Health Consultation

Groundwater Monitoring Data Review:
Response to Public Comments

BoRit Asbestos Site
Ambler, Montgomery County, Pennsylvania

Prepared by
Pennsylvania Department of Health

JULY 19, 2013

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
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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Table of Contents

Summary

Introduction

In response to concerns from some community members regarding groundwater quality at and near the BoRit asbestos site ('the site'), the Pennsylvania Department of Health (PADOH) prepared this Health Consultation (HC) document. PADOH's primary goal is to evaluate whether a community is being exposed to levels of contaminants that may harm their health and make any necessary recommendations to prevent and mitigate exposures, as well as to ensure that the community has the best information possible to protect public health. PADOH worked under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) to complete this HC document.

PADOH evaluated the groundwater sampling data collected at the site by the Environmental Protection Agency (EPA) for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), inorganics/metals, and asbestos. In addition, PADOH reviewed Safe Drinking Water Act compliance monitoring for the Ambler Borough public water system. The purpose of this HC is to provide a summary of PADOH's review, answer community concerns, and provide relevant public health findings and recommendations. This HC was previously released for public comment. This version of the HC incorporates the public comments and PADOH's responses to those comments.

Conclusions

PADOH reviewed the groundwater sampling data collected from the groundwater under the BoRit site as well as the public drinking water system serving the community, and conclude the following:

Conclusion 1

Based on an evaluation of the available site groundwater sampling data for VOCs, SVOCs, PCBs, pesticides, inorganics/metals, and asbestos, exposure to **groundwater beneath the site is not expected to harm people's health**.

Basis for Conclusion

PADOH reviewed the piezometer and groundwater monitoring data collected by EPA at the BoRit site. Piezometer data are not considered reliable for monitoring contaminants in an aquifer due to potential impacts from surface water contamination, the sampling technique and their intended use (i.e., to evaluate water depth and flow direction). Groundwater quality is better evaluated using groundwater monitoring well data. A review of the groundwater monitoring well data showed asbestos levels well below EPA's standard for public drinking water supplies or Maximum Contaminant Level (MCL). Carbon tetrachloride, tetrachloroethylene (PCE), and bis (2-ethylhexy) phthalate were detected in some groundwater wells at levels above EPA's MCL. Bis(2-ethylhexy)phthalate is a common lab contaminant. Groundwater beneath the site is not used for drinking for the public drinking water supply.

Based on information from the environmental agencies, the groundwater underneath the site does not appear to influence the public drinking water sources. The monitoring data represent shallow wells, less than 100 feet in depth, as opposed to the closest Ambler public wells, which range from 300 to 438 feet in depth. Groundwater in the shallow bedrock flows toward the Wissahickon Creek and away from the public water supply wells. The deeper aquifer layers tend to be under confined conditions, and would not be susceptible to surface contamination. Therefore, contaminants in groundwater from this site do not represent a completed exposure pathway for this community.

Next steps

EPA plans additional monitoring well groundwater sampling to continue to characterize groundwater conditions at the site. PADOH plans to produce a Public Health Assessment (PHA) document. This PHA will evaluate any additional groundwater data from the site area, as well as air, soil, and surface water/sediment data collected under EPA's Remedial Investigation/Feasibility Study (RI/FS) for this site.

Conclusion 2

Based on a review of the public water supply sampling data for the Ambler area**, exposure to asbestos, and other contaminants, in public drinking water is not expected to harm people's health.**

Basis for Conclusion

In response to concerns by some community members that asbestos could be present in the drinking water supply from the site and asbestos containing pipes, in 2010 the Borough of Ambler along with the PADEP collected water samples along the water distribution system for asbestos. Five samples were collected at or near areas that may contain asbestos containing pipes in the public drinking water system. Sampling results showed the highest level of asbestos at 0.09 million fibers per liter (MFL), which is well below the MCL of 7 MFL. In 2011, Ambler Borough conducted water testing for asbestos in the public drinking water wells. Results of this analysis did not show levels of asbestos in the public water supply above the current MCL.

Some residents have also indicated they are concerned about historical public water data showing PCE above the MCL in the Ambler Borough water system. In September 1996, Ambler public water sampling showed levels of PCE (maximum value of 70 µg/L) exceeding the MCL of 5 µg/L. However, based on quarterly monitoring data for the Ambler Borough public water system, PCE has not exceeded the MCL since 1997.

Next steps

If additional water sampling data become available, PADOH will review this data and provide a response to the community. PADOH anticipates releasing a public health assessment for the site, which will review the EPA's RI/FS.

Conclusion 3

It appears that private well water use near the site is very limited. However, PADOH does not have much information on private well use or sampling of private wells in the site area. Therefore, PADOH **cannot currently make a conclusion regarding public health and private wells in the area**.

Basis for Conclusion

Although public water is the main source of drinking water in the area, there are some private wells in the vicinity though likely at a different aquifer and depth than current EPA sampling at the site. No private wells are documented in Ambler Borough or Upper Dublin, but there are some private wells documented in Whitpain Township. A few of these wells appear to be approximately 2 miles from the BoRit site. However, currently, PADOH does not have sampling data from private wells for evaluation.

Next steps

Due to the lack of information and data on private wells, PADOH suggests EPA conduct a private well survey near the site to establish if any private well users could be impacted by site-related contamination. Any private well owner, regardless of where they live, should have their drinking water tested on a regular basis. Montgomery County residents with private wells may want to visit the county's health department's well testing program website at: http://health.montcopa.org/health/cwp/view,A,3,Q,65367.asp In addition, The Penn State Extension Program offers well water testing at low costs. You may contact the Montgomery County Extension Office for further information at 610-489-4315 or visit the Penn State Extension lab testing website: http://www.aasl.psu.edu/Water_drinking_main.html If additional information and sampling data for private wells near the site becomes available, PADOH will review this information.

For More Information

If you have concerns about your health, you should contact your health care provider. For questions concerns about the BoRit site please contact the Pennsylvania Department of Health, Division of Environmental Health Epidemiology at (717) 346-3285 or via e-mail at chlloyd@pa.gov or fahmed@pa.gov.

Background and Statement of Issues

The BoRit Asbestos Site ('the site') is located in the Borough of Ambler, Montgomery County, Pennsylvania. The site was historically used to dispose of asbestos-containing materials (ACM) from the Keasbey & Mattison Company. Keasbey & Mattison Company began manufacturing asbestos products in the Borough of Ambler in the late 1800s. Sometime during the 1930s, Keasbey & Mattison Company began dumping waste materials containing ACM. Asbestos was previously disposed of on the pile and park parcels and the reservoir was constructed using ACM. In 1962, Nicolet Industries purchased Keasbey & Mattison Company and continued to dispose of ACM at the location of the former reservoir until the 1970s, when Nicolet Industries ceased manufacturing ACM. The asbestos waste pile property is currently vacant and not used for any purpose. [1]

The site is bordered on the north by residential properties; on the northeast and east by Chestnut Avenue, West Maple Street, and commercial and residential areas; on the south by commercial properties (McDonalds, Classic Coachworks, and the Sons of Italy); on the southwest by Montgomery County and Pennsylvania Department of Transportation open space; and on the northwest by residential properties. A playground (Westside Tiny Tot Park) and basketball courts are located northeast and north of the property, respectively. Ambler Warehouse, Ambler Manor (an apartment complex), and a shopping plaza are located east of the property. The BoRit site is located a few hundred yards northwest of the asbestos piles that became the Ambler Asbestos NPL Site, which was remediated by EPA in 1993. In 1996, the Ambler Asbestos site was deleted from the NPL. [1]

The site currently consists of three parcels; an asbestos waste pile ('The Pile'), a reservoir ('The Reservoir'), and the Whitpain Wissahickon Park ('The Park') (Appendix 1, Figure 1). BoRit Asbestos site is located in three jurisdictions: the pile is in Ambler Borough, the reservoir is in Upper Dublin Township, and the park is in Whitpain Township. The Pile comprises 6 acres. During an EPA removal, trees were removed and the pile was re-graded, re-shaped, and covered. The Reservoir is a 15-acre reservoir with a berm and was constructed of asbestos shingles, millboard, and soil. Asbestos product waste, such as piping and tiles, is visible surrounding the reservoir and the nearby stream banks. However, since EPA's removal action, ACM is no longer visible. The Park is approximately 11 acres and was formally used as a park/playground for a number of years. In the mid-1980s, the park was closed and fenced due to asbestos contamination. Creeks running through the site include an intermittent tributary named Tannery Run, which is located south of the asbestos waste pile and Rose Valley Creek, located between the park and the reservoir. Both of these creeks eventually join the Wissahickon Creek, which is located along the western boundary of the site. The reservoir discharges to Wissahickon Creek. [1]

In the mid-1980s, the site was fenced (including the reservoir, park and pile) due to asbestos contamination. The asbestos waste pile is currently partially enclosed by a 12 foot high chain link fence that borders West Maple Street to the northeast and runs along Tannery Run to the south. Warning signs are posted along the fence line indicating that the enclosed area contains ACM. The asbestos waste pile is unfenced along Wissahickon Creek to the west of the pile. The asbestos waste pile on the BoRit site is currently about 20 to 30 feet above the ground surface. In April 2009, the BoRit Asbestos site was listed on the EPA National Priorities List (NPL), also known as Superfund. [2] Under the Superfund program, EPA is currently conducting a removal cleanup action and remedial investigation at the site for the asbestos waste, which includes the asbestos pile, park and areas along the reservoir and stream banks.

Public Health Involvement

The Pennsylvania Department of Health (PADOH), the Agency for Toxic Substances and Disease Registry (ATSDR) and the Centers for Disease Control and Prevention (CDC) have provided public health guidance, review of environmental sampling data, health education information and health outcome data reviews at various times for the Ambler Asbestos NPL site and BoRit asbestos site. More recently, PADOH has produced three health consultations for the site. The first HC was produced in 2009 and evaluated 2006-2007 air sampling data collected along the perimeter the site for asbestos and the second HC responded to public comments. [3] The third HC document reviewed health outcome data from the Pennsylvania Cancer Registry for the community. [4] In August 2011, at the request of the community, PADOH prepared an updated cancer evaluation in the communities surrounding the BoRit Asbestos Site. PADOH found an excess rate of mesothelioma diagnosed in men and women residing in the Ambler Zip code when compared with the Commonwealth as a whole. PADOH distributed a community fact sheet discussing the findings to the Ambler community and also presented this information to the Community Advisory Group (CAG). [5]

Some community members have expressed concern that asbestos or other chemicals could be present in residential drinking water as a result of contamination from the site. In response to this concern, PADOH evaluated the groundwater sampling data collected at the site and samples collected within the public drinking water supply system. The results of this evaluation are presented in this health consultation. Additional information about the BoRit asbestos site can be found on the EPA's On-Scene Coordinator page at: http://www.epaosc.org/site/site_profile.aspx?site_id=2475 and on EPA's National Priorities List page for this site at: http://www.epa.gov/reg3hwmd/npl/PAD981034887.htm.

Groundwater Well Installation and Sampling

In 2009, as part of the on-going Remedial Investigation/Feasibility Study (RI/FS) for the BoRit site, EPA initiated a groundwater investigation. This groundwater investigation involved the installation of two different types of wells at the BoRit site: piezometers (tubes) placed in the overburden (soil and waste just beneath the ground surface) and monitoring wells placed in the fractured bedrock beneath the overburden. Both piezometers and monitoring wells can be used to determine how groundwater flows beneath the site. However, the two well types are constructed differently leading to differences in the water quality of their samples. Piezometers and monitoring wells are compared and contrasted in Table 1 below. Piezometers function as points for collection of water level data (flow and direction), but due to their construction are prone to potential surface soil contamination and are not intended for high-quality sample collection for water quality analyses. Groundwater monitoring wells are intended for the collection of high-quality samples for chemical analysis from the bedrock aquifer, since they are constructed with a surface and sand seal and a sand filter pack which would reduce potential surface contamination. [6]

Table 1- Comparing and Contrasting of Well Types	
Overburden Piezometers	**Bedrock Monitoring Wells**
Intended for Temporary Use	More permanent construction
Groundwater is collected from within asbestos waste (pile and park disposal area)	Groundwater is collected from bedrock beneath waste
Used to access water at shallow depths: 25 feet or shallower	Used to access water at deeper depths: 50 to 100 feet
Tube allowing water to enter but having no seals or sand pack to prevent contamination from entering	Construction includes a sand seal, sand pack, and screened interval where the water sample is taken
A grab sample of groundwater is taken *without* purging (pumping the water out) to stabilize water quality parameters	Generally, groundwater is sampled after purging (pumping the water out) 3 well volumes to stabilize water quality parameters
Easily impacted by surface waste	Not easily impacted by surface waste
Water quality data can be used for qualitative analyses	Water quality data good for quantitative analyses and health assessment

Based on community questions and concerns about piezometer and groundwater sampling, PADOH is presenting both sampling efforts in the following sections. [7] However, due to the sampling method, usage and construction, PADOH summarized the peizometer data for qualitative purposes and did not use the piezometer data for public health evaluation of contaminants at the site. The data discussed below are for shallow wells, less than 100 feet in depth, as opposed to the closest Ambler public drinking water wells, which range from 300 to 438 feet in depth. Groundwater in the shallow bedrock flows toward the Wissahickon Creek and away from the public water supply wells. The deeper aquifer layers, where the public drinking water wells draw water from, tend to be under confined (pressurized) conditions, and would therefore not be susceptible to contamination from the surface. The shallower layers are unconfined, and are more likely to be impacted by surface conditions.

Piezometer Wells

In late 2009 and early 2010, during Phase I activities at the site, EPA completed geotechnical soil borings at the site. As part of this process, EPA installed six temporary piezometers, including three in the park and three on the Pile to a depth of approximately 25 feet (Appendix 1, Figure 2). The piezometers were not installed for the collection of high quality groundwater samples for laboratory analysis. The piezometers were not purged prior to sampling (and therefore are not representative of the groundwater in the water-bearing zone), making the samples potentially turbid. Turbid samples can be expected to have higher concentrations of some contaminants (e.g., metals and asbestos) because they adsorb to the fine-grained material (silt and clay) that cause the turbidity. EPA also decided to conduct laboratory analyses on the piezometers wells. Samples collected included three grab samples from the pile and park and one duplicate sample. EPA analyzed these samples for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), inorganics/metals, and asbestos. [8]

Groundwater Monitoring Wells

In November 2010, EPA completed installation of six groundwater monitoring wells around the site perimeter, along the Wissahickon Creek, near the reservoir and in areas of the site where asbestos materials were disposed, including the Pile (Appendix 1, Figure 3). The monitoring wells at the BoRit site were installed within the bedrock, ranging from 53 feet to 100 feet. [9] In contrast, Ambler Borough public water wells are deeper, ranging from 300 to 438 feet in depth. [10] As part of the Phase 2 field investigation at the site, groundwater samples were collected from all six bedrock wells, with MW-01 being sampled twice, once at its shallower depth of 53 feet and once at a final depth of 73 feet. Samples were analyzed for VOCs, SVOCs, PCBs, pesticides, inorganics/metals, and asbestos. Piezometeres were not sampled during Phase 2 site activities. [11] Lastly, in June 2011, EPA collected one groundwater sample for asbestos from monitoring well 5 (MW-5), located on the Pile. [12]

Exposure Pathways

To determine whether nearby residents are, have been, or are likely to be exposed to contaminants associated with the site, the PADOH evaluates the environmental and human components that could lead to human exposure. An exposure pathway is the way chemicals may enter a person's body. An exposure pathway includes the following five elements [13]:

1. A contaminant source
2. Environmental medium (or media) and transport mechanisms
3. A point of exposure
4. A route of exposure
5. A receptor population

Exposure pathways are categorized as completed, potential or eliminated. A completed exposure pathway is one in which all five elements are present, indicating that an exposure has occurred, is occurring or will occur in the future. In a potential exposure pathway, at least one of the pathways elements are missing and are uncertain, indicating that exposure to a contaminant could have occurred in the past, may be occurring or could occur in the future. A pathway is eliminated when one or more elements are missing and are very unlikely to be present. It is important to note, that having contact with a chemical does not necessarily result in adverse (harmful) health effects. A chemical's ability to produce adverse health effects is influenced by a number of factors in the exposure situation, including [13]:

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

In the case of the groundwater exposure pathway related to the site, the community nearest the site is on public water supply. Therefore, the groundwater pathway near the site is eliminated as a potential exposure pathway. Because VOCs have been detected below the EPA Maximum Contaminant Levels (MCLs), groundwater near the site is not expected to pose a vapor intrusion risk to the community. The public could also potentially be exposed to asbestos via private wells, although PADOH do not have any data to evaluate this pathway. Asbestos-containing pipes installed in the public drinking water system are also a potential source of exposure which is discussed in the Public Drinking Water Supply Section.

ATSDR Comparison Values and EPA Maximum Contaminant Levels

To evaluate whether the residents may be exposed to contaminants at levels that could harm their health, PADOH compared the environmental sampling data against ATSDR's comparison values (CVs). These values are used to identify contaminants at a site that require further site-specific evaluation. Exceeding a CV does not necessarily indicate a contaminant level associated with or expected to cause adverse health effects. Rather, concentrations that exceed a CV indicate the need for further assessment to determine potential public health impacts. For most contaminants that are considered to be known human carcinogens, probable human carcinogens, or possible human carcinogens, ATSDR has developed cancer risk evaluation guides (CREGs). CREGs are media-specific comparison values used to identify concentrations of cancer-causing substances that are unlikely to result in an increase of cancer rates in an exposed population. ATSDR develops CREGs using EPA's cancer slope factor (CSF), a target risk level (10^{-6}), and default exposure assumptions. ATSDR has established CVs for non-cancerous endpoints including Environmental Media Evaluation Guides (EMEGs), Minimum Risk Levels (MRLs) and reference dose media evaluation guides (RMEG). When both a cancer and non-cancer CV exists for a particular chemical, the lower of the values is selected for health-protectiveness. [13]

In addition to ATSDR CVs, PADOH also uses EPA MCLs to evaluate water sampling data. Under the Safe Drinking Water Act (SDWA), EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement the National Primary Drinking Water Regulations (NPDWRs or primary standards). The standards are legally enforceable standards that apply to public water systems. A MCL is the legal threshold limit on the amount of a substance that is allowed in public water systems. To set a MCL for a contaminant, EPA first determines how much of the contaminant may be present with no adverse health effects. This level is called the Maximum Contaminant Level Goal (MCLG). MCLGs are non-enforceable public health goals. The legally enforced MCL is then set as close as possible to the MCLG. The MCL for a contaminant may be higher than the MCLG because of difficulties in measuring small quantities of a contaminant, a lack of available treatment technologies, or if EPA determines that the costs of treatment would outweigh the public health benefits of a lower MCL. MCLs for drinking water are deemed protective of public health during a lifetime (70 years) at an exposure rate of 2 L/day. For asbestos, EPA has set a MCL of 7 million fibers per liter (MFL) for fibers longer than 10 microns (µm). [14]

Results and Discussion

Piezometer Results

PADOH reviewed the piezometer sampling data (Appendix 2) but did not perform an exposure evaluation of these results due to the limitations of these data as discussed previously in the Groundwater Well Installation and Sampling section. These piezometer water samples were grab samples intended to provide "screening level" analytical data to characterize the shallow overburden groundwater in a general sense. Piezometer groundwater sampling is prone to contamination from the surface during sampling. For instance, surface soil that contains asbestos could enter the sampling well resulting in detectable levels of asbestos. A more comprehensive groundwater investigation to determine water quality, and the potential impact from the site, is presented in the next section. In addition, the community currently is not using the groundwater immediately under the site as a drinking water source. The following provides a qualitative summary of the maximum results, by piezometer well location [7]:

- **Pile 1** – Manganese was detected at 1,180 micrograms per liter (µg/L or µg/L) and asbestos was detected at 3384 (1a) and 6057 (1b) MFL.
- **Pile 2** – Manganese was detected at 7,210 µg/L. Arsenic was detected at 22.7 µg/L. Asbestos was detected ranging from 1,247 MFL to 7,838 MFL.
- **Pile 3** - Manganese was detected at 11,500 µg/L. Arsenic and lead were detected at 28.9 µg/L and 69.6 µg/L, respectively. Asbestos was detected at 2,076 MFL (3a) and 1,440 (3b) MFL.
- **Park 1** – Manganese and lead were detected at 5,150 µg/L and 512 µg/L, respectively. Asbestos was detected at 4,008 MFL (1a) and 1,211MFL (1b).
- **Park 2/Duplicate** – Benzene was detected at 6 µg/L. Arsenic was detected at 17.2 µg/L and lead at 29.4 µg/L. Manganese was detected at 5,670 µg/L. Asbestos was found at 19,952 MFL (2a) and 9,441 MFL (2b).
- **Park 3** – Benzene was detected at 2.6 µg/L. Arsenic and lead were detected at 12.2 µg/L and 26.8, respectively. The asbestos samples were 19,315 MFL (3a) and 34,204 MFL (3b).

Groundwater monitoring well results

PADOH evaluated the results of the groundwater monitoring data (Appendix 3). The results were then compared against the ATSDR CVs and EPA MCL values. During the 2010 sampling event only one well (MW-4) had a detected level of asbestos (chrysotile) at 0.51 MFL. The June 2011 groundwater sample collected from MW-5 (pile) had an asbestos (chrysotile) level of 0.21 MFL. It is important to note, groundwater beneath the site is not used for drinking for the public drinking water supply and there appears, based on current PADOH and ATSDR knowledge, to be no private drinking water wells in the immediately adjacent to the site. The following summarizes the sampling results by groundwater monitoring well location for samples detected above EPA MCL or ATSDR CV [11]:

- **MW-1 (park)** - no contaminants detected above the EPA MCL or ATSDR CV.
- **MW-2 (park)** - Carbon tetrachloride and tetrachloroethylene (PCE) were detected at 5.8 µg/L and 22 µg/L, respectively, which exceeds the MCLs for both of these chemicals of 5 µg/L. ATSDR CREG CV for PCE is 17 µg/L. Bis(2-ethylhexy)phthalate was also detected at 55 µg/L, exceeding the EPA MCL of 6 µg/L and the ATSDR CREG of 2.5 µg/L. However, this is a common lab contaminant and this contaminant was also detected in one of the field blank quality assurance sample for this sampling event, indicating that this detection was likely from contamination introduced during the processing of the samples.
- **MW-3 (between the reservoir and the pile)** - Manganese was detected at 9,620 µg/L, which is above the EPA lifetime health advisory for drinking water (LTHA) value of 300 µg/L and the secondary MCL of 50 µg/L (note, secondary MCLs are established based on aesthetic considerations, such as taste and odor, not on health endpoints)
- **MW-4** (**between the reservoir and the pile**) - no contaminants detected above the MCL or ATSDR CV.
- **MW-5 (pile)** - Manganese was detected at a concentration of 156 µg/L, exceeding the EPA's secondary MCL of 50 µg/L. Bis(2-ethylhexy)phthalate was detected at 42 µg/L, exceeding the EPA MCL of 6 µg/L and the ATSDR CREG of 2.5 µg/L. However, bis(2-ethylhexy)phthalate is a common lab contaminant. As mentioned above, Bis(2-ethylhexy)phthalate was detected in one field blank sample during the monitoring event.
- **MW-6 (pile)** - For this well, Bis(2-ethylhexy)phthalate was detected at 14 µg/L, exceeding the EPA MCL of 6 µg/L and the ATSDR CREG of 2.5 µg/L. However, bis (2-ethylhexy)

phthalate is a common lab contaminant. As mentioned above, Bis(2-ethylhexy)phthalate was detected in one field blank sample during the monitoring event. Manganese was detected in this well at 426 µg/L, which exceeds both the EPA non-enforceable secondary MCL of 50 µg/L.

Public Drinking Water Supply

Public drinking water is supplied to residents in the immediate site area via the Ambler Borough Water Department. The sources of the water for the Ambler Water Department includes the groundwater wells (which includes the Whitemarsh Pumping Station) and surface water from the Spring Well and North Spring in Whitemarsh Township. Most of the public drinking water wells are more than a mile away from the site, with the closest well approximately 500 yards from the site. The closest Ambler well is used only during the summer months to provide additional capacity. The source wells for the Ambler public drinking water supply range from 300 to 438 feet in depth. In contrast, the BoRit groundwater monitoring wells discussed in this HC are less than 100 feet in depth. [10] The deeper aquifer layers tend to be under confined (pressurized) conditions, and would therefore not be susceptible to contamination from the surface. The shallower layers are unconfined, and are more likely to be impacted by surface conditions. [15] It appears the groundwater near the site flows toward the Wissahickon Creek and away from the public water supply wells. [10] All source water for the public drinking water is treated, and meets state and federal requirements for quality and safety, before being distributed to the public. The Ambler Borough Water Department provides water to customers in a 6.5-square-mile area encompassing Ambler Borough and sections of Lower Gwynedd, Upper Dublin, Whitemarsh and Whitpain townships and routinely monitors for constituents in drinking water as required under The EPA NPDWRs. The PADEP is responsible for enforcing the drinking water standards.

PADOH obtained and reviewed water quality monitoring reporting for the Ambler Borough Water Department. [16] Ambler public water system quarterly monitoring data are available on PADEP's website: http://www.drinkingwater.state.pa.us/dwrs/HTM/SelectionCriteria.html The website allows searches by the water authority name, contaminant, inventory information, and monitoring requirement. Primary standards protect public health by limiting the levels of contaminants in drinking water. Drinking water standards apply to public water supplies, which provide water for human consumption through at least 15 service connections, or regularly serve at least 25 individuals. [17] PADOH reviewed the quarterly monitoring data in the PADEP system, through March of 2012, and the annual water monitoring reporting, and the levels of drinking water contaminants, which includes VOC's and metals, were below MCLs. [18]

Under the Drinking Water Act, the regulation for asbestos testing in public drinking water supplies became effective in 1992. Between 1993 and 1995, EPA required water suppliers to collect water samples once and analyze them to find out if asbestos is present above the MCL, set at 7 MFL. If asbestos is present above this level, the system must continue to monitor quarterly. Based on information provided by PADEP, Ambler Borough, in response to the EPA asbestos regulation, conducted monitoring for asbestos in drinking water in the early 1990's and again in 2011. The results from the public drinking water system for asbestos were below the MCL. [10] In spring 2011, Ambler Borough applied for and received a waiver for sampling of asbestos in their water supply, after sampling wells in its distribution system for asbestos as part of DEP's waiver process. A waiver allows Ambler to sample for asbestos on a less frequent basis than the routine EPA sampling schedule. In order to be granted a waiver, water suppliers must first submit documentation showing that the contaminant in question had not been detected in recent monitoring. Only after the completed monitoring indicates that there were no detects can a waiver be granted. Three of the four samples taken in 2011 showed no levels of asbestos. One sample initially showed 1 chrysotile fiber greater than 0.5 microns (but less than 10 microns). Upon reanalysis, that result could not be confirmed. All of the samples met drinking water standards and satisfied PADEP public water supply requirements.

Some residents are concerned about historical public water data showing PCE above the MCL in Ambler Borough water system. PADOH reviewed the public water data, collected from 1994 to 2012. In September 1996, Ambler public water sampling showed levels of PCE (two detections at 44 µg/L and 70 µg/L) exceeding the MCL of 5 µg/L. As a result of these detections, the Ambler public water supply was required to collect additional monitoring sampling beginning in 1997 through 2011, as reported in the PADEP drinking water reporting system. [18] PCE was not detected from 1997 to 2001, or prior to 1996. In 2002, one sample for PCE was detected at 0.6 µg/L but was below the MCL. It appears these were isolated occurrences. Since that time, PCE has not been detected in routine water monitoring. [18] Thus these detects appears to be anomalies that could be attributed to sampling, laboratory errors or transient (non-lasting) conditions.

Based on the on-site groundwater data, some community members were concerned that manganese could be present in the public drinking water supply. Manganese is not required to be reported under the Safe Drinking Water Act and not in the PADEP on-line drinking water system. However, in order to evaluate manganese in the public water supply, PADOH consulted with the PADEP Southeast Region Safe Drinking Water Program to determine if Ambler public well sampling data for manganese was available. Based on those discussions, the Ambler public drinking water wells were sampled for manganese recently on November 28, 2012. The following is a summary of the raw sampling data (prior to treatment) for manganese in the public wells:

Public Well #	Manganse concentration (µg/L) - prior to filtration
2	<20
4	<20
6	<20
7	30
8*	320
9	<20
11	<20
12*	<20
14*	90

* Treatment system installed at these well locations

Overall, the levels of manganese in the raw samples are low. Manganese was detected in public well #8 and #14 above the EPA secondary MCL of 50 µg/L. However, public wells # 8, 12, and 14 have treatment systems and therefore the levels of manganese at the tap would potentially be even lower. PADOH would not expect these levels to harm peoples' health. The levels of manganese detected in the sampling of the Ambler public water supply are similar to background levels for the area, as discussed in the Discussion Section. It is important to note that well #4 is the closest to the BoRit site, at a horizontal distance of 1125 feet, and manganese levels were not detected above the secondary MCL. The community has also been concerned that asbestos could be present in their water either from the site or leaching from asbestos-containing pipes. In Ambler, the early water mains were constructed of cast iron. Asbestos cement pipes were installed generally from 1940 to 1980. Since 1980, ductile iron pipe has been used on all new installations. Approximately one-third of the Ambler Water Department's pipes are made of asbestos cement, but none of the asbestos containing pipes are in the downtown Ambler area which is near the site. [20] In 2010, to address community concerns, PADEP in conjunction with the Borough of Ambler, collected water samples along the distribution system for asbestos. (Appendix 4) Five samples were collected and included locations at or near the portions that were suspected of having asbestos-containing pipes. Asbestos sampling results showed the highest concentration of fibers was 0.09 MFL. [20] This level is well below the Safe Drinking Water Act standard of 7 MFL. The remaining four samples were less than 0.09 MFL. Based on the sampling data, it is unlikely that asbestos is entering the public drinking water supply at levels that could harm the public's health.

Private Wells

Although public water is the main source of drinking water in the site area, there are some private wells. Based on information available to the Montgomery County Health Department, no private wells are documented in Ambler Borough or Upper Dublin, but there are some private wells documented in Whitpain Township. A few of these wells appear to be approximately 2 miles from the site. PADOH does not have information on water quality in these private wells at this time. Based on information provided by PADEP, it appears the groundwater at the site flows towards the Wissahickon Creek and would therefore not be expected to impact water wells. [10] However, PADOH does not have data collected from private drinking water and therefore cannot currently make a conclusion regarding public health and private wells in the area. For this reason, PADOH suggests EPA conduct a private well survey in the area to determine the potential impact, if any, from the site on private drinking water wells.

As prudent public health practice, any private well owner, regardless of where they live, should have their drinking water tested on a regular basis. Montgomery County residents with private wells may want to visit the county's health department's well testing program website at: http://health.montcopa.org/health/cwp/view,A,3,Q,65367.asp In addition, The Penn State Extension Program offers well water testing at low costs. You may contact the Montgomery County Extension Office for further information at 610-489-4315 or visit the Penn State Extension lab testing website: http://www.aasl.psu.edu/Water_drinking_main.html

Discussion

Asbestos in drinking water

It is well documented that breathing asbestos fibers can increase a person's risk of developing lung cancer, asbestosis, and mesothelioma. [21] The potential health effects via the inhalation (breathing) route of exposure are not the same as through the ingestion (drinking) exposure pathway. Asbestos is primarily an inhalation risk. Current evidence does not suggest that ingestion of drinking water containing asbestos would increase a person's risk of developing lung cancer or mesothelioma. This section explores the current knowledge and scientific and epidemiological studies regarding asbestos exposures in drinking water.

Toxicology Information

If you swallow asbestos fibers (either those present in water or those that are moved to your throat from your lungs), nearly all of the fibers pass along your intestines within a few days and are excreted in the feces. A small number of fibers may penetrate into cells that line your stomach or intestines, and a few penetrate all the way through and get into your blood. Some of these become trapped in other tissues, and some are removed in your urine. The health effects from swallowing asbestos are not conclusive, but studies do indicate that levels below the current MCL are not expected to result in adverse health effects. Some groups of people who have been exposed to asbestos fibers in their drinking water have higher-than-average death rates from cancer of the esophagus, stomach, and intestines. However, it is very difficult to tell whether this is caused by asbestos or by something else. Animals that were given very high doses of asbestos in food did not get more fatal cancers than usual. Male rat in this study showed extra nonfatal polyps. [22] EPA's MCL for asbestos is based on this study, specifically the evidence of benign polyps occurring in male rats following oral administration of intermediate size chrysotile fibers (i.e., >10 micrometer range). The study did not indicate potential adverse health effects for short-range fibers. [23] According to EPA, some people who drink water containing asbestos in excess of the MCL over many years may have an increased risk of developing intestinal polyps, but the polyps are nonfatal and benign. [24]

According to the World Health Organization (WHO), the health hazards associated with the inhalation of asbestos in the occupational environment have long been recognized and include asbestosis, bronchial carcinoma, malignant mesothelioma of the pleura and peritoneum, and possibly cancers of the gastrointestinal tract and larynx. In contrast, little convincing evidence has been found of the carcinogenicity of ingested asbestos in epidemiological studies of populations supplied with drinking-water containing high concentrations of asbestos. Moreover, the ability of asbestos fibers ingested in drinking water to migrate through the walls of the gastrointestinal tract in sufficient numbers to cause adverse local or systemic effects is the subject of disagreement. [25] Based on the current scientific knowledge, as outlined above, it does not appear that asbestos ingested via drinking water, especially below the MCL for asbestos, will result in adverse health effects.

Epidemiology Studies

PADOH reviewed the available epidemiology studies on the relationship between asbestos in drinking water and potential health effects. The following is a summary of the epidemiology studies, in drinking water systems:

- A case control study was performed in Washington State in an area with an unusually high concentration of chrysotile asbestos (as high as 200 MFL at the tap) in drinking water. The community chosen for the study had a high asbestos level in drinking water, for a long time (in excess of 60 years). Data was collected on asbestos exposure based on residence, work place history, and water consumption. The study looked at the tumor registry and conducted interviews with 382 individuals diagnosed with cancer of the buccal cavity, pharynx, respiratory system, digestive system, bladder, or kidney between 1977 and 1980 over 25 census tracks. Only those individuals between ages 40 to 79 years that resided in the study area at the time of diagnosis were included. The authors conducted similar interviews of a control group of 462 individuals. Controls were chosen in same group of 25 census tracks, during the same time period and from the same age group. The case and control refusal rates were low at 13.5% and 11.7%, respectively. Cancer risk was estimated by logistic regression and other methods. There were significantly elevated risks only for male stomach and male pharyngeal cancer, and were not observed in females, based on a small numbers of cases (i.e. for males stomach cancer rates are based on eight cases and pharyngeal cancer rates are based on four cases) but probably due to other factors. It is difficult to draw conclusion though based on such a small number of samples. There were no cancers statistically elevated in males and females. Overall, there was no convincing evidence for increased cancer risk from ingesting asbestos. [26]

- A cancer mortality study in Florida attempted to study the usage of asbestos containing pipes in a public drinking water system. The study focused on Escambia County, with a population of over 200,000 and containing 40 census tracks. Asbestos was detected in the drinking water up to 33 MFL. The area was divided into three areas; no asbestos containing pipes (i.e. private wells), low levels of asbestos in public drinking water and high levels of asbestos in public drinking waters. An analysis of covariance was run to test for differences in standard mortality ratios for seven cancer sites among the three potential asbestos exposure groups based on asbestos containing pipe usage. No evidence for an association between the use of asbestos containing pipes for carrying drinking water and deaths due to gastrointestinal and related cancers was found. [27]

- New York State conducted an epidemiological investigation to study the relationship between asbestos containing pipes in drinking water and cancer incidence. Residential drinking water asbestos levels ranged from 3.2 MFL to 304.5 MFL, specifically long fiber (>10 microns) were at 0.9 to 15.1 MFL. The exact exposure duration could not be determined, but some evidence indicated exposures of some residences started in the 1950's to 1960's or as late as 1976. The water in the public drinking water system was determined to be soft, making it more likely to degrade asbestos containing pipes. A cancer incidence analysis was conducted in the area, including four census tracts, for 1973-1983 using the states cancer registry. According to the 1980 census, the collective population of the study area was 2,679. Despite the high concentrations of asbestos in the drinking water, no evidence was found for elevated cancer risk in the study area, when compared to the expected rates for that area of upstate New York. However, the major limitation of this study was many of the residents within the study area were not on the public water supply, and the study was unable to only study those on public drinking water. [28]

- Connecticut conducted two studies to investigate the potential for asbestos in drinking water to cause increased cancers. The first study looked at the relationship between asbestos in drinking water and mesothelioma. The second investigation involved rates of stomach, colon, rectum, pancreas, lungs, urinary bladder, and kidneys. Eleven of the state's 169 towns used source waters containing small amounts of asbestos (less than 0.5 MFL as delivered to users). In 82 towns, some but rarely all, of the population received water delivered through asbestos cement pipes located in some part(s) of the distribution systems. The total population exposed on a regular basis was approximately 600,000 with the average exposure duration of 20 years. No consistent evidence or correlation of a cancer risk from asbestos in water was found. However, the study could not account for population mobility and the levels of asbestos in drinking water were lower than other studies described above. [29]

Manganese, Carbon Tetrachloride and PCE

Groundwater beneath the site is not used for drinking for the public drinking water supply. There appears, based on current PADOH and ATSDR knowledge, to be no private drinking water wells in the immediately adjacent to the site. However, some community members have been concerned about the contaminants detected on-site migrating to the public water supply and potentially impacting their health.

Manganese was found in the on-site monitoring wells at a maximum of 9,620 µg/L, which is above the secondary MCL of 50 µg/L. Secondary MCLs are established based on aesthetic considerations, such as taste and odor, not on health endpoints. Manganese levels as high as those levels reported in the on-site monitoring well would produce highly unpotable water with visual levels of contamination (e.g., black to brown color, black staining, and or bitter metallic taste). However, there is no evidence that this is currently occurring in the public water supply. [35] As described in the Public Drinking Water section, manganese is not required to be reported under the Safe Drinking Water Act.

PADOH consulted with the PADEP Southeast Region Safe Drinking Water Program to determine if public well sampling data for manganese in available for the Ambler. Based on sampling data from 2012, manganese was detected in two public wells (320 µg/L and 90 µg/L) above the EPA secondary MCL. Manganese is an essential nutrient and found in soil and groundwater. However, these samples were collected in the supply well prior to treatment systems and therefore the levels of manganese at the tap would potentially be even lower. Manganese background levels for the area in the Stockton Formation aquifer range from less than 3 µg/L to 870 µg/L. [33] Therefore, the levels of manganese detected in the sampling of the Ambler public water supply are similar to background levels for the area.

Carbon tetrachloride and PCE was detected in one on-site well at 5.8 µg/L and 22 µg/L, respectively, which exceeds the MCLs for both of these chemicals of 5 µg/L. ATSDR CREG CV for PCE is 17 µg/L. There is no information available at this time indicating that the limited detections of contaminants in the groundwater under the site is affecting any of the drinking water wells used by the Borough of Ambler for the public drinking water supply. Based on a review of the PADEP drinking water monitoring system, which provides quarterly sampling results for Ambler, PCE and carbon tetrachloride are not currently being detected in the Ambler Borough water supply.

Technical Assistance Services for Communities Summary and Review of EPA's Preliminary Phase II Groundwater Report

In June 2012, a review of EPA's Phase II Groundwater Report, commissioned by the BoRit CAG and funded by the EPA, was prepared by an independent consultant under the Technical Assistance Services for Communities (TASC) program. The BoRit Groundwater TASC report was prepared and released at the same time as the public comment version of this PADOH Health Consultation report (August 2012). Therefore, the conclusions and findings from the BoRit Groundwater TASC report were not included in the initial public comment version of this health consultation report. The following section provides a general summary of the BoRit Groundwater TASC report findings.

The full BoRit Groundwater TASC report is available on-line at:
http://www.boritcag.org/pdf/TASC%20Review%20of%20Preliminary%20Phase%20II%20Groundwater%20Report%20for%20BoRit%20Draft%206-28-12.pdf

The TASC report concluded the following:

- Groundwater analytical results at the BoRit site indicate low levels of impact in the bedrock monitoring wells from the contaminants identified in the soil and shallow groundwater. However, the connection of the bedrock fractures to the shallow groundwater has not been established. Substantial evidence of extensive and connected fracture would be necessary to promote migration. Asbestos was detected above the MCL in all of the shallow wells (piezometers) because the wells were completed in or near asbestos waste. Asbestos was detected in one bedrock monitoring well (MW-04) at 0.51 MFL, which is less than the MCL of 7 MFL. Given the vertical distance and the absence of asbestos in other bedrock monitoring wells, is likely related to the introduction of asbestos waste to the well bore rather than migration from the shallow groundwater through bedrock.

- VOCs were detected in the one bedrock monitoring well above the RSL were either not detected or were reported at lower concentrations in the shallow aquifer. It appears these VOCs are migrating into the deeper aquifer and no source has been identified. Bis(2-ethylhexyl) phthalate, which is used in production of PVC resins and plastics, was detected above the RSL in three site monitoring well samples and one field blank. Detection of bis(2-ethylhexyl) phthalate in the field blank suggests it may be sampling artifact. Carbon tetrachloride and PCE are chlorinated solvents, have been use in the industrial setting and are known/suspected human carcinogens. Concentrations in bedrock monitoring well (MW-02) exceeded both RSLs and MCLs. Carbon tetrachloride was not reported in soil or shallow groundwater. Trace concentrations of PCE (0.075 µg/L, 0.075 µg/L, and 0.084 µg/L) were detected in shallow park groundwater during Phase I but less than MW-02 concentrations. Additional wells and aquifer testing would help determine if the source(s) are on or off site.

- Arsenic is naturally occurring element and used for strengthening metal alloys, in pesticides/herbicides and in semiconductors. Arsenic was detected in the soil, shallow groundwater and bedrock monitoring wells above the RSL. In bedrock wells MW-03 and MW-05 arsenic was detected above the RSL of 0.045 µg/L but below the MCL of 10 µg/L. There is no clear pattern of elevated concentrations associated with a particular waste layer or media. According to the PADEP drinking water website, Ambler did not detect arsenic above the MCL in any of their Safe Drinking Water Act samples.

- Manganese is a common, naturally occurring element used in the production of metal alloys, especially stainless steel. Manganese was detected across site in waste layers, native soil, sediment and shallow groundwater. The reported concentration in monitoring well MW-05, MW-06, and MW-03 were 156 µg/L, 426 µg/L, and 9,620 µg/L, respectively exceeded both the EPA RSL of 88 µg/L and the non-enforceable secondary MCL of 50 µg/L. While manganese levels have been documented in the local Stockton Formation groundwater, the levels in MW-03 exceed the typical concentration range reported for this local formation. No manganese data were included in the 2011 Ambler Borough Water Department Report or on the PADEP drinking water website.

- The vertical distance between the shallow and bedrock groundwater, the fracture head pressures and the poor correlation between shallow and deeper groundwater contamination do not support a direct connection between the shallow and bedrock groundwater in the BoRit site area. There is not a clear correlation between contaminants observed in the shallow and deep groundwater. However, the connection between the shallow groundwater and bedrock fractures in the site area has not been evaluated. Additional study would be required to determine the degree to which the bedrock well fractures are connected to the shallow groundwater or to each other. Pump testing one or more of the deep wells while monitoring the water level in the other wells would help establish the interconnectivity between the wells and the shallow groundwater.

- Based on the 2011 analytical report data provided by Ambler Borough, arsenic, carbon tetrachloride or PCE were not detected in wells 04, 09 or 11. The Borough does not regularly test for asbestos or manganese. The current data does not suggest that the BoRit site is influencing the Ambler drinking water supply, but there is insufficient information to make a definitive statement. There is not a clear correlation between contaminants observed in the shallow and deep groundwater at the site. No investigation of the radius of influence created under pumping conditions of the closest Ambler wells has been done. Additional study would be required to evaluate if withdrawals from the supply wells affect groundwater levels at the site and to better understand connectivity of the bedrock fracture system. This would require cooperation of Ambler Water Department to provide operation schedule for nearby supply wells.

Community Concerns

PADOH understands some community members have concerns about groundwater at the site and potential contaminants from the site that may have gotten into the drinking water system. Our agency's goal is to make sure the Ambler community has the best science information available to keep the community safe. Here is a summary of community concerns regarding groundwater at the site, and PADOH's responses:

Piezometer data showed levels of asbestos exceeding the MCL but subsequent groundwater monitoring well data showed asbestos levels below the MCL or non-detect. Therefore, based on the piezometer data, is asbestos present in the groundwater above the MCL?

Asbestos was detected above the MCL in the BoRit piezometer grab samples which were collected from areas where asbestos waste was present. The grab samples collected from the piezometers were intended to provide "screening level" analytical data to characterize the shallow overburden groundwater in a general sense. Groundwater monitoring well samples are representative of the upper bedrock groundwater zone because of proper construction in that zone and the sampling techniques used to collect the samples. Therefore, the groundwater monitoring well sampling results are the most reliable indicators of the level of asbestos in the groundwater under the site. The groundwater monitoring well results did not find asbestos above the MCL in the groundwater under the site. It is PADOH's understanding that EPA will continue to monitor the groundwater at the BoRit site.

Is contamination from the site migrating to the wells used by the Borough of Ambler for the public drinking water supply?

There is no information available at this time indicating that the limited detections of contaminants in the groundwater under the site is affecting any of the drinking water wells used by the Borough of Ambler for the public drinking water supply. PCE, carbon tetrachloride, and asbestos were detected in groundwater under the site. Based on a review of the PADEP drinking water monitoring system, which provides quarterly sampling results for Ambler, none of these chemicals are currently being detected in the Ambler Borough water supply. [18] Most of the public drinking water wells are more than a mile upgradient from the site, with the closest well approximately 500 yards from the site and located in another aquifer. This well is used only during the summer months to provide additional capacity. In addition, the groundwater near the site appears to flow toward the Wissahickon Creek and away from the public water supply wells.

Is the Borough of Ambler required to test for asbestos under EPA National Primary Drinking Water Regulations?

In Pennsylvania, the PADEP is the delegated authority for enforcing the drinking water regulations. Under the Drinking Water Act, the regulation for asbestos became effective in 1992. Between 1993 and 1995, EPA required water suppliers to collect water samples once and analyze them to find out if asbestos is present above the MCL. [17] If asbestos is present above this level, the system must continue to monitor quarterly. Based on information provided by PADEP, Ambler Borough, in response to the EPA asbestos regulation, conducted monitoring for asbestos in drinking water in the early 1990's. The results from the public drinking water system were below the MCL. [30]

In spring 2011, Ambler Borough applied for and received a waiver for sampling of asbestos in their water supply, after sampling wells in its distribution system for asbestos as part of DEP's waiver process. A waiver allows Ambler to sample for asbestos on a less frequent basis than the routine EPA sampling schedule. In order to be granted a waiver, water suppliers must first submit documentation showing that the contaminant in question had not been detected in recent monitoring. Only after the completed monitoring indicates that there were no detects can a waiver be granted. The granting of waivers follows the standards and requirements approved by EPA. Three of the four samples taken in 2011 showed no levels of asbestos. One sample initially showed 1 chrysotile fiber greater than 0.5 microns (but less than 10 microns). Upon reanalysis, that result could not be confirmed. Since the MCL for asbestos is 7 MFL, all of the samples met drinking water standards and satisfied PADEP public water supply requirements.

There are reports of Ambler Borough using asbestos containing pipes in the water supply system. Could asbestos be leaching from the pipes and entering the public water supply system?

The Borough of Ambler historically used asbestos-containing pipes in some areas of the public drinking water system. [19] However, due to the water chemistry and pipe construction, it is unlikely that asbestos from the pipes could leach into the water supply. The asbestos in the pipes is considered non-friable (meaning it won't crumble or break off) and therefore is not likely to enter the water stream. In addition, there are several other factors that would affect the potential degradation of the pipes. First, the inside of the pipes are coated with iron, which decreases the chance of degradation. Second, pH is the main cause of aggressive water, also called corrosive water. The pH of the Ambler water is neutral, generally ranging from 7.2-7.5, indicating the water is not aggressive and unlikely to cause deterioration of the pipes. Lastly, the level of calcium/hardness of the water, to a lesser degree, also affects potential break down. The water in Ambler generally is considered hard (ranging from around 30- 60 mg/L of calcium) making it less likely to degrade the pipes. [31]

To further address this concern, the Borough of Ambler, in conjunction with the PADEP, collected water samples along the distribution system, including locations at or near areas that may have asbestos containing pipes. Five samples were collected and the highest sampling result was 0.09 MFL, which is well below the Safe Drinking Water act standards of 7 MFL. [20]

Why were drinking water samples for asbestos not collected in West Ambler and South Ambler? These communities are the closest to the site.

EPA and PADEP preferentially selected areas and homes for sampling that receive drinking water from asbestos containing pipes. The reason outlying locations, versus downtown Ambler, were chosen was because the water headed to outlying homes would have spent a greater time in the pipes, and thereby more time for asbestos to potentially enter the water stream, representing the worst case scenario.

Ambler Borough had violations, historically, for PCE in public drinking water. Why were they granted a waiver by PADEP for PCE sampling?

In September 1996, Ambler public water sampling data showed four detections of PCE. Two of these detections (70 µg/L and 44 µg/L) exceeded EPA's MCL for PCE of 5 µg/L. As a result of these detections, the Ambler public water supply was required to collect additional monitoring sampling beginning in 1997 through 2011, as reported in the PADEP drinking water monitoring system. PCE was not detected from 1997 to 2001, or prior to 1996. In 2002 one sample for PCE contained a level of 0.6 µg/L, which is below the MCL. Based on these data, there were no detections above the MCL for PCE since 1996. [18] Thus these detects appear to be anomalies that could be attributed to sampling or laboratory errors or transient (non-lasting) conditions. [15]

In April 2011, Ambler Borough applied to PADEP and was granted waivers related to sampling of PCE, carbon tetrachloride, bis (2-ethylhexy) phthalate, and dioxins. This does not mean routine sampling ceases, only that the water authority is permitted to sample on a less frequent basis (once a year or every 3 years, rather than quarterly). In order to be granted a waiver, water suppliers must first submit documentation showing that the contaminant in question had not been detected in recent monitoring. Only after the completed monitoring indicates that there were no detects can a waiver be granted. All of the waivers granted followed standard requirements approved by EPA and applicable to all public water systems. Sampling schedules are based on federal requirements related to class of contaminant, source type, previous detections, treatment type, etc. Sampling cycles can vary from quarterly, annually or every three years for different contaminant classes. [32] All of Ambler's sources are in compliance with required monitoring cycles dictated by state and federal requirements. Please visit the PADEP public water systems for additional information on monitoring requirements and results: http://www.drinkingwater.state.pa.us/dwrs/HTM/SelectionCriteria.html

Public Comments

The BoRit Groundwater HC was released on August 3, 2012, and was available for public comments till October 3, 2012. The following summarizes public comments received by PADOH and ATSDR on the BoRit Groundwater HC, and the agencies' responses. PADOH grouped the comments by similar topic.

TASC report

Question: An additional independent review, commissioned by the BoRit CAG and funded by the EPA, called the TASC Summary and Review of Preliminary Phase II Groundwater Report for the BoRit Asbestos site, was being undertaken at the same time as the PADOH Groundwater HC. As a result of the coincidental time, this report was not featured in the PADOH HC. Information regarding data, lack thereof, and subsequent risk evaluation limitations, are not included in the PADOH HC and therefore not taken into consideration or referenced therein. The final version of the PADOH HC should take into considerations the findings of this report, which clearly demonstrate the need for further testing in order to properly assess the risk of any future contamination of the Ambler Borough public drinking water wells.

Response: As noted by this commenter, the PADOH public comment version health consultation report was released at the same time as the TASC report, and therefore, PADOH did not have the opportunity to review the TASC report prior to the release of the public comment version of this health consultation report. A summary of the major findings of the TASC report is included in this final version of the BoRit Groundwater health consultation document, as well as a website link to the full TASC report. Based on PADOH's review of the TASC report, if EPA and/or Ambler Borough collect additional groundwater information to establish if a potential "cone of influence" exists, then PADOH will evaluate these data and update our assessment accordingly.

Question: The HC stated that "the groundwater underneath the site does not appear to influence the public drinking water sources" and that "contaminants in groundwater from this site do not represent a completed pathway for this community. However the TASC report indicates that while no contamination of the Ambler Public water system wells has been demonstrated, there is "insufficient data to make a definitive statement about the lack of connectivity between the groundwater under the site and the Ambler public water system wells. The TASC report recommended further tests that would better establish the assumed lack of connectivity. We strongly suggest that the EPA perform further testing as recommended, or alternative testing which would provide proof of lack of connectivity for future water supplies to at least the same level of certainty.

Response: The TASC report states that "it does not appear that the public water supply wells have been impacted by the contaminants identified beneath the BoRit Site. Insufficient data exists to evaluate if the BoRit Site is within the radius of influence of the closest Ambler Borough supply wells under pumping conditions." The TASC report also concluded that the groundwater near the site is under confined to semi-confined conditions and the vertical distance between the shallow and deeper contamination do not support a direct connection between the shallow and bedrock groundwater. Given this information along with regular drinking water monitoring required by Ambler Borough, PADOH does not believe shallow groundwater is influencing the public drinking water supply. PADOH understands that this interpretation is made with incomplete information, and that therefore there is uncertainty associated with this finding. PADOH agrees with the commenter that currently additional information to further characterize the groundwater situation would be helpful. As stated in this HC document, PADOH and ATSDR recommend that EPA continue sampling the groundwater and surface water near the site, to monitor contaminant trends over time. If EPA's site groundwater investigations indicate a potential concern for offsite groundwater, we recommended that EPA conduct a private well survey near the site to establish if any private well users could be impacted by site-related contamination.

Question: The HC claims to know how the ground water flows (away from the public water supply). There is no mention of the "cone of influence" which can occur when a drinking water well is actively pumping and drawing water from farther away and even uphill. The TASC report stated that what is generally true about flow direction is not always true. I feel that more care or conditional statements are warranted in all these cases.

Response: PADOH acknowledges that this situation is possible; however, at this time we do not have information to evaluate if this scenario is occurring. The TASC report indicated based on the current evaluation, that groundwater generally flows away from the drinking water supplies. However, there could be differences in groundwater flow due to a "cone of influence." It is important to note that the TASC report also indicated the bedrock groundwater is under confined conditions and is unlikely influenced by the shallow groundwater near the BoRit site. If EPA and/or Ambler Borough collect additional groundwater information to establish a "cone of influence" that may be present during public water well pumping, PADOH will evaluate these data.

Manganese in Groundwater

Question: We realize manganese is an essential element but the orders of magnitude for manganese found at BoRit are far above the normal background range and so close to the Ambler. We know there is no mandatory MCL for manganese but there is a secondary recommendation level set by EPA. How is a community supposed to respond to the secondary MCL, which states it is an aesthetic consideration for taste and odor?

Response: First and foremost, it is important to emphasize that the health agencies are not aware of any people drinking this level of manganese in a private or public drinking water supply. We understand, however, based on discussions with CAG members that there is interest in understanding what the public health implications might be if people were drinking water with this concentration of manganese.

As the commenter points out, manganese is an essential nutrient. For most people, food is the primary source of manganese exposure. However, ingesting too much manganese in drinking water and/or food can cause health concerns. This response addresses the implication of exceeding the potability/non health based secondary standard for manganese, and the next response addresses the implication of exceeding the health-based screening values for manganese.

The maximum concentration of manganese in the monitoring wells at the BoRit site was 9,620 µg/L. This concentration of manganese significantly exceeds EPA secondary maximum contaminant level (SMCL) for public drinking water supplies for manganese of 50 µg/L. The manganese SMCL is based on aesthetic water quality parameters and is not a health-based level. Black to brown colored water, black staining and a bitter metallic taste will be the noticeable effects when manganese concentrations in water exceed 50 µg/L. Therefore, this level of manganese in a drinking water supply would not be considered palatable by most people, and private well owners and public water supplies would generally choose to treat a drinking water supply with this concentration of manganese to make it potable (drinkable). [35] Given the community concerns and the concentrations of manganese detected in the shallow groundwater under the BoRit site, PADOH will evaluate further shallow monitoring well samples from EPA to confirm if manganese levels in shallow groundwater under the site continue to be present. PADOH will continue to discuss with PADEP and the Borough of Ambler whether any additional sampling data are available from the Ambler public water supply for manganese exist, which would help determine if the public is being exposed to manganese in their drinking water.

Question: Levels of manganese were detected in water samples from monitoring well 3 and also from number 5 and 6 piezometer well samples at levels well above the EPA lifetime health advisory levels for drinking water. The very high level of manganese in samples from multiple wells appears to make it very unlikely that this is a chance finding. Manganese was detected at 9,620 µg/L. Can PADOH provide additional information on toxicity and health effects of manganese at such a high concentration?

Response: First and foremost, it is important to emphasize that the health agencies are not aware of any people drinking this level of manganese in a private or public drinking water supply at this site. We understand, however, based on discussions with CAG members that there is interest in understanding what the public health implications might be if people were drinking water with this concentration of manganese. It is important to note that manganese levels as high as those levels reported in the one on-site monitoring well would produce highly unpotable water with visual levels of contamination (e.g., black to brown color, black staining, and or bitter metallic taste). However, there is no evidence that this is currently occurring in the public water supply. [35]

For most people, food is the primary source of manganese exposure. This chemical is not considered to be carcinogenic and will only be evaluated here for non-cancer health effects. Comparing the maximum concentration of manganese detected in the BoRit monitoring well against health-based screening values, the maximum level of manganese detected in a BoRit monitoring well exceeds the EPA lifetime health advisory for drinking water value of 300 µg/L, the EPA RMEG of 500 µg/L for children, and the adult RMEG of 2,000 µg/L.

To address concerns about manganese and health, PADOH reviewed the scientific sources including information from the ATSDR draft toxicological profile for manganese and the WHO. Most results of adverse health effects to manganese are due to inhalation exposures in the workplace. The effects of manganese via ingestion are based on animal laboratory studies and epidemiology investigations. Limited data has shown that ingestion of high levels of manganese have been tied to neurological effects. There is some evidence to suggest, although not conclusive, that children exposed to high levels of manganese in drinking water may develop developmental effects, including behavior and learning. [36]

According to the WHO, manganese is often regarded as one of the least toxic elements, although there is some debate as to whether the neurological effects with inhalation exposure also occur with ingestion. Several cases of oral exposure to high level of manganese have described neurological impairments but qualitative and quantitative details of exposure are lacking. An epidemiological study in Japan of manganese in drinking water found adverse effects at manganese concentration of approximately 28,000 µg/L. An additional epidemiology study in Greece investigated long-term exposures to manganese and neurological effects in elderly. Three test areas were studied and included drinking water concentrations of manganese at 3.6-14.6 µg/L, 81-253 µg/L and 1,800-2,300 µg/L. The authors found that progressively higher levels of manganese resulted in higher prevalence of neurological symptoms. However, this study lacks details on other variables, including manganese in other sources such as food and dust. Another study in rural Greece found no neurological effects at 300 µg/L. [36]

Manganese is a normal constituent of groundwater and surface water. Groundwater in the United States contains a median manganese levels of 5 to 150 µg/L, with the 99th percentile at 2,900 µg/L and 5,600 µg/L, in rural and urban areas, respectively. [37] Groundwater acidity can affect the levels of manganese present. [36] It appears that the maximum manganese levels in the one BoRit monitoring well are above background levels for the area in the Stockton Formation aquifer (i.e., less than 3 µg/L to 870 µg/L). Manganese is not a required contaminant for monitoring, since it does not have a primary MCL, and therefore is not in the PADEP drinking water reporting system. [33] However, based on discussions with the PADEP Safe Drinking Water Program, Ambler sampled the public wells for manganese on November 28, 2012. Results of the pre-treatment data for manganese in two public well (#8 and #12) above the EPA secondary MCL, at 320 µgL and 50 µg/L, respectively. Public wells # 8 and 12 have treatment systems and therefore the levels of manganese at the tap would potentially be even lower

Evaluation of manganese in a drinking water supply must factor in simultaneous "background" ingestion of manganese from the rest of the diet. The WHO has estimated the average dietary intake of manganese ranges from approximately 2 to 8.8 milligrams per day (mg/day). EPA has estimated that the typical human intake of manganese from food is 1.28 micrograms per calorie (µg/calorie), which equates to 2.6 - 3.8 milligrams of manganese in 2000 - 3000 calorie diets. [37] The Food and Nutrition Board of the National Research Council has established Estimated Safe and Adequate Daily Dietary Intake Levels (ESADDI) for this nutrient that range from 0.3 mg/day for infants to 5 mg/day for adults. Institute of Medicine (IOM) and WHO have a tolerable upper intake level (UL) of 2-3 mg/day for 1-8 year old children; 6 mg/day for 9-13 year old children; 9 mg/day for children under 18 years of age; and, 11 mg/day for adults. (Note, these ULs include manganese from all sources, including food, water, and supplements.) [38]

Although no MRLs or RfDs have been established for manganese, ATSDR has used the upper range of the ESADDI level for manganese of 5,000 µg/day (5 mg/day) to establish an interim guidance value of 0.07 mg/kg/day [(5 mg/day)/(70 kg)]. Lower ESADDI levels for manganese are identified for children. Using the maximum ESADDI values for children (0.6-2 mg/day), an interim guidance dose values for a 16 kg child would be 0.12 mg/kg/day [(2 mg/day)/(16 kg)]. [38]

Using standard drinking water exposure assumptions for children and adults consuming the highest manganese level detected by in the BoRit groundwater (9,620 µg/L), the daily manganese dose from the drinking water alone (not including food) is 9.62 mg/day (0.601 mg/kg/day) for a 16 kg child and 19.2 mg/day (0.275 mg/kg/day) for an adult. Manganese at this level in drinking water would exceed ATSDR's interim guidance values for manganese through drinking water exposure alone, for both children and adults. [37] For example, food ingestion would add an additional 1.1-2.6 mg of manganese to a child's daily manganese exposure (based on 1.28 µg/calorie, and daily intake of 793 to 2,000 calories for a child). It should be noted that the interim guidance levels are based on what is considered to be a safe and adequate dietary intake and that adverse health effects have not been observed at these levels.

The Food and Nutrition Board of the NRC in 1989 determined an ESADDI of manganese to be 2-5 mg/day for adults. The lower end of this range was based on a study by McLeod and Robinson (1972), who reported equilibrium or positive balances at intakes of 2.5 mg/day or higher. The range of the

ESADDI also includes an "extra margin of safety" from the level of 10 mg/day, which the NRC considered to be safe for an occasional intake. While the NRC determined an ESADDI for manganese of 2-5 mg/day, some nutritionists feel that this level may be too low. Some researchers have suggested a range of 3.5-7 mg/day for adults based on a review of human studies. It is noted that dietary habits have evolved in recent years to include a larger proportion of meats and refined foods in conjunction with a lower intake of whole grains. The net result of such dietary changes includes a lower intake of manganese such that many individuals may have suboptimal manganese status. [39]
Considering the weight of evidence available for human health and exposure to manganese via ingestion, we would consider the maximum concentration of manganese detected in the BoRit monitoring well to be of public health concern for potential neurological and developmental health effects, if this were a drinking water source. However, as stated above, based on our currently understanding, PADOH is not aware any private drinking water supplies in close proximity to the site.

Private Wells

Question: The HERS subgroup strongly concurs with the recommendation that EPA conduct a private well-water survey near the site to identify any private well-water users who might be impacted by site-related contamination. We would hope that the relevant municipalities would help publicize efforts in this regard. The HERS working group suggests that the CAG may be able to help publicize actions which responded to the recommendation.

Response: In the public comment version of this Health Consultation as well as in this final version, PADOH recommends that if site groundwater investigations indicate groundwater contaminant(s) at levels of health concern offsite, EPA should conduct a private well survey near the site to establish if any private well users could be impacted by site-related contamination.

Question: Did the Montgomery County Health Department (MCHD) ask Upper Dublin or Ambler Water Department if they know of any private wells? I have heard of three wells in Ambler and one hydrant behind Lindenwold Ave. What proactive measures did MCHD take to learn of any additional wells? Was Delaware River Basin Commission (DRBC) asked about any wells?

Response: MCHD provided the information about private wells in the vicinity of the site to ATSDR Region 3 from their existing data base. MCHD records contain information on new private wells permitted after a certain date and wells brought to their attention because of a water quality complaint. To the best of our knowledge, MCHD did not ask Upper Dublin, Ambler Water Department, or DRBC about this question. PADOH is recommending that EPA take proactive measures to learn about additional wells by conducting a formal private well survey, which is a step taken at other Superfund sites with groundwater concerns.

Data Gaps

Question: As expressed in the HC, there are many gaps in the databases used by the state, including no testing of potentially important contaminants for a number of years. Although we do not believe that these data gaps are likely to be filled, CAG members feel it is important that uncertainties resulting from these data gaps continue to be acknowledged.

Response: We agree that data gaps are present at this site, as is the case with most if not all hazardous chemical exposure evaluations. We have tried to clearly delineate the data gaps and uncertainties affecting our public health reviews at the BoRit site.

Question: One outstanding difference between the TASC report and the PADOH HC is TASC report pointed out gaps in knowledge and how those gaps might be eliminated. The HC was careful to repeat that "based on available information" and does "not appear to". I feel that the HC does not fully "ensure that the community has the best information possible to protect public health." The HC only applies to the best information available and I feel the HC falls short of their stated primary goal and does not go far enough to answer community concerns or provide all relevant recommendations. On page 15 states, "best science available" – do you advocate for getting better data if there is insufficient data to draw definitive conclusions?

Response: Yes, PADOH does advocate for obtaining better data, including additional environmental sampling data, if we do not have enough information to make a public health conclusion. PADOH acknowledges in this health consultation document and in the prior public health reviews for this site there are important data gaps affecting our understanding of community's exposures, particularly for the past. In order to address gaps in the current knowledge, PADOH is recommending in this HC that EPA continue to sample the groundwater monitoring wells at the site, as well as consider collecting information on private wells in the area.

MCL for Asbestos in Drinking Water

Question: Will you include the date when EPA set standards for drinking water quality, and when the National Primary Drinking Water Regulations (i.e. EPA's MCL of 7 million fibers per liter of long fibers) were established that are relevant to the Ambler situation? What went into setting this standard? Do you think anyone in the CAG would drink water that contained 6,999,000 fibers of asbestos <10 um long?

Response: Under the Safe Drinking Water Act (SDWA), EPA is required to determine the level of contaminants in drinking water at which no adverse health effects are likely to occur. According to the Code of Federal Regulations, EPA published the current MCL for asbestos on January 30, 1991. EPA evaluated asbestos as a Category II contaminant via the oral route, based on limited evidence of carcinogenicity in animals. This evaluation considered the weight of evidence, pharmacokinetics and exposures. [40] The maximum contaminant level goal (MCLG) for asbestos is set at 7 MFL. EPA has set an enforceable regulation for asbestos, or MCL, at 7 MFL. MCLs are set as close to the health goals as possible, considering cost, benefits and the ability of public water systems to detect and remove contaminants using suitable treatment technologies. In this case, the MCL equals the MCLG, because analytical methods or treatment technology do not pose any limitation. [24]

The EPA asbestos MCLG, which is used to determine the MCL, was based on a RfD of 0.005 mg/kg/day. A RfD is an estimated, with an uncertainty spanning an order of magnitude, of daily exposure (including sensitive populations) that is likely to be without appreciable risk of deleterious health effects over a lifetime. The RfD is derived from a no observable adverse effect level (NOAEL) and/or lowest observable adverse effect level (LOAEL) identified from a specific chronic or sub-chronic study in animals. In the case of asbestos, the RfD is based a National Toxicology Program (NTP) bioassay showing benign tumors in male rats following ingestion of chrysotile asbestos fibers (>10 microns). In setting the MCL, EPA acknowledged that there are limited data on the dose response relationship. [37] EPA periodically reviews and updates MCLs, if needed, based on new information and scientific studies. In 2003, EPA reviewed asbestos as part of the Six Year Review and determined that the 7 MFL MCL is still protective of public health. [41] From a potability standpoint, we agree that residents might find a drinking water supply with a high concentration of fibers not palatable. That would be parallel to a secondary MCL concern or aesthetic effect.

Ingestion of Asbestos and Health Effects

Question: In terms of asbestos in drinking water and cancer, it is a distracting to say that drinking asbestos would unlikely increase risk of developing lung cancer or mesothelioma, without adding that health impacts to esophagus, stomach and intestines are more relevant to drinking asbestos. The statements in Toxicology Information leave me feeling there is just not enough information to make a definitive conclusion. I am left concerned. "higher than average death rates" "extra non-fatal polyps" "disagreement" "sex-inconsistent significantly elevated risks for male stomach". So concluding that "It does not appear that asbestos ingested…" feels hedging.

Response: The commenter is correct that effects to the gastrointestinal system would appear to have the most relevance for health impacts from ingestion of asbestos in drinking water. However, it can be hard to make sense of the conflicting information available about asbestos exposures and non-respiratory cancers. Research has shown an inarguable link between exposure to asbestos and respiratory cancers in humans. This is not the case with other types of cancers or other any other potential health effects to the gastrointestinal system (e.g., esophagus, stomach, and intestines). This is why we do not make emphatic statements about health impacts to these other parts of the body. This is not an attempt to be distracting, it is just that the evidence base does not support firm conclusions. Despite a few studies reporting some associations, most studies do not show a consistent relationship between asbestos exposures and non-respiratory effects. Additional information on these epidemiology studies is presented in the Epidemiology Studies section above.

Question: For all cited studies in the Epidemiology Section: What was the N=? What was the length of the study? How many or what percent of Ns were lost over that time? I cannot conclude as readily as you that there is no consistent evidence or correlation of a cancer risk from asbestos in water.

Response: In order to investigate ingestion of asbestos in drinking water, PADOH looked at the relevant laboratory animal and human epidemiological studies of ingestion of asbestos PADOH provided additional information on the populations evaluated in these studies in the Epidemiology Section, as recommended by the above public comment, if available. Additional details of these epidemiology studies is included in the section above.

The epidemiological studies described in this HC, use a cohort study design, including a prospective study or cancer incidence study, or a case-control design study. In a prospective study, a study population is selected based on their exposure (i.e. asbestos in drinking water or no asbestos in drinking water), regardless of whether they have the disease or health outcome being studied. Next, the study determines the outcomes such as cancer rate and compares them on the basis of the individuals' exposures (i.e. control group verses exposed group). A cancer incidence study investigates if the rates of cancer in the area of interest are higher than expected, based on state rates. In a case-control study (also referred to as retrospective studies), researchers work backwards, from the effect to the suspected cause. Participants are selected on the basis of the presence or absence of the disease or outcome in question, so there is one group of people with the health problem (case-subjects) and one without (controls). These groups are then compared to determine the presence of specific exposures or risk factors. Often times, epidemiological studies cannot evaluate other potential factors or sources of exposure including, diet, smoking, alcohol consumption and occupation. Information on lost over time is not relevant in a cohort study design, because the cases are based on those reported to the state cancer registry. [42] In the case-control in Washington State, described in the Epidemiology Section, the researchers provided the number of eligible cases and the number of number of people interviewed in the study. Based on this, a percent refusal rate was calculated. The case and control refusal rates were low at 13.5% and 11.7%, respectively. [26]

The WHO describes asbestos in drinking water as follows. "There has been little convincing evidence of the carcinogenicity of ingested asbestos in epidemiological studies of populations with drinking water supplies containing high concentrations of asbestos. In extensive laboratory studies, asbestos has not consistently increased the incidence of tumors in the gastrointestinal tract. There is not consistent evidence that ingested asbestos is hazardous to health". [25]

Other exposure pathways

Question: Ambler Asbestos Piles NPL site and BoRit site are air contamination sites, not groundwater or drinking water sites. The mesothelioma and lung cancer incidence in this community are not caused by groundwater, but caused by an inhalation. Why is there not the same attention to ambient air quality as groundwater? Long term air monitoring of this community has never occurred here. However, drinking water is monitored by local and state government all the time. Tropical storm Lee did serious damage to the EPA containment system. Have any ambient air quality tests been performed after that failure to determine if airborne release of asbestos occurred, or is still occurring?

Response: We agree that the air pathway is of highest relevance for public health concerns at this site. The public health agencies have reviewed the potential for historical and current air exposures to community members in prior documents, and continue to prioritize evaluation of the air pathway in our ongoing work at this site. Some community members have expressed concern that asbestos or other chemicals could be present in residential drinking water as a result of contamination from the site. In response to this concern, PADOH developed this specific health consultation. EPA has conducted air sampling along the perimeter of the site, during the removal activity work at the site, in the community, along the local trail network, and in a background location. Based on the previous HC completed by PADOH, ambient air samples collected near the site and in the community to date have not detected asbestos at levels of health concern. PADOH will continue to review the most recently collected air sampling results from the site area as part of the future Public Health Assessment for the site.

Question: In addition to any risks that might follow from ingestion of asbestos from dietary water, the presence and use of water containing asbestos for private or commercial purpose could result in airborne asbestos fibers remaining after the water has evaporated. Since inhalation of airborne asbestos is known to be harmful we would like this possibility evaluated.

Response: Unfortunately, there are not reliable methods at this time that can predict asbestos concentrations in air given concentrations in other environmental media (e.g., soil or water). Therefore, it would be difficult to estimate inhalation risk from concentrations of asbestos in drinking water. If this were to be pursued further, likely air sampling would be needed at a residence with a drinking water source contaminated with asbestos. However, this is not a relevant pathway for follow up at this time, because we do not have evidence at this site that drinking water sources (either public or private) in the site area are contaminated with asbestos. The limited sampling information for the public water supply from PADEP indicates that there is not asbestos contamination in the public drinking water supply. Given that the public drinking water wells are at much deeper depths and would not likely influenced by any surface contamination, this is consistent with the fact that we would not expect this to be a major pathway of exposure. Further, as discussed in other portions of this document, we are not aware of any private wells in use in the immediate vicinity of the site. If any private wells are identified in use near the site in the future, and if these wells are sampled for asbestos, than we could consider this potential pathway further.

Asbestos-containing Pipes

Question: Can you explain why hard water is less corrosive. Or less likely to degrade pipes?

Response: Many factors can affect corrosion of pipes used in water distribution systems, including the chemistry and characteristics of the water. The tendency of water to be corrosive depends on the pH, alkalinity, and concentrations of calcium, magnesium, phosphates, and silicates dissolved in the water. Hard water is defined as having higher level of dissolved calcium and magnesium ions. If water is "hard," it is less likely to leach metals from plumbing pipes and often leaves a deposit on the inside of the pipe. Whereas, if water is "soft" it has a lower tendency to leave deposits on the inside of plumbing pipes and might result in degradation of the pipes. [43] The Ambler water is generally considered to be hard (more alkaline), making it less likely to degrade the pipes.

Sampling

Question: In Spring 2011, the Amber Borough applied for and was granted a waiver for asbestos after sampling wells in its distribution system for asbestos as part of PADEP's waiver process. Was Well #4 specifically included in that sampling (or the wells closest to the BoRit site)? Were all active wells included in that sampling? Was sampling done at the well sites or further down the distribution system?

Response: According to the PADEP drinking water monitoring reporting system, all 11 well locations (including well #4) were included in the sampling for asbestos. The PADEP waiver for asbestos sampling is granted for all these wells and is set to expire in 2019. The EPA's Standardized Monitoring Framework allows States to grant waivers to water systems to reduce the sampling frequencies to once every 3, 6 or 9 years for inorganic compounds, synthetic organic compounds, and volatile organic compounds. Waivers of sampling requirements are granted for specified contaminants based on both a vulnerability assessment and the analytical results of previous sampling. The vulnerability assessment may be based on a determination that either the contaminant has not been used in the area or that the system is not susceptible to contamination. [44]

Question: The HC states that "EPA will be continuing its investigation of the groundwater at this site." I recall EPA stating they are not planning any further ground water sampling. Will PADOH or ASTDR proactively encourage EPA to agree to continue to sample groundwater and surface water?

Response: Per the recommendation in this Health Consultation, PADOH and ATSDR recommend that EPA continue to sample the groundwater and surface water near the site, to monitor contaminant trends over time. PADOH and ATSDR will continue to discuss implementation of this recommendation with EPA. EPA has publicly stated at CAG meetings that the agency plans to conduct future sampling of the on-site groundwater wells.

Conclusions

1. Based PADOH's current understanding, the groundwater underneath the site is not used for drinking for the public drinking water supply and therefore does not pose a health concern. A review of the groundwater monitoring well data showed asbestos levels well below the MCL. Carbon tetrachloride, tetrachloroethylene (PCE), and bis(2-ethylhexy)phthalate were detected in some groundwater wells at levels above EPA's MCL. Bis (2-ethylhexy) phthalate is a common lab contaminant and was also detected in the field blank sample from this sampling event.

2. Based on a review of the public water supply sampling data for the Ambler area, exposure to asbestos, and other contaminants, in public drinking water is not expected to harm people's health. Based on the current monitoring data for the Ambler Borough public water system, this public water supply, contaminants are below their respective MCLs and CVs and is in compliance with Safe Drinking Water Act requirements.

3. It appears that private well use near the site is very limited. However, PADOH do not have much information on private well use or sampling of private wells in the site area and cannot currently make a conclusion regarding the risk to public health from private wells in the area. Although public water is the main source of drinking water in the area, there are some private wells in the vicinity. No private wells are documented in Ambler Borough or Upper Dublin, but there are some private wells documented in Whitpain Township. A few of these wells appear to be approximately 2 miles from BoRit site.

4. Although not specific to this health consultation, PADOH supports the removal actions currently underway at the site and recommends EPA continue plans for a permanent remedy for the site that will reduce any public health hazards.

Recommendations

1. PADOH recommends that EPA continue sampling the groundwater and surface water near the site, to monitor contaminant trends over time.

   Given the community concerns and the concentrations of manganese detected in the shallow groundwater under the BoRit site, PADOH will evaluate future monitoring well samples collected by EPA to confirm if manganese levels in shallow groundwater under the site continue to be present. PADOH will continue to discuss with PADEP and the Borough of Ambler whether any additional sampling data are available from the Ambler public water supply for manganese, which would help determine if the public is being exposed to manganese in their drinking water.

2. If EPA's site groundwater investigations indicate groundwater contaminant(s) at levels of health concern offsite, EPA should conduct a private well survey near the site to establish if any private well users could be impacted by site-related contamination.

3. While not site-related, PADOH routinely recommends, as prudent public health practice, that all private well owners in Montgomery County and throughout the Commonwealth of Pennsylvania have their water tested. For additional information on private water wells and testing:

    - For general information on private wells, visit the PADEP website: http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/SrceProt/well/default.htm
    - Any private well owner, regardless of where they live, should have their drinking water tested on a regular basis.
        - Montgomery County residents with private wells may want to visit the county health department's well testing program website at: http://health.montcopa.org/health/cwp/view,A,3,Q,65367.asp The Penn State Extension Program offers well water testing at low costs. You may contact the Montgomery County Extension Office for further information at 610-489-4315 or visit the Penn State Extension lab testing website: http://www.aasl.psu.edu/Water_drinking_main.html

Public Health Action Plan

The public health action plan for the site contains a description of actions that have been or will be taken by PADOH. 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:

In 2007-2009, PADOH prepared 3 previous health consultations for the site, including two health consultations evaluating on-site and off-site air sampling data for asbestos and one health consultation on health outcome data;

In 2008, PADOH prepared a community factsheet summarizing the air sampling health consultation;

In 2011, at the request of the community, PADOH prepared an updated cancer evaluation in the communities surrounding the site;

In 2011, PADOH prepared a community fact sheet on the updated cancer evaluation for the Ambler area and distributed it to the community;

In 2011, PADOH collaborated with the University of Pennsylvania Occupational Medicine Program and reached out to health professionals serving the Ambler community;

In 2011, PADOH updated Ambler area nurse practitioners on the status of the former asbestos site and solicited their experience in serving the community surrounding the site. PADOH distributed a poster on asbestos risk factors which is designed to encourage at-risk individuals to discuss their concerns with their primary health provider; and

In 2012, PADOH prepared this health consultation document for the site;

PADOH serve as members of the BoRit CAG and attend bimonthly CAG meetings

Public health actions that currently are being or will be implemented:

PADOH will consider reviewing the RI/FS data, and any additional environmental sampling data, collected at the site and from area public and private drinking water supplies;

PADOH remain interested in knowing of any private wells near the site and reviewing any private well sampling data, if requested;

PADOH will make this health consultation available to the residents and will be available to answer the residents' health questions;

PADOH will remain available to discuss any public health questions or concerns related to the site with community members and local authorities;

PADOH will attend meetings with the community, as well as state and local government agencies; and

If EPA and/or Ambler Borough collect additional groundwater information to establish if a potential "cone of influence" exists, PADOH will evaluate these data and update our assessment accordingly.

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Report Preparation

This Health Consultation for the BoRit Site was prepared by the Pennsylvania Department of Health (PADOH) under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented. ATSDR's approval of this document has been captured in an electronic database, and the approving agency reviewers are listed below.

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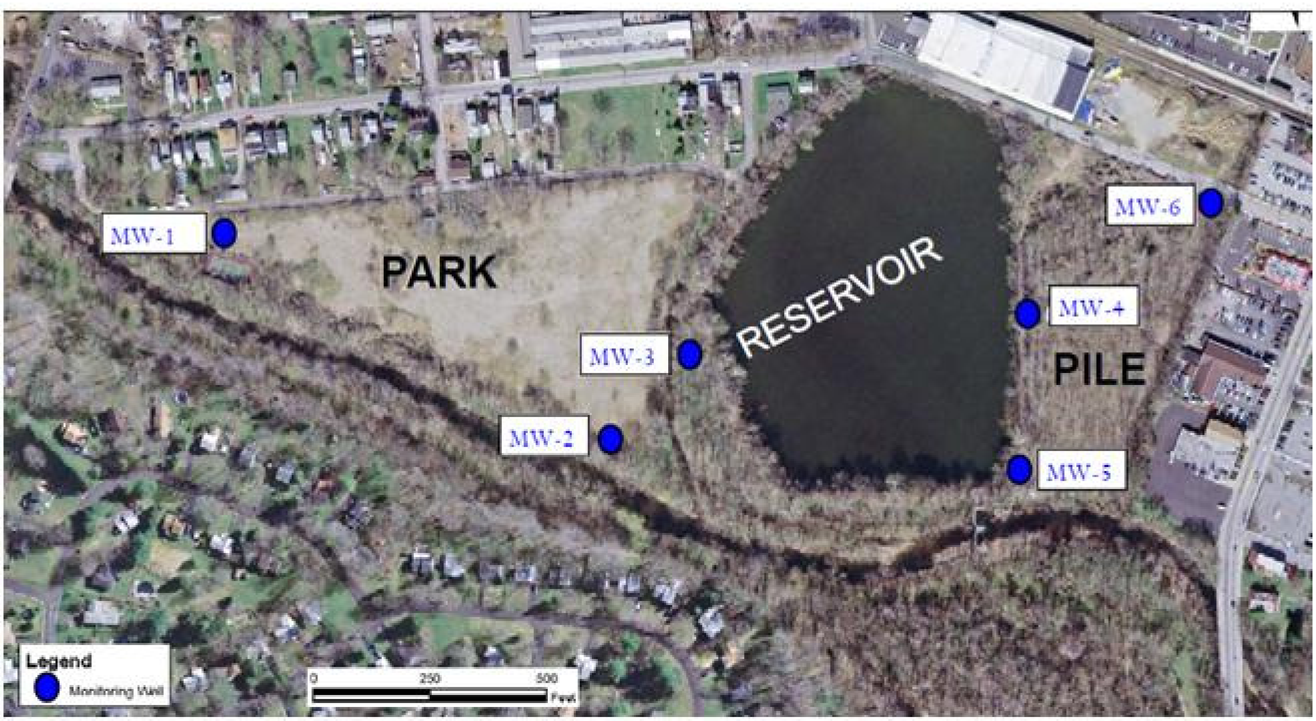
Appendix 1: Figures

Figure 1- Overview map of the BoRit site.

Figure 2- Map of approximate piezometer locations at the BoRit asbestos site

Figure 3 – Map of groundwater monitoring well locations at the BoRit asbestos site



Appendix 2: Piezometer results

Table 1 – 2010 piezometer data (µg/L) for Volatile Organic Compounds (VOC's) collected on the BoRit asbestos site.

	Pile			Park			
VOCs	**1**	**2**	**3**	**1**	**2**	**2 Dup**	**3**
1,1,1-Trichloroethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,1,2,2-Tetrachloroethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.12J	0.5U
1,1,2-Trichloroethane	0.5U	0.5UL	0.5UL	0.5U	0.5U	0.5UL	0.5UL
1,1-Dichloroethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,1-Dichloroethene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,2,3-Trichlorobenzene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,2,4-Trichlorobenzene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,2-Dibromo-3-chloropropane	R	R	R	R	R	R	R
1,2-Dibromoethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,2-Dichlorobenzene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,2-Dichloroethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,2-Dichloropropane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,3-Dichlorobenzene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,4-Dichlorobenzene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
1,4-Dioxane							
2-Butanone	14 L	78 L	1400 L	350L	21L	46L	52L
2-Hexanone	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
4-Methyl-2-pentanone	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Acetone	5.6B	5.7B	3.3B	3.7B	6.8B	5.4B	7.1B
Benzene	0.5U	0.5U	0.5U	0.5U	5.1	6	2.6
Bromochloromethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Bromodichloromethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Bromoform	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Bromomethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
CarbonDisulfide	0.43B	0.73	1.1	0.089B	0.71	0.57B	0.49B
Carbontetrachloride	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Chlorobenzene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Chloroethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Chloroform	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Chloromethane	0.15B	0.5U	0.5U	0.14B	0.5U	0.079B	0.5U
cis-1,2-Dichloroethene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
cis-1,3-Dichloropropene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5UL	0.5UL
Cyclohexane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Dibromochloromethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Dichlorodifluoromethane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Ethylbenzene	0.5U	0.5U	0.5U	0.5U	0.11J	0.11J	0.28J
Isopropylbenzene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
m,p-Xylene	0.5U	0.5U	0.5U	0.5U	0.4J	0.43J	2.6
Methylacetate	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Methylcyclohexane	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	1.2
Methylenechloride	0.086B	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U

Table 1 (continued) – 2010 piezometer data (µg/L) for VOC's collected on the BoRit asbestos site.

	Pile			Park			
VOCs	**1**	**2**	**3**	**1**	**2**	**2 Dup**	**3**
Methyltert-butylether	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
o-Xylene	0.5U	0.5U	0.5U	0.5U	0.21J	0.23J	0.63
Styrene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Tetrachloroethene	0.5U	0.5U	0.5U	0.075J	0.084J	0.074J	0.5U
Toluene	0.056J	0.054J	0.5U	0.056J	1.2	1.4	0.77
trans-1,2-Dichloroethene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
trans-1,3-Dichloropropene	0.5U	0.5UL	0.5UL	0.5U	0.5U	0.5UL	0.5UL
Trichloroethene	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Trichlorofluoromethane	0.5U	0.5U	0.5U	0.067J	0.5U	0.5U	0.5U
Vinylchloride	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U

UL = Not detected, quantitation limit is probably higher.
B = Analyte not detected substantially above the level reported in laboratory or field blanks
J = Analyte present. Reported value may not be accurate or precise.
U = Analyte not detected
R = Rejected result. Analyte may or may not be present in sample.

Table 2 – 2010 piezometer data (µg/L) for Semi Volatile Organic Compounds (VOC's) collected on the BoRit asbestos site.

	Pile			Park	
SVOC's	**1**	**2**	**3**	**1**	**3**
1,1'-Biphenyl	25U	10U	5U	5U	5U
1,2,4,5-Tetrachlorobenzene	25U	10U	5U	5U	5U
2,2'-Oxybis(1-chloropropane)	25U	10U	5U	5U	5U
2,3,4,6-Tetrachlorophenol	25U	10U	5U	5U	5U
2,4,5-Trichlorophenol	25U	10U	5U	5U	5U
2,4,6-Trichlorophenol	25U	10U	5U	5U	5U
2,4-Dichlorophenol	25U	10U	5U	10U	10U
2,4-Dimethylphenol	25U	10U	5U	5U	5U
2,4-Dinitrophenol	50U	20U	10U	5U	5U
2,4-Dinitrotoluene	25U	10U	5U	5U	5U
2,6-Dinitrotoluene	25U	10U	5U	5U	5U
2-Chloronaphthalene	25U	10U	5U	5U	5U
2-Chlorophenol	25U	10U	5U	5U	1.7J
2-Methylnaphthalene	25U	10U	5U	5U	5U
2-Methylphenol	25U	10U	5U	5U	5U
2-Nitroaniline	25U	10U	5U	10U	10U
2-Nitrophenol	25U	10U	5U	5U	5U
3,3'-Dichlorobenzidine	R	10U	5U	5U	5U
3-Nitroaniline	50U	9.2J	10U	10U	10U
4,6-Dinitro-2-methylphenol	50U	20U	10U	10U	10U
4-Bromophenyl-phenylether	25U	10U	5U	5U	5U
4-Chloro-3-methylphenol	25U	10U	5U	5U	5U
4-Chloroaniline	R	10U	5U	5U	5U
4-Chlorophenyl-phenylether	25U	10U	5U	5U	5U
4-Methylphenol	25U	10U	5U	5U	5U
4-Nitroaniline	50U	20U	10U	10U	10U
4-Nitrophenol	50U	20U	10U	10U	10U
Acenaphthene	25U	10U	5U	10U	10U
Acenaphthylene	25U	10U	5U	5U	5U
Acetophenone	25U	10U	5U	5U	5U
Anthracene	25U	10UL	5U	5U	5U
Atrazine	25U	10UL	5U	5U	5U
Benzaldehyde	25U	10U	5U	5U	5U
Benzo(a)anthracene	25U	10UL	5U	5UL	5U
Benzo(a)pyrene	25U	R	5UL	5UL	5U
Benzo(b)fluoranthene	25U	R	5UL	5UL	5U
Benzo(g,h,i)perylene	25U	R	5UL	5UL	5U
Benzo(k)fluoranthene	25U	R	5UL	5UL	5U
Bis(2-chloroethoxy)methane	25U	10U	5U	5U	5U
Bis(2-chloroethyl)ether	25U	10U	5U	5U	5U
Bis(2-ethylhexyl)phthalate	25U	10U	5U	5U	5U
Butylbenzylphthalate	25U	10U	5U	5U	5U

Table 2 (continued) – 2010 piezometer data (μg/L) for SVOC's collected on the BoRit asbestos site.

	Pile			Park	
SVOC's	**1**	**2**	**3**	**1**	**3**
Caprolactam	25U	10U	5U	5U	5U
Carbazole	25U	10U	5U	5U	0.58J
Chrysene	25U	10U	5U	5UL	5U
Dibenzo(a,h)anthracene	25U	R	5UL	5UL	5U
Dibenzofuran	2.6	10U	5U	5U	5U
Diethylphthalate	25U	10U	5U	5U	5U
Dimethylphthalate	25U	10U	5U	5U	5U
Di-n-butylphthalate	25U	10U	5U	5U	5U
Di-n-octylphthalate	25U	10U	5U	5U	5U
Fluoranthene	25U	10U	5U	5UL	5U
Fluorene	5.1	10U	5U	5U	5U
Hexachlorobenzene	25U	10U	5U	5U	5U
Hexachlorobutadiene	25U	10U	5U	5U	5U
Hexachlorocyclopentadiene	R	10U	5U	5U	5U
Hexachloroethane	25U	10U	5U	5U	5U
Indeno(1,2,3-cd)pyrene	25U	R	5UL	5UL	5U
Isophorone	25U	10U	5U	5U	5U
Naphthalene	25U	10U	5U	5U	2.1J
Nitrobenzene	25U	10U	5U	5U	5U
N-Nitroso-di-n-propylamine	25U	10U	5U	5U	5U
N-Nitrosodiphenylamine	25U	10U	5U	5U	5U
Pentachlorophenol	50U	20U	5U	10U	10U
Phenanthrene	11J	10UL	5U	5U	5U
Phenol	25U	10U	5U	5U	5U
Pyrene	4.5J	10UL	5U	5U	5U

UL = Not detected, quantitation limit is probably higher.
B = Analyte not detected substantially above the level reported in laboratory or field blanks
J = Analyte present. Reported value may not be accurate or precise.
U = Analyte not detected
R - Rejected result. Analyte may or may not be present in sample.

Table 3– 2010 piezometer data (µg/L) for polychlorinated biphenyls (PCBs) and pesticides collected on the BoRit asbestos site.

	Pile			Park			
PCB's/Pesticides	**1**	**2**	**3**	**1**	**2**	**2 Dup**	**3**
Aroclor-1016	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
*Aroclor-1221	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
*Aroclor-1232	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
*Aroclor-1242	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
*Aroclor-1248	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
*Aroclor-1254	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
*Aroclor-1260	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
*Aroclor-1262	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
*Aroclor-1268	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
Pesticide Compound	1.4UJ	1U	1UJ	1U	1UJ	1U	1UJ
4,4'-DDD	0.0057J	0.1U	0.1UJ	0.1UL	0.1UJ	0.1UJ	0.1U
4,4'-DDE	0.1U	0.1U	0.1U	0.1UL	0.1UL	0.1UJ	0.1U
4,4'-DDT	0.1U	0.1U	0.1U	0.1UL	0.1UL	0.1UJ	0.1U
Aldrin	0.05U	0.05U	0.05U	0.05UL	0.05UJ	0.05UJ	0.05U
alpha-BHC	0.05U	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05U
alpha-Chlordane	0.05U	0.05U	0.05U	0.05UL	0.05UJ	0.05UJ	0.05U
beta-BHC	0.0058J	0.0058J	0.05U	0.05UL	0.05UJ	0.05UJ	0.0087J
delta-BHC	0.05U	0.05U	0.05U	0.05UL	0.05UJ	0.05UJ	0.05U
Dieldrin	0.1UL	0.1U	0.1U	0.1UL	0.1UL	0.1UJ	0.1U
Endosulfan I	0.05UL	0.05U	0.05U	0.05UL	0.05UJ	0.05UJ	0.05U
Endosulfan II	0.0096J	0.0096J	0.1U	0.1UL	0.1UJ	0.1UJ	0.1U
Endosulfan sulfate	0.1U	0.1U	0.0076J	0.1UL	0.0080J	0.1UJ	0.1U
Endrin	0.1U	0.1U	0.1U	0.1UL	0.1UJ	0.1UJ	0.1U
Endrin aldehyde	0.1U	0.1U	0.1U	0.1UL	0.1UJ	0.1UJ	0.1U
Endrin ketone	0.01J	0.01J	0.1U	0.1UL	0.1UJ	0.1UJ	0.1U
gamma-BHC (Lindane)	0.05U	0.05U	0.05U	0.05UL	0.05Uj	0.05UJ	0.05U
gamma-Chlordane	0.05U	0.05U	0.05U	0.05UL	0.05Uj	0.05UJ	0.05U
Heptachlor	0.05U	0.05U	0.05U	0.05UL	0.05Uj	0.05UJ	0.05U
Heptachlor epoxide	0.05U	0.05U	0.05U	0.05UL	0.05Uj	0.05UJ	0.05U
Methoxychlor	0.5U	0.5U	0.051J	0.0064J	0.0071J	0.5UJ	0.5U
Toxaphene	5U	5UL	5U	5UL	5UJ	5UJ	5U

UL = Not detected, quantitation limit is probably higher.
B = Analyte not detected substantially above the level reported in laboratory or field blanks
J = Analyte present. Reported value may not be accurate or precise.
U = Analyte not detected

Table 4 - 2010 piezometer data (µg/L) for metals and inorganics collected on the BoRit asbestos site.

	Pile			Park			
Metals and Inorganics	1	2	3	1	2	2Dup	3
ALUMINUM	200U	1340	7380	6760	10500	8250	3760
ANTIMONY	60U	60U	60U	60U	60U	60U	60U
ARSENIC	6.3J	22.7	28.9	4.1J	15.2	17.2	12.2
BARIUM	317	924	1810	1600	2430	2820	154J
BERYLLIUM	5U	5U	10.3	8.8	16.9	18.2	5U
CADMIUM	5U	5U	5U	2.9J	5U	5U	5U
CALCIUM	729000	472000	146000	97200	61300	79900	34700
CHROMIUM	10U	8.2J	25.3	15.7	28	26.9	14
COBALT	50U	50U	42.2J	92	62.6	72.5	50U
COPPER	25U	25U	33.3	158	25U	25U	25U
CYANIDE	4.9J	10UL	10UL	7.9J	10UL	10UL	10UL
IRON	19800	27800	87300	5320	85600	111000	8710
LEAD	5.7J	5.5J	69.6	512	29.4	17.1	26.8
MAGNESIUM	179000	17100	23500	25400	7770	9360	2550J
MANGANESE	1180	7210	11500	5150	3750	5670	148
MERCURY	0.087B	0.071B	0.064B	0.067B	0.069B	0.069B	0.069B
NICKEL	11.5J	2.1J	51.6	51.3	41.5	39.4	18.5J
POTASSIUM	60900	24100	18300	41300	60000	65900	49200
SELENIUM	35U	35U	35U	35U	35U	35U	35U
SILVER	10U	10U	10U	10U	10U	10U	10U
SODIUM	11800	8830	31100	18900	56700	59900	18400
THALLIUM	25U	25U	25U	25U	25U	25U	25U
VANADIUM	50U	50U	134	53.3	203	189	25.4J
ZINC	1280	84	128	900	117	118	91.8

B = Analyte not detected substantially above the level reported in laboratory or field blanks
J = Analyte present. Reported value may not be accurate or precise.
U = Analyte not detected

Table 5 –Piezometer water sampling data for asbestos collected at the BoRit site.

Asbestos, chrysotile (MFL)	Park								**Pile**					
	1a	1b	2a	2b	2a Dup	2b Dup	3a	3b	1a	1b	2a	2b	3a	3b
	3384	6057	7838	1247	4547	2565	2076	1440	4008	1211	19952	9441	19315	34204

MFL= Millions of asbestos fiber per liter

Appendix 3: Groundwater monitoring well results

Table 1 – 2010 groundwater monitoring well results (µg/L) for VOCs collected at the BoRit site.

		Park		Reservoir			Pile		CV	CV Type
VOCs	**MW1**	**MW1a**	**MW2**	**MW 3**	**MW 4**	**MW5**	**MW5**	**MW 6**		
1,1,1-Trichloroethane									200	MCL
1,1,2,2-Tetrachloroethane									0.2	CREG
1,1,2-Trichloro-1,2,2-trifluoroethane									1,000,000	RMEG
1,1,2-Trichloroethane									0.6	CREG
1,1-Dichloroethane									0.4	CREG
1,1-Dichloroethene									300	Chronic EMEG
1,2,3-Trichlorobenzene										
1,2,4-Trichlorobenzene									70	MCL
1,2-Dibromo-3-chloropropane									0.2	MCL
1,2-Dibromoethane									0.02	CREG
1,2-Dichlorobenzene									600	MCL
1,2-Dichloroethane									0.4	CREG
1,2-Dichloropropane									5	MCL
1,3-Dichlorobenzene									700	Inter EMEG
1,4-Dichlorobenzene									75	MCL
1,4-Dioxane			UL	UL	UL	UL	UL		0.3	CREG
2-Butanone									4000	LTHA
2-Hexanone									200	RMEG
4-Methyl-2-pentanone										
Acetone	13	9.4B							70,000	RMEG
Benzene									0.6	CREG
Bromochloromethane									90	LTHA
Bromodichloromethane									0.6	CREG
Bromoform									4	CREG
Bromomethane									700	RMEG
CarbonDisulfide									40	MCL
Carbontetrachloride			**5.8**						5	MCL
Chlorobenzene									100	MCL
Chloroethane										
Chloroform									80	MCL
Chloromethane									30	LTHA
cis-1,2-Dichloroethene									70	MCL
cis-1,3-Dichloropropene										
Cyclohexane										
Dibromochloromethane									80	MCL
Dichlorodifluoromethane									7000	RMEG
Ethylbenzene									700	MCL
Isopropylbenzene										
m,p-Xylene									7000 total Xylene	Chronic EMEG
Methylacetate										
Methylcyclohexane										
Methylenechloride	9.0B	13B	6.6B	6.3B	6.7B	6.8B	6.6B	9.5B	**5**	MCL

Table 1 (continued) – 2010 groundwater monitoring well results (µg/L) for VOC's collected at the BoRit site

VOCs	MW1	MW1a	MW2	MW 3	MW 4	MW5	MW5	MW 6		
Methyltert-butylether									10,000	Inter EMEG
o-Xylene									7000 total Xylene	Chronic EMEG
Styrene									100	MCL
Tetrachloroethene			**22**						17	CREG
Toluene									700	RMEG
trans-1,2-Dichloroethene									100	MCL
trans-1,3-Dichloropropene										
Trichloroethene									0.76	CREG
Trichlorofluoromethane			30						2000	LTHA
Vinylchloride									0.02	CREG

MCL = EPA Maximum Contaminant Level
CV = ATSDR Comparison Value
CREG = ATSDR Cancer Risk Evaluation Guide
EMEG = ATSDR Environmental Media Evaluation Guide
RMEG = ATSDR Reference Dose Media Evaluation Guide
LTHA = EPA Lifetime Health Advisory for drinking water
Blank cells = analyte not detected
Bolded sample results indicated levels exceeding either the MCL or ATSDR CV

Table 2 – 2010 groundwater monitoring well results for SVOCs (µg/L) collected at the BoRit site.

		Park			Reservoir		Pile		CV	CV Type
SVOC's	MW1	MW1a	MW2	MW 3	MW 4	MW5	MW5 Dup	MW 6		
1,1'-Biphenyl										
1,2,4,5-Tetrachlorobenzene									10	RMEG
2,2'-Oxybis(1-chloropropane)										
2,3,4,6-Tetrachlorophenol									1000	RMEG
2,4,5-Trichlorophenol									4000	RMEG
2,4,6-Trichlorophenol									3	CREG
2,4-Dichlorophenol									100	RMEG
2,4-Dimethylphenol									700	RMEG
2,4-Dinitrophenol									70	RMEG
2,4-Dinitrotoluene									70	RMEG
2,6-Dinitrotoluene									70	RMEG
2-Chloronaphthalene									3000	RMEG
2-Chlorophenol									40	LTHA
2-Methylnaphthalene									1000	Chronic EMEG
2-Methylphenol										
2-Nitroaniline										
2-Nitrophenol										
3,3'-Dichlorobenzidine									0.08	CREG
3-Nitroaniline										
4,6-Dinitro-2-methylphenol										
4-Bromophenyl-phenylether										
4-Chloro-3-methylphenol										
4-Chloroaniline									100	RMEG
4-Chlorophenyl-phenylether										
4-Methylphenol										
4-Nitroaniline										
4-Nitrophenol									60	LTHA
Acenaphthene									2000	RMEG
Acenaphthylene										
Acetophenone									4000	RMEG
Anthracene									10000	RMEG
Atrazine									100	RMEG
Benzaldehyde									4000	RMEG
Benzo(a)anthracene										
Benzo(a)pyrene									0.005	CREG
Benzo(b)fluoranthene										
Benzo(g,h,i)perylene										
Benzo(k)fluoranthene										
Bis(2-chloroethoxy)methane										
Bis(2-chloroethyl)ether									0.03	CREG
Bis(2-ethylhexyl)phthalate	3.1J		**55**		3.0J	**42**	**26**	**14**	2; 6	CREG; MCL
Butylbenzylphthalate										

Table 2 (continued)– 2010 groundwater monitoring well results (µg/L) for VOC's collected at the BoRit site.

SVOC's	MW1	MW1a	MW2	MW 3	MW 4	MW5	MW5 Dup	MW 6		
Caprolactam									20000	RMEG
Carbazole										
Chrysene										
Dibenzo(a,h)anthracene										
Dibenzofuran										
Diethylphthalate										
Dimethylphthalate										
Di-n-butylphthalate										
Di-n-octylphthalate										
Fluoranthene									1000	RMEG
Fluorene									1000	RMEG
Hexachlorobenzene									0.02	CREG
Hexachlorobutadiene									0.006	CREG
Hexachlorocyclopentadiene									200	RMEG
Hexachloroethane									2	CREG
Indeno(1,2,3-cd)pyrene										
Isophorone									40	CREG
Naphthalene									2000	Chronic EMEG
Nitrobenzene									70	RMEG
N-Nitroso-di-n-propylamine										
N-Nitrosodiphenylamine									7	CREG
Pentachlorophenol									0.09	CREG
Phenanthrene										
Phenol									2000	LTHA
Pyrene									1000	RMEG adults

CV = ATSDR Comparison Value
CREG = ATSDR Cancer Risk Evaluation Guide
EMEG = ATSDR Environmental Media Evaluation Guide
RMEG = ATSDR Reference Dose Media Evaluation Guide
LTHA = EPA Lifetime Health Advisory
Blank cells=analyte not detected
Bolded sample results indicated levels exceeding either the MCL or ATSDR CV

Table 3- 2010 groundwater monitoring well results (µg/L) for pesticides and PCB's collected at the BoRit site.

		Park			Reservoir		Pile		CV	CV Type
PCB's/Pesticides	**MW1**	**MW1a**	**MW2**	**MW 3**	**MW 4**	**MW5**	**MW5 Dup**	**MW 6**		
Aroclor-1016									2	RMEG
*Aroclor-1221										
*Aroclor-1232										
*Aroclor-1242										
*Aroclor-1248										
*Aroclor-1254									0.7	CREG
*Aroclor-1260										
*Aroclor-1262										
*Aroclor-1268										
Pesticide Compound										
4,4'-DDD									0.1	CREG
4,4'-DDE									0.1	CREG
4,4'-DDT									0.1	CREG
Aldrin									0.002	CREG
alpha-BHC										
alpha-Chlordane										
beta-BHC										
delta-BHC										
Dieldrin									0.002	CREG
Endosulfan I									70	Chronic EMEG
Endosulfan II									70	Chronic EMEG
Endosulfan sulfate										
Endrin									10	Chronic EMEG
Endrin aldehyde										
Endrin ketone										
gamma-BHC (Lindane)										
gamma-Chlordane										
Heptachlor									0.008	Chronic EMEG
Heptachlor epoxide									0.004	Chronic EMEG
Methoxychlor									200	RMEG
Toxaphene									0.03	CREG

MCL = EPA Maximum Contaminant Level
CV = ATSDR Comparison Value
CREG = ATSDR Cancer Risk Evaluation Guide
EMEG = ATSDR Environmental Media Evaluation Guide
RMEG = ATSDR Reference Dose Media Evaluation Guide
Blank cells=analyte not detected
Bolded sample results indicated levels exceeding either the MCL or ATSDR CV

Table 4 – 2010 Groundwater monitoring well results (µg/L) for metals and inorganics collected at the BoRit site.

Dissolved Metals and Inorganics	**MW1**	**Park** **MW1a**	**MW2**	**Reservoir** **MW 3**	**MW 4**	**MW5**	**Pile** **MW5 Dup**	**MW 6**	**CV**	**CV Type**
ALUMINUM	1510								40,000	Chronic EMEG
ANTIMONY	UL	UL	UL	UL	UL	UL	UL	UL	6	MCL
ARSENIC				7.6J			5J		10	MCL
BARIUM	669	175J	112J	561	20.4J	27.4J	20.8J	101J	2000	MCL
BERYLLIUM									70	Chronic EMEG
CADMIUM						0.71J	1.1J		4	Chronic EMEG
CALCIUM	281000J	58300J	105000J	104000J	92500J	268000J	264000J	113000J		
CHROMIUM	19.4B	8.3B	2.7B	3.8B	1.7B	UL	UL	5.4B	100	MCL
COBALT									400	Interm EMEG
COPPER	25.9	1.1J	0.98J	3J		1.1J	0.98J	1.8J	400	Interm EMEG
IRON	78.2J				147	135	125			
LEAD	13.3B			3B					15	MCL
MAGNESIUM		15200	19000	15300	4860J	10800	10500	16200		
MANGANESE		4.4J		**9620**	86.7	156	121	**426**	300	LTHA
MERCURY										
NICKEL									700	Interm EMEG
POTASSIUM	73200	1490J	2150J	2140J		3120J	2670J	4260J		
SELENIUM						14.3J	13.1J		50	MCL
SILVER	2.8B	1.8B	1.2B	1.6B		2.1B	1.2B	2.7B	200	Interm EMEG
SODIUM	94200	13500	22900	34400	13400	38500	37200	40600		
THALLIUM	3.6B		6.7B	9.1B		3.7B	3.7B	3.9B	2	MCL
VANADIUM									400	Interm EMEG
ZINC		0.08B				0.05B		0.01B	10,000	Chronic EMEG

UL = Not detected, quantitation limit is probably higher.
B = Analyte not detected substantially above the level reported in laboratory or field blanks
J = Analyte present. Reported value may not be accurate or precise.
U = Analyte not detected
MCL = EPA Maximum Contaminant Level
CV = ATSDR Comparison Value
CREG = ATSDR Cancer Risk Evaluation Guide
EMEG = ATSDR Environmental Media Evaluation Guide
LTHA = EPA Lifetime Health Advisory for drinking water
RMEG = ATSDR Reference Dose Media Evaluation Guide
Blank cells=analyte not detected
Bolded sample results indicated levels exceeding either the MCL or ATSDR CV

Table 5 – 2010 and 2011 groundwater monitoring results (MFL) for asbestos (fibers greater than 10µm, based on TEM method), collected at the BoRit site.

		Park		Reservoir			Pile			
Asbestos, chrysotile	**MW1**	**MW1a**	**MW2**	**MW 3**	**MW 4**	**MW5**	**MW5 Dup**	**MW 6**	**CV**	**CV Type**
November 2010 Samples										
	<0.20	<0.20	<0.20	<0.20	0.51*	<0.20	<0.20	<0.20	7	MCL
June 2011 sample										
						0.2				

MFL= Millions of asbestos fibers per liter
Blank cells=analyte not detected
* Detected asbestos fiber was a chrysotile fiber.

Appendix 4: Public Drinking Water Sampling in Ambler Borough

Table 1 – 2011 public water supply testing along the distribution system in the Borough of Ambler for asbestos from suspected asbestos-containing pipes.

Sample	Location	Total Asbestos (MFL)	Asbestos fibers >10 microns (MFL)	CV (MFL)	CV Type
1	Davis Rd. & Marie Rd.	<0.08	<0.08	7	MCL
2	Madison Ave. & Hartranft Ave.	<0.09	<0.09	7	MCL
3	Toland Dr. & Militia Hill Rd.	0.09	<0.09	7	MCL
3a	Toland Dr. & Militia Hill Rd.	<0.06	<0.06	7	MCL
4	Batleson Rd. & Aldrin Rd.	<0.09	<0.09	7	MCL

MFL= Millions of asbestos fibers per liter
MCL = EPA Maximum Contaminant Level

Appendix 5: Glossary of Terms

Acute
Occurring over a short time [compare with chronic].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Cancer
Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

Chronic
Occurring over a long time [compare with acute].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to

hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Environmental media
Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA
United States Environmental Protection Agency.

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Maximum Contaminant Level (MCL)
Established under the EPA, the MCL is an enforceable standard for the maximum concentration of a chemical that is allowed in public drinking water system

Millions of Fibers per Liter (MFL)
For asbestos in drinking water, EPA has set an enforceable MCL for asbestos of 7 MFL, for fibers > 10 µm.

mg/kg
Milligram per kilogram.

Migration
Moving from one location to another.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)
Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

µg/L
Parts per billion.

ppm
Parts per million.

Public health action
A list of steps to protect public health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Remedial investigation
The CERCLA process of determining the type and extent of hazardous material

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

Toxicology
The study of the harmful effects of substances on humans or animals.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:
Environmental Protection Agency (http://www.epa.gov/OCEPAterms/)
National Library of Medicine (NIH) (http://www.nlm.nih.gov/medlineplus/mplusdictionary.html