LETTER HEALTH CONSULTATION

CHESTNUT VALLEY LANDFILL
REVIEW OF AIR SAMPLING DATA

MCCLELLANDTOWN TOWNSHIP, FAYETTE COUNTY, PENNSYLVANIA

February 7, 2014

Prepared by:

Pennsylvania Department of Health
Division of Environmental Health Epidemiology

Health Consultation: A Disclaimer

The Pennsylvania Department of Health (PADOH) Health Assessment Program (HAP) collaborates with the Agency for Toxic Substances and Disease Registry (ATSDR), the lead federal public health agency, to prepare health consultation (HC) documents which determine if exposure to contaminants can harm people's health as well as prevent and reduce exposures and illnesses. A HC addressed a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material, and considers the levels of hazardous substances at a site, whether people might be exposed to contaminants, by what pathways, and what potential harm the substances might cause to them. In order to prevent or mitigate exposures, a consultation may lead to specific actions and recommendations, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material. HCs may recommend additional public health actions, such as conducting health surveillance activities to evaluate trends in adverse health outcomes; recommending sampling; conducting biological indicators of exposure studies to assess exposure; conducting health studies; characterizing demographics; recommending changes/additions to related Commonwealth of Pennsylvania policies/regulations, improving quality of life; and/or providing health education for health care providers and community members.

ATSDR provides technical assistance and funding to PADOH to help identify and evaluate environmental health threats to communities using the best science, taking responsive public health actions, and providing trusted health information. While this HC was supported by funds from a cooperative agreement with the ATSDR, it was not published by ATSDR. More information about ATSDR is available online at www.atsdr.cdc.gov

The conclusions and recommendations presented in this HC document are based on an analysis of the environmental sampling data and information made available to the PADOH within a limited time frame. The availability of additional sampling data, new information and/or changes in site conditions could affect the conclusions and recommendations presented in this document. PADOH will consider reviewing additional future data related to the site, if made available and deemed appropriate.

Bureau of Epidemiology, Division of Environmental Health Epidemiology
Room 933 | Health and Welfare Building 625 Forster Street | Harrisburg, PA 17120-0701

pennsylvania
DEPARTMENT OF HEALTH

February 7, 2014

Scott Swarm
Environmental Group Manager
PADEP, Southwest Regional Office
400 Waterfront Dr.
Pittsburgh, PA 15222

Re: Review of Air Sampling Data Collected Near the Chestnut Valley Landfill, McClellandtown, Fayette County, PA

Dear Mr. Swarm:

Thank you for your request to the PADOH to review the air sampling data collected near the Chestnut Valley Landfill. The PADOH has prepared this letter health consultation (LHC) to evaluate potential public health issues related to the site. PADOH worked on this evaluation under a cooperative agreement with the ATSDR. PADOH's top priority is to ensure residents living near the Chestnut Valley Landfill have the best information to safeguard their health.

Background and Statement of Issues

Residents have expressed concerns about air quality and malodors nearby the Chestnut Valley Landfill, McClellandtown, Fayatte County, PA ('the site') (Figures 1-2). The site is owned and operated by Advanced Disposal Services and is an active engineered landfill disposal facility that currently accepts residential trash and Pennsylvania Department of Environmental Protection (PADEP) approved industrial waste including liquid-containing drill cuttings. In response to resident concerns, the PADEP performed ambient air monitoring for volatile organic compounds (VOCs) using an open path fourier-transform spectrometer (OP-FTIR). PADEP also collected air samples using SUMMA canisters and analyzed these samples for VOCs. The PADEP asked for the assistance of PADOH for evaluating the potential public health effects related to air near the landfill. PADOH collaborated with ATSDR Region 3 to review the ambient air sampling results and produce a preliminary public health evaluation.

Air Sampling Data Collection

Due to community concerns, on October 8-9, 2013, PADEP collected ambient air screening data, using an OP-FTIR device, at four locations near the landfill, which included one background upwind sample location. The OP-FTIR was used identify the presence of chemicals from a known library of chemical compounds and samples are instantaneous over a few minutes. The information provides an instantaneous average reading along the entire path of the infrared beam and due to environmental variables (e.g., humidity) has a high lower detection limit (LDL). Chemical compounds and instantaneous monitoring results are based on sample collection durations of only a few minutes and are used for qualitative screening purposes. PADOH and ATSDR report conclusions from an evaluation of OP-FTIR data as having the potential for public health concern, but would not use

instantaneous data to conduct quantitative exposure dose evaluation for public health purposes. The SUMMA canister data collected for VOCs was performed on October 1, 2013 from two locations on-site that included the tail of cell #2 and the north entrance of the site near cell #5. These samples were collected over a 24-hour period. PADOH can use SUMMA canister information for both qualitative screening purposes and to conduct quantitative exposure dose evaluation.

Data Review Process

PADOH screened the ambient air sampling data collected near the site against appropriate ATSDR health-based guidelines (acute, intermediate or chronic exposure durations) called comparison values (CVs). ATSDR CVs are conservative estimates of contaminant levels below which no health effects would be expected. Concentrations above a CV do not necessarily mean they are harmful but require further evaluation to determine whether or not adverse health effects are likely. When an ATSDR CV is not available, PADOH uses screening values from other environmental and health agencies such as the Environmental Protection Agency (EPA) or a state agency (ATSDR, 2005a). Some of the chemicals monitored near the landfill did not have CVs. For these, PADOH used either the EPA values or the Texas Commission on Environmental Quality ambient air screening values (TCEQ). It is important to note, that having simply having contact with a chemical does not necessarily result in health effects. A chemical's ability to produce adverse health effects is influenced by a number of factors in the exposure situation, including (ATSDR 2005a):

- how much of the chemical a person is exposed to (the dose);
- how long a time period a person is exposed to the chemical (the duration);
- how often the person is exposed (the frequency); and
- the amount and type of damage the chemical can cause in the body (the toxicity of the chemical)

PADOH screened the air data against the ATSDR's Cancer Risk Evaluation Guide (CREG), the ATSDR's Minimum Risk Levels (MRLs) or ATSDR Environmental Media Evaluation Guide (EMEG). CREGs are media-specific CVs that are used to identify concentrations of cancer-causing substances that are unlikely to result in an increase of cancer rates in an exposed population. ATSDR develops CREGs using EPA's cancer slope factor, a target risk level (10^{-6}), and default exposure assumptions. The target risk level of 10^{-6} represents a theoretical risk of 1 excess cancer cases in a population of 1 million. The ATSDR MRL or EMEG is an estimate of human exposure to a hazardous substance that is unlikely to have an appreciable risk of adverse non-cancer health effects over a specified route and duration of exposure. The ATSDR MRL and CREG values are not regulatory levels (ATSDR, 2005a). If the air concentrations exceeded the ATSDR CREG, PADOH calculated an estimated cancer risk and reviewed the toxicological information for that chemical. For the SUMMA data, PADOH calculated an estimated cancer risk for residents used the following equation:

$$\text{Estimating Excess Cancer Risk} = \frac{\text{Exposure Concentration} \times \text{EPA Inhalation Unit Risk (IUR)} \times \text{Exposure Years}}{70 \text{ years}}$$

Air Sampling Data Evaluation

The OP-FTIR air monitoring data collected near the landfill showed detectable levels of chemicals typically associated with landfill gases, including methane, methylamine and methyl mercaptan (Table

1-2). While these chemicals screened above the available CVs, this type of air sampling data is not of the quality needed to perform a public health evaluation, as described in the Limitations of Air Sampling Section below.

The SUMMA air data collected on-site showed levels of benzene, carbon tetrachloride and vinyl chloride exceeding ATSDR CREG CVs (Table 3-4). Since some chemicals exceeded CVs, PADOH calculated an estimated cancer risk. For residential exposures, PADOH calculated theoretical cancer risk for children 0 to 5 years, 6 years to 14 years, and adults (Table 5). Based on these calculations, the cancer risk from the SUMMA VOC data indicated a very low cancer risk (the highest at 4.8E-07, or 4.8 extra cases of cancer in 10,000,000 exposed). In general, the EPA considers excess cancer risks that are below about 1 extra cancer case in 1,000,000 people exposed (referred to numerically as 1E-06) to be small and risks above 1 extra cancer case in 10,000 people exposed (or 1E-04) to be sufficiently large that some sort of action or remediation may be necessary to protect public health (ATSDR, 2005a).

Limitations of Air Sampling

The following is a summary of the limitations to the available air sampling data and the analysis of potential public health effects:

- The detection limits for the sulfur compounds (particularly hydrogen sulfide) in the air sampling data were very high and above health-based screening values in the OP-FTIR data set. For example, the detection limit of hydrogen sulfide in the OP-FTIR ranged from approximately 11,000 to 22,000 ppb and the ATSDR CVs for acute and intermediate exposures are 70 ppb and 20 ppb, respectively.
- Data from the OP-FTIR can be used to better define a potential air contamination problem but should not be used to develop quantitative interpretations for potential exposures levels. The data can be evaluated for qualitative trends (e.g., to identify if site-related chemicals in air are migrating off-site).
- The SUMMA samples were collected on the site property and may not be representative of ambient air levels in the nearby community.

Discussion of Potential Health Effects

The OP-FTIR data show that landfill gases may be migrating off-site to the community. However, given the limitations discussed above, PADOH is not able to quantitatively evaluate this data for potential health effects. Odors detections from landfill gases may be associated with hydrogen sulfide, methane, methyl mercaptan, methyl amine and triethylamine. Hydrogen sulfide, dimethyl sulfide, and mercaptans are the three most common sulfides responsible for landfill odors. These gases produce a very strong rotten-egg smell, even at very low concentrations. Of these three sulfides, hydrogen sulfide is often emitted from landfills at the highest levels (ATSDR, 2001).

People are capable of detecting chemicals by smell at very low concentrations. A number of chemicals with offensive odors and low odor thresholds are associated with landfill gases, including dimethyl sulfide, hydrogen sulfide, methyl mercaptan and methylamine. The sense of smell, just like the other senses of sight, hearing, taste, and touch, varies from person to person. One person may be able to smell an odor like hydrogen sulfide at extremely low concentrations, while another person in the same community cannot. For some chemicals, odor thresholds can be orders of magnitude below the levels known to cause adverse human health effects. In reaction to the odor, some people may experience nausea or headaches. Although such responses are undesirable, medical attention is usually not

required. Often, symptoms such as headaches and nausea fade when the odor goes away. However, the effects on day-to-day life can be more lasting. The impact of landfill gas odors on sensitive populations such as people with pre-existing respiratory illnesses is not currently well documented or understood (ATSDR, 2001).

Figure 3 provides an example of odor thresholds compared to typical health effects levels for hydrogen sulfide. Even when chemical concentrations of odorous compounds are not high enough to cause health effects, the odors by themselves can cause health symptoms such as headaches, nausea, watery eyes, irritated throat, coughing and congestion that induce stress and negatively impact quality of life. In the case of hydrogen sulfide, the odor threshold ranges from 0.5 ppb to 10 ppb, depending on the sensitivity of the individual. Based on data in the ATSDR toxicological profile, typically, people experience transient headaches and other symptoms after exposure at approximately 50 ppb. While these exposures do not represent a long-term health effects, they can affect quality of life (ATSDR, 2006a).

Some VOCs in the SUMMA sampling data were detected above the ATSDR CREG values. VOCs are often ubiquitous in the atmosphere and have been identified in outdoor air samples of both rural and urban environments. The levels of VOCs detected in the SUMMA sampling data at this site are generally within normal background levels (ATSDR, 2005b; ATSDR, 2006b; ATSDR, 2007). PADOH's theoretical additional cancer risk estimations from the SUMMA VOC data indicate a very low additional cancer risk for community members. Therefore, based on the estimated cancer calculations and the available sampling data, PADOH finds that exposures to the detected levels of VOCs are currently not a public health risk.

Conclusions

Based on a review of the available air sampling data, PADOH concludes the following for the Chestnut Valley landfill site:

- The air sampling data shows the potential for exposures to landfill gases in the community adjacent to the site. The community has complained about odors and the off-site identification of chemicals associated with landfill gases (methane, methyl mercaptin methyl amine and triethylamine) in the OP-FTIR air monitoring indicate landfill gases are migrating off-site.
- Given the limitations of OP-FTIR monitoring, it is not possible to quantitatively assess the potential health impacts of exposures to the chemicals detected in the air of the community.
- The levels of VOCs detected in the SUMMA sampling data are within normal background levels and do not represent a public health concern based on the available sampling information.

Recommendations

Based on a review of the available data, PADOH recommend the following for the Chestnut Valley landfill:

- PADOH recommends that the best approach to mitigate the potential for off-site gas migration and confirmed nuisance odor concerns is to implement additional engineering controls at the site. Such engineering controls could include any or all of the following: installation of additional methane extraction wells, installation of additional cover materials, or other engineering controls.
- Given the high detection limits in the current air data sampling, additional air monitoring investigations would help to better characterize community exposures. These additional

investigations could include collecting fence-line continuous air monitoring samples for hydrogen sulfide.
- PADEP should continue the oversight and enforcement at the site to ensure the safety and health of the community surrounding this landfill.

PADOH appreciates the opportunity to work with your agency in evaluating the data for this site, in order to safeguard the public. For questions or concerns about this review, please contact the PADOH, Division of Environmental Health Epidemiology, at (717) 346-3285 or via e-mail at chlloyd@pa.gov and fahmed@pa.gov

Sincerely,

Christine Lloyd, M.S.
Health Assessor, PADOH Health Assessment Program
Division of Environmental Health Epidemiology

Farhad Ahmed, MBBS, MPH
Program Manager, PADOH Health Assessment Program
Division of Environmental Health Epidemiology

Cc: Lora Werner, ATSDR
Robert Helverson, ATSDR
Michael Forbeck, PADEP

References

ATSDR (2001). Landfill Gas Primer - An Overview for Environmental Health Professionals. http://www.atsdr.cdc.gov/HAC/landfill/html/ch3.html

ATSDR (2005a). Public Health Assessment Guidance Manual. http://www.atsdr.cdc.gov/HAC/PHAmanual/

ATSDR (2005b). Toxicological Profile for Carbon Tetrachloride. http://www.atsdr.cdc.gov/toxprofiles/tp30.pdf

ATSDR (2006a). Toxicological Profile for Hydrogen Sulfide. http://www.atsdr.cdc.gov/toxprofiles/tp114.pdf

ATSDR (2006b). Toxicological Profile for Vinyl Chloride. http://www.atsdr.cdc.gov/toxprofiles/tp20.pdf

ATSDR (2007). Toxicological Profile for Benzene. http://www.atsdr.cdc.gov/toxprofiles/tp3.pdf

TCEQ. Ambient Air Quality Standards. http://www.tceq.texas.gov/toxicology/AirToxics.html/#list

Figure 1- Site location map

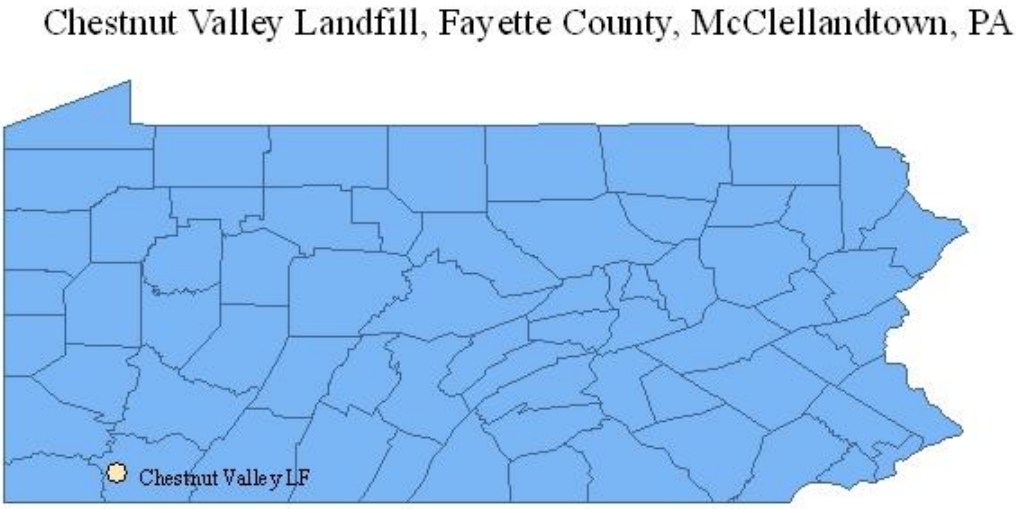

Figure 2- Aerial view of the site

Figure 3- Overview of odor threshold and health effects associated with hydrogen sulfide.

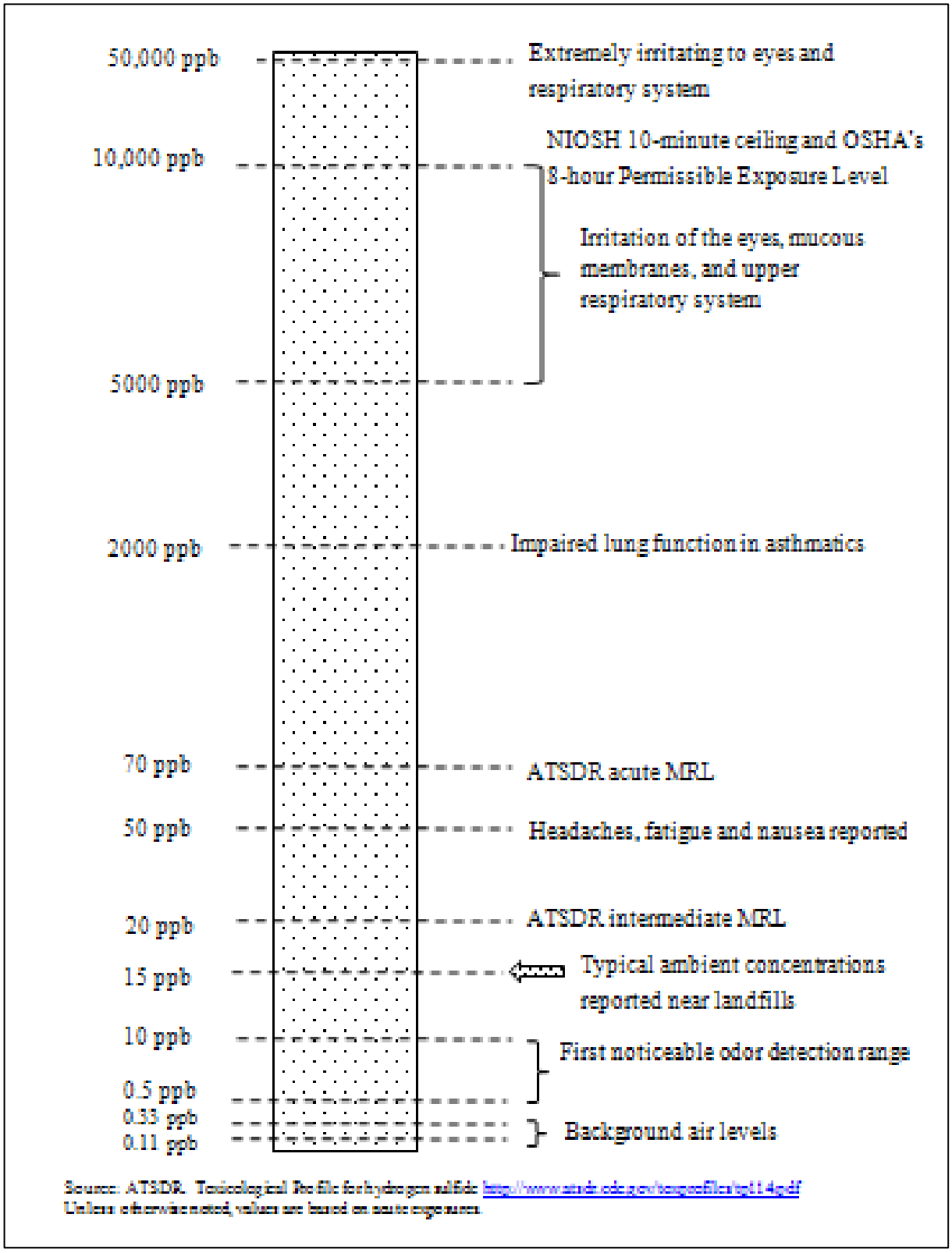

Table 1 - OP-FTIR air sampling results (ppb) of detected compounds near the Chestnut Valley Landfill.

				Sampling Locations					
				Car Wash	Footdale Fire Hall	Gun Club	Residence A	Residence A	Residence A
				Upwind/ Northwest	East	North/ Northeast	North	Northeast	East
				10/8/2013	10/8/2013	10/8/2013	10/8/2013	10/9/2013	10/9/2013
Compound	Acute CV	Chronic CV	Detection Limit range	Avg/Max	Avg/Max	Avg/Max	Avg/Max	Avg/Max	Avg/Max
Ammonia	1700 (ATSDR EMEG)	100 (ATSDR EMEG)	6 -11	NA/17	---	NA/21	---	NA/12	---
Carbon monoxide		NA	21-38	NA/2248	---	97/135	236/569	465/935	460/922
Chloromethane	500 (ATSDR)	40 (EPA RfC)	319-543	---	---	NA/438	---	---	---
Ethanol		1000 (TCEQ)	16-94	---	---	NA/144	NA/141	---	---
Hydrogen sulfide	20 (ATSDR MRL)	70 (ATSDR (MRL)	11,103-22,932	---	---	---	---	---	---
Methane		asphy	216-1657	1702/4433	---	2522/5336	9836/26841	20024/30763	11980/22874
Methanol		200 (TCEQ)	10-24	27/100	---	19/51	73/49	NA/93	16/36
Methyl mercaptan	1 (TCEQ odor)	0.5 (TCEQ)	571-679	NA/963	---	NA/1090	NA/2069	---	---
Methylamine	50 (TCEQ Health)	5 (TCEQ)	165-343	317	---	---	---	---	---
MTBE		50 (TCEQ)	16-24	---	---	---	---	NA/39	NA/33
Naphthalene	600 (ATSDR)	0.7 (ATSDR MRL)	22-49	---	---	---	---	NA/52	NA/36
Nitric acid		NA	5-8	---	---	NA/24	---	NA/96	
Nitrous Oxide		NA	19-39	---	---	NA/171	NA/57	NA/96	NA/55
Ozone		NA	25-43	---	---	27/56	NA/71	---	
Triethylamine	10 (TCEQ heatlh)	1.7 (EPA RfC)	32-82	---	---	NA/56	---	NA/184	NA/158
Xylene-m	2000 (ATSDR)	42 (TCEQ)	68-130	---	---	---	NA/144	---	NA/169

Instantaneous detection exceeds chronic CV
J = estimated value
NA = Not available
-- = Not detectable above the detection limit
EMEG = ATSDR Environmental Media Evaluation Guide
RfC = EPA Reference Concentration
MRL = ATSDR Minimum Risk Level
TCEQ = Texas Commission on Environmental Quality ambient air standards

Table 2 - OP-FTIR air sampling results (ppb) of all sampled compounds near the Chestnut Valley Landfill.

Fire Hall sampling location – East of the site

Compound	Analysis Time	Reporting Limit (ppb)	Aver. Conc. (ppb)	Maximum Conc. (ppb)	Time of Maximum
1,2,4-Trimethyl benzene	05:20 - 11:30	433	--	--	--
2-Methyl Butane	05:20 - 11:30	157	--	--	--
2-Methyl Pentane	05:20 - 11:30	125	--	--	--
3-Methyl Pentane	05:20 - 11:30	138	--	--	--
Acetaldehyde	05:20 - 11:30	285	--	--	--
Ammonia	05:20 - 11:30	13	--	17	8:34
Benzene	05:20 - 11:30	335	--	--	--
Carbon Disulfide	05:20 - 11:30	564	--	--	--
Carbon Monoxide	05:20 - 11:30	38	282	2248	8:34
Carbonyl Sulfide	05:20 - 11:30	28	--	--	--
Chloroform	05:20 - 11:30	48	--	--	--
Chloromethane	05:20 - 11:30	543	--	--	--
Dimethyl sulfide	05:20 - 11:30	245	--	--	--
Ethane	05:20 - 11:30	313	--	--	--
Ethanol	05:20 - 11:30	94	--	--	--
Ethylbenzene	05:20 - 11:30	485	--	--	--
Ethylene	05:20 - 11:30	36	--	--	--
Formaldehyde	05:20 - 11:30	31	--	--	--
Hydrogen Chloride	05:20 - 11:30	40	--	--	--
Hydrogen Sulfide	05:20 - 11:30	16833	--	--	--
iso-Butane	05:20 - 11:30	100	--	--	--
Methane	05:20 - 11:30	216	1702	4433	9:08
Methanol	05:20 - 11:30	18	27	100	11:31
Methyl mercaptan	05:20 - 11:30	678	--	963	9:23
Methyl tert-butyl ether (MTBE)	05:20 - 11:30	24	--	--	--
Methylamine	05:20 - 11:30	258	--	317	5:56
m-Xylene	05:20 - 11:30	130	--	--	--
Naphthalene	05:20 - 11:30	49	--	--	--
n-Butane	05:20 - 11:30	112	--	--	--
n-Heptane	05:20 - 11:30	1317	--	--	--
n-Hexane	05:20 - 11:30	383	--	--	--
Nitric Acid	05:20 - 11:30	26	--	--	--
Nitric Oxide	05:20 - 11:30	2029	--	--	--
Nitrogen Dioxide	05:20 - 11:30	523	--	--	--
Nitrous Acid	05:20 - 11:30	8	--	--	--
Nitrous Oxide	05:20 - 11:30	43	--	--	--
n-Octane	05:20 - 11:30	928	--	--	--
n-Pentane	05:20 - 11:30	226	--	--	--
o-Xylene	05:20 - 11:30	129	--	--	--
Ozone	05:20 - 11:30	43	--	--	--
Propane	05:20 - 11:30	208	--	--	--
p-Xylene	05:20 - 11:30	252	--	--	--
Styrene	05:20 - 11:30	41	--	--	--
Sulfur Dioxide	05:20 - 11:30	345	--	--	--
Toluene	05:20 - 11:30	269	--	--	--
Triethylamine	05:20 - 11:30	32	--	--	--

-- = Not detectable above the detection limit

Gun Club OP-FTIR air sampling – North, northeast of the site

Compound	Analysis Time	Reporting Limit (ppb)	Aver. Conc. (ppb)	Maximum Conc. (ppb)	Time of Maximum
1,2,4-Trimethyl benzene	05:20 - 11:30	433	--	--	--
2-Methyl Butane	05:20 - 11:30	157	--	--	--
2-Methyl Pentane	05:20 - 11:30	125	--	--	--
3-Methyl Pentane	05:20 - 11:30	138	--	--	--
Acetaldehyde	05:20 - 11:30	285	--	--	--
Ammonia	05:20 - 11:30	13	--	17	8:34
Benzene	05:20 - 11:30	335	--	--	--
Carbon Disulfide	05:20 - 11:30	564	--	--	--
Carbon Monoxide	05:20 - 11:30	38	282	2248	8:34
Carbonyl Sulfide	05:20 - 11:30	28	--	--	--
Chloroform	05:20 - 11:30	48	--	--	--
Chloromethane	05:20 - 11:30	543	--	--	--
Dimethyl sulfide	05:20 - 11:30	245	--	--	--
Ethane	05:20 - 11:30	313	--	--	--
Ethanol	05:20 - 11:30	94	--	--	--
Ethylbenzene	05:20 - 11:30	485	--	--	--
Ethylene	05:20 - 11:30	36	--	--	--
Formaldehyde	05:20 - 11:30	31	--	--	--
Hydrogen Chloride	05:20 - 11:30	40	--	--	--
Hydrogen Sulfide	05:20 - 11:30	16833	--	--	--
iso-Butane	05:20 - 11:30	100	--	--	--
Methane	05:20 - 11:30	216	1702	4433	9:08
Methanol	05:20 - 11:30	18	27	100	11:31
Methyl mercaptan	05:20 - 11:30	678	--	963	9:23
Methyl tert-butyl ether (MTBE)	05:20 - 11:30	24	--	--	--
Methylamine	05:20 - 11:30	258	--	317	5:56
m-Xylene	05:20 - 11:30	130	--	--	--
Naphthalene	05:20 - 11:30	49	--	--	--
n-Butane	05:20 - 11:30	112	--	--	--
n-Heptane	05:20 - 11:30	1317	--	--	--
n-Hexane	05:20 - 11:30	383	--	--	--
Nitric Acid	05:20 - 11:30	26	--	--	--
Nitric Oxide	05:20 - 11:30	2029	--	--	--
Nitrogen Dioxide	05:20 - 11:30	523	--	--	--
Nitrous Acid	05:20 - 11:30	8	--	--	--
Nitrous Oxide	05:20 - 11:30	43	--	--	--
n-Octane	05:20 - 11:30	928	--	--	--
n-Pentane	05:20 - 11:30	226	--	--	--
o-Xylene	05:20 - 11:30	129	--	--	--
Ozone	05:20 - 11:30	43	--	--	--
Propane	05:20 - 11:30	208	--	--	--
p-Xylene	05:20 - 11:30	252	--	--	--
Styrene	05:20 - 11:30	41	--	--	--
Sulfur Dioxide	05:20 - 11:30	345	--	--	--
Toluene	05:20 - 11:30	269	--	--	--
Triethylamine	05:20 - 11:30	32	--	--	--

-- = Not detectable above the detection limit

Residence A OP-FTIR air sampling – North of site 10/8/2013

Compound	Analysis Time	Reporting Limit (ppb)	Aver. Conc. (ppb)	Maximum Conc. (ppb)	Time of Maximum
1,2,4-Trimethyl benzene	16:49 - 24:00	243	--	--	--
2-Methyl Butane	16:49 - 24:00	526	--	--	--
2-Methyl Pentane	16:49 - 24:00	645	--	--	--
3-Methyl Pentane	16:49 - 24:00	596	--	--	--
Acetaldehyde	16:49 - 24:00	131	--	--	--
Ammonia	16:49 - 24:00	6	--	--	--
Benzene	16:49 - 24:00	442	--	--	--
Carbon Disulfide	16:49 - 24:00	433	--	--	--
Carbon Monoxide	16:49 - 24:00	21	236	569	23:07
Carbonyl Sulfide	16:49 - 24:00	16	--	--	--
Chloroform	16:49 - 24:00	6	--	--	--
Chloromethane	16:49 - 24:00	319	--	--	--
Dimethyl sulfide	16:49 - 24:00	250	--	--	--
Ethane	16:49 - 24:00	1458	--	--	--
Ethanol	16:49 - 24:00	44	--	141	18:31
Ethylbenzene	16:49 - 24:00	508	--	--	--
Ethylene	16:49 - 24:00	13	--	--	--
Formaldehyde	16:49 - 24:00	77	--	--	--
Hydrogen Chloride	16:49 - 24:00	91	--	--	--
Hydrogen Sulfide	16:49 - 24:00	17526	--	--	--
iso-Butane	16:49 - 24:00	503	--	--	--
Methane	16:49 - 24:00	672	9836	26841	22:38
Methanol	16:49 - 24:00	10	73	149	18:54
Methyl mercaptan	16:49 - 24:00	655	--	2069	18:31
Methyl tert-butyl ether (MTBE	16:49 - 24:00	16	--	--	--
Methylamine	16:49 - 24:00	343	--	--	--
m-Xylene	16:49 - 24:00	68	--	--	--
Naphthalene	16:49 - 24:00	22	--	--	--
n-Butane	16:49 - 24:00	215	--	--	--
n-Heptane	16:49 - 24:00	5001	--	--	--
n-Hexane	16:49 - 24:00	1287	--	--	--
Nitric Acid	16:49 - 24:00	18	--	--	--
Nitric Oxide	16:49 - 24:00	1180	--	--	--
Nitrogen Dioxide	16:49 - 24:00	2358	--	--	--
Nitrous Acid	16:49 - 24:00	5	--	--	--
Nitrous Oxide	16:49 - 24:00	19	--	57	22:30
n-Octane	16:49 - 24:00	4115	--	--	--
n-Pentane	16:49 - 24:00	696	--	--	--
o-Xylene	16:49 - 24:00	46	--	--	--
Ozone	16:49 - 24:00	35	--	71	18:31
Propane	16:49 - 24:00	779	--	--	--
p-Xylene	16:49 - 24:00	117	--	--	--
Styrene	16:49 - 24:00	30	--	--	--
Sulfur Dioxide	16:49 - 24:00	176	--	--	--
Toluene	16:49 - 24:00	133	--	--	--
Triethylamine	16:49 - 24:00	36	--	--	--

-- = Not detectable above the detection limit

Residence A OP-FTIR air sampling – Northeast of site 10/9/2013

Compound	Analysis Time	Reporting Limit (ppb)	Aver. Conc. (ppb)	Maximum Conc. (ppb)	Time of Maximum
1,2,4-Trimethyl benzene	00:11 - 03:15	319	--	--	--
2-Methyl Butane	00:11 - 03:15	873	--	--	--
2-Methyl Pentane	00:11 - 03:15	1433	--	--	--
3-Methyl Pentane	00:11 - 03:15	1049	--	--	--
Acetaldehyde	00:11 - 03:15	353	--	--	--
Ammonia	00:11 - 03:15	8	--	12	2:06
Benzene	00:11 - 03:15	351	--	--	--
Carbon Disulfide	00:11 - 03:15	819	--	--	--
Carbon Monoxide	00:11 - 03:15	33	465	935	2:25
Carbonyl Sulfide	00:11 - 03:15	20	--	--	--
Chloroform	00:11 - 03:15	14	--	--	--
Chloromethane	00:11 - 03:15	479	--	--	--
Dimethyl sulfide	00:11 - 03:15	289	--	--	--
Ethane	00:11 - 03:15	2788	--	--	--
Ethanol	00:11 - 03:15	48	--	--	--
Ethylbenzene	00:11 - 03:15	592	--	--	--
Ethylene	00:11 - 03:15	22	--	--	--
Formaldehyde	00:11 - 03:15	184	--	--	--
Hydrogen Chloride	00:11 - 03:15	223	--	--	--
Hydrogen Sulfide	00:11 - 03:15	22932	--	--	--
iso-Butane	00:11 - 03:15	1050	--	--	--
Methane	00:11 - 03:15	1657	20024	30763	3:06
Methanol	00:11 - 03:15	24	--	93	1:00
Methyl mercaptan	00:11 - 03:15	728	--	--	--
Methyl tert-butyl ether (MTBE)	00:11 - 03:15	24	--	39	2:09
Methylamine	00:11 - 03:15	306	--	--	--
m-Xylene	00:11 - 03:15	101	--	144	3:12
Naphthalene	00:11 - 03:15	34	--	52	2:42
n-Butane	00:11 - 03:15	265	--	--	--
n-Heptane	00:11 - 03:15	8182	--	--	--
n-Hexane	00:11 - 03:15	2128	--	--	--
Nitric Acid	00:11 - 03:15	32	--	--	--
Nitric Oxide	00:11 - 03:15	1426	--	--	--
Nitrogen Dioxide	00:11 - 03:15	4432	--	--	--
Nitrous Acid	00:11 - 03:15	7	--	--	--
Nitrous Oxide	00:11 - 03:15	36	--	96	1:00
n-Octane	00:11 - 03:15	7043	--	--	--
n-Pentane	00:11 - 03:15	1150	--	--	--
o-Xylene	00:11 - 03:15	82	--	--	--
Ozone	00:11 - 03:15	37	--	--	--
Propane	00:11 - 03:15	1339	--	--	--
p-Xylene	00:11 - 03:15	160	--	--	--
Styrene	00:11 - 03:15	41	--	--	--
Sulfur Dioxide	00:11 - 03:15	253	--	--	--
Toluene	00:11 - 03:15	240	--	--	--
Triethylamine	00:11 - 03:15	82	--	184	2:02

-- = Not detectable above the detection limit

Residence A OP-FTIR air sampling - East of the site 10/9/2013

Compound	Analysis Time	Reporting Limit (ppb)	Aver. Conc. (ppb)	Maximum Conc. (ppb)	Time of Maximum
1,2,4-Trimethyl benzene	03:55 - 06:30	290	--	--	--
2-Methyl Butane	03:55 - 06:30	631	--	--	--
2-Methyl Pentane	03:55 - 06:30	747	--	--	--
3-Methyl Pentane	03:55 - 06:30	734	--	--	--
Acetaldehyde	03:55 - 06:30	391	--	--	--
Ammonia	03:55 - 06:30	8	--	--	--
Benzene	03:55 - 06:30	249	--	--	--
Carbon Disulfide	03:55 - 06:30	806	--	--	--
Carbon Monoxide	03:55 - 06:30	28	460	922	4:11
Carbonyl Sulfide	03:55 - 06:30	19	--	--	--
Chloroform	03:55 - 06:30	22	--	--	--
Chloromethane	03:55 - 06:30	415	--	--	--
Dimethyl sulfide	03:55 - 06:30	265	--	--	--
Ethane	03:55 - 06:30	1756	--	--	--
Ethanol	03:55 - 06:30	57	--	--	--
Ethylbenzene	03:55 - 06:30	549	--	--	--
Ethylene	03:55 - 06:30	22	--	--	--
Formaldehyde	03:55 - 06:30	90	--	--	--
Hydrogen Chloride	03:55 - 06:30	107	--	--	--
Hydrogen Sulfide	03:55 - 06:30	21088	--	--	--
iso-Butane	03:55 - 06:30	595	--	--	--
Methane	03:55 - 06:30	796	11980	22874	4:51
Methanol	03:55 - 06:30	16	16	36	4:00
Methyl mercaptan	03:55 - 06:30	571	--	--	--
Methyl tert-butyl ether (MTBE)	03:55 - 06:30	19	--	33	3:59
Methylamine	03:55 - 06:30	217	--	--	--
m-Xylene	03:55 - 06:30	87	--	169	4:07
Naphthalene	03:55 - 06:30	30	--	36	4:05
n-Butane	03:55 - 06:30	229	--	--	--
n-Heptane	03:55 - 06:30	5966	--	--	--
n-Hexane	03:55 - 06:30	1535	--	--	--
Nitric Acid	03:55 - 06:30	24	--	--	--
Nitric Oxide	03:55 - 06:30	1348	--	--	--
Nitrogen Dioxide	03:55 - 06:30	2846	--	--	--
Nitrous Acid	03:55 - 06:30	6	--	--	--
Nitrous Oxide	03:55 - 06:30	39	--	55	4:32
n-Octane	03:55 - 06:30	5027	--	--	--
n-Pentane	03:55 - 06:30	833	--	--	--
o-Xylene	03:55 - 06:30	77	--	--	--
Ozone	03:55 - 06:30	33	--	--	--
Propane	03:55 - 06:30	936	--	--	--
p-Xylene	03:55 - 06:30	140	--	--	--
Styrene	03:55 - 06:30	36	--	--	--
Sulfur Dioxide	03:55 - 06:30	236	--	--	--
Toluene	03:55 - 06:30	239	--	--	--
Triethylamine	03:55 - 06:30	61	--	158	4:01

-- = Not detectable above the detection limit

Table 3- On-site SUMMA canister air sampling results (ppb) of detected compounds

Compound	Acute CV	Chronic CV	Chronic CV source	Tail of Cell # 2	North Entrance Cell # 5
1,1,2-Trichlorotrifluoroethane				0.086 J	---
1,2,4-TMB		25	TCEQ Long	---	0.048 J
Benzene	9 (ATSDR)	0.04/3	CREG/Chron EMEG	0.099 J	0.086 J
Carbon tetrachloride	30 (ATSDR inter)	0.03/30	CREG/Chron&Inter EMEG	0.103 J	0.086 J
Vinyl chloride	500 (ATSDR)	0.04/30	CREG/Inter EMEG	---	0.086 J
Chloromethane	500 (ATSDR)	50	Chron EMEG	0.486 J	0.288
Cyclohexane		100	TCEQ Long	---	0.089 J
Dichlorodifluoromethane		1000	TCEQ Long	---	0.153
Ethylbenzene	5000	60	Chron EMEG	0.040 J	0.185
m/p-xylene	2000 (ATSDR)	50	Chron EMEG	0.094 J	0.485
0-xylene	2000 (ATSDR)	50	Chron EMEG	---	0.122
n-heptane		85	TCEQ Long (heptane)	0.041 J	0.149
n-hexane		600	Chron EMEG	0.123	0.191
Propene		NA		0.703	1.637
Styrene		200	Chron EMEG	---	0.044 J
Toluene		80	Chron EMEG	0.153	0.643
Trichlorofluoromethane		500	TCEQ Long	0.28	0.225

Detection exceeds chronic CV
J = Estimated value
-- = Not detectable above the detection limit
EMEG = ATSDR Environmental Media Evaluation Guide
RfC = EPA Reference Concentration
TCEQ = Texas Commission on Environmental Quality ambient air standards

Table 4- On-site SUMMA canister air sampling results (ppb) for entire sampling dataset.

Analayte	Results (ppb)
1,1,1-Trichloroethane	--
1,1,2,2-Tetrachloroethane	--
1,1,2-Trichloroethane	--
1,1,2-Trichlorotrifluoroethane	0.086J
1,1-Dichloroethane	--
1,1-Dichloroethene	--
1,2,4-Trichlorobenzene	--
1,2,4-Trimethylbenzene	--
1,2-Dibromoethane	--
1,2-Dichlorobenzene	--
1,2-Dichloroethane	--
1,2-Dichloropropane	--
1,2-Dichlorotetrafluoroethane	--
1,3,5-Trimethylbenzene	--
1,3-Butadiene	--
1,3-Dichlorobenzene	--
1,4-Dichlorobenzene	--
1-Bromopropane	--
1-Ethyl-4-Methylbenzene	--
2-Hexanone	--
Acetone	3.96B
Acrolein	0.092JB
Benzene	0.099J
Bromodichloromethane	--
Bromoform	--
Bromomethane	--
Carbon Disulfide	--
Carbon Tetrachloride	0.103J
Chlorobenzene	--
Chloroethane	--
Vinyl Chloride	--
Chloroform	--
Chloromethane	0.486
cis-1,2,-Dichloroethene	--
cis-1,3-Dichloropropene	--
Cyclohexane	--
Dibromochloromethane	--
Dichlorodifluoromethane	0.206
Ethylbenzene	0.04J
Hexachlorobutadiene	--
m/p-xylene	0.094J
MEK	--
Methyl Tert-Butyl Ether	--
Methylene Chloride	0.083 JB
MIBK	--
n-Heptane	0.041J
n-Hexane	0.123
Propene	0.703
Styrene	--
Tetrachloroethene	--
Tetrahydrofuran	--
Toluene	0.153
Trans-1,2-Dichloroethene	--
Trans-1,3-Dichloropropene	--
Trichloroethene	--
Trichlorofluoromethane	0.28

-- Indicates the compound but it was not detected.
J - Indicates an estimated value, below the quantitation limit, but above the method detection limit.
B - This flag is used when the analyte is also detected in the associated blank.

Table 5- Estimated cancer risk, based on SUMMA air sampling data.

			Estimated Cancer Risk*		
Compound	**Max. SUMMA Concentration (ppb)**	**EPA's IUR (µg/m3)-1**	**Adult**	**Adolescent**	**Child**
Benzene	0.099 J	2.20E-06	1.98E-07	3.96E-08	1.70E-08
Carbon tetrachloride	0.103 J	1.50E-05	1.55E-07	3.09E-08	1.16E-08
Chloroethene (VC)	0.086 J	4.4E-06 (adult) 8.8E-06 (child from birth)	4.75E-07	9.50E-08	8.15E-08

J = Estimated value
IUR = EPA Inhalation Unit Risk
* Estimated cancer risk = maximum air concentration x EPA's Inhalation Unit Risk