Waste Management of Canada Corporation

Environmental Assessment for a New Landfill Footprint at the West Carleton Environmental Centre

AMENDED ATMOSPHERIC EXISTING CONDITIONS REPORT
Landfill Gas (VOC) Baseline Assessment

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1. Introduction

RWDI AIR Inc. (RWDI) was retained by Waste Management of Canada Corporation (WM) to determine the landfill gas volatile organic compounds (VOC) baseline condition for the existing landfill site at the proposed West Carleton Environmental Centre (WCEC) owned by WM. The existing landfill site was closed as of September 30, 2011. The baseline year has been set as 2012, which represents the first full year post-closure of the existing landfill. This report outlines the results of our baseline assessment for the landfill gas volatile organic compounds (VOC) impacts at and beyond the property line. This report updates the previous submission from June of 2011 in order to address the initial comments received by the Greater Review Team (GRT). Comments received during consultation sessions with the MOE reviewers as well as initial comments received by the GRT have been incorporated into this addendum baseline report for review by all interested parties.

This baseline report outlines the conditions at the site as of 2012. This baseline year considered the landfill site as not receiving waste at the site and the landfill gas being produced would be sent to the existing landfill gas utilization complex (generators and flares). Since other potential sources of emissions are not current installed such as the Sequencing Batch Reactor ("SBR") system for leachate treatment or ancillary processes such as the Waste Transfer Station, these emission sources are not included in the baseline assessment but will be assessed in the Detailed Impact Assessment with the preferred Alternative footprint for the proposed landfill site.

There have been no complaints regarding landfill gas or air quality issues since the closure of the landfill in September of 2011. Since the baseline evaluation reviewed the closed landfill site a detailed review of historical complaints received by the landfill was not included in this report. Readers are asked to review historical annual reports or review previous comments from the Community Liaison Committee ("CLC") regarding historical issues with the site operation.

As waste gradually decays, landfill gas is generated. Any landfill gas that is not collected by the landfill gas collection system or consumed as it passes through the soil cover typically migrates to the atmosphere. The purpose of this assessment was to predict the impact of baseline landfill gas emissions from the existing closed landfill on the surrounding area. This assessment will establish the baseline landfill gas conditions for use in future comparisons. Where appropriate, the study will provide a calibration factor to adjust the results of numerical modelling to more accurately reflect actual conditions at the landfill. In terms of scope, the assessment involved the following tasks:

- Use of gas collection records, sampling data for the concentration of contaminants in the raw landfill gas, and the U.S. EPA's LANDGEM model to predict emission rates for landfill gas compounds;

- Prediction of VOC levels at receptors surrounding the landfill using numerical modelling techniques;
- Use of a Calibration Factor, as outlined using approved MOE methodology, to adjust the modelled results to reflect the amount of some gases that are consumed as they pass through the soil cover to obtain a more representative prediction of emissions from the existing landfill site; and
- Provision of results of the assessment to other disciplines for use in their respective impact assessments.

1.1 Contaminants of Interest

Landfill gas, although consisting mainly of methane and carbon dioxide, contains trace amounts of VOCs and reduced sulphur compounds. Although these contaminants account for less than 1% by volume of landfill gas escaping from the landfill, their concentrations must be assessed because they can potentially result in health impacts at residences or businesses that surround the landfill site. The type and concentration of compounds within the landfill gas can vary greatly, depending on the composition of the decomposing waste from which the landfill gas is created. Based on the Ministry of the Environment's (MOE) Interim Guideline to Assess Air Impacts from Landfills and the Terms of Reference, 23 contaminants of interest in the landfill gas were reviewed. These compounds, which include 19 VOCs and 4 reduced sulphur species, form the basis of the landfill gas study. These 23 contaminants of interest are listed in Table 1. All 23 of these target compounds were measured in the ambient air quality assessment.

Of the 23 selected compounds, vinyl chloride has been identified as the compound of particular interest. Vinyl chloride has the strictest provincial standard or criterion relative to its concentration in raw landfill gas and, as a result, vinyl chloride was assumed to be the limiting contaminant in the landfill gas emitted. Emissions of vinyl chloride from landfill gas have the greatest potential for adverse impacts on the surrounding environment. For this reason, specific emphasis was placed on the measurement of vinyl chloride and it was analyzed in single ion mode (SIM) to produce lower detection limits.

Benzene and hydrogen sulphide were also selected as contaminants of particular interest based on historical issues at the existing WCEC facility. Detailed results are presented for all three contaminants of particular interest, while the remaining contaminants in this assessment were only compared to applicable standards.

Emissions related to combustion parameters from the flares and generators are included in the companion study noted as the Haul Route Baseline Report. The Haul Route report outlines the emissions from all related sources of combustion.

1.2 Applicable Guidelines

Predicted concentrations of VOCs and reduced sulphur compounds were compared against Ontario Regulation 419/05 Air Pollution, Local Air Quality (O. Reg. 419) Point of Impingement (POI) Limits. The term POI is taken to be in the natural environment outside the boundaries of the property. Table 1 presents the O. Reg. 419 Schedule 3 air quality standards used in the landfill gas assessment for the selected list of compounds. For compounds that do not have established Schedule 3 air quality standards, other criteria such as Ambient Air Quality Criteria (AAQC) and Jurisdictional Screening Level (JSL) were used for this assessment. The basis for the limiting effect and averaging period for each individual contaminant is included in Table 1.

Table 1. Summary of Applicable Criteria for Landfill Gas Compounds

CAS #	Compound	Averaging Period (hours)	MOE POI Limit[1] (µg/m³)	Limiting Effect	Regulation Schedule
74-93-1	Methyl Mercaptan (as Mercaptans)	10 Minute	13	Odour	3
75-08-1	Ethyl Mercaptan (as Mercaptans)	10 Minute	13	Odour	3
75-01-4	Vinyl Chloride/Chloroethene	24 Hour	1	Health	3
75-00-3	Chloroethane	24 Hour	5,600	Health	3
75-35-4	1,1-Dichloroethylene	24 Hour	10	Health	3
75-18-3	Dimethyl Sulphide	10 Minute	30	Odour	AAQC
75-09-2	Dichloromethane	24 Hour	220	Health	3
156-60-5	1,2-Dichloroethene	24 Hour	105	Health	AAQC
75-34-3	1,1-Dichloroethane	24 Hour	165	Health	3
78-92-2	sec-Butyl Alcohol/2-Butanol (as n-Butanol)	24 Hour	920	Health	3
67-66-3	Chloroform/Trichloromethane	24 Hour	1	Health	3
71-55-6	1,1,1-Trichloroethane	24 Hour	115,000	Health	3
56-23-5	Carbon Tetrachloride	24 Hour	2.4	Health	3
71-43-2	Benzene	24 Hour	2.3	CARC	3
107-06-2	1,2-Dichloroethane	24 Hour	2	Health	3
79-01-6	Trichloroethylene	24 Hour	12	Health	3
75-27-4	Bromodichloromethane	n/a	n/a	n/a	n/a
111-65-9	Octane	10 Minute	61,800	Odour	AAQC
79-00-5	1,1,2-Trichloroethane	24 Hour	0.31	JSL	-
127-18-4	Tetrachloroethylene	24 Hour	360	Health	3
106-93-4	Ethylene Dibromide	24 Hour	3	Health	3
79-34-5	1,1,2,2-Tetrachloroethane	n/a	n/a	n/a	n/a
7783-06-4	Hydrogen sulphide	24 Hour	7	Health	3
		10 Minute	13	Odour	3

1.3 Emission Sources

A source summary table for each source of emission is provided in the Table Section for review. The Source Summary Table provides a summary of each source, the type of modelled source and the overall emission rate per source of emission. Each of these sources is discussed in the following sections.

1.3.1 Baseline Assessment On-Site Sources

The on-site sources of VOCs and reduced sulphur compounds include the landfill mound under final cover, the landfill gas-fired engines, and the landfill gas flares. These sources will remain when the existing landfill closes.

1.3.1.1 Landfill Final Cover Area

The final cover area is the portion of the landfill where waste is no longer being deposited. This area is characterized by the presence of a clay landfill cap and landfill gas collection system. Once the existing landfill is closed, the entire landfill mound will be under final cover. The total landfill final cover area is estimated to be approximately 355,000 m^2 at a final peak height of 47 metres (m) above grade. However, the mound was modelled at a height of 0 m above grade for a conservative estimate. RWDI completed a sensitivity analysis to determine to worst-case height for the existing landfill. Models runs were completed with the landfill height set to 0 m metres above grade, 15 m above grade and peak height (47 m). It was determined that maximum concentrations were predicted from the site when a height of 0 m above grade was assumed. The same assumption will be used in the Detailed Impact Assessment report for comparison purposes.

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

Between the years 2004 and 2010, the efficiency of the landfill gas collection system has increased due to the progressive increase in the percentage of the landfill with final cover in place and the increase in the total number of landfill gas extraction wells at the facility. These factors have resulted in an increase in the overall landfill gas collection efficiency from 23% in 2004 to 85% in 2010.

The existing landfill gas collection system supplies landfill gas to the on-site electricity generation system (5 landfill gas-fired generators) and the gas flaring system (3 flares).

1.3.1.2 Landfill Gas-Fired Generators

The existing landfill gas collection system supplies landfill gas to the on-site electricity generation system at the landfill gas-to-energy plant (LGTE). The LGTE consists of five (5) reciprocating engine-generator sets (Source IDs: E1 to E5), all located inside a building near the property boundary along Carp Road of the site.

The landfill gas collection system supplies the five (5) reciprocating engine-generator sets, all located inside the LGTE building, with a portion of the landfill gas collected from the landfill mound. The engine-generators are used to combust the landfill gases and the energy generated through the combustion reaction is used to supply over 6 MW of electricity to the municipal grid.

Source testing results were available for the generator emissions, however to obtain a more conservative baseline condition, the AP-42 destruction efficiency was used. Based on AP-42 Document, Chapter 4.2 Municipal Waste Landfills, the destruction efficiency of the landfill gas-fired generators was estimated to be 97%. Therefore, 3% of the VOC and reduced sulphur compounds in the landfill gas are not destroyed in the combustion reaction; instead, they are emitted to the atmosphere through the generator exhausts.

Each engine-generator set exhausts into the atmosphere through its own stack, having an exit diameter of 0.4 m and extending 5.5 m above the roof of the building and 13.4 m above grade. Two types of engine-generator sets are in place at the landfill gas-to-energy facility. The first type of engine-generator set has a power rating of 800 kilowatts and a maximum landfill gas firing rate of 0.14 cubic metres per second, resulting in an exhaust flow rate of 2.96 cubic metres per second. The second type of engine-generator set has a power rating of 1,600 kilowatts and a maximum landfill gas firing rate of 0.28 cubic metres per second, resulting in an exhaust flow rate of 6.48 cubic metres per second.

The landfill gas-to-energy facility operates three (3) 1,600 kW engines and two (2) 800 kW engines for a total power rating of 6,400 kW and a maximum landfill gas firing rate of 1.12 cubic metres per second.

1.3.1.3 Landfill Gas Flares

In addition to the landfill gas-fired engine-generator sets, the WCEC landfill gas collection system also supplies three flares. The flares are utilized to combust and destroy the landfill gas that was not sent to the generators.

As with the generators, source testing results were available for the flare emissions, however to obtain a more conservative baseline condition, the AP-42 destruction efficiency was used. Based on AP-42 Document, Chapter 4.2 Municipal Waste Landfills, the destruction efficiency of the landfill gas-fired flares was estimated to be at 98%. Therefore, 2% of the VOC and reduced sulphur compounds in the landfill gas are not destroyed in the combustion reaction but are emitted to the atmosphere through the flare exhaust stacks.

The flare sources are included in the dispersion model with the following parameters:

- One (1) enclosed flare system, used to incinerate the landfill gases from a landfill gas collection system at a maximum volumetric gas flow rate of 0.57 standard 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, exhausting into the atmosphere through a stack, having an exit diameter of 2.1 m, extending 12.2 m above grade;
- One (1) enclosed flare system, used to incinerate the landfill gases from an expanded landfill gas collection system at a maximum volumetric gas flow rate of 1.04 standard 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, exhausting into the atmosphere through a stack, having an exit diameter of 2.7 metres, extending 12.2 metres above grade; and,
- One (1) candlestick flare system, used to incinerate the landfill gases from a landfill gas collection system at a maximum volumetric gas flow rate of 1.0 standard cubic metres per second based on a methane content of 50 percent by volume. The landfill flare exhausts into the atmosphere through a stack, having an exit diameter of 0.2 m, extending 10.4 m above grade.

The three flares at the WCEC facility have a maximum combined landfill gas firing rate of 2.61 cubic metres per second.

Other sources of emissions that have pending Certificate of Approval such as the SBR system for Leachate Treatment and the Waste Transfer Station have not been considered within the baseline evaluation as they currently do not exist and will not likely be fully functional within the 2012 baseline year. The potential impacts related to these sources, as well as all other future proposed sources from the preferred alternative footprint, will be evaluated within the Detailed Impact Assessment Report.

1.3.2 Off-Site Sources

In the vicinity of the landfill, there are no other major man-made sources for the majority of the VOC compounds found in the landfill gas. Benzene and other light aromatic compounds are the exception to this statement. Vehicles traveling on the major roadways adjacent to the landfill site (Carp Road and Highway 417) emit this type of compound through their tailpipes.

2. Landfill Footprint Study Areas

In accordance with the approved Terms of Reference (ToR), approved by the Minister, the generic On-Site and Site-Vicinity study areas for the proposed new landfill footprint at the WCEC are listed below:

On-Site:	the lands owned or optioned by WM and required for the new landfill. The Site is bounded by Highway 417, Carp Road and Richardson Side Road;
Site-Vicinity:	the lands in the vicinity of the site extending about 500 m in all directions; and,
Regional:	the lands within approximately 3 to 5 kilometres (km) of the Site for those discipline that require a larger analysis area (i.e., socio-economic, odour, etc.).

The study areas identified above were presented in the approved ToR with the commitment that these generic study areas would be modified during the EA to suit the requirements of each environmental component.

The evaluation considered the potential impacts from the baseline conditions at 24 receptor locations (See Figure 1a). From the 24-receptors identified, our dispersion modelling results focussed on 9 of the worst-case discrete receptor locations representing receptors of interest in the Site-Vicinity and the Regional study areas. Detailed results are presented for each of these 9 discrete receptor locations. The nine discrete receptor locations were considered in the modelling, and included nearby residences, schools, businesses, and other sensitive receptor locations. For all cases, humans were assumed to be present at these receptors for 24-hours per day. The locations of these discrete receptors are shown on Figure 1b.

The results for all other areas including the remainder of the original 24 discrete receptors are visually outlined within the isopleths provided in Figures 3 to 6. In addition, the modelling was performed using a receptor grid covering the Site-Vicinity and Regional study areas to produce isopleths of predicted concentrations. The receptor grid covers the lands within approximately 3 to 5 km of the WCEC sources.

3. Methodology

Based on the work plans presented in Appendix C of the approved ToR, the following sections outline the methodology for detailing the Landfill Gas VOC baseline condition for the WCEC.

3.1 Available Secondary Source Information Collection and Review

Available secondary sources of information were collected and reviewed by the Atmospheric Study Team to determine the landfill gas (VOC) baseline condition within the study area. The following sources of secondary information were collected and reviewed:

- Landfill Gas Assessment Ottawa Landfill Baseline Conditions Report, March 3,2005 (See Appendix A);
- VOC Emission Rates Calculations (Appendix B); and
- Landfill Gas Sampling and Monitoring Results (see Appendix C).

3.2 Process Undertaken

3.2.1 Landfill Gas Emission Rate Calculations

In order to predict impacts using numerical models, emission rates for the compounds of interest must first be developed. The United States Environmental Protection Agency's (U.S. EPA) Landfill Gas Emissions Model (LANDGEM) is typically used to estimate the emission rates for the 23 target landfill gas compounds as outlined in the approved ToR. The LANDGEM model was used to calculate landfill gas generation for the WCEC landfill for the 2010 calendar year; however, when compared to the metered landfill gas consumption data from the landfill gas-to-energy facility and the landfill gas flares, the amount of gas combusted exceeded the amount predicted by LANDGEM. Therefore, the metered consumption data was used in combination with the estimated collection efficiency of the landfill gas collection system to back calculate the amount of landfill gas generated by the landfill in 2010.

For the purposes of this baseline assessment, the 2010 gas production data was used as it represented the most recent year of data available at the time of the assessment. The use of the 2010 landfill gas production data are a conservative approach for the 2012 baseline year as landfill gas volumes will decline post-closure. The total landfill gas generated was calculated using the metered landfill gas consumption data from 2010 along with the assumed percentage of existing landfill with the gas collection system in place (100%), and the estimated efficiency of the landfill gas collection system (85%).

On-site measurements of the twenty-three target landfill gas compounds were taken June 10, 2004 and April 4, 2011, with multiple samples collected on each day. Typically, the quantity of the landfill gas in a properly maintained and balanced well field does not greatly change from year to year. At the landfill, however, a number of improvements were made to the landfill gas collection system during the period between 2004 and 2011 and therefore additional samples were collected in 2011 to supplement the 2004 data.

The two datasets (2004 and 2011) were reviewed against each other to note any changes in the landfill gas composition due to the improvements to the landfill gas collection system. The average concentration for each individual compound was calculated separately for the 2004 samples and the 2011 samples. The 2004 and 2011 concentrations were compared to one another, and the higher of the two average concentrations was used to develop the emission rate for each compound in the baseline assessment and will be utilized in the Detailed Impact Assessment.

The emission rates for each individual compound from the landfill mound were calculated by applying the measured concentration (in milligrams per cubic metre) from either 2004 or 2011 to the amount of landfill gas released fugitively from the landfill (in cubic metres per year).

The emission rates for each individual compound from the engine-generator sets and the landfill gas flares were calculated by applying the measured concentration (in milligrams per cubic metre) from either 2004 or 2011 to the maximum amount of landfill gas that can be consumed by each piece of equipment (in cubic metres per second). The calculated emissions are reduced by the destruction efficiency for each piece of equipment (98% for the flares and 97% for the engines).

The total landfill gas emission rate and the highest average vinyl chloride concentrations were used in the dispersion modelling. The use of the AP-42 destruction efficiencies allows for the scaling of emission rate for the remaining 22 compounds of interests relative to vinyl chloride results.

Further details regarding the emission rate calculations are provided in Attachment B.

3.2.2 Landfill Gas Calibration Factor

The LANDGEM Model has been developed as a landfill gas generation model and is not a landfill gas emission model. The approach taken in this assessment, 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 amount 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 an emission reduction factor to account for soil attenuation effects. This process involves examining a series of on-site ambient air quality measurements and using a numerical dispersion model to determine a predicted concentration at the sampling point under the same meteorological conditions. Guidance is provided in the MOE's Combined Assessment of Modelled and Monitored Results (CAMM) Technical Bulletin to determine the accuracy of the model predictions when matched against the on-site observations and the necessity of a calibration factor to refine emission rates. From discussions with the MOE, this is the preferred approach in order to investigate the appropriateness of the use of calibration factors for this site. If the dispersion model consistently overestimates the concentrations, a reduction factor can be developed to adjust the model output to more realistically reflect actual conditions. The assessment was performed using vinyl chloride and hydrogen sulphide monitoring results. Methodology details are included in Appendix A.

3.2.2.1 Vinyl Chloride Calibration Factor

Ambient downwind and upwind vinyl chloride samples were collected at various locations surrounding the landfill in 2004, 2007, 2008, 2009, 2010 and 2011. The analysis methodology outlined in the MOE's CAMM Technical Bulletin was followed to determine if the emission rate must be adjusted using a calibration factor. The results of the CAMM analysis show that there are no significant biases when comparing the AERMOD results to the monitoring results and therefore no calibration factor was developed or applied to the model results for vinyl chloride or any of the VOC compounds for this baseline assessment.

3.2.2.2 Hydrogen Sulphide Calibration Factor

Continuous ambient hydrogen sulphide sampling was done between June 21 and October 7 of 2011.Similarly to the vinyl chloride assessment, the analysis methodology outlined in the MOE's CAMM Technical Bulletin was followed to determine if the emission rate must be adjusted using a calibration factor. The results of the CAMM analysis show that there is a strong bias when comparing the AERMOD results to the monitoring results. For all instances, the predicted hydrogen sulphide concentration was higher than the measured concentration. The analysis resulted in the calculation of a reduction factor of 7.3.

From these results it appears that the calculation and application of a reduction factor for the hydrogen sulphide dispersion model is appropriate. However, in order to maintain a relatively conservative approach the factor was set as approximately 40% of the calculated value of 7.3, for a calibration value of 3. The emission factors for the hydrogen sulphide sources in this baseline assessment were divided by the 3 reduction factor to obtain an adjusted emission rate.

3.2.3 Dispersion Modelling

The landfill gas VOC baseline impacts from the existing landfill conditions were determined using a dispersion model and reasonable worst-case emission rates. Dispersion modelling was performed using the U.S. EPA's AERMOD dispersion model (AERMOD) to predict concentrations of LFG emitted from the WCEC existing landfill at various receptors in the vicinity. The AERMOD model is an advanced dispersion model that has been approved for use in Ontario by the Ministry of the Environment (MOE). 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. The modelling assessment was conducted in accordance with MOE's Guideline A11: "Air Dispersion Modelling Guideline for Ontario", March 2009.

Additional elements of the dispersion modelling assessment are discussed in the following sections.

3.2.3.1 VOC Compounds Modelled

The only VOC compound modelled was vinyl chloride. An average concentration of 5.11 mg/m^3 and the corrected landfill gas generation rate was used to calculate an emission flux rate or an emission rate for each source. The results for the twenty two other contaminants were scaled based on the vinyl chloride results, using the ratio of their corresponding measured concentration and the vinyl chloride concentration.

Scaling the dispersion model results was a possibility since the emissions from all sources are based on the concentration of contaminants within the landfill gas. Since the emissions from each source will maintain the same ratio to one another between contaminants, the percentage of contaminant released from each source will also be the same between contaminants. This approach allows for the scaling of the modelled results.

3.2.3.2 Sources Modelled

The sources included in the dispersion model were the five landfill-gas fired engines, the three flares, and the landfill mound, as described in Section 1.3. All five engines and three flares were assumed to be operating concurrently at maximum capacity, coupled with maximum fugitive emissions from the landfill mound. The locations of these sources are shown in Figure 1.

3.2.3.3 Meteorological Data

Five years of local meteorological data (2006-2010) were used in the AERMOD model. The meteorological data set was developed by the MOE's Environmental Monitoring and Reporting Branch (EMRB) for the WCEC facility. The data set was based on meteorological data collected from Environment Canada's Ottawa International Airport station and local land use information. 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 data set provided by the EMBR was used directly in the model, with no changes or alterations conducted by RWDI.

3.2.3.4 Area of Modelling

In order to assess compliance with Schedule 3 Standards under Reg. 419, 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. In this receptor grid the interval spacing was dependent on the receptor distance from on-site sources. The interval spacing was as follows:

Tier 1: .... 20 m spacing a minimum of 200 m from each source;
Tier 2: .... 50 m spacing up to 300 m from Tier 1;
Tier 3: .... 100 m spacing up to 500 m from Tier 2;
Tier 4: .... 200 m spacing up to 1,000 m from Tier 3; and,
Tier 5: .... 500 m spacing up to 3,000 m from Tier 4.

The property line of the WCEC Landfill facility was defined in the AERMOD dispersion model. In addition to the gridded receptors, discrete receptors were placed along the property line at 10 m intervals. Those receptors in the aforementioned grid that fell within the Ottawa Landfill property line were eliminated from consideration in the modelling. Each receptor in this grid was positioned at grade level. This approach is consistent with MOE guidance. The receptor grid was used to develop contour plots of mean predicted concentrations for vinyl chloride, benzene, and hydrogen sulphide as well as to assess compliance for all 23 contaminants in the study.

The evaluation considered the potential impacts from the baseline conditions at 24 receptor locations (See Figure 1a). From the 24-receptors identified, our dispersion modelling results focussed on 9 of the worst-case discrete receptor locations representing receptors of interest in the Site-Vicinity and the Regional study areas. Detailed results are presented for each of these 9 discrete receptor locations. The nine discrete receptor locations were considered in the modelling, including nearby residences, schools, businesses, and other sensitive receptor locations. For all cases, humans were assumed to be present at these receptors for 24-hours per day. The locations of these discrete receptors are shown on Figure 1b.

The results for all other areas including the remainder of the original 24 receptors areas selected are visually outlined within the isopleths provided in Figures 3 to 6. In addition, the modelling was performed using a receptor grid covering the Site-Vicinity and Regional study areas to produce isopleths of predicted concentrations. The receptor grid covers the lands within approximately 3 to 5 km of the Site sources.

Further details regarding the 9 worst-case receptor locations are provided in the following table. Detailed statistical analyses were performed on the results for vinyl chloride, benzene, and hydrogen sulphide at each of these sensitive receptors.

Table 2. Summary of Discrete Receptors

Receptor ID	Description	X-Co-ordinate	Y-Co-ordinate
R1	Nearest House – North	423722	5015711
R2	Nearest House – East	425095	5014365
R3	Nearest House – West	423121	5013942
R4	Nearest House – South	423999	5013673
R5	St. Stephen Catholic Elementary School	426965	5013887
R6	Huntleigh United Cemetery	423336	5016477
R7	Lloydalex Park	426103	5013580
R8	Terrace youth Residential Services	424510	5013872
R9	Nearest Sensitive Business Operation	423804	5016030

3.2.3.5 Terrain Data

Terrain information for the area surrounding the existing WCEC Landfill 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.

3.2.3.6 Building Information

The Building Profile Input Program (BPIP) is 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 BPIP model was run prior to running the AERMOD model in order to incorporate the potential building downwash effects.

3.2.3.7 Averaging Periods Used

Emissions were modelled for 24-hour and 1-hour averaging times, to correspond with the POI Limits for the various compounds. This approach is consistent with the MOE's Schedule 3 standards. Those compounds that do not have POI Limits were modelled using a 24-hour averaging period.

For certain compounds, the model output was scaled to produce results for the 10-minute averaging times, in order to be directly comparable to the relevant odour based criteria. The scaling factors were determined using Equation 1 below:

<u>Equation 1</u>

$$X_s = X_1 \left(\frac{t_p}{t_s}\right)^n$$

Where: X_s = 10-minute averaging period concentration;
X_p = 60-minute averaging period concentration;
t_l = long time interval (60-minute);
t_s = short time interval (10-minute); and
n = atmospheric stability-dependant exponent (n=0.28).

4. Landfill Gas Baseline Condition

4.1 Calibrated Dispersion Modelling Results

This section describes the existing landfill gas conditions in the study area, based on the dispersion modelling for the existing landfill operations. None of the landfill gas compounds (i.e., vinyl chloride, benzene, etc.) results have been calibrated. Only the hydrogen sulphide results have been calibrated using the calibration factor of 3, previously referred to in Section 3.2.2.

4.1.1 Predicted Concentrations at Discrete Receptors

Under the baseline conditions, with the existing landfill under final cover, the maximum vinyl chloride concentration at a discrete receptor was predicted to occur at Receptor R3 (Nearest House, West). The maximum 24-hour vinyl chloride concentration at R3 was predicted to be 0.041µg/m^3, which is less than its MOE POI Limit of 1 µg/m^3. Since the maximum predicted vinyl chloride concentration did not exceed the MOE's standard, a frequency analysis was not performed. Table 3, below, provides the maximum predicted concentration at each discrete receptor location, as well as the minimum, mean, and various percentile values. The vinyl chloride results were not calibrated.

Table 3. Modelling Results for Vinyl Chloride at Discrete Receptor Locations (24 hour averaging period in µg/m³)

	R1	R2	R3	R4	R5	R6	R7	R8	R9
Maximum	2.77E-02	2.53E-02	4.11E-02	2.42E-02	6.08E-03	9.06E-03	8.59E-03	2.33E-02	2.27E-02
Minimum	1.68E-06	3.48E-06	9.25E-07	1.88E-06	9.99E-07	8.49E-07	1.38E-06	2.28E-06	1.34E-06
Mean	2.08E-03	1.83E-03	1.84E-03	1.20E-03	3.19E-04	6.44E-04	4.33E-04	1.37E-03	1.57E-03
99th Percentile	1.46E-02	1.19E-02	1.99E-02	1.14E-02	2.99E-03	5.70E-03	3.63E-03	1.01E-02	1.10E-02
95th Percentile	8.99E-03	7.26E-03	1.04E-02	6.02E-03	1.67E-03	3.44E-03	2.03E-03	5.81E-03	7.02E-03
90th Percentile	6.77E-03	5.17E-03	6.28E-03	3.98E-03	1.02E-03	2.28E-03	1.35E-03	4.04E-03	5.30E-03
75th Percentile	3.19E-03	2.56E-03	1.48E-03	1.25E-03	3.27E-04	6.58E-04	4.94E-04	1.69E-03	2.37E-03
50th Percentile	2.63E-04	7.64E-04	4.72E-06	1.18E-04	4.57E-05	1.30E-05	7.08E-05	4.04E-04	1.43E-04

The same statistics have been produced for the benzene and hydrogen sulphide results. Table4 present the results for 24-hour benzene. The maximum 24-hour benzene concentration at R3 was predicted to be 0.029 µg/m³, which is less than its MOE POI Limit of 2.3 µg/m³. The benzene results were not calibrated.

Tables 5 and 6 present the results for 10-minute hydrogen sulphide, and 24-hour hydrogen sulphide, respectively. A calibration factor of 3 was applied to the hydrogen sulphide results only. The calibrated maximum 24-hour and 10-minute hydrogen sulphide concentrations at R3 were predicted to be 0.771 µg/m³ and 8.83 µg/m³, respectively. The maximum 24-hour and 10 minute predicted concentrations for hydrogen sulphide do not exceed the 24-hour averaging period MOE POI Limit of 7 µg/m³ or the 10-minute averaging period MOE POI Limit of 13 µg/m³.

Table 4. Modelling Results for Benzene at Discrete Receptor Locations (24 hour averaging period in µg/m³)

	R1	R2	R3	R4	R5	R6	R7	R8	R9
Maximum	1.96E-02	1.79E-02	2.90E-02	1.71E-02	4.30E-03	6.40E-03	6.08E-03	1.64E-02	1.60E-02
Minimum	1.19E-06	2.46E-06	6.54E-07	1.33E-06	7.06E-07	6.01E-07	9.73E-07	1.61E-06	9.45E-07
Mean	1.47E-03	1.29E-03	1.30E-03	8.51E-04	2.25E-04	4.55E-04	3.06E-04	9.67E-04	1.11E-03
99th Percentile	1.03E-02	8.39E-03	1.41E-02	8.03E-03	2.12E-03	4.03E-03	2.56E-03	7.17E-03	7.76E-03
95th Percentile	6.36E-03	5.14E-03	7.38E-03	4.25E-03	1.18E-03	2.43E-03	1.43E-03	4.11E-03	4.96E-03
90th Percentile	4.79E-03	3.65E-03	4.44E-03	2.81E-03	7.25E-04	1.61E-03	9.53E-04	2.86E-03	3.75E-03
75th Percentile	2.26E-03	1.81E-03	1.05E-03	8.86E-04	2.31E-04	4.65E-04	3.49E-04	1.20E-03	1.68E-03
50th Percentile	1.86E-04	5.40E-04	3.34E-06	8.33E-05	3.23E-05	9.21E-06	5.01E-05	2.86E-04	1.01E-04

Table 5. Calibrated Modelling Results for Hydrogen Sulphide at Discrete Receptor Locations (10-Minute averaging period in µg/m^3)

	R1	R2	R3	R4	R5	R6	R7	R8	R9
Maximum	3.24E+00	3.09E+00	8.83E+00	3.87E+00	1.53E+00	2.00E+00	1.63E+00	3.24E+00	2.76E+00
Minimum	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mean	6.41E-02	5.66E-02	5.66E-02	3.72E-02	9.86E-03	1.99E-02	1.34E-02	4.23E-02	4.85E-02
99th Percentile	1.98E+00	1.39E+00	1.15E+00	9.97E-01	1.81E-01	7.55E-01	2.59E-01	1.08E+00	1.47E+00
95th Percentile	2.42E-01	1.90E-01	1.37E-01	1.10E-01	2.54E-02	2.89E-02	3.76E-02	1.35E-01	1.61E-01
90th Percentile	4.18E-02	9.51E-02	2.49E-02	4.37E-02	1.07E-02	8.72E-04	1.62E-02	6.11E-02	2.66E-02
75th Percentile	3.35E-04	3.03E-02	1.55E-04	6.21E-04	1.99E-04	1.44E-04	3.54E-04	1.51E-02	2.59E-04
50th Percentile	2.42E-04	6.66E-04	1.08E-04	1.78E-04	9.42E-05	9.70E-05	1.39E-04	3.12E-04	1.82E-04

Table 6. Calibrated Modelling Results for Hydrogen Sulphide at Discrete Receptor Locations (24 hour averaging period in µg/m^3)

	R1	R2	R3	R4	R5	R6	R7	R8	R9
Maximum	5.21E-01	4.75E-01	7.71E-01	4.55E-01	1.14E-01	1.70E-01	1.61E-01	4.37E-01	4.26E-01
Minimum	3.16E-05	6.53E-05	1.74E-05	3.52E-05	1.88E-05	1.60E-05	2.58E-05	4.27E-05	2.51E-05
Mean	3.90E-02	3.43E-02	3.45E-02	2.26E-02	5.98E-03	1.21E-02	8.13E-03	2.57E-02	2.95E-02
99th Percentile	2.73E-01	2.23E-01	3.74E-01	2.13E-01	5.62E-02	1.07E-01	6.81E-02	1.90E-01	2.06E-01
95th Percentile	1.69E-01	1.36E-01	1.96E-01	1.13E-01	3.13E-02	6.45E-02	3.81E-02	1.09E-01	1.32E-01
90th Percentile	1.27E-01	9.70E-02	1.18E-01	7.48E-02	1.92E-02	4.29E-02	2.53E-02	7.59E-02	9.96E-02
75th Percentile	6.00E-02	4.80E-02	2.78E-02	2.35E-02	6.15E-03	1.24E-02	9.27E-03	3.18E-02	4.46E-02
50th Percentile	4.94E-03	1.43E-02	8.86E-05	2.21E-03	8.57E-04	2.45E-04	1.33E-03	7.59E-03	2.68E-03

The mean and maximum predicted concentration for the remaining compounds were scaled based on the vinyl chloride results. The results for all compounds are summarized the following sections. None of the compounds were predicted to exceed their corresponding MOE POI limit at any of the off-site locations.

4.1.2 Maximum and Mean Predicted 24-Hour Concentrations

Maximum 24-hour concentrations were predicted for vinyl chloride for comparison with the MOE POI Limit. In addition, the mean 24-hour vinyl chloride concentration over the 5-year modelling period was calculated from the dispersion modelling results. The maximum concentration provides an indication of the worst-case results that may occur once in the 5-year modelled period. The mean concentrations provide an indication of the typical conditions that will occur over the entire 5-year modelled period. The results for all other compounds were based on scaling relative to the maximum predicted vinyl chloride concentration.

Table 7 and Table 8 summarize the maximum and mean predicted concentrations for each of the 20 compounds in the assessment with 24-hour standards or criteria. Two contaminants, 1,1,2,2-

Tetrachloroethane and Bromodichloromethane, do not have standards or criteria available for comparison. The 24-hour average concentrations are also presented for these two compounds. Table 7 presents the maximum and mean predicted concentrations at the worst-case location along the property line or off-site. Table 8 presents the maximum and mean predicted concentrations occurring at the worst-impacted discrete receptor. None of the LFG compounds have predicted concentrations exceeding their corresponding MOE POI standard or criterion.

Contour plots showing the mean 24-hour average concentrations for vinyl chloride, benzene and hydrogen sulphide are presented in Figures 3, 4 and 5. These contours are based on the AERMOD modelling results over the entire receptor grid. These values are based on the mean of the concentrations predicted for each hour in the 5-year modelling period. The highest concentrations were predicted to occur at or near the property line along Carp Road. For all receptors in the grid, the mean 24-hour vinyl chloride, benzene and hydrogen sulphide concentrations are much lower than their corresponding 24-hour averaging period MOE POI standard of 1 µg/m^3, 2.3 µg/m^3 and 7 µg/m^3, respectively.

Table 7. Calibrated Maximum and Mean Predicted 24-HourConcentrations at the Worst-Case Location along the Property Line of Off-site

CAS #	Compounds	Average Concentration in Landfill Gas (mg/m³)	Averaging Period (hours)	MOE POI Limit (µg/m³)	Maximum Predicted Concentration (µg/m³)	Percentage of MOE POI Limit (%)	Mean Predicted Concentration (µg/m³)	Percentage of MOE POI Limit (%)
75-01-4	Vinyl Chloride/Chloroethene	5.11	24 Hour	1	1.66E-02	2%	0.002	0%
75-00-3	Chloroethane	1.34	24 Hour	5600	4.32E-03	<0.1%	0.001	<0.1%
75-35-4	1,1-Dichloroethylene	0.17	24 Hour	10	5.43E-04	<0.1%	0.000	<0.1%
75-09-2	Dichloromethane	2.43	24 Hour	220	7.88E-03	<0.1%	0.001	<0.1%
156-60-5	1,2-Dichloroethene (Trans)	0.45	24 Hour	105	1.47E-03	<0.1%	0.000	<0.1%
75-34-3	1,1-Dichloroethane	4.10	24 Hour	165	1.33E-02	<0.1%	0.002	<0.1%
156-59-2	1,2-Dichloroethene (Cis)	9.63	24 Hour	105	3.12E-02	<0.1%	0.004	<0.1%
78-92-2	sec-Butyl Alcohol/2-Butanol (as n-Butanol)	45.70	24 Hour	920	1.48E-01	<0.1%	0.018	<0.1%
67-66-3	Chloroform/Trichloromethane	0.29	24 Hour	1	9.27E-04	<0.1%	0.000	<0.1%
71-55-6	1,1,1-Trichloroethane	0.16	24 Hour	115,000	5.12E-04	<0.1%	0.000	<0.1%
56-23-5	Carbon Tetrachloride	0.03	24 Hour	2.4	8.57E-05	<0.1%	0.000	<0.1%
71-43-2	Benzene	3.62	24 Hour	2.3	1.17E-02	0.5%	0.001	<0.1%
107-06-2	1,2-Dichloroethane	0.02	24 Hour	2	5.23E-05	<0.1%	0.000	<0.1%
79-01-6	Trichloroethylene	2.76	24 Hour	12	8.94E-03	<0.1%	0.001	<0.1%
79-00-5	1,1,2-Trichloroethane	0.02	24 Hour	0.31	6.66E-05	<0.1%	0.000	<0.1%
127-18-4	Tetrachloroethylene	8.36	24 Hour	360	2.71E-02	<0.1%	0.003	<0.1%
106-93-4	Ethylene Dibromide	0.01	24 Hour	3	1.74E-05	<0.1%	0.000	<0.1%
7783-06-4	Hydrogen Sulphide[1]	288	24 Hour	7	3.11E-01	4%	0.038	0.5%
79-34-5	1,1,2,2-Tetrachloroethane	0.017	n/a	n/a	5.37E-05	n/a	n/a	n/a
75-27-4	Bromodichloromethane	0.002	n/a	n/a	4.98E-06	n/a	n/a	n/a

Notes: [1] Hydrogen sulphide is the only compound concentration to which a calibration factor of 3 was applied.

Table 8. Calibrated Maximum and Mean Predicted24-Hour Concentrations at the Worst-Case Discrete Receptor Location (R3)

CAS #	Compounds	Average Concentration of Landfill Gas (mg/m³)	Averaging Period (hours)	MOE POI Limit (µg/m³)	Maximum Predicted Concentration (µg/m³)	Percentage of MOE POI Limit (%)	Mean Predicted Concentration (µg/m³)	Percentage of MOE POI Limit (%)
75-01-4	Vinyl Chloride/Chloroethene	5.11	24 Hour	1	4.11E-02	4%	1.84E-03	0%
75-00-3	Chloroethane	1.34	24 Hour	5600	1.07E-02	<0.1%	4.80E-04	<0.1%
75-35-4	1,1-Dichloroethylene	0.17	24 Hour	10	1.35E-03	<0.1%	6.03E-05	<0.1%
75-09-2	Dichloromethane	2.43	24 Hour	220	1.95E-02	<0.1%	8.75E-04	<0.1%
156-60-5	1,2-Dichloroethene (Trans)	0.45	24 Hour	105	3.65E-03	<0.1%	1.63E-04	<0.1%
75-34-3	1,1-Dichloroethane	4.10	24 Hour	165	3.29E-02	<0.1%	1.48E-03	<0.1%
156-59-2	1,2-Dichloroethene (Cis)	9.63	24 Hour	105	7.73E-02	<0.1%	3.46E-03	<0.1%
78-92-2	sec-Butyl Alcohol/2-Butanol (as n-Butanol)	45.70	24 Hour	920	3.67E-01	<0.1%	1.64E-02	<0.1%
67-66-3	Chloroform/Trichloromethane	0.29	24 Hour	1	2.30E-03	0%	1.03E-04	<0.1%
71-55-6	1,1,1-Trichloroethane	0.16	24 Hour	115,000	1.27E-03	<0.1%	5.69E-05	<0.1%
56-23-5	Carbon Tetrachloride	0.03	24 Hour	2.4	2.12E-04	<0.1%	9.51E-06	<0.1%
71-43-2	Benzene	3.62	24 Hour	2.3	2.90E-02	1%	1.30E-03	<0.1%
107-06-2	1,2-Dichloroethane	0.02	24 Hour	2	1.30E-04	<0.1%	5.81E-06	<0.1%
79-01-6	Trichloroethylene	2.76	24 Hour	12	2.22E-02	0%	9.92E-04	<0.1%
79-00-5	1,1,2-Trichloroethane	0.02	24 Hour	0.31	1.65E-04	<0.1%	7.39E-06	<0.1%
127-18-4	Tetrachloroethylene	8.36	24 Hour	360	6.71E-02	<0.1%	3.01E-03	<0.1%
106-93-4	Ethylene Dibromide	0.01	24 Hour	3	4.31E-05	<0.1%	1.93E-06	<0.1%
7783-06-4	Hydrogen sulphide [1]	288	24 Hour	7	7.71E-01	11%	3.45E-02	0%
79-34-5	1,1,2,2-Tetrachloroethane	0.017	n/a	n/a	1.33E-04	n/a	5.96E-06	n/a
75-27-4	Bromodichloromethane	0.002	n/a	n/a	1.23E-05	n/a	5.53E-07	n/a

Notes: [1] Hydrogen sulphide is the only compound concentration to which a calibration factor of 3 was applied.

4.1.3 Maximum and Mean Predicted 10-Minute Concentrations

Five of the contaminants of concern have 10-minute odour-based standards under Reg. 419. According to MOE guidance, impacts for the 10-minute averaging period are to be assessed at odour-sensitive locations only, not at the property line. Therefore, only the discrete off-site sensitive receptors were considered in the analysis of 10-minute concentrations. The maximum and mean predicted 10-minute concentrations for these five compounds are summarized in Table 9. A calibration factor was applied to hydrogen sulphide only.

All the contaminant results were scaled relative to the vinyl chloride maximum and mean predicted concentrations at Receptor 3, as this is the worst case maximum and mean concentration. All results were compared to their 10-minute odour based standard or guideline.

Table 9. Calibrated Maximum and Mean Predicted 10-minute Concentrations at the Worst-Case Discrete Receptor (R3) compared to 10-minute Odour based Standard/Guideline

CAS #	Compounds	Average Sample Concentration[1] (mg/m³)	Averaging Period (hours)	MOE POI Limit (µg/m³)	Calibrated Maximum Predicted Concentration (µg/m³)	Percentage of MOE POI Limit (%)	Calibrated Mean Predicted Concentration (µg/m³)	Percentage of MOE POI Limit (%)
74-93-1	Methyl Mercaptan (as Mercaptans)	0.005	10-Min	13	4.42E-04	<0.1%	3.10E-06	<0.1%
75-08-1	Ethyl Mercaptan (as Mercaptans)	7.75	10-Min	13	7.13E-01	5.5%	5.00E-03	<0.1%
111-65-9	Octane	5.47	10-Min	61,800	5.03E-01	<0.1%	3.53E-03	<0.1%
75-18-3	Dimethyl Sulphide	2.35	10-Min	30	2.16E-01	0.72%	1.51E-03	<0.1%
7783-06-4	Hydrogen Sulphide [1]	288	10-Min	13	8.83	68%	1.86E-01	1.43%

Notes: *[1] Average sample concentrations in landfill gas are based on results of LFG analysis from samples taken in April, 2011.*
[2] Hydrogen sulphide is the only compound concentration to which a calibration of 3 was applied.

5. Conclusions

RWDI AIR Inc. (RWDI) was retained by Waste Management of Canada Corporation (WM) to determine the landfill gas volatile organic compounds (VOC) baseline condition for the existing landfill site at the proposed West Carleton Environmental Centre (WCEC) owned by WM. The existing landfill site was to be closed as of September 30, 2011. The baseline year has been set as 2012, which represents the first full year post-closure of the existing landfill. This report outlines the results of our baseline assessment for the landfill gas volatile organic compounds (VOC) impacts at and beyond the property line.

When the existing landfill closes in 2011, the significant landfill gas sources will be the existing landfill mound, which will be completely covered with final cover (clay clap), the landfill gas-fired generators and the landfill flares. The emission rates for each of the 23 compounds of interest were calculated based on the measured concentrations in the raw landfill gas.

The U.S. EPA's AERMOD dispersion modelling program was used in conjunction with local meteorological data and calculated landfill gas emission rates to develop a baseline (existing conditions) modelling scenario. A calibration factor was not deemed necessary for VOCs, but was deemed necessary for sulphur compounds. A calibration factor was therefore applied to the modelling of hydrogen sulphide only to account for the fact that the emissions were based on the amount of landfill gas generated, not the amount of landfill gas fugitively released. The effect of gas passing through several feet of moistened soil, full of microbes and reactive minerals greatly reduces the amount of many gas compounds. The results of this calibrated modelling indicated that the maximum impacts at the nearby discrete sensitive receptor, the property line receptor and off-site location would be less than the MOE POI Limits for all twenty three assessed compounds.

6. Recommendations/Future Work

The baseline will be included in the final assessment by including modelled results for the existing landfill as well as the proposed landfill and if there are minor alterations in the reduction factor, the model will alter the baseline along with the proposed case.

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7. References

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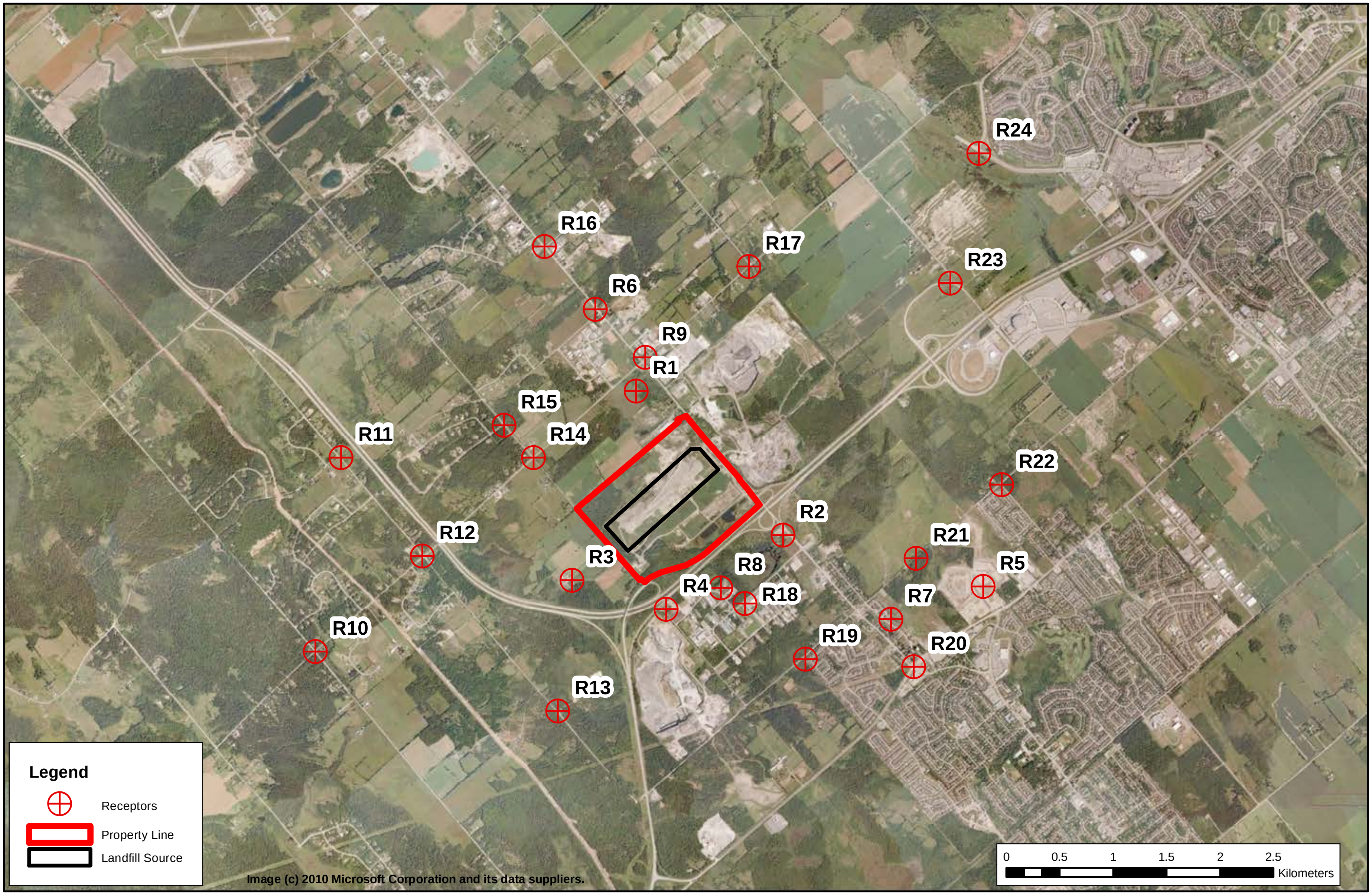
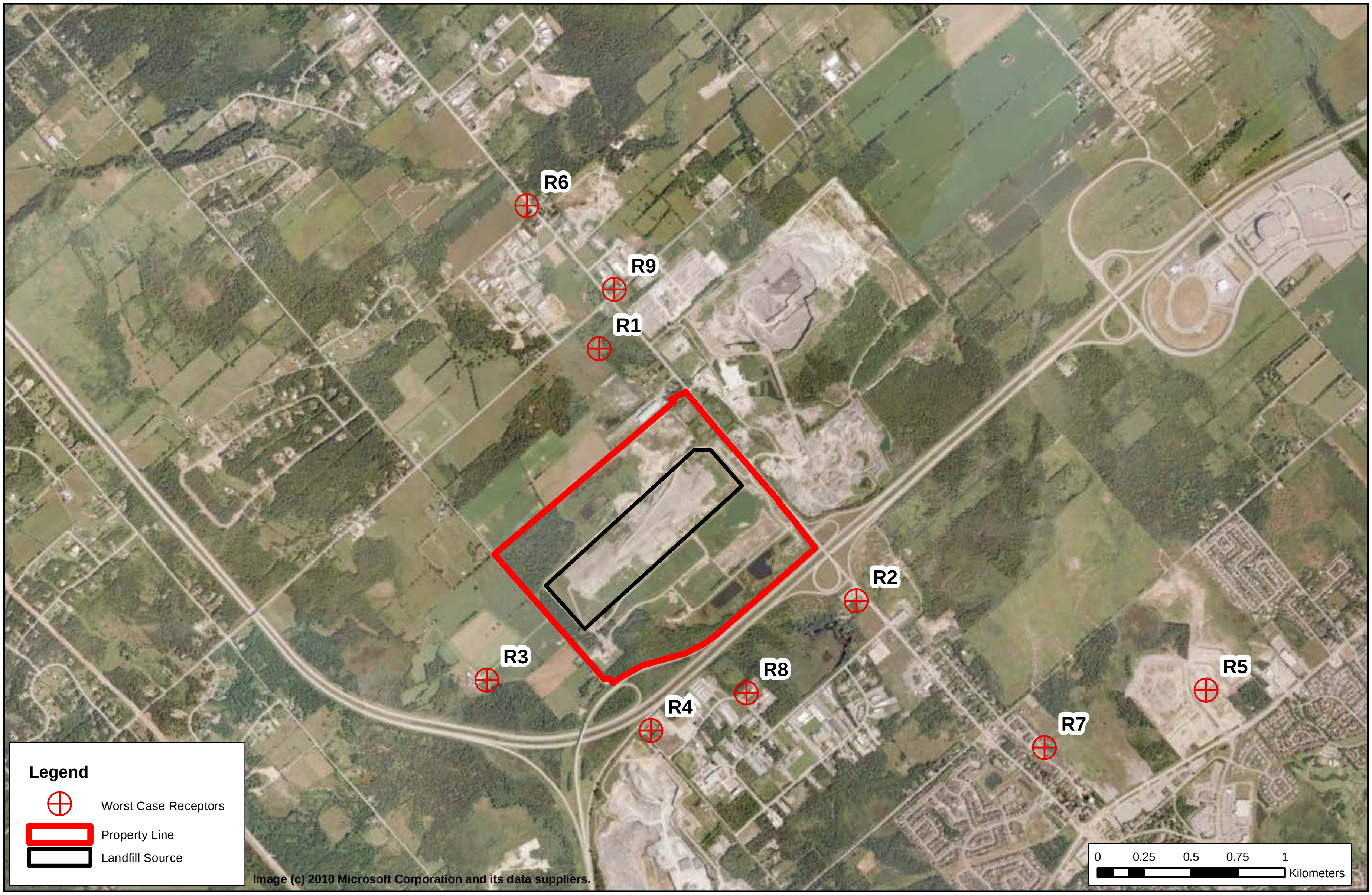
Figures



Site Plan Showing Modelled Area Source and Discrete Receptor Locations	True North	Drawn by: CAM	Fig: **1a**
		Approx. Scale: 1:52,500	
West Carleton Environmental Centre - LFG Baseline Report - Ottawa, Ontario	Project #1100798	Date Revised: Nov. 29, 2011	

RWDI



Site Plan Showing Modelled Area Source and Worst-Case Discrete Receptor Locations

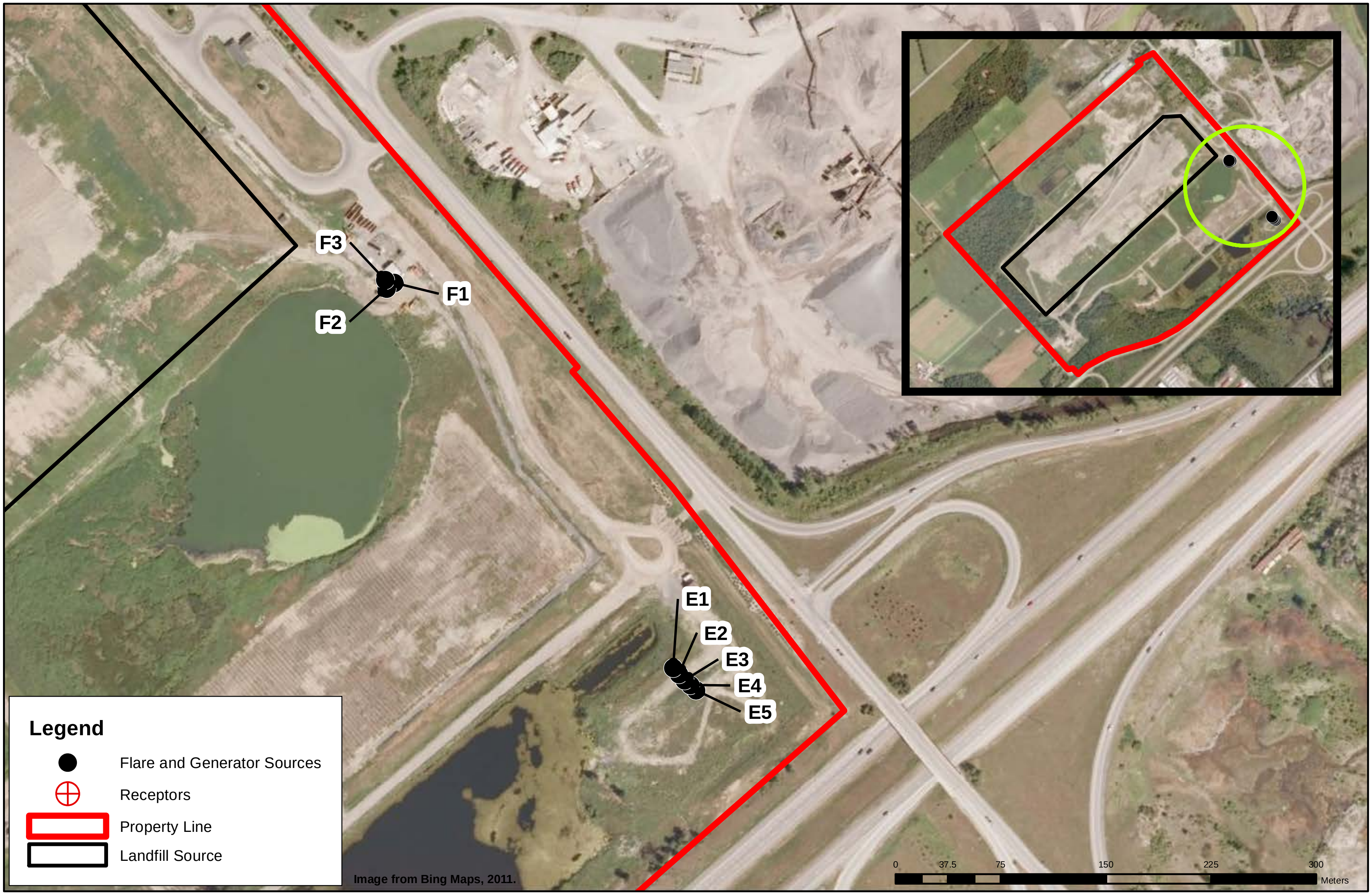
West Carleton Environmental Centre - LFG Baseline Report - Ottawa, Ontario

True North

Project #1100798

Drawn by: CAM	Fig: **1b**
Approx. Scale: 1:30,000	
Date Revised: Nov. 29, 2011	

RWDI



Site Plan Showing Modelled Point Source Locations

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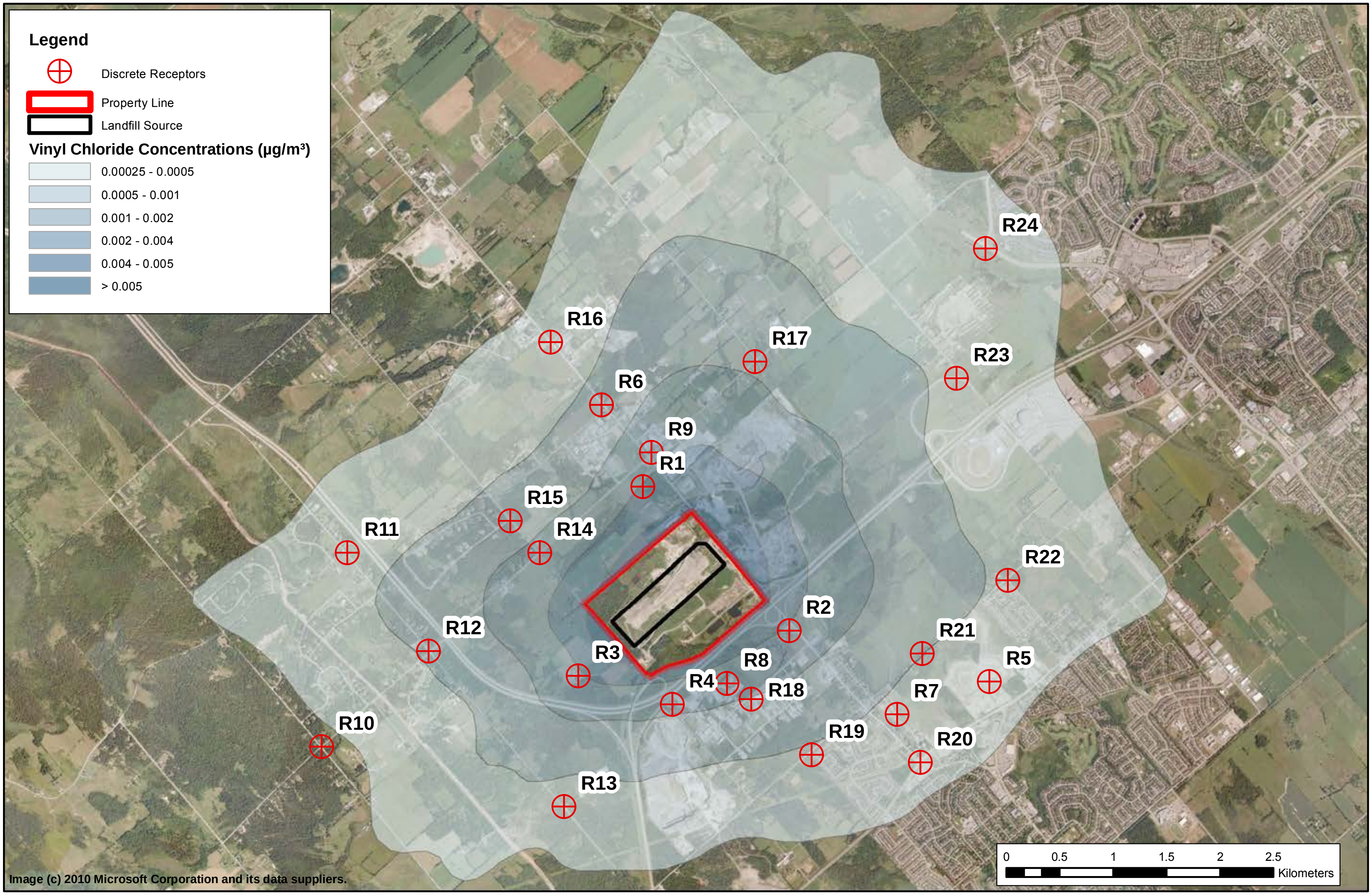
True North

Project #1100798

Drawn by: CAM	Fig: 2
Approx. Scale: 1:4,000	
Date Revised: Jun. 27, 2011	

RWDI



Isopleths of the Mean Predicted Vinyl Chloride Concentration - 24-Hour Averaging Period

*Schedule 3 MOE POI Limit for Vinyl Chloride = 1µg/m³

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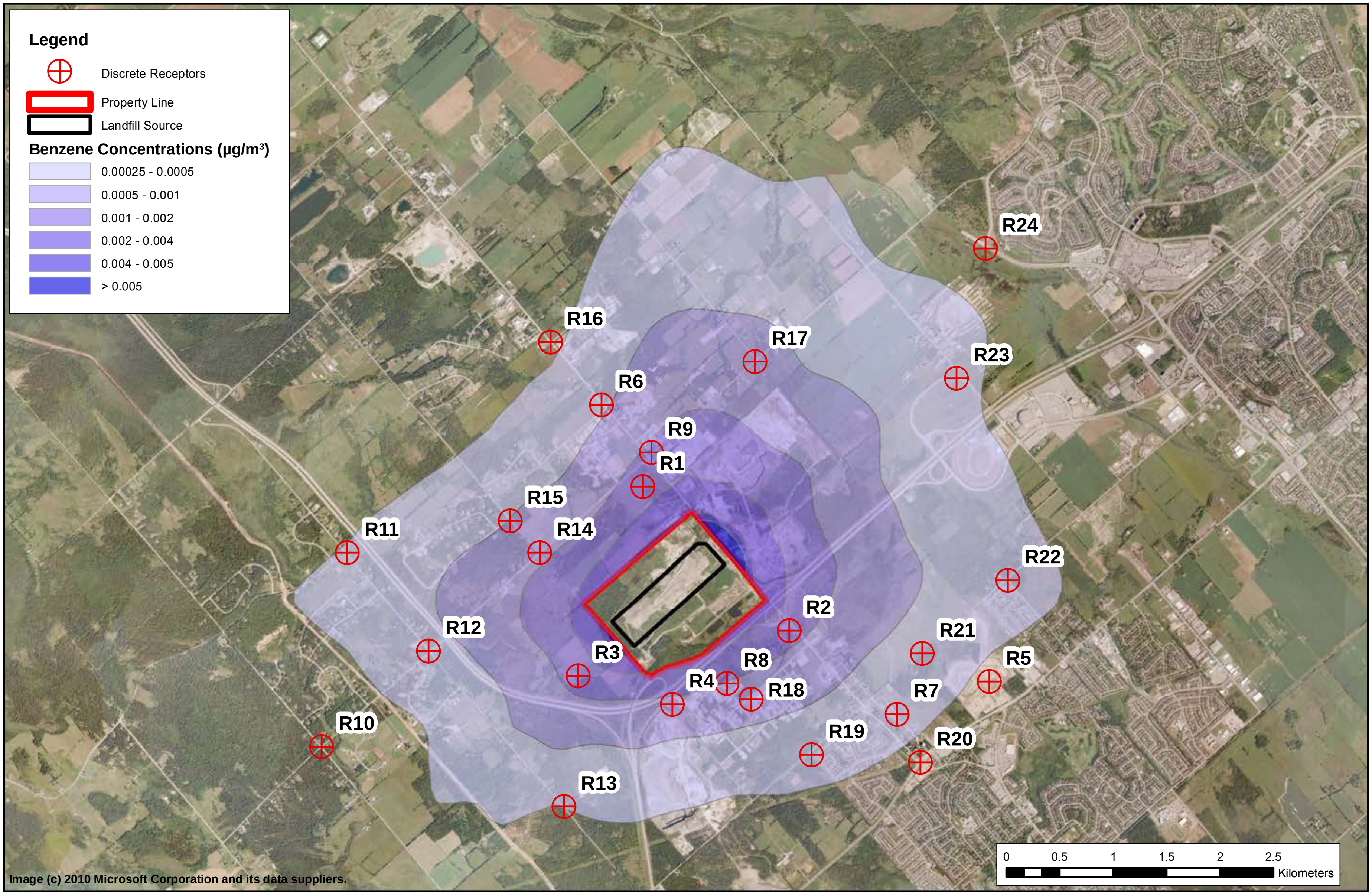
True North	Drawn by: CAM	Fig: 3	RWDI
	Approx. Scale: 1:52,500		
Project #1100798	Date Revised: Nov. 29, 2011		



Isopleths of the Mean Predicted Benzene Concentration - 24-Hour Averaging Period

*Schedule 3 MOE POI Limit for Benzene = 2.3µg/m³

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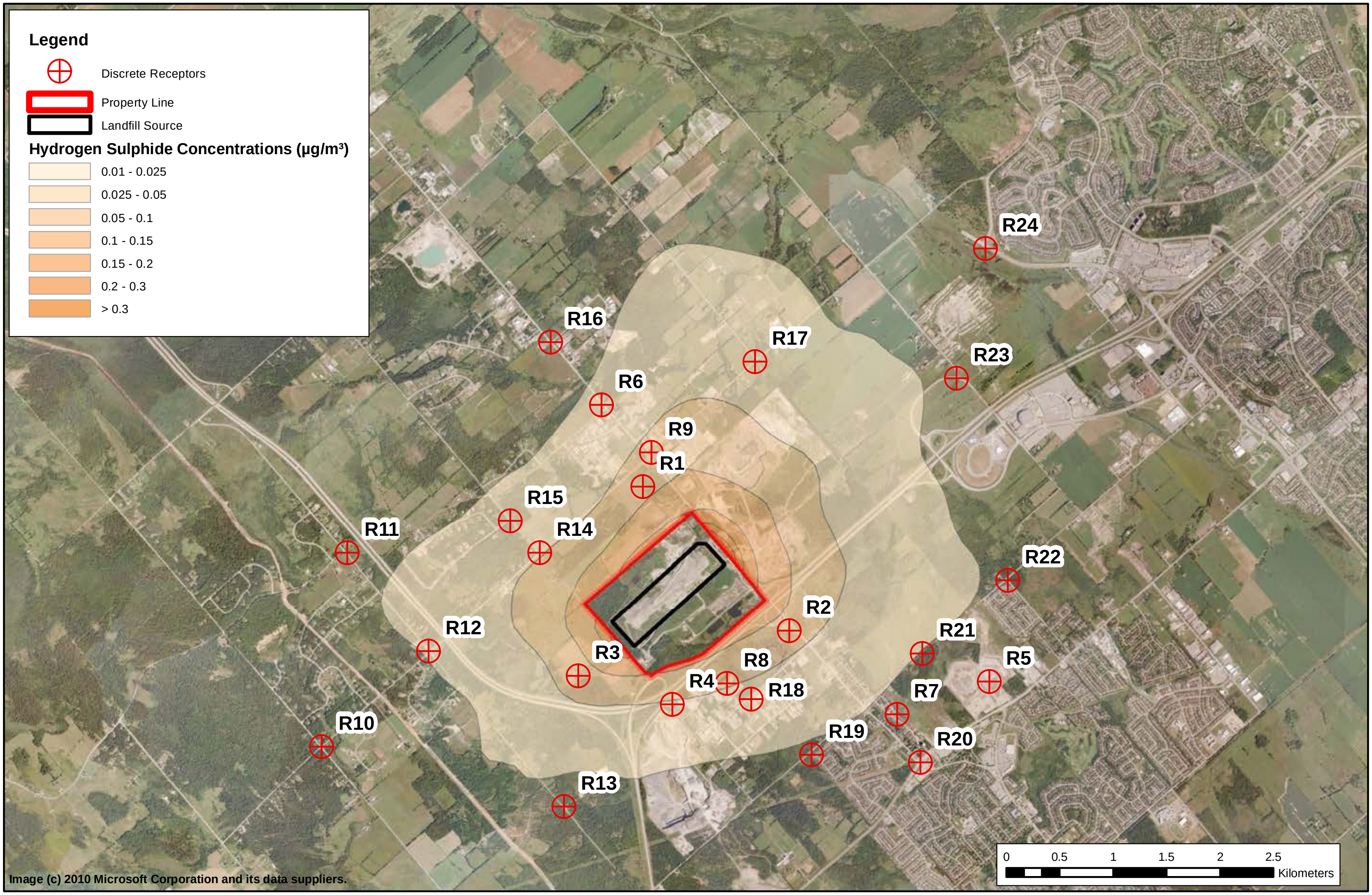
Project #1100798

Drawn by: CAM	Fig: 4
Approx. Scale: 1:52,500	
Date Revised: Nov. 29, 2011	

RWDI



Isopleths of the Mean Predicted Hydrogen Sulphide Concentration - 24-Hour Averaging Period

*Schedule 3 MOE POI Limit for Hydrogen Sulphide = 7µg/m³

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True North

Project #1100798

Drawn by: CAM	Fig: 5
Approx. Scale:	1:52,500
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Tables

5.1 Source Summary Table (by source)

RWDI Project #1100798

Source ID [1]	Source Type [1]	Source Description	Source Data						LFG		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)	Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions %
E1	Point	LFG Engine #1 - CAT 3516	2.97	356	0.4	23.6	13.4	5.5	424756	5014676	1,1,1-Trichloroethane	71-55-6	6.65E-07	24	MB	Above-Average	1%
											1,1,2,2-Tetrachloroethane	79-34-5	7.14E-08	24	MB	Above-Average	1%
											1,1,2-Trichloroethane	79-00-5	8.64E-08	24	MB	Above-Average	1%
											1,1-Dichloroethane	75-34-3	1.72E-05	24	MB	Above-Average	1%
											1,1-Dichloroethylene	75-35-4	7.05E-07	24	MB	Above-Average	1%
											1,2-Dichloroethane	107-06-2	6.79E-08	24	MB	Above-Average	1%
											1,2-Dichloroethene (Cis)	156-59-2	4.04E-05	24	MB	Above-Average	1%
											1,2-Dichloroethene (Trans)	156-60-5	1.91E-06	24	MB	Above-Average	1%
											Benzene	71-43-2	1.52E-05	24	MB	Above-Average	1%
											Bromodichloromethane	75-27-4	6.46E-09	24	MB	Above-Average	1%
											Carbon Tetrachloride	56-23-5	1.11E-07	24	MB	Above-Average	1%
											Chloroethane	75-00-3	5.61E-06	24	MB	Above-Average	1%
											Chloroform/Trichloromethane	67-66-3	1.20E-06	24	MB	Above-Average	1%
											Dichloromethane	75-09-2	1.02E-05	24	MB	Above-Average	1%
											Dimethyl sulfide	75-18-3	9.85E-06	24	MB	Above-Average	1%
											Ethyl Mercaptan	75-08-1	3.25E-08	24	MB	Above-Average	1%
											Ethylene Dibromide	106-93-4	2.10E-08	24	MB	Above-Average	1%
											Hydrogen sulfide	04-06-7783	1.21E-03	24	MB	Above-Average	1%
											Methyl Mercaptan	74-93-1	2.02E-08	24	MB	Above-Average	1%
											Octane	111-65-9	3.65E-05	24	MB	Above-Average	1%
											sec-Butyl Alcohol/2-Butanol	78-92-2	1.92E-04	24	MB	Above-Average	1%
											Tetrachloroethylene	127-18-4	3.51E-05	24	MB	Above-Average	1%
											Trichloroethylene	79-01-6	1.16E-05	24	MB	Above-Average	1%
											Vinyl Chloride/Chloroethene	75-01-4	2.15E-05	24	MB	Above-Average	1%
E2	Point	LFG Engine #2 - CAT 3516	2.97	356	0.4	23.6	13.4	5.5	424760	5014671	1,1,1-Trichloroethane	71-55-6	6.65E-07	24	MB	Above-Average	1%
											1,1,2,2-Tetrachloroethane	79-34-5	7.14E-08	24	MB	Above-Average	1%
											1,1,2-Trichloroethane	79-00-5	8.64E-08	24	MB	Above-Average	1%
											1,1-Dichloroethane	75-34-3	1.72E-05	24	MB	Above-Average	1%
											1,1-Dichloroethylene	75-35-4	7.05E-07	24	MB	Above-Average	1%
											1,2-Dichloroethane	107-06-2	6.79E-08	24	MB	Above-Average	1%
											1,2-Dichloroethene (Cis)	156-59-2	4.04E-05	24	MB	Above-Average	1%
											1,2-Dichloroethene (Trans)	156-60-5	1.91E-06	24	MB	Above-Average	1%
											Benzene	71-43-2	1.52E-05	24	MB	Above-Average	1%
											Bromodichloromethane	75-27-4	6.46E-09	24	MB	Above-Average	1%
											Carbon Tetrachloride	56-23-5	1.11E-07	24	MB	Above-Average	1%
											Chloroethane	75-00-3	5.61E-06	24	MB	Above-Average	1%
											Chloroform/Trichloromethane	67-66-3	1.20E-06	24	MB	Above-Average	1%
											Dichloromethane	75-09-2	1.02E-05	24	MB	Above-Average	1%
											Dimethyl sulfide	75-18-3	9.85E-06	24	MB	Above-Average	1%
											Ethyl Mercaptan	75-08-1	3.25E-08	24	MB	Above-Average	1%
											Ethylene Dibromide	106-93-4	2.10E-08	24	MB	Above-Average	1%
											Hydrogen sulfide	04-06-7783	1.21E-03	24	MB	Above-Average	1%
											Methyl Mercaptan	74-93-1	2.02E-08	24	MB	Above-Average	1%
											Octane	111-65-9	3.65E-05	24	MB	Above-Average	1%
											sec-Butyl Alcohol/2-Butanol	78-92-2	1.92E-04	24	MB	Above-Average	1%
											Tetrachloroethylene	127-18-4	3.51E-05	24	MB	Above-Average	1%
											Trichloroethylene	79-01-6	1.16E-05	24	MB	Above-Average	1%
											Vinyl Chloride/Chloroethene	75-01-4	2.15E-05	24	MB	Above-Average	1%

Source ID [1]	Source Type [1]	Source Description	Source Data						LFG		Emission Data						
			Stack Volumetric Flow Rate (Am³/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 %
E3	Point	LFG Engine #3 - CAT 3520	6.48	445	0.4	51.6	13.4	5.5	424764	5014667	1,1,1-Trichloroethane	71-55-6	1.33E-06	24	MB	Above-Average	2%
											1,1,2,2-Tetrachloroethane	79-34-5	1.43E-07	24	MB	Above-Average	2%
											1,1,2-Trichloroethane	79-00-5	1.73E-07	24	MB	Above-Average	2%
											1,1-Dichloroethane	75-34-3	3.45E-05	24	MB	Above-Average	2%
											1,1-Dichloroethylene	75-35-4	1.41E-06	24	MB	Above-Average	2%
											1,2-Dichloroethane	107-06-2	1.36E-07	24	MB	Above-Average	2%
											1,2-Dichloroethene (Cis)	156-59-2	8.09E-05	24	MB	Above-Average	2%
											1,2-Dichloroethene (Trans)	156-60-5	3.82E-06	24	MB	Above-Average	2%
											Benzene	71-43-2	3.04E-05	24	MB	Above-Average	2%
											Bromodichloromethane	75-27-4	1.29E-08	24	MB	Above-Average	2%
											Carbon Tetrachloride	56-23-5	2.22E-07	24	MB	Above-Average	2%
											Chloroethane	75-00-3	1.12E-05	24	MB	Above-Average	2%
											Chloroform/Trichloromethane	67-66-3	2.41E-06	24	MB	Above-Average	2%
											Dichloromethane	75-09-2	2.04E-05	24	MB	Above-Average	2%
											Dimethyl sulfide	75-18-3	1.97E-05	24	MB	Above-Average	2%
											Ethyl Mercaptan	75-08-1	6.51E-08	24	MB	Above-Average	2%
											Ethylene Dibromide	106-93-4	4.20E-08	24	MB	Above-Average	2%
											Hydrogen sulfide	04-06-7783	2.42E-03	24	MB	Above-Average	2%
											Methyl Mercaptan	74-93-1	4.04E-08	24	MB	Above-Average	2%
											Octane	111-65-9	7.31E-05	24	MB	Above-Average	2%
											sec-Butyl Alcohol/2-Butanol	78-92-2	3.84E-04	24	MB	Above-Average	2%
											Tetrachloroethylene	127-18-4	7.02E-05	24	MB	Above-Average	2%
											Trichloroethylene	79-01-6	2.32E-05	24	MB	Above-Average	2%
											Vinyl Chloride/Chloroethene	75-01-4	4.30E-05	24	MB	Above-Average	2%
E4	Point	LFG Engine #4 - CAT 3520	6.48	445	0.4	51.6	13.4	5.5	424768	5014663	1,1,1-Trichloroethane	71-55-6	1.33E-06	24	MB	Above-Average	2%
											1,1,2,2-Tetrachloroethane	79-34-5	1.43E-07	24	MB	Above-Average	2%
											1,1,2-Trichloroethane	79-00-5	1.73E-07	24	MB	Above-Average	2%
											1,1-Dichloroethane	75-34-3	3.45E-05	24	MB	Above-Average	2%
											1,1-Dichloroethylene	75-35-4	1.41E-06	24	MB	Above-Average	2%
											1,2-Dichloroethane	107-06-2	1.36E-07	24	MB	Above-Average	2%
											1,2-Dichloroethene (Cis)	156-59-2	8.09E-05	24	MB	Above-Average	2%
											1,2-Dichloroethene (Trans)	156-60-5	3.82E-06	24	MB	Above-Average	2%
											Benzene	71-43-2	3.04E-05	24	MB	Above-Average	2%
											Bromodichloromethane	75-27-4	1.29E-08	24	MB	Above-Average	2%
											Carbon Tetrachloride	56-23-5	2.22E-07	24	MB	Above-Average	2%
											Chloroethane	75-00-3	1.12E-05	24	MB	Above-Average	2%
											Chloroform/Trichloromethane	67-66-3	2.41E-06	24	MB	Above-Average	2%
											Dichloromethane	75-09-2	2.04E-05	24	MB	Above-Average	2%
											Dimethyl sulfide	75-18-3	1.97E-05	24	MB	Above-Average	2%
											Ethyl Mercaptan	75-08-1	6.51E-08	24	MB	Above-Average	2%
											Ethylene Dibromide	106-93-4	4.20E-08	24	MB	Above-Average	2%
											Hydrogen sulfide	04-06-7783	2.42E-03	24	MB	Above-Average	2%
											Methyl Mercaptan	74-93-1	4.04E-08	24	MB	Above-Average	2%
											Octane	111-65-9	7.31E-05	24	MB	Above-Average	2%
											sec-Butyl Alcohol/2-Butanol	78-92-2	3.84E-04	24	MB	Above-Average	2%
											Tetrachloroethylene	127-18-4	7.02E-05	24	MB	Above-Average	2%
											Trichloroethylene	79-01-6	2.32E-05	24	MB	Above-Average	2%
											Vinyl Chloride/Chloroethene	75-01-4	4.30E-05	24	MB	Above-Average	2%

Source ID [1]	Source Type [1]	Source Description	Source Data LFG: Stack Volumetric Flow Rate (Am³/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)	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	51.6	13.4	5.5	424772	5014660	1,1,1-Trichloroethane	71-55-6	1.33E-06	24	MB	Above-Average	2%
											1,1,2,2-Tetrachloroethane	79-34-5	1.43E-07	24	MB	Above-Average	2%
											1,1,2-Trichloroethane	79-00-5	1.73E-07	24	MB	Above-Average	2%
											1,1-Dichloroethane	75-34-3	3.45E-05	24	MB	Above-Average	2%
											1,1-Dichloroethylene	75-35-4	1.41E-06	24	MB	Above-Average	2%
											1,2-Dichloroethane	107-06-2	1.36E-07	24	MB	Above-Average	2%
											1,2-Dichloroethene (Cis)	156-59-2	8.09E-05	24	MB	Above-Average	2%
											1,2-Dichloroethene (Trans)	156-60-5	3.82E-06	24	MB	Above-Average	2%
											Benzene	71-43-2	3.04E-05	24	MB	Above-Average	2%
											Bromodichloromethane	75-27-4	1.29E-08	24	MB	Above-Average	2%
											Carbon Tetrachloride	56-23-5	2.22E-07	24	MB	Above-Average	2%
											Chloroethane	75-00-3	1.12E-05	24	MB	Above-Average	2%
											Chloroform/Trichloromethane	67-66-3	2.41E-06	24	MB	Above-Average	2%
											Dichloromethane	75-09-2	2.04E-05	24	MB	Above-Average	2%
											Dimethyl sulfide	75-18-3	1.97E-05	24	MB	Above-Average	2%
											Ethyl Mercaptan	75-08-1	6.51E-08	24	MB	Above-Average	2%
											Ethylene Dibromide	106-93-4	4.20E-08	24	MB	Above-Average	2%
											Hydrogen sulfide	04-06-7783	2.42E-03	24	MB	Above-Average	2%
											Methyl Mercaptan	74-93-1	4.04E-08	24	MB	Above-Average	2%
											Octane	111-65-9	7.31E-05	24	MB	Above-Average	2%
											sec-Butyl Alcohol/2-Butanol	78-92-2	3.84E-04	24	MB	Above-Average	2%
											Tetrachloroethylene	127-18-4	7.02E-05	24	MB	Above-Average	2%
											Trichloroethylene	79-01-6	2.32E-05	24	MB	Above-Average	2%
											Vinyl Chloride/Chloroethene	75-01-4	4.30E-05	24	MB	Above-Average	2%
F1	Point	LFG Flare #1	31.3	871	2.1	9.0	12.19	n/a	424557	5014950	1,1,1-Trichloroethane	71-55-6	1.80E-06	24	MB	Above-Average	3%
											1,1,2,2-Tetrachloroethane	79-34-5	1.94E-07	24	MB	Above-Average	3%
											1,1,2-Trichloroethane	79-00-5	2.34E-07	24	MB	Above-Average	3%
											1,1-Dichloroethane	75-34-3	4.68E-05	24	MB	Above-Average	3%
											1,1-Dichloroethylene	75-35-4	1.91E-06	24	MB	Above-Average	3%
											1,2-Dichloroethane	107-06-2	1.84E-07	24	MB	Above-Average	3%
											1,2-Dichloroethene (Cis)	156-59-2	1.10E-04	24	MB	Above-Average	3%
											1,2-Dichloroethene (Trans)	156-60-5	5.18E-06	24	MB	Above-Average	3%
											Benzene	71-43-2	4.12E-05	24	MB	Above-Average	3%
											Bromodichloromethane	75-27-4	1.75E-08	24	MB	Above-Average	3%
											Carbon Tetrachloride	56-23-5	3.02E-07	24	MB	Above-Average	3%
											Chloroethane	75-00-3	1.52E-05	24	MB	Above-Average	3%
											Chloroform/Trichloromethane	67-66-3	3.26E-06	24	MB	Above-Average	3%
											Dichloromethane	75-09-2	2.77E-05	24	MB	Above-Average	3%
											Dimethyl sulfide	75-18-3	2.67E-05	24	MB	Above-Average	3%
											Ethyl Mercaptan	75-08-1	8.83E-08	24	MB	Above-Average	3%
											Ethylene Dibromide	106-93-4	5.70E-08	24	MB	Above-Average	3%
											Hydrogen sulfide	04-06-7783	3.28E-03	24	MB	Above-Average	3%
											Methyl Mercaptan	74-93-1	5.48E-08	24	MB	Above-Average	3%
											Octane	111-65-9	9.91E-05	24	MB	Above-Average	3%
											sec-Butyl Alcohol/2-Butanol	78-92-2	5.21E-04	24	MB	Above-Average	3%
											Tetrachloroethylene	127-18-4	9.53E-05	24	MB	Above-Average	3%
											Trichloroethylene	79-01-6	3.15E-05	24	MB	Above-Average	3%
											Vinyl Chloride/Chloroethene	75-01-4	5.83E-05	24	MB	Above-Average	3%

Source ID [1]	Source Type [1]	Source Description	Source Data						LFG		Emission Data						
			Stack Volumetric Flow Rate (Am³/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 %
F2	Point	LFG Flare #2	57.3	900	2.7	10.0	12.2	n/a	424551	5014946	1,1,1-Trichloroethane	71-55-6	3.29E-06	24	MB	Above-Average	6%
											1,1,2,2-Tetrachloroethane	79-34-5	3.54E-07	24	MB	Above-Average	6%
											1,1,2-Trichloroethane	79-00-5	4.28E-07	24	MB	Above-Average	6%
											1,1-Dichloroethane	75-34-3	8.53E-05	24	MB	Above-Average	6%
											1,1-Dichloroethylene	75-35-4	3.49E-06	24	MB	Above-Average	6%
											1,2-Dichloroethane	107-06-2	3.36E-07	24	MB	Above-Average	6%
											1,2-Dichloroethene (Cis)	156-59-2	2.00E-04	24	MB	Above-Average	6%
											1,2-Dichloroethene (Trans)	156-60-5	9.46E-06	24	MB	Above-Average	6%
											Benzene	71-43-2	7.52E-05	24	MB	Above-Average	6%
											Bromodichloromethane	75-27-4	3.20E-08	24	MB	Above-Average	6%
											Carbon Tetrachloride	56-23-5	5.50E-07	24	MB	Above-Average	6%
											Chloroethane	75-00-3	2.78E-05	24	MB	Above-Average	6%
											Chloroform/Trichloromethane	67-66-3	5.96E-06	24	MB	Above-Average	6%
											Dichloromethane	75-09-2	5.06E-05	24	MB	Above-Average	6%
											Dimethyl sulfide	75-18-3	4.88E-05	24	MB	Above-Average	6%
											Ethyl Mercaptan	75-08-1	1.61E-07	24	MB	Above-Average	6%
											Ethylene Dibromide	106-93-4	1.04E-07	24	MB	Above-Average	6%
											Hydrogen sulfide	04-06-7783	5.99E-03	24	MB	Above-Average	6%
											Methyl Mercaptan	74-93-1	9.99E-08	24	MB	Above-Average	6%
											Octane	111-65-9	1.81E-04	24	MB	Above-Average	6%
											sec-Butyl Alcohol/2-Butanol	78-92-2	9.51E-04	24	MB	Above-Average	6%
											Tetrachloroethylene	127-18-4	1.74E-04	24	MB	Above-Average	6%
											Trichloroethylene	79-01-6	5.74E-05	24	MB	Above-Average	6%
											Vinyl Chloride/Chloroethene	75-01-4	1.06E-04	24	MB	Above-Average	6%
F3	Point	LFG Candlestick Flare #3	1.0	900	0.2	31.8	10.4	n/a	424551	5014952	1,1,1-Trichloroethane	71-55-6	3.17E-06	24	MB	Above-Average	6%
											1,1,2,2-Tetrachloroethane	79-34-5	3.40E-07	24	MB	Above-Average	6%
											1,1,2-Trichloroethane	79-00-5	4.11E-07	24	MB	Above-Average	6%
											1,1-Dichloroethane	75-34-3	8.21E-05	24	MB	Above-Average	6%
											1,1-Dichloroethylene	75-35-4	3.36E-06	24	MB	Above-Average	6%
											1,2-Dichloroethane	107-06-2	3.23E-07	24	MB	Above-Average	6%
											1,2-Dichloroethene (Cis)	156-59-2	1.93E-04	24	MB	Above-Average	6%
											1,2-Dichloroethene (Trans)	156-60-5	9.09E-06	24	MB	Above-Average	6%
											Benzene	71-43-2	7.23E-05	24	MB	Above-Average	6%
											Bromodichloromethane	75-27-4	3.08E-08	24	MB	Above-Average	6%
											Carbon Tetrachloride	56-23-5	5.29E-07	24	MB	Above-Average	6%
											Chloroethane	75-00-3	2.67E-05	24	MB	Above-Average	6%
											Chloroform/Trichloromethane	67-66-3	5.73E-06	24	MB	Above-Average	6%
											Dichloromethane	75-09-2	4.87E-05	24	MB	Above-Average	6%
											Dimethyl sulfide	75-18-3	4.69E-05	24	MB	Above-Average	6%
											Ethyl Mercaptan	75-08-1	1.55E-07	24	MB	Above-Average	6%
											Ethylene Dibromide	106-93-4	1.00E-07	24	MB	Above-Average	6%
											Hydrogen sulfide	04-06-7783	5.76E-03	24	MB	Above-Average	6%
											Methyl Mercaptan	74-93-1	9.61E-08	24	MB	Above-Average	6%
											Octane	111-65-9	1.74E-04	24	MB	Above-Average	6%
											sec-Butyl Alcohol/2-Butanol	78-92-2	9.14E-04	24	MB	Above-Average	6%
											Tetrachloroethylene	127-18-4	1.67E-04	24	MB	Above-Average	6%
											Trichloroethylene	79-01-6	5.52E-05	24	MB	Above-Average	6%
											Vinyl Chloride/Chloroethene	75-01-4	1.02E-04	24	MB	Above-Average	6%

Source ID [1]	Source Type [1]	Source Description	Source Data						LFG		Emission Data						
			Stack Volumetric Flow Rate (Am³/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 %
LM_EX	Area	Existing Landfill Mound Area of Landfill Mound: 355,013 m^2	n/a	n/a	n/a	n/a	n/a	n/a	423470	5014385	1,1,1-Trichloroethane	71-55-6	4.33E-05	24	V-ST	Above-Average	76%
											1,1,2,2-Tetrachloroethane	79-34-5	4.65E-06	24	V-ST	Above-Average	76%
											1,1,2-Trichloroethane	79-00-5	5.63E-06	24	V-ST	Above-Average	76%
											1,1-Dichloroethane	75-34-3	1.12E-03	24	V-ST	Above-Average	76%
											1,1-Dichloroethylene	75-35-4	4.59E-05	24	V-ST	Above-Average	76%
											1,2-Dichloroethane	107-06-2	4.42E-06	24	V-ST	Above-Average	76%
											1,2-Dichloroethene (Cis)	156-59-2	2.64E-03	24	V-ST	Above-Average	76%
											1,2-Dichloroethene (Trans)	156-60-5	1.24E-04	24	V-ST	Above-Average	76%
											Benzene	71-43-2	9.90E-04	24	V-ST	Above-Average	76%
											Bromodichloromethane	75-27-4	4.21E-07	24	V-ST	Above-Average	76%
											Carbon Tetrachloride	56-23-5	7.24E-06	24	V-ST	Above-Average	76%
											Chloroethane	75-00-3	3.65E-04	24	V-ST	Above-Average	76%
											Chloroform/Trichloromethane	67-66-3	7.84E-05	24	V-ST	Above-Average	76%
											Dichloromethane	75-09-2	6.66E-04	24	V-ST	Above-Average	76%
											Dimethyl sulfide	75-18-3	6.42E-04	24	V-ST	Above-Average	76%
											Ethyl Mercaptan	75-08-1	2.12E-06	24	V-ST	Above-Average	76%
											Ethylene Dibromide	106-93-4	1.37E-06	24	V-ST	Above-Average	76%
											Hydrogen sulfide	04-06-7783	7.89E-02	24	V-ST	Above-Average	76%
											Methyl Mercaptan	74-93-1	1.32E-06	24	V-ST	Above-Average	76%
											Octane	111-65-9	2.38E-03	24	V-ST	Above-Average	76%
											sec-Butyl Alcohol/2-Butanol	78-92-2	1.25E-02	24	V-ST	Above-Average	76%
											Tetrachloroethylene	127-18-4	2.29E-03	24	V-ST	Above-Average	76%
											Trichloroethylene	79-01-6	7.55E-04	24	V-ST	Above-Average	76%
											Vinyl Chloride/Chloroethene	75-01-4	1.40E-03	24	V-ST	Above-Average	76%
Total	n/a	Total of all listed sources									1,1,1-Trichloroethane	71-55-6	5.69E-05	--	--	--	100%
											1,1,2,2-Tetrachloroethane	79-34-5	6.11E-06	--	--	--	100%
											1,1,2-Trichloroethane	79-00-5	7.39E-06	--	--	--	100%
											1,1-Dichloroethane	75-34-3	1.48E-03	--	--	--	100%
											1,1-Dichloroethylene	75-35-4	6.03E-05	--	--	--	100%
											1,2-Dichloroethane	107-06-2	5.81E-06	--	--	--	100%
											1,2-Dichloroethene (Cis)	156-59-2	3.46E-03	--	--	--	100%
											1,2-Dichloroethene (Trans)	156-60-5	1.63E-04	--	--	--	100%
											Benzene	71-43-2	1.30E-03	--	--	--	100%
											Bromodichloromethane	75-27-4	5.53E-07	--	--	--	100%
											Carbon Tetrachloride	56-23-5	9.51E-06	--	--	--	100%
											Chloroethane	75-00-3	4.80E-04	--	--	--	100%
											Chloroform/Trichloromethane	67-66-3	1.03E-04	--	--	--	100%
											Dichloromethane	75-09-2	8.75E-04	--	--	--	100%
											Dimethyl sulfide	75-18-3	8.43E-04	--	--	--	100%
											Ethyl Mercaptan	75-08-1	2.79E-06	--	--	--	100%
											Ethylene Dibromide	106-93-4	1.80E-06	--	--	--	100%
											Hydrogen sulfide	04-06-7783	1.04E-01	--	--	--	100%
											Methyl Mercaptan	74-93-1	1.73E-06	--	--	--	100%
											Octane	111-65-9	3.13E-03	--	--	--	100%
											sec-Butyl Alcohol/2-Butanol	78-92-2	1.64E-02	--	--	--	100%
											Tetrachloroethylene	127-18-4	3.01E-03	--	--	--	100%
											Trichloroethylene	79-01-6	9.92E-04	--	--	--	100%
											Vinyl Chloride/Chloroethene	75-01-4	1.84E-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.

Appendix A

Calibration Data from the Landfill Gas Assessment Ottawa Landfill Baseline Conditions Report, March 3, 2005

Appendix A: 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.

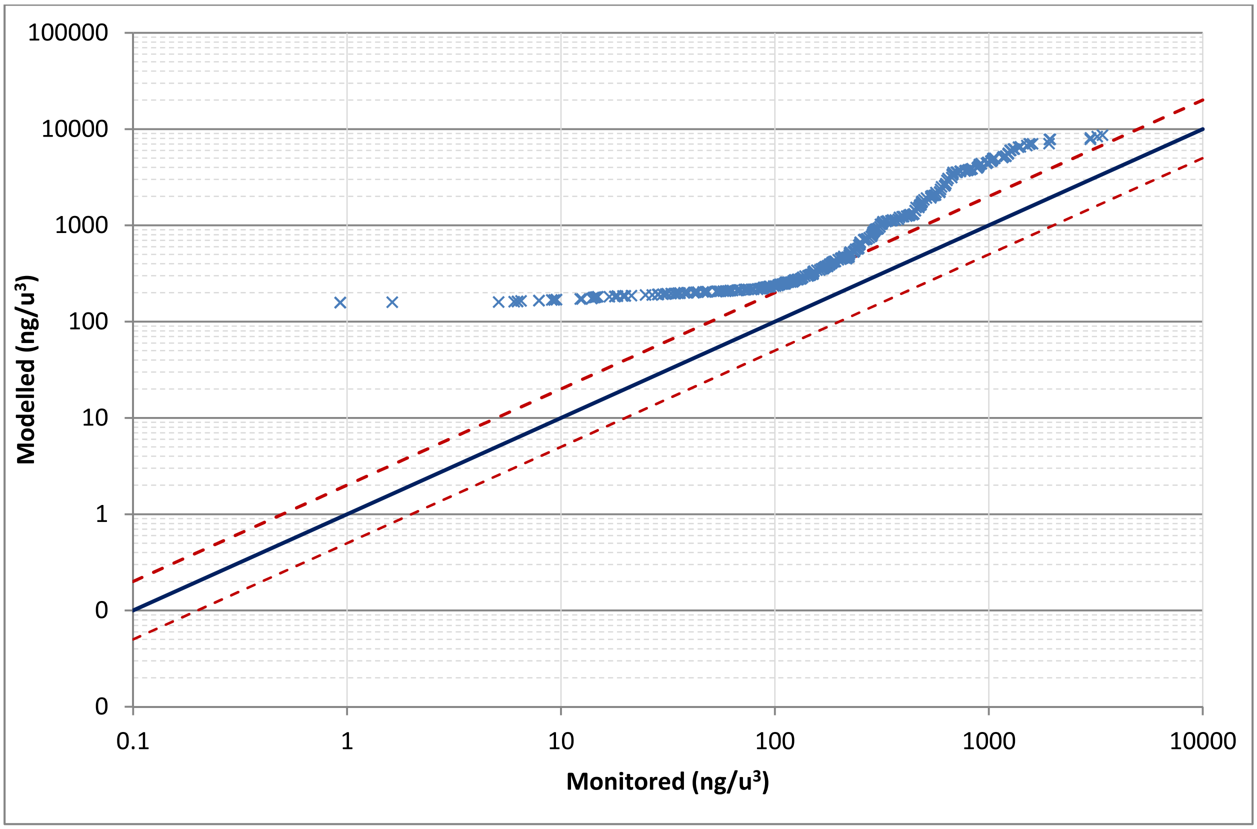
As outlined in the MOE's CAMM Technical Bulletin, the assessment primarily focuses on the use of quantile:quantile (Q:Q)plots and other statistical measures to assess for systematic bias. In accordance with the MOE, the Q:Q plot allows rapid identification of biases towards either the modelling or monitoring 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.

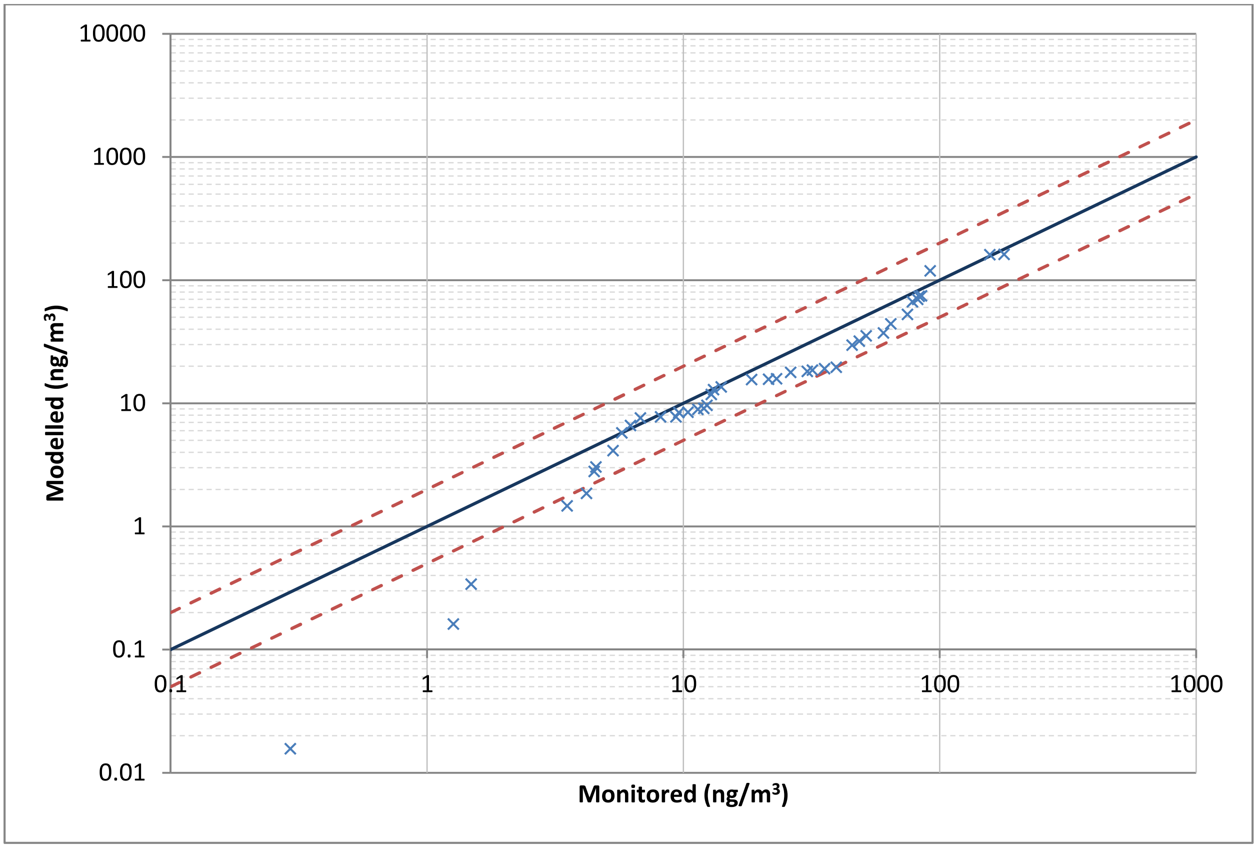
The RHC calculated from the modelled and monitored hydrogen sulphide results was 0.137, meaning the initial hydrogen sulphide emission rate could be divided by 7.3. However, to maintain a relatively conservative approach, the calibration factor was reduced by approximately 40%, to a value of 3. All hydrogen 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 Modelled	Amount (ng)	Sample Volume	Measured Concentration
		Start Time	End Time				
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 (ng)	Sample Volume	Measured Concentration
		Start Time	End Time			
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.

Appendix B

Existing Ottawa Landfill Baseline Studies – VOC Emissions Rates Based on Scaling 2010 Flow Data

WCEC Baseline Studies - VOC Emission Rates - Based on Scaling 2010 Flow Data

Landfill Gas Consumed (2010) 48,911,689 m^3/year (from flowmeter data as provided in 2010 NPRI Info)

Percent of Existing Landfill with Gas Collection System in Place 100%
Estimated Efficiency of Landfill Gas Collection System 85%
Overall Gas Collection 85%

Total Landfill Gas Generated 57,543,164 m^3/year (based on gas consumed & overall gas collection)

Total Landfill Gas Released 8,631,475 m^3/year (based on gas generated & overall gas collection)

Continuous Emission Rate 0.27 m^3/s

Emission Flux Rate from Landfill
Landfill Area 355,013 m^2

Vinyl Chloride Concentration 5.115 mg/m3 (2011 results from on-site measurements)
5.11E-03 g/m3

Source	Flow Rate (g/s)	Destruction Efficiency	Emission Rate (g/s)
LFG from Mound [1]	0.27	0	1.40E-03
E1	0.14	0.97	2.15E-05
E2	0.14	0.97	2.15E-05
E3	0.28	0.97	4.30E-05
E4	0.28	0.97	4.30E-05
E5	0.28	0.97	4.30E-05
F1	0.57	0.98	5.83E-05
F2	1.04	0.98	1.06E-04
TF	1.00	0.98	1.02E-04

<u>Notes:</u> [1] The LFG from Mound Source was modelled as an area source and therefore an emission flux rate was used.

Emission Flux Rate = Emission Rate (g/s) / Area of Source (m^2)
= 1.40E-03 / 355,015
= 3.9435E-09 g/s m^2

Appendix C

Landfill Gas Sampling 2004 and 2011

C1. Raw Landfill Gas Analysis

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

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

CAS #	DESCRIPTION COMPOUND	11042003 No.1-VOC 4/19/11 V=5.0mL	11042004 No.1-VOC 4/19/11 V=15mL	11042005 No.2-VOC 4/19/11 V=15mL	11042006 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"

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.

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 Analytics Inc

•DRIVEN BY SERVICE AND SCIENCE•
www.maxxamanalytics.com

Rowan Williams Davies & Irwin Inc
RWDI)
650 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

C2. TRS Monitoring Report

CONSULTING ENGINEERS & SCIENTISTS

Memorandum

Tel: 519.823.1311
Fax: 519.823.1316
RWDI AIR Inc.
650 Woodlawn Road West
Guelph, Ontario, Canada N1K 1B8
Email: solutions@rwdi.com

Date: **November 8, 2011** **RWDI Reference #:** 1101710

To: Remi Godin
Waste Management of Canada Corporation **E-Mail:** Rgodin@wm.com

From: John DeYoe **E-Mail:** John.DeYoe@rwdi.com

Re: **DRAFT**
TRS Monitoring Results, Waste Management of Canada Corporation Ottawa Landfill

RWDI AIR Inc. (RWDI) was retained by Waste Management of Canada Corporation (WM) to complete an ambient air quality monitoring program for total reduced sulphur compounds (TRS) at their Ottawa Landfill Site located on Carp Road, in Ottawa, Ontario.

TRS is mainly comprised of hydrogen sulphide (H_2S) but the instrument that was installed will respond to other TRS compounds such as mercaptans. Typically concentrations of H_2S will be equal to or just slightly less than concentrations of TRS.

The intent of the program was to collect continuous TRS data at a fixed location in order to determine a relationship between the improvements made to the landfill gas collection efficiency and the predicted concentrations from the baseline evaluation of the Environment Assessment studies currently underway for the proposed site expansion.

MONITORING EQUIPMENT SUMMARY

The station was equipped with a Thermo 43i analyser in conjunction with a sulphur dioxide scrubber and a thermal oxidizer. In this mode, the instrument is a Untied States Environmental Protection Agency (U.S. EPA) reference method equivalent device. The concentrations from the instrument as well as the temperature of the thermal oxidizer were recorded on a 1-minute average using a Campbell Scientific data logger. The instruments were housed in a climate controlled trailer. In addition, a 3-metre meteorological tower was located roughly 20 metres east of the trailer. The meteorological tower recorded wind speed and direction using an RM Young 5103 wind head.

The program was initiated on July 7, 2011 and was completed on October 12, 2011. The scope of work was for 3-months of continuous monitoring. The program was extended slightly past October 7 to ensure a complete 3-months of data was available for the station.

RESULTS

The results of the monitoring showed nearly no measureable concentrations of TRS. The maximum measured value of TRS was 1 part per billion (PPB) and nearly all readings were below the detection limit of 1 PPB (0.5 PPB was rounded up to 1 PPB). The table below shows the highlights of the monitoring.

TABLE 1: Summary of TRS Monitoring Statistics

	No. of Valid Readings	No. of Non-Zero Readings	Maximum Reading (PPB)
10- Minute Averages	13252	57	1
1-Hour Averages	2221	8	1

The times for the non-zero readings of 1-hour TRS concentrations are listed below:

TABLE 2: Listing of Non-Zero TRS Readings (1-Hour Averages)

Date	Time (EDST)	TRS Concentration (PPB)
July 8	5:00	1
July 8	6:00	1
July 11	18:00	1
July 12	18:00	1
July 12	19:00	1
July 29	18:00	1
August 31	7:00	1
September 28	18:00	1

The wind data recorded on site is attached in the Tables Section. The attached Figure 1 shows the location of the monitoring station as well as a wind rose for the monitoring period. A wind rose is a graphic depiction of the distribution of wind angles (blowing from). An additional figure which shows the wind rose in a larger scale is also attached. The complete record of 10-minute average concentrations is in Appendix A which is attached as a separate PDF file.

The instrument was calibrated on installation and on removal. Additionally, there were daily checks of instrument response which went through a zero span zero cycle between 1600 and 1700 daily. This hour of data is removed from the reporting. A graph of the span results is attached to this document in the Figures section.

Generally, the span data was within 10% of the span point concentration. There was a notable exception during July when span values were considerably higher. This was due to the elevated temperatures in the trailer and more specifically within the instrument rack. The zero span assembly was at a temperature greater than the heater set point, thus causing an elevated span point. The issues with the air conditioning were remedied and the converter was removed from the instrument rack to reduce the heat load. This eliminated the issue with the elevated spans and it was determined that the issue was with the span system and not the analyser. The monitoring data for the period was therefore determined to be valid.

There was less than an hour of missing data over the monitoring period. These were related to fluctuations in the power supply.

CLOSING

The results of the report validate that the corrective measures taken to reduce odourous landfill gas emissions have been effective.

We believe that this brief letter report addresses current needs due to the paucity of measured values but we will await comments to finalize this document.

If you have any questions, comments or additional requirements, please do not hesitate to contact me at (519) 823-1311 x 2258 or on my mobile at (519) 835-0961. You can also reach Brad Bergeron at (519) 823-1311 x 2428 or on his mobile at (519) 817-9888.

Yours very truly,

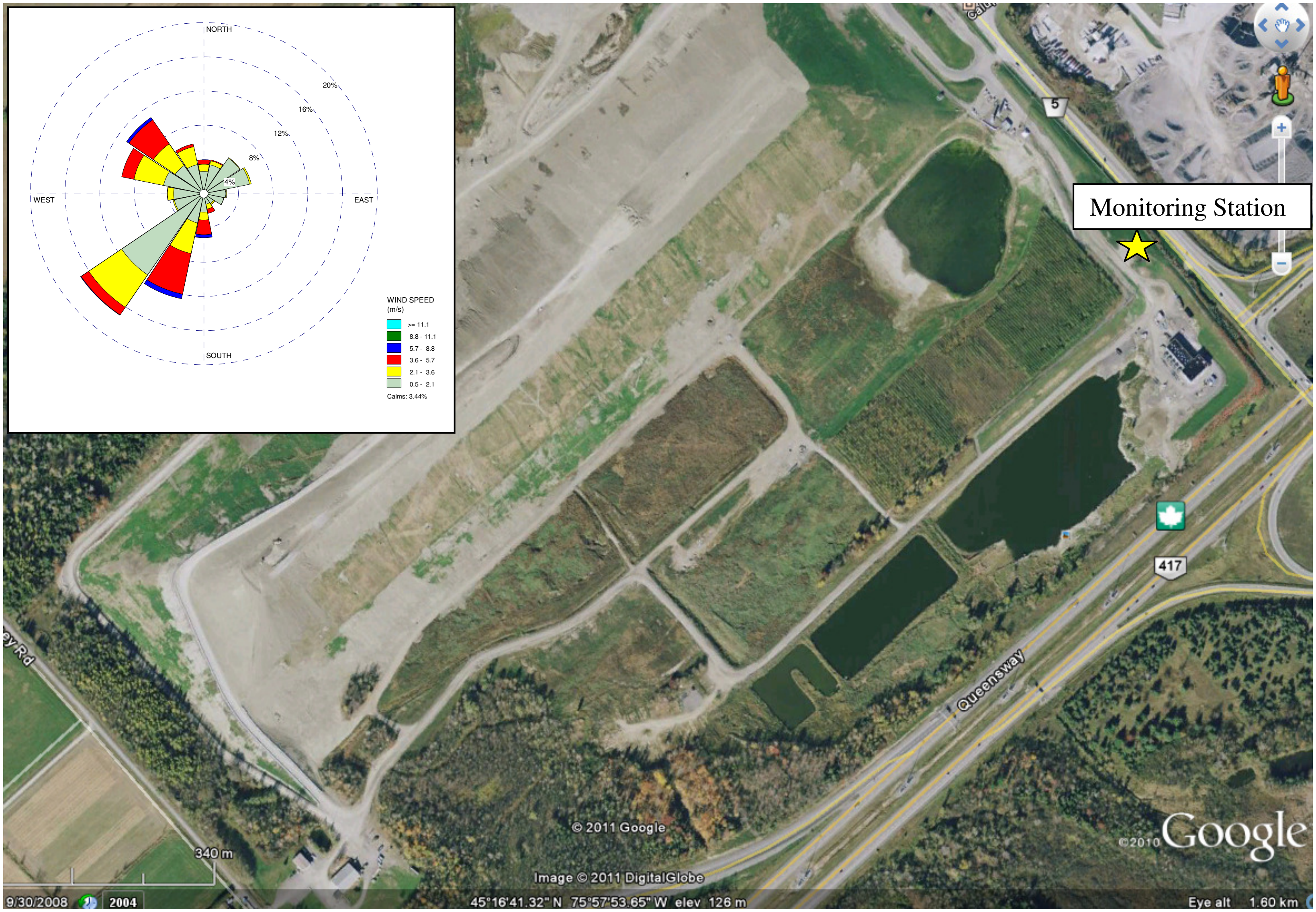
RWDI AIR Inc.

John DeYoe, B.A.
Project Director / Associate

JD

Attach.

C2. Figures



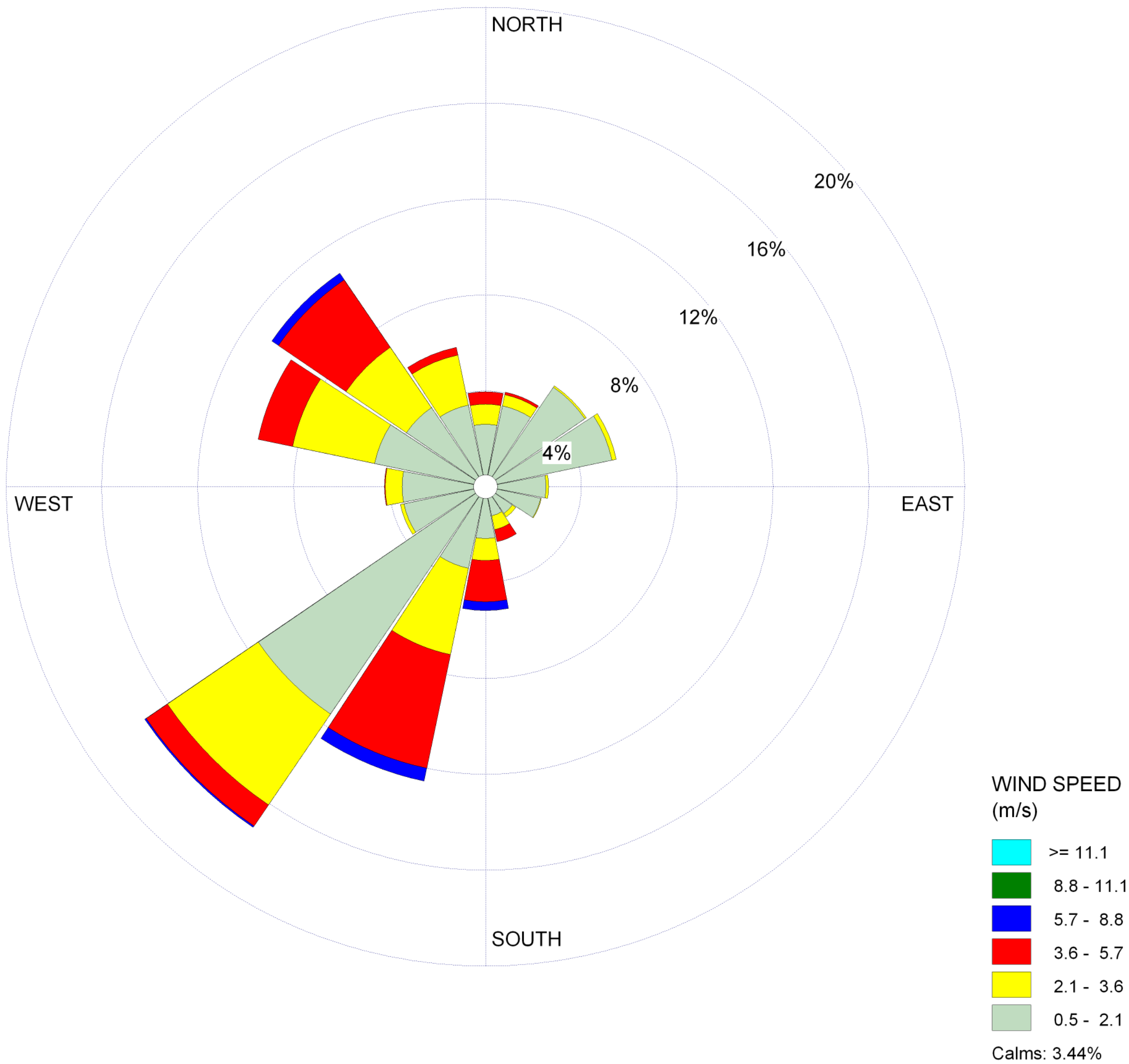
WM Ottawa Landfill TRS Monitoring **Monitoring Station Location and Wind Rose** WCEC, Ottawa, Ontario — Project #1100798	Figure No: 1 Date: Nov. 3, 2011	RWDI

WIND ROSE PLOT:

Station # 1

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

Wind Distribution June 20 to October 12, 2012

DATA PERIOD:

2011
Jan 1 - Dec 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

3.44%

TOTAL COUNT:

2732 hrs.

AVG. WIND SPEED:

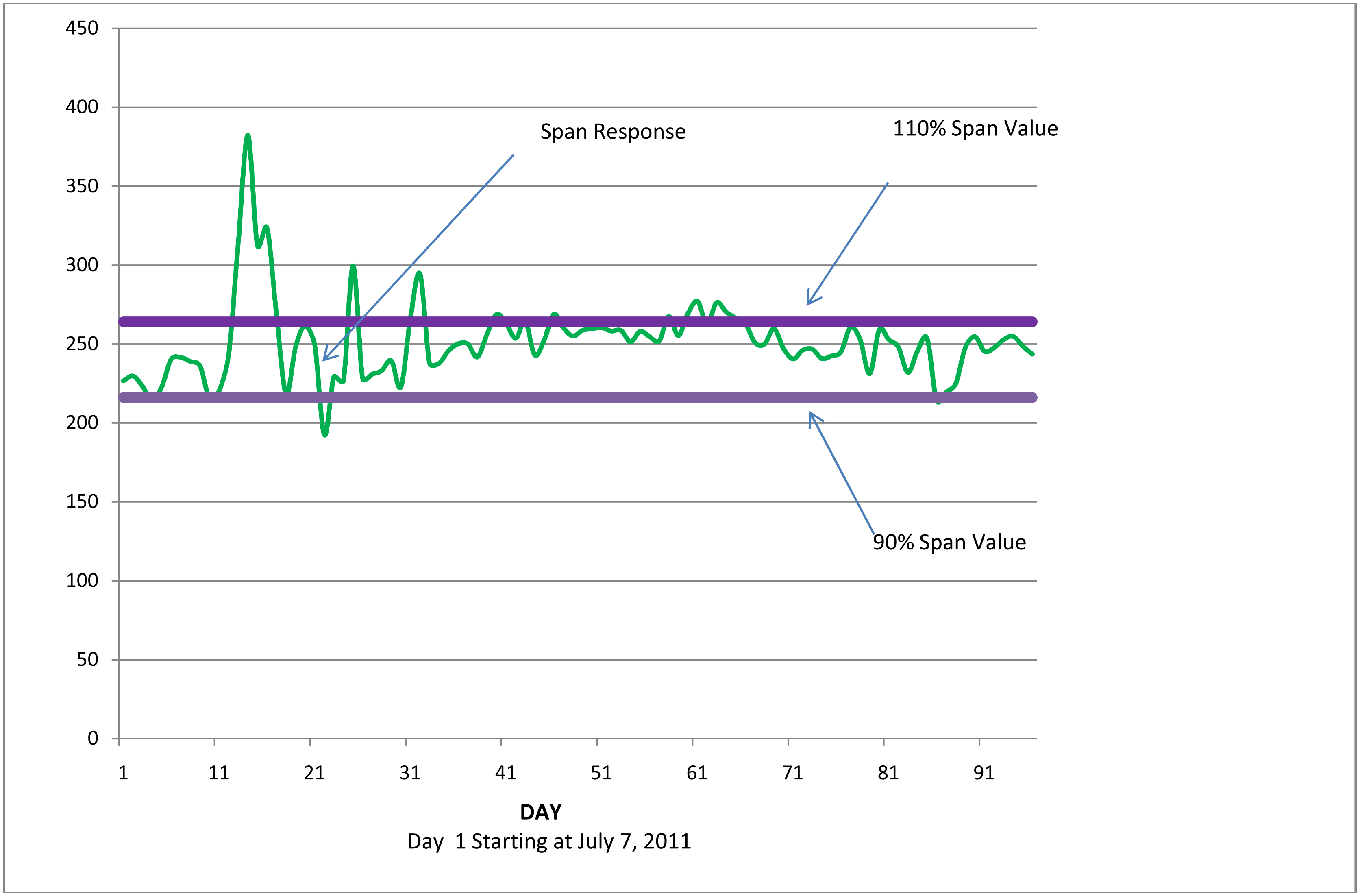
2.23 m/s

DATE:

11/3/2011

PROJECT NO.:

WM Ottawa Landfill



WM Ottawa Landfill TRS Monitoring **Instrument Span Results** WCEC, Ottawa, Ontario Project #1101710	Figure No: 3 Date: Nov. 3, 2011	RWDI

C2. Tables

WM Ottawa Landfill
Meteorological Data

Average Wind Direction (deg.)
And Average Wind Speed (m/s)
JULY 01, 2011 to JULY 31, 2011

Day	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
Jul 1	WNW	NW	NW	NW	NW	W	W	W	WNW	NW	NW	NNW	N	NNW	NNW	N	NNW	NNW	N	NNW	WNW	WSW	SW	SW
	1.8	1.6	1.6	1.2	2.0	0.7	1.0	1.2	2.1	2.1	2.4	2.4	2.6	2.5	2.4	2.1	2.0	1.8	1.3	1.1	0.8	0.8	1.1	1.4
Jul 2	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SSW	SW	SW	SSW	SSW	S	SSW	SSW	SSW	S	SSW	S	S	SSW	SSW
	2.3	2.2	2.3	1.8	0.8	1.1	1.2	2.3	1.8	1.9	2.9	3.2	3.5	4.6	5.2	6.0	5.4	4.7	4.8	4.1	3.5	3.2	3.1	3.8
Jul 3	SSW	SSW	SW	SW	SW	SW	SW	WSW	WNW	NW	NW	NW	NW	WNW	WNW	WNW	W	WNW	WNW	NW	WNW	WSW	WSW	WNW
	3.6	4.1	3.2	1.9	1.6	1.9	1.9	1.0	2.7	3.1	2.6	2.2	1.3	1.2	1.8	3.0	2.4	3.1	3.2	3.3	2.3	1.2	1.5	2.4
Jul 4	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WSW	NW	WNW	WNW	NW	NW	NW	NW	W	WSW	SW
	3.1	2.5	1.7	2.1	2.5	2.2	2.6	2.8	2.8	1.6	1.4	1.0	1.3	1.5	2.1	2.3	2.4	2.5	3.0	2.6	1.8	1.3	1.3	1.4
Jul 5	SW	WSW	WSW	W	W	W	W	WNW	WNW	NW	NW	WNW	WSW	SW	SW	SW	SW	W	WSW	SW	SW	SW	SSW	SW
	1.6	1.7	1.8	2.2	2.3	2.0	2.2	2.2	2.6	3.1	2.7	1.3	1.7	1.9	2.2	1.9	2.6	2.4	1.6	1.5	1.7	2.0	3.5	3.3
Jul 6	SW	SW	SSW	SSW	SSW	SSW	SW	SW	SSW	SSW	SW	SW	SW	SW	W	WSW	WNW	NW	NW	NNW	NNW	NNW	NW	WNW
	3.6	4.0	4.0	4.2	4.3	4.2	2.5	2.0	4.3	4.4	2.6	1.7	1.6	2.7	2.8	2.4	2.6	2.8	4.2	3.4	3.2	2.5	2.5	1.8
Jul 7	WSW	WSW	W	WNW	WNW	WNW	WNW	WNW	NW	NW	NW	NW	NW	NW	NW	WNW	NW	NNW	NW	NNW	N	E	S	SSW
	1.4	1.6	1.9	3.0	3.0	2.6	2.6	2.9	3.3	3.1	2.5	2.4	2.8	2.5	2.0	1.8	2.2	2.2	2.5	1.8	1.1	0.5	0.9	0.5
Jul 8	SSW	SSW	SSW	SSW	SSW	S	S	NE	ENE	SSW	S	SSW	S	SSE	S	SSW	SSW	WNW	NNE	ENE	NNE	W	NW	W
	0.9	2.2	2.5	2.0	2.7	2.1	1.7	0.5	0.6	0.9	1.3	1.2	2.3	2.5	2.4	3.1	2.0	2.8	1.3	1.0	0.4	0.8	4.3	1.0
Jul 9	SW	W	WSW	W	WNW	WNW	NW	NW	NW	NW	NNW	N	NNW	NNW	NNW	NNW	WNW	NW	NW	NW	NW	NW	WNW	SW
	1.3	1.2	1.5	1.9	3.2	3.3	3.2	3.8	3.4	3.5	2.9	2.6	2.6	3.0	2.6	2.8	2.7	3.1	3.5	2.8	2.3	1.1	0.7	1.2
Jul 10	SW	SW	SW	SW	SSW	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW
	1.3	2.0	1.9	2.0	2.8	3.1	2.5	2.8	2.9	3.1	3.2	4.2	5.6	5.0	4.9	4.8	4.6	5.6	5.0	4.9	4.8	4.1	3.9	3.8
Jul 11	SSW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SW	SW	SSW	SSW	SSW	SSW	S	SSW	SW	WSW	NNW	ESE	SE
	3.7	3.6	3.3	3.3	3.2	3.0	2.9	2.7	3.1	2.9	3.0	2.5	2.3	3.1	4.2	4.4	4.2	4.9	3.3	2.8	1.7	1.1	0.4	1.0
Jul 12	SE	NNE	N	NNE	NNW	WNW	WNW	WNW	WNW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	WNW	WNW
	1.2	0.2	0.3	0.6	1.0	2.0	1.9	2.6	3.1	4.2	4.3	4.6	3.8	4.3	4.4	5.1	5.0	5.3	4.5	4.3	3.1	2.1	2.3	2.5
Jul 13	WNW	NW	WNW	NW	NW	WNW	WNW	W	WNW	NW	NW	NNW	NW	NW	NW	NNW	NW	WNW	NNW	WNW	WNW	NW	WNW	WNW
	2.3	2.4	2.7	2.6	1.9	1.9	2.3	2.1	2.9	2.3	2.7	3.0	4.3	6.6	5.7	3.1	2.7	2.8	1.7	2.1	1.8	2.2	2.9	3.8
Jul 14	NW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	NW	NW	WNW	NW	NW	NW	NW	NW	NW	WNW	WNW	W	W	W	WNW	WNW
	3.5	3.2	2.6	2.0	2.1	2.3	2.6	2.8	3.9	3.4	2.2	2.9	2.7	3.2	3.0	2.9	2.6	1.8	1.7	1.3	0.7	1.1	1.8	1.8
Jul 15	NW	NNW	SW	SSW	NW	WSW	SW	SW	WSW	NW	NW	NW	N	NW	NNE	NNE	NNE	NW	W	SE	S	SSW	SW	SW
	1.6	0.8	0.6	0.8	1.4	1.0	1.4	0.8	0.9	1.5	1.8	2.0	1.5	1.2	1.3	1.2	1.3	1.0	0.8	1.4	1.9	1.2	1.1	1.1
Jul 16	SW	SW	SW	NW	NNW	SW	SSW	SSW	N	NNE	NE	NE	S	S	SSW	SSW	SSW	SW	SW	SSW	S	SSW	SSW	SSW
	1.7	1.7	1.8	0.6	0.3	0.5	0.9	0.4	0.5	0.6	0.8	0.9	1.3	2.3	2.2	2.3	2.5	2.0	2.0	2.1	2.0	1.0	2.1	3.1
Jul 17	SW	SW	SW	SW	SW	SW	SW	SW	WSW	W	W	W	W	SW	SW	W	W	WSW	SW	WSW	NW	W	W	SW
	3.0	2.7	2.8	2.6	1.7	0.5	1.0	1.7	1.2	1.2	2.0	2.2	2.7	3.0	3.1	2.4	2.4	2.4	3.4	2.3	7.6	2.5	1.2	2.4
Jul 18	WSW	SSE	W	SSW	SSW	SSW	WNW	SW	W	N	NW	NNW	N	N	NW	WNW	NW	NW	NW	NNW	NNW	NNW	WNW	WSW
	2.3	1.6	1.6	1.9	3.2	3.7	2.6	2.3	1.3	1.3	2.0	2.4	2.2	2.1	2.5	2.9	3.0	3.2	3.1	2.0	1.6	1.5	0.6	1.3
Jul 19	NW	NW	WNW	WNW	WNW	WNW	NW	WNW	NW	N	NNE	NNE	ENE	N	N	WNW	N	N	WNW	W	WSW	SW	SW	SSW
	1.8	2.0	2.1	2.5	2.2	1.9	1.5	1.3	1.8	1.1	1.3	1.2	0.9	1.2	1.0	1.1	1.1	1.0	1.2	0.9	0.6	0.3	1.3	1.8
Jul 20	SSW	SSW	SW	SSW	SSW	SW	SW	SW	SW	SW	SW	SSW	SW	SW	SSW	SSW	SSW	SW	SW	SW	SW	SSW	SW	SW
	1.8	1.7	2.0	2.5	2.8	3.2	2.5	1.2	1.9	1.9	2.4	3.3	3.1	2.9	4.4	4.7	4.2	3.9	3.4	2.7	2.2	3.2	3.2	2.9
Jul 21	SSW	SSW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	WSW	WSW	W	W	WSW	SW	SW	SW	SW	WSW	SW
	3.1	3.7	3.3	4.0	3.6	4.0	4.9	5.3	6.0	5.2	5.8	5.5	3.8	3.2	3.1	3.0	3.0	2.4	2.5	2.7	2.7	2.4	2.0	2.7
Jul 22	SW	WSW	WSW	WSW	WSW	W	W	WNW	WNW	WNW	WNW	W	W	W	W	WNW	WNW	WSW	SW	SW	SW	SW	SW	SW
	2.6	1.9	1.8	1.7	1.8	1.8	2.3	3.0	3.2	3.7	2.8	2.5	2.5	2.8	2.7	2.7	2.7	1.4	1.2	2.3	2.8	2.4	2.0	1.5
Jul 23	SW	SW	SW	SW	SW	WSW	SW	SW	SW	W	WNW	W	WNW	W	W	NW	NW	NW	NW	NNW	NNW	NNW	NNW	NNW
	2.2	2.7	2.6	1.7	2.0	1.0	1.7	2.2	2.1	2.1	2.7	2.1	2.4	2.7	3.1	4.4	4.3	4.4	3.5	2.7	2.3	2.0	2.9	2.6
Jul 24		N	NNW	NNW	NNW	NNW	WNW	NW	NNW	NNE	NE	NE	NNE	NNE	N	N	NNW	N	NNW	N	NW	NW	WNW	SSW
	2.4	2.3	2.2	1.8	1.7	1.4	1.5	1.6	2.3	1.8	1.6	1.5	1.5	1.6	1.8	1.5	1.9	1.7	1.9	1.4	2.1	1.2	0.5	0.3
Jul 25	SSW	SW	SSW	SW	ENE	SSE	NNE	NE	NE	ESE	WSW	ENE	NE	SE	SE	ESE	SSE	SE	S	S	SW	SW	SW	SSW
	0.6	0.2	1.0	0.4	0.5	0.4	0.5	0.5	0.9	1.0	1.3	0.7	1.1	1.7	1.6	1.5	2.2	2.2	1.8	1.4	1.4	1.5	1.1	1.3
Jul 26	SW	SW	SW	SW	SW	SW	SW	SW	SW	SSW	SW	SSW	SW	WNW	NW	NW	NW	NW	WNW	WNW	NW	WNW	WNW	WNW
	1.5	2.6	2.3	2.2	2.9	2.9	2.4	2.1	2.0	3.5	3.2	3.1	2.3	3.3	4.7	4.0	4.1	4.0	4.1	3.3	3.1	3.2	2.9	2.8
Jul 27	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NW	WNW	NW	NW	N	SSW	SW
	3.6	2.6	3.8	2.4	2.1	2.6	2.6	3.7	4.0	2.9	2.6	2.0	1.9	1.9	2.1	2.0	2.1	1.6	1.6	1.7	1.1	0.4	0.9	1.3
Jul 28	SW	SW	SW	SW	SW	SSW	SE	S	S	SSW	SSW	S	S	S	SSE	S	SSW	SSW	SSW	SSW	SSW	S	SSW	SSW
	1.8	2.4	1.9	1.8	1.2	1.2	0.9	1.8	2.5	2.7	3.5	4.1	4.1	4.0	4.1	4.0	3.8	4.1	3.8	3.6	3.8	2.7	2.2	1.7
Jul 29	SSW	SSW	SSW	SW	SW	SW	WSW	SSE	SSE	SSW	SSW	SSW	S	SSW	S	WSW	SSW	W	NW	WNW	WSW	SW	SW	NW
	1.5	2.1	2.4	2.4	2.4	2.0	0.9	0.8	1.7	2.6	2.2	2.4	1.9	1.4	1.4	1.0	1.6	1.8	2.1	1.3	0.9	1.0	1.7	4.7
Jul 30	NW	SW	WNW	WNW	WNW	WNW	WNW	NW	NW	NW	NW	NNW	NNW	NW	NNW	NW	NNW	WNW	NW	WNW	WNW	WSW	WSW	SW
	1.4	1.3	2.5	2.8	2.7	3.1	3.5	3.3	3.6	4.1	3.7	2.7	3.1	3.6	2.7	2.5	2.4	3.4	2.9	2.4	1.9	1.2	1.1	1.1
Jul 31	SW	SW	SW	N	NW	WNW	NNW	SSE	S	SSW	S	S	SSE	S	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW
	1.3	1.2	1.0	0.3	0.5	0.4	0.2	0.4	0.6	1.8	2.4	2.3	2.6	2.6	2.7	2.6	3.4	3.7	3.8	3.9	3.8	3.7	3.7	4.2

Value below the cutoff threshold are displayed as blanks.
The instrument was operating 100.0 percent of the time.

WM Ottawa Landfill
Meteorological Data

Average Wind Direction (deg.)
And Average Wind Speed (m/s)
AUGUST 01, 2011 to AUGUST 31, 2011

Day	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
Aug 1	SSW	SSW	SW	SW	SW	SW	SW	SW	WSW	WNW	WNW	WNW	WNW	WNW	WNW	W	WNW	NW	NW	NW	WNW	WSW	SW	WSW
	4.3	3.7	3.6	3.5	2.3	2.2	2.0	1.9	1.6	2.7	3.4	3.3	2.7	4.1	3.7	3.0	3.8	5.1	4.7	3.9	2.0	1.2	1.4	1.4
Aug 2	WSW	WSW	WSW	WSW	WNW	NW	NW	NW	NW	NNW	NNW	NNW	NNW	NNW	NW	NNW	NNW	NW	NNW	N	NNW	NNE	NNE	NW
	1.8	1.5	1.8	1.8	2.4	3.2	3.2	3.2	3.5	3.5	3.4	2.9	3.2	3.6	3.2	2.7	2.4	3.0	2.6	2.1	1.7	1.0	0.5	0.5
Aug 3	SW	SW	NNW	N	NNW	WSW	ENE	ENE	ENE	ENE	ENE	E	E	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	NE
	0.5	0.5	0.2	0.1	0.1	0.3	0.2	0.2	0.6	1.1	1.1	1.1	1.2	1.6	1.6	1.5	1.5	1.5	1.8	1.5	1.4	1.2	0.7	0.6
Aug 4	NE	NE	NE	NNE	NNE	NNE	NNE	NNE	N	NE	NE	NNE	NNE	NE	NE	E	E	ESE	E	E	ESE	SE	SSE	SSE
	0.8	0.5	0.7	0.8	0.6	0.7	0.5	0.6	0.7	1.2	0.9	1.1	1.3	1.4	1.3	1.1	1.2	1.6	1.1	1.1	1.3	1.3	1.7	2.0
Aug 5	SSE	SSE	NNW	NNW	SSW	N	NNW	ENE	E	ESE	ESE	ESE	SE	ESE	SSE	SE	SSE	SSE	SE	ESE	SE	SE	S	SSW
	1.9	0.7	0.2	0.3	0.5	0.3	0.3	0.3	0.8	1.3	1.4	1.4	1.4	1.5	1.8	1.8	1.8	1.9	1.8	1.5	1.6	1.9	1.9	1.8
Aug 6	SW	SW	SW	SW	SSW	E	SW	SE	NNE	ENE	SSE	SE	SE	SSE	S	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SW
	1.5	1.5	1.7	1.9	0.6	0.2	1.1	0.4	0.6	0.7	1.4	1.4	1.9	2.5	3.3	3.6	4.9	4.5	4.0	4.2	3.9	2.8	2.8	1.1
Aug 7	S	SSW	SSW	SW	SW	SE	S	S	S	SSW	SSW	S	S	S	SSW	WNW	NNW	NNW	NW	N	N	NNW	NW	NNW
	2.5	2.3	2.9	1.9	1.1	0.7	2.1	1.4	2.2	2.4	2.3	2.3	2.8	2.1	1.6	1.6	1.7	1.9	2.3	1.4	1.0	0.9	1.2	1.4
Aug 8	N	NNW	NW	NW	NW	NW	NNW	NW	NNW	NNW	NNW	N	N	N	N	NNW	NNW	N	N	N	NNE	NNE	S	SSW
	1.2	1.4	1.4	2.3	2.0	2.4	2.3	2.0	2.0	2.2	2.2	2.2	2.3	2.1	2.4	2.7	2.6	2.6	2.6	2.2	1.3	0.8	0.5	0.5
Aug 9	SW	WSW	NW	NW	NNW	SW	W	NNE	E	E	ENE	ENE	ENE	ENE	ENE	ENE	ESE	ESE	ESE	NNE	NNE	NNE	NNW	WNW
	0.3	0.5	0.5	0.3	0.3	0.3	0.1	0.2	0.7	1.2	1.4	1.0	1.1	1.2	0.9	0.9	1.3	1.8	1.1	0.9	1.4	1.1	1.4	1.6
Aug 10	WNW	WNW	W	W	WSW	WSW	SW	SW	SW	SSW	SSW	SSW	SSW	SW	SSW	SSW	SW	SW	W	NNW	SW	SW	SW	SW
	1.6	1.7	1.6	1.8	1.4	1.2	1.6	1.5	2.0	2.9	3.1	2.7	2.7	1.7	2.0	3.4	4.8	3.0	2.0	1.9	1.0	1.4	2.6	2.6
Aug 11	SW	SW	SW	SW	SW	SW	SW	SW	WSW	W	W	W	WSW	WSW	W	WSW	SW	SW	SW	SW	SW	SW	SW	SW
	1.5	2.7	2.5	2.0	1.4	1.5	1.6	1.6	1.7	1.6	2.7	2.2	1.7	1.6	2.1	1.8	2.1	2.1	2.3	2.4	1.7	1.6	1.5	1.4
Aug 12	WSW	SW	SW	SW	SW	SW	SW	S	SSW	WNW	NW	SSW	SSW	W	WNW	WNW	WNW	WSW	WSW	W	SW	SW	SSW	SSW
	1.6	1.6	1.5	1.9	2.0	2.0	1.7	0.9	0.6	1.3	1.3	1.1	2.0	1.7	2.2	1.9	2.2	1.5	1.4	1.8	1.4	1.8	2.6	3.4
Aug 13	SW	SW	SW	SW	SW	WSW	SSW	S	SW	SSW	SSW	SSW	SW	SW	SW	SSW	SSW	SSW	SW	SSW	SSW	SSW	S	N
	3.4	3.0	2.3	1.9	1.4	0.5	0.6	1.6	1.1	1.5	1.8	1.6	2.4	3.1	3.1	4.3	4.8	3.2	2.1	2.7	1.9	1.1	0.8	1.5
Aug 14	NNE	ENE	ENE	E	ENE	E	NE	NE	ENE	NE	ENE	ENE	E	NE	ESE	E	NNE	N	NE	NNE	NE	ENE	ENE	ESE
	0.8	1.4	0.9	0.6	0.7	0.9	0.6	0.8	1.0	1.4	1.2	1.2	1.3	1.3	1.3	1.1	1.2	2.2	1.9	1.3	1.1	1.1	1.2	1.4
Aug 15	ESE	ENE	NNE	NNE	NNW	N	NNE	NNE	NNE	NNE	NNE	NE	NE	NNE	NNE	NE	NE	ENE	ENE	E	ENE	ENE	NE	NE
	1.0	0.4	0.4	0.4	0.9	0.9	0.6	0.7	0.7	0.9	1.2	1.3	1.5	1.6	1.8	1.7	2.0	2.1	2.0	1.7	1.5	1.4	0.9	0.5
Aug 16	NNW	NNW	NNW	NNW	NW	WNW	WNW	WNW	NW	NNW	NW	NW	NNW	N	NNW	NW	NW	NW	NW	NNW	NW	W	NW	NW
	1.0	1.3	1.5	1.3	1.1	1.6	2.1	3.2	2.3	2.7	2.6	3.1	2.6	2.5	2.8	2.8	4.5	5.2	4.4	3.1	1.8	1.5	1.0	1.4
Aug 17	NW	WNW	NW	SW	SW	WSW	SW	SW	W	NW	NE	SW	SW	WNW	SSW	SSW	SSW	S	SSW	SSW	SSW	SSW	SSW	SSW
	1.4	1.5	1.0	1.2	1.1	0.9	0.9	1.0	1.0	0.9	0.8	1.2	1.6	1.5	2.1	2.6	2.9	3.2	3.6	4.6	4.9	4.0	3.3	3.4
Aug 18	SSW	SSW	SW	SSW	SW	SSW	SSW	SW	SW	SW	SW	SW	SSW	SW	W	NW	W	WNW	WNW	NW	SSW	SW	SSW	SW
	3.2	2.9	2.8	3.5	2.8	3.1	2.6	2.0	3.2	3.0	2.0	2.2	3.8	3.9	2.6	2.2	2.7	3.0	2.0	1.4	0.9	1.6	1.1	1.6
Aug 19	SW	SW	SW	SW	SW	WSW	SW	SW	SW	W	NW	WSW	SW	WNW	WNW	WNW	WNW	NW	NW	NNW	N	NW	SW	SW
	2.6	2.4	1.9	1.6	1.4	1.4	0.8	1.4	1.1	1.3	2.2	1.9	2.2	2.4	2.5	3.2	2.5	2.4	1.9	1.6	1.1	1.3	0.9	1.3
Aug 20	SW	SW	SW	SW	SW	SSW	WSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SW	WNW	WSW	SW	SSW	SW	SSW	SSW	SSW	WSW
	1.9	2.3	2.3	2.0	1.2	0.6	0.7	1.0	1.8	2.3	2.3	3.0	4.2	4.1	3.4	3.3	1.3	3.2	4.4	3.2	3.2	2.7	2.7	0.8
Aug 21	WNW	WNW	S	SE	WNW	S	SSE	S	SSE	SSE	SSE	S	S	SSE	SW	W	NNW	ENE	S	S	S	SW	SW	WNW
	3.3	1.4	1.7	1.8	0.7	2.0	2.7	1.9	2.3	2.3	2.1	2.0	1.7	2.2	1.2	2.2	2.0	0.7	1.9	1.3	0.9	2.2	1.9	2.9
Aug 22	WNW	WNW	WNW	W	WSW	W	WNW	W	W	WNW	NW	NW	NW	WNW	NW	NW	NW	NW	WNW	NW	NW	WNW	SW	SW
	3.2	3.4	3.4	2.4	2.1	2.6	3.0	2.5	2.1	4.2	6.5	6.5	5.2	5.2	5.3	4.2	5.9	5.8	4.8	3.5	2.7	1.5	1.5	1.9
Aug 23	SW	W	W	WSW	SW	SW	SW	WSW	WNW	WNW	NW	SSW	SW	SSW	SW	SSW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SSW
	1.7	1.3	1.5	1.4	1.4	1.4	1.2	1.4	0.9	1.5	1.0	1.3	2.1	3.2	3.0	3.5	3.1	4.1	3.4	2.9	2.7	3.7	4.1	4.9
Aug 24	SSW	SSW	SSW	SSW	SSW	SSW	S	S	S	S	S	SSW	S	S	S	S	S	S	S	S	S	SSE	SSE	S
	5.1	4.6	4.2	4.7	4.1	3.6	3.1	2.8	3.2	4.5	5.0	6.6	5.8	6.0	6.1	6.8	5.8	6.1	5.1	4.5	4.0	3.7	4.5	5.4
Aug 25	S	SSW	S	SSW	SW	SSW	SSW	SSW	SSW	SSW	SW	SW	W	WNW	W	W	WNW	NW	NW	WNW	NW	NW	NW	NNW
	6.3	5.8	7.4	5.8	2.0	3.6	5.9	4.9	4.7	4.8	3.0	2.7	2.0	4.1	2.4	3.3	3.7	4.2	4.2	2.9	3.8	4.6	4.6	3.3
Aug 26	NNW	NW	NNW	N	N	NNW	NW	WNW	NW	N	N	N	W	WNW	NW	WNW	SW	SW	SSW	SW	S	S	S	S
	3.1	2.5	2.2	2.5	1.8	1.6	1.7	1.1	2.0	1.6	1.4	1.2	1.4	1.6	1.4	1.6	1.7	2.0	2.1	2.0	2.1	2.5	2.7	3.0
Aug 27	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	WSW	WNW	WNW	NNW	NNW	NW	NNW	N	NE	NNE	NNE	NNE	ENE	ENE	NNE
	3.0	3.4	3.2	3.3	2.8	2.2	1.6	1.1	1.1	1.9	1.8	1.6	2.0	1.9	1.3	1.6	1.4	1.2	1.2	1.0	0.5	0.5	0.2	0.6
Aug 28	NNE	NE	NNE	NE	NE	NNE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NNE	N	N	N	N	N	NNW	NNW	NNW	NW	NW
	0.8	1.1	1.2	1.7	1.7	1.5	2.0	2.0	2.2	2.3	2.5	2.9	3.3	3.4	3.7	4.5	4.0	4.5	4.6	4.5	5.2	5.5	4.9	4.7
Aug 29	NW	NW	NW	NW	NW	WNW	WNW	WSW	W	WNW	WNW	NW	NW	NW	NW	NW	WNW	WNW	NW	NNW	SW	S	SSW	SSW
	5.0	4.6	4.8	4.6	4.0	3.9	3.0	1.4	1.8	4.0	3.5	3.4	3.9	4.6	4.2	3.6	2.3	2.4	1.8	1.2	2.0	2.7	3.0	3.4
Aug 30	SW	SW	SW	SW	SW	SW	SW	SW	SW	W	NW	SE	SSE	SSE	SSW	SW	W	NNW	NW	SW	SW	SW	SW	SW
	3.0	3.1	2.6	2.8	2.8	2.5	1.9	1.6	1.4	1.1	1.5	1.1	2.7	2.9	3.1	2.4	0.7	0.6	0.7	1.0	1.6	1.4	1.5	1.4
Aug 31	WSW	WSW	NW	NNW	WSW	N	N	N	NNE	NE	ENE	E	E	ESE	E	ESE	ESE	ESE	ESE	ESE	E	ESE	ESE	ESE
	1.4	1.4	1.2	1.3	0.6	0.2	0.2	0.5	0.6	0.6	1.0	1.3	1.5	1.7	1.6	1.7	1.4	1.7	1.6	1.4	1.0	0.9	0.8	1.1

Value below the cutoff threshold are displayed as blanks.
The instrument was operating 100.0 percent of the time.

WM Ottawa Landfill
Meteorological Data

Average Wind Direction (deg.)
And Average Wind Speed (m/s)
SEPTEMBER 01, 2011 to SEPTEMBER 30, 2011

Day	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
Sep 1	ESE	E	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	E	E	E	E	E	ESE	ESE	SE	ENE	ENE	ENE	ENE	NE
	1.2	1.0	1.5	1.5	1.3	1.5	1.5	1.5	1.7	1.6	2.0	2.4	2.1	2.3	2.0	2.0	2.1	2.3	1.9	1.2	1.0	1.1	0.8	0.7
Sep 2	E	E	ESE	ESE	ENE	ENE	ENE	ENE	ESE	SSE	S	SSW	S	SSE	S	S	SSW	SSW	S	S	SSW	SSW	SSW	SSW
	0.8	0.5	0.6	0.8	0.3	0.6	0.5	0.5	1.2	2.1	2.9	2.8	3.6	4.2	4.4	4.3	5.4	5.2	5.8	5.0	4.9	4.8	5.8	6.0
Sep 3	SSW	SSW	SSW	SSW	SW	SW	SW	SW	WSW	WNW	WNW	NNW	NNW	N	W	WNW	NW	NNW	NNW	NNE	NE	NE	E	ESE
	5.1	3.4	4.2	4.4	4.1	3.2	2.3	1.8	1.1	1.8	1.5	1.6	1.3	1.1	1.7	2.1	2.5	2.0	2.0	1.2	0.8	1.2	1.4	1.3
Sep 4	E	ESE	ENE	E	NNE	E	ESE	SE	SSE	SSW	SW	SW	SW	SW	SW	WSW	WNW	WSW	WSW	SW	SW	SSW	SW	SW
	1.4	0.7	0.4	1.2	1.1	1.1	0.8	1.3	1.9	4.8	3.2	3.1	3.2	3.0	3.7	2.1	2.9	1.9	1.9	1.7	1.4	2.4	2.4	2.6
Sep 5	SW	W	SW	SW	SW	SW	WSW	NW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	NNW	N	N	N	NNW	NNW	NNW	NNW
	2.0	1.7	1.4	1.6	1.7	1.9	2.0	3.2	3.4	3.2	3.4	3.0	3.8	3.3	3.0	4.0	3.0	2.5	2.3	2.2	2.7	2.9	3.0	3.2
Sep 6	NNW	NW	NNW	NNW	NNW	NNW	NNW	NW	NW	NNW	N	NNW	N	N	NNE	NNE	NNE	NNE	NNE	NE	NE	NE	NE	NE
	2.9	3.3	2.0	2.6	2.7	2.6	2.5	2.6	3.0	2.7	2.6	2.7	2.5	2.0	2.1	1.8	1.6	1.7	1.8	1.6	1.5	1.3	1.1	1.1
Sep 7	NE	NE	NE	NE	NE	NE	NE	NE	ENE	NE	NE	NE	NE	ENE	ENE	NE	E	NE	NE	NE	ENE	NE	NE	NE
	0.8	0.8	0.9	0.8	1.1	0.9	1.0	1.1	1.2	1.6	1.4	1.6	1.3	1.4	1.4	1.4	1.3	1.2	0.9	1.0	0.9	1.2	1.3	1.2
Sep 8	NNE	NE	NE	NNE	NNE	NNE	NNE	NNE	NNE	NE	NE	NE	NE	NE	NE	NE	NNE	NNE	NNE	NNE	NNW	NNW	WNW	NW
	1.0	1.0	0.8	0.9	0.9	1.1	1.2	0.9	0.7	1.3	1.5	1.4	1.5	1.4	1.9	1.5	1.3	1.1	1.1	1.0	1.2	1.2	1.0	0.7
Sep 9	WNW	SSW	SSW	WNW	SW	WNW	WNW	WNW	WNW	WNW	NW	NW	NW	NW	NW	NW	NW	NW	WNW	W	W	WNW	NNW	NNE
	1.7	1.8	1.5	1.2	1.2	2.4	1.7	2.1	2.6	3.3	4.0	3.6	3.1	3.4	3.1	3.7	4.5	4.5	2.7	1.6	1.2	2.2	1.7	0.9
Sep 10	N	NW	NNW	N	NNE	NNW	NW	NW	NNW	N	N	N	NNE	NNW	NW	NNW	NNW	NNW	N	N	NNE	NNE	NE	S
	1.0	0.9	1.4	1.1	1.2	1.4	1.9	2.1	2.0	1.8	2.0	2.1	2.0	2.0	2.6	1.8	2.3	2.2	1.7	1.2	0.7	0.6	0.5	0.8
Sep 11	S	S	SW	SW	N	SE	S	SSE	S	SSW	SSE	S	S	SSW	SSW	SSW	S	S	SSW	SSW	SSW	SSW	SW	SW
	1.0	0.8	0.7	0.3	0.5	0.7	0.8	0.9	1.0	1.1	1.5	1.8	2.1	2.6	3.0	3.3	3.6	4.1	4.2	5.2	4.8	4.8	4.1	3.7
Sep 12	SW	SW	SW	SW	S	SW	SW	SW	SW	SW	SW	SW	WSW	SSW	SW	SW	SW	S	S	S	SSW	S	SSE	S
	3.1	3.1	2.8	1.1	0.8	1.6	2.6	3.0	3.3	2.9	2.4	1.9	1.7	2.5	2.0	1.6	3.1	3.4	4.5	4.2	1.5	1.8	2.0	3.3
Sep 13	SSW	SSW	SSW	S	SSW	S	S	SSW	SSW	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW	SW	SW	SW	WSW	WNW	WNW
	3.9	4.5	4.2	4.1	5.0	4.5	4.3	5.4	5.7	6.3	5.2	6.5	5.6	5.1	5.4	5.2	4.5	4.6	3.0	2.2	1.9	2.0	3.8	3.8
Sep 14	WNW	NW	NW	NW	WNW	NW	WSW	SSW	SW	WSW	SSW	SSW	SW	SW	SSW	SSW	SSW	SSW	SSW	SSW	S	SSW	SSW	SW
	3.3	2.8	2.3	2.3	1.8	1.4	0.7	0.7	0.9	0.9	1.5	2.8	2.7	3.0	3.3	3.2	3.4	4.5	4.0	3.8	4.2	4.1	4.1	2.1
Sep 15	WNW	NW	WNW	WNW	WSW	SW	SSW	SW	SW	W	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	WNW	WNW	WNW
	3.6	3.0	2.1	2.2	1.3	1.5	2.6	2.4	1.8	1.7	4.4	4.2	3.7	4.1	3.9	4.5	5.4	6.0	5.3	5.1	3.6	2.9	2.0	3.5
Sep 16	WNW	WNW	W	W	WNW	W	W	W	W	WNW	NW	NW	WNW	WNW	NW	WNW	NW	NW	WNW	NW	NW	SW	SW	SW
	4.0	3.2	2.0	2.1	2.5	2.0	2.5	2.2	2.3	3.0	4.9	4.7	4.1	4.0	4.3	3.9	3.7	3.5	3.5	2.5	1.1	0.4	0.9	1.2
Sep 17	SW	SW	SW	SW	WNW	NW	WNW	W	SW	NNW	N	NNE	ESE	ESE	SSE	NNE	NE	N	NW	SE	SE	SE	S	SW
	1.2	1.4	1.2	1.4	0.7	1.2	1.1	0.9	0.4	0.8	0.9	0.9	1.1	1.4	1.7	1.0	1.0	0.9	0.6	0.4	1.0	1.2	1.8	1.3
Sep 18	SW	WSW	NNE	SSE	SW	NNE	NNE	NNE	NNE	NE	ENE	E	ESE	ESE	ENE	ESE	E	ESE	ESE	E	E	ENE	E	ESE
	0.8	0.6	0.6	0.5	1.2	0.4	0.3	0.3	0.4	0.8	1.2	1.5	2.0	1.9	1.7	2.0	1.9	2.2	1.7	1.2	0.8	0.7	0.7	0.8
Sep 19	E	E	ENE	SE	NE	E	E	ESE	ESE	SE	SSE	SSE	S	S	SSE	SSE	S	SSE	SSE	SSE	SSE	SSE	SE	S
	0.4	0.6	0.5	0.3	0.4	0.5	0.4	0.7	0.7	1.7	2.7	3.7	4.5	5.3	5.3	5.3	5.2	4.9	4.2	3.8	3.5	2.9	2.9	3.9
Sep 20	S	S	S	S	SSW	SSW	SSW	SW	SW	W	NW	NW	WNW	WNW	NW	NW	NW	NW	NW	WNW	NW	SW	SW	SSW
	3.7	4.8	4.5	4.5	4.1	3.5	3.8	3.0	1.9	1.8	4.4	3.9	3.9	3.4	4.0	3.8	4.1	3.5	2.9	0.9	0.6	0.3	1.2	2.8
Sep 21	SSW	SSW	SSW	SSW	SSE	S	S	S	S	SSE	SSE	E	E	ESE	SE	SE	SSE	S	S	S	S	SE	SE	SSE
	2.9	3.1	3.1	2.0	1.0	1.1	1.4	1.6	1.6	1.1	1.4	1.0	1.5	2.8	3.1	3.2	4.7	4.4	4.2	3.1	2.5	2.1	2.3	3.4
Sep 22	S	S	S	S	SSW	SW	SSW	SSW	S	SSW	SSW	SW	SSW	SSW	SSW	SSW	SW	SW	SW	WSW	WNW	WNW	W	WSW
	3.9	3.6	3.1	3.7	3.3	2.3	1.4	2.3	2.9	3.3	3.1	2.9	3.3	4.4	4.0	3.9	3.9	3.9	2.3	1.8	2.4	2.3	1.8	1.4
Sep 23	WSW	WSW	W	WSW	SW	NW	WSW	W	NW	NNW	ENE	ENE	ENE	NE	NE	E	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE
	1.4	1.4	1.5	1.2	0.8	1.0	0.7	0.8	1.2	1.2	0.8	1.4	1.6	1.5	1.6	1.9	2.3	2.2	2.0	2.0	2.4	2.2	1.6	1.3
Sep 24	NE	ENE	NE	NE	NE	NE	NE	NE	NE	NNE	NE	NE	NE	NE	E	SSW	SSW	SSW	SW	SW	SW	SW	SW	SW
	1.4	1.3	1.2	1.1	1.1	0.9	0.9	0.8	0.9	0.9	1.2	1.4	1.3	1.0	1.2	1.7	1.3	1.8	1.6	1.9	2.2	1.6	1.4	1.3
Sep 25	SW	SW	W	SW	SW	SW	WSW	WNW	WNW	NW	NW	NW	NNW	NW	NNW	NW	NW	WNW	NW	WNW	NW	WNW	SSW	SSW
	1.2	1.6	1.3	1.1	1.8	1.7	1.4	1.7	2.0	3.2	2.5	2.3	2.5	3.5	3.4	2.8	3.0	2.7	2.5	1.5	1.4	1.6	1.7	1.1
Sep 26	SSW	SW	NNW	NW	WNW	W	W	WNW	W	NNW	NNE	NNE	NNE	NE	ENE	NE	NE	NE	NE	NE	NE	NE	NE	NNE
	1.2	1.0	1.2	0.9	0.7	1.6	1.4	0.8	0.5	1.4	0.9	1.1	1.3	1.4	1.3	1.6	1.6	1.2	1.5	1.5	0.6	0.7	0.8	0.7
Sep 27	NE	NE	NE	ENE	ENE	NE	NE	NE	ENE	ENE	ENE	E	E	ENE	E	ENE	ENE	E	ENE	ENE	ENE	ENE	ENE	ENE
	1.1	0.4	0.6	0.8	0.9	0.8	1.0	1.0	1.3	1.9	2.3	2.6	2.4	2.5	2.7	2.6	2.6	2.6	2.6	2.3	2.1	2.1	1.9	2.3
Sep 28	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	ENE	E	E	E	ESE	ESE	ESE	E	ENE	ENE	ESE	ESE	ESE	SE	SE
	2.4	1.8	1.6	1.5	1.4	1.7	1.6	1.5	1.4	1.8	1.9	1.6	1.4	1.2	1.6	1.9	1.8	1.8	1.5	1.1	1.4	1.3	2.5	1.6
Sep 29	SE	SE	SSE	S	S	S	S	SW	NE	SW	SW	W	SW	SW	SSW	SW	SW	SW	SW	W	WSW	SW	SW	SW
	2.2	3.1	3.5	3.6	2.4	1.6	1.8	1.4	0.4	1.3	1.4	1.0	1.7	1.8	2.0	1.6	1.2	1.7	1.4	1.5	1.2	2.4	1.9	2.6
Sep 30	SW	SW	SW	SW	SW	SSW	SSW	SSW	SSE	SSE	S	SSW	SW	SW	SSW	SSW	WSW	NNW	NNW	N	N	N	N	N
	3.6	3.4	3.5	3.9	3.1	3.4	3.1	2.4	1.3	2.7	4.2	5.6	3.9	3.4	4.6	3.7	2.9	2.7	2.5	2.1	2.2	2.5	2.4	2.2

Value below the cutoff threshold are displayed as blanks.
The instrument was operating 100.0 percent of the time.

WM Ottawa Landfill
Meteorological Data

Average Wind Direction (deg.)
And Average Wind Speed (m/s)
OCTOBER 01, 2011 to OCTOBER 12, 2011

Day	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
Oct 1		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	NNE	NNE	NNE	NNE	N	NNE	NNE
	2.3	2.3	2.6	2.9	3.3	3.2	2.6	3.0	3.4	3.1	3.9	3.4	4.5	4.6	4.0	4.0	3.8	3.8	3.8	3.2	3.5	2.9	3.5	3.7
Oct 2	NNE	NNE	NNE	N	N	N	N	N	NNE	NNE	NNE	NE	NE	NE	NE	NE	NNE	NE	NNE	NE	NE	NNE	NE	NNE
	3.5	3.0	3.3	2.6	2.1	2.3	2.8	2.8	2.8	2.7	2.8	2.7	2.9	2.4	2.2	2.2	2.3	2.1	1.9	1.8	0.9	1.3	1.6	1.4
Oct 3	NNE	NNE	NNE	NE	NNE	NE	NE	ENE	ENE	ENE	NE	NE	NE	NE	NE	ENE	ESE	ENE	NNE	NE	ENE	NE	NE	E
	1.8	1.9	2.1	1.4	1.6	1.7	1.4	1.1	1.5	1.4	1.3	1.7	1.5	1.5	1.5	1.0	0.8	0.5	0.7	0.7	1.1	0.9	0.7	1.0
Oct 4	E	ENE	NE	NE	NE	NNW	NNW	NNW	NW	NW	NNW	NNW	NW	NW	NW	NW	N	NNW	NNE	NNE	SW	SW	SSW	SSW
	1.2	1.1	0.8	0.8	0.6	0.8	1.3	1.0	1.5	2.0	1.6	2.3	3.0	2.8	3.0	3.4	2.5	1.9	1.4	0.9	1.0	1.5	1.5	1.7
Oct 5	WSW	WNW	WNW	W	WNW	WNW	WNW	NW	NW	NW	NNW	NNW	N	N	N	N	NNW	N	N	NNW	NW	WNW	NW	NNW
	1.2	2.1	2.6	1.9	2.6	3.3	3.6	4.0	3.8	3.9	3.7	3.6	4.1	3.9	3.3	3.2	4.1	3.8	2.9	1.1	1.0	2.1	2.5	1.9
Oct 6	WNW	WNW	WNW	WNW	WNW	WNW	W	WNW	WNW	NW	NNW	N	NW	NW	WNW	NW	NW	NW	WNW	W	WSW	SW	SW	SW
	2.0	1.3	1.7	1.9	2.2	2.6	2.6	2.4	2.3	2.4	1.7	1.5	2.4	3.1	2.5	3.3	3.3	3.3	2.2	1.0	1.1	1.1	1.4	1.4
Oct 7	SW	SW	SSW	SW	SW	ENE	W	NNW	ENE	SSW	WSW	SW	SW	SSW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SW
	1.6	1.2	0.4	0.5	0.8	0.4	0.9	0.4	0.4	0.9	0.6	0.8	1.1	1.8	2.5	3.0	2.8	3.5	3.4	4.2	5.0	5.0	4.3	4.1
Oct 8	SW	SW	SW	SW	SW	SW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	SSW	S	SSW	SSW	SSW	SW	SW
	3.5	3.1	2.5	1.2	1.4	2.2	1.7	3.0	2.8	2.9	3.0	4.1	3.8	3.1	3.2	3.2	3.6	4.3	3.9	4.0	4.5	4.9	4.6	3.5
Oct 9	SW	WSW	SW	SW	W	W	SW	SW	SW	SSW	SSW	SSW	SW	SSW	SW	WSW	SW	SW	SW	SW	SW	SW	SW	SW
	1.0	1.2	2.5	2.2	0.9	0.6	1.1	2.8	2.6	1.7	3.0	3.1	2.8	2.9	2.4	2.3	3.4	3.5	2.6	2.6	3.0	3.4	3.3	2.4
Oct 10	SW	SW	SW	SW	W	WNW	WNW	WNW	WNW	WNW	WNW	NW	NNW	NW	NNW	N	NW	NW	NW	WNW	WNW	NW	NNE	NE
	2.4	2.2	1.7	2.1	2.0	2.4	2.7	2.6	2.7	3.0	2.2	1.8	1.4	2.0	2.7	1.9	1.9	2.9	2.6	1.9	1.7	1.4	1.2	1.0
Oct 11	ESE	ESE	SE	NE	NNE	NE	NE	NE	ENE	ENE	ENE	E	E	ESE	ENE	ENE	E	E	ENE	ENE	ENE	ESE	ESE	SE
	0.8	0.4	0.5	0.3	0.2	0.6	1.0	0.8	1.0	1.2	2.2	2.1	2.0	1.9	1.6	1.9	1.7	1.4	1.2	0.8	0.8	0.5	0.7	1.3
Oct 12	E	ENE	ENE	ENE	NE	ENE	ENE	E	ENE	ENE	ENE	ENE	E	E	E	ESE	M	M	M	M	M	M	M	M
	0.9	1.2	1.3	1.3	1.5	1.3	1.6	1.2	1.7	1.9	2.2	1.7	1.8	1.4	1.6	1.5								

Value below the cutoff threshold are displayed as blanks.
The instrument was operating 97.2 percent of the time.

C2. Appendix A

Ottawa Landfill TRS Monitoring Program

Note: the zero concentration readings are omitted.

Date	Time	10-Minute TRS Concentration (ppm)
7-Jul-11	2100	1
7-Jul-11	2050	1
7-Jul-11	2120	1
7-Jul-11	2130	1
7-Jul-11	2110	1
8-Jul-11	10	1
8-Jul-11	120	1
8-Jul-11	330	1
8-Jul-11	510	1
8-Jul-11	50	1
8-Jul-11	200	1
8-Jul-11	340	1
8-Jul-11	610	1
8-Jul-11	620	1
8-Jul-11	410	1
8-Jul-11	540	1
8-Jul-11	600	1
8-Jul-11	530	1
8-Jul-11	500	1
8-Jul-11	420	1
8-Jul-11	450	1
8-Jul-11	430	1
8-Jul-11	520	1
8-Jul-11	440	1
8-Jul-11	550	1
11-Jul-11	1730	1
11-Jul-11	1720	1
11-Jul-11	1710	1
12-Jul-11	1720	1
12-Jul-11	1730	1
12-Jul-11	1710	1
16-Jul-11	2130	1
16-Jul-11	630	1
16-Jul-11	500	1
17-Jul-11	1710	1
17-Jul-11	1720	1
17-Jul-11	440	1
18-Jul-11	1850	1
18-Jul-11	1830	1
18-Jul-11	1800	1
18-Jul-11	1740	1

Blank Spaces indicate concentrations below instrument detection limit.
The letter M indicates missing data points.

Ottawa Landfill TRS Monitoring Program

Note: the zero concentration readings are omitted.

Date	Time	10-Minute TRS Concentration (ppm)
18-Jul-11	1730	1
18-Jul-11	1820	1
18-Jul-11	1720	1
18-Jul-11	1710	1
24-Jul-11	2230	1
29-Jul-11	1820	1
29-Jul-11	1810	1
29-Jul-11	1750	1
29-Jul-11	1800	1
29-Jul-11	1740	1
29-Jul-11	1720	1
29-Jul-11	1710	1
29-Jul-11	1730	1
4-Aug-11	700	1
4-Aug-11	710	1
8-Aug-11	2340	1
8-Aug-11	2300	1
31-Aug-11	610	1
31-Aug-11	700	1
31-Aug-11	630	1
31-Aug-11	620	1
31-Aug-11	650	1
31-Aug-11	640	1
2-Sep-11	1710	1
4-Sep-11	1720	1
17-Sep-11	1940	1
28-Sep-11	1830	1
28-Sep-11	1730	1
28-Sep-11	1740	1
28-Sep-11	1710	1
28-Sep-11	1720	1
1-Oct-11	710	1
1-Oct-11	720	1
11-Oct-11	140	1

Blank Spaces indicate concentrations below instrument detection limit.
The letter M indicates missing data points.