# **Health Consultation**

### CHEM FAB FACILITY NPL SITE DOYLESTOWN, BUCKS COUNTY, PENNSYLVANIA

### EPA FACILITY ID: PAD002323848

**SEPTEMBER 30, 2008** 

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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#### HEALTH CONSULTATION

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Prepared By:

Pennsylvania Department of Health Under Cooperative Agreement with the U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry



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#### I. EXECUTIVE SUMMARY

The former Chem Fab facility was proposed to the National Priorities List (NPL) in September 2007 and listed in March 2008. The Agency for Toxic Substances and Disease Registry (ATSDR) is mandated to prepare a Public Health Assessment (PHA) for each proposed/listed NPL site. Under cooperative agreement with the ATSDR, the Pennsylvania Department of Health (PADOH) prepared this Health Consultation (HC) document to evaluate whether past, current and/or future exposure to contaminants from the Chem Fab site pose a public health threat to area residents, current business occupants, and/or visitors to impacted areas. A future PHA is planned to be produced by PADOH and ATSDR.

The Chem Fab site, a former metal plating company, is an approximately one-acre parcel currently located at 300 through 360 North Broad Street in Doylestown, Bucks County, Pennsylvania. For the purposes of this HC, on-site refers to the property originally containing the Chem Fab Corporation manufacturing business. This includes a former part of the original Chem Fab facility property, now owned by an adjacent self-storage business (Extra Space, Inc., aka Doylestown Store and Lock) at 390 North Broad Street, which has soil contamination and was also used in the past for the manufacturing processes. Off-site refers to the bulk of the self-storage property, the nearby businesses and residential areas, a nearby stream (Cooks Run), and nearby public water production wells. Contamination (both inorganic and organic chemicals) still exists on the former Chem Fab facility and continues to migrate off-site in a ground water plume and in surface water running through the next-door Extra Space self-storage property and continuing into Cooks Run stream.

Primary human health concerns associated with the former Chem Fab facility are that past and current exposures via contaminated surface water and ground water may pose a public health hazard. The Chem Fab Corporation operated an electroplating and metal etching facility from 1965 to approximately 1986. In 1987 it was discovered that private wells in the surrounding area were contaminated with volatile organic compounds (VOCs). In the March 1988 ATSDR Health Consultation, exposures to contaminants in the private wells in this area were evaluated and it was concluded that an imminent health threat existed. Alternate drinking water was provided in 1988 through 1991 and the affected local businesses and residences were connected to a public water system. EPA determined that there are 67 private wells in use for drinking water between 0.5 to 1 mile from the site, but PADOH and ATSDR have determined that only four (4) of these currently uncontaminated wells are located downgradient and may be at-risk from the migrating ground water plume.

The Doylestown Borough Water Department (which services the borough) has five active and one inactive public water production well within 1.0 mile of the Chem Fab NPL site. The inactive production well (DB-13) was closed in 2001 due to VOC contamination and the risk of hexavalent chromium contamination. One of the five remaining active production wells is



downgradient of the site, and sampling results indicate that the ground water plume is migrating in the direction of this production well (Well DB-8). Thus, Well DB-8 is at-risk of becoming contaminated until the ground water is remediated/controlled. In response to a prior PADEP request, ATSDR evaluated the public health significance of current community exposures to chemicals from the site. As a result, ATSDR released a previous health consultation (HC) on June 19, 2007. Recent surface water sample results from a drainage swale near the site and ground water monitoring results indicated that hexavalent chromium and trichloroethylene (TCE) were elevated above health levels for short-term exposures. Also, at the request of EPA, ATSDR reviewed EPA indoor air modeling results and recommended that additional characterization of the potential indoor air exposure pathway and vapor intrusion issues be conducted.

Further characterization of indoor air exposures was performed due to concerns about possible vapor intrusion. Vapor intrusion refers to the migration of volatile chemicals from the subsurface into the overlying buildings. This sampling was performed in 2008 in the indoor air of structures over the ground water plume containing businesses and a residence. Two rounds of indoor air results were evaluated by PADOH and ATSDR. PADOH and ATSDR concluded that currently the levels of VOCs in the indoor air do not pose a public health hazard to the workers or visitors, though, indoor air levels could change over time and levels should be further assessed. In addition, indoor air results from the residence/office on the adjacent self-storage property and office space at the nearby sewage treatment plant were evaluated by PADOH and ATSDR. Currently, it appears that the levels of VOCs in the indoor air do not pose a public health hazard to the adjacent self-storage property and office space at the nearby sewage treatment plant were evaluated by PADOH and ATSDR.

PADOH and ATSDR conclude the following in this health consultation (HC):

1) Current Exposures to Surface Water

Historical exposure to maximum levels of the hexavalent chromium in the surface water could have caused acute health effects if a child drank the water or got it on his or her skin. Based on levels of hexavalent chromium in surface water on the Extra Space self-storage property, exposures would be categorized as a public health hazard. The recently installed metal grating over the drainage areas on this property essentially eliminates the potential for exposure. Exposure to site-related chemicals in Cooks Run is not expected to result in health effects (but exposure to bacteria in the Cooks Run could pose a hazard; thus, exposures to Cooks Run should be avoided).

2) Current Exposures to Ground Water

A public water system serves area businesses and residences, and there are six (five active and one inactive) public water production wells within 1 mile of the Chem Fab site. Of the five active wells, one is downgradient of the site and considered to be at-risk of becoming contaminated until the ground water is remediated/controlled. Of the 67 private wells in use for drinking water



between 0.5 and 1 mile of the site, four (4) wells are considered to be potentially at-risk of contamination from the migrating ground water plume.

#### 3) Past Exposures to Ground Water

Based on the 1988 health consultation, past exposures to impacted ground water via private drinking water wells posed an imminent public health hazard. It is possible that health effects related to past exposures could have occurred based on the highest detected levels. In 1988, EPA supplied alternate water and public water connections which effectively mitigated exposure via contaminated drinking water.

4) Current Exposures to Indoor Air

Based on limited sampling results, PADOH and ATSDR conclude that reported levels of VOCs in indoor air from on-site structures (businesses), do not pose a public health hazard to the employees or visitors. However, over time indoor levels could change and further characterization is warranted. In addition, indoor air levels could change under varying circumstances. The levels of VOCs detected in the indoor air of the off-site residence and offices currently are not at levels of health concern.

5) Current Exposures to Surface Soil

In a future PHA, PADOH and ATSDR will be reviewing the 2008 investigation summary report which includes soil sample results and soil boring information. Until this information is reviewed, PADOH and ATSDR cannot make a public health determination.

PADOH and ATSDR recommend that:

 PADOH and ATSDR evaluate EPA's proposed remedial plan for public health protectiveness;
 Further characterization of the potential indoor air exposure pathway via vapor intrusion by the environmental agencies (EPA, PADEP) take place;

3) PADOH and ATSDR be provided with 2008 Investigation Summary Report as soon as available; and

4) Local authorities, in conjunction with environmental agencies (EPA, PADEP), continue monitoring of Doylestown Borough Public Water well system to monitor for any changes in water quality, especially given the apparent at-risk status of production well DB-8.



#### **II. BACKGROUND AND STATEMENT OF ISSUES**

In cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), the Pennsylvania Department of Health (PADOH) prepared this HC document to evaluate whether exposure to contaminants from the Chem Fab site pose a public health threat to area residents and occupants of businesses on or visitors to impacted properties. The Chem Fab site in Doylestown, Bucks County, Pennsylvania was proposed to the National Priorities List (NPL) in September 2007 and finalized in March 2008. ATSDR is mandated to evaluate each NPL site. A future PHA is planned to be produced by PADOH and ATSDR. In the past, both the Pennsylvania Department of Environmental Protection (PADEP), formerly the Pennsylvania Department of Environmental Resources (PADER), and the Bucks County Health Department (BCHD) were involved in the investigation, environmental sampling, and evaluation at this site. The U.S. Environmental Protection Agency (EPA) became involved at the Chem Fab site in 1987.

Past Chem Fab Corporation operations resulted in soil, surface water, and ground water contamination on-site. Contamination still exists on the original Chem Fab facility property and continues to migrate off-site as a ground water plume and by way of surface water into a nearby stream, Cooks Run stream. For the purposes of this PHA, *on-site* refers to the property originally containing the Chem Fab manufacturing business. This includes a former part of the Chem Fab manufacturing property which is now owned by an adjacent self-storage business (Extra Space, Inc., aka Doylestown Store and Lock) at 390 North Broad Street. *Off-site* refers to the nearby public water production wells, and a nearby stream (Cooks Run). For this HC, the *past* is defined as pre-2008, and *current* is defined as 2008 up to or until remediation by EPA takes place at the site.

The Chem Fab NPL site is an approximately one-acre parcel located at 300 through 360 North Broad Street, Doylestown, Bucks County, Pennsylvania (see <u>Appendix A - Figure 1</u> and <u>Appendix A - Figure 2</u>). The United States Geological Service (USGS) coordinates for this facility are latitude: 40°18'57.45" north and longitude: -75°08'09.61" west [2]. The site is in the Doylestown Borough, though the ground water plume extends into the adjacent Doylestown Township [3,4,5]. The former Chem Fab facility buildings are presently used for business offices and warehouse storage. The facility is bordered to the east by an operating business, to the west and south by an active self-storage business, and to the north by North Broad Street (see <u>Appendix A - Figure 3</u>). A drainage swale for surface water runs through the self-storage business at 390 North Broad Street, and ultimately the water reaches a stream, Cooks Run.

The Chem-Fab Corporation operated an electroplating and metal etching company on the site from 1965 to approximately 1986 [5]. During this time, the facility generated wastes that included ferric chloride, mineral spirits, chromic acid rinse water and sludge, chromic acid, sulfuric acid, sodium bisulfate, sodium hydroxide, and lime. Before 1969 and through 1971,



chemical spills were known to have occurred onto surface soil on-site and into surface water offsite [2]. A trichloroethylene (TCE) vapor degreasing process was used until 1973. The former Chem-Fab facility contained four buildings (two industrial buildings, a residence, a large warehouse / manufacturing building) and two trailers. Residential neighborhoods were located nearby. By 1994, the facility was fenced and bordered on three sides by industrial facilities. There were three buildings (a computer component building, an abandoned warehouse, a residence) and two trailers located on the property. In 1999, the property underwent renovations and on-site soil was covered with pavement and concrete. More details about the history of this site may be found on EPA's Mid-Atlantic Superfund Chem-Fab Corporation Webpage [1].

#### **III. SITE VISIT**

On November 21, 2007, PADOH, ATSDR, and EPA staff visited the Chem Fab site. Significant observations noted:

- Buildings (warehouse type building and smaller buildings) on-site currently house various businesses, which are located over the ground water plume;
- The businesses on-site use public water from the Doylestown Borough Water Department;
- The Chem Fab facility at 300-360 North Broad Street is paved and/or covered with stone;
- The locations of the monitoring wells on-site are mostly toward the south and southwest, but include an old 50 foot deep water well in the front of the Chem Fab property next to North Broad Street;
- There are monitoring wells dispersed through the properties adjacent to and south and southwest (direction of the contaminated ground water plume) of the Chem Fab site;
- The location of nearby residential homes are upgradient from the site, except for two residences located on the other side of and next to Cooks Run stream;
- A self-storage business and residence/office (Extra Space, Inc.) is located on the adjacent property south and southwest of the site. Part of this business was built on an area originally used by the Chem Fab facility;
- The locations on the self-storage property where high levels of chromium have been found in the surface water and soil and where a grated drain over a swale had been installed to protect the public (especially children) from the highly contaminated surface water were noted; and
- The location on the southern most side of the self-storage area where the surface water empties into a second fenced drainage area was noted. The surface water flows toward a nearby stream, Cooks Run (the surface water goes beneath the surface of the ground at the end of the drainage area and then resurfaces in a tiny, unnamed tributary before reaching the stream). The small area, located immediately before Cooks Run stream, is not fenced and could pose a potential risk of exposure to children playing in this area.



#### **IV. DEMOGRAPHICS**

The population of Doylestown is 8,200 persons [6]. There are 1,359 children (16.5 percent) under the age of 18 years and, out of this number, there are 377 children (4.6 percent) below the age of 5 years [6]. Renter-occupied housing accounts for 51.7 percent of the population and owner-occupied housing accounts for 48.3 percent [6].

#### V. DISCUSSION

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 will *never* be present.

#### A. PATHWAYS ANALYSIS

Overview of the Complete and/or Potential Exposure Pathways Determined to be Significant by PADOH and ATSDR

Past and current completed and potential human exposure pathways are associated with the onsite and off-site contaminated surface water, surface soil, and ground water and resulting vapor intrusion from subsurface contamination beneath structures. Details of the exposure pathways are described in the following **Table 1 Chem Fab Site - Completed and Potential On-site and Off-site Human Exposure Pathway**.

#### B. TOXICOLOGICAL AND DATA EVALUATION

#### PADOH and ATSDR Toxicological Screening 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. If a chemical concentration is found in the environment at levels below the CV, it is not likely to cause adverse health effects, though



Time Frame	Medium	Exposure Medium	Exposure Point	Receptor Population	Adult / Child	Exposure Route	Completed or Potential Pathway	Exposure Pathway
Past / Current	Ground water	Ground water	Drinking water from private wells and public water well	Residents of Doylestown	Adult / Child	Ingestion / Inhalation / Skin contact	Completed / Potential	<ul> <li>Past. Use of private wells from 1965 until early 1988 and public water well use 1965 to the present.</li> <li>Current - One PWS and four private wells are downgradient and are at-risk [7].</li> </ul>
Past / Current	Surface water	Surface water	Playing in the surface water (swale, stream)	Visitors (to the Extra Space self- storage and area of the stream)	Child	Ingestion/ Skin contact	Completed / Potential	<b>Past</b> . Children playing/wading in the surface water (drainage from/through the Extra Space self- storage property and to Cooks Run stream), including accidental ingestion. <b>Current</b> . Grated cover over drainage lowers exposures, but an area is still open to the public at and before Cooks Run stream.
Past / Current	Subsurface soil; Ground water	Gas vapors (volatile compounds)	Indoor air	Residents; Visitors; Employees	Adult / Child	Inhalation	Potential	<b>Past</b> . Vapor intrusion into the indoor air of structures on-site or off-site is unknown. <b>Current</b> . Vapor intrusion to businesses on-site and residence/ offices off-site.
Past / Current	Surface soil	Surface soil	Playing in the surface soil	Residents; Visitors	Child	Ingestion / Skin contact	Potential (self- storage property)	<b>Past, Current.</b> Children playing in surface soil (in addition to exposures to the surface water) on the adjacent self-storage property. It is <i>unlikely</i> that children would play or have played <i>on-site</i> in the soil due to the pavement / concrete covers and to this being an occupational facility in the past.

 Table 1

 Chem Fab Site - Completed and Potential On-site and Off-site Human Exposure Pathways



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 <u>Appendix C</u> for more information about the ATSDR health effects evaluation process.

#### Assumptions Used to Evaluate Exposure Levels and Public Health

*Private drinking water*: It was assumed that residents were exposed to the maximum levels of contaminants detected from late 1965 into early 1988. For evaluations of theoretical increased cancer risks, it was assumed that the exposures occurred for a maximum of 22 years (1965 to 1987). Small children were assumed to drink one (1) liter of water per day and to weigh 10 kilograms (22 pounds). Adults were assumed to drink two (2) liter of water per day and to weigh 70 kg (154 pounds).

*Public drinking water*: Exposures may have occurred in the public water from 1965 to 2008. VOCs were unregulated contaminants prior to 1989 (though some PADEP guidance was in affect from 1987 until MCLs were established) [3]. In 2001, TCE levels were found in the public wells (DB13) well at 13.5 ppb TCE and this well was closed [2]. Ground water from all wells in this system is blended and treated prior to distribution; no single well provides greater than 40 percent of the total public water supply to the Doylestown Residents [2]. For this assessment, it was assumed that no exposures above the TCE MCL of 5 ppb occurred in the public water served to the residents by the Doylestown Borough Water Department after 1989 due to the EPA and the Pennsylvania monitoring requirements under the Safe Drinking Water Act for metals and VOCs. *Because of the lack of sampling information prior to 1988 and the levels detected prior to 2001, it was assumed that the residents may have received public water containing levels up to maximum levels of 5 ppb TCE and 5 ppb PCE, though levels could have been greater. Therefore, the actual levels and, therefore, the assessment are uncertain. For evaluations of theoretical increased cancer risks, it was assumed that the exposures occurred at these maximum levels for 43 years (1965 to 2008).* 

*Indoor air*: The assumptions included that employees worked for 8 hours per day, but for less than ten (10) years on-site and for residents, the exposures were for 24 hours per day for thirty (30) years.

#### Toxicological Evaluation of the Exposures and Contaminant Levels

The toxicological evaluation includes the exposure doses as per completed and/or potential exposure pathways as follows:

1) <u>Toxicological Evaluation of Exposures to Contaminants Associated with the Ground Water</u> <u>Used as Drinking Water</u>



#### Private Well Water

Prior to receiving public water, some residents were exposed to contaminated drinking water from private wells near the Chem Fab site from an unknown point in time (possibly beginning in 1965) until EPA provided alternate drinking water in 1988 and public water was installed [2, 4]. In October 1987 through February 1988, sample results taken from nearby private wells yielded the following: TCE at a maximum of 592 ppb; PCE at a maximum of 143 ppb; 1,1,1-TCA at a maximum of 4,578 ppb; and 1,1-DCE at a maximum of 1,681 ppb (levels of the contaminant detected are listed in the previous section in this PHA titled Site Contamination and Environmental Sampling). In April 12, 1988, a study was published by ATSDR titled Collection and Analysis of Blood Samples from Doylestown, Pennsylvania Residents [4]. The purpose of the study was to determine the level of VOCs in the blood of selected fourteen (14) Doylestown residents living in homes where contaminated water from private wells was continued to be used for other purposes than drinking water [4]. Today, most of the businesses near or residents, living close to and down gradient of the site, use the public water for drinking water purposes and have abandoned these contaminated private wells [3,7]. One business and two residential private wells (that were determined to be contaminated in the past) appear to remain connected for outdoor uses such as yard watering. A fourth business opted not to hook up to public water for drinking water and purchases bottled water and/or treats the ground water. A shallow well (50 foot depth) monitoring well on-site might possibly have been used on the original Chem Fab property at some point in the past, but this is unknown (see Appendix A- Figure 4, for the location of this well, DW, and Appendix B – Table 2 and Appendix B – Table 3 for levels of contaminants on-site).

Residents living near the site may have been exposed by ingesting well water contaminated with a maximum level of 592 ppb TCE [4]. The second highest level of TCE detected in the residential wells was 326 ppb [4]. ATSDR and PADOH evaluated the potential for noncancerous health effects. Based on the assumptions previously discussed and assessing exposures to the *maximum* levels that were detected in the ground water, the estimated total past daily dose for a small child and an adult would have been 0.059 and 0.017 mg/kg/day, respectively. These estimated doses are above the EPA's reference dose or RfD (currently proposed and under EPA review at 0.0003 mg/kg/day), but the estimated doses are about three (3) to four (4) orders of magnitude - meaning 1000 to 10,000 times - less than the no observable adverse effect levels (NOAEL) in animal studies of 250 mg/kg/day. Some recent reviews show that a lower NOAEL or LOAEL such as a lowest observed adverse effect level (LOAEL) at 50 mg/kg day might be considered, therefore, this dose for a child ingesting this ground water might only be about three (3) orders of magnitude less than the LOAEL. *There appears to be an adequate margin of safety, so non-cancerous health effects related to these exposures at the highest levels of TCE in the ground water would not be expected.* 

EPA considers TCE to be a probable carcinogen [9]. To evaluate the theoretical increased cancer risk to residents exposed chronically at the maximum TCE level of 592 ppb, the TCE CSF (note – the CSF is currently under review by EPA) was used to calculate the cancer risk at this level. The expected increased cancer risk would be *one* (1) additional cancer per 1,000



people. In early 1988, the population was provided alternative drinking water, so there would have been a significant reduction in excess cancer risk due to that action [4]. **PADOH and ATSDR classifies this as a low to moderate increased cancer risk and consistent exposures to** these levels could contribute to carcinogenic health effects over the residents' lifetimes. This is a very conservative estimate, though, and assumed that the residents consistently ingested ground water that consistently contained these maximum levels for 22 years.

#### Tetrachloroethene (PCE)

The residents may have been exposed to a maximum level of 143 ppb PCE by way of drinking the ground water from their private wells [4]. The next highest level detected in residential wells was 136 ppb [4]. Based on the assumptions previously discussed and assessing the *maximum* levels detected in the ground water, the estimated total daily dose for a small child and an adult would have been 0.014 mg/kg/day and 0.004 mg/kg/day, respectively. This child's dose is three times more than the EPA's chronic oral RfD of 0.01 mg/kg/day, but four (4) to five (5) orders of magnitude less than the NOAEL in animal studies [9]. It is *very unlikely that noncancerous health effects* would have occurred for residents, even for consistent exposures to the PCE in the contaminated well water.

EPA considers PCE to be a probable carcinogen [9]. Based on the theoretical excess cancer risk estimation for past exposures to maximum levels detected for 22 years, the predicted increased cancer risk would be *three (3) additional cancers per 100,000 people*. This is classified as *a no apparent to low increased cancer risk*.

#### 1,1-Dichloroethene (1,1-DCE)

Children and adults may have been exposed to 1,1-DCE from their private well water at the maximum levels of 1,681 ppb and second highest detect of 1,526 ppb [4]. The estimated exposure oral dose for chronic ingestion at the maximum level detected would have been about 0.048 mg/kg/day for an adult and about 0.168 mg/kg/day for a small child. *The estimated dose for a child is almost 20 times more than the ATSDR MRL for 1,1-DCE of 0.009 mg/kg/day and more than three times greater than the EPA RfD of 0.05 mg/kg/day. This oral dose for an adult is 200 times less than, and this oral dose for a child is only 60 times less than, the NOAEL of 10 mg/kg/day observed in animal studies [9]. Assuming maximum exposures to the ground water via ingestion, the maximum daily doses might not have enough margin of safety. This is an even greater possibility for children. Therefore, it is <i>possible that noncancerous health effects could have occurred due to exposures especially in children, assuming that the residents consistently ingested ground water that consistently contained these maximum levels of 1,1-DCE.* 

The International Agency for Research on Cancer has determined that 1,1-DCE is *not classifiable as to its carcinogenicity* in humans. EPA considers 1,1-DCE as a *possible* human carcinogen (there is limited evidence). *Assuming carcinogenic potential*, based on EPA's cancer risk numbers for ingesting drinking water, the theoretical increased cancer risk could be



one (1) increased cancer per 100 persons exposed to the maximum level. Even though this is a very conservative estimate and *the cancer risk for 1,1-DCE is very uncertain, this level of theoretical excess cancer risk could be significant and could be classified as an increased excess cancer risk. ATSDR considers there to only be 'suggestive evidence of carcinogenic potential' for ingestion exposures to 1,1-DCE and, according to the ATSDR toxicological profile, no studies were located regarding cancer in humans after oral exposure to 1,1-DCE [9].* 

#### 1,1,1-Trichloroethane (1,1,1-TCA)

The compound 1,1,1-TCA was also found in the ground water of private wells in 1988 at a maximum concentration of 4,578 ppb and at a second highest level of 4,180 ppb [4]. Assuming consistent exposures to the maximum levels in the ground water , the estimated oral dose would have been 0.131 mg/kg/day for an adult and 0.458 mg/kg/day for a small child. Both of the child and adult doses are about three (3) orders of magnitude less than the NOAEL in animal studies and would have been below levels of health concern [9]. It is *very unlikely that noncancerous health effects* would have occurred in people exposed to 1,1,1-TCA in the contaminated ground water from private wells off-site.

The International Agency for Research on Cancer has determined that 1,1,1-TCA is not classifiable as to its carcinogenicity in humans. EPA and ATSDR have also determined that 1,1,1-TCA is not classifiable as to its human carcinogenicity.

#### Multiple Chemical Exposures (TCE and PCE Combined)

ATSDR and PADOH reviewed the scientific literature surrounding chemical interactions and the agencies note that if the estimated exposure doses for individual contaminants found in the private wells in the past are well below the doses shown to cause adverse health effects, that the combined effect of more than one like chemicals is not expected to result in adverse health effects. TCE and PCE conservatively estimated exposure doses are below health effect levels reported in the scientific literature. TCE is not below an insignificant level for increased cancer risk, but PCE is below any significant level. Therefore, PADOH does not expect additive or interactive health effects of the two chemicals.

#### **Public Water**

A completed pathway of exposure exists via ingesting the ground water from the PWS. In 2001, TCE levels were found in the two Public Water wells, at 1.8 ppb TCE for production well DB8 and 13.5 ppb TCE for production well DB13 [2]. Ground water from all wells in this system is blended and treated prior to distribution; no single well provides greater than 40 percent of the total public water supply to the Doylestown Residents [2]. No exposures to the community occurred above the TCE MCL in the public water served by the Doylestown Boro Water Department PWS during the past 10 years [3, 8].



#### Trichloroethylene (TCE)

The Doylestown Borough public drinking water may contain TCE up to the MCL of 5 ppb. Based on this, the estimated *maximum* daily dose for children and adults is 0.0005 and 0.0001 mg/kg/day, respectively. The estimated dose for a child is above the EPA's RfD (currently proposed and under EPA review at 0.0003 mg/kg/day), but this dose is at least five (5) orders of magnitude less than the NOAEL or LOAEL (a LOAEL at 50 mg/kg day could be considered) [9]. *This is a large margin of safety and non-cancerous health effects related to these exposures at the highest levels of TCE in the ground water would not be expected*.

To evaluate the theoretical increased cancer risk for residents, the TCE CSF (as previously noted, currently under review by EPA) was used to calculate the increased cancer risk, which is *two (2) excess cancers per 100,000 people*. This is *an insignificant theoretical increased cancer risk*. Since it might be expected that the public water would be consumed for a person's lifetime, this was considered. The theoretical cancer risk would be *three (3) additional cancers per 100,000 people* and this would be *an insignificant increased cancer risk*. Because of the lack of sampling information prior to 1988, the levels from 1965 to 1988 are uncertain and could have been greater than 5 ppb TCE. Therefore, the increased cancer risk is actually uncertain.

#### Tetrachloroethene (PCE)

The Doylestown Borough public drinking water may contain PCE up to the MCL of 5 ppb. Assuming maximum exposures, the estimated daily dose for a small child and an adult is 0.0005 mg/kg/day and 0.0001 mg/kg/day, respectively. The estimated dose for a child is two (2) orders of magnitude less than the EPA's chronic oral RfD of 0.01 mg/kg/day and about three (3) orders of magnitude less than the NOAEL in animal studies [9]. Therefore, it is *extremely unlikely that noncancerous health effects* would occur in residents even if the public drinking water was consistently ingested with this maximum level of PCE.

Based on the theoretical increased cancer risk estimation for past exposures to the maximum level of PCE allowed in drinking water for 43 years, the predicted increased cancer risk would be about *two (2) additional cancers per 100,000 people*. This is classified as *an insignificant increased cancer risk*. Because of the lack of sampling information prior to 1988, the levels from 1965 to 1988 are uncertain and could have been greater than 5 ppb PCE. Therefore, the increased cancer risk is actually uncertain.



#### TCE and PCE Combined (Multiple Chemical Exposures)

ATSDR and PADOH reviewed the scientific literature surrounding chemical interactions and the agencies determined that if the estimated exposure doses for individual contaminants in the public water system 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 because for each chemical evaluated the conservatively estimated exposure doses are below health effect levels reported in the scientific literature.

#### 2) <u>Toxicological Evaluation of Ingestion (Oral) and Dermal (Skin) *Exposures to the Contaminated* <u>Surface Water in the Drainage Areas (Swale) and Into Cooks Run Stream</u></u>

After the Extra Space self-storage buildings were installed next door to the Chem Fab site, yellow-colored surface water (due to high levels of chromium) was noticed [9]. Due to the Doylestown borough and PADEP community health concerns, in 2007 a grated culvert was placed over the drainage area to minimize surface water exposures, especially to children visiting the self-storage property. Currently, exposures would be expected to be reduced due to this installation, though the culvert does not cover the entire off-site drainage areas. The grated cover is a temporary solution until EPA mitigates the site. Exposures to this contaminated surface water include *potential human exposures* during playing and/or wading in the surface water by children: 1) In the *past* before the grated culvert was installed; and 2) *Currently* in the drainage that leads to the unnamed tributary prior to Cooks Run stream, since the area just prior to entry into the stream is not fenced or covered.

In 2006, samples showed that the surface water on the Extra Space self-storage property contained maximum levels of hexavalent chromium up to 36,400 ppb and total chromium up to 39,700 ppb. *In 'worst case' scenarios, the ingestion dose for a small child might be between 1 to 4 mg/kg/day. In acute human exposures to hexavalent chromium, the LOAELs for serious health effects were found to range from approximately 4.1 mg/kg/day to 29 mg/kg/day and some health effects were reported after a single dose [10]. It is thought to be highly unlikely that a visitor to this area would intentionally drink the surface water; PADOH and ATSDR conclude that the <i>exposures via ingestion might be extremely small, but nonetheless most likely significant* [10]. Additionally, ATSDR considers skin exposures to high levels of chromium to be a contributing factor to the overall exposure dose, since high enough doses could cause skin rashes [10]. The maximum hexavalent chromium concentration detected in the tributary entering Cooks Run stream was 580 ppb. This level is at least 100 fold lower than the maximum levels found in the drainage swale, due to dilution at points of entry into the stream [10]. Therefore, hexavalent chromium exposure doses from the surface water would be expected to be much lower at Cooks Run (see Appendix B – Table 4).

Ingesting a very small amount of hexavalent chromium generally is not harmful; however, ingestion of large amounts can cause upset stomach, gastrointestinal (GI) effects, ulcers, kidney, liver damage and high enough levels even death [9, 10]. Hexavalent chromium is



about 200 times more toxic than trivalent chromium (this information is based on animal studies) [10]. Ingestion of chromium has not been shown to cause cancer, although chronic inhalation of chromium has been shown to cause lung cancer [10]. According to the International Agency for Research on Cancer, chromium metal and trivalent chromium are not classifiable as to their carcinogenicity. EPA has insufficient evidence that hexavalent chromium in food or water causes cancer [9, 10]. Birth defects have been observed in animals exposed to chromium, but there is no reliable information proving that human birth defects might be caused by chromium exposures [10]. For consistent, long-term (chronic) ingestion exposures in humans, a LOAEL of 0.57 mg/kg/day has been cited [10].

Several VOCs were also found in the surface water (see <u>Appendix B – Table 4</u>). This water is not being used for drinking water and the levels of the VOCs would not be high enough to warrant public health considerations for occasional exposures to the surface water. A *Cooks Run Watershed Assessment* found that the surface water in the Cooks Run stream is deemed unacceptable for primary contact recreation due to bacterial contamination by bacteria [10].

#### In summary:

- Exposure to reported levels of the hexavalent chromium in the surface water from the drainage swale could cause acute effects if an individual drank the water or got it on their skin. This scenario appears to be unlikely, but the potential does exist. Based on levels of hexavalent chromium in surface water from the storage facility swale, we have categorized exposures as a *potential public health hazard*;
- Exposure to chromium in surface water from the Cooks Run stream is not expected to result in adverse health effects, but exposure to fecal coliform (bacteria) in the Cooks Run stream could pose a public health problem, therefore, ingestion and skin exposure should be avoided.
- •

#### 3) <u>Toxicological Evaluation of Exposures Associated with Potential Gas Vapor Intrusion from</u> <u>Soil Gases and Contaminated Ground Water Into Business Buildings and Off-site Residence</u>

Based on soil gas vapor results, concerns that vapor intrusion into the indoor air of business buildings over the plume and into an adjacent residence might be occurring prompted indoor air monitoring. Vapor intrusion refers to the migration of volatile chemicals from the subsurface into the overlying buildings. In the June 19, 2007 *Chem Fab Site Health Consultation*, ATSDR compared the maximum predicted modeled indoor air concentrations for this site to ATSDR health-based screening values for indoor air [10]. Chronic, intermediate, and (in one case) acute duration screening values were exceeded for 1,2-DCE, PCE, and TCE (see the June 19, 2007 *Chem Fab Site Health Consultation* for details) [10]. It was determined that occupants of these buildings could potentially be inhaling volatile contaminants by this pathway, and modeled results indicated a *public health hazard*. Consequently, ATSDR recommended that



this potential indoor air / vapor intrusion pathway be more fully characterize [3, 10]. Subsequently, in March and June, 2008, PADEP performed two rounds of indoor air sampling at the 300 to 360 North Broad Street business locations on the Chem Fab site and, off-site, at the residence / business office located at 390 North Broad Street, at the business located at 280 North Broad Street, and at the sewer treatment plant offices at 300 Harvey Avenue (see <u>Appendix A - Figure 5</u> and <u>Appendix A - Figure 6</u>) [3].

Upon receipt of the indoor air / vapor intrusion data, ATSDR and PADOH reviewed the data. ATSDR and PADOH concluded that currently the levels of VOCs detected in the indoor air, *do not pose a public health hazard* to the employees or visitors *on-site* [11]. Even though it appears that vapor intrusion may be occurring into some locations *on-site, it is not expected that these low levels would pose health effects* due to chronic exposures, but indoor air levels could change under varying circumstances (see <u>Appendix B – Table 5</u> and <u>Appendix B – Table 6</u>). *On-site Indoor Air Sample Results* 

#### Methylene Chloride

ATSDR and PADOH evaluated the maximum level of methylene chloride of 5.9 ug/m<sup>3</sup> detected in the indoor air on-site for the potential for noncancerous health effects. Based on the assumptions, the estimated total daily dose for an adult (employee) would be 0.0003 mg/kg/day. These level detected well is below the EPA RfC of 1,100 ug/m<sup>3</sup>. There is an adequate margin of safety, so non-cancerous health effects related to these exposures at the highest levels of methylene chloride in the indoor air would not be expected.

EPA considers methylene chloride to be a probable carcinogen [9]. To evaluate the theoretical increased cancer risk to adults exposed chronically at the maximum level of  $5.9 \text{ ug/m}^3$ , the CSF was used to calculate the cancer risk at this level. The expected increased cancer risk would be *one* (1) additional cancer per 1,000,000 people. PADOH and ATSDR categorize this as an insignificant cancer risk.

#### Trichloroethylene (TCE)

ATSDR and PADOH evaluated the maximum level of TCE of 63.5 ug/m<sup>3</sup> detected in the indoor air on-site for the potential for noncancerous health effects. This level is above the EPA RfC, but well below the intermediate MRL of 500 ug/m<sup>3</sup>. Based on the assumptions, the estimated total daily dose for an adult (employee) would be 0.0045 mg/kg/day. The estimated dose is three (3) orders of magnitude - meaning 1,000 times - less than NOAEL in animal studies [9]. *There is an adequate margin of safety, so non-cancerous health effects related to these exposures at the highest levels of TCE in the ground water would not be expected.* 

EPA considers TCE to be a probable carcinogen [9]. To evaluate the theoretical increased cancer risk to adults exposed chronically at the maximum TCE level of 63.5 ppb, the TCE CSF (note – the CSF is currently under review by EPA) was used to calculate the cancer risk at this level. The expected increased cancer risk would be *one* (1) additional cancer per 10,000



people. PADOH and ATSDR categorize this as a low increased cancer risk and consistent exposures to these levels could contribute to carcinogenic health effects over the residents' lifetimes. This is a very conservative estimate, though, and assumes that the person consistently was exposed at work to the maximum levels for 10 years. None of the businesses has existed for ten years on-site, so the cancer risk would be much lower and in all likelihood should realistically categorized as no apparent or insignificant increased risk.

#### Tetrachloroethene (PCE)

ATSDR and PADOH evaluated the maximum level of PCE of 83.5 ug/m<sup>3</sup> detected in the indoor air on-site for the potential for noncancerous health effects. This estimated dose is above the EPA's RfC, but below the chronic MRL of 300 ug/m<sup>3</sup>. Based on the assumptions, the estimated total daily dose for an adult (employee) would be 0.0060 mg/kg/day. This estimated dose is three (3) orders of magnitude below the NOAEL in animal studies [9]. There is *an adequate margin of safety, so effects related to these exposures at the highest levels of PCE would not be expected*.

EPA considers PCE to be a probable carcinogen [9]. To evaluate the theoretical increased cancer risk to adults exposed chronically at the maximum level, the PCE CSF (note – the CSF is currently under proposed by EPA) was used to calculate the cancer risk at this level. The expected increased cancer risk would be about *one* (1) additional cancer per 100,000 people. PADOH and ATSDR categorize this as an insignificant increased cancer risk.

#### **Off-Site Indoor Air Sample Results**

#### **Chloroform**

ATSDR and PADOH evaluated the maximum level of chloroform of 1.1 ug/m<sup>3</sup> detected in the indoor air at the residence for health effects. Based on the assumptions, the estimated daily dose for a child or adult be would be 0.0009 mg/kg/day and 0.0002 mg/kg/day, respectively. The level detected is well below the EPA RfC of 98 ug/m<sup>3</sup> and the intermediate MRL of 100 ug/m<sup>3</sup>. There is an adequate margin of safety, so non-cancerous health effects related to these exposures at the highest levels of chloroform in the indoor air would not be expected.

EPA considers chloroform to be a probable carcinogen [9]. To evaluate the theoretical increased cancer risk to adults exposed chronically at the maximum level of 1.1 ug/m<sup>3</sup>, the CSF was used to calculate the cancer risk at this level. The expected increased cancer risk would be two (2) additional cancer per 100,000 people. PADOH and ATSDR categorize this as an insignificant cancer risk

#### Methylene Chloride

ATSDR and PADOH evaluated the maximum level of methylene chloride of 26 ug/m<sup>3</sup> detected in indoor air off-site for noncancerous health effects. Based on the assumptions, the estimated



total daily dose for a child and an adult would be 0.021 mg/kg/day and 0.0056 mg/kg/day. The levels detected are well below the EPA RfC of 1,100 ug/m<sup>3</sup> and the intermediate MRL of 1,000 ug/m<sup>3</sup>. There is an adequate margin of safety, so non-cancerous health effects related to these exposures at the highest levels of in the indoor air would not be expected.

EPA considers methylene chloride to be a probable carcinogen [9]. To evaluate the theoretical increased cancer risk to adults exposed chronically at the maximum level of 26 ug/m<sup>3</sup>, the CSF was used to calculate the cancer risk at this level. The expected increased cancer risk would be one (1) additional cancer per 1,000,000 people. PADOH and ATSDR categorize this as an insignificant cancer risk and consistent exposures to these levels could contribute to carcinogenic health effects over the residents' lifetimes.

#### Trichloroethylene (TCE)

ATSDR and PADOH evaluated the maximum level of TCE of 8.7 ug/m<sup>3</sup> detected in the indoor air off-site for the potential for health effects. Based on the assumptions, the estimated total daily dose for a child and for an adult would be 0.0070 mg/kg/day and 0.0019 mg/kg/day, respectively. The maximum level is below the EPA RfC of 40 ug/m<sup>3</sup> and the chronic MRL of 500 ug/m<sup>3</sup>. There appears to be an adequate margin of safety, so health effects related to these exposures at the highest levels of TCE in the ground water would not be expected.

EPA considers TCE to be a probable carcinogen [9]. To evaluate the theoretical increased cancer risk to adults exposed chronically at the maximum TCE level of 8.7 ug/m<sup>3</sup>, the TCE CSF (note – the CSF is currently under review by EPA) was used to calculate the cancer risk at this level. The expected increased cancer risk would be *one* (1) additional cancer per 1,000 people. PADOH and ATSDR categorize this as a low to moderate increased cancer risk and consistent exposures to these levels could contribute to carcinogenic health effects over the residents' lifetimes. This is a very conservative estimate, though, and assumes that the person is consistently exposed for 30 years.

#### Tetrachloroethene (PCE)

ATSDR and PADOH evaluated the maximum level of PCE of 1.8 ug/m<sup>3</sup> detected in the indoor air off-site for the potential for health effects. Based on the assumptions, the estimated total daily dose for a child and for an adult would be 0.0014 mg/kg/day and 0.00039 mg/kg/day, respectively. The maximum level is below the EPA RfC of 20 ug/m<sup>3</sup> and the chronic MRL of 300 ug/m<sup>3</sup>. There is an adequate margin of safety, so health effects related to these exposures at the highest levels of TCE in the ground water would not be expected.

EPA considers PCE to be a probable carcinogen [9]. To evaluate the theoretical increased cancer risk to adults exposed chronically at the maximum PCE level of 1.8 ug/m<sup>3</sup>, the EPA proposed PCE CSF was used to calculate the cancer risk at this level. The expected increased cancer risk would be *one* (1) additional cancer per 1,000,000 people. PADOH and ATSDR categorize this as an insignificant increased cancer risk.



It is recommended that levels should be further assessed by PADEP for chronic exposures due to vapor intrusion by performing more indoor air sampling on-site. In addition, the indoor air of the residence / office and businesses on the adjacent self-storage properties and in the office locations at the sewer treatment plant off-site were sampled and data evaluated by PADOH and ATSDR. The results for the monitoring in the resident's living area are well below EPA reference concentrations (RfCs). Currently, the levels of VOCs detected in all of the indoor air sampled off-site *do not pose an imminent public health hazard* to the residents, employees, or visitors. Further, it is expected that *currently* these low levels would *not pose health problems from chronic exposures* to the indoor air.

#### 4) Toxicological Evaluation of Exposures to Contaminants in Soil

Surface soil contamination on residential property has not been documented [2]. Initial investigations on the Chem Fab site and the adjacent Extra Space self-storage properties revealed that the *subsurface soils* (subsurface soil sampling is usually at soil depths greater than 3 inches) were contaminated with chromium; cis-1, 2-DCE; 1, 2-DCE; methylene chloride; PCE; 1,1,1-TCA; and TCE [1]. Phase II investigation revealed that the *subsurface* soils of the former facility were primarily contaminated with hexavalent and trivalent chromium, TCE, and PCE [2]. Hexavalent chromium was detected in the subsurface soil of the self-storage property, but not above the ATSDR screening levels for soil [2]. The highest levels found above ATSDR screening levels on the Chem Fab site and on the adjacent self-storage property in 2000 and 2001 are listed in <u>Appendix B – Table 7</u>.

The *off-site* exposure pathways for the visitors (especially children) entering the self-storage property potentially could occur for children while playing in contaminated <u>surface soil</u> (surface soil sampling is at soil depths zero to three inches where contact would be most likely to occur). Since samples taken on the self-storage property were from *subsurface* soils rather than *surface* soils, *contaminant levels* in the surface soil *cannot be determined*. *Exposures to the subsurface* soil would not be expected on the self-storage site. EPA is planning mitigation in the near future. Currently, the area on the former Chem Fab facility has a pavement and concrete cover so *exposures by employees and visitors to on-site surface soil would be very limited or non-existent*. Additionally, it was assumed that in the past it was *unlikely* that children would have been *playing* in the soil on the Chem Fab facility because the site had been an *occupational* setting.

#### VI. CHILD HEALTH CONSIDERATIONS

PADOH and ATSDR recognize that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of environmental media. In general, children appear to be more sensitive to the effects of contaminants, presumably because of a higher body burden. Children *may have been exposed to significant levels of VOCs in the private wells*, possibly as early as 1965 to 1988, and to very low levels of TCE and PCE in the public water. Due



to public accessibility to the contaminated surface water in the swale (drainage areas) and the Cooks Run stream, it was determined that there was and possibly still is (to a much lesser extent due to the grated cover) a past and current *public health hazard for children playing in the surface waters in this area.* This is especially for children of persons renting storage space on the Extra Space self-storage property and for children living in the residential areas at or near the Chem Fab NPL site. It is not expected that children were or are exposed to contaminants in soil on the Chem Fab NPL site at levels of health concern due to the pavement and concrete covers and because this property was an occupational facility.

#### VII. CONCLUSIONS

PADOH and ATSDR conclude the following in this health consultation (HC):

1. Current Exposures to Surface Water

Exposure to maximum levels of the hexavalent chromium in the surface water could cause acute health effects if a child drank the water or got it on his or her skin. Based on levels of hexavalent chromium in surface water on the Extra Space self-storage property, exposures would be categorized as a public health hazard. The recently installed metal grating over the drainage areas on this property essentially eliminates the majority of exposure. Exposure to site-related chemicals in Cooks Run is not expected to result in health effects (but exposure to bacteria in the Cooks Run could pose a hazard and thus exposures to Cooks Run should be avoided);

2. Current Exposures to Ground Water

A public water system serves area businesses and residences, and there are six (five active and one inactive) public water production wells within 1 mile of the Chem Fab site. Of the five active wells, one is downgradient of the site and considered to be at-risk of becoming contaminated until the ground water is remediated/controlled. Of the 67 private wells in use for drinking water between 0.5 and 1 mile of the site, four (4) wells are considered to be potentially at-risk of contamination from the migrating ground water plume. Currently this exposure is considered to pose no apparent public health hazard. EPA is planning mitigation in the near future and theses actions should help to protect future public health.

#### 3. Past Exposures to Ground Water

Based on the 1988 health consultation, past exposures to impacted ground water via private drinking water wells posed an imminent public health hazard. It is possible that health effects related to past exposures could have occurred based on the highest detected levels. In 1988, EPA supplied alternate water and public water connections which effectively mitigated exposure via contaminated drinking water.



#### 4. Current Exposures to Indoor Air

Based on limited sampling results, PADOH and ATSDR conclude that reported levels of VOCs in indoor air from on-site structures (businesses) pose no apparent public health hazard to the employees or visitors. However, over time indoor levels could change and further characterization is warranted. In addition, indoor air levels could change under varying circumstances. The levels of VOCs detected in the indoor air of the off-site residence and offices currently are not at levels of health concern.

5. Current Exposures to Surface Soil PADOH and ATSDR will be reviewing the 2008 investigation summary report which includes soil sample results and soil boring information. As such PADOH and ATSDR cannot make a public health determination at this time.

#### VIII. PUBLIC HEALTH RECOMMENDATIONS

PADOH and ATSDR recommend the following:

- 1. PADOH and ATSDR evaluate EPA's proposed remedial plan for public health protectiveness;
- 2. Further characterization of the potential indoor air exposure pathway via vapor intrusion by the environmental agencies (EPA, PADEP) take place;
- 3. PADOH and ATSDR be provided with 2008 Investigation Summary Report as soon as it is made available; and
- 4. Local authorities, in conjunction with environmental agencies (EPA, PADEP), continue monitoring of Doylestown Borough Public Water well system to monitor for any changes in water quality, especially given the apparent at-risk status of production well DB-8.

#### XVI. PUBLIC HEALTH ACTIONS COMPLETED AND PLANNED

- 1. On June 19, 2007, ATSDR finalized the Chem Fab site Health Consultation.
- 2. In March and June of 2008, PADEP performed two rounds of indoor air sampling in the business, office areas, and residence above the current ground water plume. The indoor air sample results were evaluated by PADOH and ATSDR in this HC.



- 3. In 2001, the Doylestown Borough Public Water Production Well No. 13 (DB-13) was closed due to contamination and/or threat of contamination of tricholorethylene (TCE), tetrachloroethene (PCE), their degradation products, and hexavalent chromium.
- 4. Recently installed metal grating over the drainage areas on the Chem Fab property essentially eliminate the potential for exposure to surface water at that location.
- 5. PADOH and ATSDR will evaluate future sampling results as well as the 208 investigation summary report and will prepare a public health assessment (PHA) document that addresses the public health significance of the data.
- 6. PADOH and ATSDR will plan to conduct a public meeting to inform the community of the public health implications associated with the site. In addition, PADOH and ATSDR will work with the environmental agencies and the local municipality to warn residents of the potential exposure to chromium and bacteria in the surface water. PADOH and ATSDR will tailor these activities, as needed, as more information becomes available.



#### X. REFERENCES

- 1. The NPL Listing Packages for the Chem Fab Corporation, Bucks County, Pennsylvania are available on-line at: <u>http://www.epa.gov/reg3hwmd/super/sites/PAD002323848/index.htm</u>, last accessed 2008 September.
- 2. Hazard Ranking System (HRS) Documentation Record for the Chem Fab site containing relatively recent and past data. United States Environmental Protection Agency (U.S. EPA Region 3), 16<sup>th</sup> and Arch Streets, Philadelphia, PA. This document is available from the U.S. EPA Region 3 or on-line at: <u>http://www.epa.gov/superfund/sites/docrec/pdoc1769.pdf</u>, last accessed 2008 September.
- 3. Phone calls / Discussions with the Pennsylvania Department of Environmental Protection, South East Regional Office, 2 East Main Street, Norristown. Pennsylvania 19401 and with the Bucks County Department of Health, 55 East Court Street, Doylestown, Pennsylvania 18901 and other PADEP and BCDH historical information.
- Historical information on the *Doylestown Ground water Site* including : 1) Agency of Toxic Substances and Disease Registry *Immediate Health Consultation: Doylestown Ground water Site, Doylestown, Pennsylvania*, prepared by David N. Mellard, Ph.D., March 10, 1988; and
   Collection and Analysis of Blood Samples from Doylestown, Pennsylvania, Residents, Midwest Research Institute (MRI) Project No. 9151-A for Agency of Toxic Substances and Disease Registry, Final Report. April 12, 1988. Available from ATSDR Region 3, 1650 Arch Street, Philadelphia, Pennsylvania 19103.
- The *Pennsylvania Bulletin*, the Commonwealth's official gazette for information and rulemaking, announcements for the Chem Fab site may be found on-line at: <u>http://www.pabulletin.com/secure/data/vol34/34-4/149b.html</u>, and <u>http://www.pabulletin.com/secure/data/vol37/37-17/749d.html</u>, last accessed 2008 September.
- 6. Census tract block data available online at: <u>www.factfinder.census.gov</u>, last accessed 2008 September.
- HRS Documentation Record References 3, 65, 67, and 69. United States Environmental Protection Agency (U.S. EPA Region 3), 16<sup>th</sup> and Arch Streets, Philadelphia, PA. The references are available from EPA Region 3. The HRS and references titles are also available from the U.S. EPA Region 3 or on-line at: <u>http://www.epa.gov/superfund/sites/docrec/pdoc1769.pdf</u>, last accessed 2008 September.
- The EPA Safe Drinking Water Information System (SDWIS) Report for the Doylestown Public Water Systems may be found on-line at: <u>http://oaspub.epa.gov/enviro/sdw\_form\_v2.create\_page?state\_abbr=PA</u>, last accessed 2008 September.



- 9. Agency for Toxic Substances and Disease (ATSDR) Registry Toxicological Profile. Atlanta: US Department of Health and Human Services; A Web page is available for ATSDR may be found on-line at: <u>http://www.atsdr.cdc.gov/</u>, last accessed 2008 September.
- Agency of Toxic Substances and Disease Registry *Chem Fab Site Health Consultation*, prepared by Karl V. Markiewicz, Ph.D. on June 19, 2007. Available from ATSDR Region 3, 1650 Arch Street, Philadelphia, Pennsylvania 19103.



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Chem Fab Facility NPL Site Doylestown, Bucks County, Pennsylvania

#### CERTIFICATION

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

CDR Alan G. Parham, REHS, MPH

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 Yarbrough

Team Leader, CAT, SPAB, DHAC, ATSDR



#### **APPENDIX A - FIGURES**















> Figure 3 Map of the Former Chem Fab Facility Site at 300 North Broad Street, Doylestown, PA, and Locations of Contamination

















#### **APPENDIX B - TABLES**



## Table 2Highest VOCs and Chromium<sup>+6</sup> Concentrations Above the Screening Values in<br/>the Chem Fab NPL Site Related Monitoring Wells, 2001 to 2006

Chemical	Highest Level of Detect	Second Highest Level of Detect	Above Screening Value : Source	Monitoring Well Locations (see Appendix A- Figure 4)
VOCs				
Carbon Tetrachloride	10	10	Yes: ATSDR CV	MW11
1,1-Dichloroethene	270	260	Yes: ATSDR CV	MW04
cis-1,2- Dichloroethene	1,400	1,200	Yes: ATSDR CV	MW05
1,4-Dioxane	36	24	Yes: ATSDR CV	MW16 / MW05
Methylene Chloride	1,000	860	Yes: ATSDR CV	MW07
Tetrachloroethene (PCE)	1,900	1,800	Yes: ATSDR CV	MW07 / MW02
1,1,1-Trichloroethane	620	480	Yes: ATSDR CV	MW07 / MW02
Trichloroethylene (TCE)	35,000	35,000	Yes: ATSDR CV	MW04
Vinyl Chloride	11*	10*	Yes: ATSDR CV	MW07 / MW02
Metals				
Chromium+6	229,000	220,000	Yes: ATSDR CV	MW04

Units are micrograms per liter (ug/L) unless otherwise noted.

MW = Monitoring Well

EPA MCL = U.S. Environmental Protection Agency's Maximum Contaminant Level for Public Drinking Water

EPA RBC = U.S. Environmental Protection Agency's Risk Based Concentrations

\* - Value was estimated.

t - MCL is based on total chromium (no distinction is made between chromium <sup>+3</sup> and chromium <sup>+6</sup> in the analysis)

Data Source: EPA HRS Document for the Chem Fab Site [2]



# Table 3 Chem Fab NPL Site: Highest VOCs and Chromium<sup>+6</sup> Concentrations Above the Screening Values in Private Residential Well Sample Results, 2001 to 2006 (Ground Water is No Longer Consumed and Wells Are Used as Monitoring Wells)

Chemical	Highest Level of Detect	Second Highest Level of Detect	Above Screening Value : Source	Well Number Location (see Appendix A- Figure 4)
VOCs				
Carbon Tetrachloride	13	5.3	Yes: ATSDR CV	RW10
1,1-Dichloroethene	55	39	Yes: ATSDR CV	RW05 / RW10
cis-1,2-Dichloroethene	87	74	Yes: ATSDR CV	DW / RW08
1,4-Dioxane	8	7	Yes: ATSDR CV	RW05 / RW10
Methylene Chloride	120	110	Yes: ATSDR CV	DW
Tetrachloroethene (PCE)	96	86	Yes: ATSDR CV	DW/ RW05
Trichloroethylene (TCE)	1,400	970	Yes: ATSDR CV	DW
Vinyl Chloride	10	2*	Yes: ATSDR CV	DW
Metals				
Chromium +6	11,300	10,600	Yes: ATSDR CV <sup>t</sup>	DW / RW10

Units are micrograms per liter (ug/L) unless otherwise noted.

DW or RW = Private wells being used as monitoring wells (*no longer in use for drinking water purposes*); DW is a 50 foot well and was most likely used by persons living on the original Chem Fab property in the distant past.

\* - Value was estimated.

t - Based on total chromium MCL (no distinction is made between chromium<sup>+3</sup> and chromium<sup>+6</sup> in the EPA method of analysis); MCL is the U.S. Environmental Protection Agency's Maximum Contaminant Level for Public Drinking Water.

Data Source: EPA HRS Document [2]



## Table 4Chem Fab NPL Site: Highest VOCs Levels and Chromium Levels in the Surface Water(Drainage Swale, Tributary, and Cooks Run) Sample Results in 2006 Above the Screening Values

Location	Drainage Swale on Storage Facility Adjacent to Chem Fab		Tributary Where Storm Water Enters the Stream	Where Storm Water Enters the Stream (mixing zone)	Screening Value : Source
Chemical	Highest Level	Second Highest Level	Highest Level	Highest Level	
VOCs					
1,1-Dichloroethene	31	23	ND	ND	Yes: ATSDR CV
cis-1,2- Dichloroethene	240	230	ND	ND	Yes: ATSDR CV
Methylene Chloride	43	36	ND	ND	Yes: ATSDR CV
Tetrachloroethene (PCE)	280	210	ND	ND	Yes: ATSDR CV
Trichloroethylene (TCE)	1,300	1,100	23	10	Yes: ATSDR CV
Vinyl Chloride	3	2.2	ND	ND	Yes: ATSDR CV
Metals					
Chromium	39,700	35,800	2490	1200	Yes: ATSDR CV
Chromium +6	36,400	34,900	2000	580	Yes: ATSDR CV*

Units are micrograms per liter (ug/L) unless otherwise noted.

*ND* = *none detected; level is not above the detection limit* 

\* - Based on total chromium MCL (no distinction is made between chromium <sup>+3</sup> and chromium <sup>+6</sup> using the EPA analytical method); the MCL is the U.S. Environmental Protection Agency's Maximum Contaminant Level for Public Drinking Water.

Data Source: EPA HRS Document for the Chem Fab site [2]



## Table 5Maximum Results Higher than the Screening Values and Locations On-site in the<br/>Two Rounds of the Chem Fab NPL Site Indoor Air Samples

Chemical	Maximum Result		Sample Location – Address on North Broad Street*		Screening Number (EPA RBC)	EPA RfC
	1 <sup>st</sup> Round	2 <sup>nd</sup> Round	1 <sup>st</sup> Round	2 <sup>nd</sup> Round		
Methylene Chloride	5.9	ND	310	-	3.8	1,100
Tetrachloroethylene (PCE)	58	83.5	300	300	0.31	20
Trichloroethylene (TCE)	47	63.5	330	300	0.016	40

All concentrations are in units of microgram per cubic meter  $(ug/m^3)$ 

*ND* = *none detected*; *level is not above the detection limit* 

\* = Businesses / Office areas

*EPA RBC =EPA risk-based concentration; used as 'screening number' for the indoor air levels detected.* 

*EPA RfC* = *EPA reference concentration or the dose of a chemical not expected to result in noncarcinogenic health effect* 



## Table 6Maximum Results Higher than the Screening Values and Locations Off-siteTwo Rounds of the Chem Fab NPL Site Indoor Air Samples

Chemical	Maximu Result	т		Screening Number (EPA RBC)	EPA RfC	
	1 <sup>st</sup> Round	2 <sup>nd</sup> Round	1 <sup>st</sup> Round	2 <sup>nd</sup> Round		
Chloroform	1.1	ND	390 North Broad Street*	-	0.077	98
Methylene Chloride	ND	26	-	300 Harvey Ave.**	3.8	1,100
Tetrachloroethylene (PCE)	1.4J	1.8	390 North Broad Street*	300 Harvey Ave.**	0.31	20
Trichloroethylene (TCE)	3.4J	8.7	390 North Broad Street*	300 Harvey Ave. **	0.016	40

All concentrations are in units of microgram per cubic meter  $(ug/m^3)$ 

*ND* = *none detected; level would is below the detection limit* 

J = estimated value

\* = Residential / Office areas

\*\* = Businesses / Office areas

EPA RBC = EPA risk-based concentration; used as 'screening number' for the indoor air levels detected.

*EPA RfC* = *EPA reference concentration or the dose of a chemical not expected to result in noncarcinogenic health effect* 



### Table 7 Maximum TCE and PCE and Hexavalent Chromium Levels (Above ATSDR CVs) Detected in the <u>Subsurface Soil</u> Samples Taken On the Chem Fab Site and On the Adjacent Self-Storage Area in 2000 and in 2001

Chemical	Highest Level of Detection in <u>Subsurface Soil</u> of the Extra Space Self-storage Property*	Highest Level of Detection in the <u>Subsurface Soil</u> On-site <sup>t</sup>
VOCs		
Tetrachloroethene (PCE)	**	190 (4 to 6 feet depth)
Trichloroethylene (TCE)	500 (8.5 to 9.5 feet depth)	2,200 (6 to 8 feet depth)
Metals		
Chromium +6	**	500 (11 to 12 feet depth)

Units are milligrams of contaminant per kilograms of soil (mg/kg).

\*- *No samples were taken from the surface soil (0 - 3 inches in soil depth); Concentrations are unknown in the surface soil.* t - No concentrations above screening levels were found in a zero to 2-foot soil depth sample; Exposures to contaminants in surface soil are unlikely due soil covering (pavement and stones) on-site.

\*\* - Detected but levels were below the ATSDR CV for Soil

ATSDR CVs- Agency for Toxic Substances and Disease Registry Comparison Values (for soil)

AST – Above ground storage tanks

UST – Underground storage tanks

Data Source: EPA HRS Document [2]



## 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<sup>3</sup>). 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 exposure 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<sup>-6</sup>) 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.