1,1,1-Trichloroethane	1.28E-10	5.13E-07
79-34-5	1,1,2,2-Tetrachloroethane	N/A	N/A
79-00-5	1,1,2-Trichloroethane	N/A	N/A
75-34-3	1,1-Dichloroethane	N/A	N/A
75-35-4	1,1-Dichloroethylene	N/A	N/A
107-06-2	1,2-Dichloroethane	7.97E-10	3.19E-06
156-59-2	1,2-Dichloroethene (Cis)	N/A	N/A
156-60-5	1,2-Dichloroethene (Trans)	N/A	N/A
71-43-2	Benzene	3.38E-08	1.35E-04
75-27-4	Bromodichloromethane	N/A	N/A
56-23-5	Carbon Tetrachloride	N/A	N/A
75-00-3	Chloroethane	N/A	N/A
67-66-3	Chloroform/Trichloromethane	N/A	N/A
75-09-2	Dichloromethane	6.75E-09	2.70E-05
75-18-3	Dimethyl sulfide	N/A	N/A
75-08-1	Ethyl Mercaptan	N/A	N/A
106-93-4	Ethylene Dibromide	N/A	N/A
04-06-7783	Hydrogen sulfide	N/A	N/A
74-93-1	Methyl Mercaptan	N/A	N/A
111-65-9	Octane	1.59E-08	6.38E-05
78-92-2	sec-Butyl Alcohol/2-Butanol	1.60E-10	6.40E-07
127-18-4	Tetrachloroethylene	1.34E-09	5.38E-06
79-01-6	Trichloroethylene	1.47E-09	5.87E-06
75-01-4	Vinyl Chloride/Chloroethene	N/A	N/A

Notes:

[1] The results were obtained from a contaminated soil emission sampling conducted July 7 and July 8, 2004

Sample Calculations

1,1,1-Trichloroethane Emission Rate (g/s) = $\frac{1.28E\text{-}10\ g}{m^2 \cdot s} \times 4000\ m^2$

1,1,1-Trichloroethane Emission Rate (g/s) = 5.12E-07

APPENDIX H

Appendix H1: Comparison of Leachate Influent Characteristics - All Measured Leachate Contaminants at Ottawa Landfill

Contaminant	Ottawa Landfill Raw Leachate Jan. 6, 2010 (ug/L)	Ottawa Landfill Raw Leachate Jan. 6, 2010 (mg/L)	Ottawa Landfill Raw Leachate Jan. 15, 2010 (ug/L)	Ottawa Landfill Raw Leachate Jan. 15, 2010 (mg/L)	Maximum Measured Ottawa Landfill Raw Leachate (mg/L)	Twin Creeks Landfill Estimated Influent Characteristics (SBR) (mg/L)
Methane	3600	3.6	1900	1.9	3.6	
Ammonia	1600000	1600	1600000	1600	1600	800
Inorganics						
Total BOD	- -	1200	- -	1600	1600	1750
Total Kjeldahl Nitrogen (TKN)	- -	1600	- -	1800	1800	960
pH	- -	7.6	- -	7.5 (pH)	7.6	6.8-7.5
Phenols-4AAP	- -	0.42	- -	0.22	0.42	1
Total Phosphorus	- -	11	- -	12	12	3
Total Suspended Solids	- -	61	- -	140	140	150
Dissolved Sulphate (SO4)	- -	200	- -	200	200	500
Sulphide	- -	1.5	- -	4.2	4.2	
Total Cyanide (CN)	- -	0.017	- -			
Metals						
Mercury (Hg)	3	0.003	3	0.003	0.003	0.005
Total Aluminum (Al)	800	0.8	1900	1.9	1.9	4.09
Total Antimony (Sb)	14	0.014	13	0.013	0.014	
Total Arsenic (As)	67	0.067	63	0.063	0.067	<0.11
Total Bismuth (Bi)	5	0.005	10	0.01	0.01	
Total Boron (B)	18000	18	16000	16	18	50
Total Cadmium (Cd)	1	0.001	1	0.001	0.001	0.12
Total Chromium (Cr)	250	0.25	220	0.22	0.25	0.5
Total Cobalt (Co)	80	0.08	87	0.087	0.087	<0.115
Total Copper (Cu)	20	0.02	20	0.02	0.02	0.1
Total Lead (Pb)		0	28	0.028	0.028	1.38
Total Manganese (Mn)	1200	1.2	780	0.78	1.2	1
Total Molybdenum (Mo)	37	0.037	30	0.03	0.037	<0.06
Total Nickel (Ni)	300	0.3	320	0.32	0.32	0.5
Total Selenium (Se)	50	0.05	50	0.05	0.05	<0.100
Total Silver (Ag)	0.5	0.0005	1	0.001	0.001	
Total Tin (Sn)	47	0.047	48	0.048	0.048	
Total Titanium (Ti)	280	0.28	330	0.33	0.33	0.29
Total Vanadium (V)	59	0.059	47	0.047	0.059	0.115
Total Zinc (Zn)	640	0.64	2400	2.4	2.4	0.3
Volatile Organics						
Benzene	10	0.01	6	0.006	0.006	0.046
Bromodichloromethane	10	0.01	2	0.002	0.01	
Bromoform	20	0.02	4	0.004	0.02	
Bromomethane	50	0.05	10	0.01	0.05	
Carbon Tetrachloride	10	0.01	2	0.002	0.01	
Chlorobenzene	10	0.01	7	0.007	0.007	
Chloroform	10	0.01	2	0.002	0.01	
Dibromochloromethane	20	0.02	4	0.004	0.02	
1,2-Dichlorobenzene	20	0.02	4	0.004	0.02	
1,3-Dichlorobenzene	20	0.02	4	0.004	0.02	
1,4-Dichlorobenzene	25	0.025	22	0.022	0.025	0.023
1,1-Dichloroethane	10	0.01	2	0.002	0.01	
1,2-Dichloroethane	20	0.02	4	0.004	0.02	0.035
1,1-Dichloroethylene	10	0.01	2	0.002	0.01	0.046
cis-1,2-Dichloroethylene	10	0.01	6	0.006	0.006	
trans-1,2-Dichloroethylene	10	0.01	2	0.002	0.01	
1,2-Dichloroethylene	- -	- -	- -	0.008	0.008	1.104
1,2-Dichloropropane	10	0.01	2	0.002	0.01	
cis-1,3-Dichloropropene	20	0.02	4	0.004	0.02	
trans-1,3-Dichloropropene	20	0.02	4	0.004	0.02	
Ethylbenzene	50	0.05	40	0.04	0.05	0.391
Ethylene Dibromide	20	0.02	4	0.004	0.02	
Methylene Chloride(Dichloromethane)	50	0.05	10	0.01	0.05	7.59
Styrene	20	0.02	4	0.004	0.02	
1,1,2,2-Tetrachloroethane	20	0.02	4	0.004	0.02	
Tetrachloroethylene	10	0.01	2	0.002	0.01	0.046
Toluene	250	0.25	120	0.12	0.25	2.21
1,1,1-Trichloroethane	10	0.01	2	0.002	0.01	
1,3,5-Trimethylbenzene	20	0.02	7	0.007	0.007	
1,1,2-Trichloroethane	20	0.02	4	0.004	0.02	
Trichloroethylene	10	0.01	2	0.002	0.01	0.127
Vinyl Chloride	20	0.02	4	0.004	0.02	0.127
p+m-Xylene	97	0.097	90	0.09	0.097	1.3
o-Xylene	40	0.04	40	0.04	0.04	0.529
Xylene (Total)	140	0.14	130	0.13	0.14	1.829
Chloroethane	20	0.02	4	0.004	0.02	
Chloromethane	50	0.05	10	0.01	0.05	
Trichlorofluoromethane (FREON 11)	20	0.02	4	0.004	0.02	
Semivolatile Organics						
Acenaphthene	4	0.004	1	0.001	0.004	
Acenaphthylene	4	0.004	1	0.001	0.004	
Di-N-butyl phthalate	30	0.03	10	0.01	0.03	
3,3'-Dichlorobenzidine	10	0.01	4	0.004	0.01	
Pentachlorophenol	20	0.02	5	0.005	0.02	
Phenanthrene	4	0.004	2	0.002	0.004	
Anthracene	4	0.004	1	0.001	0.004	
Fluoranthene	4	0.004	1	0.001	0.004	
Pyrene	4	0.004	1	0.001	0.004	
Benzo(a)anthracene	4	0.004	1	0.001	0.004	
Chrysene	4	0.004	1	0.001	0.004	
Benzo(b/j)fluoranthene	4	0.004	1	0.001	0.004	
Benzo(k)fluoranthene	4	0.004	1	0.001	0.004	
Benzo(a)pyrene	4	0.004	1	0.001	0.004	
Indeno(1,2,3-cd)pyrene	8	0.008	3	0.003	0.008	
Dibenz(a,h)anthracene	8	0.008	3	0.003	0.008	
Fluorene	30	0.03	4	0.004	0.03	
Benzo(g,h,i)perylene	8	0.008	3	0.003	0.008	
1-Methylnaphthalene	30	0.03	4	0.004	0.03	
2-Methylnaphthalene	30	0.03	4	0.004	0.03	
Dibenzo(a,i)pyrene	8	0.008	3	0.003	0.008	
Naphthalene	42	0.042	10	0.01	0.042	
Benzo(e)pyrene	4	0.004	1	0.001	0.004	
Hexachlorobenzene	80	0.08	10	0.01	0.08	
Perylene	4	0.004	1	0.001	0.004	
Dibenzo(a,j)acridine	8	0.008	3	0.003	0.008	
7H-Dibenzo(c,g)Carbazole	8	0.008	3	0.003	0.008	
1,6-Dinitropyrene	8	0.008	3	0.003	0.008	
1,3-Dinitropyrene	8	0.008	3	0.003	0.008	
1,8-Dinitropyrene	8	0.008	3	0.003	0.008	
Benzyl butyl phthalate	80	0.08	10	0.01	0.08	
Bis(2-chloroethoxy)methane	80	0.08	10	0.01	0.08	
Bis(2-ethylhexyl)phthalate	120	0.12	65	0.065	0.12	
Di-N-butyl phthalate	300	0.3	40	0.04	0.3	
Di-N-octyl phthalate	100	0.1	20	0.02	0.1	
Diethyl phthalate	200	0.2	20	0.02	0.2	
Indole	200	0.2	20	0.02	0.2	
Calculated Parameters		0				
Total PAHs (18 PAHs)	8	0.008	3	0.003	0.008	

<-- note: shaded values were presented in the lab report as less than (<) the indicated amount.

Appendix H2: Comparison of Leachate Influent Characteristics - Detected and/or Matching Twin Creeks Contaminants

Contaminant	Maximum Measured Ottawa Landfill Raw Leachate (mg/L)	Twin Creeks Landfill Estimated Influent Characteristics (SBR) (mg/L)	Maximum Value (mg/L)	Source of Maximum Value
Methane	3.6	- -	3.6	Ottawa
Ammonia	1600	800	1600	Ottawa
Inorganics				
Total BOD	1600	1750	1750	Twin Creeks
Total Kjeldahl Nitrogen (TKN)	1800	960	1800	Ottawa
pH	7.6	6.8-7.5	7.6	Ottawa
Phenols-4AAP	0.42	1	1	Twin Creeks
Total Phosphorus	12	3	12	Ottawa
Total Suspended Solids	140	150	150	Twin Creeks
Sulphide	4.2	- -	4.2	Ottawa
Volatile Organics				
Benzene	0.006	0.046	0.046	Twin Creeks
Chlorobenzene	0.007	- -	0.007	Ottawa
1,4-Dichlorobenzene	0.025	0.023	0.025	Ottawa
cis-1,2-Dichloroethylene	0.006	- -	0.006	Ottawa
1,2-Dichloroethylene	0.008	1.104	1.104	Twin Creeks
Ethylbenzene	0.05	0.391	0.391	Twin Creeks
Toluene	0.25	2.21	2.21	Twin Creeks
1,3,5-Trimethylbenzene	0.007	- -	0.007	Ottawa
p+m-Xylene	0.097	1.3	1.3	Twin Creeks
o-Xylene	0.04	0.529	0.529	Twin Creeks
Xylene (Total)	0.14	1.829	1.829	Twin Creeks
Chloroethane	0.02	- -	0.02	Ottawa
Chloromethane	0.05	- -	0.05	Ottawa
Semivolatile Organics				
Phenanthrene	0.004	- -	0.004	Ottawa
Naphthalene	0.042	- -	0.042	Ottawa
Bis(2-ethylhexyl)phthalate	0.12	- -	0.12	Ottawa

(purple)	= compound reported as less than the indicated amount
(orange)	= compound listed in Water9 program

Appendix H3: Raw Leachate Equalization Tank
Emissions from Water9 - based on Concentrations in Raw Leachate

WASTEWATER TREATMENT SUMMARY I 10-22-2010 16:31:48

Project C:\Documents and Settings\sjp\Desktop\05 Water9\ottawa_equal 24/09/2010 10:47:11 AM

COMPOUND	RATE (g/s)	Fraction				error
		Air	Removal	Exit	Adsorb	
AMMONIA *	3.06E-04	0.00004	.	1	0	0
METHANE	1.66E-02	0.95693	.	0.0431	0	0
PHENOL	9.44E-07	0.0002	.	0.9998	0	0
SULFIDE *	0.00E+00	.	.	1	0	0
PHOSPHORUS	0.00E+00	.	.	1	0	0
BENZENE	5.48E-05	0.24656	.	0.7534	0	0
CHLOROBENZENE	9.90E-06	0.29309	.	0.7069	0	0
CHLOROETHANE (ethyl chloride)	3.96E-05	0.41018	.	0.5898	0	0
1,4 DICHLOROBENZENE (-p)	2.62E-05	0.21746	.	0.7825	0	0
DICHLOROETHYLENE(1,2) cis	6.80E-04	0.12764	.	0.8724	0	0
ETHYLBENZENE	4.46E-04	0.23621	.	0.7638	0	0
METHYLENE CHLORIDE, dichloromethane	2.76E-03	0.07533	.	0.9247	0	0
TOLUENE	1.74E-03	0.16266	.	0.8373	0	0
TRIMETHYLBENZENE (1,3,5)	1.27E-05	0.3763	.	0.6237	0	0
XYLENE	1.59E-03	0.18024	.	0.8198	0	0
BIS(2-ETHYLHEXYL)PHTHALATE	3.04E-07	0.00052	.	0.9995	0	0
NAPHTHALENE	2.04E-05	0.10015	.	0.8999	0	0
PHENANTHRENE	3.70E-07	0.0192	.	0.9808	0	0

Appendix H4: SBR Tank

Emissions from Water9 - based on Concentrations in Raw Leachate

WASTEWATER TREATMENT SUMMARY I 10-22-2010 16:32:38

Project C:\Documents and Settings\sjp\Desktop\05 Water9\ottawa_sbr 24/09/2010 10:49:10 AM

COMPOUND	RATE	Fraction				error
	(g/s)	Air	Removal	Exit	Adsorb	
AMMONIA	1.03E-01	0.00226	.	0.9977	0	0
METHANE	1.01E-01	0.9859	0.0124	0.0017	0	0
PHENOL	6.52E-08	.	0.9979	0.0021	0	0
SULFIDE	9.57E-18	.	.	1	0	0
PHOSPHORUS	2.73E-17	.	.	1	0	0
BENZENE	1.45E-04	0.11094	0.8717	0.0174	0	0
CHLOROBENZENE	2.53E-06	0.01272	0.9845	0.0028	0	0
CHLOROETHANE (ethyl chloride)	2.27E-04	0.39965	0.5673	0.033	0	0
1,4 DICHLOROBENZENE (-p)	3.36E-05	0.04737	0.9397	0.0129	0	0
DICHLOROETHYLENE(1,2) cis	2.59E-02	0.827	.	0.173	0	0
ETHYLBENZENE	1.27E-03	0.114	0.8734	0.0126	0	0
METHYLENE CHLORIDE, dichloromethane	3.78E-02	0.17557	0.7711	0.0533	0	0
TOLUENE	5.09E-03	0.08109	0.908	0.0109	0	0
TRIMETHYLBENZENE (1,3,5)	9.07E-06	0.04563	0.9462	0.0081	0	0
XYLENE	4.29E-03	0.08253	0.9023	0.0152	0	0
BIS(2-ETHYLHEXYL)PHTHALATE	2.54E-06	0.00075	0.7587	0.2406	0	0
NAPHTHALENE	5.15E-05	0.04319	0.9276	0.0292	0	0
PHENANTHRENE	4.23E-08	0.00037	0.9774	0.0223	0	0

Appendix H5: Effluent Equalization Tank
Emissions from Water9 - based on Concentrations in Raw Leachate

WASTEWATER TREATMENT SUMMARY I 10-22-2010 16:29:58

Project C:\Documents and Settings\sjp\Desktop\05 Water9\ottawa_effluent 24/09/2010 10:44:31 AM

COMPOUND	RATE	Fraction				error
	(g/s)	Air	Removal	Exit	Adsorb	
AMMONIA	5.08E-06	0.00004	.	1	0	0
METHANE	1.53E-02	0.91733	.	0.0827	0	0
PHENOL	4.48E-07	0.0001	.	0.9999	0	0
SULFIDE	0.00E+00	.	.	1	0	0
PHOSPHORUS	0.00E+00	.	.	1	0	0
BENZENE	3.12E-05	0.14703	.	0.853	0	0
CHLOROBENZENE	5.58E-06	0.17279	.	0.8272	0	0
CHLOROETHANE (ethyl chloride)	2.44E-05	0.26363	.	0.7364	0	0
1,4 DICHLOROBENZENE (-p)	1.44E-05	0.12471	.	0.8753	0	0
DICHLOROETHYLENE(1,2) cis	3.92E-04	0.07667	.	0.9233	0	0
ETHYLBENZENE	2.64E-04	0.14596	.	0.854	0	0
METHYLENE CHLORIDE, dichloromethane	1.62E-03	0.04613	.	0.9539	0	0
TOLUENE	1.03E-03	0.10133	.	0.8987	0	0
TRIMETHYLBENZENE (1,3,5)	7.52E-06	0.23232	.	0.7677	0	0
XYLENE	9.50E-04	0.11239	.	0.8876	0	0
BIS(2-ETHYLHEXYL)PHTHALATE	1.42E-07	0.00026	.	0.9997	0	0
NAPHTHALENE	1.05E-05	0.05423	.	0.9458	0	0
PHENANTHRENE	1.76E-07	0.0095	.	0.9905	0	0

Appendix H6: Sludge Tank
Emissions from Water9 - based on Concentrations in Raw Leachate

WASTEWATER TREATMENT SUMMARY I 10-22-2010 16:33:39

Project C:\Documents and Settings\sjp\Desktop\05 Water9\ottawa_sludge 24/09/2010 10:50:44 AM

COMPOUND	RATE (g/s)	Fraction				error
		Air	Removal	Exit	Adsorb	
AMMONIA	1.64E-03	0.00065	.	0.9994	0	0
METHANE	3.62E-01	0.99676	.	0.0032	0	0
PHENOL	3.22E-05	0.00032	.	0.9997	0	0
SULFIDE	9.34E-18	.	.	1	0	0
PHOSPHORUS	2.68E-17	.	.	1	0	0
BENZENE	3.18E-03	0.68477	.	0.3152	0	0
CHLOROBENZENE	3.96E-04	0.55916	.	0.4408	0	0
CHLOROETHANE (ethyl chloride)	1.69E-03	0.83612	.	0.1639	0	0
1,4 DICHLOROBENZENE (-p)	8.96E-04	0.3545	.	0.6455	0	0
DICHLOROETHYLENE(1,2) cis	7.48E-02	0.67122	.	0.3288	0	0
ETHYLBENZENE	2.50E-02	0.63158	.	0.3684	0	0
METHYLENE CHLORIDE, dichloromethane	4.42E-01	0.57601	.	0.424	0	0
TOLUENE	1.48E-01	0.66133	.	0.3387	0	0
TRIMETHYLBENZENE (1,3,5)	2.38E-04	0.33693	.	0.6631	0	0
XYLENE	1.12E-01	0.6041	.	0.3959	0	0
BIS(2-ETHYLHEXYL)PHTHALATE	2.42E-06	0.0002	.	0.9998	0	0
NAPHTHALENE	7.44E-04	0.17555	.	0.8244	0	0
PHENANTHRENE	6.72E-07	0.00166	.	0.9983	0	0

Appendix H7: SBR System Odour Emission Rate - AIHA Odour Thresholds

Contaminant Name	CAS Number	Molecular Weight	Odour Threshold (ppm)	Odour Threshold (mg/m^3)	Odour Threshold Reference
1,1 Dichloroethene (vinylidene chloride)	75-35-4	96.94	n/a	n/a	- -
1,2 Dichloroethane	107-06-2	98.96	6.00	24.28	[1]
1,3,5 Trimethylbenzene	108-67-8	120.19	0.037	0.18	[2]
1,4 Dichlorobenzene (-p)	106-46-7	147.01	15	90.19	[2]
Ammonia	7664-41-7	17.03	0.043	0.03	[2]
Benzene	71-43-2	78.11	34	108.62	[1]
Bis(2-Ethylhexyl)Phthalate	117-81-7		n/a	n/a	- -
Chlorobenzene	108-90-7	112.56	0.087	0.40	[2]
Chloroethane (ethyl chloride)	75-00-3		n/a	n/a	- -
Chloroethylene (vinyl chloride)	75-01-4	62.50	10	25.56	[2]
Chloromethane (methylchloride)	74-87-3	50.49	10	20.65	[2]
Chromium (total)	7440-47-3		n/a	n/a	- -
cis-1,2 Dichloroethylene	156-59-2	96.95	n/a	n/a	- -
Ethylbenzene	100-41-4	106.16	0.092	0.40	[2]
Mercury	7439-97-6		n/a	n/a	- -
Methane	74-82-8		n/a	n/a	- -
Methylene Chloride (dichloromethane)	75-09-2	84.94	1.2	4.17	[2]
Naphthalene	91-20-3	128.16	0.0095	0.05	[2]
Phenanthrene	85-01-8		n/a	n/a	- -
Phenol	108-95-2	94.11	0.0045	0.02	[2]
Tetrachloroethene	127-18-4	165.84	2	13.57	[2]
Toluene	108-88-3	92.13	0.16	0.60	[1]
Trichloroethylene	79-01-6	131.40	0.50	2.69	[2]
Xylene	1330-20-7	106.16	0.081	0.35	[2]

Notes:

[1] Minimum odour threshold value from range of "Acceptable Values" from AIHA, 1989. Odour Thresholds for Chemicals with Established Occupational Health Standards. Akron, Ohio.

[2] Minimum odour threshold value from range of "All Referenced Values" from AIHA, 1989. Odour Thresholds for Chemicals with Established Occupational Health Standards. Akron, Ohio.

Conversion from ppm to mg/m^3

$$\frac{\text{(gram molecular weight of substance) x (TLV in ppm)}}{24.45}$$

These formulas can be used when measurements are taken at 25°C and the air pressure is 760 torr (= 1 atmosphere or 760 mm Hg).

Appendix H8: SBR System Odour Emission Rates

Source ID [1]	Source Type [1]	Source Description	Source Data						LFG		Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	In-Stack Concentration (mg/m^3)	Odour Threshold (mg/m^3)	In-Stack Odour Concentration (OU/m^3)	Maximum Odour Emission Rate (OU/s)	Total Odour Emission Rate [1] (OU/s)
RAWLEACH	Point	Raw Leachate Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424269	5014684	1,2 Dichloroethane	107-06-2	1.64E-05	1.64E+02	2.43E+01	6.75E+00	6.75E-04	**20**
											1,3,5 Trimethylbenzene	108-67-8	1.27E-05	1.27E+02	1.82E-01	6.99E+02	6.99E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	2.62E-05	2.62E+02	9.02E+01	2.90E+00	2.90E-04	
											Ammonia	7664-41-7	3.06E-04	3.06E+03	3.00E-02	1.02E+05	1.02E+01	
											Benzene	71-43-2	5.48E-05	5.48E+02	1.09E+02	5.05E+00	5.05E-04	
											Chlorobenzene	108-90-7	9.90E-06	9.90E+01	4.01E-01	2.47E+02	2.47E-02	
											Chloroethylene (vinyl chloride)	75-01-4	1.25E-04	1.25E+03	2.56E+01	4.88E+01	4.88E-03	
											Chloromethane (methylchloride)	74-87-3	7.92E-05	7.92E+02	2.07E+01	3.84E+01	3.84E-03	
											Ethylbenzene	100-41-4	4.46E-04	4.46E+03	3.99E-01	1.12E+04	1.12E+00	
											Methylene Chloride (dichloromethane)	75-09-2	2.76E-03	2.76E+04	4.17E+00	6.62E+03	6.62E-01	
											Naphthalene	91-20-3	2.04E-05	2.04E+02	4.98E-02	4.10E+03	4.10E-01	
											Phenol	108-95-2	9.44E-07	9.44E+00	1.73E-02	5.45E+02	5.45E-02	
											Tetrachloroethene	127-18-4	1.04E-04	1.04E+03	1.36E+01	7.70E+01	7.70E-03	
											Toluene	108-88-3	1.74E-03	1.74E+04	6.03E-01	2.88E+04	2.88E+00	
											Trichloroethylene	79-01-6	2.04E-04	2.04E+03	2.69E+00	7.59E+02	7.59E-02	
											Xylene	1330-20-7	1.59E-03	1.59E+04	3.52E-01	4.53E+04	4.53E+00	
SBR	Point	Sequencing Batch Reactor Tank	0.0001	32	0.2	0.003	6.6	0.6	424317	5014732	1,2 Dichloroethane	107-06-2	3.63E-05	3.63E+02	2.43E+01	1.49E+01	1.49E-03	**3473**
											1,3,5 Trimethylbenzene	108-67-8	9.07E-06	9.07E+01	1.82E-01	4.99E+02	4.99E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	3.36E-05	3.36E+02	9.02E+01	3.73E+00	3.73E-04	
											Ammonia	7664-41-7	0.103	1030000	0.030	34,388,044.78	3439	
											Benzene	71-43-2	1.45E-04	1.45E+03	1.09E+02	1.33E+01	1.33E-03	
											Chlorobenzene	108-90-7	2.53E-06	2.53E+01	4.01E-01	6.32E+01	6.32E-03	
											Chloroethylene (vinyl chloride)	75-01-4	1.12E-03	1.12E+04	2.56E+01	4.38E+02	4.38E-02	
											Chloromethane (methylchloride)	74-87-3	3.91E-04	3.91E+03	2.07E+01	1.89E+02	1.89E-02	
											Ethylbenzene	100-41-4	1.27E-03	1.27E+04	3.99E-01	3.18E+04	3.18E+00	
											Methylene Chloride (dichloromethane)	75-09-2	3.78E-02	3.78E+05	4.17E+00	9.07E+04	9.07E+00	
											Naphthalene	91-20-3	5.15E-05	5.15E+02	4.98E-02	1.03E+04	1.03E+00	
											Phenol	108-95-2	6.52E-08	6.52E-01	1.73E-02	3.76E+01	3.76E-03	
											Tetrachloroethene	127-18-4	5.31E-04	5.31E+03	1.36E+01	3.91E+02	3.91E-02	
											Toluene	108-88-3	5.09E-03	5.09E+04	6.03E-01	8.44E+04	8.44E+00	
											Trichloroethylene	79-01-6	9.65E-04	9.65E+03	2.69E+00	3.59E+03	3.59E-01	
											Xylene	1330-20-7	4.29E-03	4.29E+04	3.52E-01	1.22E+05	1.22E+01	

Appendix H8: SBR System Odour Emission Rates

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temp. (ºC)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	LFG Source Coordinates X (m)	Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	In-Stack Concentration (mg/m^3)	Odour Threshold (mg/m^3)	In-Stack Odour Concentration (OU/m^3)	Maximum Odour Emission Rate (OU/s)	Total Odour Emission Rate [1] (OU/s)
EFFLUENT	Point	Effluent Equalization Tank	0.0001	25	0.2	0.003	6.6	0.6	424290	5014662	1,2 Dichloroethane	107-06-2	8.50E-06	8.50E+01	2.43E+01	3.50E+00	3.50E-04	6
											1,3,5 Trimethylbenzene	108-67-8	7.52E-06	7.52E+01	1.82E-01	4.13E+02	4.13E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	1.44E-05	1.44E+02	9.02E+01	1.60E+00	1.60E-04	
											Ammonia	7664-41-7	5.08E-06	5.08E+01	3.00E-02	1.70E+03	1.70E-01	
											Benzene	71-43-2	3.12E-05	3.12E+02	1.09E+02	2.87E+00	2.87E-04	
											Chlorobenzene	108-90-7	5.58E-06	5.58E+01	4.01E-01	1.39E+02	1.39E-02	
											Chloroethylene (vinyl chloride)	75-01-4	8.24E-05	8.24E+02	2.56E+01	3.22E+01	3.22E-03	
											Chloromethane (methylchloride)	74-87-3	4.76E-05	4.76E+02	2.07E+01	2.31E+01	2.31E-03	
											Ethylbenzene	100-41-4	2.64E-04	2.64E+03	3.99E-01	6.61E+03	6.61E-01	
											Methylene Chloride (dichloromethane)	75-09-2	1.62E-03	1.62E+04	4.17E+00	3.88E+03	3.88E-01	
											Naphthalene	91-20-3	1.05E-05	1.05E+02	4.98E-02	2.11E+03	2.11E-01	
											Phenol	108-95-2	4.48E-07	4.48E+00	1.73E-02	2.59E+02	2.59E-02	
											Tetrachloroethene	127-18-4	6.62E-05	6.62E+02	1.36E+01	4.88E+01	4.88E-03	
											Toluene	108-88-3	1.03E-03	1.03E+04	6.03E-01	1.72E+04	1.72E+00	
											Trichloroethylene	79-01-6	1.22E-04	1.22E+03	2.69E+00	4.56E+02	4.56E-02	
											Xylene	1330-20-7	9.50E-04	9.50E+03	3.52E-01	2.70E+04	2.70E+00	
SLUDGE	Point	Sludge Tank	0.0001	25	0.2	0.003	6.6	0.6	424340	5014708	1,2 Dichloroethane	107-06-2	1.23E-03	1.23E+04	2.43E+01	5.05E+02	5.05E-02	809
											1,3,5 Trimethylbenzene	108-67-8	2.38E-04	2.38E+03	1.82E-01	1.31E+04	1.31E+00	
											1,4 Dichlorobenzene (-p)	106-46-7	8.96E-04	8.96E+03	9.02E+01	9.93E+01	9.93E-03	
											Ammonia	7664-41-7	1.64E-03	1.64E+04	3.00E-02	5.48E+05	5.48E+01	
											Benzene	71-43-2	3.18E-03	3.18E+04	1.09E+02	2.93E+02	2.93E-02	
											Chlorobenzene	108-90-7	3.96E-04	3.96E+03	4.01E-01	9.89E+03	9.89E-01	
											Chloroethylene (vinyl chloride)	75-01-4	4.62E-03	4.62E+04	2.56E+01	1.81E+03	1.81E-01	
											Chloromethane (methylchloride)	74-87-3	4.06E-03	4.06E+04	2.07E+01	1.97E+03	1.97E-01	
											Ethylbenzene	100-41-4	2.50E-02	2.50E+05	3.99E-01	6.26E+05	6.26E+01	
											Methylene Chloride (dichloromethane)	75-09-2	4.42E-01	4.42E+06	4.17E+00	1.06E+06	1.06E+02	
											Naphthalene	91-20-3	7.44E-04	7.44E+03	4.98E-02	1.49E+05	1.49E+01	
											Phenol	108-95-2	3.22E-05	3.22E+02	1.73E-02	1.86E+04	1.86E+00	
											Tetrachloroethene	127-18-4	3.82E-03	3.82E+04	1.36E+01	2.82E+03	2.82E-01	
											Toluene	108-88-3	1.48E-01	1.48E+06	6.03E-01	2.45E+06	2.45E+02	
											Trichloroethylene	79-01-6	1.01E-02	1.01E+05	2.69E+00	3.77E+04	3.77E+00	
											Xylene	1330-20-7	1.12E-01	1.12E+06	3.52E-01	3.17E+06	3.17E+02	

Notes:
[1] Source ID, Source Type: should provide information on the modelling source type (e.g., Point, Area or Volume Source); the process source or sources within the modelling source (e.g., Process Line #1); and the stack or stacks within each process source.
[2] Emission Estimating Technique Short-Forms are V-ST (Validated Source Test), "ST" (Source Test), EF (Emission Factor), MB (Mass Balance), and EC (Engineering Calculation).
[3] Data Quality Categories: Highest; Above-Average; Average; and Marginal.

Sample Calculations

RAWLEACH In-Stack Concentration (1,2 Dichloroethane in mg/m3) = $\frac{1.64E\text{-}05\ g}{s} \times \frac{s}{0.0001\ m^3} \times \frac{1000\ mg}{1\ g}$

RAWLEACH In-Stack Concentration (1,2 Dichloroethane in mg/m3) = 164

RAWLEACH In-Stack Allowable Concentration (1,2 Dichloroethane in OU/m^{-3}) = $\frac{1.64E+02\ \text{(In-stack Concentration)}}{2.43E+01\ \text{(Odour Threshold)}}$

RAWLEACH In-Stack Allowable Concentration (1,2 Dichloroethane in OU/m^{-3}) = 6.75

RAWLEACH In-Stack Allowable Concentration (1,2 Dichloroethane in OU/s) = $\frac{6.75\ OU}{m^3} \times \frac{0.0001\ m^3}{s}$

RAWLEACH In-Stack Allowable Concentration (1,2 Dichloroethane in OU/s) = 6.75E-04

Total Odour Emission Rate for a source (OU/s) = Σ(Contaminants Maximum Odour Emission Rates for 1 source

APPENDIX I

Appendix I1: Combustion Emission Rate Calculations for the Diesel-Fired Emergency Generator

based on manufacturer specifications

Contaminant	Emission Factor (lb/hp-hr)	Emission Factor (g/hp-hr)	Emission Rate (g/hr)	Emission Rate (g/s)	Data Quality Rating
Oxides of Nitrogen [1]	- -	4.35	2262	0.63	A
Carbon Monoxide [1]	- -	0.54	281	0.078	A
Particulate Matter [1]	- -	0.05	26	0.007	A
Sulphur Dioxide [2]	0.00205	0.93	484	0.13	D

Notes:

[1] Emission Factors from specifications provided by Cummins for a DFEG-320 kW Generator

[2] Emission Factor from AP-42 Chapter 3.3 "Gasoline and Diesel Industrial Engines"

Additional Information from specifications provided by Cummins for a DFEG-320 kW Generator

HP at Rated kW = 520 hp based on Cummins Specifications

Exhaust Gas Flow = 2610 cfm
1.23 m^3/s

Exhaust Temperature = 810 ^oF
432 ^oC

Sample Calculations:

$$\text{Emission Rate (NOx in g/s)} = 520\ \text{hp} \times \frac{4.35\ \text{g}}{\text{hp-hr}} \times \frac{\text{hr}}{3600\ \text{s}}$$

Emission Rate (NOx in g/s) = 0.63

Table 1: Summary of Sampling Parameters and Methodology

Source Location	No. of Tests	Sampling Parameter	Sampling Method
Leachate Evaporator Stack NW	3	Flow Rate, Temperature, Moisture	OSTC[1] Methods 1 to 4 (including US EPA Method 2G)
Leachate Evaporator Stack NW	2	Total Particulate Matter[1]	OSTC[1] Method 5
Leachate Evaporator Stack NW	2	Metals (including Hg)	US EPA[2] Method 29
Leachate Evaporator Stack NW	1	Polycyclic Aromatic Hydrocarbons, Dioxins and Furans	Environment Canada Method RM/2
Leachate Evaporator Stack NW	3	Volatile Organic Compounds	US EPA[2] SW846 Method 0030 VOST
Leachate Evaporator Stack SE	3	Flow Rate, Temperature, Moisture	OSTC[1] Methods 1 to 4 (including US EPA Method 2G)
Leachate Evaporator Stack SE	1	Total Particulate Matter[1]	OSTC[1] Method 5
Leachate Evaporator Stack SE	1	Metals (including Hg)	US EPA[2] Method 29
Leachate Evaporator Stack SE	2	Polycyclic Aromatic Hydrocarbons, Dioxins and Furans	Environment Canada Method RM/2
Leachate Evaporator Stack SE	2	Oxygen/Carbon Dioxide	US EPA[2] Method 3A (CEM)
Leachate Evaporator Stack SE	2	Sulphur Dioxide	US EPA[2] Method 6C (CEM)
Leachate Evaporator Stack SE	2	Nitrogen Oxides (NOx)	US EPA[2] Method 7E (CEM)
Leachate Evaporator Stack SE	2	Carbon Monoxide (CO)	US EPA[2] Method 10 (CEM)
Leachate Evaporator Stack SE	2	Total Hydrocarbon (THC)	US EPA[2] Method 25A (CEM)
Leachate Evaporator Stack NW	1	Oxygen/Carbon Dioxide	US EPA[2] Method 3A (CEM)
Leachate Evaporator Stack NW	1	Sulphur Dioxide	US EPA[2] Method 6C (CEM)
Leachate Evaporator Stack NW	1	Nitrogen Oxides (NOx)	US EPA[2] Method 7E (CEM)
Leachate Evaporator Stack NW	1	Carbon Monoxide (CO)	US EPA[2] Method 10 (CEM)
Leachate Evaporator Stack NW	1	Total Hydrocarbon (THC)	US EPA[2] Method 25A (CEM)
Leachate Evaporator Stack NW	3	Ammonia	US EPA Method 26
Leachate Evaporator Stack SE	3	Odour	MOE Method “Source Sampling for Odours (Version #2)

Notes:
[1] OSTC - Ontario Source Testing Code (Version 2)
[2] USEPA - United States Environmental Protection Agency
[3] NCASI - National Council for Air and Stream Improvement, Inc.
[4] CARB - California Air Resources Board

Table 2: Sampling Summary and Sample Log

Source and Test #	Sampling Date	Start Time	End Time	RWDI Sample ID	Lab Sample ID
Velocity / Total Particulate / Metals					
Test #1	27-Sep-11	9:45 AM	1:16 PM	T1-BASELINE-M5/29	LC3471
Test #2	28-Sep-11	8:13 AM	12:09 PM	T2-BASELINE-M5/29	LC3472
Test #3	28-Sep-11	1:47 PM	5:20 PM	T3-BASELINE-M5/29	LC3473
Velocity / PAH / Dioxins and Furans					
Test #1	27-Sep-11	9:45 AM	1:20 PM	T1-BASELINE- SVOC	LC1531
Test #2	28-Sep-11	10:15 AM	12:03 PM	T2-BASELINE -SVOC	LC1532
Test #3	28-Sep-11	1:47 PM	5:12 PM	T3-BASELINE- SVOC	LC1533
Continuous Emissions Monitor[1]					
Test #1	27-Sep-11	9:45 AM	1:16 PM	-	-
Test #2	28-Sep-11	8:12 AM	12:10 PM	-	-
Test #3	28-Sep-11	1:47 PM	5:22 PM	-	-
Volatile Organic Compounds					
Test #1	27-Sep-11	11:39 AM	1:25 PM	T1-BASELINE-PAIR 1 A/B	LC1382
Test #2	27-Sep-11	3:46 PM	4:46 PM	T2-BASELINE-PAIR 2 A/B	LC1384
Test #3	27-Sep-11	4:38 PM	5:58 PM	T3-BASELINE-PAIR3 A/B	LC1386
Odour					
Test #1	29-Sep-11	10:02 AM	10:22 AM	Odour Baseline #1 / 21:1	1
Test #2	29-Sep-11	10:25 AM	10:45 AM	Odour Baseline #1 / 21:1	2
Test #3	29-Sep-11	10:50 AM	11:10 AM	Odour Baseline #1 / 21:1	3
Ammonia					
Test #1	28-Sep-11	8:23 AM	9:23 AM	T1-BASELINE-CTM27	LC1769
Test #2	28-Sep-11	10:13 AM	11:15 AM	T2-BASELINE-CTM27	LC1770
Test #3	28-Sep-11	1:44 PM	2:44 PM	T3-BASELINE-CTM27	LC1771

Notes:
[1] CEM's: Sulphur Dioxide, Oxides of Nitrogen, Oxygen, Carbon Dioxide, Carbon Monoxide, Total Hydrocarbons

Table 3: Sampling Summary - Flow Characteristics

Stack Gas Parameter		Test No. 1			Test No. 2			Test No. 3			TOTAL AVERAGE
		SVOC[1]	TPM[2]	Average	SVOC[1]	TPM[2]	Average	SVOC[1]	TPM[2]	Average	
Testing Date											-
Stack Temperature	°F	183	182	183	184	182	183	185	182	184	183
	°C	84	84	84	84	83	84	85	83	84	84
Moisture	%	0.482	0.5	0.474	0.469	0.5	0.471	0.466	0.5	0.47	0.5
Velocity	ft/s	67.6	61.8	64.7	65.5	57.9	61.7	63.8	58.8	61.3	62.6
	m/s	20.6	18.8	19.7	19.9	17.7	18.8	19.5	17.9	18.7	19.1
Actual Flow Rate	CFM	16,700	15,300	16,000	16,200	14,300	15,300	15,800	6,390	11,100	14,100
Referenced Flow Rate[3]	CFM	7,230	6,840	7,040	7,160	6,310	6,740	7,020	181	3,600	5,790
	m^3/s	3.41	3.2	3.3	3.38	3.0	3.2	3.31	3.0	3.2	3.2
Sampling Isokinetic Rate	%	99	94.7	96.8	96	98	97	97	98	97.5	97

Notes:

[1] SVOC = Sampling for PAH's, Dioxins, and Furans

[2] TPM = Sampling for total particulate matter and metals

[3] Referenced flow rate expressed as dry at 101.3 kPa, 25 °C, and Actual Oxygen

APPENDIX J

Ottawa Landfill Hourly Emission File Generator - Material Handling and Wind Erosion Sources
TSP Emissions

									Threshold for Wind Erosion	6.25862069		Emission Rates						
		Total Hours with Emissions Turned Off:				120		11712		11812	18312	Moisture Content =	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%
										Wind Erosion	Material Handling	Hourly Material Handled (Mg) =	32	16	129	16	274	32
												ulate Size Factor (for Wind Erosion) =	0.74	0.74	0.74	0.74	0.74	0.74
												% control for months with precip	0%	0%	0%	0%	0%	0%
												Modelled Area Source (m2)						
Threshold					Precipitation (flag) Threshold	2	Snow Cover Depth (cm) Threshold	10	Wind Speed (m/s)	Product of Precipitation Flag * Wind Speed	Adjusted for hours of operation - 6:00 am to 8:00 pm		Landfill Working Stage-Active Face Material Handling	Construction Working Stage Material Handling	Contaminated Soil Stockpiles Material Handling	Overburden Stockpiles Material Handling	Construction Working Stage Material Unloading	Landfill Working Stage Material Unloading
Data count	43824			43824	43818	43824	43818	43824	43824									
												Source ID	ACTFCE	CWS_MH	CSS_MH	OB_MH	CF_UNL	ACT_UNL
	Year	Month	Day	Hour	Value	On/Off	Value	On/Off	Value	Value (m/s)	Value (m/s)		rate (g/s)	rate (g/s)	rate (g/s)	rate (g/s)	rate (g/s)	rate (g/s)
	6	1	1	1	0	1	15	0	7.2	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	1	2	0	1	15	0	3.6	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	1	3	0	1	15	0	4.1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	1	4	0	1	15	0	4.1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	1	5	0	1	15	0	2.6	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	1	6	0	1	15	0	3.6	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	1	7	0	1	15	0	3.1	0	3.1		1.35E-03	6.73E-04	5.38E-03	6.73E-04	1.14E-02	1.35E-03
	6	1	1	8	0	1	15	0	3.1	0	3.1		1.35E-03	6.73E-04	5.38E-03	6.73E-04	1.14E-02	1.35E-03
	6	1	1	9	0	1	15	0	2.6	0	2.6		1.07E-03	5.36E-04	4.28E-03	5.36E-04	9.10E-03	1.07E-03
	6	1	1	10	0	1	15	0	3.1	0	3.1		1.35E-03	6.73E-04	5.38E-03	6.73E-04	1.14E-02	1.35E-03
	6	1	1	11	0	1	15	0	2.6	0	2.6		1.07E-03	5.36E-04	4.28E-03	5.36E-04	9.10E-03	1.07E-03
	6	1	1	12	0	1	15	0	1.5	0	1.5		5.24E-04	2.62E-04	2.10E-03	2.62E-04	4.45E-03	5.24E-04
	6	1	1	13	0	1	15	0	2.1	0	2.1		8.11E-04	4.06E-04	3.25E-03	4.06E-04	6.90E-03	8.11E-04
	6	1	1	14	0	1	15	0	1	0	1		3.09E-04	1.55E-04	1.24E-03	1.55E-04	2.63E-03	3.09E-04
	6	1	1	15	0	1	15	0	1	0	1		3.09E-04	1.55E-04	1.24E-03	1.55E-04	2.63E-03	3.09E-04
	6	1	1	16	0	1	15	0	1	0	1		3.09E-04	1.55E-04	1.24E-03	1.55E-04	2.63E-03	3.09E-04
	6	1	1	17	0	1	15	0	1	0	1		3.09E-04	1.55E-04	1.24E-03	1.55E-04	2.63E-03	3.09E-04
	6	1	1	18	0	1	15	0	1	0	1		3.09E-04	1.55E-04	1.24E-03	1.55E-04	2.63E-03	3.09E-04
	6	1	1	19	0	1	15	0	1	0	1		3.09E-04	1.55E-04	1.24E-03	1.55E-04	2.63E-03	3.09E-04
	6	1	1	20	0	1	15	0	1	0	1		3.09E-04	1.55E-04	1.24E-03	1.55E-04	2.63E-03	3.09E-04
	6	1	1	21	0	1	15	0	1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	1	22	0	1	15	0	1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	1	23	0	1	15	0	1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	1	24	0	1	15	0	1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	1	0	1	14	0	1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	2	0	1	14	0	1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	3	0	1	14	0	1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	4	0	1	14	0	2.1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	5	0	1	14	0	1.5	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	6	0	1	14	0	1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	7	0	1	14	0	2.1	0	2.1		8.11E-04	4.06E-04	3.25E-03	4.06E-04	6.90E-03	8.11E-04
	6	1	2	8	0	1	14	0	2.6	0	2.6		1.07E-03	5.36E-04	4.28E-03	5.36E-04	9.10E-03	1.07E-03
	6	1	2	9	0	1	14	0	1	0	1		3.09E-04	1.55E-04	1.24E-03	1.55E-04	2.63E-03	3.09E-04
	6	1	2	10	0	1	14	0	1.5	0	1.5		5.24E-04	2.62E-04	2.10E-03	2.62E-04	4.45E-03	5.24E-04
	6	1	2	11	0	1	14	0	1.5	0	1.5		5.24E-04	2.62E-04	2.10E-03	2.62E-04	4.45E-03	5.24E-04
	6	1	2	12	0	1	14	0	2.6	0	2.6		1.07E-03	5.36E-04	4.28E-03	5.36E-04	9.10E-03	1.07E-03
	6	1	2	13	0	1	14	0	1.5	0	1.5		5.24E-04	2.62E-04	2.10E-03	2.62E-04	4.45E-03	5.24E-04
	6	1	2	14	0	1	14	0	1.5	0	1.5		5.24E-04	2.62E-04	2.10E-03	2.62E-04	4.45E-03	5.24E-04
	6	1	2	15	0	1	14	0	3.1	0	3.1		1.35E-03	6.73E-04	5.38E-03	6.73E-04	1.14E-02	1.35E-03
	6	1	2	16	0	1	14	0	3.6	0	3.6		1.64E-03	8.18E-04	6.54E-03	8.18E-04	1.39E-02	1.64E-03
	6	1	2	17	0	1	14	0	4.6	0	4.6		2.25E-03	1.12E-03	8.99E-03	1.12E-03	1.91E-02	2.25E-03
	6	1	2	18	0	1	14	0	3.1	0	3.1		1.35E-03	6.73E-04	5.38E-03	6.73E-04	1.14E-02	1.35E-03
	6	1	2	19	0	1	14	0	5.1	0	5.1		2.57E-03	1.29E-03	1.03E-02	1.29E-03	2.19E-02	2.57E-03
	6	1	2	20	0	1	14	0	5.1	0	5.1		2.57E-03	1.29E-03	1.03E-02	1.29E-03	2.19E-02	2.57E-03
	6	1	2	21	0	1	14	0	4.1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	22	0	1	14	0	4.6	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	23	0	1	14	0	5.1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	2	24	0	1	14	0	5.7	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	3	1	0	1	14	0	4.6	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	3	2	0	1	14	0	5.7	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	3	3	0	1	14	0	5.1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	3	4	0	1	14	0	5.1	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	3	5	0	1	14	0	5.7	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	3	6	0	1	14	0	6.2	0	0		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	6	1	3	7	0	1	14	0	4.6	0	4.6		2.25E-03	1.12E-03	8.99E-03	1.12E-03	1.91E-02	2.25E-03
	6	1	3	8	0	1	14	0	3.6	0	3.6		1.64E-03	8.18E-04	6.54E-03	8.18E-04	1.39E-02	1.64E-03
	6	1	3	9	0	1	14	0	6.2	0	6.2		3.31E-03	1.66E-03	1.33E-02	1.66E-03	2.82E-02	3.31E-03
	6	1	3	10	0	1	14	0	4.6	0	4.6		2.25E-03	1.12E-03	8.99E-03	1.12E-03	1.91E-02	2.25E-03
	6	1	3	11	0	1	14	0	4.1	0	4.1		1.94E-03	9.68E-04	7.75E-03	9.68E-04	1.65E-02	1.94E-03
	6	1	3	12	0	1	14	0	7.2	0	7.2		4.03E-03	2.01E-03	1.61E-02	2.01E-03	3.42E-02	4.03E-03

APPENDIX K

APPENDIX K1: Bulldozing at Overburden Pile and Construction Working Face - TSP Emission Rates

--> Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines, AP-42 11.9-2

TSP = 2.6 (s)^1.2/(M)^1.3 (kg/hr)
PM15 = 0.45(s)^1.5/(M)^1.4 (kg/hr)

M = 12% material moisture content (%)
s = 9% material silt content (%)

--> chosen from AP42 Table 13.2.4-1 to match parameters for Material Handling Sources
Material: Cover

Scaling Factors	
TSP	1
PM10	0.75*PM15
PM2.5	0.105*TSP

Hour of Day	TSP		Surface Area (m^2): 4000 — Overburden Pile	Surface Area (m^2): 900 — Construction WorkingFace
	kg/hr	g/s	g/s*m^2	g/s*m^2
1:00	0	0	0	0
2:00	0	0	0	0
3:00	0	0	0	0
4:00	0	0	0	0
5:00	0	0	0	0
6:00	0	0	0	0
7:00	2.28	0.63	1.58E-04	7.02E-04
8:00	2.28	0.63	1.58E-04	7.02E-04
9:00	2.28	0.63	1.58E-04	7.02E-04
10:00	2.28	0.63	1.58E-04	7.02E-04
11:00	2.28	0.63	1.58E-04	7.02E-04
12:00	2.28	0.63	1.58E-04	7.02E-04
13:00	2.28	0.63	1.58E-04	7.02E-04
14:00	2.28	0.63	1.58E-04	7.02E-04
15:00	2.28	0.63	1.58E-04	7.02E-04
16:00	2.28	0.63	1.58E-04	7.02E-04
17:00	2.28	0.63	1.58E-04	7.02E-04
18:00	2.28	0.63	1.58E-04	7.02E-04
19:00	2.28	0.63	1.58E-04	7.02E-04
20:00	2.28	0.63	1.58E-04	7.02E-04
21:00	0	0	0	0
22:00	0	0	0	0
23:00	0	0	0	0
24:00	0	0	0	0

APPENDIX L

Appendix L1: Combustion Emission Rates for Impact Crusher Generator

RWDI Project #1302177

RWDI Project Name:	Cambridge Aggregates	--> used Cambridge Aggregates specs for WM WCEC
RWDI Project Number:	1302177	
Manufacturer:		
Engine Model:	300 HP Crusher Engine	

Parameter	Units	Value
Engine Fuel		Diesel
Fuel Heating Value	(Btu/gal)	1020
Stroke Cycle		4-Stroke
Engine Loading	(%)	90-105%
Burn Style		Rich
NOx Controlled?		No

Site Specific Emission Factors	Units	Emission Factor
Oxides of Sulphur (SOx)	g/hp-hr	
Oxides of Nitrogen (NO_x)	lb/hp-hr	
Carbon Monoxide (CO)	g/hp-hr	
PM	g/hp-hr	
Source:		

Rating (enter one set of units)	Units	Value
Engine Horsepower (hp)	(hp)	300
Transfer Efficiency	(%)	90
Calculated Input	(hp)	300.00

Emission Factors	Units	Emission Factor	Source:
Oxides of Sulphur (SOx)	lb/hp-hr	0.00205	AP 42 (10/1996) Ch 3.3, Tables 3.3-1
Oxides of Nitrogen (NO_x)	lb/hp-hr	0.031	AP 42 (10/1996) Ch 3.3, Tables 3.3-1
Carbon Monoxide (CO)	lb/hp-hr	0.00668	AP 42 (10/1996) Ch 3.3, Tables 3.3-1
PM	lb/hp-hr	0.0022	AP 42 (10/1996) Ch 3.3, Tables 3.3-1

	Units	Value
Exhaust Temperature (ºC)	(ºC)	600
Calculated Exit Temperature	(K)	873

Fuel Sulphur Information	Units	Value
Natural Gas Sulphur Content	(%)	
Fuel Oil Sulphur Content	(%)	0.05

Emission Rates	Units	Emission Rate	Quality
Oxides of Sulphur (SOx)	(g/s)	7.75E-02	D
Oxides of Nitrogen (NO_x)	(g/s)	1.17E+00	D
Carbon Monoxide (CO)	(g/s)	2.52E-01	D
Particulate Matter (PM)	(g/s)	8.32E-02	D

Sample Calculation

Emission Rate (SOx in g/s) =	300 hp	0.00205 lb	453.5924 g	1 hr
		hp-hr	lb	3600

Emission Rate (SOx in g/s) = 0.0775

Appendix L2: Crushed Stone Processing & Pulverized Mineral Processing TSP Emission Rates

Project # 1302177

CRUSHED STONE PROCESSING & PULVERIZED MINERAL PROCESSING - AP-42 Section 11.19.2

ID [1]	Process Name / Description	AP-42 Process Description	Process Code [2]	Processing Rate Hourly (Mg/h)	Processing Rate Daily (Mg/d)	Processing Rate Annual (Mg/a)	Control Efficiency Applied [4] (%)	Comments
CR	Impact Crusher	Primary crushing (controlled)	6	200	2400	876000		Emissions include feed and outlet conveyor

[1] ID corresponds to process flow diagram for facility and / or material

[2] Process code used by spreadsheet to pull correct factor based on slected activity - does not require entry.

[3] Enter the control efficiency for each source - if no controls are applied, leave blank

Sample calculation for TSP emissions from Source CR: Impact Crusher

$$\frac{200\ Mg_{processed}}{1\ h} \times \frac{0.00060\ kg_{TSP}}{1\ Mg_{processed}} \times \frac{1\ h}{3600\ s} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{100\%\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 3.33E\text{-}02\ g_{TSP} / s$$

APPENDIX M

Frequency Analysis Based on Odour Emission Rates

WM ECA Assessment

RWDI Project #1302177

Receptor Information					Maximum Predicted 10-Minute Concentration (OU/m³)	Predcited Excusrions Above Specified 10-Minute Values					
ID#	Description	X	Y	Z		Events > 1 OU		Events > 3 OU		Events > 5 OU	
						Count	Frequency	Count	Frequency	Count	Frequency
R2		425095	5014365	1.5	2.5	142	0.32%	0	0.00%	0	0.0%
R4		423999	5013673	1.5	2.5	64	0.15%	0	0.00%	0	0.0%
R5		426965	5013887	1.5	0.5	0	0.00%	0	0.00%	0	0.0%
R6		423336	5016477	1.5	0.7	0	0.00%	0	0.00%	0	0.0%
R7		426103	5013580	1.5	0.7	0	0.00%	0	0.00%	0	0.0%
R8		424510	5013872	1.5	2.6	59	0.14%	0	0.00%	0	0.0%
R9		423804	5016030	1.5	1.3	40	0.09%	0	0.00%	0	0.0%
R10		420720	5013279	1.5	0.5	0	0.00%	0	0.00%	0	0.0%
R11		420960	5015092	1.5	0.7	0	0.00%	0	0.00%	0	0.0%
R12		421721	5014171	1.5	0.8	0	0.00%	0	0.00%	0	0.0%
R13		422987	5012721	1.5	1.0	0	0.00%	0	0.00%	0	0.0%
R14		422760	5015091	1.5	1.5	35	0.08%	0	0.00%	0	0.0%
R15		422484	5015393	1.5	1.1	3	0.01%	0	0.00%	0	0.0%
R16		422861	5017064	1.5	0.6	0	0.00%	0	0.00%	0	0.0%
R17		424773	5016880	1.5	0.5	0	0.00%	0	0.00%	0	0.0%
R18		424739	5013726	1.5	1.9	46	0.11%	0	0.00%	0	0.0%
R19		425302	5013206	1.5	1.0	0	0.00%	0	0.00%	0	0.0%
R20		426318	5013134	1.5	0.6	0	0.00%	0	0.00%	0	0.0%
R21		426338	5014149	1.5	0.6	0	0.00%	0	0.00%	0	0.0%
R22		427140	5014836	1.5	0.5	0	0.00%	0	0.00%	0	0.0%
R23		426659	5016723	1.5	0.4	0	0.00%	0	0.00%	0	0.0%
R24		426927	5017938	1.5	0.3	0	0.00%	0	0.00%	0	0.0%

43824	Total Number of Hours in the Met File
0	Number of Calm Hours
126	Number of Missing Hours
43698	Hours of valid Meterological Data (enter number of VALID hours in met data file)

APPENDIX N

Appendix N: Landfill Gas Calibration Factor

1.0 Background

As stated in the “Existing Conditions Report – Landfill Gas (VOC) Baseline Assessment”, the landfill gas emission rate could be developed using the LANDGEM Model, which is a landfill gas generation model, not a landfill gas emission model. The approach taken in this baseline assessment, which was based on the metered landfill gas consumption data, also produces an estimate of landfill gas generation rather than landfill gas emission. This is a very critical distinction when assessing air quality. The effect of landfill gas passing through several feet of moistened soil, full of microbes and reactive minerals, greatly reduces the emissions of many landfill gas compounds. This is particularly true for reduced sulphur compounds such as hydrogen sulphide.

As part of the assessment of landfill gas, an assessment has been made to determine the applicability of a landfill emission rate calibration factor to account for soil attenuation effects. The assessment was performed using vinyl chloride (to represent VOCs present in the landfill gas) and hydrogen sulphide monitoring results.

Guidance to perform this assessment was provided in the Ministry of the Environment’s (MOE) Combined Assessment of Modelled and Monitored Results (CAMM) Technical Bulletin, Version 4.0, August 2011. A CAMM assessment compares modelled concentrations to actual measured (monitored) concentrations and identifies any systematic biases using the Initial Unpaired Analysis.

Biases in the model could be due to numerous factors including meteorological inputs, uncertainties in the emission data, or, in this instance, unaccounted soil attenuation effects. It is assumed that monitoring concentrations are accurate and that the meteorology is reasonable and therefore implying that any discrepancies between modelled and monitored results are primarily due to uncertainties in the modelled emissions. This assumption, that systematic biases encountered are due to uncertainty in the landfill gas emission rate, justifies only looking at refining emission rates of the landfill.

2.0 Monitoring Data

Waste Management of Canada Corporation (WM) has retained RWDI Air Inc. to conduct several ambient monitoring programs at the Ottawa Landfill facility. Continuous wind speed and wind direction measurements were taken concurrently during the sample collection by the on-site weather station installed by RWDI.

Reduced sulphur samples were collected using a continuous monitoring station in a fixed location. The samples were collected between July 7 and October 7 of the year 2011. On-site meteorological data was used to identify concentrations taken when the wind directions placed the monitoring station downwind of the landfill and to exclude the concentrations taken when the wind directions placed the monitoring station upwind.

VOC samples were collected between 2004 and 2011, excluding the years of 2005 and 2006 in sample tubes in various locations around the landfill. A total of sixty (60) VOC samples were collected during 30-minute time periods. Vinyl chloride was analyzed using selective ion mode (SIM) to obtain lower detection limits. The ambient VOC samples were generally paired (with exception of the samples collected in 2004) and collected at locations directly downwind and upwind of the landfill mound. The sampling locations (upwind and downwind) were pre-selected based on forecasts of wind directions provided by Environment Canada, information from the on-site meteorological station, on-site observations, and any directives provided by the MOE. The upwind concentrations, representing background levels of vinyl chloride, were removed from the downwind concentration values in the CAMM assessment. The VOC samples were screened for applicability and completeness and 42 of the samples results were deemed suitable for use in the CAMM assessment.

3.0 Air Dispersion Modelling

As this assessment is to determine the accuracy of the landfill gas emission rate, the landfill mound is the only source included in the CAMM modelling. AERMOD model runs were set up to correspond directly to the time, sample location and meteorological conditions present at the time of sample collection. The on-site meteorological data was provided to the MOE for processing. This MOE processed meteorological dataset was used in the dispersion modelling.

The receptor configuration used in the modelling was chosen to be more conservative than the configuration outlined in the MOE's CAMM Technical Bulletin. Instead of a 5 receptor array (for fixed location monitoring) or 10 receptor array (variable location monitoring), a grid of 81 receptors was used, with the center receptor positioned over the monitoring station location. The dimension of the receptor grid, 40 metres by 40 metres , with an inter-receptor spacing of 5 meters, representing the monitoring station, was chosen as the distance between the landfill and the monitoring location was a relatively small distance. Sampling height of the monitoring station was approximately 1.5 m and therefore the receptor heights were set at 1.5 meters.

The modeling results that were reported and used in comparisons with the monitoring data were the average of the results obtained for the 81 receptors for each sampling period. This procedure reduces the impacts of discrepancies between the actual wind directions transporting the landfill's emissions and the wind directions in the MOE processed meteorological dataset used for modelling.

4.0 Initial Unpaired Analysis

The accuracy of modeling results is improved by refining emission rates using a process that the MOE has termed "Initial Unpaired Analysis" to identify and remove inherent bias, either high or low, in POI concentrations predicted by dispersion models. This process involves a comparison of modelled and monitored results to determine ifemission rate adjustments are necessary to match dispersion model predicted POI concentrations with the monitored data. Adjustments are made using a defined set of rules to ensure that no bias is introduced by the individual making adjustments to the emission rates. The process has been defined by the MOE in the CAMM Technical Bulletin.

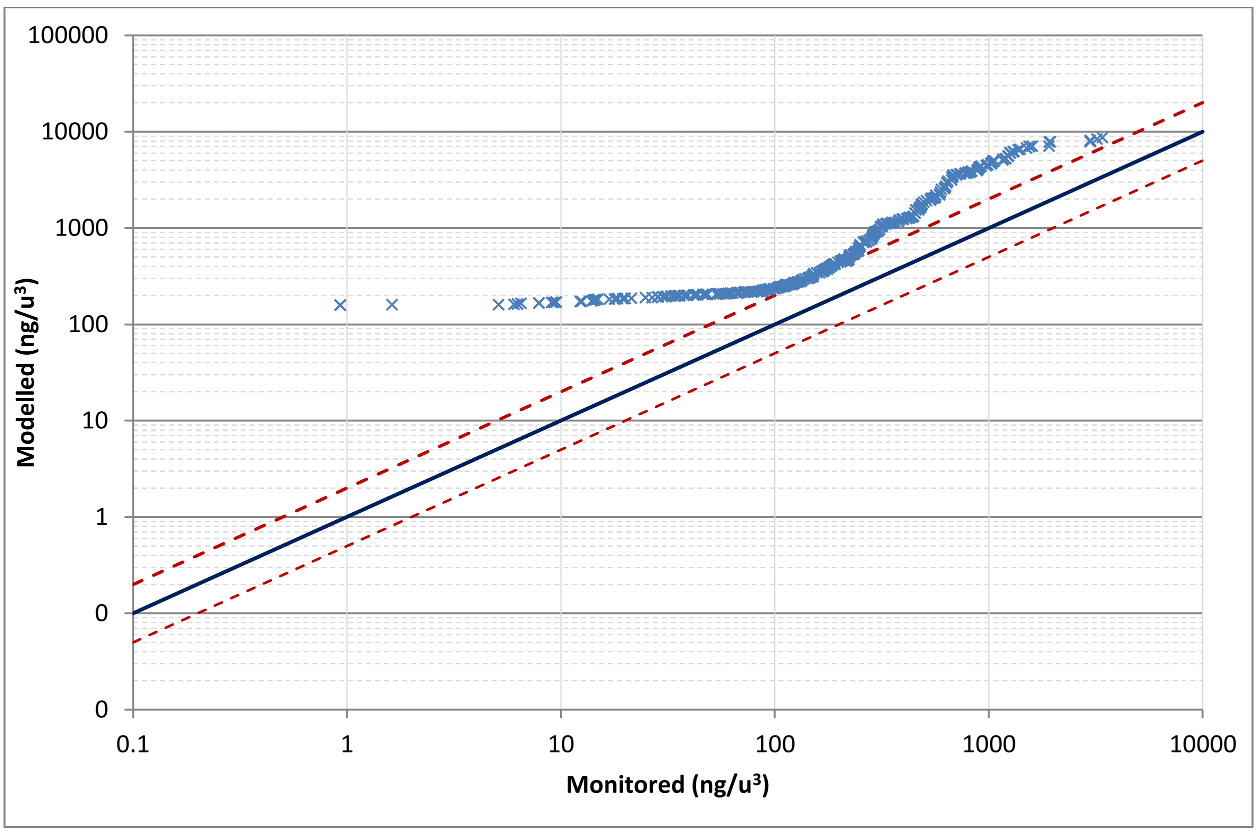
As outlined in the MOE's CAMM Technical Bulletin, the assessment primarily focuses on the use of quantile:quantile (Q:Q)plots and other statistical measures to assess for systematic bias. In accordance with the MOE, the Q:Q plot allows rapid identification of biases towards either the modelling or monitoring results. The closer the points are to the center line (i.e. the 1-to-1 factor line) the better the correlation between the modelling and the monitoring data. If values are consistently beyond the "factor of two lines" or the "tolerance lines", this would indicate a strong bias towards modeling (either over predictions or under predictions).

As shown in Figure A2, a strong bias is presented in the Q:Q plot for hydrogen sulphide modelled and monitored results, as all the points fall above the 1-to-1 factor line and outside of the factor of two tolerance line. The AERMOD model appears to consistently overestimate the hydrogen sulphide concentrations present in the ambient air. The strong bias towards over-estimating modelled concentrations warrants further analysis to determine an emission rate adjustment factor or calibration factor.

A Robust Highest Concentrations (RHC) analysis was used to determine the value of the calibration factor used to adjust the hydrogen sulphide landfill gas emission rate. The RHC ratio is less vulnerable to unusual events which may unnecessarily distort comparisons if the entire distribution of these results were considered. The RHC ratio is calculated using the top 26 highest modelled and monitored concentration values.

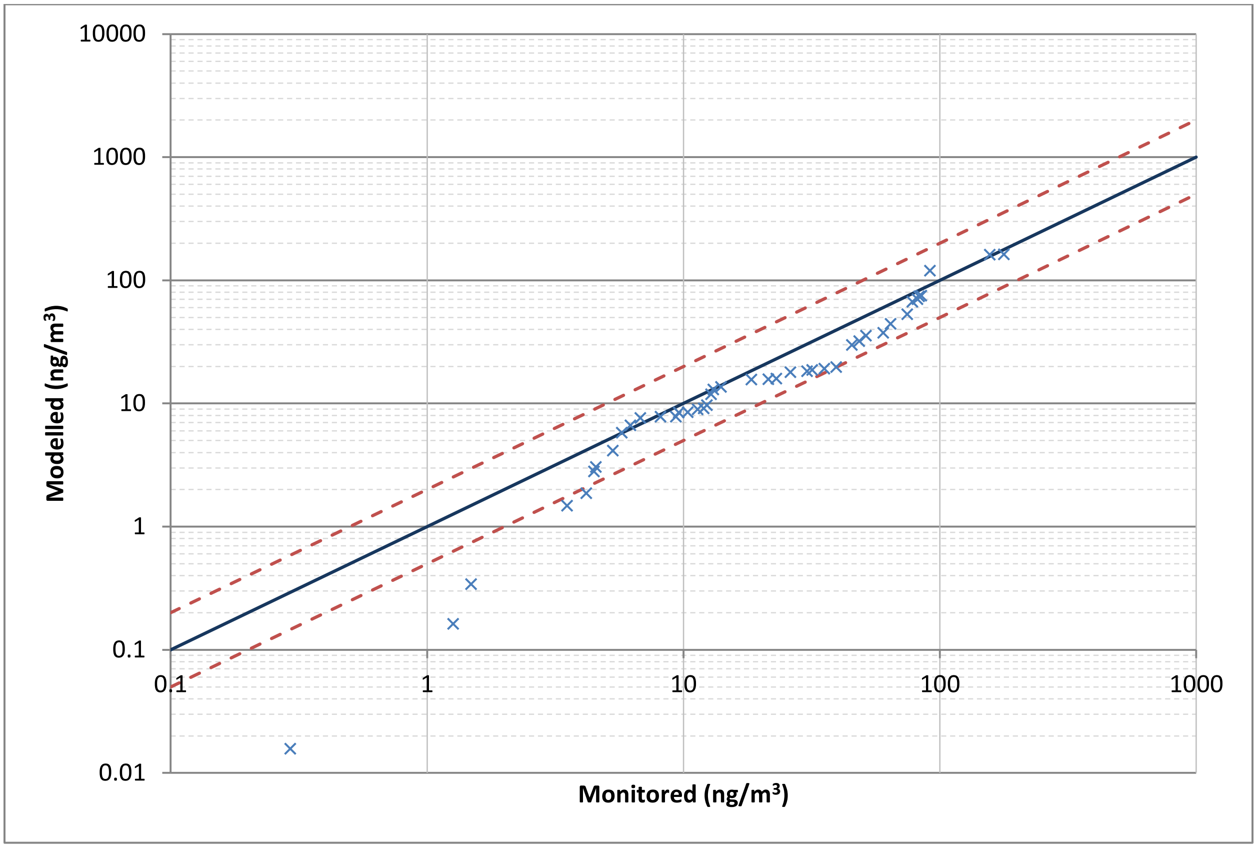
The RHC calculated from the modelled and monitored hydrogen sulphide results was 0.137, meaning the initial hydrogen sulphide emission rate could be divided by 7.3. However, to maintain a relatively conservative approach, the calibration factor was reduced by approximately 40%, to a value of 3. All hydrogen sulphide concentration presented in the "Existing Conditions Report – Landfill Gas (VOC) Baseline Assessment" represent a calibrated concentrations where the emission rate was divided by a calibration factor of 3.

Figure A2: Initial Unpaired Analysis for Hydrogen Sulphide



As previously mentioned, a total of 42 observations and model predictions were used to construct the Q:Q plot for vinyl chloride, shown in Figure A3. The majority of the data points lie within the factor of two tolerance lines, the outliers being lower value observations and model predictions. This indicates that modeling results are reasonably well matched to the monitoring results. Thus, no calibration factor was applied to vinyl chloride emission rates or any other VOC emission rates found in the “Existing Conditions Report – Landfill Gas (VOC) Baseline Assessment”.

Figure A3: Initial Unpaired Analysis for Vinyl Chloride



5.0 Conclusion

The MOE’s CAMM Technical Bulletin was used as guidance to determine the applicability of a landfill emission ratecalibration factor to account for soil attenuation effects. A calibration factor of 3 will be applied to the landfill’s hydrogen sulphide emission rate. A calibration factor was not deemed necessary for the vinyl chloride emission rates or any of the VOCs that it is representing.

Downwind Ambient Vinyl Chloride Sample Summary

TUBE No.	DATE	Sampling Time Period [1]		Hours	Amount	Sample	Measured
		Start Time	End Time	Modelled	(ng)	Volume	Concentration
SS 32	19-Jul-04	4:57	5:27	4-6	0.397	9.5	0.042
SS 28	22-Jul-04	8:35	9:05	8-10	0.721	9.7	0.074
SS 4	26-Jul-04	8:29	8:59	8-9	0.095	9.9	0.010
SS 11	29-Jul-04	9:08	9:38	9-10	0.105	9.2	0.011
SS 25	30-Jul-04	12:15	12:45	12-13	0.479	9.7	0.049
STA 04	9-Aug-04	5:18	5:48	5-6	0.187	7.8	0.024
SS 23	17-Aug-04	9:00	9:30	9-10	0.267	8.5	0.031
SS14	24-Aug-04	8:38	9:08	8-10	0.042	7.9	0.005
SS31	25-Aug-04	8:40	9:10	8-10	0.185	8.3	0.022
SS10	26-Aug-04	8:24	8:54	8-9	0.456	7.8	0.058
SS29	31-Aug-04	8:26	9:01	8-10	0.155	9.6	0.016
STA02	1-Sep-04	8:33	9:03	8-10	0.179	8.4	0.021
SS7	2-Sep-04	3:45	4:15	3-5	0.072	7.7	0.009
SS26	3-Sep-04	8:28	8:58	8-9	0.036	7.9	0.005
SS24	7-Sep-04	7:55	8:25	7-9	0.644	7	0.092
SS30	13-Sep-04	7:52	8:22	7-9	0.511	8.3	0.062
SS43	14-Sep-04	7:58	8:28	7-9	0.036	8.6	0.004
SS42	15-Sep-04	8:21	8:51	8-9	0.449	8.1	0.055
SS32	16-Sep-04	8:09	8:39	8-9	0.227	8	0.028
SS52	11-Jun-07	10:44	11:20	10-12	0.084	7	0.012
SS56	7-Jul-07	11:42	12:12	11-13	0.678	7	0.097
SS57	23-Jul-07	2:48	3:25	14-16	1.381	8.8	0.157
SS83	20-Aug-07	15:12	15:12	15-16	0.127	2.5	0.051
SS63	28-Aug-07	9:18	9:48	9-10	0.748	7.6	0.098
SS54	24-Jun-08	[1]	[1]	8-11	1.247	7	0.178
SS55	26-Jun-08	14:24	14:54	14-15	0.404	6.7	0.060
SS42	22-Jul-08	14:00	14:30	14-15	0.509	6.8	0.075
SS74	27-Aug-08	13:25	13:55	13-14	0.633	20.8	0.030
SS71	28-Aug-08	12:30	13:00	12-13	0.474	20.6	0.023
SS58	12-Aug-09	[1]	[1]	13-16	0.209	7.4	0.028
SS51	19-Aug-09	[1]	[1]	11-14	0.135	7	0.019
SS55	26-Aug-09	[1]	[1]	12-15	0.105	6.8	0.015
SS19	15-Jun-10	14:27	14:57	14-15	0.095	7.4	0.013
SS32	27-Jul-10	15:50	16:20	15-17	0.118	7.8	0.015
SS34	29-Jul-10	14:27	14:58	14-15	0.053	7.8	0.007
SS22	19-Aug-10	13:50	14:20	13-15	0.618	7.9	0.078
SS26	31-Aug-10	14:35	15:05	14-15	0.052	8.4	0.006
SS12	21-Jun-11	15:26	15:56	15-16	0.0985	7.5	0.013
SS16	28-Jun-11	11:22	11:52	11-12	0.772	7.1	0.109
SS20	21-Jul-11	15:48	16:16	15-17	0.194	7.4	0.026
SS32	28-Jul-11	14:26	14:56	14-15	0.405	8	0.051
SS58	8-Sep-11	15:38	16:08	15-17	0.066	8.1	0.008

Notes: [1] Field notes with exact start time and end time were missing for these samples.
Hours used in the creation of wind roses, were used for modelling purposes.

Upwind Ambient Vinyl Chloride Sample Summary

TUBE No.	DATE	Sampling Time Period [1]		Amount	Sample	Measured
		Start Time	End Time	(ng)	Volume	Concentration
SS 16	29-Jul-04	8:26	9:07	0.034	12.8	0.003
STA05	17-Aug-04	9:53	10:23	0.043	11.3	0.004
SS33	31-Aug-04	8:53	9:23	0.052	10.3	0.005
SS1	2-Sep-04	4:01	4:29	0.031	8.3	0.004
SS28	15-Sep-04	8:39	9:14	0.051	7.6	0.007
SS31	17-Sep-04	2:48	3:23	0.084	7.2	0.0117
STA 04	24-Sep-04	8:27	9:02	0.151	8.6	0.0176
SS25	30-Sep-04	8:19	8:48	0.24	8.5	0.0282
SS43	11-Jun-07	10:37	11:07	0.090	7	0.013
SS65	7-Jul-07	12:50	1:20	0.084	7	0.012
SS35	23-Jul-07	2:25	2:55	0.001	6.9	0.000
SS81	20-Aug-07	15:18	15:57	0.125	8.2	0.015
SS78	28-Aug-07	9:28	10:04	0.137	8.9	0.015
SS52	24-Jun-08	9:52	10:22	1.575	7	0.225
SS53	26-Jun-08	14:35	15:05	0.515	6.9	0.075
SS41	22-Jul-08	[1]	[1]	0.604	7.1	0.085
SS72	27-Aug-08	[1]	[1]	1.47	20.8	0.071
SS90	28-Aug-08	[1]	[1]	0.252	20	0.013
SS54	12-Aug-09	[1]	[1]	0.178	7.2	0.025
SS52	19-Aug-09	[1]	[1]	0.042	6.8	0.006
SS56	26-Aug-09	[1]	[1]	0.063	6.5	0.010
SS16	15-Jun-10	2:43	3:13	--	LOST	8.2
SS36	27-Jul-10	3:06	3:36	0.083	7.8	0.011
SS29	29-Jul-10	1:43	2:13	0.077	7.9	0.010
SS21	19-Aug-10	1:06	1:36	0.826	8.4	0.098
SS25	31-Aug-10	3:11	3:41	0.046	7.8	0.006
SS15	21-Jun-11	14:29	14:59	0.089	7.5	0.012
SS14	28-Jun-11	12:04	12:34	0.127	7.5	0.017
SS25	21-Jul-11	15:05	15:35	0.31	7.6	0.041
SS34	28-Jul-11	15:30	16:00	0.223	8.1	0.028
SS63	8-Sep-11	14:40	15:10	0.59	8	0.074

Notes: [1] Field notes with exact start time and end time were missing for these samples.
Upwind samples were not modelled.