



# AIR AND ODOUR EMISSIONS ASSESSMENT OF OPERATIONAL SHUTDOWN STACK RELEASE

CLEAN HARBORS CANADA INC.  
CORUNNA, ONTARIO

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## 1.0 INTRODUCTION

On Wednesday, August 10, 2011 at approximately 9:00 p.m., an air release occurred from the emergency release vent connected to the Thermal Desorber Unit (TDU) at the Clean Harbors Canada Inc. (Clean Harbors) facility (Facility) located in Corunna, Ontario.

This assessment report has been prepared by Conestoga-Rovers & Associates (CRA) to evaluate the potential air quality and odour impacts from the release.

At the time of the release, the waste being treated in the TDU was a mixture of oily lagoon and separator solids and soil containing coal tar. Clean Harbors has provided CRA with an analysis of the volatile organic compounds (VOCs) contained in the waste. The wastes, their percentages in the mixture being treated at the time of the release, and the constituents in the waste are listed in Table 1.

### 1.1 EMERGENCY RELEASE

The emergency release was vented through the Operational Shutdown Stack (OSS), which only operates in the event of an emergency. Based on a review of the process and the stage at which the emergency release occurred, Facility personnel estimated that there was 1,711 kg of waste in the TDU drum at the time of the shutdown. This 1,711 kg was comprised of an estimated 15 percent organics, 33 percent moisture, and 52 percent solids. It was also estimated that 50 percent of the organics and moisture contained in the drum had already been treated at the time of the release. Therefore, 128.3 kg of untreated organics remained in the drum.

The release began at 9:00 pm and continued for 21 minutes, as indicated by the recorded log for the TDU process and discretion with Facility operations personnel.

## 2.0 ESTIMATED AIR EMISSIONS

As detailed in Section 1.1, approximately 128.3 kg of untreated organics remained in the drum at the time of the emergency release. The breakdown of the organic waste contained in the drum was as follows:

- 60 percent Soil containing Coal Tar
- 40 percent Oily Lagoon and Separator Solids

The breakdown of volatile organic compounds in each waste, in ppm, was provided by Clean Harbors based on laboratory analysis conducted on site. The analysis is provided in Appendix A.

Clean Harbors conducts a pre-screening test on all wastes to determine if they contain less than 1 percent VOCs by weight. If the waste does not pass this pre-screening, it goes for further refined testing to determine if it contains less than 2 percent VOCs. Facility personnel have indicated that the wastes being treated in the TDU at the time of the emergency release passed the pre-screening test, therefore containing less than 1 percent VOCs by weight.

## 2.1 SAMPLE EMISSION CALCULATION

For this assessment CRA assumed that all of the organics were volatized and transported in air as vapour. The total organics emission rate is calculated as follows for the 21 minute release period.

$$\frac{128.3\text{kg}}{21\text{min}} \times \frac{\text{min}}{60\text{s}} \times \frac{1000\text{g}}{\text{kg}} = 102 \frac{\text{g}}{\text{s}}$$

In the 21 minute release time period, the estimated emission rate of anthracene (contained in the oily lagoon and separator solids), is as follows:

$$\frac{128.3\text{kg}}{21\text{min}} \times \frac{\text{min}}{60\text{s}} \times 40\%(\text{waste\_mix}) \times \left( 8.7\text{ppm} \left( \frac{\text{mg}}{\text{kg}} \right) \times \frac{\text{g}}{1000\text{mg}} \right) = 3.54\text{E} - 4 \frac{\text{g}}{\text{s}}$$

The AERMOD model is a Gaussian plume model that is used to model steady-state emissions. Since the shortest averaging period calculated by the AERMOD model is 1 hour, a 1 hour emission rate was calculated for use with the model:

$$\frac{128.3\text{kg}}{\text{hr}} \times \frac{\text{hr}}{3600\text{s}} \times 40\%(\text{waste\_mix}) \times \left( 8.7 \text{ ppm} \left( \frac{\text{mg}}{\text{kg}} \right) \times \frac{\text{g}}{1000\text{mg}} \right) = 1.24\text{E} - 4 \frac{\text{g}}{\text{s}}$$

The emission estimates for all VOCs and other organic compounds are summarized on Table 1.

### 3.0 DISPERSION MODELLING

CRA completed air dispersion modelling for the release based on a unitized gram per second (g/s) emission rate from the TDU OSS. A unitized model was employed because the release occurred from a single source, the OSS. Results from the unitized model can then be scaled, based on the estimated emission rate of each air contaminant, to determine the impact of downwind concentrations.

The AERMOD model is a Gaussian plume model that is used to model steady-state emissions. During the 21 minute release from the OSS, the source emission was considered to be continuously venting at a steady-state rate at the emission rates summarized in Table 1.

#### 3.1 MODEL EXECUTABLES

CRA used the following executable files in this assessment:

- AERMET, version 06341
- AERMOD, version 09292
- AERMAP, version 09040
- BPIP, version 04274

#### 3.2 METEOROLOGICAL DATA

CRA collected meteorological data from the Environmental Canada climate archive for the Sarnia Airport station (WMO ID 71704) and the Sarnia Climate station (WMO ID 71746) for the date of the emergency release (i.e., August 10, 2011). Both stations are located on or within the vicinity of the Sarnia Airport, which is located approximately 13 km to the north-northwest of Clean Harbor.

CRA was also provided with onsite meteorological data for the day of the emergency release as collected by Clean Harbor's onsite meteorological station. This monitor collects onsite wind speed, wind direction and temperature in one-minute increments. This information was averaged into 1 hour increments for the purpose of the dispersion modelling. Before pre-processing the meteorological data via AERMET, the onsite data

was supplemented with data from the Sarnia Climate station (dew point temperature, relative humidity and station pressure) and the Sarnia Airport (visibility).

The wind speed and wind direction data for the release period was similar for the three meteorological data.

CRA processed the meteorological data using AERMET with the following setup parameters:

- Surface Station (Clean Harbor, onsite monitor):
  - Latitude 42°52'00"N, Longitude 82°17'00"W
  - Elevation above mean sea level, 200 m
- Facility Information
  - Latitude 42°52'00"N, Longitude 82°17'00"W
  - Elevation above mean sea level, 200 m
- Meteorological Period: August 10, 2011
- AERMET input file format: SAMSON surface file based on onsite monitored data, supplemented with Sarnia Climate and Airport station data; upper air was estimated using an upper air estimation tool
- Application site anemometer height: 10 m (assumed)
- Surface sectors (Albedo, Bowen Ratio, Surface Roughness): 000-360 degrees, monthly values, cultivated land

CRA used the processed meteorological data set (surface and upper air) in the emergency release scenario modelling. As the release occurred at 9:00:45 pm (Local Standard Time), CRA modelled the release hour and the following hour of meteorological data. The rationale for the use of the following hour was to account for uncertainty of the wind conditions over the 21-minute release period, and to account for the travel time of the released plume downwind.

### **3.3 AVERAGING PERIODS AND EMISSION RATES**

The shortest averaging period calculated by the AERMOD model is 1 hour. As the release occurred over a short period of time, the 1 hour averaging period was used to calculate ground level concentrations (GLCs) as if the release occurred over the entire hour. As only a single emission source experienced the emergency release, the source

was modelled using a unitized emission rate of 1 g/s. This unitized emission rate results in a calculated unitized dispersion factor for GLCs. Calculation of air contaminant specific GLCs can then be performed using the dispersion factor (in ug/m<sup>3</sup> per 1 g/s) and the maximum air contaminant emission rate (in g/s).

### **3.4 DIGITAL ELEVATION MODEL DATA**

CRA developed the AERMOD dispersion model using UTM coordinates to allow for the inclusion of site-specific digital elevation model (DEM) (7.5 minute format) data from the Sarnia/Corunna terrain tile set.

AERMOD captures the essential physics of dispersion in complex terrain through the use of a separate height scale factor for each receptor (USEPA, 1998 - AERMAP UG). The highest scale factor represents the terrain that would dominate flow in the vicinity of the receptor.

### **3.5 SOURCE INPUT PARAMETERS**

CRA modelled the OSS as a point source. Operating conditions of the source were provided by Clean Harbor based on their process monitoring data. Based on the provided information, CRA used the following parameters:

- Stack Height, 19.81 m above grade
- Exit Temperature, 400°C
- Exit Velocity, 11.74 m/s (based on release flow rate of 0.858 m<sup>3</sup>/s)
- Exit Diameter, 0.31 m
- Emission Rate, 1 g/s (unitized)

The release flow rate was calculated based on operating conditions as summarized in Table 2.

### **3.6 ON-SITE BUILDING DATA**

CRA included the Facility buildings in AERMOD to account for building cavity downwash. Cavity downwash can result in air contaminants being forced to ground

level prematurely under certain meteorological conditions, which can result in greater than expected near-field concentrations.

CRA used the USEPA Building Profile Input Program (BPIP) to calculate downwash effects for use with AERMOD.

### **3.7 MODELLING RESULTS**

A contour plot illustrating the extent of the estimated ground level concentrations, as a percentage of maximum predicted concentration, is provided as Figure 1.

## 4.0 ASSESSMENT OF IMPACTS

### 4.1 AIR QUALITY

A point of impingement (POI) concentration for each contaminant emitted during the emergency release was calculated based on the 1 hour average emission rates listed in Table 1 and the unitized 1 hour dispersion factor, converted to a 24-hr averaging period. The results are presented in Table 3A. The calculated POI concentrations were compared against the Schedule 3 24 hour criteria listed in the publication "Summary of O. Reg. 419 Standards, Point of Impingement Guidelines and Ambient Air Quality Criteria (AAQC)" dated February 2008.

To conservatively assess off-site impacts from all Facility sources, the maximum GLCs for the same contaminants listed in the Facility's Emission Summary and Dispersion Modelling (ESDM) Report were added to the maximum GLCs from the emergency release to the OSS for each compound, as summarized on Table 3B. The total was then compared against the Reg. 419 Schedule 3 24 hour criteria. This approach is very conservative because it is unlikely that the maximum modelled GLC in the ESDM would occur at the same location or at the same time for the OSS release. The modelled concentrations presented in the ESDM Report are based on 5 years of meteorological data (43,000 hours), whereas the ones from the OSS release are based on 2 hours.

As demonstrated on Table 3A and 3B, the assessment indicates that the Facility did not exceed any MOE POI limits for the VOC compounds released during the OSS emergency release.

The majority of the emissions identified as total organic compounds did not have specific POI criteria to assess.

### 4.2 ODOUR

The calculated point of impingement (POI) concentration for each contaminant emitted during the emergency release was converted to a 10-minute averaging period for comparison to odour threshold values. The odour threshold values were obtained from the Haz-Map occupational health database. The following sources were also consulted:

- *Compilation of Odor and Taste Threshold Values Data*. Ed. F.A. Fazzalari. Philadelphia: American Society for Testing and Materials, 1978. Print.

- *Odor Thresholds for Chemicals with Established Occupational Health Standards. Fairfax, Virginia: American Industrial Hygiene Association, 1989. Print.*

*Atlas of Odor Character Profiles.* Comp. Andrew Dravnieks. Philadelphia, PA: American Society for Testing and Materials, 1985. Print.

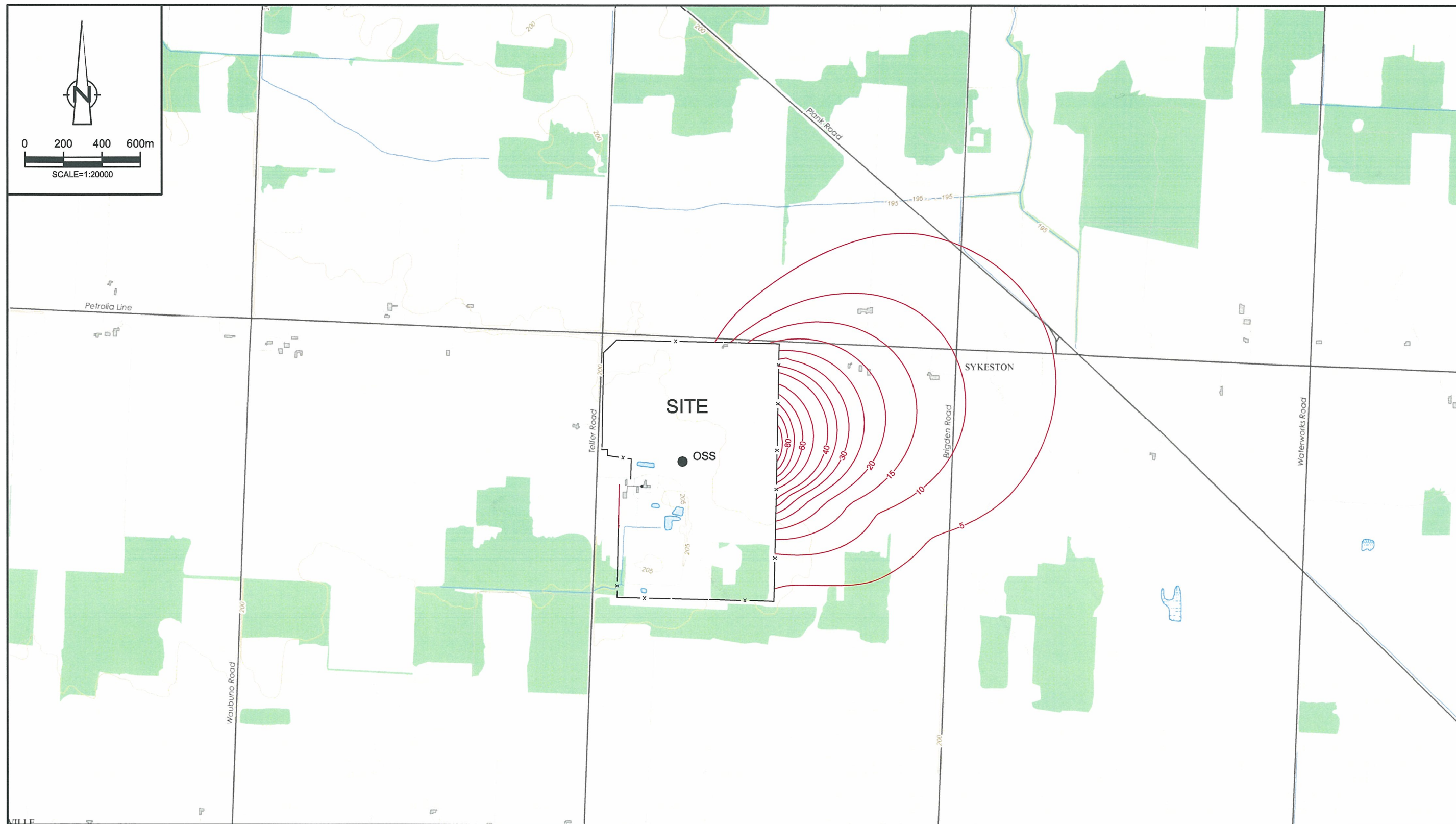
Not all of the compounds modelled in the emergency release have an odour threshold value published in the consulted databases. The results are presented in Table 4A.

To assess off-site impacts from all Facility sources, the maximum GLCs listed in the Facility's Emission Summary and Dispersion Modelling (ESDM) Report were converted to a 10 minute averaging period and added to the 10 minute POI concentrations from the emergency release to the OSS, as summarized on Table 4B. The total was then compared against the odour threshold values.

As mentioned in Section 4.1, this approach is very conservative because it is unlikely that the maximum modelled results would occur at the same location. The concentrations in the ESDM Report are based on 5 years of meteorological data, whereas the OSS release is based on 2 hours.

As demonstrated on Table 4A and 4B, the assessment indicates that the Facility did not exceed any odour threshold values due to the VOC emissions from the TDU SSO emergency release.

The majority of the emissions identified as total organic compounds did not have specific odour threshold values to assess.



**LEGEND**

—10— PERCENT OF MAXIMUM CONCENTRATION

figure 1

OPERATIONAL SHUTDOWN STACK RELEASE  
 AUGUST 10, 2011  
 CLEAN HARBORS CANADA INC.  
 Corunna, Ontario



TABLE 1

OPERATIONAL SHUTDOWN STACK RELEASE - AUGUST 10, 2011  
 CLEAN HARBORS CANADA INC.  
 CORUNNA, ONTARIO

Untreated Organics in Waste (1) Length of Release		128.3 21	kg min				
		<i>Waste Components (2)</i>			<i>Emission Rate - 21 min average</i>	<i>Emission Rate - 1 hr average</i>	
<i>Waste Description</i>	<i>Percent of Mix</i>	<i>Compound</i>	<i>CAS #</i>	<i>Composition (ppm)</i>	<i>(g/s)</i>	<i>(g/s)</i>	
Oily Lagoon and Separator Solids	40%	Anthracene	120-12-7	8.7	3.54E-04	1.24E-04	
		Benz (a) anthracene	56-55-3	20.4	8.31E-04	2.91E-04	
		Benzo (a) pyrene	50-32-8	9.7	3.95E-04	1.38E-04	
		Chrysene	218-01-9	36.3	1.48E-03	5.18E-04	
		Fluorene	86-73-7	9.5	3.87E-04	1.35E-04	
		Phenanthrene	85-01-8	67	2.73E-03	9.55E-04	
		Pyrene	129-00-0	59.3	2.42E-03	8.46E-04	
		Xylenes - mixed isomers	1330-20-7	3.8	1.55E-04	5.42E-05	
Soil containing Coal Tar	60%	Hexane	110-54-3	6	3.67E-04	1.28E-04	
		Benzene	71-43-2	965	5.90E-02	2.06E-02	
		n-Heptane	142-82-5	5.2	3.18E-04	1.11E-04	
		Toluene	108-88-3	778	4.75E-02	1.66E-02	
		Ethylbenzene	100-41-4	102	6.23E-03	2.18E-03	
		p- & m- Xylene	108-36-3/106-42-3	39.8	2.43E-03	8.51E-04	
		o-Xylene	95-47-6	150	9.17E-03	3.21E-03	
		1,3,5-Trimethylbenzene	108-67-8	70	4.28E-03	1.50E-03	
		1,2,4-Trichlorobenzene	120-82-1	2.4	1.47E-04	5.13E-05	
Napthalene	91-20-3	350	2.14E-02	7.49E-03			
Combined	100%	Total Organic Compounds	NA	NA	1.02E+02	3.56E+01	

**Notes:**

- (1) At the time of feed shutdown and the emergency release.  
 (2) As analyzed by Clean Harbors Laboratory.

TABLE 2

**EXHAUST FLOW RATE CALCULATIONS  
OPERATIONAL SHUTDOWN STACK RELEASE - AUGUST 10, 2011  
CLEAN HARBORS CANADA INC.  
CORUNNA, ONTARIO**

**KNOWN**

Waste in drum @ shutdown	1711	kg
% Untreated (organics and moisture)	50% (1)	
Volume of 1 mole of ideal gas	22.4	L
Temperature of Desorber Drum	400 (2)	C
Length of Release	21 (3)	min

<i>Content of Waste</i>		(kg)	Molecular Weight g/g-mole	Flow Rate	
				Standard m <sup>3</sup> /s	Actual m <sup>3</sup> /s
Organics	15%	128.3	42 (4)	0.054	0.125
Moisture	33%	282.3	18	0.28	0.640
Nitrogen Feed In	-	-	-	0.041	0.093
				<b>TOTAL</b>	<b>0.858</b>

**Notes:**

- (1) As indicated by Clean Harbors, approximately 50% of the material contained within the desorber drum at the time of the feed shutdown and subsequent emergency release had been treated. It is estimated that 50% of the material remained available for release of organics and moisture.
- (2) As provided by Clean Harbors.
- (3) As determined from the TDU log for August 10, 2011. The release began when the pressure in the desorber drum became positive. Normally the drum is kept under negative pressure. When negative pressure was restored, the release was no longer occurring.
- (4) Conservatively estimated based on Clean Harbors' expertise. The molecular weight may actually be higher, which would yield a lower flow rate.

TABLE 3A

EMISSION SUMMARY TABLE - OSS RELEASE SCENARIO  
CLEAN HARBORS CANADA INC.  
CORUNNA, ONTARIO

<i>Contaminant</i>	<i>CAS No.</i>	<i>Emission Rate (g/s)</i>	<i>Air Dispersion Model Used</i>	<i>Max. POI Concentration (ug/m3)</i>	<i>Averaging Period (hours)</i>	<i>MOE POI Limit (ug/m3)</i>	<i>Limiting Effect</i>	<i>Regulation Schedule #</i>	<i>Percentage of MOE POI Limit</i>
1,2,4-Trichlorobenzene	120-82-1	5.13E-05	AERMOD	4.51E-05	24	400	Health	Guideline	0.00%
1,3,5-Trimethylbenzene	108-67-8	1.50E-03	AERMOD	1.32E-03	24	220	Health	3	0.00%
Anthracene	120-12-7	1.24E-04	AERMOD	1.09E-04	24	0.2	NA	JSL	0.05%
Benz (a) anthracene	56-55-3	2.91E-04	AERMOD	2.56E-04	24	NA	NA	NA	NA
Benzene	71-43-2	2.06E-02	AERMOD	1.81E-02	24	2.3	Carcinogen	Proposed Standard	0.79%
Benzo (a) pyrene	50-32-8	1.38E-04	AERMOD	1.22E-04	24	0.0011	Health	Guideline	11.05%
Chrysene	218-01-9	5.18E-04	AERMOD	4.55E-04	24	NA	NA	NA	NA
Ethylbenzene	100-41-4	2.18E-03	AERMOD	1.92E-03	24	NA	NA	NA	NA
Fluorene	86-73-7	1.35E-04	AERMOD	1.19E-04	24	NA	NA	NA	NA
Hexane	110-54-3	1.28E-04	AERMOD	1.13E-04	24	7,500	Health	3	0.00%
Napthalene	91-20-3	7.49E-03	AERMOD	6.58E-03	24	22.5	Health	Guideline	0.03%
n-Heptane	142-82-5	1.11E-04	AERMOD	9.77E-05	24	11,000	Health	3	0.00%
o-Xylene	95-47-6	3.21E-03	AERMOD	2.82E-03	24	100	NA	JSL	0.00%
p- & m- Xylene	108-36-3/106-42-3	8.51E-04	AERMOD	7.48E-04	24	100	NA	JSL	0.00%
Phenanthrene	85-01-8	9.55E-04	AERMOD	8.39E-04	24	NA	NA	NA	NA
Pyrene	129-00-0	8.46E-04	AERMOD	7.43E-04	24	0.2	NA	JSL	0.37%
Toluene	108-88-3	1.66E-02	AERMOD	1.46E-02	24	2000	Odour	Guideline	0.00%
Xylenes - mixed isomers	1330-20-7	5.42E-05	AERMOD	4.76E-05	24	730	Health	3	0.00%
Total Organic Compounds	NA	3.56E+01	AERMOD	3.13E+01	24	NA	NA	NA	NA

**Notes:**

3 - refers to Standards in Schedule 3 of O. Reg. 419/05

G - Guideline

JSL - Jurisdictional Screening Level list

Dispersion Factor (ug/m3/g/s)

2.20

(1-hr)

0.879

(24-hr)

3.62

(10-min)

TABLE 3B

MAXIMUM PREDICTED OFF-SITE IMPACTS - AIR  
CLEAN HARBORS CANADA INC.  
CORUNNA, ONTARIO

Contaminant	CAS No.	Air Dispersion Model Used	Max. POI Concentration			Averaging Period (hours)	MOE POI Limit (ug/m3)	Limiting Effect	Regulation Schedule #	Percentage of MOE POI Limit
			OSS Release (1) (ug/m <sup>3</sup> )	ESDM Report (ug/m <sup>3</sup> )	TOTAL (ug/m <sup>3</sup> )					
1,2,4-Trichlorobenzene	120-82-1	AERMOD	4.51E-05	8.80E-06	5.39E-05	24	400	Health	Guideline	0.00%
1,3,5-Trimethylbenzene	108-67-8	AERMOD	1.32E-03	NA	1.32E-03	24	220	Health	3	0.00%
Anthracene	120-12-7	AERMOD	1.09E-04	1.36E-02	1.37E-02	24	0.2	NA	JSL	6.85%
Benz (a) anthracene	56-55-3	AERMOD	2.56E-04	NA	2.56E-04	24	NA	NA	NA	NA
Benzene	71-43-2	AERMOD	1.81E-02	1.62E+00	1.64E+00	24	2.3	Carcinogen	Proposed Standard	71.22%
Benzo (a) pyrene	50-32-8	AERMOD	1.22E-04	9.50E-08	1.22E-04	24	0.0011	Health	Guideline	11.06%
Chrysene	218-01-9	AERMOD	4.55E-04	1.34E-02	1.39E-02	24	NA	NA	NA	NA
Ethylbenzene	100-41-4	AERMOD	1.92E-03	7.57E+00	7.57E+00	24	NA	NA	NA	NA
Fluorene	86-73-7	AERMOD	1.19E-04	NA	1.19E-04	24	NA	NA	NA	NA
Hexane	110-54-3	AERMOD	1.13E-04	NA	1.13E-04	24	7,500	Health	3	0.00%
Napthalene	91-20-3	AERMOD	6.58E-03	8.32E+00	8.33E+00	24	22.5	Health	Guideline	37.01%
n-Heptane	142-82-5	AERMOD	9.77E-05	9.57E-01	9.57E-01	24	11,000	Health	3	0.01%
o-Xylene	95-47-6	AERMOD	2.82E-03	7.26E+00	7.26E+00	24	100	NA	JSL	7.26%
p- & m- Xylene	108-36-3/106-42-3	AERMOD	7.48E-04	1.95E+01	1.95E+01	24	100	NA	JSL	19.50%
Phenanthrene	85-01-8	AERMOD	8.39E-04	NA	8.39E-04	24	NA	NA	NA	NA
Pyrene	129-00-0	AERMOD	7.43E-04	NA	7.43E-04	24	0.2	NA	JSL	0.37%
Toluene	108-88-3	AERMOD	1.46E-02	1.71E+01	1.71E+01	24	2000	Odour	Guideline	0.86%
Xylenes - mixed isomers	1330-20-7	AERMOD	4.76E-05	2.72E+01	2.72E+01	24	730	Health	3	3.73%
Total Organic Compounds	NA	AERMOD	3.13E+01	NA	3.13E+01	24	NA	NA	NA	NA

**Notes:**

3 - refers to Standards in Schedule 3 of O. Reg. 419/05

G - Guideline

JSL - Jurisdictional Screening Level list

(1) As calculated on Table 3A.

(2) From CRA Report 'Emission Summary and Dispersion Modelling Report' prepared March 2010 for Clean Harbors.

TABLE 4A

**ODOUR THRESHOLD SUMMARY TABLE - OSS RELEASE SCENARIO  
CLEAN HARBORS CANADA INC.  
CORUNNA, ONTARIO**

<i>Contaminant</i>	<i>CAS No.</i>	<i>Molecular Weight</i>	<i>Max. POI Concentration (ug/m3)</i>	<i>Averaging Period</i>	<i>Odour Threshold (1) (ppm)</i>	<i>Odour Threshold (1) (ug/m3)</i>	<i>Percentage of Odour Threshold</i>
1,2,4-Trichlorobenzene	120-82-1	181.45	1.86E-04	10-minute	2.96	21,967	0.00%
1,3,5-Trimethylbenzene	108-67-8	120.2	5.43E-03	10-minute	2.2	10,816	0.00%
Anthracene	120-12-7	178.24	4.50E-04	10-minute	-	-	-
Benz (a) anthracene	56-55-3	228.3	1.05E-03	10-minute	-	-	-
Benzene	71-43-2	78.11	7.48E-02	10-minute	34	108,619	0.00%
Benzo (a) pyrene	50-32-8	252.32	5.01E-04	10-minute	-	-	-
Chrysene	218-01-9	228.3	1.88E-03	10-minute	-	-	-
Ethylbenzene	100-41-4	106.17	7.91E-03	10-minute	0.09	391	0.00%
Fluorene	86-73-7	166.22	4.91E-04	10-minute	-	-	-
Hexane	110-54-3	86.18	4.65E-04	10-minute	65	229,108	0.00%
Napthalene	91-20-3	128.18	2.71E-02	10-minute	0.0095	50	0.05%
n-Heptane	142-82-5	100.21	4.03E-04	10-minute	40	163,943	0.00%
o-Xylene	95-47-6	106.17	1.16E-02	10-minute	0.08	347	0.00%
p- & m- Xylene	108-36-3/106-42-3	106.17	3.09E-03	10-minute	0.08	347	0.00%
Phenanthrene	85-01-8	178.24	3.46E-03	10-minute	-	-	-
Pyrene	129-00-0	202.26	3.06E-03	10-minute	-	-	-
Toluene	108-88-3	92.14	6.03E-02	10-minute	0.16	603	0.01%
Xylenes - mixed isomers	1330-20-7	106.17	1.96E-04	10-minute	0.08	347	0.00%
Total Organic Compounds	NA	NA	1.29E+02	10-minute	-	-	-

**Notes:**

(1) From Haz-Map occupational health database, online: <http://hazmap.nlm.nih.gov/>.

**TABLE 4B**  
**MAXIMUM PREDICTED OFF-SITE IMPACTS - ODOUR**  
**CLEAN HARBORS CANADA INC.**  
**CORUNNA, ONTARIO**

<i>Contaminant</i>	<i>CAS No.</i>	<i>OSS Release (ug/m<sup>3</sup>)</i>	<i>Max. POI Concentration ESDM Report (ug/m<sup>3</sup>)</i>	<i>TOTAL (ug/m<sup>3</sup>)</i>	<i>Averaging Period</i>	<i>Odour Threshold (1)</i>		<i>Percentage of Odour Threshold</i>
						<i>(ppm)</i>	<i>(ug/m3)</i>	
1,2,4-Trichlorobenzene	120-82-1	1.86E-04	1.45E-05	2.01E-04	10-minute	2.96	21,967	0.00%
1,3,5-Trimethylbenzene	108-67-8	5.43E-03	NA	5.43E-03	10-minute	2.2	10,816	0.00%
Anthracene	120-12-7	4.50E-04	2.24E-02	2.29E-02	10-minute	-	-	-
Benz (a) anthracene	56-55-3	1.05E-03	NA	1.05E-03	10-minute	-	-	-
Benzene	71-43-2	7.48E-02	2.67E+00	2.75E+00	10-minute	34	108,619	0.00%
Benzo (a) pyrene	50-32-8	5.01E-04	1.57E-07	5.01E-04	10-minute	-	-	-
Chrysene	218-01-9	1.88E-03	2.21E-02	2.40E-02	10-minute	-	-	-
Ethylbenzene	100-41-4	7.91E-03	1.25E+01	1.25E+01	10-minute	0.09	391	3.20%
Fluorene	86-73-7	4.91E-04	NA	4.91E-04	10-minute	-	-	-
Hexane	110-54-3	4.65E-04	NA	4.65E-04	10-minute	65	229,108	0.00%
Napthalene	91-20-3	2.71E-02	1.37E+01	1.38E+01	10-minute	0.0095	50	27.62%
n-Heptane	142-82-5	4.03E-04	1.58E+00	1.58E+00	10-minute	40	163,943	0.00%
o-Xylene	95-47-6	1.16E-02	1.20E+01	1.20E+01	10-minute	0.08	347	3.45%
p- & m- Xylene	108-36-3/106-42-3	3.09E-03	3.22E+01	3.22E+01	10-minute	0.08	347	9.26%
Phenanthrene	85-01-8	3.46E-03	NA	3.46E-03	10-minute	-	-	-
Pyrene	129-00-0	3.06E-03	NA	3.06E-03	10-minute	-	-	-
Toluene	108-88-3	6.03E-02	2.82E+01	2.83E+01	10-minute	0.16	603	4.69%
Xylenes - mixed isomers	1330-20-7	1.96E-04	4.49E+01	4.49E+01	10-minute	0.08	347	12.92%
Total Organic Compounds	NA	1.29E+02	NA	1.29E+02	10-minute	-	-	-

**Notes:**

(1) From Haz-Map occupational health database, online: <http://hazmap.nlm.nih.gov/>.

APPENDIX A

WASTE ANALYSIS, CLEAN HARBORS

Analyzed/Reported:

Nov. 5/10

				Land Disposal Treatment		F037
				Aqueous Waste	Non-aqueous Waste	
				Column 5	Column 6	
F037	Petroleum refinery primary oil/water/solids separation sludge - Any sludge generated from the gravitational separation of oil/water/solids during the storage or treatment of process wastewaters and oily cooling wastewaters from petroleum refineries. Such sludges include, but are not limited to, those generated in: oil/water/solids separators; tanks and impoundments; ditches and other conveyances; sumps; and stormwater units receiving dry weather flow. Sludge generated in stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oily cooling waters, sludges generated in aggressive biological treatment units as defined in s. 261.31(b)(2) <sup>9</sup> (including sludges generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units) and K051 wastes are not included in this listing. This listing does include residuals generated from processing or recycling oil-bearing hazardous secondary materials excluded under s.261.4(a)(	Acenaphthene	83-32-9	0.059	NA	ND
		Anthracene	120-12-7	0.059	3.4	8.7
		Benzene	71-43-2	0.14	10	ND
		Benz(a)anthracene	56-55-3	0.059	3.4	20.4
		Benzo(a)pyrene	50-32-8	0.061	3.4	9.7
		bis(2-Ethylhexyl)phthalate	117-81-7	0.28	28	ND
		Chrysene	218-01-9	0.059	3.4	36.3
		Di-n-butylphthalate	84-74-2	0.057	28	ND
		Ethylbenzene	100-41-4	0.057	10	ND
		Fluorene	86-73-7	0.059	NA	9.5
		Naphthalene	91-20-3	0.059	5.6	ND
		Phenanthrene	85-01-8	0.059	5.6	67
		Phenol	108-95-2	0.039	6.2	ND
		Pyrene	129-00-0	0.067	8.2	59.3
		Toluene	108-88-3	0.08	10	ND
		Xylenes-mixed isomers (sum of o, m-, and p-xylene concentrations)	1330-20-7	0.32	30	3.8
		Chromium (Total)	7440-47-3	2.77	0.60 mg/L TCLP	
		Cyanides (Total) <sup>7</sup>	57-12-5	1.2	590	
		Lead	7439-92-1	0.69	NA	
		Nickel	7440-02-0	NA	11 mg/L TCLP	

CLEAN HARBORS Lambton

C#460886B

Volatile Analysis

Samples Received In Landfill Oct. 21/10

Analyzed/Reported: Oct. 22/10

Compound	D22576207	D22576042	D22575940	D22575911	D22575066
	Conc. ug/g	Conc. ug/g	Conc. ug/g	Conc. ug/g	Conc. ug/g
Acetonitrile	ND	ND	ND	ND	ND
Acetone	ND	ND	ND	ND	ND
Isopropanol	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND
1,1-Dichloroethylene	ND	ND	ND	ND	ND
Dichloromethane	ND	ND	ND	ND	ND
Methyl Ethyl Ketone	ND	ND	ND	ND	ND
Hexane	6 2	✓ 11	3	9	5
Ethyl Acetate	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND
Benzene	965 610	1 530	770	1 600 ✓	1 280
Carbon Tetrachloride	ND	ND	ND	ND	ND
p-Dioxane	ND	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	ND
n-Heptane	5.2 ND	14.1 ✓	ND	10	7
Methyl Isobutyl Ketone	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND
Toluene	778 420	1 100 ✓	460	1 040	870
n-Butyl Acetate	ND	ND	ND	7	ND
Tetrachloroethylene	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND
Ethylbenzene	20	63	19	53	44
p- & m- Xylene	364 210	551 ✓	190	460	410
Styrene	ND	ND	ND	ND	ND
o-Xylene	150 80	233 ✓	78	190	170
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	70 40	110 ✓	33	88	79
1,3-Dichlorobenzene	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND
1,3,5-Trichlorobenzene	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	2.4 7.0 ✓	ND	2	3	ND
1,2,3-Trichlorobenzene	ND	ND	ND	ND	2
Naphthalene	350 230	450	180	490 ✓	400

Σ = 965 ppm

CH46088615

# CLEAN HARBORS Lambton

Benzene Analysis

Analyzed/Reported: Oct. 25/10

Compound	Conc. ug/g
Benzene	964

D22590477  
D22590476  
D22590475  
D22590591  
D22590590  
D22590588  
D22590589

Loads were received Sat. Oct. 23/10 dumped in TDU tent open to atmospheric conditions.  
Composite of 12 sampling points.

APPENDIX B

DISPERSION MODELLING FILES (ELECTRONIC)