Health Consultation

ALLIANCE LANDFILL SITE

TAYLOR BOROUGH, LACKAWANNA COUNTY, PENNSYLVANIA

EPA FACILITY ID: PAD982366148

Prepared by the
Pennsylvania Department of Health

MARCH 12, 2010

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

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Summary

Introduction

At the request of the concerned community members, the Pennsylvania Department of Health (PADOH) and the Agency for Toxic Substances and Disease Registry (ATSDR) prepared this Health Consultation (HC) document for the Alliance Landfill ("the site"). The community is concerned about potential odors and particulate emissions associated with landfill activities that could harm their health. Since 2003, PADOH and ATSDR have been evaluating air monitoring data from the Alliance Landfill. However, data from previous sampling events were insufficient to conclude on any potential health effects to the local community, and PADOH and ATSDR recommended additional sampling. In this HC document, PADOH and ATSDR reviewed the 2008 ambient air monitoring data collected during the landfill operations from within the landfill perimeter and in the community to determine if exposure to these the reported levels could harm people's health. PADOH and ATSDR's primary goal for the community is to evaluate whether a community is being exposed, has been exposed, or will be exposed to levels of contaminants that may harm their health, as well as to ensure that the community has the best information possible to safeguard their health. PADOH worked under a cooperative agreement with ATSDR to complete this health consultation document.

Conclusions

Based upon a review of the data and information available to date, PADOH and ATSDR conclude that:

Conclusion 1

Air monitoring data collected by the Pennsylvania Department of Environmental Protection (PADEP) at community-based air monitoring stations indicate that exposure to the detected levels of arsenic, beryllium, cadmium, chromium, lead, manganese, and zinc ***is not expected to harm people's health.***

Basis for conclusion

The average levels of contaminants detected during the community-based air monitoring events were below ATSDR's comparison values (CVs), with the exception of chromium and arsenic. For non-cancer effects, the observed average levels of chromium were well below ATSDR's minimum risk level (MRL), and average arsenic concentrations were below the no-observed-adverse-effects-level (NOAEL) and the lowest-observed-adverse-effects level (LOAEL) documented in the literature following chronic inhalation exposures. Estimated theoretical cancer risk levels for chromium and arsenic, calculated by PADOH and ATSDR, were within EPA's acceptable risk range (i.e., 1 excess cancer in 10,000 to 1 excess cancer in 1,000,000 persons exposed). PADOH and ATSDR conservatively assumed that all chromium was hexavalent chromium (Cr VI), which is considered the most toxic chromium species.

Next Steps

PADOH and ATSDR will review additional air monitoring data when available.

Conclusion 2

Air monitoring data collected from the five Alliance Landfill air monitoring stations, within the landfill and along the perimeter, indicates that exposure to the detected levels of arsenic, beryllium, cadmium, chromium, lead, manganese, and zinc ***is not expected to harm people's health.***

Basis for conclusion

The average levels of contaminants found in the air samples collected by Alliance Landfill were below ATSDR's comparison values (CVs), with the exception of chromium. The observed average values of chromium (conservatively assumed to be the more toxic hexavalent form of chromium) were well below ATSDR's minimum risk level (MRL). Theoretical cancer risk levels for chromium were within EPA's acceptable risk range (i.e., 1 excess cancer in 10,000 to 1 excess cancer in 1,000,000 persons exposed). The highest 24-hour concentration (and not the average value) for arsenic, cadmium and beryllium were above their respective ATSDR CVs, with most of the samples non-detect. However, the highest concentration for arsenic, cadmium and beryllium are below levels documented in the literature to cause adverse health effects, and PADOH and ATSDR do not anticipate the public would be exposed to the maximum concentrations of these contaminants.

Next Steps PADOH and ATSDR will review additional air monitoring data when available.

Conclusion 3 PADOH and ATSDR reviewed ambient air concentrations of particulate matter (PM_{10} and $PM_{2.5}$) collected in the community and along the perimeter of the landfill. Based on this review, *PADOH and ATSDR conclude that levels of particulate matter (PM_{10} and $PM_{2.5}$) in ambient air surrounding the Alliance landfills are not expected to harm people's health.*

Basis for conclusion Ambient air monitoring data, collected by PADEP and Alliance, showed particulate matter levels in ambient air were below EPA's National Ambient Air Quality Standards (NAAQS). The NAAQS were developed to protect the environment and public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. The levels of particulate matter detected near the Alliance monitoring events are similar to background levels.

Next Steps PADOH and ATSDR will review additional air monitoring data collected for NAAQS.

Conclusion 4 PADOH and ATSDR reviewed hydrogen sulfide air monitoring data collected in the community and along the perimeter of the landfill. Based on this review, *PADOH and ATSDR conclude the levels of hydrogen sulfide are not expected to harm people's health.*

Basis for conclusion The levels of hydrogen sulfide were below ATSDR's inhalation MRL for both acute (i.e., 14 days or less) and intermediate (i.e., 15–364 days) exposure durations.

Next Steps PADOH and ATSDR will review additional air monitoring data and providing a public health conclusion.

For More Information If you have concerns about your health, you should contact your health care provider. For questions or concerns about the Alliance Landfill site, please contact the Pennsylvania Department of Health, Division of Environmental Health Epidemiology at (717) 346-3285.

Background and Statement of Issues

Background

The Alliance Landfill, formerly known as the "Empire Sanitary Landfill", is municipal solid waste (MSW) landfill located in Ransom Township and Taylor Borough, Lackawana County, Pennsylvania. The Alliance Landfill encompasses 196 acres of a 513 acre parcel of land. The landfill property was used for waste disposal by the City of Scranton in the 1960's. In 1987, the landfill started operations as Empire Sanitary Landfill. In 1998, ownership of the landfill changed to Waste Management. [1] Waste Management (WM) is the current owner and operator of the landfill [3]

In 2002, the Agency for Toxic Substances and Disease Registry (ATSDR) was petitioned to perform a public health assessment of the Alliance Landfill. The petitioner was concerned with "air particulate emissions" from the landfill and cancer incidence rates in the community. In response to the petition, ATSDR and the Pennsylvania Department of Health (PADOH) released two health consultations evaluating available environmental data in 2005 [2] and 2008 [1]. The 2008 health consultation categorized the Alliance Landfill as an *indeterminate public health hazard* and recommended additional air sampling to better assess potential public health impacts the landfill may have on the nearby community. Per this recommendation, ATSDR, PADOH, the Pennsylvania Department of the Environment (PADEP), and Waste Management worked together to establish and conduct additional ambient air monitoring that would fill the identified data gaps. Between August 2008 and October 2008, additional ambient air samples were collected by PADEP and Waste Management at the landfill perimeter and the nearby community.

This health consultation evaluates the ambient air sample results collected during the August 2008 through October 2008 air monitoring event. This air monitoring event involved measuring ambient air concentrations of the following contaminants: hydrogen sulfide (H_2S), sulfur dioxide (SO_2), total suspended particulate matter (TSP), particulate matter less than or equal to 10 micron in diameter (PM_{10}) and particulate matter less than or equal to 2.5 microns ($PM_{2.5}$) in diameter. The TSP samples were further analyzed in the laboratory for various trace metals.

Site Description and History

The Alliance Landfill began operations as a municipal solid waste (MSW) landfill in 1987. The landfill is located on the side of a mountain approximately 2.5 miles south to southwest of Scranton, Pennsylvania. The Alliance Landfill encompasses 196 acres of a 512.9-acre parcel of land. In 1996, Waste Management Inc. purchased the site property [1]. Waste Management is currently seeking to expand its landfill operations to an additional 87 acre area [30]

Three communities border the landfill: one to the south, one to the east, and one to the northeast. (Figure 1) Approximately 2,800 people live within a 1-mile radius of the site. Information gathered from these households determined that the number of homes in Taylor borough built before 1970 was 2200. The ESRI Landfill is within a 1-mile radius of the Alliance Landfill site. The Pennsylvania Turnpike is located just east of the site [4].

In 1986, the landfill received its operating permit from PADEP [1]. The landfill is not permitted to accept, hazardous, liquid, or infectious medical waste. Per its original operating permit the landfill is allowed to handle approximately 5,000 tons of waste per day. Approximately 80% of the waste received is classified as municipal solid waste. Construction and demolitions waste account for approximately 10.5%, and incinerator ash and residual waste account for 8.1% and 1.5 % of the total waste, respectively.

In February 1994, PADEP authorized the landfill to accept for disposal municipal incinerator ash from Union County Utilities, New Jersey. Per PADEP's permit modification letter, the incinerator waste has to be lime-stabilized ash residue (bottom ash and fly ash) from burning mixed municipal waste. The landfill cells are double-lined and contain a leachate collection and treatment system. Quarterly monitoring occurs for on-site leachate and groundwater. Waste Management, Inc. collects methane gas from capped areas of the landfill. Site operators use flares to burn landfill gas (permitted by PADEP) and remove liquid impurities from the processing. This burned material is disposed off site. In July 2001, PADEP granted the landfill an Air Quality Program Title V Operating Permit under the Clean Air Act [5]. The landfill also has a National Pollutant Discharge Elimination System (NPDES) permit which requires the collection of 75% of the landfill gas and for odors not to leave the site. The site uses odor-neutralizing agents at times to help mitigate landfill odors [1].

In January 2000, a third party performed an evaluation of the landfill's gas management operations. This evaluation identified significant deficiencies in the landfill's gas collection and recovery systems [6]. Between 2002 and 2004, PADEP issued the landfill a total of 60 violations and responded to multiple community reported odor complaints. PADEP cited the landfill for leachate treatment systems failure, blockages in gas collections lines, and ineffective cover material. These deficiencies were identified as the causes for odor complaints in the nearby community [2].

In April, 2003, the landfill closed for 1 month to address the deficiencies PADEP identified [1]. The landfill also changed its operator, Dominion Energy, and made significant changes to its gas management system. Among its changes, the landfill added four enclosed flares, installed more than 100 additional gas collection wells, and installed approximately 1,500 feet of "new and replacement gas header transmission piping" within the landfill. More information on the landfill's operational improvements since 2003 can be found on Appendix 1. [6] From April 15, 2003 to April 2008, PADEP has conducted over 90 inspections of the landfill. These inspections resulted in only one violation (on June 2005), which was quickly corrected [7]. Since 2005, PADEP has received over 40 odor complaints from area residents; however, these were not confirmed off-site and did not result in violations.

ATSDR and PADOH Involvement

Since receiving a petition in 2002 for a public health assessment of the Alliance Landfill, ATSDR and PADOH have conducted a number of public health-related activities associated with this site. The table below summarizes these activities:

Timeline of ATSDR and PADOH involvement at the Alliance Landfill Site:

Date	**Activity**
March 2002	A community activist petitions ATSDR to perform a public health assessment of the Alliance landfill. The petitioner is concerned with “air and particulate emissions” and cancer incidence rates in the community.
May 2002	An ATSDR representative from ATSDR Region 3 office performs a site visit. ATSDR’s Petition Screening Committee and the Exposure Investigation Section recommend a public health consultation to address the petitioner’s concern.
August 2003	ATSDR releases a health consultation (HC) for public comment evaluating available environmental data. The document includes a review of cancer incidence and cancer mortality rates performed by PADOH. ATSDR concludes the Alliance Landfill is an *Indeterminate Public Health Hazard* based on the lack of available data. ATSDR recommends additional ambient air monitoring for volatile organic compounds and particulate matter.
November 2003	ATSDR holds a public availability session in Taylor Borough to discuss with the community the findings of the HC document.
August 2004	ATSDR releases the final health consultation document which responded to comments and questions received during public comment of the August 2003 HC.
September 2004	ATSDR and PADEP begin discussions about conducting additional ambient air sampling/monitoring to fill the identified data gaps.
January 2005	PADEP identifies a drive in range located on Keyser Avenue as a potential location for an ambient air monitoring station. ATSDR and PADEP conduct discussions about the contaminants to be included in the air monitoring program.
May 2006	The Keyser Avenue air monitoring station begins operations. The monitoring station collects ambient air samples for total suspended particles (TSP), hydrogen sulfide and sulfur dioxide. The TSP is further analyzed in the laboratory to determine concentrations of the following metals: arsenic, beryllium, cadmium, chromium, lead, manganese, nickel and zinc.
December 2006	Representatives of ATSDR, PADOH and PADEP perform another visit of the landfill. ATSDR, PADOH and PADEP officials meet with Waste Management officials to discuss the data gaps and data needs for ATSDR and PADOH to fully evaluate the potential public health exposures of the community near the landfill.

April 2007	ATSDR submits letter to Waste Management officials to follow up on the discussions that took place during the December 2006 meeting. The letter recommends two to four community-based and/or landfill perimeter air monitoring stations and one background air monitoring station. The monitoring event should measure the following contaminants in ambient air: metals, $PM_{2.5}$, PM_{10}, hydrogen sulfide and sulfur dioxide.
June 2007	Waste Management prepares a draft Supplemental Ambient Air Monitoring Plan for the Alliance Landfill. Waste Management requests ATSDR and PADOH to review it.
October 2007	ATSDR and PADOH submit letter to Waste Management with specific comments and recommendations on their draft supplemental air monitoring plan for the Alliance landfill.
February 2008	PADOH, working under cooperative agreement with ATSDR, releases a health consultation which evaluates the air samples collected at the Keyser Avenue Air Monitoring Station. Sample results for sulfur dioxide and metals indicate *no apparent public health hazard.* However, due to the lack of speciation of TSP into particulate matter ($PM_{2.5}$ and PM_{10},), the site is categorized as an *indeterminate public health hazard.* PADOH and ATSDR recommend further additional air sampling of the selected contaminants at the community level.
March 2008	PADOH prepares a fact sheet [8] summarizing the findings of the Keyser Ave. Air Monitoring HC and a press release announcing an upcoming public meeting and open house. The purpose of the public meeting and open house are to discuss the HC with area residents and answer their questions and concerns.
April 2008	PADOH and ATSDR hold an Open House and a Public Meeting in the Old Forge High School Auditorium. Approximately fifty people participate in both activities.
May 2008	ATSDR, PADOH, and PADEP officials start discussions about conducting a community-based ambient air monitoring event. The agencies also discuss follow up actions in response to comments and concerns brought up by area residents during the open house and public meeting events held in April 2008.
June and July 2008	ATSDR, PADOH and PADEP officials hold various conference calls with Waste Management personnel to discuss potential locations for air monitors, duration of monitoring event and other details related to the sampling event. Waste Management officials agree to conduct ambient air monitoring at the landfill's perimeter. Other ambient air monitors will be located around the nearby community. PADOH informs Waste Management via email of other landfill-related information the health agencies' will need to perform the public health evaluation of the landfill. ATSDR agrees to lend its "single point monitors" to PADEP. The monitors will be used to monitor hydrogen sulfide and sulfur dioxide levels in the community near the landfill.

August 2008	An ATSDR Subject Matter Expert (SME) visits the proposed community-based monitoring locations and trains PADEP personnel to use the single point monitors. The SME also visits the locations Waste Management chose for the landfill perimeter monitoring stations.
September, 2008 through October 2008.	Community-based and landfill perimeter air monitoring begins. The monitoring event goes through the first week of October 2008. Air monitoring event collects measurements of the following contaminants: hydrogen sulfide, sulfur dioxide, $PM_{2.5}$, PM_{10} and Total Suspended Particulates (TSP). The TSP will be further analyzed in the laboratory for metals.

Air Monitoring Events

In accordance with an air sampling plan, PADOH and ATSDR received and evaluated the 2008 air monitoring data for the Alliance Landfill site from two sources:

1) Particulate matter, TSP, trace metals, SO_2, and H_2S data at off-site collected by PADEP from community-based air monitoring station locations.

2) Particulate matter, TSP, trace metals, SO_2, and H_2S data collected by Alliance Landfill on the landfill and along the perimeter, as well as on-site mercury flare emissions data collected to determine the efficiency of the mercury flares for destruction of landfill gas (see Appendix 4 for an evaluation of the mercury flares data).

The ambient air monitoring event started on August 28, 2008, and concluded on October 2, 2008. The monitoring event measured the concentrations of the following contaminants in ambient air: hydrogen sulfide, sulfur dioxide, $PM_{2.5,}$ $PM_{10,}$ and TSP. TSP samples were further analyzed in the laboratory to determine concentrations of trace metals (arsenic, beryllium, cadmium, chromium, lead, manganese, nickel and zinc). ATSDR and PADOH had previously selected these contaminants for monitoring based on past evaluations of landfill activities and community concerns. [32, 33]

A total of eight ambient air monitoring stations were established for the monitoring event. Four (4) ambient air monitoring stations were established along the perimeter of the landfill and three (3) were established in the nearby community. An additional background air monitoring station (Station 1) was established off-site approximately 3,000 feet north from the landfill. The landfill perimeter monitoring stations were operated and maintained by Waste Management with PADEP's oversight. These perimeter ambient air stations are identified as Stations: 2, 2A, 3 and 4.

The three (3) community-based air monitoring stations were located between 3,000 and 5,000 feet away from the landfill. These monitoring stations are identified as the McDade Park Station, located approximately 5,500 feet northeast of the landfill; the Golf Course Station, located approximately 3,000 feet east of the landfill; and, the Auto Repair Shop Station, located approximately 5,000 feet south of the landfill. These monitoring stations were deployed and run by PADEP officials. Figure 2 shows the locations of all monitoring stations.

The landfill perimeter monitoring and, the community-based ambient air monitoring were conducted simultaneously. The contractors rotated the PM_{10}, TSP, trace metals, and SO_2 monitors between monitoring stations 2, 3, and 4. Air monitoring for all contaminants was continuous for station 1; H_2S and $PM_{2.5}$ were continuously monitored at all five stations. (Table 5) Additional information about the monitoring equipment, data quality objectives, and laboratories used to analyze the collected samples can be found on Appendix 2. [11]

Table 1. Locations and Schedule of Community-Based Air Monitoring (2008)

Location	$PM_{2.5}$	PM_{10}	TSP*	H_2S and SO_2
Golf Course	Sept 17–28	Aug 28–Sept 7	Sept 8–16	Sept 17–24
Auto Shop	Sept 9–15	Sept 17–29	Aug 28–Sept 7	Sept 10–17
McDade Park	Sept 1–7	Sept 8–16	Sept 17–29	Sept 24– Oct 2

* TSP collected for arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, and zinc

The community-based and Alliance air monitoring programs included ambient air monitoring for SO_2. However, because a later field study indicated that measurements made using similar instruments may underreport ambient air concentrations of SO_2, these data were determined to be of insufficient quality to characterize human exposures.

Table 2. Locations and Schedule of Alliance Landfill Perimeter Monitoring (2008)

Location	$PM_{2.5}$	PM_{10}	TSP*	H_2S	SO_2
Station 1	Aug 28–Oct 1	Aug 28–Oct 1	Aug 28–Oct 1	• Aug 28–Sept 1 • Sept 8–12 • Sept 24–Oct 2	Sept 5–24
Station 2	Aug 28–Oct 1	Aug 28–Sept 10	Sept 9–18	• Sept 5–12 • Sept 17–20 • Sept 29–Oct 2	Sept 17–20
Station 2A	Aug 28–Oct 1	Not sampled	Not sampled	Aug 28–Sept 29	Not sampled
Station 3	Aug 28–Oct 1	Sept 17–Oct 1	Aug 28–Sept 9	Aug 28–Oct 2	Sept 8–17
Station 4	Sept 4–Oct 1	Sept 10–17	Sept 18–Oct 1	Aug 28–Oct 2	Sept 5–8

* TSP collected for arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, and zinc

In addition to the above mentioned monitoring stations, PADOH and ATSDR also evaluated the data obtained from a PADEP owned ambient air monitoring station located in Scranton, Pennsylvania. This monitoring station (identified as SO1) has been in operation for several years and is located approximately 6 miles northeast of Alliance Landfill. PADOH and ATSDR used the data of this monitoring station as an additional background comparison data set for the site collected data. [5] This monitoring station collects measurements of the following: PM_{10}, $PM_{2.5}$, and SO_2 air data.

Meteorology

The data packet and report from Alliance noted three meteorological stations (MS) on the landfill that recorded weather: MS 1, MS 2, and MS 3. While MS 1 only measures precipitation, MS 2 and MS 3 both measure wind speed and wind direction. Data provided to PADOH and ATSDR included wind speed and direction information collected during the sampling period of September 28, 2008 to October 1, 2008 [28, 29]. Wind speed and wind direction data were collected at two meteorological stations located inside the landfill's boundaries. These stations are different from the landfill perimeter ambient air monitoring stations. [12] Appendix 3 shows wind roses prepared with the data from the meteorological stations. They indicate that during the ambient air monitoring event, the majority of the time the wind blew out of the west. Therefore, the background ambient air monitoring station (Station 1) was predominantly upwind during the monitoring event.

Ambient Air Monitoring Results

This section presents the results from the air monitoring event conducted on August, 2008 through October, 2008. The detected concentrations of contaminants in ambient air are compared to ATSDR CVs in this section. Contaminant concentrations (average) detected above their respective CVs in ambient air are further evaluated in the Contaminant Evaluation section of this document.

How Are ATSDR Comparison Values Used?
Comparison values are doses (health guidelines) or substance concentrations (environmental guidelines) set well below levels that are known or anticipated to result in adverse health effects. ATSDR and other government agencies have developed these values to help assess whether substance concentrations or dose levels associated with site exposures might require a closer look. Comparison values are derived for substances for which adequate toxicity data exist for the exposure route of interest, if available. However, *comparison values are not thresholds of toxicity and are not used to predict adverse health effects.* These values serve only as guidelines to provide an initial screen of human exposure to substances. Although concentrations at or below the relevant comparison value may reasonably be considered safe, it does not automatically follow that any environmental concentration that exceeds a comparison value would be expected to produce adverse health effects.

Community-Based Monitoring Results

PADOH and ATSDR evaluated the ambient air monitoring measurements collected at the three (3) community based monitoring stations (Table 3) collected by PADEP. PADOH and ATSDR compared these results against available CVs. Particulate matter ($PM_{2.5}$ and PM_{10}) and metal results (from TSP) represent 24-hour average values. Sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) sample results represent one (1) hour averages. Table 3 shows the community-based monitoring measurements for TSP, PM_{10}, $PM_{2.5}$, and metals and their respective CV. Table 5 shows H_2S and SO_2 monitoring results.

Overall, in evaluating the community-based air monitoring data, arsenic and chromium were the only two contaminants found at levels above ATSDR's CVs and selected for additional analysis. A review of the community-based monitoring results shows the following:

- The levels of beryllium, cadmium, lead, manganese, nickel, and zinc were below their respective CVs or not detected from the three off-site monitoring sites during the sampling events
- Average and 24-hour maximum concentrations of $PM_{2.5}$, PM_{10} and TSP were below comparison values in all monitoring stations including the background station (See note at the end of this section about PADOH and ATSDR's use of EPA's NAAQS as surrogate CVs for particulate matter results).
- Arsenic and chromium concentrations were the only two metals detected above their respective CVs. All three community based monitors detected arsenic concentrations above the CV. Chromium concentrations detected above the CV were measured only at the "Auto Shop" monitor.
- One (1) hour average measurements of H2S and SO2 were below CVs in all monitoring stations.

Table 3. Community-based Air Monitoring Results for Particulates and Metals

Analyte	*Program-Average Concentration ($\mu g/m^3$)*			*Maximum 24-Hour Average Concentration ($\mu g/m^3$)*	*CV ($\mu g/m^3$)*
	Golf Course	*Auto Shop*	*McDade Park*		
PM_{10}	18.9	13.1	12.8	37.3 (Golf Course)	150 [1]
$PM_{2.5}$	7.0	5.8	10.9	24.4 (McDade Park)	35 [1], 15 [2]
TSP	16.2	27.4	41.3	27.6 (Golf Course) 60.9 (Auto Shop) 99.2 (McDade Park)	150 [1], 60 [3]
Arsenic	0.00069	0.0011	0.00061	0.0030 (Auto Shop)	0.0002 [4]
Beryllium	<0.00020	<0.00020	<0.00020	<0.00021 (Auto Shop)	0.0004 [4], 0.02 [5]
Cadmium	0.00011	0.00015	0.00012	0.00033 (Auto Shop)	0.0006 [4]
Chromium	<0.0040	0.0046	<0.0040	0.0071 (Auto Shop)	0.00008 [4], 0.1 [5] 1.0 [9] 2 [10]
Lead	0.0033	0.0065	0.0044	0.011 (Auto Shop)	0.15 [6]
Manganese	0.0057	0.011	0.021	0.060 (McDade Park)	0.09 [7], 0.05 [5]
Nickel	<0.0020	<0.0020	<0.0020	<0.0021 (Auto Shop)	0.09 [7]
Zinc	0.014	0.017	0.015	0.026 (Auto Shop)	3.6 [8]

1 EPA NAAQS – 24-hour average
2 EPA NAAQS – Annual average
3 EPA NAAQS – Annual geometric mean
4 ATSDR CREG
5 EPA RfC
6 EPA NAAQS – 3-month rolling average
7 ATSDR chronic MRL
8 ATSDR acute NOAEL
9 ATSDR EMEG
10 EPA LOAEL
Values above ATSDR's CVs are shaded

Alliance Landfill Perimeter Monitoring Results

For this air monitoring event, four (4) landfill perimeters and one (1) background air monitoring station were established. Table 4 below shows the ambient air monitoring measurements at these monitoring stations. In summary the landfill perimeter air monitoring results were the following:

- Average and 24-hour maximum concentrations of $PM_{2.5,}$ $PM_{10,}$ and TSP were below comparison values in all monitoring stations (including background station)

- Average concentrations for all metals (from TSP) were below CVs in all monitoring stations except for <u>chromium</u>. Chromium concentrations were detected above CVs in monitoring station 1 (background), 3 and 4.

- Maximum 24-hour concentrations were below CVs for all metals except for <u>beryllium, chromium and cadmium</u>. Beryllium and cadmium concentrations above CVs were detected in monitoring station 1 and 3. Maximum 24-hour concentration for chromium above CV value was detected on monitoring Station 4.

- Average and maximum 24-hour concentrations of <u>arsenic</u> were non-detect in all sample results. However, the detection limit for arsenic was above ATSDR's CV. The detection limit was 0.007 and ATSDR's CV (CREG) is 0.0002.

- One (1) hour average maximum concentration of SO_2 detected at background station (Station 1) was slightly higher than the concentrations detected at the other landfill perimeter monitoring stations. The background station is located off-site approximately 3,000 feet north of the landfill. One hour average maximum concentration at Station 1 was 10.3 parts per billion (ppb), and ATSDR's acute minimal risk level (MRL) for SO_2 is 10 ppb. The background station was located predominantly upwind from the landfill during the monitoring event. Additional information about area meteorological conditions is available in Appendix 3.

Table 4- Alliance Landfill Air Monitoring Results (24-hour)

Analyte	Program-Average Concentration ($\mu g/m^3$)					Highest 24-Hour Concentration ($\mu g/m^3$)	CV ($\mu g/m^3$)
	Station 1 (Background)	Station 2	Station 2A	Station 3	Station 4		
PM_{10}	20.2	19.5	Not sampled	21.9	20.0	42.6 (Station 1)	150 [1]
$PM_{2.5}$	9.1	9.2	9.0	8.9	9.1	33 (Stations 2A&4)	35 [1], 15 [2]
TSP	18.4	16.4	Not sampled	20.0	12.7	55 (Station 1)	150 [1], 60 [3]
Arsenic	NC	NC	Not sampled	NC	NC	<0.0070 (Station 1)	0.0002 [4]
Beryllium	NC	NC	Not sampled	NC	NC	0.0014 (Stations 1&3)	0.0004 [4], 0.02 [5]
Cadmium	NC	NC	Not sampled	NC	NC	0.0010 (Station1)	0.0006 [4]
Chromium	0.0021	NC	Not sampled	0.0014	0.0077	0.013 (Station 4)	0.00008 [4], 0.1 [5]
Lead	0.0052	0.0054	Not sampled	0.0054	0.0052	0.010 (Stations 1&3)	0.15 [6]
Manganese	0.0094	0.0058	Not sampled	0.0073	0.0045	0.022 (Stations 1&3)	0.09 [7], 0.05 [5]
Nickel	0.0011	NC	Not sampled	0.0012	0.0010	0.005 (Station 4)	0.09 [7]
Zinc	0.028	0.041	Not sampled	0.018	0.025	0.057 (Station 2)	3.6 [8]

1 EPA NAAQS – 24 hour average
2 EPA NAAQS – Annual average
3 EPA NAAQS – Annual geometric mean
4 ATSDR CREG
5 EPA RfC
6 EPA NAAQS – 3-month rolling average
7 ATSDR chronic MRL
8 ATSDR acute NOAEL
NC= not calculated; fewer than three samples had results above the laboratory detection limit
Values above ATSDR's CVs are shaded

PADEP SO1 Monitoring Station

In addition to the eight monitoring stations established for this event, PADOH and ATSDR evaluated the ambient air measurements collected at a PADEP owned monitoring station located approximately 6 miles away from the landfill. (Tables 6) This monitoring station (identified as SO1) is located in Scranton, PA and collects ambient air measurements of the following contaminants: $PM_{2.5}$, PM_{10}, and SO2. ATSDR and PADOH then compared the measurements from the SO1 monitoring station against the measurements detected at the community-based monitoring stations. Average 24-hour $PM_{2.5}$ measurements at the SO1 station were similar to the community-based monitoring results. For example, on September 1 through September 7, 2008, average 24 hour $PM_{2.5}$ results were 10.84 ug/m^3 at the SO1 station and, 10.91 ug/m3 at the McDade Park monitoring station. On September 21, 2008, $PM_{2.5}$ concentrations were 14.90 at the SO1 station and 14.80 at the Golf Course station. (Table 5)

The $PM_{2.5}$ results from the SO1 station and the perimeter-based stations seem to fluctuate in a similar manner. A comparison of the SO1 station and the community-based stations is presented in Table 7. Measurements from these monitoring stations seem to change on similar dates and measure similar concentrations. These results suggest that particle matter measurement variability detected in all monitoring stations may be due to ambient air changes at the regional level and not specific to landfill activities. It is also worth noting that Scranton (Lackawanna County) is an attainment designated area for $PM_{2.5}$. EPA designates areas as achieving "attainment" status, which indicates this area meets the National Ambient Air Quality Standard (NAAQS) Attainment status, as defined in the Clean Air Act and detailed below [27].

PADOH and ATSDR's use of EPA's NAAQS as CVs

For lack of available ATSDR CVs for particulate matter, PADOH and ATSDR utilized EPA's National Ambient Air Quality Standard (NAAQS) as a surrogate CV. PADOH and ATSDR compared $PM_{2.5}$ and PM_{10} sample results to EPA's NAAQS values. The NAAQS for PM_{10} is 150 µg/m^3 over a 24-hour period. (Concentrations should not exceed this value more than once a year over a 3-year period. The NAAQS for $PM_{2.5}$ is 35 µg/m^3 for a 24-hour period over a 3-year average. Annually, a 3-year weighted mean from one or multiple community monitors may not exceed a level of 15 µg/m^3 [14]. In addition, PADOH and ATSDR used EPA's old NAAQS value for TSP. In 1990, EPA replaced the older TSP standard under NAAQS with particulate matter (PM2.5 and PM10) designations to better quantify and gauge air quality particles by size. It's worth noting that measured concentrations of $PM_{2.5}$, PM_{10} and TSP are not directly comparable to EPA's NAAQS because EPA's standards are based on annual average concentrations and this monitoring event lasted only five weeks. However, PADOH and ATSDR included this information to put the monitoring results in perspective.

Exposure Pathway Analysis

An exposure pathway is how a person comes in contact with contaminants originating from a site. A completed pathway requires that all five elements be present: 1) a source of contamination, 2) an environmental medium that transports contaminants, 3) a point of exposure, 4) a route of human exposure, and 5) a receptor population. PADOH and ATSDR consider the air pathway to be a completed pathway, as described in the table below. The presence of a completed exposure pathway does not, however, necessarily mean that adverse health effects will occur or have occurred in the past as a result of such exposure. [15]

Completed Exposure Pathway Table

Source of Contamination	***Transport via Environmental Medium***	***Point of Exposure***	***Route of Exposure***	***Receptor Population***
Alliance Landfill, Pennsylvania Turnpike, roads, other landfills, and industrial businesses	Air	Ambient outdoor air	Inhalation	Residents near the Alliance Landfill

Discussion

Evaluation of Air Monitoring Data

ATSDR has developed health-based Comparison Values (CVs) as a screening tool to help determine the likelihood of possible health effects related to exposures to site-specific contaminants. CVs are health guidelines or environmental guidelines set well below levels that are known or anticipated to result in adverse health effects. ATSDR developed these values to help health assessors make consistent decisions about what site related substance concentrations or dose levels associated with site exposures might require further assessment and evaluation. PADOH uses these CVs to evaluate whether site related contaminants are present at harmful levels.

CVs are not thresholds of toxicity and cannot be used to predict adverse health effects. These values serve only as guidelines when performing an initial screen of site-specific chemicals. Although concentrations at or below the relevant comparison value may reasonably be considered safe, it does not automatically follow that any environmental concentration that exceeds a comparison value would be expected to produce adverse health effects. In general, CVs are derived for substances for which adequate toxicity data exist, based on route of exposure. CVs are typically available for three specified exposure periods: acute (14 days or less), intermediate (15 to 364 days), and chronic (365 days or more). In addition, CVs are generally available for two exposure routes: ingestion and inhalation.

ATSDR has developed environmental guidelines (i.e., EMEGs) for substances in drinking water, soil, and air. For many substances that cause cancer in humans and/or animals, ATSDR had developed CREGs; these are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10^{-6}) persons exposed during their lifetime (70 years). ATSDR's CREGs are calculated from unit risk values for inhalation exposures. These values are based on EPA evaluations and assumptions about hypothetical cancer risks at low levels of exposure. The CREGs do not establish a level at which people exposed above the CV are expected to get cancer. Rather, CREGs allow health assessors to estimate the number of hypothetical (extra/excess) cancers that might be caused if a group of people was exposed to contaminant levels above the CREG everyday, 24 hours a day, for a lifetime.

For carcinogenic substances, PADOH and ATSDR calculated a theoretical cancer risk for analytes that exceeded ATSDR's CREGs. (Table 8) Cancer risk is usually calculated for 30 years using adult parameters as defaults in the calculations unless an individual assessment is needed for a specific time frame or if different factors are used. For inhalation exposures the highest average contaminant concentration in $\mu g/m^3$ was multiplied by the inhalation unit risk (IUR) factor in $(\mu g/m^3)^{-1}$, then multiplied by 30 years, and then divided by 70 years. The formula is as follows:

$$CR = ED \times IUR \times EY/70 \text{ years}$$

CR = Cancer Risk ED = Exposure Dose in $\mu g/m^3$

IUR = Inhalation Unit Risk in $(\mu g/m^3)^{-1}$ EY = Exposure in years

Cancer exposure scenarios generally assume a lifetime exposure to the suspected carcinogen. PADOH and ATSDR used an exposure duration of 30 years, which is the amount of time assumed that a resident would reside at single residence. PADOH evaluates these theoretical risk estimates by evaluating whether they fall within EPA's acceptable risk range for cancer of one additional cancer per ten thousand (1×10^{-4}) exposed to one additional cancer per 1 million (1×10^{-6}) people [15].

For noncarcinogenic health effects, PADOH and ATSDR compared the air data for contaminants that exceeded their respective CVs against the ATSDR's Minimal Risk Levels (MRLs), if available. The MRL represents estimates of a daily human dose to a substance that is likely to be without noncarcinogenic health effects during a specified duration of exposure. For inhalation exposures, MRLs are typically represented in parts per billion [ppb] or in $\mu g/m^3$. In addition, PADOH and ATSDR also compared the contaminant results against the available highest No Observed Adverse Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL), if available. The LOAEL represents the lowest dose level at which an adverse or toxic effect has been observed in either human epidemiologic or experimental animal studies. The NOAEL corresponds to the highest dose level at which no adverse or toxic effect has been observed, based on available from human epidemiologic or experimental animal studies-from an individual study [15]

Changes to the landfill permit (e.g., specified landfill capacity, types of waste the landfill can accept) may require additional air monitoring in the future. If substantial or significant changes regarding landfill scope or activities were to occur, there are several options to further evaluate the potential impact, if any, to the residents and to address their public health concerns regarding emissions from the landfill. These include options such as additional sampling points and stations and modeling to simulate or predict exposure levels based on increased or decreased capacity or activity of the landfills.

A Note on Public Health Conclusions Terminology

In the 2008 HC, produced by ATSDR and PADOH, the Alliance Landfill site was designated as an "indeterminate public health hazard. Since the generation of the 2008 HC for Alliance Landfill, ATSDR has changed the public health conclusions terminology (or hazard category) used in health assessment documents and issued a new guidance, in order to provide more clarity to the community on potential adverse health effects. However, the process that ATSDR and PADOH use for evaluating environmental sampling data, the community exposure levels, and the potential adverse health effects has not changed under the new guidance. For this HC, based on the data evaluated, the previous hazard category language would classify the site as "no apparent health hazard", which is equivalent to the new hazard category language of "not expected to harm people's health".

Public Health Evaluation of Air Monitoring Data Results

ATSDR and PADOH further evaluated contaminants detected above their respective CVs during the August through October, 2008 monitoring event. However, it is important to note that ATSDR CVs are based on exposures to fumes and not particulate matter, as is the case with the data evaluated in this HC. Overall, in evaluating the air sampling data collected by PADEP:

Arsenic and chromium were the only two contaminants found at levels above ATSDR's CVs and selected for additional analysis.

PADOH and ATSDR also reviewed the sampling data collected by Alliance Landfill. In summary:

- Arsenic was detected below laboratory detection levels;

- Maximum (but not average) levels of beryllium and cadmium exceeded ATSDR's CREGs;
- Maximum and average levels of chromium exceeded ATSDR's CREGs;
- The maximum hourly average level of SO_2 slightly exceeded ATSDR's acute MRL; and,
- The maximum 1-hour average of H_2S exceeded PADEP's 24-hour ambient air standard, and some maximum and average levels were above EPA's RfC but well below ATSDR's MRLs.

The following text discusses how PADOH and ATSDR evaluated these contaminants from both data sets to determine whether exposure to the detected levels could harm people's health.

Arsenic

Arsenic (as particulates) was detected above ATSDR's CREG of 0.0002 µg/m^3 during both air monitoring events. The 24-hour arsenic levels detected at all three PADEP monitoring stations were above the arsenic CREG nearly every day during the sampling. The PADEP program-average (or the average from the air monitoring event by monitoring station) arsenic concentrations were 0.00069 µg/m^3 at the Golf Course monitoring location, 0.0011 µg/m^3 at the Auto Shop monitoring location, and 0.00061 µg/m^3 at the McDade Park monitoring location. The maximum 24-hour average arsenic concentration was reported as 0.0030 µg/m^3 at the Auto Shop monitoring location. Out of the 33 detections for arsenic from community-based monitoring locations, 30 were above the CREG of 0.0002 µg/m^3, with all of the detected levels at the Auto Shop above the CREG. For the Alliance sampling event, the average 24-hour arsenic readings at Alliance stations 1, 2, 3, and 4 were not calculated, as the arsenic readings were below the laboratory detection levels. The lowest value reported was <0.0065 µg/m^3, and the maximum value reported was <0.0070 µg/m^3 at Alliance station 1. Although it cannot be determined whether or not these "less than" values were below the arsenic CREG of 0.0002 µg/m^3, PADOH and ATSDR believe that the readings were less than the typical levels of 0.02–0.10 µg/m^3 found in urban air [16].

Although some of the arsenic levels exceeded the arsenic CREG, they were all within the range of what is considered typical arsenic background levels for this area. It is not unexpected to find typical rural and urban background levels to be 10 to 100 times above the CREG, respectively, for arsenic [16-17]. The lowest NOAEL found in the scientific literature for chronic inhalation of arsenic was 613 µg/m^3, based on occupational exposures, and a LOAEL of 0.7 µg/m^3 , based on human environmental exposures, was found to be associated with increased the risk of stillbirth [16]. The maximum concentration of arsenic sampled (0.0030 µg/m^3 and < 0.0070 µg/m^3) is well below the NOAEL and LOAEL.

The calculated excess cancer risk, for a 30 year exposure duration, using the maximum arsenic value (as 0.0070 µg/m^3) is 1.29 E-5. Put another way, this is an excess cancer risk of 1.29 case per 100,000 persons exposed, and is interpreted and classified within EPA's acceptable risk range of 1 in 10,000 to 1 in 100, 000 excess cases of cancer, based on data evaluated (see table 8 below). It is important to note that PADOH and ATSDR used the highest average value and PADOH and ATSDR would not expect the public would be exposed to highest average levels on an on-going basis. Based on the data and evaluated by PADOH and ATSDR, exposures to the arsenic levels recorded and evaluated in the air in the vicinity of the Alliance Landfill are *not expected to harm people's health*.

Table 8 – Theoretical excess cancer risk calculations for arsenic and chromium

Contaminant	Maximum Concentration (μg/m^3)	EPA IUR (μg/m^3)	Theoretical Excess Cancer Risk
Arsenic	0.007	0.0043	1.290E-05
Chromium	0.0077	0.012	3.960E-05

<u>Chromium</u>

Chromium (as particulates) was detected during both sampling events above the ATSDR CREG CV of 0.00008 μg/m^3. However, the concentrations of chromium observed during the sampling events were all below or within typical chromium background levels. Atmospheric total chromium is less than 0.01 μg/m^3 in rural areas and between 0.01 to 0.03 μg/m^3 in urban areas [18]. Typical rural and urban background levels are reportedly 1,000 to 8,000 times above ATSDR's CREG, respectively, for chromium. The CREG is a very conservative number that represents a value several orders of magnitude below levels associated with observed health effects. Chromium VI has an intermediate EMEG of 1.0 μg/m^3 and EPA Reference Concentration (Rfc) of 0.1 μg/m^3. The LOAEL for chromium is 2.0 μg/m^3 based on a case study of an occupational worker with nasal problems and decreased lung function [16]. However, the laboratory method could not determine whether hexavalent chromium was present, and therefore, for the public health evaluation of chromium, PADOH and ATSDR conservatively assumed all chromium to be chromium VI [12].

Chromium was found at all three community-based monitoring stations above the CREG. The PADEP program-average chromium concentration for chromium were <0.0040 μg/m^3 for the Golf Course monitoring location, 0.0046 μg/m^3 for the Auto Shop monitoring location, and <0.0040 μg/m^3 for McDade Park monitoring location. The maximum measured 24-hour concentration of total chromium from the Auto Shop location was 0.0071 μg/m^3. Most of the detected levels of chromium from the Auto Shop monitoring location were above 0.004 μg/m^3. Chromium levels detected in the community-based monitoring events, however, were below the available LOAEL, intermediate EMEG, and EPA Rfc. The chromium levels detected are typical of background levels of chromium.

During the sampling events performed by Alliance along the landfill perimeter, the 24-hour program averages of chromium were above the CREG. The 24-hour program averages for chromium at monitoring stations 3 and 4 were above the CREG value at 0.00014 μg/m^3 and 0.0077 μg/m^3, respectively. Chromium was also detected at the background monitoring Station 1 (0.0021 μg/m^3 24-hour program averages) above the CREG, indicating chromium levels near the landfill are similar to background levels. Chromium levels detected during the landfill perimeter monitoring events, however, were below the available LOAEL, intermediate EMEG, and EPA Rfc. The chromium levels are typical to background levels.

PADOH and ATSDR calculated an excess cancer risk for chromium exposure, based on EPA's IUR value of 0.012 (μg/m^3)$^{-1}$ for chromium VI and the highest average sampling value (Table 8 above). It is important to note that PADOH and ATSDR used the maximum average value and PADOH and ATSDR would not expect the public would be exposed to maximum levels on an on-going basis. The calculated excess cancer risk using the highest average reading, which occurred during the Alliance perimeter monitoring (0.0077 µg/m^3) is 3.96 x E-05, or 3.96 cancers cases per 100,000 persons exposed, and falls within EPA's definition of 'acceptable' risk range (i.e., 1 excess cancer in 10,000 to 1 excess cancers in 1,000,000 persons exposed).

Cadmium

During the community-based sampling, cadmium (as particulates) was not detected above the CREG of 0.0006 µg/m^3. For the Alliance landfill perimeter monitoring, the maximum 24-hour average concentrations of cadmium (as particulates) was 0.001 µg/m3 for station 1 (background monitoring location), which is above the cadmium CREG. However, the rest of the cadmium results reported for stations 1, 2, 3, and 4 were less than 0.00069 µg/m3, and most were non-detect.

The highest 24-hour concentration was (0.001 µg/m^3) during the Alliance sampling event) is consistent with background levels and well below (10 times lower) the ATSDR MRL for chronic exposure to cadmium of 0.01 µg/m3. The MRL is based on studies on workers inhaling cadmium fumes and well below a study showing exposure to 17 µg/m^3 of cadmium dust for 30 years and 25 µg/m^3 of cadmium fumes for 24 years resulted in respiratory problems amongst workers [19]. The potential for cancer effects was evaluated based on a cancer LOAEL of 0.1 mg/m3 (100 µg/m^3) that was derived from epidemiologic studies of male workers who developed lung cancer and died after being occupationally exposed to cadmium oxide for up to 45 years. [19]

Typical background concentrations of cadmium in ambient air are 0.001 µg/m^3 in non-industrialized areas and 0.04 µg/m^3 in urban areas and the observed levels near the Alliance Landfill are consistent with background levels [23, 19]. Also, PADOH and ATSDR do not expect the public would be exposed to maximum levels on an on-going basis and therefore, would not be expected to harm people's health. Exposure to the cadmium levels recorded and evaluated in the air in the vicinity of the Alliance Landfill is *not expected to harm people's health* based on data and evaluated by PADOH and ATSDR.

Beryllium

The 24-hour program averages for both the community-based and Alliance air monitoring events were below the ATSDR CREG value of 0.0004 µg/m^3. During the Alliance monitoring event, the maximum 24-hour measurement for beryllium was 0.0014 µg/m^3 for stations 1 (background) and 3 which exceeded the ATSDR CREG value but is below EPA's RfC value of 0.02 µg/m^3 for non-carcinogenic effects. The remainder of the beryllium measurements were below the laboratory detection limit of 0.0013 µg/m^3 which is higher than the beryllium CREG. It should be noted the PADEP beryllium standard for ambient air is 0.01 µg/m^3 for a 30 day average. The maximum detected beryllium level for this site (0.0014 µg/m^3) is lower than the PADEP beryllium standard. [34] Although PADOH and ATSDR conservatively evaluated these maximum concentrations, it would not be expected that the public would be exposed to maximum levels on an on-going basis.

The average concentration of beryllium in the air of US cities is 0.2 ng/m^3 or 0.0002 µg/m^3. The EPA has determined that inhaled beryllium is a probable human carcinogen based on limited human studies and animal studies. The EPA's RfC of 0.02 µg/m^3 for non-carcinogenic effects comes from two occupational studies of chronic inhalation exposure. One study reported damage to the lungs from beryllium inhalation resulting in acute beryllium disease with a NOAEL of 0.01–0.1 µg/m^3. A second study identified a LOAEL of 0.55 µg/m^3 based on individuals working with beryllium over long periods of time who suffered from hypersensitivity to beryllium. The maximum 24-hour concentration was 0.0014 µg/m^3 and is significantly lower than the above mentioned LOAEL and NOAEL values. Based on the data evaluated, PADOH and ATSDR do *not expect exposure to these levels would harm people's health.*

Sulfur Dioxide

The community-based and Alliance air monitoring programs also included air monitoring for SO_2. Continuous measurements were made using Single Point Monitor (SPM) devices and a new tape technology that was expected to have a detection limit of up to 200 ppb. This detection limit is important for community-based air monitoring. Laboratory studies conducted prior to the Alliance air monitoring program suggested that SPMs using the new tape technology would measure airborne SO_2 concentrations accurately. However, as a result of questionable SO_2 data obtained during another air monitoring program using similar SPMs and tape technology, ATSDR conducted a field study in 2009 to determine if the SO_2 SPM and tape technology provided accurate measurements of ambient SO_2 concentrations. The field study compared the performance of SO_2 SPMs (devices similar to those used during the Alliance air monitoring program) to instruments used for SO_2 NAAQS measurements. Results from the field study showed that SPMs using the new tape technology consistently underreported ambient air concentrations of SO_2 [36].

It is unclear why the SO_2 SPMs performed well in the controlled laboratory setting, yet did not perform well when deployed in the field. Nonetheless, with evidence that the SPMs may underreport SO_2 concentrations, *ATSDR and PADOH determined the entire SO_2 monitoring data set from the community-based and Alliance air monitoring program to be of insufficient quality to characterize human exposures, and the SO_2 data from the air monitoring program are not discussed further in this report.* The subsequent field study explains in greater detail why those data were rejected[36].

The use of the SO_2 SPM technology used during the community-based and Alliance air monitoring program was a result of good faith effort on the part of the Agencies and the Alliance Landfill. At the time the SO_2 SPM technology was deployed for the monitoring program, it was fully expected that these instruments would provide the type and quality of information needed.

It should be noted that the discussion in the previous three paragraphs does not apply to the SO_2 data obtained from Scranton NAAQS station (SO1) or to other measurements (i.e., metals, particulate matter, H_2S) collected during the community-based and Alliance air monitoring program.

Hydrogen Sulfide

The 1-hour average levels of hydrogen sulfide (H_2S) ranged from 0.54 ppb to 1.8 ppb, with the highest 1-hour average measurement occurring at Station 4 during the Alliance monitoring event in August through September 2008. The maximum 1-hour average H_2S measurement was 5.3 ppb at stations 1 (background) and station 4, with a corresponding program average value of 1.5 ppb and 1.8 ppb, respectively. The PADEP 24-hour ambient air standard is 5.0 ppb [20]. ATSDR does not currently have a chronic-duration inhalation MRL for hydrogen sulfide. No health effects have been found in humans exposed to typical environmental concentrations of H_2S (i.e., 0.11 ppb to 0.33 ppb), as discussed further in the Community Concerns Section. [20] H_2S is not classified as a carcinogen. Some of the observed values for maximum and average levels were above EPA's RfC of 1.0 ppb, but well below ATSDR's acute (i.e., less than 14 days) MRL of 70 ppb and intermediate MRL (i.e., 15 to

364 days) of 20 ppb, which is based on a NOAEL of 0.46 ppm, determined by laboratory observations. [21] Therefore, PADOH and ATSDR *would not expect exposure to these levels to harm people's health*.

Contaminant Evaluation

This section provides more information on the chemicals detected above CVs during air monitoring and sampling conducted by PADEP and Alliance Landfill's in 2008, as discussed above. Based on monitoring program averages, as discussed above, arsenic and chromium were retained for further evaluation. The majority of information summarized below, including context for how the levels for the various CVs were developed, has been extracted from ATDSR's chemical-specific Toxicological Profiles. For more information about each chemical, please refer to these online profiles at http://www.atsdr.cdc.gov/toxpro2.html.

As explained in the previous public health evaluation section, based on the monitoring and sampling data evaluated by PADOH and ATSDR, exposure to the levels that have been detected at the community-based and perimeter monitoring stations would not be expected to result in harmful effects for the public. That being said, the adverse health effects documented in the toxicological literature and summarized here are based on much higher levels than were observed in communities living near the Alliance Landfill. Often times human toxicological data is not available so studies of laboratory animals or occupational workers are used to calculate NOAEL and LOAEL. Occupational workers are generally exposed to much higher levels of contaminants that the general population would be, and the resulting NOAEL or LOAEL values would be much lower. Therefore, the health effects observed in some occupational studies would be much higher than those anticipated in the general population, such as the community adjacent to Alliance Landfill. Lastly, some of the studies discussed in this section pertain to exposures to chemical fumes (in an occupational or laboratory setting) and not to particulate matter, which in the form present at Alliance Landfill. Lastly, simply being exposed to a hazardous substance does not make it a hazard. The magnitude, frequency, timing, and duration of exposure and the toxicity characteristics of individual substances affect the degree of hazard, if any.

Arsenic

Arsenic was identified as a chemical for consideration because of its elevation in community ambient air samples collected in 2008. Inhalation exposure to inorganic arsenic (primarily arsenic trioxide dust in air at copper smelters) is, in multiple studies, associated with increased risks of lung cancer in occupational settings. However, scientific literature does not support associations between lung cancer and exposure to airborne arsenic in residential settings as the form of arsenic is different than that found in occupational (smelter) settings. For the general population, food is the primary source of arsenic exposure; inhalation exposure is generally negligible by comparison. Most information on human inhalation exposure to arsenic derives from occupational settings such as smelters and chemical plants, where the predominant form of airborne arsenic is arsenic trioxide dust. [16].

The lowest LOAEL for lung cancer reported in ATSDR's Toxicological Profile for Arsenic (Sept 2000) is 50 $\mu g/m^3$. [16] It is based on a study of workers chronically exposed at a Swiss smelter for periods ranging from 3 months to 30 years. Since smoking was more common in this occupational cohort than in the general population (as is generally the case), and the synergistic effect of smoking and occupational inhalation of arsenic on lung cancer risk was not taken into account, the true LOAEL for lung cancer attributable to arsenic exposure alone is likely to be significantly higher than 50 µg/m^3. When confounding factors such as smoking have been taking into account, no statistically significant increase of lung cancer has been observed at 50 µg/m^3. [22]

The reason that all of these levels still exceed ATSDR's cancer risk evaluation guide (CREG) and EPA's cancer-based RBC is that the latter represent hypothetical 1-in-a-million risk levels derived by making the assumption that no threshold exists for carcinogenic effects. In its 1986 Guidelines for Carcinogenic Risk Assessment, EPA was careful to point out that such risk estimates do not predict the true risk which is "unknown and may be as low as zero." Thus, while cancer-based CVs may be of some use as screening values, they are not practical as a single method for conducting an assessment of the public health implications of chemical exposures. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans. [16]

Background levels of arsenic in outdoor air range from less than 0.001–0.003 µg/m^3 in remote areas to 0.02–0.3 µg/m^3 in urban areas (1,000 times lower than the LOAEL). [16] The maximum 24-hour average values observed during the air sampling events was 0.0030 µg/m^3 and is similar to urban background levels. However, the vast majority of detects were well below that level. [16]. Based on its evaluation of the data, ATSDR concludes that concentrations of arsenic in the ambient air near the Alliance Landfill site are not a threat to human health.

Chromium

Chromium is a naturally-occurring element found in rocks, animals, plants, soil, and volcanic dusts and gases. Chromium is present in the environment in several forms. The most common forms are elemental chromium (Cr 0), trivalent chromium (Cr III), and hexavalent chromium (Cr VI). Cr III occurs naturally in the environment and is an essential nutrient. Cr VI and Cr 0 are generally produced by industrial processes. The metal chromium, which is the Cr 0 form, is used for making steel. Cr VI and Cr III are used for chrome plating, making dyes and pigments, leather tanning, and wood preserving. Most of the chromium compounds, usually Cr III and Cr VI, form fine dust in the air and settle on the ground or in water. The respiratory tract is the major target organ for chromium (VI) toxicity, for acute (short-term) and chronic (long-term) inhalation exposures. Shortness of breath, coughing, and wheezing were reported from a case of acute exposure to chromium (VI), while perforations and ulcerations of the septum, bronchitis, decreased pulmonary function, pneumonia, and other respiratory effects have been noted from chronic exposure. The main health effects associated with chronic (long-term) inhalation exposure to hexavalent chromium are irritation of the skin and mucous membranes. Lung cancer has been documented from occupational exposure to Cr VI. [18]

EPA has designated Cr VI as a known human carcinogen (Group A) by the inhalation route of exposure. Human studies have clearly established that inhaled chromium (VI) is a human carcinogen, resulting in an increased risk of lung cancer. The results of toxicological studies using animal models suggest that chromium (VI) can cause lung tumors via inhalation exposure of fumes. Because emissions and exposure data for chromium do not identify specific compounds or valence states, there is greater uncertainty associated with risk estimation for this class of pollutants.

The LOAEL for chromium is 2.0 µg/m^3, is derived from a case study of occupational workers. The effects observed in this study included mild decreased lung function and atrophy of the nasal mucosa. [15] The potential for cancer effects was evaluated based on a LOAEL of 0.04 mg/m3 (40 µg/m^3) derived from epidemiologic studies of male workers who developed lung cancer after being occupationally exposed to mixtures of chromium III and IV for up to 49 years. In human studies, the NOAEL is 1,990 µg/m^3, resulting from an occupational medicine study on trivalent chromium compounds. In this study, respiratory system effects were observed in workers occupationally exposed to chromium for up to 23.6 years. [23]

Background level of chromium are typically less than 0.01 µg/m^3 in rural areas to 0.01-0.03 µg/m^3 in urban areas [18] The highest 24-hour levels of chromium detected during the sampling events (0.013 µg/m^3) is 150 times lower than the LOAEL for chromium of 2.0 µg/m^3. Therefore, PADOH and ATSDR would not anticipate adverse health effects to the public from exposure to the observed levels.

Quality Assurance and Quality Control

ATSDR and PADOH are limited to the information provided in the referenced documents. It is expected that adequate quality assurance and quality control measures were adhered to regarding data gathering, chain of custody processes, laboratory procedures, and data reporting. In addition, during all aspects of sample collection, analyses, and reporting, extreme care is required to ensure that high quality data are acquired using the best applicable science techniques. ATSDR and PADOH expect that the laboratory only used certified, clean-sample collection devices. Once samples were collected, it is expected that they were stored according to the method protocol and delivered to the analytical laboratory within the specified limits. Sometimes sample collection problems, the testing equipment, dilution factor, outside contaminants and such need to be addressed and evaluated for validity. Finally, it is expected that standard laboratory operating procedures and other procedures and guidance for sample analysis, reporting, and chain of custody processes were followed. If ATSDR and PADOH believed the laboratory data were flawed in any way, further evaluation of the quality assurance and quality control procedures would have been conducted. Any analyses, conclusions, and recommendations in this health consultation are limited by the completeness and reliability of the referenced documents. Appendices 1 and 2 provide additional information on the quality control used during the sampling events.

Child Health Considerations

PADOH and ATSDR recognize that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of environmental media. In general, children appear to be more sensitive to the effects of contaminants, presumably because of a higher body burden. Child health considerations were taken into account during this evaluation. Arsenic has been documented to cross the placenta, is present in human breast milk, and long-term exposure to arsenic in children may result in lower IQ scores. In addition, children with asthma may be especially sensitive even to low concentrations of sulfur dioxide, but it is not known whether asthmatic children are more sensitive than asthmatic adults. However, based on the levels of arsenic and sulfur dioxide detected in air in the three communities outside the Alliance Landfill perimeter, PADOH and ATSDR do not consider inhalation exposure to the levels of arsenic and sulfur dioxide in air to be a public health concern to children.

Community Concerns

PADOH and ATSDR have received several concerns from the adjacent communities regarding the Alliance Landfill operations. [31] This section addresses these community concerns.

Landfill Operating Capacity

Residents have expressed concern about the landfill operating at reduced capacity during the air sampling timeframe in order to lower the landfill gas emissions and potential odors. Landfills usually produce appreciable amounts of gas within 1 to 3 years. Peak gas production usually occurs 5 to 7 years after wastes are dumped. Almost all gas is produced within 20 years after waste is dumped; however, small quantities of gas may continue to be emitted from a landfill for 50 or more years. Landfill gas is generated during the natural process of bacterial decomposition of organic material contained in landfills. A number of factors influence the quantity of gas that a landfill generates and the components of that gas. These factors include, but are not limited to, the types and age of the waste buried in the landfill, the quantity and types of organic compounds in the waste, and the moisture content and temperature of the waste. Temperature and moisture levels are influenced by the surrounding climate [35]. PADOH and ATSDR do not anticipate this would affect any landfill gas generation because landfill gas takes a long time to generate and would not be immediately affected by operating conditions.

Odors

The community has also expressed concern regarding odors in the community, potentially from the Alliance Landfill activities. Potential sources of landfill odors, if present at high enough concentrations, can include sulfides, ammonia, and certain non-methane organic compounds (NMOCs). Landfill odors may also be produced by the disposal of certain types of wastes, such as manures and fermented grains. Sulfides, such as H_2S, dimethyl sulfide, and mercaptans, are common sources of landfill odors because they produce a very notable strong rotten egg smell—even at very low concentrations. Of these three sulfides, H_2S is typically emitted from landfills at the highest rates and concentrations. Humans are extremely sensitive to H_2S odors and can smell such odors at concentrations as low as 0.5 to 1 ppb. People can find the odor offensive at levels approaching 50 ppb. Unfortunately, the impact of landfill gas odors on sensitive populations such as people with pre-existing respiratory illnesses is not well documented or understood.

Many people may find the odors emitted from a landfill offensive or unpleasant. In reaction to the odor, some people may experience nausea or headaches. Although such responses are undesirable, medical attention is usually not required. Acute effects are usually reversed when the odor or exposure ends. However, the effects on day-to-day life can be more lasting. Unfortunately, the impact of landfill gas odors on sensitive populations such as people with pre-existing respiratory illnesses is not well documented or understood. In general, levels of individual landfill gases in ambient air are not likely to reach harmful levels. In other words, low levels of landfill gases are unlikely to cause obvious, immediate health effects. To date, researchers have not identified any long-term health effects associated with exposure to the low-level H_2S concentrations that normally occur in communities living near landfills. However, the potential health effects from long-term exposures to low levels of landfill gases released to ambient air are not easy to evaluate, largely because exposure data are often lacking. Many exposures to landfill gases involve chemicals at low or trace levels, as well as a mixture of chemicals. Most studies that look at health effects from chemical exposures consider much higher chemical levels than those typically associated with landfills. Therefore, PADOH and ATSDR recommend that PADEP continue to monitor odor complaints from the community and continue to inspect the facility to ensure proper operation [35].

Average concentrations in ambient air range from 0.11 to 0.33 ppb, with H_2S concentrations in the air around a landfill usually less than 15 ppb. ATSDR has set an acute and intermediate MRL value of 70 ppb and 20 ppb, respectively. For this HC, the maximum and average levels of H_2S were well below these values, and specifically were 3.7 and 11.1 times lower, respectively, than the ATSDR intermediate MRL mentioned above. Based on the data evaluated, PADOH and ATSDR would not anticipate adverse health effects in the community for exposure to the observed H_2S levels. [35]

Deodorizer Product

Community members expressed concern regarding the use of a deodorizer product at Alliance Landfill. The concerned citizens stated that based on the MSDS for the deodorizer utilized by Alliance Landfill, the product contains benzene and could potentially pose a public health threat. After reviewing the MSDS for the current deodorizer (OCC Fragrance Free, Benzaco Scientific Inc.) utilized by Alliance Landfill and speaking with the manufacturing company of the deodorizer, ATSDR and PADOH confirmed that the deodorizer apparently does not contain benzene. The deodorizer product currently utilized by Alliance Landfill is therefore not considered by ATSDR and PADOH to be a public health threat at the Alliance Landfill site, based on the information provided to and evaluated by ATSDR and PADOH regarding the deodorizer product. Thus**,** ATSDR and PADOH do not anticipate recommending community, perimeter, or inlet/outlet gas sampling/monitoring for benzene. It is assumed by ATSDR and PADOH that the product is being utilized in compliance with manufacturer, PADEP permitting requirements, and other appropriate regulations and/or procedures. [25]

Mercury

Some community members are concerned that Alliance Landfill could be generating, producing, and/or emitting mercury. Alliance Landfill, with PADEP oversight, conducted mercury flare destruction sampling. PADOH and ATSDR reviewed the mercury flares testing and resulting community air modeling data by PADEP (Appendix 4). It is expected the primary source of mercury from the Alliance Landfill to the surrounding community would be emissions from the Alliance Landfill flaring system. Mercury emissions from the flares were well below the chronic inhalation EMEG/MRL. In addition, it is the current position of ATSDR, PADOH, and PADEP that a properly operated flaring system would ensure mercury emissions would not constitute a public health issue to the nearby communities.. It is assumed by ATSDR and PADOH that Alliance Landfill operations are conducted in compliance with PADEP permitting requirements, and other appropriate regulations and/or procedures. Based on this, ATSDR and PADOH do not anticipate recommending community or perimeter sampling/monitoring for mercury at this time.

Dioxins

Community members have expressed concern regarding the generation, production, and/or emission of dioxins at the Alliance Landfill site. The potential for dioxin and furan emissions from the site is believed to be small. After discussions with and obtaining information from PADOH and Alliance Landfill /Waste Management, appears, that Alliance Landfill flares do not emit dioxins, since the flares operate at temperatures exceeding 1,500 ^{o}F (See Appendix 4). EPA has concluded, based on literature reviews and studies, that at temperatures over 1,000 ^{o}F, dioxin and furan compounds are readily oxidized and therefore would not be formed to any significant degree. Since the initial performance tests were conducted for the flares, no instances of non-compliance related to temperature have been identified by PADEP. Dioxins are therefore not considered by ATSDR and PADOH to be a public health threat at the Alliance Landfill site. Thus, ATSDR and PADOH do not anticipate recommending community, perimeter, or inlet gas sampling/monitoring for dioxins at this time. It is assumed by ATSDR and PADOH that Alliance Landfill operations are conducted in compliance with PADEP permitting requirements, and other appropriate regulations and/or procedures.

VOCs

Some community members expressed concern regarding the generation, production, and/or emission of volatile organic compounds (VOCs) at Alliance Landfill. It is expected the primary source of VOCs from the Alliance Landfill to the nearby communities would be VOCs contained in uncaptured landfill gas. It is the current position of ATSDR, PADOH, and PADEP that a properly operated Landfill gas collection system would ensure that VOC emissions do not constitute a public health issue to the nearby communities. PADEP oversees the appropriate operation of the Alliance Landfill gas collection system. PADEP has informed ATSDR and PADOH that the Alliance Landfill has permit conditions that require them to capture a minimum 75% of the landfill gas generated and destroy a minimum 98% of that which is captured. The Alliance Landfill demonstrates compliance with these conditions by conducting quarterly surface monitoring and calculating landfill gas collection efficiency daily [37]. The results of Alliance Landfill's quarterly surface monitoring have shown very few instances of surface emissions. PADEP surface monitoring conducted at the site during semiannual inspections have also shown very few instances of surface emissions. Alliance landfill has been showing landfill gas collection efficiencies greater than 100% [37]. This calculation compares a theoretical gas generation number to an actual gas collected number. This calculation coupled with very good surface monitoring results; clearly demonstrate that they are complying with the minimum landfill gas collection efficiency of 75%. Alliance reported emissions of 8.9 tons of VOCs in 2008 [37]. Based on this information and data provided to PADOH and ATSDR, Alliance has been in compliance with the landfill gas collection conditions of their permit and therefore, PADOH and ATSDR would not anticipate adverse health effects in the community.

Conclusions

Based on a review of the air monitoring data, PADOH and ATSDR conclude the following:

Air monitoring data collected by the Pennsylvania Department of Environmental Protection (PADEP) at community-based air monitoring stations indicate that exposure to the detected levels of arsenic, beryllium, cadmium, chromium, lead, manganese, and zinc ***is not expected to harm people's health.*** The average levels of contaminants detected during the community-based air monitoring events were below ATSDR's comparison values (CVs), with the exception of chromium and arsenic. For non-cancer effects, the observed average levels of chromium were well below ATSDR's minimum risk level (MRL), and average arsenic concentrations were below the no-observed-adverse-effects-level (NOAEL) and the lowest-observed-adverse-effects level (LOAEL) documented in the literature following chronic inhalation exposures. Estimated theoretical cancer risk levels for chromium and arsenic, calculated by PADOH and ATSDR, were within EPA's acceptable risk range (i.e., 1 excess cancer in 10,000 to 1 excess cancer in 1,000,000 persons exposed). PADOH and ATSDR conservatively assumed, without data to support the contrary, that all chromium was hexavalent chromium (Cr VI), which is considered the most toxic chromium species.

Air monitoring data collected from the five Alliance Landfill air monitoring stations, within the landfill and along the perimeter, indicates that exposure to the detected levels of arsenic, beryllium, cadmium, chromium, lead, manganese, and zinc ***is not expected to harm people's health.*** The average levels of contaminants found in the air samples collected by Alliance Landfill with below ATSDR's comparison values (CVs), with the exception of chromium. The observed average values of chromium (conservatively assumed to be the more toxic hexavalent form of chromium) were well below ATSDR's minimum risk level (MRL). Theoretical cancer risk levels for chromium were within EPA's acceptable risk range (i.e., 1 excess cancer in 10,000 to 1 excess cancer in 1,000,000 persons exposed). The highest 24-hour concentration (and not the average value) for arsenic, cadmium and beryllium were above their respective ATSDR CVs, with most of the samples non-detect. However, the highest concentration for arsenic, cadmium and beryllium are below levels documented in the literature to cause adverse health effects, and PADOH and ATSDR do not anticipate the public would be exposed to the maximum concentrations of these contaminants.

Based on a review of available monitoring data, ***exposure to particulate matter (PM_{10} and $PM_{2.5}$), is not expected to harm people's health.*** Ambient air monitoring data, collected by both PADEP and Alliance, showed that particulate matter concentrations detected in ambient air were below EPA's National Ambient Air Quality Standards (NAAQS). The NAAQS were developed to protect the environment and public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. The levels of particulate matter detected near the Alliance monitoring events are similar to background levels.

PADOH and ATSDR reviewed the hydrogen sulfide air monitoring data collected in the community and along the perimeter of the landfill. Based on this review, ***PADOH and ATSDR conclude the levels of hydrogen sulfide are not expected to harm people's health.*** The levels of hydrogen sulfide were below ATSDR's inhalation MRL for both acute (i.e., 14 days or less) and intermediate (i.e., 15–364 days) exposure durations.

Public Health Recommendations

PADOH and ATSDR recommend the following:

1. ATSDR and PADOH recommend that representatives of PADEP, Waste Management Inc., and Alliance Landfill consider additional air monitoring if the Alliance Landfill makes substantial or significant changes in its scope, activity, and/or capacity, and to continue to address residents' concerns in regard to air quality, exposure levels, and potential health effects.

2. PADEP should continue maintaining a record of all odor complaints to characterize the nature, location, time, and frequency of such complaints.

3. Management at the landfill (Waste Management, Inc./Alliance) and PADEP should ensure continued compliance with required landfill gas emission controls and odor-control practices.

Public Health Actions

The public health action plan for the Alliance Landfill contains a description of actions that have been or will be taken by PADOH, ATSDR, and other government agencies at the site. The purpose of the public health action plan is to ensure that this health consultation both identifies public health hazards and provides a plan of action designed to mitigate and prevent harmful human health effects resulting from exposure to hazardous substances.

Public health actions that have been taken include:

- PADOH and ATSDR conducted a visit of the site and the surrounding community.

- PADOH and ATSDR met with PADEP Northeast Regional staff members to discuss site background information and community concerns.

- The additional air monitoring stations addressed in the 2008 HC were installed in several locations by Waste Management, Inc./Alliance Landfill in accordance with or in consideration of ATSDR, PADOH, and PADEP recommendations and input to better determine the full extent of air quality and potential health effects for residents in the community surrounding Alliance Landfill.

- PADOH and ATSDR completed this HC.

Public health actions that currently or will be implemented:

- PADOH and ATSDR will hold a public meeting or have another type of public forum to discuss the conclusions and recommendations of this HC and to answer any questions.

- PADOH and ATSDR will consider reviewing additional environmental sampling and monitoring data, if requested and deemed appropriate, and issuing a public health conclusion.
- PADOH and ATSDR will remain available to discuss any public health questions or concerns related to the site with community members and local authorities as appropriate.

References

1. [ATSDR] Agency for Toxic Substances and Disease Registry. 2008. Health consultation for Alliance Landfill Site, Taylor Borough and Ransom Township, Taylor, Lackawanna County, Pennsylvania. Atlanta, GA: US Department of Health and Human Services

2. [ATSDR] Agency for Toxic Substances and Disease Registry. 2005. Health consultation for Alliance Landfill Site, Taylor Borough and Ransom Township, Taylor, Lackawanna County, Pennsylvania. Atlanta, GA: US Department of Health and Human Services; 10 January. Available at: http://www.atsdr.cdc.gov/HAC/pha//EmpireSanitary082604HC/EmpireSanitary082604HC.pdf. Last accessed 2010 January 19.

3. Site History." Alliance Landfill. Web. 22 Feb. 2010. http://alliance.wm.com/facility/history.asp

4. US Bureau of the Census. 2000. Profile of general demographic characteristics: 2000. Geographic area: Taylor borough, Pennsylvania. Available at: http://pasdc.hbg.psu.edu/pasdc/census_2000/Data/SF3/DP1-DP4/1604276184.pdf. Last accessed 2010 January 19.

5. [PADEP] Pennsylvania Department of Environmental Protection. 2009. Air sampler specifications and data. Meadville, PA: Northwest Regional Office.

6. Berks County Pennsylvania. Landfill Gas Basics. Last accessed 2010 January 19.http://www.co.berks.pa.us/eac/lib/eac/environmental_library/70_waste/70.71_waste_landfills/70.71.02.02_landfill_gas_chapter_2_(atsdr).pdf

7. [PADEP] Pennsylvania Department of Environmental Protection. 2009. Pennsylvania's Environment Facility Application Compliance Tracking System (eFACTS): Violation details for inspection id 1460732. Available at: http://www.ahs2.dep.state.pa.us/eFactsWeb/default.aspx. Last accessed 2010 January 19.

8. PADOH. "Community Fact Sheet." Keyser Avenue Air Monitoring Station Health Consultation (Feb. 2008). Print. Copy available at ATSDR Regional Office, Philadelphia. PA

9. [USEPA] US Environmental Protection Agency. 2008. Code of Federal Regulations 40, Chapter 1, Appendix B, Part 50. 1 July edition. Available at: http://edocket.access.gpo.gov/cfr_2008/julqtr/pdf/40cfr50AppB.pdf. Last accessed 2010 January 19.

10. [USEPA] US Environmental Protection Agency. Method 200.8. Determination of trace elements in waters and wastes by inductively coupled plasma – mass spectrometry. Revision 5.4, EMMC

version. Cincinnati, OH: Environmental Monitoring Systems Laboratory, Office of Research and Development. Available at: http://www.epa.gov/waterscience/methods/method/files/200_8.pdf. Last accessed 2010 January 19.

11. Bellas, Roger, and PADEP. Data Acquisition Plan for Alliance Health Consultation Study. Wilkes-Barre, PA. Print. Copy available at ATSDR Regional Office, Philadelphia, PA

12. CPF Associates, Inc. Evaluation of Ambient Air Sampling Data Collected at and in the Vicinity of Alliance Sanitary Landfill, Inc. in Lackawanna County, PA. Rep. Takoma Park, MD, 2009. Print.

13. CPF Associates. Public Health Assessment Summary Alliance Sanitary Landfill. Rep. Takoma Park, MD, 2009. Print.

14. [USEPA] US Environmental Protection Agency. 2010. National Ambient Air Quality Standards (NAAQS). Available at: http://www.epa.gov/air/criteria.html. Last updated 2010 January 7. Last accessed 2010 January 19.

15. [ATSDR] Agency for Toxic Substances and Disease Registry. 2005. Public health assessment guidance manual. Available at: http://www.atsdr.cdc.gov/HAC/PHAManual/toc.html. Last accessed 2010 January 19.

16. [ATSDR] Agency for Toxic Substances and Disease Registry. 2007. Toxicological profile for arsenic. Atlanta, GA: US Department of Health and Human Services; August. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp2.html. Last accessed 2010 January 19.

17. [ATSDR] Agency for Toxic Substances and Disease Registry. 2007. ToxFAQs for arsenic. Atlanta, GA: Division of Toxicology and Environmental Medicine; August. Available at: http://www.atsdr.cdc.gov/tfacts2.html. Last accessed 2010 January 19.

18. [ATSDR] Agency for Toxic Substances and Disease Registry. 2008. Toxicological profile for chromium. Atlanta, GA: US Department of Health and Human Services; September. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp7.html#bookmark09. Last accessed 2010 January 19.

19. [ATSDR] Agency for Toxic Substances and Disease Registry. 2008. Toxicological profile for cadmium. Atlanta, GA: US Department of Health and Human Services; September. Available at: http://www.atsdr.cdc.gov/toxprofiles/phs5.html. Last accessed 2010 January 19.

20. [ATSDR] Agency for Toxic Substances and Disease Registry. 1998. Toxicological profile for sulfur dioxide. Atlanta, GA: US Department of Health and Human Services; December. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp116.html. Last accessed 2010 January 19

21. [ATSDR] Agency for Toxic Substances and Disease Registry. 2006. Toxicological profile for hydrogen sulfide. Atlanta, GA: US Department of Health and Human Services; July. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp114.html. Last accessed 2010 January 19.

22. Welch, A.C., et.al. 1982. Arsenic exposure, smoking, and respiratory cancer in copper smelter workers. Archives of Environmental Health, 37(6):325-335].

23. [ATSDR] Agency for Toxic Substances and Disease Registry. May 2008. Case Studies in Environmental Medicine: Cadmium. http://www.atsdr.cdc.gov/csem/cadmium/index.html

24. [ATSDR] Agency for Toxic Substances and Disease Registry. September 2005. Evaluation of Ambient Air Data – Coronet Industries, Plant City, Hillsborough County, Florida. http://www.atsdr.cdc.gov/HAC/pha/Coronet%20Industries,%20Inc/CoronetAirFinalHC091305.pdf

25. Werner, Lora (ATSDR) and White, Mark (PADOH). Letter to Mr. Doug Coenen, (Alliance Landfill / Waste Management) and Richard Hayden (CHH Partners) regarding follow-up conference call discussions on Alliance Landfill. July 9, 2008

26. [ATSDR] Agency for Toxic Substances and Disease Registry. 2009. Sulfur Dioxide Measurements Comparative Field Application Study.

27. Jackson, Lisa P., and US. EPA. Letter to Governor Edward G Rendell. 8 Oct. 2009. Pennsylvania Department of Environmental Protection. Web. 22 Feb. 2010. http://www.dep.state.pa.us/dep/DEPUTATE/AIRWASTE/AQ/attain/PM25Des/Pennsylvania_Rendell.pdf

28. Conestoga-Rovers & Associates. Ambient Air Monitoring Report. Rep. Niagara Falls, NY, 2009. Print. Copy available at ATSDR Regional Office, Philadelphia, PA.

29. Conestoga-Rovers & Associates. Supplemental Ambient Air Monitoring Plan, Alliance Sanitary Landfill. Rep. Niagara Falls, NY, 2007. Print.

30. Waste Management. "Area 2A Represents Smaller Expansion Plan." Alliance Landfill: A Partner with Our Community (May & June 2005). Print.

31. Werner, Lora. "Alliance Sanitary Landfill." Letter to Public Health Assessment Petitioner, Anonymous. 8 Mar. 2007. MS. ATSDR Regional Office, Philadelphia, PA.

32. McRae, Tammie, and ATSDR. Letter to Doug Coenen. 16 Apr. 2007. MS. ATSDR Regional Office, Philadelphia, PA.

33. McRae, Tammie, and ATSDR. Letter to Doug Coenen. 18 Oct. 2007. MS. ATSDR Regional Office, Philadelphia, PA.

34. ATSDR] Agency for Toxic Substances and Disease Registry. Toxicological profile for beryllium. Atlanta, GA: US Department of Health and Human Services; September. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp4.html. Last accessed 2010 January

35. [ATSDR] Agency for Toxic Substances and Disease Registry. 2001. Landfill gas primer – An overview for environmental health professionals. Atlanta, GA: US Department of Health and Human Services; November. Available at: http://www.atsdr.cdc.gov/HAC/landfill/html/ch2.html. Last accessed 2010 January 19.

.

36. Gable, Debra. "Alliance Landfill Health Consult." Message to the author. 3 Mar. 2010. E-mail. This email discusses ATSDR's lack of confidence on the SO2 SPM results and how to address them in the health consultation.

37. Bellas, Roger, and PADEP-NERO. "Alliance Landfill Health Consultation." Message to the author. 4 Mar. 2010. E-mail.

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Certification

This health consultation for Alliance Landfill site was prepared by the Pennsylvania Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated. Editorial review was completed by the cooperative agreement partner.

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The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

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Figures

Figure 1. Alliance Landfill and Surrounding Areas

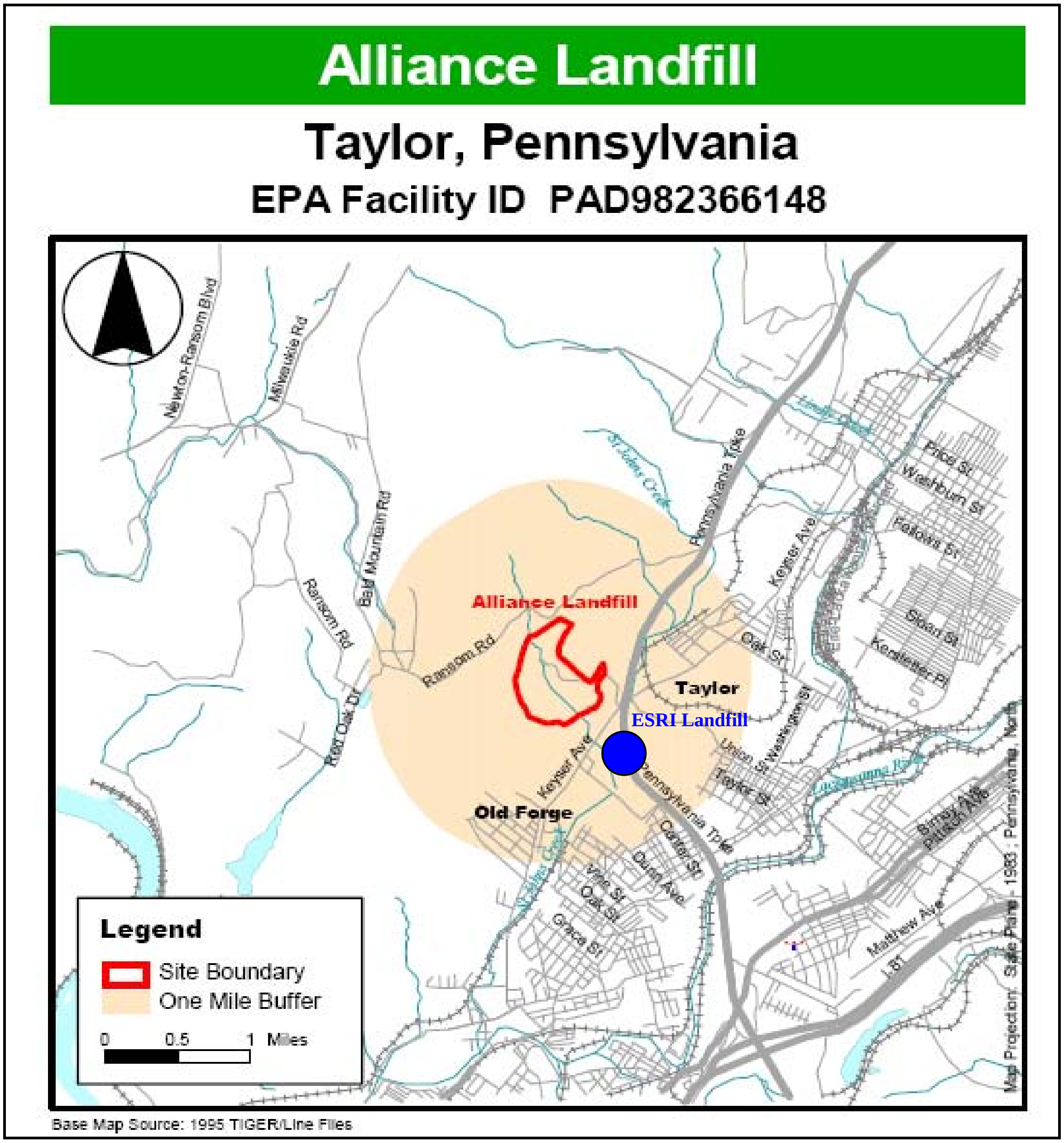

Figure 2. Arial View of the Site with the Location of Air Monitors

Community Monitoring Stations in **Green**
Alliance Monitoring Stations in **Purple**
Alliance Ambient Air Monitoring Station in **Red (Background)**
Alliance Meteorological Stations in **Blue**

Tables

Table 5. PADEP and Alliance Landfill Sulfur Dioxide and Hydrogen Sulfide Sampling Data Compared to ATSDR's CVs and EPA's NAAQS (1-Hour)

Analyte	***Maximum and Average 1-Hour Concentrations (ppb) at Each Monitoring Station***			***ATSDR CV/ EPA NAAQS***
PADEP Samples				
	Golf Course	**Auto Shop**	**McDade Park**	
SO_2	Maximum - 1.79 Average - 0.15	Maximum - 2.34 Average - 0.15	Maximum - 1.85 Average - 0.15	Acute MRL- 10 ppb NAAQS 24-hr - 140 ppb NAAQS Annual-30 ppb
H_2S	Maximum - 4.3 Average - 0.06	Maximum - 2.2 Average - 0.1	Maximum - 2.1 Average - 0.06	Acute MRL - 70 ppb Intermediate MRL - 20 ppb EPA RfC - 1 ppb PADEP 24 hr – 5.0 ppb

Alliance Landfill Samples						
	Station 1	**Station 2**	**Station 2A**	**Station 3**	**Station 4**	
SO2	Maximum - 10.3 Average - 1.0	Maximum - 2.7 Average - 0.82	Not sampled	Maximum - 3.1 Average - 0.73	Maximum - 1.3 Average -0.69	Acute MRL- 10 ppb NAAQS 24-hr - 140 ppb NAAQS Annual-30 ppb
H2S	Maximum - 5.3 Average - 1.5	Maximum - 3.3 Average - 0.77	Maximum - 3.0 Average - 1.1	Maximum - 2.0 Average - 0.54	Maximum - 5.3 Average - 1.8	Acute MRL – 70 ppb Intermediate MRL - 20 ppb EPA RfC - 1 ppb PADEP 24 hr – 5.0 ppb

Values that exceed ATSDR's acute MRL are shaded in yellow

Table 6. Air Results for PM_{10}, $PM_{2.5}$, and SO_2 from 2004–2008 at PADEP's S01 Monitoring Station Used for Comparison Purposes

Measured Parameter	***Year of Monitoring Data Collection***					***EPA NAAQS***
	2004	***2005***	***2006***	***2007***	***2008***	
PM_{10} (µg/m^3)						
Annual 24-hour	16	17	17	17	16	24-hour average – 150 µg/m^3
Maximum 24-hour mean	55	62	57	53	43	
Minimum 24-hr mean	2	0	5	4	3	
99% 24-hour	42	51	47	48	38	
$PM_{2.5}$ (µg/m^3)						
Annual 24-hour	11.6	12.5	10.6	11.3	10.1	Annual average - 15 µg/m^3; 24-hour average - 35 µg/m^3
Maximum 24-hr mean	47.2	49.9	47.4	44.4	38.2	
Minimum 24-hour mean	0	0	1.7	0	1.3	
99% 24-hour	31.2	32.8	28.7	32	27.7	
SO_2 (ppb)						
Annual mean	5	5	4	5	3	Annual average - 30 ppb; 24-hour average- 140 ppb
Maximum 24-hr mean	20	29	18	20	15	
Maximum 1-hour mean	46	57	80	42	39	

Table 7. $PM_{2.5}$ Data from Alliance Landfill Compared to PADEP's Scranton SO1 Monitoring Station

Date of Monitoring	*Location of $PM_{2.5}$ (µg/m^3) Monitoring*	
	McDade Park	***Scranton SO1***
9/1/2008	5.30	6.40
9/2/2008	8.00	6.50
9/3/2008	10.70	10.70
9/4/2008	24.40	22.40
9/5/2008	18.60	19.10
9/6/2008	5.20	6.10
9/7/2008	4.20	4.70
Average	10.91	10.84
	Auto Shop	***Scranton SO1***
9/9/2008	2.70	10.40
9/10/2008	5.10	2.00
9/11/2008	3.50	5.20
9/12/2008	6.20	6.60
9/13/2008	11.20	9.00
9/14/2008	8.40	13.90
9/15/2008	3.40	3.20
Average	5.79	7.19
	Golf Course	***Scranton SO1***
9/17/2008	9.20	6.90
9/18/2008	2.90	4.90
9/19/2008	3.10	3.90
9/20/2008	13.10	8.00
9/21/2008	14.80	14.90
9/22/2008	2.50	9.70
9/23/2008	13.40	4.90
9/24/2008	9.30	8.10
9/25/2008	4.20	6.50
9/26/2008	4.60	2.40
9/27/2008	3.20	4.50
9/28/2008	4.20	2.70
Average	7.04	6.45

Appendix 1: Landfill Operational Improvements

Operational Improvements, and Surveillance and Compliance Programs at Alliance Sanitary Landfill

Information	Description	Additional Information
Landfill gas management system	A variety of methods are used to ensure proper operation of the landfill gas collection and treatment system.	Since the departure of a third-party gas management contractor in mid-2003, Alliance has developed and operated a state-of-the-art landfill gas management system that includes new flares and an extensive and efficient landfill gas collection system. The improvements in landfill gas collection and treatment at Alliance that have occurred since 2003 have substantially enhanced the control of potential emissions from the facility and, therefore, greatly reduced potential off-site air quality impacts. These improvements include installing 161 new wells, 47 replacement wells, more than 5 miles of new horizontal collection piping and more than 6 miles of gas conveyance piping. Since 2003, odor-related issues at Alliance have been mitigated and the facility has received no odor-related violations. Examples of the landfill gas management practices conducted by Alliance include: * Monthly or more frequent gas well monitoring * Quarterly or more frequent surface methane emissions scans * On-site & off-site odor monitoring by the Quality Assurance Team * Enclosed flare performance testing * Continuous flare performance and operational monitoring requirements * Gas management system collection efficiency requirements and demonstrations
Nuisance Minimization and Control Plan	Nuisance monitoring is conducted on site during operating and non-operating periods by Alliance's designated Quality Assurance Team (QAT) members.	The Nuisance Minimization and Control Plan was established in 2004. It specifies controls and procedures to minimize nuisance conditions, and includes a nuisance monitoring and observation program which is implemented by the Quality Assurance Team (QAT). If a problem is detected during the QAT surveillance, the issue is quickly communicated to site management and corrective action is then taken.
PADEP Waste Management Program inspections	Monthly or more frequent inspections are conducted by PADEP Waste Management Program personnel.	PADEP Waste Management staff has conducted more than 90 site inspections and other visits from 2004 to the present. Alliance has received no violations regarding emissions or nuisance conditions from any of these inspections.

Operational Improvements, and Surveillance and Compliance Programs at Alliance Sanitary Landfill

Information	Description	Additional Information
Landfill gas management system	A variety of methods are used to ensure proper operation of the landfill gas collection and treatment system.	Since the departure of a third-party gas management contractor in mid-2003, Alliance has developed and operated a state-of-the-art landfill gas management system that includes new flares and an extensive and efficient landfill gas collection system. The improvements in landfill gas collection and treatment at Alliance that have occurred since 2003 have substantially enhanced the control of potential emissions from the facility and, therefore, greatly reduced potential off-site air quality impacts. These improvements include installing 161 new wells, 47 replacement wells, more than 5 miles of new horizontal collection piping and more than 6 miles of gas conveyance piping. Since 2003, odor-related issues at Alliance have been mitigated and the facility has received no odor-related violations. Examples of the landfill gas management practices conducted by Alliance include: * Monthly or more frequent gas well monitoring * Quarterly or more frequent surface methane emissions scans * On-site & off-site odor monitoring by the Quality Assurance Team * Enclosed flare performance testing * Continuous flare performance and operational monitoring requirements * Gas management system collection efficiency requirements and demonstrations
Nuisance Minimization and Control Plan	Nuisance monitoring is conducted on site during operating and non-operating periods by Alliance's designated Quality Assurance Team (QAT) members.	The Nuisance Minimization and Control Plan was established in 2004. It specifies controls and procedures to minimize nuisance conditions, and includes a nuisance monitoring and observation program which is implemented by the Quality Assurance Team (QAT). If a problem is detected during the QAT surveillance, the issue is quickly communicated to site management and corrective action is then taken.
PADEP Waste Management Program inspections	Monthly or more frequent inspections are conducted by PADEP Waste Management Program personnel.	PADEP Waste Management staff has conducted more than 90 site inspections and other visits from 2004 to the present. Alliance has received no violations regarding emissions or nuisance conditions from any of these inspections.

Appendix 2: Data Acquisition Plan and Ambient Air Monitoring Report

Data Acquisition Plan for Alliance Health Consultation Study

Taylor & Old Forge Boroughs,

Pennsylvania

Prepared by:

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Wilkes-Barre, PA 18711

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A – Data Acquisition Overview

SECTION 1

PROBLEM DESCRIPTION

1.1 Background

Taylor and Old Forge are boroughs located in Northeast Pennsylvania that contain residential areas that are situated in close proximity to Alliance Landfill (landfill).

1.2 Problem Definition

The Agency for Toxic Substances and Disease Registry (ATSDR) & the Pennsylvania Department of Health (PADOH) were petitioned by residents of the area to conduct a Health Consult of the area to determine whether the landfill posed a health risk to the surrounding communities. Beginning in May of 2006 and running into December of 2007, the Pennsylvania Department of Environmental Protection (PADEP) operated a sample station located southeast of the Landfill on Keyser Avenue in Taylor. This station provided approx 18 months of SO2, H2S, TSP with metals, and meteorological data that the ATSDR and the PADOH could utilize in making a health risk assessment. Although the data collected showed none of the pollutants tested for posed a health risk in and around the sample location, both entities determined additional data was required to make a conclusive health risk assessment for the surrounding communities.

1.3 Project Objectives

In order to better assess potential impacts the landfill may have on the community, this project will provide the ATSDR and the PADOH with H2S, SO2, TSP with metals, PM10, and PM2.5 data from 3 separate sampling locations surrounding the site. This data, in conjunction with on-site sampling being conducted by Alliance, will be utilized to provide an assessment of any health impacts that the landfill may have on the communities near the landfill.. The project will run for approximately 4 weeks.

SECTION 2

PROJECT ORGANIZATION

2.1 Pennsylvania Department of Environmental Protection

The PADEP Project Director and Technical Monitor, in conjunction with technical advisors in Harrisburg, will be Roger Bellas. In the capacity of Project Director, Mr. Bellas will serve as the primary interface between the PADEP, ATSDR and PADOH. He will be responsible for obtaining consent agreements from potential program participants identified. In the capacity of Technical Monitor, Mr. Bellas will be responsible for overseeing overall coordination and logistics, and serve as a technical advisor. Mr. Bellas will also serve as a Field Technician.

2.2 Field Technicians

The Field Techs for this project will be Mr. Roger Bellas, Ms. Erika Bloxham, Mr. Christian Ostrowski, and Mr. Carl Pecora. In the capacity of Field Technicians (field team members), they will perform the pre-deployment checks of the measurement and sample collection systems, deploy sampling equipment, perform daily sites visits, perform the sample collections, perform data downloading, and conduct the equipment recovery efforts.

SECTION 3

PROJECT DESCRIPTION

3.1 Siting

Siting will be the joint responsibility of PADEP, ATSDR & PADOH. PADEP will recruit participants (i.e., private and/or public) located in the vicinity of the landfill, and inform them of what is involved in general program participation. After the recruiting efforts have been completed, PADEP with the concurrence of the ATSDR and PADOH will select participants to host monitoring site locations. After the sites have been selected, and participation consent has been obtained, PADEP will contact the participants to schedule site events (i.e., deployment, operation, and recovery).

There will be 3 sample sites utilized for the project. Each site will host one of the following sampler configurations at a time. Site 1 will host a TSP sampling unit; Site 2 will host a PM10 sampler; and site 3 will host a PM2.5 sampler in conjunction with the 2 single point monitors. These sampler configurations will be rotated after a minimum of seven (7) days worth of sampling data is collected. At the conclusion of the project there will be a minimum of seven (7) days of data for each pollutant being sampled for, for each site.

3.2 Pre-Site Survey

As part of the site selection process, the Field Technicians will visit the Taylor-Old Forge area to perform a pre-site survey. During this pre-site survey, the field team members will become familiar with the layout of the area and determine the most viable locations for the samplers.

During the pre-site survey, the Field Technicians will visit each of the selected monitoring site locations. Site locations will be documented by longitude and latitude using a hand held global positioning system (GPS). All needs associated with installing and operating the monitoring systems (i.e., access, ability to utilize sampling probes, adequate power, internal/external physical constraints, compatibility with the specifications of the equipment to be deployed, special materials needed) prior to deployment, or identify problems that may preclude use of a selected site will be determined during the pre-site survey . The Field Technicians will develop site-specific approaches for deploying the systems/equipment in the field.

3.3 Staging

Continuous measurement systems for this project will be provided by ATSDR. These systems include 2 single point monitors (SPM), one for H2S and a second for SO2, and a data acquisition system (DAS). The systems/equipment will be set up and rigorously checked to insure that everything is functioning correctly. For the SPMs, pre-deployment calibration and mid-point Quality Control (QC) checks will be performed to qualify precision and accuracy before the systems are deployed and during the sampling event. Each site specific DAS will be set up, configured, and tested. PADEP will perform pre-deployment calibrations and inspections of the particulate sampling equipment. (the TSP, PM10, and PM2.5 samplers)

3.4 Deployment

PADEP personnel will transport the equipment to the site locations. Equipment installation of each of the chemical measurement systems and particulate collection systems, in accordance with the site specific approaches developed during the pre-site survey, will be performed. Once the equipment set-up is completed, each system will be tested to ensure that no damage occurred during transport. All meteorological data will be obtained from a met. station located on the landfill.

3.5 Monitoring

From the point that the samplers are brought on-line, monitoring will be conducted continuously for duration of approximately 4-weeks. A field team member will visit the sites daily to assess the functional status of the chemical and particulate measurement equipment and correct any problems identified. Team members will also make daily observations of the sites and document any activities that could influence the sample results for that day. Each week, data will be downloaded from the H2S and SO2 monitors, chemcassetes reloaded, and 2-point internal optical calibration checks will be conducted.

Attempts will be made to have one redundant or backup SPM planned for this study. In the event that there is a failure of one of the primary chemical monitors, a back up SPM could be substituted. If a second failure should occur, the corresponding collocated SPM would be used to replace the second detective primary system. Primary systems will be repaired as quickly as possible and then returned to the network.

TSP and PM10 samples will be collected daily. The duration of each sampling event will be as close to 24 hours as possible. PM 2.5 sampling will be conducted daily with each filter running for 24-hours. PM 2.5 operational data will be downloaded from the sampler prior to moving to the next location. When seven days worth of data is collected, the samplers will be rotated to the next site as described above in section 3.1 **Siting**.

3.6 Recovery

When the 4-week duration of the monitoring effort has been completed, the Field Technicians will visit each site and perform the internal optical 2-point calibration checks for the SPMs and download data for the last time. After these activities have been completed, the Field Technicians will breakdown and pack all equipment, and return that equipment to the appropriate entity. To the greatest extent possible, the monitoring sites will be returned to the condition they were in prior to installing the equipment.

3.7 Reporting

After all data collection activities have been completed, PADEP will prepare a Draft and Final Field Report. The report will be submitted to the ATSDR and the PADOH and will address the following items:

- Site descriptions
- Quality Assurance (QA) and Quality Control (QC)
- Results

SECTION 4

QUALITY ASSURANCE AND CONTROL

All samples collected from the particulate samplers will be collected in such a manner as to comply with the QA/QC protocols for collecting NAAQS from the same units. The SPM will be operated as per manufacturer's specifications and as per training received from ERG representative Dave Dayton.

SECTION 5

DOCUMENTS AND RECORDS

A field project notebook will be used to record the monitoring systems' operational parameters, pertinent observations and instrumentation records including calibration, QC checks, and any raw data.

The project's final summary report will include all applicable raw data and records. A summary of any outliers or findings will be presented in the report.

B – MEASUREMENTS / DATA ACQUISITION

SECTION 6

MONITORING APPROACHES

6.1 Hydrogen Sulfide and sulfur dioxide

Measurements of H2S and SO2 will be made using SPMs owned by ATSDR. Primary calibration of these instruments is performed at the factory. Two-point internal optical calibration performance checks will be conducted (i.e., initially before deployment, weekly onsite, and again after equipment recovery). The linear detection range for this instrument for H2S is 2-90 ppbv. The linear detection range for this instrument for SO2 is 5-200ppbv. Ambient air is drawn into the instrument through a length of Teflon tubing (i.e., 0.250 inch outside diameter), outfitted with an inverted glass funnel connected at the inlet end. Measurement of the H2S and SO2 detected is automatic, and the resulting data are stored in the DAS.

6.2 PM10, TSP, and PM2.5

Measurements of PM10, TSP, and PM 2.5 will be made using the following equipment obtained from Central Office in Harrisburg. PM10 -Thermo Model GUV-16HBL high volume air sampler, PM10 manual Reference Method; TSP -Thermo Model GV-2360 Series High Volume Air Sampler; and PM2.5-Met-One Model 2025 Sequential Air Sampler Federal Reference Method. All particulate filters will be analyzed by the PA Bureau of Laboratories and final data will be available approximately four weeks after the sampling event.

6.3 Meteorological Parameters

All met data will be obtained from a met station located on the Alliance Landfill. This data can be accessed 24/7 at the following web site:
www.allianceweather.com/test1/flashweather.asp

6.4 Data Acquisition

Electronic signals from the H2S and SO2 measurement systems will be collected and stored using HOBO Micro Station DASs with 4-20 mA adapters and BoxCar Pro 4.3 software. Each DAS is capable of collecting 6 channels of amperage input simultaneously, and offers internal storage for 1 million data points per system.

The PM2.5 monitor will have its own data logging system to record operational data (sample flow, temperature, pressure, valid running time, etc.) that will be downloaded prior to the sampler being moved to its next location by field team member Carl Pecora.

SECTION 7

DATA VALIDATION AND USABILITY

7.1 Verification and Usability Processes

The Project Directors will perform a two-step process of verification and validation for data review. This process will begin with an objective review of whether or not the data collection plans and protocols were followed and whether the basic operations and calculations were performed correctly. The ongoing QA review that started with the development of this Monitoring Plan, will be reviewed to verify that the sampling and analytical methodology planned for this project was accomplished or that changes were identified documented and met project quality objectives. Only data collected by the Field Technicians will be reviewed and validation of data collected by the Project Directors.

The second step will be to validate the technical usability of the data by determining whether the procedures followed were appropriate for the actual situations encountered, and whether the results make sense in the context of the study objectives. This validation will be done by comparing the original study objectives and data quality objectives with the actual circumstances encountered by the Field Technicians.

7.2 Verification Methods

Evaluation of the Experimental Design—The first step in validating the data set is to assess if the project, as executed, meets the requirements of the sampling design.

Sample Collection Procedures—Actual sample collection procedures will be documented in the field notebook and on applicable data sheets, and checked against any applicable requirements contained in this Monitoring Plan. Deviations from the Monitoring Plan will be classified as acceptable or unacceptable, and critical or noncritical.

Sample Handling—Internal sample handling and tracking procedures for samples generated in the laboratory will be checked. Holding times will be monitored to ensure timely analysis and reporting of analytical results. Labeling and sample identification will be checked for variation from the Monitoring Plan; Good Laboratory Practices will be followed in the labeling of samples and standards. All deviations will be documented in the final summary report.

7.3 Validation Methods

Calibration—Documentation of equipment calibration (i.e., where applicable) will be assessed to ensure that the values obtained are appropriate for data collection. Errors and omissions will be discussed in the final summary report. The documentation will be checked to ensure that the calibrations: (1) were performed at the specified intervals, (2) included the proper number of calibration points, and (3) were performed using appropriate approaches/standards for the reported measurements. Results generated during periods when calibration requirements are met will be considered conditionally valid and ready for Quality Control Validation review.

QC Results and Procedures—QC measurements and QC procedures performed during the experimental program will be checked against the monitoring program requirements. Omissions will be discussed in the final summary report. Quality control results will be reviewed. Results that meet the DQOs and all other validation are considered valid. All results outside specified parameters will be discussed with the ATSDR and PADOH for corrective action.

AMBIENT AIR MONITORING REPORT

ALLIANCE SANITARY LANDFILL
LACKAWANNA COUNTY
TAYLOR, PA 18517

DISCLAIMER:
SOME FORMATTING CHANGES MAY HAVE OCCURRED WHEN THE ORIGINAL DOCUMENT WAS PRINTED TO PDF; HOWEVER, THE ORIGINAL CONTENT REMAINS UNCHANGED.

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1.0 INTRODUCTION

Conestoga-Rovers and Associates (CRA) was retained by Alliance Sanitary Landfill in Lackawanna County, Pennsylvania (Alliance, Landfill, or Site) to perform ambient monitoring in accordance with communications between Alliance, the Agency for Toxic Substances Disease Registry (ATSDR), the Pennsylvania Department of Health (PADOH), and the Pennsylvania Department of Environmental Protection (PADEP) (collectively the "Agencies").

ATSDR and PADOH requested that PADEP perform air sampling in neighborhood areas near Alliance (at three individual locations). The Agencies, in turn, asked Alliance to conduct background monitoring, and monitor within the Landfill property boundary. This testing was organized so as to coincide with PADEP's off-site monitoring. CRA, on behalf of Alliance, prepared a Draft Ambient Air Monitoring Plan in August 2008 (Alliance Monitoring Plan) (CRA, 2008) that was submitted to the Agencies for review and comment prior to implementation.

The Alliance Monitoring Plan also called for landfill gas testing. Details and results associated with this work were included in a separate CRA report dated October 30, 2008.

The Alliance Monitoring Plan had the following goals:

1. Quantify the background concentrations of the same compounds being monitored for by PADEP; and
2. Quantify concentrations of these compounds between the Landfill and PADEP monitoring stations.

PADEP and CRA monitored for the following:

- Total suspended particulates (TSP), followed by metals analysis;
- Particulate matter (PM) less than or equal to 10 microns in size (PM_{10});
- Particulate matter less than or equal to 2.5 microns in size ($PM_{2.5}$);
- Hydrogen sulfide (H_2S); and
- Sulfur dioxide (SO_2).

Consensus between PADEP, Alliance, and CRA deemed that CRA perform ambient monitoring on the parameters listed above. Also, meteorological parameters (wind speed [WS], wind direction [WD], humidity, barometric pressure, and temperature) were measured at the existing on-site Alliance weather stations. At sampling locations not adjacent to any existing meteorological station, anemometers were installed to measure WD.

Monitoring locations were also selected by consensus: one off-site background station, three on-site monitoring locations to run tandem with those of PADEP, and one supplemental station suggested by ATSDR. A detailed discussion of Site locations appears in Section 2. The station locations are shown on Figure 1.

The monitoring program began on August 28th, 2008 and concluded on October 2nd, 2008. Sampling was actually conducted for most compounds (H_2S, PM, and metals) for 4.5-5 weeks, as opposed to the four-week period originally agreed upon by Alliance and the Agencies, in order to coincide with PADEP's sampling program. In general, sampling for H_2S and $PM_{2.5}$ occurred at each station throughout the sampling period, and all five parameters were sampled at two principal locations during the sampling period. The sampling schedule for the stations was dictated by PADEP's off-site sampling schedule. A summary of the sampling periods by station and parameter is provided in Section 2.

PADEP, in conjunction with ATSDR, used one sampling device per parameter, rotating the samplers between their three monitoring locations. These PADEP station locations are shown on Figure 1.

The purpose of this report is to describe the sampling program undertaken by CRA for the five monitoring locations described within this report, and to present the resultant data.

2.0 MONITORING ACTIVITIES

2.1 STATION LOCATIONS

The selection of sampling locations was based on the off-site sampling proposed to be conducted by PADEP and included evaluating criteria discussed in ATSDR's Landfill Gas Primer air monitoring guidelines (e.g., upwind or background conditions, and consideration of access, utility availability, obstructions, physical security and nearby sources, such as roadways and nearby land uses) (ATSDR, 2001).

Five sampling stations were selected for monitoring, after consultation with the Agencies:

- Station 1: This station was the background monitoring site. It was off-site, located approximately 3,000 feet north of the Landfill on a private property (approximately 1,600 feet above mean sea level [AMSL]). Alliance arranged for approval from the property owner for access to the site and electricity.
- Station 2: This station was the principle intermediate site between landfill activities and the PADEP monitoring location at the Pine Hills Golf Course parking lot. It was within the Alliance property, along Berm Road (an on-site unpaved perimeter roadway. This location was predominantly downwind of the working face, soil handling operations, and principal unpaved on-Site roadways, and predominantly upwind of and near the Pennsylvania Turnpike (approximately 880 feet AMSL) and directly above previously landfilled areas. Due to potential tree canopy obstructions, this station was situated on the landfill cap. It was immediately adjacent to Berm Road, and near several Site leachate risers and gas wells.
- Station 2A: This station was included at the suggestion of ATSDR to augment Station 2, in order to provide additional intermediate monitoring coverage. It was within the Alliance property, along Berm Road. This location was predominantly downwind of the working face, soil handling operations, and principal unpaved on-site roadways, predominantly upwind of and near the Pennsylvania Turnpike (approximately 880 feet AMSL) and directly above previously landfilled areas. This station was generally intermediate between landfill activities and the PADEP monitoring location at the Pine Hills Golf Course parking lot. Due to potential tree canopy obstructions, this station was situated on the landfill cap. It was immediately adjacent to Berm Road and was near the Site's enclosed flares, leachate pump station, condensate drop-out unit, several Site leachate risers and gas wells, and the Site's incoming truck staging area.

2.2 AMBIENT AIR MONITORING EQUIPMENT

The sampling methods comprised a combination of USEPA protocols and methods proven for similar applications. CRA selected analyzers and used methods equivalent, and in some cases identical, to those used by PADEP for the off-site locations.

Ambient monitoring was conducted with the following monitors:

5-each:	Graseby Andersen Model RAAS 2.5-300 Sequential Ambient Air Sampler ($PM_{2.5}$);
2-each:	GMW Model 1200 High-Vol PM-10 Air Sampler (PM_{10});
2-each:	Thermo Model GV-2360 High Volume Air Sampler (TSP and metals);
5-each:	Jerome 651 gold film analyzer (H_2S), containing WS and WD monitoring equipment; and
2-each:	Honeywell Single Point Monitor (SO_2).

One complete set of all equipment was installed and operated at the background location (Station 1) for the entire 5 week sampling program. One Jerome unit (for H_2S and WD) and one Graseby Anderson $PM_{2.5}$ sampler was installed and operated at each of the remaining four locations (Stations 2, 2A, 3, and 4) for all five weeks of the sampling program. The remaining set of equipment (for SO_2, PM_{10}, and TSP) was rotated among the three primary intermediate locations (Stations 2, 3, and 4). Sampling rotation was coordinated with PADEP monitoring such that Alliance was monitoring for the same parameters at the primary intermediate locations that PADEP was monitoring for at the paired off-site location. CRA and PADEP discussed locations at least weekly. Both parties cooperated so that start/stop times and equipment relocation took place in the same general time period.

Sampling equipment was chosen in consultation with the Agencies, and matched as closely as possible to that used by PADEP. The Honeywell Single Point Monitors were matched exactly for SO_2, for example. However, sufficient number of these units was not commercially available for rental to sample for H_2S as well. Therefore, the Jerome 651 was selected as it is designed and used commonly for the ambient measurement of H_2S. Each of the particulate monitors follows the same USEPA reference method as the equipment used by PADEP. In some instances the same make and model instrument was utilized.

Summary of Monitoring Locations

	Sta. 1	Sta. 2	Sta. 2A	Sta. 3	Sta. 4
TSP	C	R	NS	R	R
PM_{10}	C	R	NS	R	R
$PM_{2.5}$	C	C	C	C	C
SO_2	C	R	NS	R	R
H_2S	C	C	C	C	C
Met Data	C	C	C	C	C

Notes:

C = Continuous
R = Rotating
NS = Not Sampled for at this location

Due to the remoteness and lack of nearby available electricity at Stations 2, 3, and 4, generators were required to provide power to the monitoring equipment. Generators were located a minimum of 50 feet from sampling equipment, and side-wind or down-wind of the samplers, (as based on predominant wind directions gathered during recent years at the Alliance meteorological stations). Propane generators were selected to minimize possible interference potentially caused by diesel engine exhaust. Stations 1 and 2A were situated such that 110-volt power could be supplied by a nearby building.

Scaffolding was erected at each of the four on-site and one off-site locations to hold the sampling equipment. At each location, a single section of scaffolding plus railings was installed, with monitoring equipment secured to the top of the scaffolding and along the railing. The scaffolding was fastened to Jersey barriers to prevent the scaffolding from falling over. This maintained the monitoring equipment at a height of 10-12 feet above ground surface per USEPA guidance. Photographs are included in Appendix A.

Details on the monitoring equipment are provided in Appendix B.

2.2.1 PARTICULATE MATTER

PM_{10}

The particulate samplers used for PM_{10} monitoring were GMW Model 1200 High-Vol PM_{10} samplers, Volumetric Flow Controlled (Manual Reference Method RFPS-1287-063). This is the same monitor used by PADEP.

Samples were collected on pre-weighed filter media at a standard volumetric sample flow rate for 24 hours. After sampling, the filters were removed and shipped to DataChem laboratory for weighing. DataChem is a Pennsylvania-certified laboratory.

$PM_{2.5}$

The particulate samplers used for $PM_{2.5}$ monitoring were Graseby Andersen Model RAAS 2.5-300 Sequential Ambient Air Samplers (Manual Reference Method RFPS-0598-120). These are not the same monitors used by PADEP, but they perform to the same method and specifications.

Samples were collected on pre-weighed filter media at a standard volumetric sample flow rate for 24 hours. After sampling, the filters were removed and shipped to DataChem laboratory for weighing.

TSP (and metals)

The particulate samplers used for TSP monitoring were Thermo Model GV-2360 High Volume Air Samplers. This is the same monitor that PADEP used. There is no reference method for TSP as it is no longer considered a criteria pollutant. Particulate matter samples were collected in accordance with PADEP's schedule.

Following gravimetric analysis, speciated metals analysis was performed on each TSP sample for arsenic, zinc, lead, cadmium, chromium, nickel, manganese, and beryllium, using Method EPA 200.8, Rev 5.4 and Standard Operating Procedure for the Determination of Metals in Ambient Particulate Matter by Inductively Coupled plasma/Mass Spectrometry, September, 2005.

Samples were collected on pre-weighed filter media at a standard volumetric sample flow rate for 24 hours. After sampling, the filters were removed and shipped to ALS laboratory for weighing and metals analysis. ALS labs, a Pennsylvania-certified laboratory, was used for these samples since DataChem could not perform the metals analysis using the same methodology utilized by PADEP.

Copies of laboratory registrations are included in Appendix C.

2.2.2 SULFUR COMPOUNDS

H_2S

Jerome 651 gold film analyzers were used to monitor H_2S. The 651 is a fence or pole mounted instrument that provides the accuracy of +/- 0.005 parts per million (ppm) at 0.05 ppm and detection ranges of 0.001 – 50 ppm. This instrument is not the same instrument as those used by PADEP, but is commonly used in programs at other facilities to perform continuous monitoring and to screen for H_2S at landfills.

The Jerome utilizes a gold film sensor that automatically regenerates itself once per day for approximately 30 minutes or more frequently if the sensor becomes saturated.

The Jerome sampler includes an anemometer, allowing WD to be measured and recorded.

Data were recorded, retained, and downloaded from a data logger that is built into the unit.

SO_2

Honeywell Single Point Monitors (SPMs) were used to monitor sulfur dioxide (SO_2). These incorporate Honeywell's ChemCassette Detection System, using low level detection keys to achieve detection limits of 0-200 ppb. Data were recorded and retained on an on-board data logger that was downloaded to a personal computer weekly.

2.3 DATA ACQUISITION

The air sampling technicians recorded equipment start/stop times in their field logbooks along with general observations, such as:

- Weather;
- Location and nature of site activities occurring;
- Unusual or noteworthy conditions such as visible dust, haze, substantial on- and off-site activities; and
- Problems with monitoring equipment.

2.4 SAMPLING SCHEDULE

2.4.1 GENERAL

The sampling schedule was dictated by PADEP's off-site program. The sampling was conducted from August 28th, 2008 through October 2nd, 2008, as described below.

Monitoring Locations and Dates

	Sta. 1	Sta. 2	Sta. 2A	Sta. 3	Sta. 4
TSP & metals	8/28-10/1	9/9-9/18	NA	8/28-9/9	9/18-10/1
PM_{10}	8/28-10/1	8/28-9/10	NA	9/17-10/1	9/10-9/17
$PM_{2.5}$	8/28-10/1	8/28-10/1	8/28-10/1	8/28-10/1	9/4-10/1
SO_2	9/5-9/24	9/17-9/20	NA	9/8-9/17	9/5-9/8
H_2S	8/28-9/1 9/8-9/12 9/24-10/2	9/5-9/12, 9/17-9/20, 9/29-10/2	8/28-9/29	8/28-10/2	8/28-10/2
Met Data	8/28-9/1 9/24-10/2	9/5-9/13, 9/16-9/19, 9/28-10/2	8/28-9/29	8/28-10/2	8/28-10/2

Notes:

NA = Not applicable

All equipment was shutdown periodically for maintenance or for generator level checks (typically only a few minutes per day).

2.4.2 PARTICULATE MATTER

$PM_{2.5}$, PM_{10}, and TSP samples were collected on the same schedule as performed by PADEP. Samples were collected daily at each monitor in coordination with the PADEP scheduled monitoring. Each sample was collected over an approximate 24-hour period (typically afternoon to afternoon).

Sampling for all three particulate matter parameters ($PM_{2.5}$, PM_{10}, and TSP) was conducted daily at the background location (Station 1).

Sampling for $PM_{2.5}$ was conducted daily at each of the remaining on-site stations (Stations 2, 2A, 3, and 4).

Sampling for PM_{10} and TSP was conducted at Stations 2, 3, and 4 on a rotating basis as dictated by PADEP's off-site monitoring program.

2.4.3 SULFUR COMPOUNDS

Sampling for H_2S was conducted at all five of the sampling stations throughout the sampling period. The H_2S monitors ran continuously, recording instantaneous (i.e., roughly 60-second) measurements. Concentrations were recorded every 15 minutes, although they were initially recording at 1-minute intervals for roughly two weeks at Stations 1, 2, and 2A. After approximately 2-weeks' time, the sampling frequency was changed to 15 minutes after it was determined that more frequent sampling was causing problems due to the frequency of the instrument's automated sensor regeneration and the capacity of the data loggers to retain data.

One SO_2 monitor was operated at the predominantly upwind Station 1 for the majority of the sampling period. A second SO_2 monitor was rotated among the three principle intermediate locations (Stations 2, 3, and 4). The SO_2 monitors ran continuously, recording instantaneous readings at 1-minute intervals.

3.0 DATA HANDLING

Data from the various devices were handled as follows:

- Data (airflow, humidity, temperature, and sample duration) were recovered from each of the particulate monitoring stations once a week.
- Data from the SO_2 and H_2S analyzers were downloaded from the data loggers to a personal computer once a week.
- Meteorological data were downloaded from each station's data acquisition system to a personal computer once a week.
- All raw data were compiled into spreadsheets for data evaluation.
- SO_2 and H_2S data were placed into a database and compiled into one-hour averages.
- Metals were detected in the blank TSP filters, as is expected, and these concentrations were subtracted from the total concentration.
- Values below detectable limits were noted with a "<" sign and entered as one-half of the detection limit.

The raw monitoring data are included in Appendix D. Copies of the laboratory analytical reports are included in Appendix E.

Data validation activities included:

- Weekly review of data for completeness. If any changes were needed, they were made during the next most recent site visit;
- Review of sample logs and chain of custody forms;
- Review of analytical reports. Once received from the lab, analytical results were reviewed against the field sample key for completeness; and
- Documentation of deviations from acceptable parameters for any quality assurance sample or procedure.

No data quality issues were identified with the exception of the following:

- Of the 288 1-hour averages recorded at Station 2, H_2S was not detected in 170 readings and the hourly averages (excluding an anomalous value discussed below) ranged from <1 ppb to 3.25 ppb). One hourly average concentration was 879 ppb based on a single "instantaneous" elevated reading. Since the preceding 500 minutes worth of data were all less than 1 ppb and the following 500 minutes of readings were all less than 1 ppb, the single reading is considered anomalous and was excluded from the final data set per USEPA Guidance (USEPA 2006, 2007).

- Station 3 collected H_2S readings at 15-minute intervals; however, the instrument was set to compile one-hour averages from these readings directly, and the 15-minute readings were not recorded (only the 1-hour average). CRA confirmed with the instrument supplier that the readings were indeed comprised of four 15-minute readings per hour.

- WS indicators did not operate properly at most sampling locations during the first two weeks of the sampling program. The more important parameter, WD, was verified with a hand-held compass for proper operation. Alliance's on-Site meteorological monitoring stations successfully recorded WD and WS throughout the 5-week sampling period.

- There were periods of equipment downtime for equipment malfunction or repair that resulted in some periods when no data was collected for a particular instrument. This is accurately reflected in the data sheets provided in Appendix D.

3.1 DATA QUALITY OBJECTIVES

Monitoring equipment was calibrated and maintained in general accordance with manufacturer's recommendations and the approved sampling plan.

Data completeness refers to the number of valid data points with respect to the total number of possible data points. For a field data collection program such as this, an overall completeness value of 80% was initially targeted after discussions with ATSDR.

Although there were periods of downtime with various pieces of equipment, considering that the program continued for 4.5-5 weeks rather than the four proposed, the equipment operated for a greater number of days than proposed (477 equipment-days as opposed to 437 equipment days) or 109%. The equipment operated for 90 percent of equipment days over the 4 weeks proposed (394 of 437 equipment days). This satisfies the targeted completeness values.

3.2 DATA EVALUATION

Tables 1 and 2 present summaries of all of the data as compiled by CRA. Tabulated results are included in Appendix D.

3.2.1 METEROLOGICAL DATA

WD was collected for each of the five monitoring stations on the H_2S data logger and is included with that data (as an hourly average). WS and WD were collected at the existing Alliance meteorological stations 2 and 3, station 2 being adjacent to monitoring station 3 (see Figure 1).

Wind roses were prepared for the two meteorological stations maintained by Alliance (see Appendix F). These wind roses indicate that the wind blew out of a westerly direction the majority of time during sampling and, therefore, Station 1 was predominantly upwind (background) during the monitoring period.

3.2.2 AIR MONITORING RESULTS

3.2.2.1 PARTICULATES, TSP, H_2S, SO_2, AND METALS

The following is a summary of the monitoring data collected at each of the five monitoring stations.

Summary of Analytical Results

Analyte	*Number of Samples*	*Averaging Time of Compiled Monitoring Data*	*Range of Results*
PM_{10}	68	24-hour	9.8 - 43 µg/m³
$PM_{2.5}$	154	24-hour	<2.2 - 33 µg/m³
TSP	67	24-hour	3.3 - 55 µg/m³
H_2S	3,150	1-hour	<1.0 - 5.3 ppb
SO_2	810	1-hour	0.048 - 10 ppb

Summary of Analytical Results (cont'd)

Analyte	*Number of Samples*	*Averaging Time of Compiled Monitoring Data*	*Range of Results*
Arsenic	67	24-hour	<0.0065 - <0.0070 µg/m³
Zinc	67	24-hour	<B - 0.057 µg/m³
Lead	67	24-hour	0.0025 - 0.010 µg/m³
Cadmium	67	24-hour	<0.00065 - 0.0010 µg/m³
Chromium	67	24-hour	<B - 0.013 µg/m³
Nickel	67	24-hour	<B - 0.0050 µg/m³
Manganese	67	24-hour	0.00073 - 0.022 µg/m³
Beryllium	67	24-hour	<0.0013 - 0.0014 µg/m³

Notes:

<B – Minimum reported sample concentration was less than the concentrations reported in blank samples

More detailed summaries of the data are included in Appendix D. The raw monitoring data is available upon request; it was not included as an appendix due to volume. Copies of the laboratory analytical reports are included in Appendix E.

4.0 CONCLUSIONS

CRA was retained by Alliance Sanitary Landfill in Lackawanna County, Pennsylvania to perform ambient monitoring in accordance with communications between Alliance, ATSDR, PADOH, and PADEP.

CRA prepared a Monitoring Plan on behalf of Alliance, which had the following goals:

1. Quantify the background concentrations of the same compounds being monitored off-site by PADEP; and
2. Quantify concentrations of these compounds between the Landfill and PADEP monitoring stations.

CRA monitored for the following parameters at five monitoring locations over the course of a five-week period:

- TSP, followed by metals analysis;
- PM_{10};
- $PM_{2.5}$;
- H_2S; and
- SO_2.

The monitoring program was completed successfully. At Alliance's request, CRA has provided the data to CPF Associates for review and evaluation.

5.0 REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR) 2001. Landfill Gas Primer: An Overview for Environmental Health Professionals. Ambient Air Monitoring. November 2001.

ATSDR 2004. Health Consultation for Alliance Landfill Site, Taylor Borough and Ransom Township, Taylor, Lackawanna County, Pennsylvania. September 15, 2004, updated February 2008 by the Pennsylvania Department of Health.

ATSDR 2007. Electronic mail communication from A. Pomales, ATSDR. Taylor Monitoring air station/Preliminary assessment of collected air data. February 20, 2007.

American Industrial Hygiene Association. 1989. Odor Thresholds for Chemicals with Established Occupational Health Standards.

Andersen Instruments. Operations Manual Model GS2310 Series, Total Suspended Particulate Sampling Mass Flow Controlled.

Anderson Instruments, Inc 2001. RAAS Operator's Manual, Reference Ambient Air Sampler. Revision 6. January 2001.

Arizona Instruments LLC 2007. Jerome 651 Hydrogen Sulfide Fixed Point Monitor Operation Manual. August 2007.

CPF Associates and Conestoga-Rovers and Associates (CRA), 2005. Human Health Risk Assessment for Alliance Sanitary Landfill in Lackawanna County, PA. February 2005.

CPF Associates and CRA, 2005. Addendum to Human Health Risk Assessment for Alliance Sanitary Landfill in Lackawanna County, PA. August 2005.

CPF Associates, Inc 2008. Peer Review of the 2008 "Health Consultation: Keyser Avenue Air Monitoring Station (A/K/A Alliance Landfill Site), Taylor Borough, Lackawanna County, Pennsylvania)." April 2008.

CRA 2008. Draft Ambient Air Monitoring Plan for Alliance Sanitary Landfill in Lackawanna County, PA. August 2008.

Honeywell 2007. SPM Single Point Monitor Technical Handbook. Revision 6.0. May 2007.

ThermoAndersen. Operator Manual, PM10 High Volume Air Sampler. Draft.

TRC Corporation. Standard Operating Procedures, Ohio Lumex Mercury Analyzer (Lumex RA 915), Prepared by TRC Corporation. Revision 0. November 2005.

U.S. Environmental Protection Agency (USEPA). Code of Federal Regulations (CFR), Title 40, Part 50, Appendix B.

USEPA. CFR, Title 40, Part 58, Appendix E.

USEPA. Compendium of Methods for the Determination of Toxic Organic Compounds in Air. EPA-600/ 4-84-041.

USEPA. 1995. Superfund Program Representative Sampling Guidance - Volume 2: Air (Short-Term Monitoring). Interim Final. Office of Solid Wastes and Emergency Response. EPA 540/R-95/140. December 1995.

USEPA 2000. Data Quality Objectives Process for Hazardous Waste Site Investigations. Office of Environmental Information. EPA/600/R-00/007. January 2000.

USEPA 2000. Guidance for the Data Quality Objectives Process. Office of Environmental Information. EPA/600/R-96/055. August 2000.

USEPA 2003. Revision to the Guideline On Air Quality Models: Adoption Of A Preferred Long Range Transport Model and Other Revisions; Final Rule. 68 FR 18453. April 15, 2003.

USEPA 2005. Method EPA 200.8, Rev 5.4 and Standard Operating Procedure for the Determination of Metals in Ambient Particulate Matter by Inductively Coupled plasma/Mass Spectrometry. September 2005

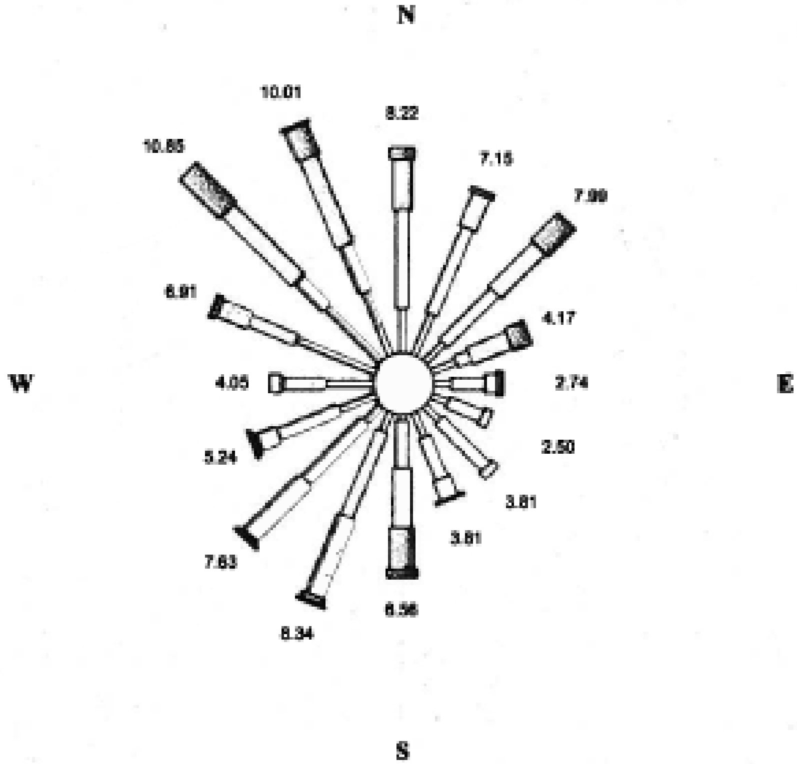
USEPA 2006. Data Quality Assessment: Statistical Methods for Practitioners. Office of Environmental Information. EPA QA/G9S. February 2006.

USEPA 2007. ProUCL Version 4.00.02 User Guide. Office of Research and Development. EPA/600/R-07/038. April 2007.

USEPA 2007. Field Test Measurement at Five Municipal Solid Waste Landfills with Landfill Gas Control Technology, Final Report. EPA/600/R-07-043. April 2007.

Appendix 3: Wind Rose Data

Alliance Site 3
60-minute data
August 28, 2008 through October 1, 2008



Wind Speed (Miles Per Hour)

Calms excluded.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.4	3.5	6.9	11.5	18.4	24.2
N	1.79	3.93	2.03	0.48	0.00	0.00
NNE	1.79	3.69	1.43	0.24	0.00	0.00
NE	1.07	2.86	2.50	1.55	0.00	0.00
ENE	1.07	0.60	1.67	0.83	0.00	0.00
E	0.72	1.31	0.48	0.24	0.00	0.00
ESE	0.72	1.43	0.36	0.00	0.00	0.00
SE	0.83	2.62	0.36	0.00	0.00	0.00
SSE	1.07	1.79	0.83	0.00	0.12	0.00

TOTAL OBS - 839 MISSING OBS - 0

PERCENT OCCURRENCE: Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

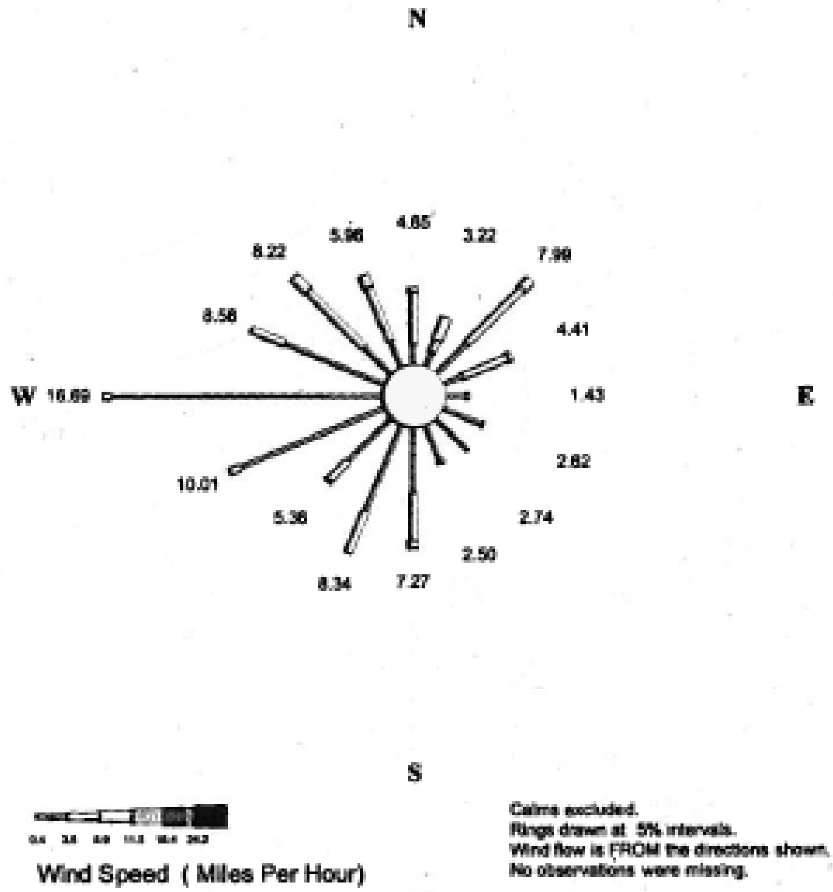
DIR	0.4	3.5	6.9	11.5	18.4	24.2
S	0.24	1.91	2.38	1.67	0.36	0.00
SSW	0.83	3.69	3.46	0.24	0.12	0.00
SW	0.95	3.34	3.10	0.12	0.12	0.00
WSW	1.55	2.62	0.83	0.12	0.12	0.00
W	1.91	1.67	0.48	0.00	0.00	0.00
WNW	3.34	2.03	1.31	0.24	0.00	0.00
NW	3.10	1.55	3.93	2.26	0.00	0.00
NNW	2.74	2.03	3.81	1.31	0.12	0.00

CALM OBS - 0

Alliance Site 2

60-minute data

August 28, 2008 through October 1, 2008



PERCENT OCCURRENCE: Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.4	3.5	6.9	11.5	18.4	24.2
N	1.19	3.10	0.36	0.00	0.00	0.00
NNE	0.95	0.72	1.55	0.00	0.00	0.00
NE	2.50	4.65	0.83	0.00	0.00	0.00
ENE	1.19	2.86	0.36	0.00	0.00	0.00
E	1.19	0.24	0.00	0.00	0.00	0.00
ESE	2.50	0.12	0.00	0.00	0.00	0.00
SE	2.74	0.00	0.00	0.00	0.00	0.00
SSE	2.26	0.24	0.00	0.00	0.00	0.00

TOTAL OBS - 839 MISSING OBS - 0

PERCENT OCCURRENCE: Wind Speed (Miles Per Hour)
LOWER BOUND OF CATEGORY

DIR	0.4	3.5	6.9	11.5	18.4	24.2
S	3.93	2.86	0.48	0.00	0.00	0.00
SSW	5.60	2.74	0.00	0.00	0.00	0.00
SW	3.69	1.55	0.12	0.00	0.00	0.00
WSW	9.30	0.72	0.00	0.00	0.00	0.00
W	16.21	0.48	0.00	0.00	0.00	0.00
WNW	6.44	2.15	0.00	0.00	0.00	0.00
NW	2.26	4.77	1.19	0.00	0.00	0.00
NNW	1.67	3.46	0.83	0.00	0.00	0.00

CALM OBS - 0

Appendix 4: Mercury Flares Evaluation

Sampling Results

Due to community concerns, ATSDR and PADOH recommended that PADEP and Alliance perform additional sampling to evaluate the destruction efficiency of the on-site mercury flares. On September 17, 2008, Conestoga-Rovers & Associates, Inc. (CRA), accompanied by PADEP and Alliance staff, conducted sampling of the mercury flares at Alliance Landfill to determine the concentration of mercury within the collected landfill gas. PADOH and ATSDR reviewed the mercury flare destruction sampling data to ensure mercury is not leaving the site at levels that could harm the health of the adjacent community.

Mercury measurements were collected from the inlet to each of the four landfill gas flares utilizing a Lumex RA-915+ analyzer, after consultation with personnel from PADEP and ATSDR. [1] The Lumex instrument is an atomic absorption analyzer that allows measurement primarily of elemental mercury in air, and may measure additional gaseous mercury species if present, with a minimum detection limit of 2 nanograms per cubic meter (ng/m^3) and an upper measurement value of 20,000 ng/m^3. The instrument calculates a percent relative accuracy (%RA) based on readings compared to a known concentration, or standard. The Lumex instrument collects and analyzes samples immediately, providing an instantaneous response. Three runs of approximately three minutes each were conducted for each flare, with readings occurring every 20 seconds. Next, the highest 20-second average was recorded for each run. Background samples were collected between runs from ambient air. [1] The following table summarizes the mercury flare sampling results:

Sample Location	Flare Flow (scfm)	Sample Number	Background Concentration (ng/m^3)	Landfill Gas Concentration at Header (ng/m^3)
Flare 1843E	2000	1	4	4131
		2	4	4143
		3	5	4177
			Avg.	4150
Flare 1842W	1900	1	2	4098
		2	5	4079
		3	4	4073
			Avg.	4083
Zink Flare	3380	1	3	1384
		2	7	1378
		3	7	1365
			Avg.	1376
Portable Flare	1171	1	23	471
		2	22	466
		3	21	471
			Avg.	469

The average mercury concentration detected during the sampling event was 2,520 ng/ m^3 (or 2.52 µg/m^3). [1] Published standard methods for monitoring mercury in landfill gas are not currently available. The development, testing and application of methods for measuring mercury in landfill gas is an ongoing area of research. Many mercury species, including elemental mercury, inorganic mercury compounds (e.g., mercuric chloride, mercurous chloride), and forms of organic mercury (e.g.

methyl mercury) would be considered to be volatile and may be present at trace levels in landfill gas. [2]

Air Modeling Data

In order to estimate the potential levels of on-site mercury the community might be exposed to, PADEP used the flare data, to perform an air modeling analysis and inhalation risk assessment. The model analysis encompassed receptors located with approximately 500 meter (or approximately 0.3 miles) of the site, to determine the potential levels of mercury from the flares in the adjacent community. The model summarized 24-hour concentration and then converts the levels to a 1-hour and annual concentration at community-based receptor locations. The combined maximum 1-hour, maximum 24-hour and annual levels for the four flares used in the model were 1.23 $x10^{-4}$ $\mu g/m^3$, 4.91 x 10^{-4} $\mu g/m^3$, 4.91 x 10^{-5} $\mu g/m^3$, respectively. [3] PADOH and ATSDR reviewed the air modeling data and compared the results to available comparison values for mercury in the following table:

Mercury Air Modeling Data (µg/m3)	**Typical Background Levels (µg/m3)**	**Comparison Values (µg/m3)**
1.23 $x10^{-4}$ (1-hr max) 4.91 x 10^{-4} (24-hr max) 4.91 x 10^{-5} (Annual max)	1 $x10^{-2}$- $2x10^{-2}$ (urban areas) 2x10-3 (non-urban areas)	ATSDR EMEG CV/MRL- 0.2 CalEPA Reference Exposure Level-0.009 USEPA Reference Concentration- 0.3

CPF Associates, Inc. (CPF) used the above-mentioned site-specific mercury levels to perform a human health risk assessment for the adjacent community. Based on CPF's assessment, the maximum averages, listed above, for off-site mercury levels in the community are more than 10,000 times lower than health-based comparison values established by the USEPA (0.3 $\mu g/m^3$ – Reference Concentration (Rfc)) and California EPA (0.09 $\mu g/m^3$ - Reference Exposure Level (REL)) for chronic toxicity, and therefore, do not pose a health concern. In addition, the calculated levels are also well below background air levels of approximately 1 $x10^{-2}$ $\mu g/m^3$to $2x10^{-2}$ $\mu g/m^3$ for urban areas and $2x10^{-3}$ $\mu g/m^3$ for non-urban areas. [2] The ATSDR environmental media evaluation guide (EMEG)/minimal risk level(MRL) CV for chronic mercury inhalation is 0.2 $\mu g/m^3$, which is well above (the 400 times lower) the estimated above mentioned potential mercury emissions in the community.

Permit Requirements and Compliance

Alliance operates the mercury flares under a PADEP to ensure compliance, destruction efficiency and controls for the enclosed flares. The 3 primary enclosed flares were constructed in accordance with the Pennsylvania Department of Environmental Protection (PADEP) Plan Approval #35-322-006 that was later incorporated into the Title V permit. The fourth, smaller enclosed flare (1600-scfm portable enclosed flare) at Alliance was constructed in accordance with the PADEP Plan Approval 35-322-007 that was later incorporated into the Title V permit. The flares also had to meet the New Source Performance Standard specifications in 40 CFR Part 60, Subpart WWW, which govern municipal solid waste landfills, as well as the standards in 40 CFR Part 60, Subpart AAAA, which imposes Maximum Achievable Control Standard limitations on municipal solid waste landfill gas collection and control systems. Alliance is also permitted to maintain a back-up \ flare on the site for emergency use, to be used if another flare is inoperable. This flare has only been used for brief periods of time since the enclosed flares were installed, and was operated within the parameters established by the Title V permit. Regulatory agencies assure compliance with destruction efficiency and operational requirements for open flares by mandating the maximum exit velocity as specified in 40 CFR 60.18.

The Title V air permit incorporated all of these applicable requirements relating to the flares into what is known as a “Federally enforceable operating permit.” The permit identified all applicable requirements for the flares, including standards/emission limits, work practice standards, as well as monitoring, testing, recordkeeping, and reporting requirements. [2] The site permits require the flares be operated at a certain flow rate and temperature and be monitored (with monitoring of temperature and flow occurring every 15 minutes). The monitoring data are reported to PADEP and USEPA on a semi-annual basis and identify deviations from permit requirements. The measurement of flow is important to ensure the flare is operating within the permit levels and the required retention time is being achieved to ensure proper destruction. The measurement of temperature is also important in flare operation, especially in relation to possible formation of dioxins and furans and proper destruction of mercury. Alliance has both minimum and maximum temperatures, with the flares shutting down if the flares drop below the minimum required temperature. Based on performance testing, the mercury flares operated a temperature of greater than 1500 ^{o}F which has a destruction efficiency of greater than 99.64%. EPA has concluded, based on literature reviews and studies, that at temperatures over 1,000 ^{o}F, dioxin and furan compounds is readily oxidized and therefore would not be formed to any significant degree. Since the initial performance tests were conducted for the flares, no instances of non-compliance related to temperature or flow have been identified by PADEP . **[3]**

Conclusions

PADOH and ATSDR reviewed the mercury flare sampling data and agree with PADEP that Alliance is in compliance and operating the mercury flares within the applicable permit requirements. In addition, PADOH and ATSDR reviewed the air modeling data, conducted by PADEP and inhalation risk assessment performed by CPF, based on the mercury flare data, to determine if the community would be exposed to mercury at levels that could harm their health. The data showed a maximum 24-hour value (4.91×10^{-4}) 400 times lower than the ATSDR CV EMEG/MRL (0.2 µg/m^3). Based on a sampling and air modeling data, PADOH and ATSDR do not expect the community to be exposed to mercury at levels that could harm their health.

References

1. Conestoga-Rovers & Associates. Letter on Mercury Sampling Results for Alliance Landfill. October 30, 2008
2. CPF Associates, Inc. Letter to Mr. Doug Coenen, of Alliance Landfill regarding mercury flare sampling. November 3, 2008
3. Letter from John M. LaRosa (PADEP), Regarding a summary of air quality analysis and risk assessment for Mercury, Alliance Landfill. June 11, 2009