Health Consultation

Public Health Evaluation of Off-Site Sample Results

BERKLEY PRODUCTS COMPANY SITE

AKRON, LANCASTER COUNTY, PENNSYLVANIA

EPA FACILITY ID: PAD003003894

SEPTEMBER 28, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR 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 which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared By:

Pennsylvania Department of Health
Division of Environmental Health Epidemiology
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Executive Summary

At the request of the US Environmental Protection Agency (EPA), the Pennsylvania Department of Health (PADOH), working under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), prepared this public health consultation for the **Berkley Product Company site**. Specifically, EPA requested that PADOH and ATSDR review the Environmental Protection Agency off-site and on-site sample results and determine if the site posed and currently poses a human public health hazard for residents living adjacent to the site.

Berkley Products Company manufactured various types of custom blended coatings, such as for appliances, beginning in 1955. In 1974, the company purchased equipment to recover wash solvents on-site. Recovery activities were expanded later to include spent solvents from customers. The facility was granted Resource Conservation and Recovery Act (RCRA) interim status as a hazardous waste treatment and storage facility in 1981. By then Berkley was blending waste for cement kiln fuel and consolidating waste for shipment to various disposal facilities. Since December 1990, no additional wastes were received for processing. Soil, ground water and surface water contamination have been identified on-site and off-site. Numerous waste chemicals had been found on-site, including trichloroethylene (TCE) and toluene, in the soil gas and in the monitoring wells. Additionally, TCE and other volatile organic compounds or VOCs have been detected at low levels in the indoor air and in at least one shallow residential well and one off-site shallow ground water monitoring point (at a backyard piezometer). The detection of acrolein in samples collected both on and off-site, including detections in the indoor air of 10 out of 15 residences sampled, was reported as possibly present by the laboratory. It is notable that acrolein is ubiquitous in the environment and is generated by both natural and anthropogenic (manmade) processes. It is present in auto exhaust and is otherwise commonly present in outdoor air. Additionally, due to its chemical properties, analysis for acrolein is complex, and reported detections may potentially be inaccurate. These chemical levels were evaluated by ATSDR and PADOH regarding health concerns and exposure pathways. EPA plans to conduct additional sampling and analysis to help determine whether acrolein is present on-site and/or has migrated off-site.

Numerous community concerns were noted including: concerns about chronic noncancerous health problems of at least three residents living next to and across from the site; concerns about children growing up in a home in this area; concerns about current and past indoor air quality; concerns that health problems are related to past spills at the company's former south yard storage area (stacked drums) that used to be behind one home and the North Yard storage area (above-ground tanks); concerns that, as a child, a resident occasionally ingested small amounts of contaminated ground water during use as pool water in the past; and concerns about exposures from using the contaminated ground water from an old, hand-dug well for outdoor household uses (i.e., car washing, plant watering, swimming pool uses).

EPA has determined which residents may be affected by the contaminated ground water plume. After thoroughly reviewing the data and information for the site, ATSDR and PADOH conclude that: 1) Overall, for current and future exposures from the indoor air of the affected homes, there is an indeterminate public health hazard based on the two rounds of air sampling. Whether acrolein is present is still to be determined and currently appears not to be site related. Whether

benzene is consistently detected in affected homes and is above background levels and levels of health risk is uncertain. Specifically, chronic exposures to the maximum levels of TCE in the contaminated indoor air from vapor intrusion pose an indeterminate public health hazard based on the pre-mitigation system installation levels detected in the affected homes; 2) Overall *current* and *future* off-site exposures through household water use of the contaminated ground water pose *no apparent public health hazard.* All of the homes immediately down gradient of this site and most of the homes in this area are on a public water system (one private well up gradient from the site is still in use, but no data was available for evaluation on this well); and 3) In general, there is uncertainty about *past* exposures due to a lack of sample data for residential wells and lack of data for indoor air quality, so past exposures must be classified as an *indeterminate public health hazard*.

ATSDR and PADOH recommend that: 1) Additional off-site soil gas sampling be performed. Also, more sampling should be performed to determine if acrolein is present. Since acrolein was found in the on-site soil gas, it is possible that this chemical may have migrated off-site. Alternative laboratory procedures should be performed as needed to help confirm whether acrolein is present; and 2) Air mitigation systems should be installed in homes affected by vapor intrusion from the contaminated ground water as the most prompt interim action (versus ground water treatment, which would take more time and be more cost intensive). Reducing or eliminating potential indoor air exposures could be completed through installing carbon filtration systems, sub slab vapor reduction systems, or positive pressure systems in these homes. If household carbon filtration or other system to reduce the VOCs is not installed, then ATSDR and PADOH recommend that the indoor air be retested at least twice annually. If levels in homes remain above those of health concern, action by EPA is strongly recommended by ATSDR and PADOH; 3) Post-mitigation system installation indoor air sampling be performed to determine whether systems are working and levels of contaminants are lower in the homes where new mitigation systems are installed; 4) Where the indoor air sample results of homes tested showed detections of contaminants, most likely from household sources, at levels that could result in health effects, the residents should continue efforts to remove any possible household sources of these VOCs from their homes; and 5) monitoring the levels of VOCs in the ground water off-site be continued, especially since it is possible that higher concentrations of VOCs might move off-site in the future.

PADOH and ATSDR completed actions include: 1) Data and information obtained from EPA and PADEP have been evaluated by PADOH and ATSDR to determine the public health implications of human exposure pathways via all media; and, 2) PADOH participated in a PADEP public hearing and meeting for the community residents in June 2006. Ongoing or planned actions include: 1) PADOH and ATSDR will make this HC available to the public and PADEP. In addition, PADOH and ATSDR will individually distribute this HC to the affected residents by mail. A letter of explanation and a table of Common Indoor Air Sources of VOCs will be included with the letter and HC; 2) PADOH and ATSDR agree with EPA's plans to perform additional sampling off-site. As of June 2006, EPA has begun some additional sampling; and, 3) If requested, PADOH and ATSDR will review the results from the additional sampling performed by EPA and/or PADEP including the post-mitigation system installation indoor air sample results, when those data are available.

Introduction

The Pennsylvania Department of Health (PADOH), working under cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), was requested by the U.S. Environmental Protection Agency (EPA) to review the 2003/2004 on-site and off-site ground water, soil, soil gas, and residential indoor air sampling data taken from the Berkley Products Company Plant site and to prepare this health consultation (HC) for the public. Both EPA and the Pennsylvania Department of Environmental Protection (PADEP) are involved in the investigation, the evaluation, and media sampling at this site. PADOH and ATSDR were asked to determine if the site posed and currently poses a human health hazard for the residents living near the site.

Site Layout and History

The Berkley Products Company Plant is located at 405 South 7th Street, West Earl Township and borders Akron, Pennsylvania in Lancaster County (see Appendix A - Figure 1 and Figure 2). The United States Geological Survey coordinates for the site are 40^{o} 14' 01" latitude and 76^{o} 12' 33" longitude. The EPA identification number for this site is PAD003003894. Residential properties surround the site and a few commercial properties are present in the locality. Specifically, a small residential area is adjacent to the facility (see Appendix A - Figure 2 and Figure 3). Since 1955, the facility manufactured various types of custom blended coatings, such as for appliances [1]. During most of their operations, facility solvents were used as drying agents in the coatings and for cleaning the manufacturing equipment. In 1974, equipment was purchased to recover wash solvents on-site and the company began the reuse operations [1]. Recovery activities were later expanded to include spent solvents from customers. Then in 1981, the facility was granted Resource Conservation and Recovery Act (RCRA) interim status as a hazardous waste treatment and storage facility. By then Berkley was blending waste for cement kiln fuel and consolidating waste for shipment to various disposal facilities [2]. No additional wastes were received for processing since December 1990 [1].

Berkley Products Company is currently an operating facility producing customized coatings. The chemicals on-site primarily include those found today in paint and paint products and include toluene, xylene, and methyl isobutyl ketone. These wastes are stored on-site for less than 90 days before being transported off-site or recycled on-site [1]. Since 1990, waste solvents generated by the facility have either been disposed of at off-site facilities or recovered on-site by a contractor and then reused in the facility processes [1]. The Berkley Products Company facility is currently in the RCRA Corrective Action Program [2].

Site Contamination and Environmental Sampling History

The past waste streams at the Berkley Products Company facility included volatile organic compounds (VOCs) such as toluene, trichloroethylene (TCE), and various other individual solvents and chemicals, and chemical mixtures. Ground water, soil gas, and soil contamination have been identified on-site and/or off-site (see Appendix A - Figure 3) [2]. The Berkley Products Company facility reported data information to the EPA Toxics Release Inventory data (TRI) for this site between 1988 and 1999 (see http://www.epa.gov/tri/ for more detailed information on the TRI data and reporting requirements). These reporting requirements began in

1987. The 1988 TRI data reported by the facility listed acetone, methanol, methyl ethyl ketone, methyl isobutyl ketone, toluene, and xylenes. From 1989 through 1999, the same six chemicals had been reported to EPA and included dichloromethane and isopropyl alcohol. These reported releases included *fugitive stack emissions, total emissions, total on-site disposal or other releases*, and *total on-site and off-site disposal or other releases*.

In addition, between 1983 and 1997, there were at least nine chemical spills on the Berkley Products Company site recorded by PADEP [1]. Most of the spills occurred in the drum storage area on the south side of the facility, but the north and northeast parts of the facility have also been involved in spills in the past (see the aerial photo of the facility in the past in Appendix A - Figure 4). Although the area is served by a public water system, the shallow contaminated ground water extends beneath neighboring residences and presents a ground water-to-indoor-air (vapor intrusion) threat [2]. The ground water table in this area is relatively high. Numerous VOCs – including: 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; benzene; toluene; ethylbenzene; TCE; vinyl chloride; and xylene - have been detected in the on-site ground water monitoring wells during Phase 1 and Phase 3 sampling. Ground water sample results from both sampling events were similar [1]. Ground water sample data for 2 residential wells, located approximately 1100 feet south of the facility, indicated that constituents analyzed for in these wells were either nondetect or detected below regulated EPA maximum contaminant levels (MCLs) for public drinking water. One residential well (a shallow, hand-dug well) located adjacent and south of the facility showed elevated contamination possibly related to the site. Additionally, a shallow residential backyard monitoring point (piezometer) located off-site and east of the facility also showed elevated contamination possibly related to the site. These impacted off-site locations are not used by residents for their drinking water supply, and residents directly down gradient of the facility and most of the residents in the area use public drinking water. TCE was found in all of the off-site seep samples adjacent to the site [1].

Recently, testing was performed for residential indoor air in some homes mostly located down gradient and side gradient from the site during the Phase 1 and Phase 3 sampling. Many VOCs were detected in the residential indoor air samples of the homes sampled during Phase 1, and in the residential indoor air of at least 14 homes adjacent to the site during Phase 3 sampling. Several of the VOC levels were above those of health concern (See Appendix B - Table 1) [1]. Initially during Phase 3 sampling, low levels of acrolein were thought to possibly have been detected off-site in residential indoor air [1]. In June 2006, EPA completed an additional round of on-site soil gas and ground water sampling for acrolein. The samples were collected in an area where acrolein was previously reported at 30,000 micrograms per cubic meter (ug/m^3) in soil gas and was detected in ground water, as well. The preliminary results of this recent sampling do not indicate the presence of acrolein. Whether the detections of acrolein were related to the site is still uncertain and needs to be confirmed with additional sampling data. Difficulties in assessing the extent of acrolein released on-site and whether acrolein has migrated off-site include: 1) the reactive nature of acrolein, which makes it difficult to confirm detections; and 2) the ubiquitous nature of acrolein, which is generated by both natural and anthropogenic (or man-made) processes.

Site Visits and Public Meeting

In 2005, EPA and ATSDR staff visited and viewed the layout of the residential area in relationship to the Berkley Products company site. ATSDR reviewed sample data results for the wells and residential indoor air. Also in 2005, staff from PADOH and PADEP visited the site to view the site layout and topography, the monitoring and residential well locations, the soil and soil gas sampling points, and the locations of the potentially affected homes in relationship to the site. The locations of a drainage ditch, seeps, and a small stream in relationship to the site and the homes were also noted during the site visit.

On June 7, 2006, PADOH participated at a PADEP public hearing and public meeting. During the meeting, there was a review and discussion about the history of the site and the numerous spills (including one of about 300 gallons of virgin wash solvent), cleanups, and notices of violations over the years. One resident made a formal statement about having lived all or most of his life next to this site and questioned if his health concerns could be related to the site. The fact that several neighbors near the site have severe health problems was briefly discussed. Another resident talked about the creek containing visible amounts of lacquer in the 1950s, behind the homes.

Demographics

The Berkley Products Company site is in West Earl Township, in Lancaster County, Pennsylvania, and is bordered by the borough of Akron, Pennsylvania. According to the 2000 census records, West Earl Township had a total population of 6,766 persons. About 49 percent of the population is male and about 51 percent is female. About 29 percent of the population are children less than 18 years and about 8 percent are children under the age of five. Fourteen percent of the population are 65 years or over. The median age is about 36 years.

Also according to the 2000 census records, Akron Borough had a total population of 4,046 persons. About 47 percent of the population is male and 53 percent is female. Twenty-two percent of the population are children under 18 years and about 6 percent are children under the age of five. Nineteen percent of the population are 65 years or over. The median age is 41 years. Demographics for West Earl Township and the borough of Akron may be found online on the 2000 census Web Pages [4].

Discussion

Exposure Pathways Analysis

ATSDR and PADOH consider how individuals might come into contact with contaminated media or exposure pathways, as well as the *duration* and *frequency* of identified exposures. Exposure pathways are classified as completed, potential, or eliminated, based on 5 elements. The five elements are: (a) a source of contamination; (b) a fate or way of transport; (c) an environmental medium in which the contaminants may be present or may migrate; (d) a human exposure point (such as by drinking water, having skin contact, or by inhalation); and (e) a receptor population. In *completed exposure pathways*, the five elements exist, and so exposure

has occurred, is occurring, or will occur. In *potential exposure pathways*, however, one or more of the elements may not be present, but information is insufficient to eliminate or exclude the element. An exposure pathway can be *eliminated* if at least one of the five elements is missing and never will be present.

Current, Future, and Past Off-site Completed and Potential Exposure Pathways Associated with Contaminated Ground water

Some residential and monitoring wells were tested around the site, though currently residents near the site use public drinking water [1]. *Past* exposure pathways associated with VOCs in ground water are unknown (past data are not available), but could have occurred through inhalation during bathing, cooking or other water uses. Degraded indoor air quality in some homes may be from *vapor intrusion* due to the facility-related ground water contamination beneath the homes. Vapor intrusion is the migration of VOC vapors at this site from the contaminated ground water into overlying residential homes.

Current, Future, and Past Off-site Potential Exposure Pathways Associated with Soil

Chemicals spilled on-site may have migrated by means of backyard seeps and/or shallow ground water or surface water to the residential areas. Soil gas samples collected along the eastern and northern property boundaries of the facility showed that, 1,2,4-trimethylbenzene, TCE, and, possibly, acrolein were present. Analysis of off-site soil gas samples collected during the EPA and PADEP environmental investigations revealed the detection of several contaminants. Based on the results of the indoor air sampling it appears that certain VOCs have migrated towards the residential homes. Indoor air samples of at least 10 homes detected VOCs that might be facility related. Additional sampling may be necessary to confirm whether acrolein is a facility-related contaminant that has migrated below ground surface toward off-site residences, though most recent sampling shows that it is not site related [1].

Some Assumptions and Scenarios Used in the Evaluation Process

ATSDR and PADOH considered various exposure scenarios in this evaluation. Current, future and past exposures (the worst-case exposure period of 30 years was considered) of community residents were evaluated for ground water.

Assumptions Used to Evaluate Exposures to Contaminated Ground water and Vapor Intrusion Exposures due to the Contaminated Ground water Off-site

Public water is used in this area. Assuming that the residential wells became contaminated around or after 1955, residents could have been exposed to contaminated ground water in the past and until public water was installed. None of the residents living down or side gradient near the site currently ingest ground water from private wells (up gradient from the site one private well is still in use, but no data was available for evaluation on this well). One of the three off-site residential wells did indicate contamination possibly related to the facility. However, this shallow, hand-dug well was never used for drinking water purposes, but was used for outdoor purposes (swimming pools, car washing, plant watering). On occasion, a very small amount of ingestion may have occurred by children during pool swimming and water play. PADOH and

ATSDR are not aware of any available sampling data from earlier than 2004 for the private residential wells [1].

In regard to the residential indoor air sampling, a canister was placed in the lowest level of each residence that was tested and the worst-case scenario assumed. For vapor intrusion and indoor air calculations, residents were assumed to be exposed to contaminants for 24 hours per day for 350 days per year. Children were assumed to inhale 12 cubic meters of the indoor air per day (m^3/day) and to weigh 15 kilograms (kg). Adults were assumed to inhale 15 m^3/day and to weigh 70 kg.

Toxicological and Data Evaluation

PADOH and ATSDR Toxicological Evaluation Process

ATSDR has developed health-based comparison values (CVs) that are chemical-specific concentrations, which help to determine which environmental contaminants are of possible health concern and need further evaluation [5]. If a chemical concentration is found in the environment at levels below the CV, it is not likely to cause adverse health effects, though chemicals that exceed CVs do not necessarily produce adverse health effects. If a contaminant exceeds its corresponding CV or does not have a CV, PADOH examines health-based guideline levels and evaluates toxicological research and data for the contaminant. See Appendix C for more information about the ATSDR health effects evaluation process.

Toxicological Evaluation at the Site

The primary public health issue evaluated in this HC was the past and current off-site exposure to VOCs, specifically due to the indoor air vapor intrusion from the contaminated ground water and backyard seeps of several residences adjacent to the site.

Toxicological Evaluation of the Completed and Potential Exposure Pathways Associated with the Off-site Contaminated Ground water

Some VOCs were detected in a shallow, hand-dug residential well; however, this well has never been used for drinking water purposes (except by accidental ingestion during outdoor uses). The levels of the contaminants found in this well either were below CVs or were below levels of health concern and the EPA MCLs for public water [4,5].

Toxicological Evaluation of the Completed and Potential Exposure Pathways Associated with Vapor Intrusion in the Residential Indoor Air

TCE was detected in off-site soil gas between the facility and four residences and was detected in both sub slab soil gas and indoor air of these same four residences. It should be noted that 1,2,4-trimethylbenzene has also been detected in on-site soil gas and off-site ground water and residential indoor air. During the first (Phase 1) indoor air sampling event, 64 VOCs were detected and identified in at least 15 homes adjacent to the site. During the second (Phase 3) indoor air sampling event, 41 VOCs were detected and identified in 14 homes. Certain VOC sample results exceeded the PADEP medium specific concentrations (MSCs) for vapor intrusion and/or the EPA risk based concentrations (RBCs) [1]. All of the indoor air results were evaluated by PADOH and ATSDR and were compared to the ATSDR CVs for inhalation

exposures. The VOCs with *levels that exceeded the ATSDR CV were evaluated further*. If the compound level was below the ATSDR CV (even if the compound concentration was above the PADEP MSC or the EPA RBC such as is the case for 1,3,5-trimethylbenzene), it was not considered by PADOH and ATSDR as a health concern. The VOCs with levels that exceeded the ATSDR CV are discussed further in the following section.

Evaluation of the Contaminants Determined To Be Most Likely Site Related

The site related or possibly site related contaminants include: 1,2,4-trimethylbenzene and TCE. These are listed in the Appendix B - Table 1 and are discussed in the following section:

1,2,4-TRIMETHYLBENZENE

The maximum level of 1,2,4-trimethylbenzene detected in the indoor air was 6.2 ug/m^3. This level is a*bove* the EPA RBC. ATSDR does not list a specific CV for this compound in the CV tables, but PADOH and ATSDR researched the concentration levels and determined that the maximum levels found in the indoor air were *below* any levels that would be considered to be of a *health concern* [5]. In addition, 1,2,4-trimethylbenzene has not been evaluated for carcinogenicity by EPA or by the International Agency for Research on Cancer, but it is currently *not* thought to cause cancer by the agencies [6].

TRICHLOROETHYLENE (TCE)

A chronic ATSDR MRL is not currently listed for TCE. The highest level detected in the indoor air in homes near the site is well below the ATSDR intermediate MRL and levels for non-carcinogenic health effects, thus TCE is *not* found in these homes at levels *expected to cause noncancerous health effects* [5]. TCE is also found in some common household products and these sources may add to site related sources (see Appendix B - Table 2).

PADOH estimates the maximum excess cancer risk for 30 years exposure to TCE at 21.9 ug/m^3 is about one (1) additional cancer per 1,000 persons. Chronic exposure to this level of TCE is classified as a *low to moderate increased cancer risk*, though these levels are commonly found in households, especially where cigarette smokers are present. PADOH and ATSDR do not believe this is an acceptable level for chronic inhalation in indoor air. The cancer risk is based on theoretical, additional lifetime cancers using EPA cancer risk calculations for chronic inhalation exposures to TCE where the cancer risk of one increased cancer per one million persons is 0.021 ug/m^3.

Evaluation of the Contaminants Determined To Be From Household Sources and Most Likely Not Site Related

Some of the compounds that were detected and determined to be a potential health concern to PADEP, EPA, and/or ATSDR and are commonly found in household products, but likely not associated with the ground water plume. The source of these VOCS within the household should be determined and an attempt should be made by the residents to remove the major source(s) of these VOCs. Many of these household product sources are listed in Appendix B - Table 2. If the compound level was below the ATSDR CV it is not discussed in the text. The VOCs with levels

that exceeded the ATSDR CV were evaluated further and are listed in Appendix B - Table 3. These include: 1,3-butadiene; 1,4-dichlorobenzene; acrolein (the results and sources need to be confirmed with additional sampling); acrylonitrile; benzene; chloroform; hexachlorobutadiene; hexachloroethane, methylene chloride; and tetrachloroethene (PCE) and are discussed in the following section:

1, 3-BUTADIENE

This chemical is very commonly used in adhesives and rubber and household products. The sample results for 1,3-butadiene were above the ATSDR CV, the EPA Inhalation Reference Concentration (RfC), and the PADEP MSC. Comparison of the levels found in the indoor air to levels of 1,3-butadiene in animal and occupational studies show that the levels found in the residents' indoor air at this site are well *below* (at least 3 to 4 orders of magnitude or 1,000 to 10,000 times below) any *levels that ATSDR considers to be of noncancerous health concern* [5,8]

The compound 1,3-butadiene is considered by EPA to be carcinogenic to humans by inhalation [4,7]. PADOH and ATSDR used the current EPA inhalation unit risk of $(0.00003\ ug/m3)^{-1}$ in their calculations. PADOH and ATSDR estimate that the cancer risk for 30 years exposure (assuming a consistent 24 hour exposure period per day to 6.8 ug/m3 of 1,3-butadiene) is about one (1) additional cancer per ten thousand (10,000) people. This increased cancer risk is classified by ATSDR and PADOH as a *low increased cancer risk* [8]. Household products are the most likely the reason this chemical was detected in the indoor air sample results.

1,4-DICHLOROBENZENE

PADOH and ATSDR have determined that the levels of 1,4-dichlorobenzene found in the indoor air at this site were *below the ATSDR CV* and *below levels that ATSDR considers to be of noncancerous health concern*, even though the levels were above the PADEP MSC and EPA RBC [5].

EPA considers 1,4-dichlorobenzene to be a human carcinogen [5]. PADOH calculated the estimated exposure dose of 0.17 ug/kg/day and multiplied this dose by the EPA proposed cancer slope factor or CSF of $(0.013\ mg/kg/day)^{-1}$. EPA's CSF is used to derive probabilities of increased cancer risks in a population and is used as the ATSDR CV in this case as a comparison (see Appendix C for more information about the use of ATSDR CVs). Assuming exposures at this level were for 30 years and using the maximum result of 79 ug/m^3 (assuming a consistent exposure at this level for a 24-hour exposure period per day), PADOH estimated that this would theoretically yield about one (1) additional cancer per 10,000 people. This "worst-case" risk would be classified by ATSDR and PADOH as a *low increased cancer risk* [8]. Household products are most likely the source of this VOC.

ACROLEIN

Acrolein was reportedly detected on-site site at a maximum concentration of 30,000 ug/m^3 in soil gas at one location on-site. All other reported detections both on-site and off-site in soil gas and residential indoor air have been at a maximum of 11.7 ug/m^3. According to the Merck Index of

Chemicals, Drugs, and Biologicals (1983), acrolein has been used in the manufacture of colloidal forms of metals, in making plastics and perfumes, as a warning agent in methyl chloride refrigerant, and in military poison gas mixtures. Additionally, it is also a photo-oxidation product of various hydrocarbons including 1,3-butadiene. It is currently used as an aquatic pesticide to control algae, weeds, bacteria, and mollusks and to make other chemicals. Acrolein may also be formed when fats are heated and is found in fried foods, cooking oils, and roasted coffee. It is a common contaminant found in outdoor air and forms during the combustion of organic matter such as tobacco and fuels like gasoline and oil. Smoking one cigarette produces acrolein and may lead to generating concentrations of 450 to 840 $\mu g/m^3$ acrolein within 10 to 13 minutes. The levels of acrolein within the air of a typical home range between less than 0.05 and 27 ug/m^3 but can be higher if you smoke tobacco in your home [9]. In urban air, average acrolein levels has been measured at levels around 0.46 $\mu g/m^3$ and 0.27 $\mu g/m^3$ in rural air. However, in several large cities acrolein has been measured at levels as high as 12.8 $\mu g/m^3$ [9]. Close to exhaust pipes, levels ten to one hundred times even higher may occur.

No information is available on the carcinogenic effects of acrolein in humans and limited animal cancer data are available. The major effects from chronic inhalation exposure to acrolein in humans consist of general respiratory congestion and eye, nose, and throat irritation [9]. The EPA reference concentration (RfC) is 0.02 ug/m^3 [5]. ATSDR does not list a chronic minimum risk level (MRL). MRLs are health guide levels derived by ATSDR (see Appendix C for more information). The ATSDR MRL for intermediate (exposures for 15 to 364 days) is 0.09 ug/m^3 [5]. Studies in rats showed the lowest observable adverse effect level (LOAEL) is 916 ug/m^3 acrolein, based on nasal squamous and epithelial metaplasia [8]. This is 78 times greater than the levels in the indoor air in homes adjacent to this site. Additionally, the ATSDR acute (exposure up to 14 days) MRL is 7 ug/m3 and is based on nose and throat irritations and a decrease in respiratory rate in humans exposed to acrolein, where the LOAEL is about 687 ug/m^3 [8]. This LOAEL for acute exposures is more than 57 times higher than the maximum level found in the indoor air of homes at this site. In a study, human volunteers exposed to acrolein vapors for 35 minutes reported statistically significant nose irritation at 595 ug/m^3, throat irritations at 985 ug/m^3, and a decrease in respiratory rate at 1374 ug/m^3 [8].

In all of these studies, health problems were only seen at concentrations at much greater levels than those found in the indoor air of homes around the Berkley Products site. Also the acrolein found around this site might not be facility-related contamination. Based on the two rounds of indoor air sampling in these homes adjacent to this site, the acrolein levels in the indoor air are not likely to reach annoyance or harmful levels under normal circumstances. PADOH and ATSDR *do not expect* exposures to the acrolein, at the maximum levels recently found off-site, to result in *health effects*.

ACRYLONITRILE

Measurable amounts of acrylonitrile are found primarily near factories and hazardous waste sites [9]. Extremely small amounts of acrylonitrile may be found in water near some factories that make or use it, but acrylonitrile rapidly breaks down and disappears from water. Plastic food containers that might contain acrylonitrile are regulated by the Food and Drug Administration and intake from food packaging would be extremely low. A chronic MRL does not currently exist for this chemical. The highest concentration detected in the residential indoor air is close to

the EPA RfC for non-carcinogenic health effects [5]. In animal studies (rat), the no observed adverse effect level (NOAEL) was four orders of magnitude greater than the levels found at this site, so *non-carcinogenic health effects would not be expected.*

PADOH estimates the maximum excess cancer risk for 30 years exposure (assuming a consistent exposure at this acrylonitrile level of 1.8 ug/m^3 for a 24 hour exposure period per day) is about two (2) additional cancers per 10,000 people and classified by ATSDR and PADOH as a *low increased cancer risk* [5].

BENZENE

Benzene is widespread in the environment. Airborne benzene is usually produced by processes associated with chemical manufacturing or the gasoline industry, including gasoline bulk-loading and discharging facilities and combustion engines (e.g., automobiles, lawn mowers, and snow blowers). Benzene is a component of both indoor and outdoor air pollution. Industrial processes are the main sources of benzene in the environment. Benzene levels measured in ambient outdoor air have a global average of 6 ug/m^3 (range 2 ug/m^3 to 9 ug/m^3). In almost all cases, benzene levels inside residences or offices are higher than levels outside and still higher in homes with attached garages and those occupied by smokers, since tobacco smoke contains high levels of benzene. Benzene can also pass into air from water and soil surfaces contaminated with benzene. Once in the air, benzene reacts with other chemicals and breaks down within a few days. Seasonal variations also affect benzene levels, with higher levels found in the fall and winter when buildings are less well ventilated.

The levels of benzene found in the indoor air at this site also fall within the normal background concentrations for ambient air. The highest level detected in the residential indoor air was slightly less than the ATSDR chronic MRL for non-carcinogenic health effects [5]. In human studies (occupational less than one year), the lowest observed adverse effect level (LOAEL) (health effect for leucopenia) was 2201 ug/m^3 [8]. The levels at this site are less than three orders of magnitude below this LOAEL (about 300 times less). Therefore, the margin of safety (MOS) *might not be great enough to protect public health from noncancerous health effects* and further indoor air sampling may be necessary in these residences.

Exposure to benzene at the levels commonly found in the indoor air would not be expected to cause adverse health effects, but very long-term (chronic) exposures at levels above that could result in increases of the risk for cancers over a lifetime. PADOH estimates the maximum excess cancer risk for 30 years exposure (assuming a 24 hour exposure period per day) to benzene at 6.5 ug/m^3 is about three (3) additional cancers per 100,000 people and classified by ATSDR and PADOH as *no apparent increased cancer risk* [5].

CHLOROFORM

Chloroform is often detected in homes where public water is in use since public water usually contains low levels of the compound from chlorination process [7]. The levels at 2.0 ug/m^3 found in the indoor air at this site are well below the chronic MRL of 100 ug/m^3 and two orders of magnitude below the noncancerous effect level, so the levels found are *not levels for non-carcinogenic health effects* [4,7].

PADOH estimates the maximum excess cancer risk for 30 years exposure (assuming a 24 hour exposure period to these levels per day) to chloroform at 2.0 ug/m3 is about two (2) additional cancers per 100,000 people and classified the exposure as *no apparent increased cancer risk* [5].

HEXACHLOROBUTADIENE

A chronic or intermediate MRL is not currently listed for this chemical, but the levels detected were determined *not* to be a *noncancerous health concern.* The maximum concentration detected was 32.5 ug/m^3 and is 1,000 times less than the intermediate NOAEL and LOAEL for this chemical in animal studies, and is *not found at a level of a noncancerous health concern* [5].

EPA considers this chemical to be an animal and possible human carcinogen and the EPA inhalation unit risk for hexachlorobutadiene is (0.000022 ug/m^3)$^{-1}$. Based on this inhalation unit risk, PADOH estimates the maximum excess cancer risk for 30 years exposure (assuming consistent exposures at this maximum level for a 24 hour exposure period per day) to hexachlorobutadiene at 32.5 ug/m^3 is about three (3) additional cancers per 10,000 people and classified as a *low increased risk* [5]. A household product is most likely the source of this VOC.

HEXACHLOROETHANE

The intermediate MRL for this chemical is 60,000 ug/m^3. The maximum concentration detected was 2 ug/m^3 and is 4 orders of magnitude less than the MRL, so it is *not found at a level of a noncancerous health concern*.

EPA considers this chemical to be an animal and possible human carcinogen and the EPA inhalation unit risk for hexachloroethane is (0.000004 ug/m^3)$^{-1}$. PADOH estimates the maximum excess cancer risk for 30 years exposure (assuming a 24 hour exposure period per day) to hexachloroethane at 2 ug/m^3 (the maximum level detected) is about three (3) additional cancers per one million (1,000,000) persons and is classified as *no increased cancer risk* [5].

METHYLENE CHLORIDE

Methylene chloride is commonly found in household products.
The levels found in the indoor air at this site are well below the chronic MRL and so are *not at levels for non-carcinogenic health effects* [5].

PADOH estimates the maximum excess cancer risk for 30 years exposure (assuming a 24 hour exposure period per day) to methylene chloride at 21.2 ug/m^3 is about three (3) additional cancers per 1,000,000 persons and is classified as *no increased cancer risk* [5].

TETRACHLOROETHENE (PCE)

The levels of PCE found in the indoor air at this site are well below the chronic MRL and so are *not levels for non-carcinogenic health effects* [5].

PADOH estimates the maximum excess cancer risk for 30 years exposure to PCE at 6.9 ug/m^3 is one (1) additional cancers per 100,000 people, based on EPA's proposed CSF, and is classified as *no apparent increased cancer risk.*

Multiple Chemical Exposures (such as Trimethylbenzenes Combined Exposures or TCE and PCE Combined Exposures)

ATSDR reviewed the scientific literature surrounding chemical interactions, and the agency notes that if the estimated exposure doses for individual contaminants are well below doses shown to cause adverse effects, that the combined effect of multiple chemicals is not expected to result in adverse health effects. Therefore, PADOH does not expect interactive health effects of multiple chemicals, given that for each chemical evaluated the conservatively estimated exposure doses are below health effect levels reported in the scientific literature.

Child Health Considerations

ATSDR and PADOH recognize that children may be especially sensitive when exposed to many contaminants. ATSDR and PADOH evaluated the likelihood that children living adjacent to the site might have been or may currently be exposed to contaminants at levels of health concern due to the contaminated ground water from seeps off-site and due to vapor intrusion into the residential indoor air.

Community Health Concerns

Community health concerns center on the possible exposures to chemicals by way of the contamination of the monitoring wells, the backyard seeps, the shallow hand-dug residential well, and the possibility that vapor intrusion into the residences is occurring directly because of the contaminated ground water. Residents' health-related concerns include:

1) Concerns about chronic noncancerous health problems of at least three residents living next to and across from the site.

   Response
   Though there was no indoor air sampling in the past and, therefore, the past indoor air contaminant levels are unknown, the recent indoor air sample results indicate that the contaminant levels currently are well below those of any noncancerous health levels. The TCE levels that were found theoretically could be considered levels of health concern for low to moderate increased cancer risk, if levels were consistent for 30 years or more. It should be noted though, that these levels are not uncommon in households, especially where cigarette smokers are present as is discussed in the *Toxicological and Data Evaluation* section of this document. This is an extremely conservative health assessment, based on the current data. The following chemicals were also of concern because they might pose a cancer risk if chronic exposures were to occur in the indoor air of homes: acrylonitrile; 1,3-butadiene; 1,4-dichlorobenzene; and hexachlorobutadiene. Appendix B – Table 2 shows some common household sources of these chemicals. Residents should try to remove any sources of these VOCs from their households.

2) The company's storage area (stacked drums) was behind one home and the resident could often smell the chemicals. A resident feels that he has health problems related to the site as well as noting that a dog that often drank water running down from the site died from tumors.

   Response
   Fugitive releases of VOCs in the air most likely occurred in the past, especially during the times of the documented spills. There was no indoor or ambient air sampling in the past and, therefore, the past outdoor and indoor air contaminant levels during this time are unknown. Some EPA Toxics Release Inventory data are available for the facility beginning in 1988 (available on the EPA website http://www.epa.gov/tri/).

3) Concerns about children growing up in a home in this area.

   Response
   The past indoor air contaminant levels are not known since there was no past indoor air sampling performed and it is uncertain if there was a public health hazard. However, the recent indoor air sample results indicate contaminant levels are well below those of any noncancerous health levels for children and adults. If exposures to the maximum TCE levels found in 2003 and 2004 were chronic and consistently high in the indoor air of the home, exposures to TCE could pose an increased cancer risk over a person's lifetime.

4) A shallow, hand-dug well exists on the property and was never used for drinking, but was used for outside purposes (i.e., plant watering and car washing). A health concern was expressed by a resident that, as a child, he occasionally ingested small amounts of this contaminated water during use as pool water, in the past. Another health concern was expressed by this resident about exposures from the outdoor water during use of the contaminated water.

   Response
   VOCs were detected in one shallow residential well. However, recent levels of the contaminants found in this well were below CVs or were evaluated further on a health basis and were below the EPA MCLs for public water [4,5]. Based on the assumption that a child ingests 1 liter of water daily, there would not be a health hazard. In this case, ingestion of 1 liter per day would be an extremely conservative health assessment and actual ingestion was most likely far less than this amount. None of the wells tested are currently used as a residential drinking water supply. EPA, PADOH, and ATSDR have recently addressed the issue of past outdoor uses of ground water contaminated with VOCs (much higher levels than at the Berkley Products site) at some other sites and concluded that the risks associated with using the ground water contaminated with VOCs for *outdoor* purposes (i.e., car washing, plant watering, swimming pool uses) were very low.

Health Outcome Data Evaluation

The Commonwealth of Pennsylvania maintains health outcome databases including vital statistics and the cancer registry. These databases provide information on total mortality, cancer

morbidity and birth defects. The residential population exposed around the Berkley Products Company site is too small to provide a meaningful review of this health outcome data, i.e. poor statistical power - if a data set is too small, the statistical review cannot be not valid.

Conclusions

EPA has determined which residents may affect by the contaminated ground water plume via the pathway of vapor intrusion into the indoor air of homes. Based on a thorough evaluation, ATSDR and PADOH conclude that:

1. Overall, for *current and future* exposures from the indoor air of the affected homes, there is an *indeterminate public health hazard* based on the two rounds of air sampling. Whether benzene is consistently detected in affected homes and is above background levels and levels of health risk is uncertain. Whether acrolein is present is still to be determined, but currently appears not to be site related. Specifically, chronic exposures to the maximum levels of TCE in the contaminated indoor air from vapor intrusion pose an *indeterminate public health hazard* based on the pre-mitigation system installation levels detected in the affected homes.

2. Overall, *current* and *future* off-site exposures through ingestion of the contaminated ground water pose *no apparent public health hazard.* Most of the homes in this area and all of the homes near this site use public drinking water, except for one home where the residents use a private well up gradient from the site.

3. In general, there is uncertainty about *past* exposures due to a lack of sample data for residential wells and lack of data for ambient and indoor air quality, so past exposures must be classified as an *indeterminate public health hazard*.

Recommendations

ATSDR and PADOH recommend that:

1. Additional off-site soil gas sampling be performed. Also, more sampling should be performed to determine whether acrolein is present above background levels on-site and off-site and should include more sampling of indoor air of homes where acrolein were previously reported as possibly present. Improving the analytical method for acrolein may be necessary for this determination and, if possible, analytical sensitivity should be improved. This could be done by employing alternate acrolein analytical procedures as needed to help confirm whether acrolein is present and the levels present, if applicable.

2. Installing an air mitigation system in residences affected by the contaminated ground water as the most prompt interim action (versus ground water treatment, which would be more time and cost intensive). Reducing or eliminating exposures could be completed through the installation of carbon filtration systems, sub slab vapor reduction systems, or positive pressure systems in these homes. Available data suggests that certain residents' homes are likely to have been impacted by vapor intrusion attributable by the facility and

the contaminated ground water. Mitigation would reduce stress and uncertainty for all of the residents in this affected neighborhood. It is important to note that VOCs not originating from the facility-related contamination, such as household products stored within the home, may not be removed by installing the sub slab gas reduction systems or positive pressure systems. If household carbon filtration or other system to reduce the VOCs is not installed in all of the homes determined to be affected, ATSDR and PADOH recommend that the indoor air in the affected homes be retested at least twice annually and in the future. If levels in individual homes remain above those of health concern, action by EPA is strongly recommended by ATSDR and PADOH.

3. Post installation indoor air sampling be performed to determine whether the new mitigation systems are working and whether levels of contaminants are lower in the homes that received these systems.

4. Where there were VOC detections in the indoor air of residences adjacent to the site, the residents should continue to remove any possible sources of VOCs from their homes. Some of the compounds that were detected and are of a potential health concern to PADEP, EPA, and/or ATSDR are also commonly found in household products and might not be associated with the ground water plume. A list of these compounds may be found in Appendix B - Table 2. Additionally, the residents may wish to visit the National Institutes of Health and the National Library of Medicine web page for ***Health & Safety Information on Household Products.*** This web page/database may be found on-line at http://householdproducts.nlm.nih.gov/products.htm or information may be obtained by writing to the U.S. National Library of Medicine, 8600 Rockville Pike, Bethesda, MD 20894.

5. Monitoring the levels of VOCs in the off-site ground water be continued, especially since it is possible that higher concentrations of VOCs may move off-site in the future.

Public Health Action Plan

The public health action plan contains a description of actions to be taken or that have been taken by PADOH, ATSDR and/or other government agencies at and near the site. The purpose of the public health action plan is to ensure that this public health assessment not only identifies public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment.

Completed Actions

1. Data and information obtained from EPA and PADEP have been evaluated by PADOH and ATSDR to determine the public health implications of human exposure pathways via all media.

2. PADOH participated in a PADEP public hearing and public meeting for the community residents in June 2006.

Ongoing or Planned Actions

1. PADOH and ATSDR will make this HC available to the public and PADEP upon publishing. Also PADOH and ATSDR will individually distribute this HC to the affected residents by mail.
2. A letter to the residents about the detection of VOCs will be included with the HC mailing. In the letter, there will be an explanation that the some of the VOCs are not site related and some are at levels higher than normal levels in homes. A table of *Common Indoor Air Sources of VOCs* will also be included with the letter and HC.
3. PADOH and ATSDR agree with DEP and EPA's plans to perform additional sampling off-site and post-mitigation system installation sampling. As of June 2006, some additional sampling has been performed. If requested, PADOH and ATSDR will review the results from the additional sampling performed including the post-mitigation system installation indoor air sample results, when those data are available.

References

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Authors, Technical Advisors

Pennsylvania Department of Health:

Pauline Risser-Clemens, M.S.
Epidemiology Program Specialist

Barbara Allerton, R.N., MPH
Nursing Services Consultant

Mark V. White, MD, MPH
Epidemiologist, Program Director

ATSDR Reviewers:

Alan G. Parham, MPH, REHS
Technical Project Officer
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

And

Lora Werner, MPH
Senior Regional Representative
ATSDR Region 3

Certification

This health consultation for the Berkley Products Company site was prepared by the PADOH under a cooperative agreement with ATSDR. It is in accordance with approved methodology and procedures existing at the time the health consultation were initiated. Editorial review was completed by the cooperative agreement partner.

CDR Alan G. Parham, MPH, REHS

Technical Project Officer, CAT, CAPEB, DHAC, ATSDR

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

Alan W. Yarbrough, MS

Lead, Cooperative Agreement Team, SPS, CAPEB , DHAC, ATSDR

Appendix A - Figures

Figure 1 – Berkley Products Company Site Location in Lancaster County, Pennsylvania

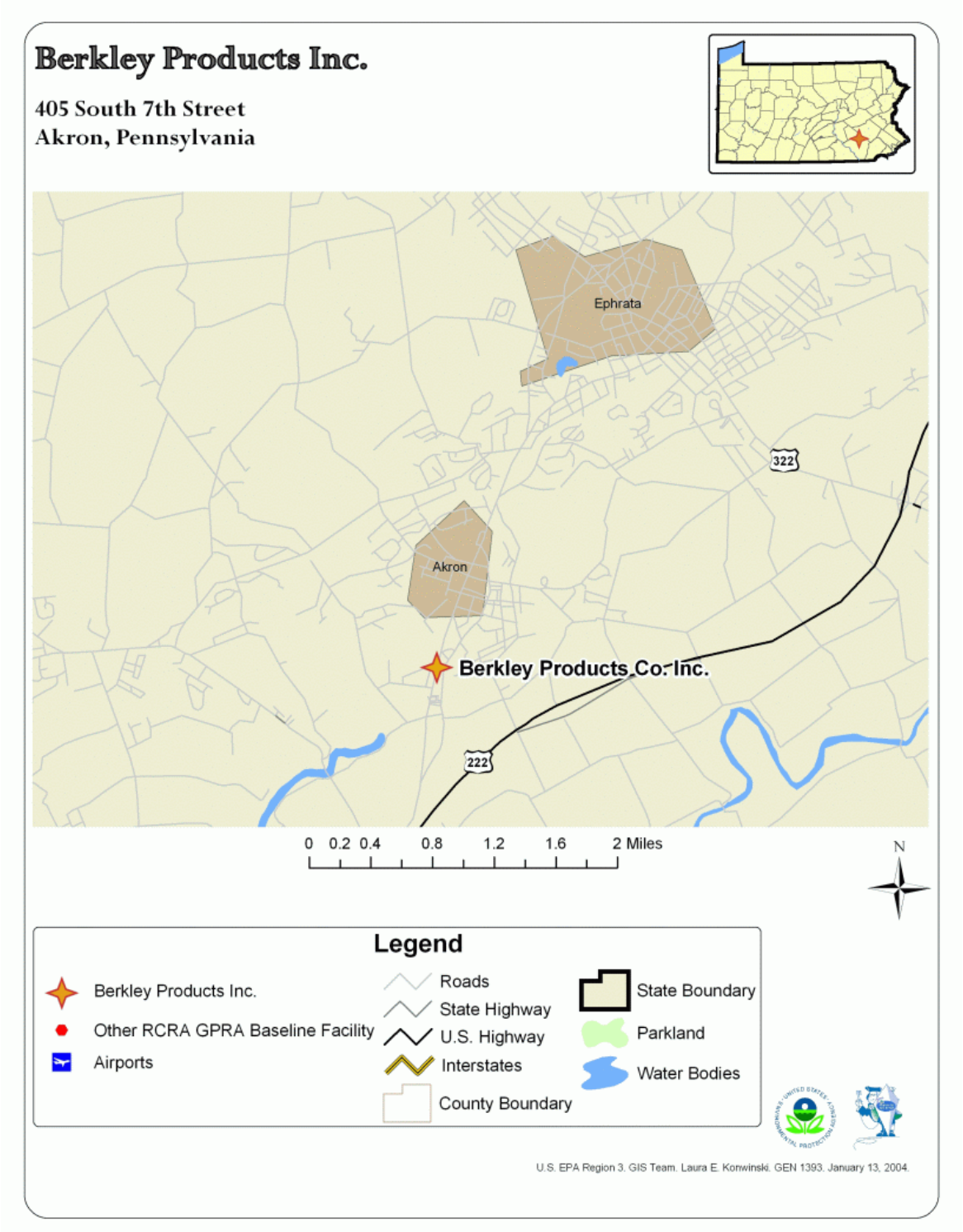

Figure 2 - Berkley Products Company Site Location in Akron, Pennsylvania

Figure 3 - Residential Area Adjacent and Down Gradient of the Berkley Products Site – Akron, Pennsylvania

Figure 4 – Past Aerial Photo of Berkley Products Company in West Earl Township, Akron, PA

Appendix B - Tables

Table 1 - Site Related VOCs Detected in the Residential Indoor Air and Where Maximum Results Are *Above* the ATSDR CVs and/or EPA RBC (Berkley Products Company Site)

Chemical	*Highest Detects (12 hour)*	*Second Highest Detects (12 hour)*	*Comparison Value : Source*
1,2,4-Trimethylbenzene	14.9	10J	6.2 : EPA RBC
Trichloroethylene (TCE)	21. 9	10.9J	0.016 : EPA RBC

Units are ug/m^3

J = Compound detected but below reporting limit; estimated value.
ATSDR CV = ATSDR Comparison Values (See Appendix C for specific details on how CVs are used in the evaluation process).
ATSDR MRL = the health guideline levels derived by ATSDR; ATSDR has developed environmental guidelines by media type.
EPA RfC = EPA's Reference Concentrations; an estimate of a continuous inhalation exposure to the human population that is likely to be without an appreciable risk of deleterious effects during a lifetime.
EPA Proposed CSF = EPA's proposed (not final) cancer slope factor to determine cancer risk of a specific dose.

Table 2 - Common Indoor Air Sources of VOCs Detected at Levels of Potential Health Concern to PADEP, EPA, and/or PADOH and ATSDR in the Residential Indoor Air (Berkley Products Company Site)

Chemical	*Common Uses/Sources*
1,2,4-Trichlorobenzene	Used as a dye carrier, an herbicide intermediate, a heat-transfer medium, a dielectric fluid in transformers, a degreaser, a lubricant, in synthetic transformer oils, and as a solvent in chemical manufacturing. Formerly used as an insecticide against termites.
1,2,4-Trimethylbenzene	Used to make dyes and drugs. It is found in gasoline, certain paints and cleaners.
1,3-Butadiene	Used to make synthetic rubber and plastics including acrylics. It is a chemical made from the processing of petroleum and small amounts are found in gasoline. It is also associated with cigarette smoke and waste incineration and wood burning.
1,4-Diclorobenzene	Used as mothballs and insecticidal fumigant.
Acetaldehyde	Used to make plastics, synthetic rubbers, perfumes, flavors, and aniline dyes.
Acrylonitrile	Used to make plastics, synthetic rubber, and acrylic fibers. A mixture with carbon tetrachloride was used as a pesticide in the past.
Acrolein	Used to make plastics, drugs, tear gas, perfumes, aquatic herbicides, and found in cigarettes and automobile exhaust. It is also a photo-oxidation product of various hydrocarbons including 1,3-butadiene. It is released during the process of frying foods.
Benzene	Used to make other chemicals, which are used to make plastics, resins, and nylon and synthetic fibers. Used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

Table 2 - Common Indoor Air Sources of VOCs Detected at Levels of Potential Health Concern to PADEP, EPA, and/or PADOH and ATSDR in the Residential Indoor Air (Berkley Products Company Site) – *continued*

Chemical	*Common Uses/Sources*
Chloroform	Used to make other chemicals and may be formed when chlorine is added to water from the reaction of chlorine with organic material.
Hexachlorobutadiene	Used as a fluid for gyroscopes, a heat transfer liquid, or a hydraulic fluid and in the manufacturing of rubber.
Hexachloroethane	Used in rubber vulcanization and as an ingredient in some fungicides, insecticides, lubricants, plastics and cellulose, and as a solvent.
Methylene Chloride	Used as an industrial solvent and as a paint stripper. It may also be found in some aerosol and pesticide products and is used in the manufacture of photographic film.
Naphthalene	Major commercial use of naphthalene is to make other chemicals used in making polyvinyl chloride plastics. The major consumer products made from naphthalene are moth repellents and toilet deodorant blocks. It is used in making dyes, resins, leather tanning agents, and the insecticide Carbaryl.
Tetrachloroethene (PCE)	Used in dry cleaning solutions and metal degreasers. Also found in adhesives, glues, insecticides, and rug cleaners.
Trichloroethylene (TCE)	Used in home and auto cleaners, adhesives, tape, spot removers, cosmetics, insulation, photographic equipment, opaquing fluid, and typewriter correction fluid. Used in dry cleaning solutions and metal degreasers.

Table 3 - VOCs (Determined Not to be Facility Related) Detected in the Residential Indoor Air and and Where Maximum Results were *Above* the ATSDR CVs (Berkley Products Company Site)

Chemical	*Highest Detects (12 hour)*	*Second Highest Detects (12 hour)*	*Comparison Value: Source*
1,3-Butadiene	6.8J	4.5	2 / 0.063 : EPA RfC / EPA RBC
1,4-Dichlorobenzene	79	48	0.28 : EPA RBC
Acrolein*	11.7	9.3	0.02 : EPA RfC / EPA RBC
Acrylonitrile	1.8J	1.6J	2 / 0.0014 : EPA RfC / EPA RBC
Benzene	6.5	6.5J	0.23 : EPA RBC
Chloroform	2.0J	1.0J	0.077 : EPA RBC
Hexachlorobutadiene	32.5	21.7	0.08 : EPA RBC
Hexachloroethane	2J	1.9J	0.45 : EPA RBC
Methylene Chloride	21.2	17.8	3.8 : EPA RBC
Tetrachloroethene (PCE)	6.9J	4.8J	0.31: EPA RBC

Units are ug/m^3 unless otherwise noted.

J = Compound detected but below reporting limit; estimated value.
ATSDR CV = ATSDR Comparison Values (See Appendix C for specific details on how CVs are used in the evaluation process)
EPA RBC = EPA's risk based concentrations/EPA's chemical concentrations corresponding to fixed levels of cancer risk
EPA RfC = EPA's inhalation reference concentrations

* - Sample results are not confirmed; more sampling may be required to determine if this contaminant is present or not.

Appendix C - Health Effects Evaluation Process Used by PADOH and ATSDR

ATSDR has developed a toxicological evaluation process for chemicals and exposure pathways in question at Superfund sites. This evaluation consists of two processes: a screening analysis and, at some sites, based on the results of the initial screening analysis, a weight-of-evidence analysis. The screening analysis, however, involves more than a simple comparison of one number against another. Site information is reviewed to select the substance concentrations and comparison values (CVs) that best represent site and exposure conditions. Typically, selecting the maximum detected substances concentrations and the lowest available CVs is used to screen the data. However, an evaluation may also be refined so that the analysis reflects more realistic exposure scenarios. During this selection process, an assessor should be mindful of community concerns, health outcomes of interest, the characteristics of potentially exposed populations, and possible exposures to multiple chemicals and/or pathways.

CVs are concentrations or doses that are conservatively derived (i.e., with many uncertainty or safety factors applied) based on the health effects literature and are below the levels associated with adverse health effects. CVs are used to assess voluminous data sets in an efficient and consistent manner during the screening analysis. They enable identification of substances that are not expected to result in adverse health effects (i.e., substances detected below CVs) and substances requiring further evaluation (i.e., substances detected above CVs). CVs should not be used to predict adverse health effects or to set cleanup levels at a site. These values serve only as guidelines to provide an initial screen of human exposure to substances. ATSDR has developed two types of CVs: health guidelines and environmental guidelines.

Health guidelines generally represent doses of a substance, usually expressed as milligrams of a substance per kilogram of body weight per day (mg/kg/day). For air exposures, the health guidelines are expressed as exposure concentrations (usually in parts per billion [ppb] or ug/m^3). Health guidelines are protective of human health and are developed for both non-carcinogenic and carcinogenic effects. Health guidelines for non-carcinogenic effects are derived from human or experimental animal data and modified, as necessary, by a series of "uncertainty" factors (also known as safety factors) that ensure that guidelines are set at levels safely below those that could result in adverse health effects. Health guidelines for cancer are derived by the EPA and represent hypothetical estimates of cancer risk at low levels of exposure. Health guidelines are available for specific routes of exposure, such as ingestion and inhalation. No CVs have been established for dermal contact exposures.

ATSDR and EPA have developed health-driven CVs for non-carcinogenic effects resulting from substance exposures. Minimal Risk Levels (MRLs) are the health guidelines derived by ATSDR. Reference doses (RfDs) and reference concentrations (RfCs) are the health guidelines derived by EPA. In addition, EPA has derived factors to measure the relative potency of various carcinogens (known as cancer slope factors or CSFs and unit risk values for oral and inhalation exposures, respectively).

ATSDR and others (e.g., EPA, state governments, the World Health Organization) derive CVs for substances for which adequate data regarding time periods of exposure and routes of exposure are available. CVs are generally available for three specified exposure periods: acute (14 days or less), intermediate (15 to 365 days), and chronic (more than 365 days). CVs are also generally available for two exposure routes: ingestion (soil and water) and inhalation. Usually CVs are available for many, but not always all substances found at a site. When CVs are available for a substance, the screening analysis is used. When no CVs are available, the data for the contaminant is generally retained for further evaluation. Exceptions exist, however. For example, essential nutrients (e.g., calcium, iron, magnesium) might only be harmful at very high concentrations or doses and would not necessarily be retained for further analysis. During the assessment it may be helpful to compare these and other naturally occurring elements to background concentrations. In selecting environmental guidelines for screening, the assessor should also consider several issues beyond which value is lowest. Consideration should also be given to e*xposure duration, site-specific conditions, and toxicological equivalency of specific chemicals.*

ATSDR has developed environmental guidelines for substances in drinking water, soil, and air. These guidelines include environmental media evaluation guidelines (EMEGs), cancer risk evaluation guidelines (CREGs), and reference dose media evaluation guidelines (RMEGs). ATSDR sometimes uses these EPA-generated CSFs to derive CREGs. CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10^{-6}) persons exposed during their lifetime (70 years). ATSDR's CREGs are calculated from EPA's CSFs for oral exposures or unit risk values for inhalation exposures. These values are based on EPA evaluations and assumptions about hypothetical cancer risks at low levels of exposure.

To meet their unique mandates, other government agencies, such as EPA, the Food and Drug Administration, and state and tribal environmental and health departments, have developed their own CVs. These other CVs may address hazardous substances in water, soil, air, fish, or other biota. Because the mandates of other agencies may not always be strictly health-driven or consistent with the concerns of Superfund sites, fully understanding the derivation, uncertainties, and possible limitations of a comparison value is key to determining its appropriateness for use in the public health assessment process. Understanding the derivation of a particular comparison value is more important during the weight-of-evidence analysis when evaluating the possible public health significance of exceeding that value.

When RfDs and MRLs are not available, and to estimate chronic health guideline doses below which no adverse health effects (noncancerous) are expected, no observed adverse effect levels (NOAELs) and lowest observed adverse effect levels (LOAELs) are often used where there are recognized studies. Greatest weight is put on human or primate chronic exposure studies, if available. One approach is the use of margin of safety (MOS) analysis based on LOAELs. In general, when the MOS is greater than 1000, harmful effects are not expected. When the MOS ranges from approximately 100 to 1000, further toxicological evaluation is needed. If the MOS is less than 10, harmful effects might be possible, but further toxicological evaluation might still be advisable.