Evaluation of Ambient Air Sampling Performed on February 6, 2016
Near Arbor Hills Landfill, Washtenaw County, Michigan

February 12, 2016

Prepared by:
Mike Depa, Senior Toxicologist, Toxics Unit, Air Quality Division, Michigan Department of Environmental Quality

Robert Sills, Toxics Unit Supervisor, Air Quality Division, Michigan Department of Environmental Quality

Summary

Landfill gas emissions from a Washtenaw County landfill have been associated with numerous citizen complaints for nuisance odors, and have raised citizens' concerns about potential health effects. Two canister grab samples were taken near the landfill and analyzed for volatile organic compounds (VOCs) and methane. The results do not raise public health concerns, but interpretation of the data is tempered by the small number of samples and the scope of the air contaminants analyzed.

Background

A significant number of citizens' nuisance odor complaints were received by the Michigan Department of Environmental Quality (MDEQ), Air Quality Division (AQD) beginning on January 4, 2016 and continuing to the present, associated with the Arbor Hills Landfill in northeast Washtenaw County, Michigan. The landfill is located SW of the intersection of 6 Mile Rd. and Napier Rd. Many complainants reportedly had concerns for potential health effects associated with the exposures. Some complainants reported headache, sore throat, cough, nausea, and asthma aggravation, which they associated with the strong odors.

Staff from the AQD Jackson District Office collected two canister "grab" samples on the evening of February 6, 2016 when landfill gas-like odors were present in a downwind direction from the landfill (see Appendix 1). The first sample ("Nature Area SC") was collected at 6:13 PM in the Steeplechase subdivision, approximately ¼ mile northeast of the intersection of 6 Mile Rd. and Napier Rd. in western Wayne County. The second sample ("AHLF 6 Mile") was taken at 6:39 PM just west of the intersection of 6 Mile Rd. and Napier Rd., close to the landfill on the NNE side. Landfill gas odors near this source are typically characterized as methane-like, bitter, and sometimes somewhat sulfury; not sweet or garbage-like (Kavanaugh Vetort, personal communication). The canisters were filled immediately, as "grab" samples, and analyzed at the MDEQ Laboratory for the TO-15 list of VOCs and methane.

Approach to Evaluating the Sampling Results

Raw landfill gas can reportedly contain many VOCs, ammonia, and sulfur-containing compounds such as hydrogen sulfide (EPA, 2007, 2008; EREF, 2007; ATSDR, 2016). Canister samples were analyzed for methane (a major constituent of landfill gas) and the TO-15 list of VOCs. The VOCs were of primary interest because they can pose health concerns if present at sufficiently high levels. Appendix 1 consists of the laboratory report for the canister grab samples. Appendix 2 is a graphical display of the detected levels of VOCs (excluding methane). The authors compared the detected levels to available relevant health protective benchmarks to initially assess if they may pose any public health concerns (Appendices 3-4). Appendix 3 compares the detected levels to the AQD health protective screening levels utilized in New Source Review permitting. These screening levels include Initial Threshold Screening Levels (ITSLs), which are protective for potential noncancer health effects for the general public including sensitive subpopulations; and Initial Risk Screening Levels (IRSLs), which are associated with a one-in-one million increased lifetime risk of cancer for those chemicals that are regulated as carcinogens. Appendix 4 presents a comparison of the detected levels to other health protective acute (short-term) benchmark values available from other reputable environmental and public health agencies. Finally, Appendix 5 compares the detected levels to the maximum 24-hour levels and annual average levels measured in 2014 at the AQD monitor in Detroit at Fort Street. The AQD's air toxics screening levels and Annual Air Quality Reports are available at: http://www.michigan.gov/deq/0,4561,7-135-3310---,00.html.

Results

Methane is commonly a major constituent of raw landfill gas. It was the highest detected air contaminant in the samples, with an estimated level of 19 parts per million (ppm) at the landfill sampling site; it was not detected at the residential site. Methane is not regulated by the MDEQ as a toxic air contaminant because it is very low in potential toxicity and acts as a simple asphyxiant. An asphyxiant is a minimally toxic gas that reduces or displaces the normal oxygen concentration in breathing air. Asphyxiation is normally only a concern when exposures are in confined spaces where high concentrations can occur. The authors estimate that asphyxiants such as methane would not raise a concern for asphyxiation unless present at more than 36,000 ppm (3.6 %), based on protective guidance for workers (ACGIH, 2014). Therefore, the estimated level of 19 ppm does not raise a health concern.

Benzene is a component of landfill gas, and also occurs in vehicle exhaust and industrial emissions. Benzene is regulated by the MDEQ as a carcinogen, and it is commonly present at detectable levels in ambient air (Appendix 5, and AQD Annual Air Quality Reports). The levels detected (0.77 and 1.3 micrograms per cubic meter (ug/m^3)) are not unusual or elevated compared to the Detroit monitoring data (Appendix 5) or compared to the health protective benchmarks (Appendices 3 and 4), except the levels exceed the one-in-one million cancer risk benchmark (IRSL) of 0.1 ug/m^3. Ambient air cancer risk is appropriately evaluated based on long-term average

exposure data, not from just two grab samples. The measured levels are not unusual and do not raise a concern.

For the remaining VOCs that were detected, none raise particular concerns based on comparison to health protective screening levels or other appropriate benchmarks, or the Detroit ambient air monitoring data. 2-Butanone (also known as methyl ethyl ketone, or MEK) was the VOC that was detected at the highest level, at 5 and 22 ug/m^3. While not a health concern, these levels are higher than levels typically measured in Detroit's ambient air.

Discussion

Although this report does not find any levels of air contaminants that raise public health concerns, there are some important limitations of the study to consider. First, this report only addresses the results of two grab samples taken on February 6, 2016. While limited, these results provide very valuable information reflecting the ambient air quality at times when landfill gas odors were present near the landfill. However, it should be noted that some citizens' complaints have reported very intense odors and therefore transient, intermittent levels may have been higher than sampled. Discussions have occurred between the AQD and staff of the United States Environmental Protection Agency (USEPA) Region 5 office regarding the availability of their mobile monitoring van to measure instantaneous levels of methane and hydrogen sulfide. Further canister sampling by AQD or USEPA may also occur.

The results of this study are also limited by the scope of the air contaminants measured and the laboratory's reporting limits (detection levels). As noted above, the USEPA's mobile monitoring van is capable of measuring hydrogen sulfide. Raw landfill gas may contain hydrogen sulfide and other reduced sulfur compounds that are highly odorous, although they typically have odor thresholds that are substantially lower than levels that pose toxicity concerns.

References:

American Council for Governmental Industrial Hygienists (ACGIH). 2014. TLVs and BEIs. Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.

Agency for Toxic Substances and Disease Registry (ATSDR). 2016. Landfill Gas Primer – An Overview for Environmental Health Professionals. http://www.atsdr.cdc.gov/HAC/landfill/html/ch3a.html

EPA. 2007. Field Test Measurements at Five Municipal Solid Waste Landfills with Landfill Gas control Technology. EPA/600/R-07/043.

EPA. 2008. Background Information Document for Updating AP42 Section 2.4 for Estimating Emissions from Municipal Solid Waste Landfills. EPA/600/R-08-116.

Environmental Research and Education Foundation (EREF). 2007. Research Bulletin V.5, Issue 3, Summer/Fall 2007.

Kavanaugh Vetort, D. 2016. Personal communication between Diane Kavanaugh Vetort, MDEQ-AQD Environmental Quality Analyst, and Robert Sills, MDEQ-AQD.

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL LABORATORY

P.O. Box 30270
Lansing, MI 48909
TEL: (517) 335-9800
FAX: (517) 335-9600

10 February 2016

Work Order: 1602055

Price: $1,160.00

Diane Kavanaugh Vetort
MDEQ-AQD-JACKSON
301 E. Louis Glick Highway
Jackson, MI 49201-1556

RE: ARBOR HILLS LF

I certify that the analyses performed by the MDEQ Environmental Laboratory were conducted by methods approved by the U.S. Environmental Protection Agency and other appropriate regulatory agencies.

Sincerely,

George Krisztian
Laboratory Director

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MDEQ-AQD-JACKSON
301 E. Louis Glick Highway
Jackson MI, 49201-1556

Project: ARBOR HILLS LF
Site Code: LB041660
Project Manager: Diane Kavanaugh Vetort

Reported:
02/10/2016

Analytical Report for Samples

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received	Qualifier
Nature Area SC	1602055-01	Air	02/06/2016	02/08/2016	
AHLF 6 Mile	1602055-02	Air	02/06/2016	02/08/2016	

Notes and Definitions

Y11	Unidentified peaks present in sample.
T	Reported value is less than the reporting limit (RL). Result is estimated.
A05	Result and reporting limit are estimated due to low continuing calibration standard criteria failure.
ND	Indicates compound analyzed for but not detected
RL	Reporting Limit
NA	Not Applicable

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Client ID: Nature Area SC
Lab ID: 1602055-01

CAS #	Analyte	Result	RL	Units	Dilution	Analyzed Date	QC Batch	Method	Qualifier
Organics-Volatiles									**See note Y11**
71-55-6	1,1,1-Trichloroethane	ND	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	
79-34-5	1,1,2,2-Tetrachloroethane	ND	2.0	ug/m3	1	02/09/16	B6B0912	TO-15	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.2	ug/m3	1	02/09/16	B6B0912	TO-15	
79-00-5	1,1,2-Trichloroethane	ND	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	
75-34-3	1,1-Dichloroethane	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
75-35-4	1,1-Dichloroethylene	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
120-82-1	1,2,4-Trichlorobenzene	ND	2.2	ug/m3	1	02/09/16	B6B0912	TO-15	
95-63-6	1,2,4-Trimethylbenzene	ND	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	
106-93-4	1,2-Dibromoethane	ND	2.2	ug/m3	1	02/09/16	B6B0912	TO-15	
76-14-2	1,2-Dichloro-1,1,2,2-Tetrafluoroetha	ND	2.0	ug/m3	1	02/09/16	B6B0912	TO-15	
95-50-1	1,2-Dichlorobenzene	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	
107-06-2	1,2-Dichloroethane	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
78-87-5	1,2-Dichloropropane	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
108-67-8	1,3,5-Trimethylbenzene	ND	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	
106-99-0	1,3-Butadiene	ND	0.64	ug/m3	1	02/09/16	B6B0912	TO-15	
541-73-1	1,3-Dichlorobenzene	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	
106-46-7	1,4-Dichlorobenzene	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	
540-84-1	**2,2,4-Trimethylpentane**	**0.71**	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	T
78-93-3	**2-Butanone (MEK)**	**22**	14	ug/m3	1	02/09/16	B6B0912	TO-15	
126-99-8	2-Chloro-1,3-butadiene	ND	1.1	ug/m3	1	02/09/16	B6B0912	TO-15	
108-10-1	**4-Methyl-2-pentanone (MIBK)**	**2.1**	4.0	ug/m3	1	02/09/16	B6B0912	TO-15	T
75-05-8	Acetonitrile	ND	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	
107-13-1	Acrylonitrile	ND	1.1	ug/m3	1	02/09/16	B6B0912	TO-15	
71-43-2	**Benzene**	**1.3**	0.93	ug/m3	1	02/09/16	B6B0912	TO-15	
75-27-4	Bromodichloromethane	ND	2.0	ug/m3	1	02/09/16	B6B0912	TO-15	
75-25-2	Bromoform	ND	3.0	ug/m3	1	02/09/16	B6B0912	TO-15	
74-83-9	Bromomethane	ND	1.1	ug/m3	1	02/09/16	B6B0912	TO-15	
56-23-5	Carbon tetrachloride	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	
108-90-7	Chlorobenzene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
75-00-3	Chloroethane	ND	0.77	ug/m3	1	02/09/16	B6B0912	TO-15	
67-66-3	Chloroform	ND	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	
74-87-3	**Chloromethane**	**1.2**	0.60	ug/m3	1	02/09/16	B6B0912	TO-15	
156-59-2	cis-1,2-Dichloroethylene	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
10061-01-5	cis-1,3-Dichloropropylene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
124-48-1	Dibromochloromethane	ND	2.5	ug/m3	1	02/09/16	B6B0912	TO-15	
75-71-8	**Dichlorodifluoromethane**	**2.0**	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	
100-41-4	Ethylbenzene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
87-68-3	Hexachlorobutadiene	ND	3.1	ug/m3	1	02/09/16	B6B0912	TO-15	
110-54-3	**Hexane**	**0.87**	3.4	ug/m3	1	02/09/16	B6B0912	TO-15	T
1330-20-7	m & p - Xylene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	

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CAS #	Analyte	Result	RL	Units	Dilution	Analyzed Date	QC Batch	Method	Qualifier
Organics-Volatiles									**See note Y11**
75-09-2	**Methylene chloride**	**0.74**	1.0	ug/m3	1	02/09/16	B6B0912	TO-15	T
1634-04-4	Methyltertiarybutylether	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	A05
95-47-6	o-Xylene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
100-42-5	Styrene	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
127-18-4	Tetrachloroethylene	ND	2.0	ug/m3	1	02/09/16	B6B0912	TO-15	
108-88-3	**Toluene**	**1.6**	1.1	ug/m3	1	02/09/16	B6B0912	TO-15	
156-60-5	trans-1,2-Dichloroethylene	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
10061-02-6	trans-1,3-Dichloropropylene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
79-01-6	Trichloroethylene	ND	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	
75-69-4	**Trichlorofluoromethane**	**1.6**	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	
75-01-4	Vinyl chloride	ND	0.74	ug/m3	1	02/09/16	B6B0912	TO-15	
Organics-Methane									
74-84-0	Ethane	ND	20	ppmv	1	02/08/16	B6B0907	8015	
74-85-1	Ethylene	ND	20	ppmv	1	02/08/16	B6B0907	8015	
74-82-8	Methane	ND	20	ppmv	1	02/08/16	B6B0907	8015	

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Lab ID: 1602055-02

CAS #	Analyte	Result	RL	Units	Dilution	Analyzed Date	QC Batch	Method	Qualifier
Organics-Volatiles									**See note Y11**
71-55-6	1,1,1-Trichloroethane	ND	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	
79-34-5	1,1,2,2-Tetrachloroethane	ND	2.0	ug/m3	1	02/09/16	B6B0912	TO-15	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.2	ug/m3	1	02/09/16	B6B0912	TO-15	
79-00-5	1,1,2-Trichloroethane	ND	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	
75-34-3	1,1-Dichloroethane	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
75-35-4	1,1-Dichloroethylene	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
120-82-1	1,2,4-Trichlorobenzene	ND	2.2	ug/m3	1	02/09/16	B6B0912	TO-15	
95-63-6	1,2,4-Trimethylbenzene	ND	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	
106-93-4	1,2-Dibromoethane	ND	2.2	ug/m3	1	02/09/16	B6B0912	TO-15	
76-14-2	1,2-Dichloro-1,1,2,2-Tetrafluoroetha	ND	2.0	ug/m3	1	02/09/16	B6B0912	TO-15	
95-50-1	1,2-Dichlorobenzene	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	
107-06-2	1,2-Dichloroethane	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
78-87-5	1,2-Dichloropropane	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
108-67-8	1,3,5-Trimethylbenzene	ND	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	
106-99-0	1,3-Butadiene	ND	0.64	ug/m3	1	02/09/16	B6B0912	TO-15	
541-73-1	1,3-Dichlorobenzene	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	
106-46-7	1,4-Dichlorobenzene	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	
540-84-1	**2,2,4-Trimethylpentane**	**0.47**	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	T
78-93-3	**2-Butanone (MEK)**	**5.0**	14	ug/m3	1	02/09/16	B6B0912	TO-15	T
126-99-8	2-Chloro-1,3-butadiene	ND	1.1	ug/m3	1	02/09/16	B6B0912	TO-15	
108-10-1	4-Methyl-2-pentanone (MIBK)	ND	4.0	ug/m3	1	02/09/16	B6B0912	TO-15	
75-05-8	**Acetonitrile**	**0.74**	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	T
107-13-1	Acrylonitrile	ND	1.1	ug/m3	1	02/09/16	B6B0912	TO-15	
71-43-2	**Benzene**	**0.77**	0.93	ug/m3	1	02/09/16	B6B0912	TO-15	T
75-27-4	Bromodichloromethane	ND	2.0	ug/m3	1	02/09/16	B6B0912	TO-15	
75-25-2	Bromoform	ND	3.0	ug/m3	1	02/09/16	B6B0912	TO-15	
74-83-9	Bromomethane	ND	1.1	ug/m3	1	02/09/16	B6B0912	TO-15	
56-23-5	Carbon tetrachloride	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	
108-90-7	Chlorobenzene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
75-00-3	Chloroethane	ND	0.77	ug/m3	1	02/09/16	B6B0912	TO-15	
67-66-3	Chloroform	ND	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	
74-87-3	**Chloromethane**	**1.3**	0.60	ug/m3	1	02/09/16	B6B0912	TO-15	
156-59-2	cis-1,2-Dichloroethylene	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
10061-01-5	cis-1,3-Dichloropropylene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
124-48-1	Dibromochloromethane	ND	2.5	ug/m3	1	02/09/16	B6B0912	TO-15	
75-71-8	**Dichlorodifluoromethane**	**2.7**	1.4	ug/m3	1	02/09/16	B6B0912	TO-15	
100-41-4	Ethylbenzene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
87-68-3	Hexachlorobutadiene	ND	3.1	ug/m3	1	02/09/16	B6B0912	TO-15	
110-54-3	**Hexane**	**2.5**	3.4	ug/m3	1	02/09/16	B6B0912	TO-15	T
1330-20-7	**m & p - Xylene**	**0.78**	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	

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Client ID: AHLF 6 Mile
Lab ID: 1602055-02

CAS #	Analyte	Result	RL	Units	Dilution	Analyzed Date	QC Batch	Method	Qualifier
Organics-Volatiles									**See note Y11**
75-09-2	**Methylene chloride**	**1.4**	1.0	ug/m3	1	02/09/16	B6B0912	TO-15	
1634-04-4	Methyltertiarybutylether	ND	1.8	ug/m3	1	02/09/16	B6B0912	TO-15	A05
95-47-6	o-Xylene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
100-42-5	Styrene	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
127-18-4	Tetrachloroethylene	ND	2.0	ug/m3	1	02/09/16	B6B0912	TO-15	
108-88-3	**Toluene**	**3.0**	1.1	ug/m3	1	02/09/16	B6B0912	TO-15	
156-60-5	trans-1,2-Dichloroethylene	ND	1.2	ug/m3	1	02/09/16	B6B0912	TO-15	
10061-02-6	trans-1,3-Dichloropropylene	ND	1.3	ug/m3	1	02/09/16	B6B0912	TO-15	
79-01-6	Trichloroethylene	ND	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	
75-69-4	**Trichlorofluoromethane**	**3.7**	1.6	ug/m3	1	02/09/16	B6B0912	TO-15	
75-01-4	Vinyl chloride	ND	0.74	ug/m3	1	02/09/16	B6B0912	TO-15	
Organics-Methane									
74-84-0	Ethane	ND	20	ppmv	1	02/08/16	B6B0907	8015	
74-85-1	Ethylene	ND	20	ppmv	1	02/08/16	B6B0907	8015	
74-82-8	**Methane**	**19**	20	ppmv	1	02/08/16	B6B0907	8015	T

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Michigan Department of Environmental Quality
Laboratory Services Section

Analysis Request Sheet

Lab Work Order Number	Project Name	Matrix
1602055	ARBOR HILLS LF	AIR

Site Code/Project Number	AY	CC Email 1	Project TAT Days	Sample Collector	D. Kavanaugh Vetort
Dept-Division-District: DEQ - AQD - Jackson	Index: 41110	CC Email 2: kavanaughd@michigan.gov	Project Due Date	Sample Collector Phone: 517 780 7864	
State Project Manager: Diane Kavanaugh-Vetort	PCA: 36503	CC Email 3		Contract Firm	
State Project Manager Email: Kavanaughd@michigan.gov	Project	Overflow Lab Choice 1	Accept Analysis hold time codes	Contract Firm Primary Contact	
State Project Manager Phone: 517-780-7864	Phase	Overflow Lab Choice 2		Primary Contact Phone	

	Lab Use Only	Field Sample Identification	Collection Date	Collection Time	Container Count	Comments	AQ-tag Regulator ID	Canister/Bottle Vac Number
1	01	Nature Area SC	2-6-16	6:13PM		Grab	312-0081	2999
2	02	AHLF 6 Mile	2-6-16	6:39PM		Grab	312-0082	3005
3								
4								
5								
6								
7								
8								
9								
10								

ORGANIC CHEMISTRY

VOA - Volatile Organic Analysis
- Bottlevac 1 2 3 4 5 6 7 8 9 10
- (Canister - AQD) 1 2 3 4 5 6 7 8 9 10
- Canister - RRD 1 2 3 4 5 6 7 8 9 10
- Tedlar - Volatiles 1 2 3 4 5 6 7 8 9 10

METH - Methane, Ethane, Ethene
- (Methane), Ethane, Ethene 1 2 3 4 5 6 7 8 9 10

if possible

TO-15 List

Chain of Custody	Relinquished by	Received By	Date / Time
	Print Name & Org. Diane Kavanaugh Vetort	Alex Whitlow	2/8/2016, 12:15pm
	Signature: Diane Kavanaugh Vetort		
	Print Name & Org. Alex Whitlow MDEQ	Susan Kilmer	2-8-2016 1:30 pm
	Signature: Alex Whitlow	Susan Kilmer	
	Print Name & Org. Susan Kilmer MDEQ	Michelle Smith	2/8/16 1601
	Signature: Susan Kilmer		

DEQ Laboratory Services Section
Phone: 517-335-9800

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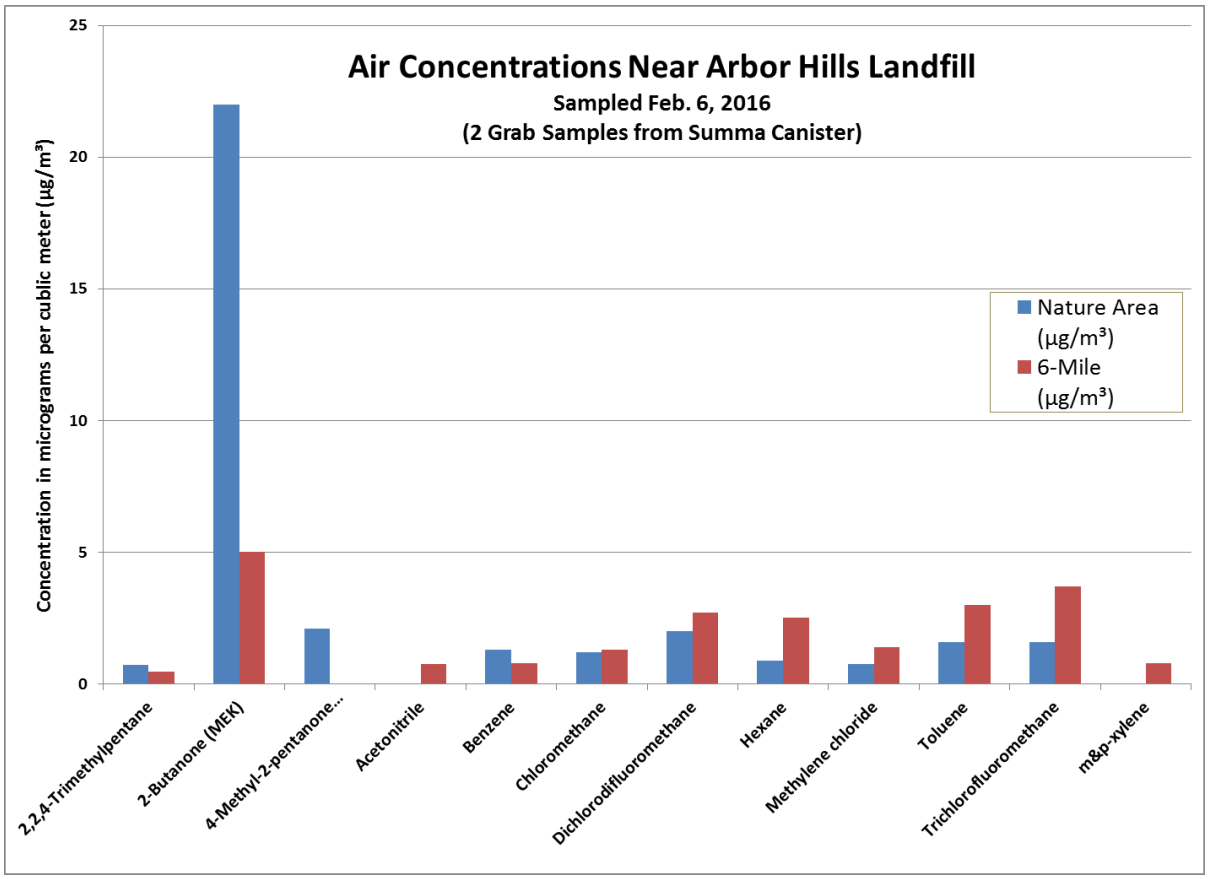
Appendix 2: Bar Graph of Grab Sample Air Concentrations



Appendix 3: Comparison of Grab Samples to Air Quality Division Screening Levels

CAS #	Analyte	Nature Area (µg/m³)	6-Mile (µg/m³)	ITSL (µg/m³)	AvgT	2nd ITSL (µg/m³)	2nd ITSL AvgT	IRSL (µg/m³)
540-84-1	2,2,4-Trimethylpentane	0.71	0.47	3500	8 hr			
78-93-3	2-Butanone (MEK)	22	5	5000	24 hr			
108-10-1	4-Methyl-2-pentanone (MIBK)	2.1		3000	24 hr			
75-05-8	Acetonitrile		0.74	200	annual			
71-43-2	Benzene	1.3	0.77	30	annual	30	24 hr	0.1
74-87-3	Chloromethane	1.2	1.3	90	annual			
75-71-8	Dichlorodifluoromethane	2	2.7	49500	8 hr			
110-54-3	Hexane	0.87	2.5	700	24 hr			
75-09-2	Methylene chloride	0.74	1.4	2000	annual	14000	1 hr	60
108-88-3	Toluene	1.6	3	5000	24 hr			
75-69-4	Trichlorofluoromethane	1.6	3.7	56200	1 hr			
1330-20-7	m&p-xylene		0.78	390	annual			

Footnotes for Appendix 3: CAS: Chemical Abstract Service; µg/m³ = micrograms per cubic meter (air concentration); ITSL = Initial Threshold Screening Level; IRSL = Initial Threshold Screening Level; AvgT= Averaging Time associated with the screening level

Appendix 4: Comparison of Grab Samples to Acute Health Benchmarks

CAS #	Analyte	Sample 1 Results: **Nature Area** (mg/m³)	Sample 2 Results: **6-Mile** (mg/m³)	AEGL-1 (1-h) (mg/m³)	AEGL-1 (8-h) (mg/m³)	AEGL-2 (1-h) (mg/m³)	AEGL-2 (8-h) (mg/m³)	ERPG-1 (mg/m³)	ERPG-2 (mg/m³)	MRL (mg/m³)	REL (mg/m³)	IDLH/10 (mg/m³)	TEEL-0 (mg/m³)	TEEL-1 (mg/m³)	California 1-hr REL (mg/m³)
540-84-1	2,2,4-Trimethylpentane	0.00071	0.00047										350	350	
78-93-3	2-Butanone (MEK)	0.022	0.005	589	589	7951	5006				590	885			13
108-10-1	4-Methyl-2-pentanone (MIBK)	0.0021	*<MDL*										310	310	
75-05-8	Acetonitrile	*<MDL*	0.00074	22 [i]	22 [i]	540 [i]	140 [i]					84			
71-43-2	Benzene	0.0013	0.00077	170 [i]	29 [i]	2600 [i]	640 [i]	160	480	0.029	1.3	160			0.027
74-87-3	Chloromethane	0.0012	0.0013		[i]	1900 [i]	780 [i]		830	1		410			
75-71-8	Dichlorodifluoromethane	0.002	0.0027								4950	7418			
110-54-3	Hexane	0.00087	0.0025		[i]	12000 [i]	12000 [i]					390			
75-09-2	Methylene chloride	0.00074	0.0014	690 [i]	[i]	1900 [i]	210 [i]	1000	2600	2.1	14	800			14
108-88-3	Toluene	0.0016	0.003	750 [i]	750 [i]	4500 [i]	2400 [i]	190	1100	7.5	37	190			37
75-69-4	Trichlorofluoromethane	0.0016	0.0037								5600	1124			
1330-20-7	m&p-xylene	*<MDL*	0.00078	560 [i]	560 [i]	4000 [i]	1700 [i]			8.7	22	390			22

<MDL **:** Less than the analytical method detection limit

AEGL-1: Acute Emergeny Exposure Level (AEGL) "Notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure." (**i:** interim value)

AEGL-2: "Irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape."

ERPG-1: Emergency Response Planning Guidelines (ERPGs). The maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient health effects or perceiving a clearly defined objectionable odor.

ERPG-2: The maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

MRL: A Minimal Risk Level is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. The acute MRL (shown above) is for durations from 1-14 days.

REL: Reference Exposure Level is an occupational exposure level safe for worked to be exposed for 8-hr per day, 5-days per week, over a 20 year period.

TEELs: Temporary Emergency Exposure Limits are an estimate the concentrations at which most people will begin to experience health effects if they are exposed to a hazardous airborne chemical for a given duration

Immediately Dangerous to Life or Health (IDLH) are levels when respiratory protection is required.

California Acute REL: A REL is an airborne level of a chemical that is not anticipated to present a significant risk of an adverse non-cancer health effect. The averaging time for an acute REL is 1-hr.

(prepared by Mike Depa, MDEQ-AQD; February 11, 2016)

Appendix 5: Comparison of Grab Samples to Air Monitored At Detroit Fort Street Monitor During 2014 (latest data available)

	Detroit Fort St. 2014		**Arbor Hills Landfill**	
ParameterName	**24-hr Max** µg/m³	**Annual Average** w/nd=mdl/2 µg/m³	Grab Sample 1 **Nature Area** (µg/m³)	Grab Sample 2 **6-Mile** (µg/m³)
2,2,4-Trimethylpentane	3.5	0.29	*0.71	*0.47
Methyl Ethyl Ketone	4.1	1.69	**22	**5
Methyl Isobutyl Ketone	21.0	2.34	2.1	*<MDL*
Acetonitrile	3.2	0.50	*<MDL*	*0.74
Benzene	2.4	0.73	*1.3	*0.77
Chloromethane	2.1	1.10	*1.2	*1.3
Dichlorodifluoromethane	3.1	2.16	2	*2.7
N-Hexane	3.9	0.90	0.87	*2.5
Dichloromethane	1.7	0.55	*0.74	*1.4
Toluene	9.5	1.63	1.6	*3
Trichlorofluoromethane	1.5	1.15	**1.6	**3.7
M/P Xylene	5.8	0.94	*<MDL*	0.78

* above 2014 annual average concentration measured at Detroit Fort Street air monitor.
** above both the 2014 annual average concentration and the highest 24-hr sample measured at Detroit Fort Street air monitor.