Health Consultation

Public Health Evaluation of Residential Indoor Air and Well Water Sample Results

IVY INDUSTRIAL PARK SITE

CLARKS SUMMIT, LACKAWANNA COUNTY, PENNSYLVANIA

EPA FACILITY ID: PAN000306197

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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 Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Executive Summary

The Pennsylvania Department of Health (PADOH), working under cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), was requested by the Pennsylvania Department of Environmental Protection (PADEP) to review the recent on-site and off-site ground water and residential indoor air samples and soil gas samples taken from the ***Ivy Industrial Park site.*** Both PADEP and the U.S. Environmental Protection Agency (EPA) are involved in the evaluation and media (such as water, soil, or air) sampling at this site. Specifically PADEP asked PADOH and ATSDR to determine whether the site posed a human health hazard to any off-site residents.

The Ivy Industrial Park site is an industrial park just north of Clarks Summit in Lackawanna County, Pennsylvania and houses a number of businesses. Currently, PADEP investigation is focused on three facilities in the industrial park. In July 2005, PADOH was contacted by an Ivy Industrial Park employee concerned about the use of a contaminated on-site well. By August 2005 it was evident that the contamination was more widespread and was impacting the local community. PADOH and ATSDR were requested to address the potential for public health effects related to off-site exposures. PADOH and ATSDR actively solicited *community health concerns* through a variety of mechanisms including: fielding numerous phone calls from the residents and their physicians; conducting numerous discussions with PADEP and EPA; meetings with PADEP, individuals responsible for regulatory issues, and the local Township Officials and State Representatives; attending the unified command meetings between the officials and the agencies involved; meeting with affected residents in a home and; meeting individually with a large number of local residents during the four Ivy Industrial Park site PADEP public meetings.

From fall 2005 through fall 2006, PADOH and ATSDR completed numerous *activities* related to this site including: 1) participating in site visits, meetings, and teleconferences with PADEP and EPA; 2) participating with various State and Federal Representatives and Senators, EPA, PADEP, and other government officials in unified command meetings, as well as a press conference; 3) receiving numerous health-related phone calls and questions from the community at PADOH (Harrisburg, PA) and ATSDR (Region 3 in Philadelphia, PA and headquarters in Atlanta, GA); 4) evaluating sample data and information obtained from EPA and PADEP to determine the public health implications of human exposure pathways via all media; 5) participating in meetings with the community; and 6) participation in physicians' meetings.

PADOH's and ATSDR's *completed actions* at this site include: 1) Data and sample results obtained from EPA and PADEP have been evaluated by the PADOH and ATSDR to determine the public health implications of human exposure pathways via all media; 2) Health Education Activities were completed as planned to date and included development of a Fact Sheet with the PADOH recommendations, presentations and participations at two (2) physicians' meetings (hospitals), participations in a home visit with residents to discuss indoor air results, and presentations and participation at three (3) public meetings including discussions with individuals (*personal consultations* were offered by ATSDR and PADOH) during and after the meetings; 3) Other completed activities are listed in this Ivy Industrial Park site health consultation. Included in the activities are the health-related informational meeting sponsored by ATSDR and PADOH which were held during the physicians' staff meeting at the Mercy

Hospital in Scranton and during the physician staff meeting for Mid-Valley Hospital. Physicians from ATSDR and PADOH presented information to the physicians and staff about the chemical contamination and exposures around this site, especially concerning any possible exposures of current and potential patients. Additionally, the ATSDR Region 3 medical toxicologist and toxicologist have consulted with residents' physicians as requested by the residents, and have reviewed health records for any possible association with exposures from the Ivy Industrial Site; and 4) the agencies have been working together to help the citizens living around this site to learn about the health effects associated with TCE at these relatively low levels in the residential wells, the meaning of the sample results, and the removal of VOC exposures off-site.

Based on a thorough evaluation, ATSDR and PADOH conclude that *overall current* and *future* off-site exposures to ground water and indoor air vapor intrusion from the contaminated ground water pose *no apparent public health hazard*. *Current* off-site exposures to contaminated ground water pose *no apparent public health hazard* since exposures have been reduced by carbon filtration. Future off-site exposures to contaminated ground water pose *no public health* hazard if exposures continue to be reduced or if ground water quality improves to acceptable levels or if public water is installed. The water contaminant levels and length of exposures are unknown prior to the 2005 sampling events. Based on current information, since past levels and duration of exposures are unknown, *past* chemical long-term exposures at the pre-treatment levels would have posed a *public health hazard.* Assuming **thirty-five years** of exposure to the **highest** concentrations, theoretical expected increased lifetime cancer risks ***might*** be between moderately increased to low increased risk. PADOH and ATSDR took proactive actions.

PADOH and ATSDR *recommendations* include: 1) Well water samples should continue to be collected to determine if ground water quality is improving; 2) ATSDR and PADOH agree with PADEP's plans to retest the indoor air in the affected residents' homes; 3) PADOH Division of Community Epidemiology should evaluate the disease and cancer registry data available within the area of the chemical plume affected residential area of the Ivy Industrial Park site; 4) Local townships should consider requiring procedures for the installation of new private wells in the future in or near this affected area; and 5) PADOH and ATSDR will provide follow-up information about TCE exposures to concerned physicians and hospitals and will prepare information for concerned residents and their physicians on request.

PADOH's and ATSDR's *public health action plan, ongoing and planned actions* at this site include that PADOH and ATSDR: 1) Will make this health consultation available to the public and will conduct a public availability session to present the findings of this health consultation and to again respond to individual health-related concerns; 2) Will evaluate new information and data as it becomes available and make recommendations and conclusions based on that information; 3) Will review the Pennsylvania disease and cancer registry data available. The data queried should be directed to the area within the circumference of the chemical plume affected residential area of the Ivy Industrial Park site; 4) Will make the interpreted conclusion based on the results of the registry data review available to the affected community; and 5) Will attempt to facilitate discussions evaluating any feasibility and any benefits that could be expected by an academic institution conducting a health study as has been discussed with various State and Federal Representatives and Senators, as well as the Ivy Industrial Park site unified command team.

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 Pennsylvania Department of Environmental Protection (PADEP) to prepare this health consultation (HC) for the Ivy Industrial Park site. PADEP asked PADOH and ATSDR to review the recent on-site and off-site ground water, as well as residential indoor air sampling data taken from the Ivy Industrial Park site. Specifically, PADOH and ATSDR were asked to determine whether people in the community are currently being exposed to hazardous chemicals that have been released into the environment and to determine whether human contact with these chemicals might have or will result in illness or other harmful heath effects. Both PADEP and the U.S. Environmental Protection Agency (EPA) are involved in the evaluation and media (such as soil, air, or water) sampling at this site. In this HC, *off-site* refers to homes, residential wells and monitoring wells not on the industrial park property and *on-site* refers to the multiple businesses located within the Ivy Industrial Park Site.

Ground water contamination on-site became known to DOH and ATSDR in July 2005 and off-site in September 2005. The ground water in this area is contaminated on-site primarily with three volatile organic chemicals or VOCs (TCE, PCE, and cis-1, 2-dichloroethene) and off-site with TCE and PCE. Past operations at the industrial park appear to have caused chemical contamination, especially TCE, to the soil and aquifer under the site and under the residential neighborhood, including some of the residents' drinking water [1,2]. TCE and PCE (the predominant VOCs) were used in the past at the site even though no EPA Toxics Release Inventory VOC data (found on-line at http://www.epa.gov/tri/) is available for any reporting years. In July 2005, PADEP, EPA and contractors collected and analyzed hundreds of environmental samples on-site and off-site. At a minimum, the results from the samples with the highest concentrations were shared with DOH and ATSDR.

The contamination plume from the Ivy Industrial Park site presents a complex hydrogeological evaluation, complex chemical source issue, and complex human exposure problem for investigators, especially since contaminants were found in high concentrations at various locations within the industrial park ground water and surface water, both on-site and off-site. The area of concern (current detects of either or both TCE and PCE) covers a radius of about 1.75 miles out from the Ivy Industrial Park site. Within this radius, at least 446 private wells have been sampled. Most residents in this area use private wells for their drinking water and other household uses [1].

Site Layout and Description

The Ivy Industrial Park is located just north of Clarks Summit in Lackawanna County, Pennsylvania and consists of a number of businesses (Appendix B - Figure 1). The Ivy Industrial Park site is an area of contaminated soil and ground water located primarily near the intersection of Griffin Pond and Carbondale Roads (Appendix B - Figure 2). Locational coordinates of the Ivy Industrial Park site are 41.52699 north and 75.6610047 west. The site is a rural area where four townships (Abington, North Abington, South Abington, and Scott Townships) meet. The

volatile organic chemicals (VOCs) contamination is primarily in Abington Township, though the contamination has spread to the three other townships (Appendix B - Figure 2 and Figure 3) [1].

Remedial and Regulatory History

Details of PADEP remedial and regulatory history of the site investigation may be viewed in Appendix A in this document [1]. The PADEP Webpage may list additional details and information than what is found in this HC [2].

Key PADOH Activities: PADOH and ATSDR Site Visits, Pubic Meetings, Physicians' Meetings, and Other Public Health Assessment Activities

As part of the public health consultation process, PADOH and ATSDR conducted site visits and met with other government officials, physicians and hospital employees, and community residents in 2005 and 2006. The purposes of these visits and meetings were:

- To identify, prevent, and reduce exposure to the community including identification of contaminated private residential wells and public water sources;
- To more involve and familiarize PADOH and ATSDR with the community and the site;
- To discuss the work to be performed by the regulatory agencies (PADEP and EPA), including possible identification of contamination sources in the ground water and the impacted neighborhoods, as well as the sampling points;
- To identify community health concerns and to provide education and information to community members about potential health effects and how to reduce or eliminate their exposure;
- To explain the results of indoor air samples to the community residents whose homes were tested and to discuss other household sources of indoor air pollutants;
- To work with EPA and PADEP on discussing and reviewing the Ivy Industrial Park TCE sample data and resulting maps; and
- To participate in the unified command meetings with PADEP, EPA, and other federal , state, and local government representatives to present health information and to address health-related questions from government agencies and elected officials.

Detailed Description of PADOH and ATSDR Activities, Visits, and Meetings

ATSDR and PADOH conducted site visits and met with other government officials and community residents during public meetings to gather more information about the site as well as to identify community health concerns. Some of the health-related concerns that were raised by the community are addressed in the *Community Health Concerns* section of this document and/or were addressed during public meetings and phone calls to ATSDR and PADOH. Specific activities included:

- July 2005 – PADOH was contacted by PADEP for a technical assist concerning Ivy Industrial Park regarding employees drinking water from on-site contaminated well. At that time, based on the sample results taken from the business' well, PADOH and ATSDR determined that there was no public health hazard associated with the use of this ground water.
- By August 2005, it became apparent to PADEP, PADOH and ATSDR that there was widespread ground water contamination affecting four Lackawanna County townships in the Clarks Summit area including Scott, South Abington, North Abington, and Abington Townships. PADOH visited the site and EPA staging station set up in the Company A parking lot. EPA and PADEP described their sampling and mapping procedures on and off-site to identify possible source(s).
- August 2005 to present, PADOH in Harrisburg, PA and ATSDR in Philadelphia, PA and Atlanta, GA are actively involved in the site and community. PADOH and ATSDR are engaged in answering numerous health-related questions and phone calls from the community regarding current and past exposures to the contaminated ground water. PADOH and ATSDR strongly recommended reducing ingestion exposures to drinking water contaminated with TCE and/or PCE above their respective public water MCL (5 ppb). PADOH and ATSDR also issued *advice and information* regarding any use of contaminated water for cooking, showering and other household uses in the absence of well water carbon filtration systems. Additionally, the community asked PADOH and ATSDR about the possible adverse health effects related to drinking the contaminated water in the past.
- On September 15, 2005, a State Representative held a press conference at the Scott Municipal Building in Scott Township in Lackawanna County, concerning the site, ground water contamination of the local area, and community health concerns. PADOH met with the State Representative, PADEP, township managers/supervisors, and other officials. PADOH issued its official Interim Recommendations regarding the use of the contaminated ground water, as follows:

For private well water contaminated *above the 5 ppb level* of TCE and PCE, the Interim Recommendations included:

1. Drinking bottled water;
2. Water may be used as an interim measure for laundry and bathing/showering, using cooler temperature water, ventilating (e.g. opening a window or using a fan which ventilates outdoors) as much as possible and shortening bathing/showering time until remedial measures are taken; and,
3. Water with TCE and PCE detects up to the maximum levels at the time may be safely used for cooking. As an extra precaution, you may consider ventilating while cooking or use bottled water for cooking.

- On September 20, 2005, staff from PADOH and PADEP visited the Ivy Industrial Park site and local area in Lackawanna County, Clarks Summit, PA.
- On October 18, 2005, members of the PADOH Health Assessment Program participated with ATSDR in the first Ivy Industrial Park site PADEP public meeting. State and Federal Representatives and Senators, and staff from PADEP and EPA participated in a public meeting at the Lakeland High School (Jermyn, Pennsylvania). PADEP was the lead agency at the public meeting and announced the progress in the ground water contamination investigation at the Ivy Industrial site. PADOH and ATSDR talked about health related concerns and issues with community members individually or in small groups during the three sessions of the public meeting.
- On November 14, 2005, PADEP held a second Ivy Industrial Park site public meeting. PADOH and ATSDR representatives, including the ATSDR Region 3 Toxicologist and Medical Toxicologist. Dr. Keith Burkhart, MD, presented health information about TCE at this public meeting and up to date information on available and reliable health studies related to TCE in drinking water. ATSDR and PADOH again talked to community residents on a personal level about health concerns and offered *personal consultations* to over 100 residents immediately following this public meeting.
- November 2005 to January 2006 - PADOH and ATSDR participated in several teleconferences with PADEP concerning the site and provided public health insight regarding sample results and the effectiveness and type of water treatment systems installed at the residences.
- In December 2005, ATSDR and PADOH contacted all of the local hospitals in the area and offered to talk to physicians and staff about the community's exposure to the contaminated ground water in the areas and the possible relevant health effects. Two hospitals (Mercy Hospital and Mid Valley Hospital) accepted the offer.
- On February 10, 2006, ATSDR, and PADOH and PADEP conducted a Grand Rounds presentation at Mercy hospital in Scranton, PA titled *Community Exposure to Contaminated Ground water & Relevant Health Effects* for information dissemination regarding the Ivy Industrial site. Eighteen allied health staff and 42 physicians attended the grand rounds held at the Mercy Hospital. The majority of Physicians and health staff attending stated that they were satisfied and very satisfied with the presentations.
- On February 16, 2006, PADOH and ATSDR attended and participated at the PADEP (Ivy Industrial Park) unified command meeting. A State Representative spoke briefly about the community's request for some type of health study. Discussions that took place centered on the feasibility, likely conclusions, and current related information.
- On March 13, 2006, ATSDR, PADOH, and PADEP representatives met with six community members at a residents' home to discuss the indoor air sample results, health issues, and other related issues concerning the residents that live near this site. Previously, based on December 6, 2005 and February 13, 2006 sub-slab and indoor air sampling, letters summarizing the rounds of air and sub-slab sampling results were sent to residents by PADEP. PADOH and ATSDR had provided their evaluation of

the results to PADEP which was included in the letters. In March 2006, another unified command team meeting was held by PADEP and attended by ATSDR and PADOH.

- On March 30, 2006, PADEP held a third Ivy Industrial Park site public meeting. PADOH and ATSDR representatives, including the ATSDR Region 3 Toxicologist and Medical Toxicologist, participated in the meeting. Slides were presented about PADOH and ATSDR preliminary conclusions and recommendations, and the public health action plan in the draft Ivy Industrial Park site health consultation. Representatives of the two agencies again talked to community residents on an individual level about their health concerns during and after this meeting.
- In April 2006, ATSDR and PADOH conducted a presentation titled *Community Exposures & Relevant Health Effects* at a local restaurant for the physician at Mid Valley Hospital in Scranton, PA for the purpose of disseminating information regarding the Ivy Industrial site. Twenty-two physicians attended the program for the Mid Valley Hospital. The majority of physicians stated that they were very satisfied with the presentations by ATSDR and PADOH.
- From April 2006 through June 2006, PADOH and ATSDR continued to answer technical and health related question and community concerns about the site and continued to participate in the PADEP (Ivy Industrial Park) unified command meetings.
- By June 2006, in part because of ATSDR and PADOH's evaluation and recommendations, for the more than 400 private residential wells serving homes near this site.
- By October 2006, 500 homes and businesses wells had been sampled. Additionally, 189 water treatment systems had been installed on private wells where VOCs had been detected. The number of systems installed based on PADOH and ATSDR recommendations where TCE and/or PCE exceeded the safe drinking water (public water) standards was 59 systems. The rest of the systems were installed voluntarily by the two companies, based on VOC detects.
- Throughout 2006, unified command meetings between the officials and the agencies involved, including PADOH and ATSDR, continued. PADOH had participated in three more of these 2006 meetings by November 2006.
- On November 13, 2006, PADEP held a fourth Ivy Industrial Park site public meeting. PADOH and ATSDR representatives again participated in the meeting. Slides were presented with the conclusions, recommendations, and the public health action plan in the Ivy Industrial Park site health consultation.

Environmental Sampling

There is apparently no sample data relevant for the private residential wells or other environmental sample data relevant for residential exposures prior to August 2005. Since August 2005, EPA and PADEP sampled numerous on-site monitoring wells, soil, points for soil gas, and sewer line points, and off-site residential wells and indoor air [1]. The off-site sample results were evaluated by PADOH and ATSDR and included off-site residential well samples and indoor air sample results.

Off-Site Residential Well Data

Residential wells were sampled around the Ivy Industrial Park site (see Appendix B - Figure 2). The maximum levels of TCE and PCE contamination found in residential wells at that time are summarized in Appendix C - Table 1. In 2005, Company A began the installation of carbon filters to the 76 residential wells detecting VOCs – most above 5 ppb TCE and/or PCE. In March 2006, the re-sampling process for these wells within the affected area began. By May 2006, the maximum concentrations found in any private well were 700 ppb TCE and 382.5 ppb PCE (see Appendix C - Table 1). To date, 500 private home wells have been tested in the residential area surrounding the Ivy Industrial Park site. Additionally, 189 water treatment systems have been installed on private home wells where VOCs had been detected. The number of systems that have been installed based on PADOH and ATSDR recommendations (where TCE and/or PCE exceeded the safe drinking water or public water standards) is 59 systems. The rest of the systems were installed voluntarily based on detects by the two companies. As per PADEP, ATSDR, and PADOH's request, microbial samples were also run in the previously installed systems beginning in May and June 2006 [1].

The contamination was found to be wide-spread and as far out from the site as 1.75 miles (see Appendix B - Figure 3). Throughout 2006, Company A's consultant is continuing to perform the residential well sampling. Company A has contracted with a local water treatment system supplier to review the water quality parameter and to install water treatment systems, if necessary. Company B has sampled two rounds of the installed residential water treatment systems (pre and post-treatment) to be certain that post-treatment water remained under 5 ppb TCE and/or PCE. Most results were at very low concentrations, below the MCL and/or well below the analytical method detection level [1].

Off-Site Public Water Data

In July 2005, the local public water company, Pennsylvania American Water Company, sampled their production wells near the site. This public water facility samples for volatile organic compounds on a bi-annual basis and the most recent sampling had just been completed in July 2005 [1]. In a review of the historical data for this water system, very low levels of VOCs were first detected in a Waverly well in 1993. The VOC levels were well below the MCLs and both TCE and 1,1,1-trichloroethane were found in this well (see Appendix C - Table 2). Only 1, 1, 1-trichloroethane was found in the well in 1994 and TCE was not detected again until 2001. In 2001, TCE was found at very low levels in this same well and continued to show up sporadically at very low levels through 2005 [1].

Additionally, in November 2005, at least 15 public water systems (including small systems and transient, noncommunity public water systems) were sampled for VOCs. One transient, noncommunity public water system and one large community water system tested positive for very low levels of TCE [1].

Indoor Air Data

In December 2005 and February 2006, PADEP took soil gas and indoor air samples from residences determined to be at potential risk of vapor intrusion from the contaminated ground water. Sub-slab vapor samples were collected from homes based on the soil boring drilling information and the analytical results for the soil gas samples previously collected at the site. Collection of indoor air samples was also based on soil boring drilling information and analytical results for the soil gas samples collected at the site in 2005. Specifically, indoor air samples were collected in homes if a refusal of the drill rods was encountered before reaching the target depth below the bottom of the building slab or basement floor. Indoor and ambient air samples were collected from six residential properties. Two rounds of sampling were conducted - one during January 2006 and one during April 2006. The indoor air samples were collected in accordance with standard operating procedures.

Reviews of the sample results indicate no detectable concentrations of TCE or PCE and the contaminants that were detected in the indoor air of these homes, based on the two rounds of indoor air sampling, did not appear to be the same VOCs found in the contaminated ground water contamination. Additionally, there was no detection of the breakdown product cis 1,2-DCE that has been documented in some of the contaminated ground water at some locations. During the setup of the air canisters in the first round of sampling, PADEP utilized the Hazardous Air Pollutants (HAPS) Gas Chromatograph/Mass Spectrometer instrument to determine potential pathways for these site related contaminants. The field observations did not detect levels of any of the three VOCs [1]. PADEP asked PADOH and ATSDR to review and comment on the indoor air data. PADOH and ATSDR selected the chemicals that had concentrations in the indoor air that were determined to be above the health screening levels for further review (Appendix C - Table 3). The presence of these types of compounds, summarized on Attachment 2, can be attributed to commonly used products. The summary table provides the past sampling with this latest round of samples for comparison (Appendix C - Table 4).

Discussion

Pathway Analysis

ATSDR and PADOH evaluate whether people in the community currently are, have been in the past, or may be in the future, exposed to harmful levels of contaminants that were released into the environment. ATSDR and PADOH consider how individuals might come into contact with contaminated media (such as water, soil, or air) as well as the duration and frequency of any exposures. To determine whether people have been exposed to the contaminants migrating from the site, PADOH evaluates the environmental and human components that lead to human exposure. In completed exposure pathways, the five elements exist, and so exposure has occurred, is occurring, or will occur. 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 potential exposure pathways, however, at least one of the five elements is or may have been present, and exposure to a contaminant might have occurred in the past, or may possibly occur in the future. An exposure pathway is classified as eliminated if at least one of the five elements is missing and will never be present. For example,

based on the off-site ground water and sub-slab sampling data at the Ivy Industrial Park site, residential indoor air contaminant plume exposure pathways are currently nonexistent and not expected to be completed in the future. None of the site related contaminants were detected in the subslab samples and contaminant levels in the ground water do not appear to be increasing.

Ivy Industrial Park Contamination Pathway Analysis

Off-site *Completed* and *Potential* Exposure Pathways Associated with the Contaminated Ground Water

PADOH and ATSDR identified the exposure pathways to the contaminated ground water as completed, potential, or eliminated as shown in the following table entitled *Off-site Contaminated Ground Water - Ivy Industrial Park Site Exposure Pathways*. Due to contaminated ground water found in some residential wells surrounding this site, residents may have ingested contaminants from the drinking water and may have inhaled contaminants during bathing, cooking, or other water uses. The length of exposures to the ground water is currently unknown and could have been as long as 35 years. Installation of water treatment units in homes, beginning in 2005, eliminated *current* exposure pathways via ground water use and eliminated *future* exposures via ground water use as long as the systems continue to be maintained.

Off-site Contaminated Ground Water – Ivy Industrial Park Site Exposure Pathways

Site Related Exposure Pathway Elements					*Time Frame*	*Exposure Status*
Source	*Environmental Media*	*Point of Exposure*	*Routes of Exposure*	*Exposed Population*		
Chemicals (TCE or PCE) in ground water under the affected residents' homes	Off-site ground water	Using and drinking the contaminated ground water	Ingestion (drinking water and cooking); Dermal contact (bathing); and Inhalation (bathing, cooking, and other water uses)	Residents within the area of the contaminated ground water plume	Current	Eliminated
					Future	Eliminated (based on the maintenance of water treatment systems)
					Past	Completed

Additionally, vapor intrusion from the contaminated ground water in the aquifer underlying homes was considered as a pathway of exposure as shown in the following table entitled *Residential Indoor Air Vapor Intrusion - Ivy Industrial Park Site Exposure Pathway*. Vapor

intrusion is the migration of volatile chemical vapors from the subsurface (at this site, from the contaminated ground water of the underlying aquifers) into overlying buildings (in this case, the residential homes). In December 2005 and February 2006 indoor air samples were taken from potentially affected homes, based on the levels of contaminants in the residence's well water, and, in some cases, also based on the sub-slab sample results (if sub-slab sampling was performed based on pre-determined factors) [1]. Based on the two rounds of sampling data, residential vapor intrusion does not appear to be occurring. Therefore, the indoor air exposure pathway to contaminants volatilizing from the ground water plume does not appear to be currently complete. This exposure pathway is not expected to be complete in the future but this pathway is still classified as potential because of the uncertainty.

Residential Indoor Air Vapor Intrusion – Ivy Industrial Park Site Exposure Pathway

Site Related Exposure Pathway Elements					*Time Frame*	*Exposure Status*
Source	*Environmental Media*	*Point of Exposure*	*Routes of Exposure*	*Exposed Population*		
Site related chemicals (TCE or PCE) in ground water	Off-site indoor air vapor intrusion from the contaminated ground water	Breathing indoor air	Inhalation	Residents within the area of the contaminated ground water plume	Current	Eliminated
					Future	Potential
					Past	Indeterminate

Toxicological and Data Evaluation

The primary public health issues evaluated by PADOH and ATSDR to date and in this HC were the past and current off-site exposures to chemicals, especially TCE and PCE, through the contaminated ground water and possible residential indoor air vapor intrusion from the plume beneath the homes. ATSDR compiles health-based comparison values (CVs) by media–specific and chemical-specific concentrations. These CVs help to identify the environmental contaminants that are of possible health concern and may need further evaluation. If a chemical is detected at levels below the CV, it is very unlikely to cause adverse health effects, though chemical levels that exceed CVs do not necessarily cause adverse health effects. If a contaminant exceeds the corresponding CV, PADOH and ATSDR will examine other health-based guideline values for the contaminant to determine if health effects to that level of exposure are likely. For a more detailed explanation of this process, please refer to Appendix D.

Some Assumptions Used in the Evaluation Process

ATSDR and PADOH considered various exposure scenarios of this community's residents to off-site ground water in this health consultation. These included: 1) past and current ground water exposures by the three routes of exposure (ingestion, inhalation, and skin contact) through drinking water, as well as bathing, cooking, and other water uses; and 2) possible current plume and non-plume related indoor air vapor intrusion exposures (the worst case exposures were assumed based on limited sampling). Assumptions used in evaluating drinking water would be 2 liters per day of water (for adults) and 1 liter per day of water (for children) where the highest levels of the contaminants detected are and/or were assumed to be consumed daily. Body weights used in the drinking water exposure assumptions were 10 kilograms or 10 kg (for children) and 70 kg (for adults). Many uncertainties exist, but exposures may have occurred for as long as 35 years. For vapor intrusion and indoor air, residents were assumed to be exposed for 24 hours per day, 350 days per year. Children were assumed to inhale 12 cubic meters of indoor air per day (m^3/day) and be 0 to 7 years of age. Adults were assumed to inhale 20 m^3/day and to weigh 70 kg.

Specific Off-site Contaminant Toxicological and Data Evaluation

Evaluation of Data from Off-Site Wells

TCE

Human health effects from exposures to TCE in the mid to high parts per billion ranges are currently somewhat controversial and uncertain, though several key studies have been recognized [6,7,8,9]. Overall, there are a number of studies of TCE contamination in drinking water, but there are also great difficulties interpreting the results. In the Arizona and New Jersey studies, exposures could not be quantified accurately in most cases and thus, by themselves, the studies cannot resolve whether the drinking water contaminants caused the adverse birth outcomes [10]. In the Massachusetts study, there were a small number of individuals exposured and the exposure doses were not known for certain [10]. In animal studies, there is evidence that TCE causes some types of cancer (especially, kidney and liver cancers), but there is limited evidence in humans. In the Camp Lejune, North Carolina study there was a link found between pregnant mothers drinking the contaminated water and lower birth weight infants [10]. This study is still ongoing.

In this community, residents (children and adults) were exposed to TCE off-site in the residential well water. The concentration of TCE in residential well water ranged from nondetect (or below 1 ppb) to a *maximum* detected concentration of *700 ppb* (see Appendix C - Table 1). For the purpose of this evaluation, the assumption was made that all affected residents with any TCE above 5 ppb in their well were conservatively exposed to the highest levels of TCE found in any residential well at the site. Thus, PADOH evaluated the potential for health effects at the highest level found during this investigation. Assuming exposure at the maximum detected concentration in ground water via ingestion and inhalation, the estimated total daily dose for children and adults would have been about 0.08 and 0.023 mg/kg/day, respectively (see the previous section on 'Some Assumptions Used in the Evaluation Process'). The estimated exposure doses are three (3) orders of magnitude, or about 1000 times, less than levels shown to

cause non-cancer adverse effects in animals and humans [5]. Therefore, *non-cancer health effects are not expected* from exposures even at the *highest* reported levels of TCE in the residential well samples.

The length of exposure to contaminants for the residents has yet to be determined, but could have been as long as 35 years. In calculating theoretical increased cancer risks, it was assumed for purposes of the worst case scenario, that the residents might have been exposed at the maximum TCE level detected for the maximum length of time. The most recent EPA cancer slope factor (CSF) was used in the evaluation for this HC. Using the EPA methodology, the theoretical increased cancer risks for residents assuming exposure to the maximum levels of TCE detected in well water is about three (3) increased cancers per 1,000 people (see Appendix B - Figure 4) [3]. This is classified as a relatively moderate increased cancer risk over a person's lifetime if chronic (consistent exposures for more than one year and long-term) exposure occurred at similar and constant levels.

The Estimated TCE Exposure Dose and Comparison to Oral Animal and Human Cancer Studies

It is possible that the exposures will contribute to carcinogenic health effects over the exposed residents' lifetime, though the dose calculated in this HC is an *extremely conservative estimate* and takes into account the worst-case scenario, such as assumed exposures at the *highest levels* and extrapolating an increased cancer risk estimate *over a person's lifetime.*

PCE

Residents (children and adults) were exposed to PCE in the off-site well water. The concentration ranges from nondetects (below 1 ppb) to the *maximum* detected concentration of 383 ppb PCE (see Appendix C - Table 1). ATSDR and PADOH assumed that the residents were exposed at the maximum PCE levels and evaluated the potential for health effects (cancer and non-cancer) at the highest levels found during this investigation. Assuming exposures to the *maximum* detected concentration in ground water via ingestion and inhalation, the estimated total past *maximum* daily dose for children and adults would have been about 0.076 and 0.022 mg/kg/day, respectively. The estimated doses are about 2 to 7 times greater than EPA's reference dose or RfD (this RfD of 0.01 mg/kg/day is currently provisional under EPA review), but the estimated doses are about three (3) orders of magnitude, or 1000 times, less than the no observable adverse effect levels (NOAEL) in animal studies [5]. Therefore, it is *very unlikely* that there would have been *non-cancerous health effects* related to these exposures at the *highest* levels of PCE currently found in this contaminated ground water.

The length of exposure to residents is currently unknown, but could be as long as 35 years. The EPA proposed PCE cancer slope factor (CSF) was used to determine theoretical increased lifetime cancer risks. Given the assumption that worst case scenario was assumed that residents may have been exposed at the maximum PCE levels detected, the theoretical expected increased cancer risk would be two *(2) per 10,000 people*. This is classified as a *relatively low increased cancer risk* over a person's lifetime *if* chronic exposure occurred at similar and constant levels. It is possible that these exposures will contribute to carcinogenic health effects over their lifetime, though this is an *extremely conservative estimate* since it takes into account the worst-case scenario including exposures by ingestion, inhalation, and skin contact and extrapolates a

theoretical increased cancer risk estimate over a person's lifetime. The findings from animal and human health studies provide some evidence for PCE carcinogenicity in animals and limited evidence for carcinogenicity in humans. However, there is little consistency between the types of cancers reported in animals and humans, suggesting that there is not a common outcome for PCE exposure.

TCE and PCE Combined (Multiple Chemical Exposures)

ATSDR and PADOH reviewed the scientific literature surrounding chemical interactions and the agencies note that if the estimated exposure doses for individual contaminants are well below doses shown to cause adverse effects, then 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.

Evaluation of Residential Indoor Air Sample Results

Evaluation of Residential Indoor Air Sample Results - Plume Related

To date, no TCE was found in any of the residential indoor air samples. Though PCE was detected at very low levels in the indoor air of one home, the pathway is not complete and not plume related. The conclusion is based on the results showing that no PCE was detected in the sub-slab soil gas samples, so the source must be a household product inside the home (see the previous section on 'Pathway Analysis' and the following section 'Evaluation of Residential Indoor Air Sample Results – Not Plume Related, PCE').

Evaluation of Residential Indoor Air Sample Results – Not Plume Related

There are many sources of indoor air pollution in any home. More information may be found on the EPA webpage on-line at http://www.epa.gov/iaq/pubs/insidest.html#Intro1. The VOCs that were detected in the residential indoor air during the 2 rounds and common household products that may be sources of the VOCs are listed in Appendix C - Table 3. The affected residents should try to determine the source of the VOCs within the household and to remove them. If the detected compound level was below the ATSDR CV it is not discussed in the text. Two of the VOCs that were detected in the indoor air of two different homes were determined to be above health screening values. These contaminants are commonly found in household products and likely not associated with the ground water plume. The VOCs with levels that exceeded the health screening values were evaluated further and are listed in (Appendix C - Table 4). These VOCs include benzene and tetrachloroethene (PCE) 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 14 ug/m^3. This level is above the EPA risk based concentration (or RBC and the chemical concentrations corresponding to fixed levels of theroeterical increased cancer risk). ATSDR does not list a specific CV for this compound, but PADOH and ATSDR researched the concentration levels and

determined that the maximum levels found in the indoor air were well *below* any levels that would be considered to be of a *health concern*. 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 [4].

Benzene

Benzene was detected in both sampling rounds and in multiple samples taken at different locations in one home, but was not detected in any of the contaminated ground water off-site or in the off-site sub-slab sampling. The maximum benzene concentration detected was 35 ug/m3 and is above the ATSDR CV (Table 2). Even though the levels detected are most likely not representative of the chronic levels in this home (since a limited amount of sampling was completed), PADOH and ATSDR evaluated the samples and determined that *chronic* (long-term and equal to or more than one year) *exposures* at these levels could present *a low hypothetical increased health risk.*

Benzene is commonly detected in ambient or background levels in the environment. Some contribution to the increased levels of benzene in the air include burning coal and oil, motor vehicle exhaust, benzene waste and storage operations, tobacco smoke, and evaporation from gasoline service stations (see Appendix C - Table 3). Like other VOCs, benzene can also pass into air from water and soil contaminated with benzene. In the air, benzene breaks down within a few days. In human studies (occupational less than one year), the lowest observed adverse effect level or LOAEL (health effect for leucopenia) was 2201 ug/m^3 [5]. The levels in the indoor air of homes near the Ivy Industrial Park site are one order of magnitude less than this LOAEL (about 62 times less). Therefore, the margin of safety (MOS) might not be great enough to protect public health from noncancerous health effects if levels remain this high continuously in the home. Further evaluation and more sampling may be needed. Exposure to benzene at the levels commonly found in the indoor air would not be expected to cause noncarcinogenic adverse health effects, but very long-term (chronic) exposures could theoretically increase the risk of cancers over a lifetime.

Methylene Chloride

Methylene chloride is commonly found in household products (see Appendix C - Table 4). The levels found in the indoor air at this site are well below the chronic minimal risk levels (MRLs or the health guidelines derived by ATSDR). The levels of methylene chloride detected are *not* at levels for *non-carcinogenic health effects* [3].

PADOH estimates the theoretical increased cancer risk for 30 years exposure to methylene chloride at the maximum detected concentration of 5.5 ug/m^3 is about two (2) additional cancers per 1,000,000 persons. Therefore, chronic exposures to these levels would be classified as resulting in *no increased cancer risk* over a person's lifetime [3].

PCE

PCE was detected at very low levels (maximum level of 4 ug/m^3) in one home. *The pathway for indoor air, though originally thought to be a potential pathway, is not complete based on sub-slab soil gas samples (no PCE detects), so the source must be a household product inside the*

home. The estimated total daily exposure doses for the residents (assumed based on the maximum level) was six (6) orders of magnitude less than the levels where cancers were seen in test animal studies, suggesting that *cancer effects* from human exposures to the PCE are *not likely* [11].

Child Health Considerations

Children are different from adults in their: distribution, absorption, metabolism, and excretion of chemicals; intake of air and water in relationship to their body weights; and susceptibility of an organ to the exposure. It is always important to address chemical exposures of the most sensitive populations. Since children generally receive higher doses of contaminants than adults under similar circumstances, PADOH uses the higher doses in forming its conclusions about the health effects of exposures to site-related contaminants when children are known or thought to be involved. Fetuses, infants, and children are more vulnerable to the toxic effects of chemicals for the following reasons: 1) children are more likely to be exposed to certain media (e.g., soil, sediment, air, surface water or water from springs) because they play outdoors and have more of a tendency to put their fingers and objects in their mouths than adults; 2) children are shorter than adults, which means they can breathe dust, soil, and vapors close to the ground; and 3) children are smaller, therefore childhood exposure results in higher doses of chemicals per body weight than adults. Children can sustain permanent damage if these factors lead to toxic exposure during critical growth stages. ATSDR is committed to evaluating sites such as the Ivy Industrial Park site using child health considerations.

ATSDR and PADOH evaluated the likelihood that children living near this site may have been exposed to contaminants at levels of health concern. After reviewing the information for each of the completed and potential exposure pathways, ATSDR and PADOH concluded there are too many uncertainties about past chronic TCE exposures at the *highest levels* of TCE found in the community's well water due to: a lack of information to date about the length of exposures; uncertain and conflicting information about TCE and its effects on children and fetuses; and uncertainties about the past combined pathways of ingestion and inhalation. In light of these uncertainties, and in an attempt to adequately protect address human health, *ATSDR and PADOH recommended* installation of carbon filter well water treatment units where water was being ingested and where a sample results were greater than 5 ppb (also see Appendix E, questions #1 and #2).

Demographics

The Ivy Industrial Site is located at the junction of Carbondale Road and Griffin Pond Road outside of Clarks Summit, Pennsylvania. The affected area covers four townships – Abington, South Abington, North Abington, and Scott. Clarks Summit, Pennsylvania and Olyphant, Pennsylvania are the main mailing addresses. According to the year 2000 census records, *Abington Township* has a total population of 1616 persons [12]. In this census, about 49 percent of the population is male and 51 percent is female. About 26 percent of the population is children and 4.9 percent are under the age of five. About 16 percent of the population is 65 years or over; the median age is 44 years. *North Abington Township* has a total population of 787

persons [12]. In this census, about 53 percent of the population is male and 47 percent is female. About 25 percent of the population is children and 5 percent are under the age of five. About 13 percent of the population is 65 years or over; the median age is 42 years. *Scott Township* has a total population of 4931 persons [12]. About 51 percent of the population is male and about 49 percent is female. About 23 percent of the population is children and about 5 percent are under the age of five. About 14 percent of the population is 65 years or over; the median age is 41 years. *South Abington Township* has a total population of 8638 persons [12]. In this census, about 48 percent of the population is male and 52 percent is female. About 26 percent of the population is children and about 6 percent are under the age of five. About 13 percent of the population is 65 years or over; the median age is 37 years. More information may be found on the Pennsylvania Data Center Web Census 2000 site [12].

Community Health Concerns

Between August 2005 and spring 2006, ATSDR and PADOH identified the community health concerns around the Ivy Industrial Park site (residents living in Abington, North Abington, Scott, and South Abington Townships) via:

- Fielding numerous phone calls (50 – 100 calls) from local residents and their physicians to PADOH and ATSDR;
- Conducting numerous discussions with PADEP and EPA;
- Meetings between PADOH and ATSDR, PADEP, and the local Township Officials and State Representatives;
- Attending the unified command meetings beginning in 2005 through 2006 between the officials and the agencies involved;
- Meeting with affected residents in one home; and
- Meeting individually with a large number of local residents during the *four* Ivy Industrial Park site PADEP public meetings.

The community's health concerns to date were identified by PADOH and ATSDR and are discussed in Appendix E. Additionally the *Ivy Park Neighbors* group formally presented a set of community concerns and questions to PADEP, PADOH, and ATSDR. The community concerns and questions that related to health were officially answered by DOH and ATSDR and are listed in Appendix F. Additionally, there was health information presented by ATSDR and PADOH at the two physicians' meetings at two local hospitals. This included the latest information concerning health effects in regard to exposures to these chemicals.

Health Outcome Data Evaluation

The Commonwealth of Pennsylvania maintains health outcome databases including vital statistics and the cancer registries. These databases provide information on total mortality, cancer morbidity, and birth defects. In October 2005, PADOH Bureau of Statistics completed cancer incidence searches for Clarks Summit ZIP Code 18411 and Olyphant ZIP Code 18447. State rates for all cancers as well as specific cancers were compared to the Clarks Summit and Olyphant rates (also sorted by gender). Specific criteria are used by PADOH to evaluate the

PADOH local area cancer rate screening and to score ZIP Code area cancer screening evaluations (see Appendix G for additional information and clarification). When conducting cancer risk screening, a standard morbidity ratio (SMR) of 2.0 or greater is generally regarded as more noteworthy; however, statistical significance (z-scores of 1.96 or greater) should also be found in order to help rule out the possibility of chance variation. A z-score of 1.96 equates to a 95% level of statistical significance (or a 1 in 20 chance that the results are due to random variation). To help interpret the differences, the "statistical significance" of the difference is calculated. "Statistical significance" for this health consultation means that there is less than a 5% chance that the observed differences are due to random chance alone ($p<0.05$). In other words, if the differences were found to be statistically significant, then the difference between the expected and observed cases is probably due to some set of factors that influences the rate of that disease. It could be environmental factors, lifestyle factors, and/or family histories or combinations of all factors. Copies of these summaries were made available at the three PADEP Ivy Industrial Park site public meetings and are included in this HC as Appendix G. Overall, cancer incidence in the combined ZIP Code area was not statistically significantly different from that in the remainder of Pennsylvania.

As a response to the Ivy Industrial Park site community's interest and because the site is in a rural area with at least two populated ZIP codes as mailing addresses, PADOH is currently attempting to pursue more specific and refined disease and cancer registry data queries within the 3.5-mile circumference of the Ivy Industrial Park. Cancer is not a single disease. It is a group of more than 200 different diseases. Different types of cancer have different causes and are likely to be linked to different risk factors. Therefore, the specific cancer types (and health conditions) that are scientifically the most plausible related to TCE and/or PCE exposure, will be selected according to recognized studies in the scientific and medical literature. Specifically, these are total cancers, kidney cancers, liver cancers, leukemia, and some diseases/health problems (i.e., diabetes, miscarriages, and birth defects). None of these health conditions has been proven absolutely to be linked to human exposures to TCE and/or PCE, even at levels of exposure much higher than those found in the private well water in this community. However, ATSDR and PADOH felt it was useful to attempt to perform such as this evaluation in order to address community concerns at this site.

Conclusions

Based on a thorough evaluation, ATSDR and PADOH conclude that *overall current and future* off-site exposures to contaminated ground water pose *no apparent public health hazard*, in general, though there is some uncertainty about past cumulative effects of all of the combined VOC exposures, from all combined exposure pathways off-site and on-site:

1. *Current* and *future* off-site exposures to contaminated ground water via ingestion pose *no apparent public health hazard*. Exposures have been reduced or eliminated by installation of whole house carbon water treatment systems. Future off-site exposures to contaminated ground water pose no public health hazard if exposures continue to be reduced by the installation and maintenance of carbon filtration systems or if public water is installed or if ground water quality improves to acceptable levels. The water contaminant levels and length of exposures are unknown prior to the 2005 sampling

events, so *past exposures* from residential well water pose some uncertainty relating to expected adverse health effects. Based on current information, since past levels and duration of exposures are unknown, *past* chemical long-term exposures at the pre-treatment levels would have posed a *public health hazard.* Although it is unclear how long exposures occurred and at what levels, the past (pre-treatment) levels identified would have posed a public health hazard with long-term exposure. Exposures in the past to ground water with the **highest levels** obtained off-site might possibly and may have potentially yielded cancer and/or non-cancer adverse health effects. Assuming **thirty-five years** of exposure to the **highest** TCE and PCE concentrations, theoretical non-cancer effects would not be expected and would be unlikely. Also assuming **thirty-five years** of exposure to the **highest** TCE and PCE concentrations, theoretical expected increased lifetime cancer risks ***might*** be between moderately increased risk (3 increased cancers expected per 1,000 people exposed) to low increased risk (2 increased cancers expected per 10,000 people exposed). PADOH and ATSDR took proactive actions based on this information (see the section *Public Health Action Plan – Completed Actions* in this health consultation).

2. Exposures to VOCs in indoor air due to vapor intrusion from the contaminated ground water beneath the homes are currently non-existent based on the PADEP sampling data to date. The pathway for indoor air, though originally thought to be a potential pathway, is not complete based on current sub-slab soil gas samples. Therefore, it has been determined that overall *current* exposures pose *no apparent public health hazard. Future* exposures seem to pose *no apparent public health hazard*. Based on currently available sampling results, no plume-related exposures are expected in the *future*, though there is some uncertainty that there could still be a *potential* pathway. Based on the current data, it is extremely unlikely that residents were exposed to site related contaminants via vapor intrusion in the past. Though it has been determined that *past* exposures seem not to have posed a public health hazard due to an apparently incomplete pathway of exposure, *past exposures* must be classified as *indeterminate* due to the lack of sampling data.

Recommendations

1. Well water samples should continue to be collected to determine if ground water quality is improving.

2. PADOH (Division of Community Epidemiology) should look at the pertinent and reliable Pennsylvania disease and cancer registry data available. The data queried should be directed to the area within the circumference of the chemical plume in time affected residential area of the Ivy Industrial Park site.

3. Local townships should consider requiring health protective procedures or measures to prevent ingestion of contaminated ground water for the installation of new private wells in the future in or near this affected area.

4. PADOH and ATSDR will provide follow-up information about TCE exposures to concerned physicians and hospitals and will prepare information for concerned residents and their physicians.

Public Health Action Plan

The public health action plan (PHAP) contains a description of actions to be taken (or that have been taken) by ATSDR and/or other government agencies at and in the vicinity of the site subsequent or prior to the completion of this public health assessment. The purpose of the PHAP 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 the PADOH and ATSDR to determine the public health implications of human exposure pathways via all media.

2. Health Education Activities were completed as planned. These activities completed to date included:
   - Presentations and participation at three (3) Ivy Industrial Park site PADEP public meetings including "personalized health consults" conducted by ATSDR and PADOH after the meetings.
   - Participations at two (2) physicians' meetings (hospitals).
   - One (1) home visit with affected residents to discuss indoor air results.
   - One (1) Fact Sheet prepared for the PADOH recommendations and the ATSDR and PADOH participation in PADEP Ivy Industrial Park site public meetings.

3. Other completed activities are listed under the section *PADOH and ATSDR Site Visits and Meetings and Other Assessment Activities, Description of Visits and Meetings* in this HC. Included in the activities is the health-related informational meeting sponsored by ATSDR and PADOH and held during the physicians' staff meeting at the Mercy Hospital (Scranton, PA) and the Mid-valley Hospital (Scranton, PA) physicians' staff meeting. Physicians from ATSDR and PADOH presented information to the physicians and hospital staff about the chemical contamination and exposures around this site, especially concerning any possible exposures of current and potential patients. Additionally, in late 2005 and early 2006, the ATSDR Medical Toxicologist consulted with some residents' physicians (as requested by residents) and reviewed health records for any possible association with exposures from the Ivy Industrial Site.

4. The agencies have been working together to help the citizens of these four townships to learn about the health effects associated with TCE at these relatively low levels in the residential wells, the meaning of the sample results, and the removal of VOC exposures off-site.

Ongoing or Planned Actions

PADOH's and ATSDR's ongoing *public health action plan – ongoing and planned actions* at this site include:

1) PADOH will make this health consultation available to the public and will conduct a public availability session to present the findings of this health consultation and to again respond to individual health-related concerns;

2) PADOH will evaluate new information and data as it becomes available and make recommendations and conclusions based on that information;

3) PADOH will review the available and reliable Pennsylvania disease and cancer registry data. The data queried should be directed to the area within the circumference of the chemical plume affected residential area of the Ivy Industrial Park site; and

4) PADOH and ATSDR will attempt to facilitate discussions evaluating any feasibility and any benefits that could be expected from an academic institution conducting a health study as has been discussed with various State and Federal Representatives and Senators, as well as the Ivy Industrial Park site unified command team.

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Certification

This health consultation for the Ivy Industrial Park 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.

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

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Appendix A - Remedial and Regulatory History Details

Metso Paper/Ivy Industrial Park Groundwater Investigation

(The PADEP Webpage may list more details [2])

- January 2005 – Metso Paper approached DEP to enter the voluntary Act 2 Land Recycling Program due to groundwater contamination identified in monitoring wells on their property.
- DEP directed Metso to delineate the identified contaminants in groundwater at the January 2005 meeting.
- March 15, 2005 – DEP conducted a site visit with a Metso representative and their consultant, which included a facility tour of Metso operations.
- Metso had difficulty obtaining off-site access from adjacent property owners for installation of monitoring wells. It was determined that another facility at the Ivy Industrial Park had an on-site drinking water well and on May 2, 2005 the well was sampled. On June 8, 2005 the DEP was verbally notified that elevated concentrations of volatile compounds were identified in that well in the industrial park. These volatile compounds, TCE and PCE, were commonly used industrial solvents.
- June 28, 2005 – DEP met with Metso and directed them to perform a well user survey within a 1,000-foot radius of the site. An aerial photo was supplied at the meeting and two residential homes were identified within this radius. Other facilities within the industrial park were also identified and Metso was asked to verify public water use and to sample the identified well-water users.
- July 8, 2005 – DEP received a work plan outlining the site investigation activities, including the sampling of four private groundwater wells and two surface water locations. The plan also included a geophysical investigation at an off-site water supply well to aid in location and depth of additional off-site and on-site monitoring wells.
- July 20, 2005 well and surface water samples were obtained by PA Tectonics, and provided to Quantum Laboratories, Dickson City, for analysis.
- August 18, 2005 – DEP received the results of initial water well sampling from Metso, which included three private wells and two surface water samples. All well samples had contamination and one of the surface water samples had contaminants identified. Metso was directed to provide bottled water to the affected well owners.
- August 19, 2005 – DEP provided written notification of the investigation to date to Scott, Abington and South Abington townships, the county EMA and the legislators for this area.
- Metso was directed to conduct a groundwater survey in a one-half-mile radius, and to sample all identified wells.
- August 25, 2005 – DEP issued a letter to Sandvik Materials Technology to complete a groundwater investigation to evaluate the potential relationship to the groundwater contamination problem. DEP also issued letters to additional facilities in the Ivy Industrial Park to inform them of the investigation and to identify any historic or current chemical usage at their property.
- August 31, 2005 – PA Water Company (PAWC) sampled their production wells in the vicinity. They sample for volatile organic compounds on a bi-annual basis, which had been conducted in July, but they resampled based on this investigation.

- September 6, 2005 -U.S. Environmental Protection Agency has joined the investigation, providing technical assistance and additional sampling capabilities. On September 8-9, EPA and DEP took over 60 well samples to add to the data already obtained by Metso and their consultant. All available data is being analyzed and plotted visually on maps to determine what area is affected and what areas are not impacted. EPA has committed to additional home well sampling.
- As of September 9, 2005, EPA/DEP and Metso have sampled over 230 wells and surface water points. Approximately forty-seven (47) sample points have shown TCE and/or PCE, cis 1,2-DCE. The Department of Health (DOH) and the Agency for Toxic Substances and Disease Registry (ATDSR) were informed of this situation, beginning with the discovery of contaminants in the off-site facility well. DOH has discussed the contaminant levels with the facility owner and the affected residences and they are currently preparing health consultations.
- Metso is installing water treatment systems on affected private wells. As of September 14, 2005 twenty-five (25) treatment units were installed and three (3) more were to be installed by September 15, 2005.
- A command trailer has been placed at the Ivy Industrial Park. Staff from EPA or DEP will be using this as a base of operations for the investigation. In addition, EPA and DEP will initiate routine meetings with legislators, the county EMA and township officials to update them on the progress of the investigation.
- Residents or business owners with questions about sampling can contact DEP at 570-826-2511 from 8 a.m. to 4:30 p.m. Ask to speak to Toni Suda.
- DEP and EPA are determining the affected area and will prepare a map specifically outlining that area for residents and business owners.
- DEP and EPA will host a public information meeting October 17 at Lakeland High School. This meeting will include hourly presentations at 5 p.m., 6 p.m. and 7 p.m. and then an opportunity for residents to ask questions of environmental and health experts. The Department of Health (DOH) and the federal Agency for Toxic Substances and Disease Registry (ATSDR) will also attend to provide confidential health information or consultations.
- The investigation continued to determine the source or sources of the contamination through the use of the DEP mobile laboratories the week of September 26. DEP staff was able to collect over 130 soil-gas samples in the Ivy Industrial Park. In addition, 39 surface water samples were collected and analyzed. The preliminary results of both the soil gas survey and the surface water sampling are being evaluated and plotted by DEP and EPA.
- Private well sampling by Metso, EPA and DEP is continuing. It is hoped that this sampling will enable DEP and EPA to specifically define the affected area, and have that information available for the public prior to the October 17 public information meeting. Metso has installed 58 activated carbon water treatment units as of October 14.
- A unified command meeting was held October 13 at the Scott Township building. Representatives from DEP and EPA provided updates on the investigation to federal, state and local officials. It is also an opportunity for the officials to ask questions about the investigation. These meetings will be held on a routine basis to keep the elected officials current with the status of the investigation. This recent meeting was also a preview of the upcoming public meeting that will be held October 17 at Lakeland High School.

Additional Ivy Industrial Park Site Information:

- November 2005 - The second unified command team meeting and PADEP informational public meeting were held in November. PADOH and ATSDR again participated in and presented at the meeting. PADEP continued sampling and revealed that soil and ground water samples on a property contained TCE, PCE and other organic chemicals. The sampling was conducted as part of PADEP's ongoing investigation of ground water contamination in Abington, South Abington, North Abington and Scott townships in Lackawanna County. Sandvik's site characterization work plan was under review by PADEP.
- By December 2005, Metso had installed 76 carbon filtration treatment systems in the homes where TCE and/or PCE was detected in the wells. Another company (Sandvik) at the industrial park decided to provide filter units to residents with sample results for TCE and PCE levels below the EPA maximum contaminant level (MCL) for public water systems of 5 ppb. PADEP prepared a list of 63 residents that had these low detection levels. Sandik began installing or planning to install treatment systems. One of the homes had connected to public water whenSandvik's consultant contacted the resident. As of the end of 2005, PADEP and EPA were continuing to sample private wells and conducting soil and ground water investigations in and around the Ivy Industrial Park in an effort to protect public health and determine the source or sources of the ground water contamination. Based on the TCE and PCE levels in the ground water at residential locations and the sub-slab sample results, indoor air sampling was conducted by PADEP.
- By early 2006, residential sub-slab and indoor air sampling were initiated by PADEP. This was a subset of the sampling at residential and business properties with the highest levels of ground water contamination. Based on sample rounds of December 6, 2005 and February 13, 2006, letters summarizing the rounds of air and sub-slab sampling results were sent to residents by PADEP after input from PADOH and ATSDR.
- In March 2006, PADEP, DOH, and ATSDR met with residents about the indoor air sample results. Also in March, PADEP held another unified command team meeting and another public meeting.
- By June 2006, more than 400 private residential wells were sampled. Unified command meetings continued into mid 2006. PADEP sampling of soil, soil gas, sewer contents, sewer gases, and ground water continued within the industrial park. Installation requirements of UV light additions for water treatment systems testing high in coliform bacteria and/or heterotrophic plate bacteria (HTP) were discussed.
- In early July 2006, sample results showed that PCE levels in the soil were greater than 1000 micrograms of PCE per kilogram soil (ug/kg) at Bostik, another Ivy Industrial Park tenant, according to PADEP based on sample results released by state officials. In July 2006, PADEP led discussions regarding the disassembly of the defunct NPDES drainage line (Outfall 001) running through the Sandvik property as part of the site investigation. Earlier, TCE had been found by PADEP around this pipe on the Sandvik property.
- October 2006 - The disassembly of this defunct NPDES drainage line and sampling along this line began in October.

Appendix B – Figures

Figure 1 – Ivy Industrial Park Site Location in Lackawanna County, Pennsylvania

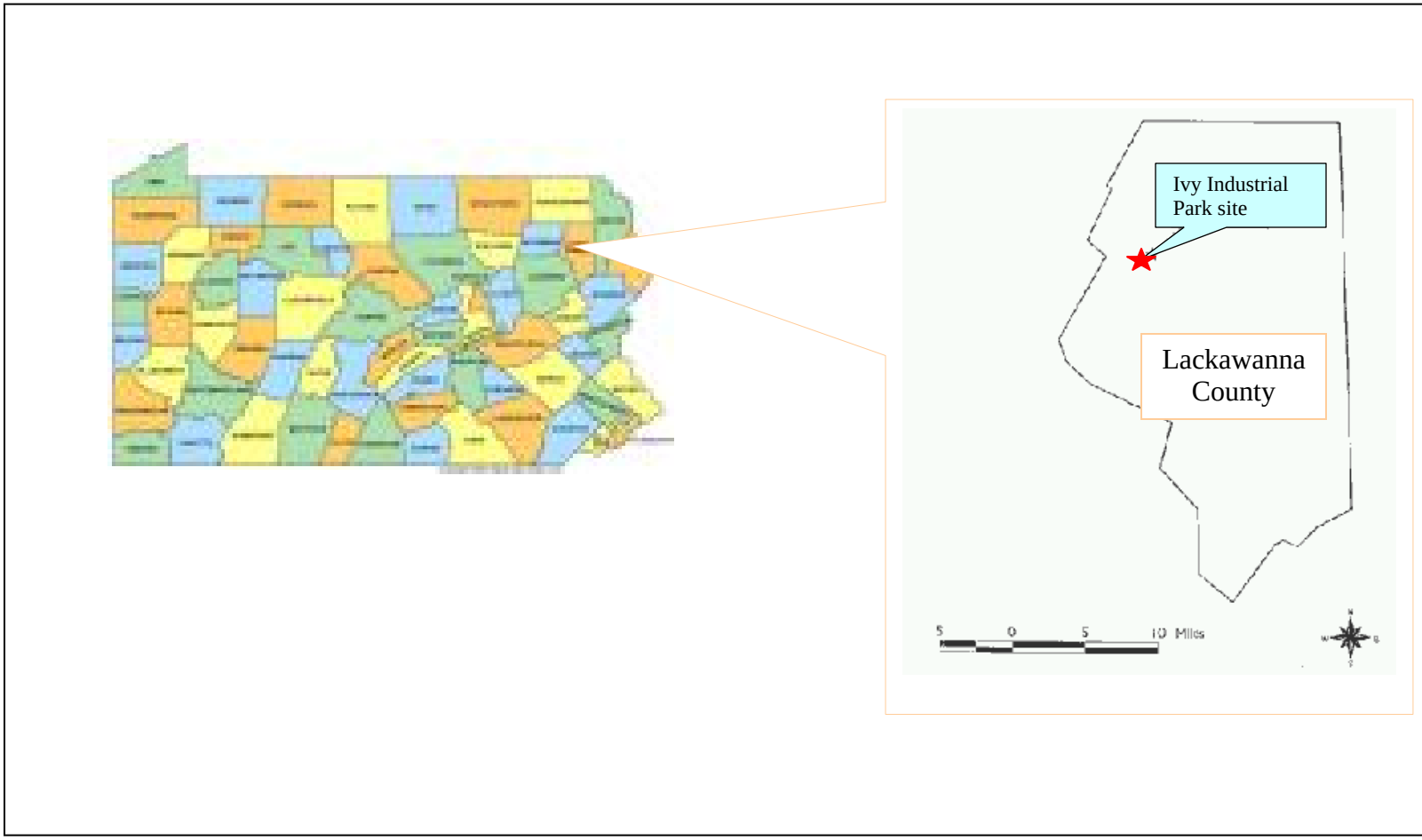
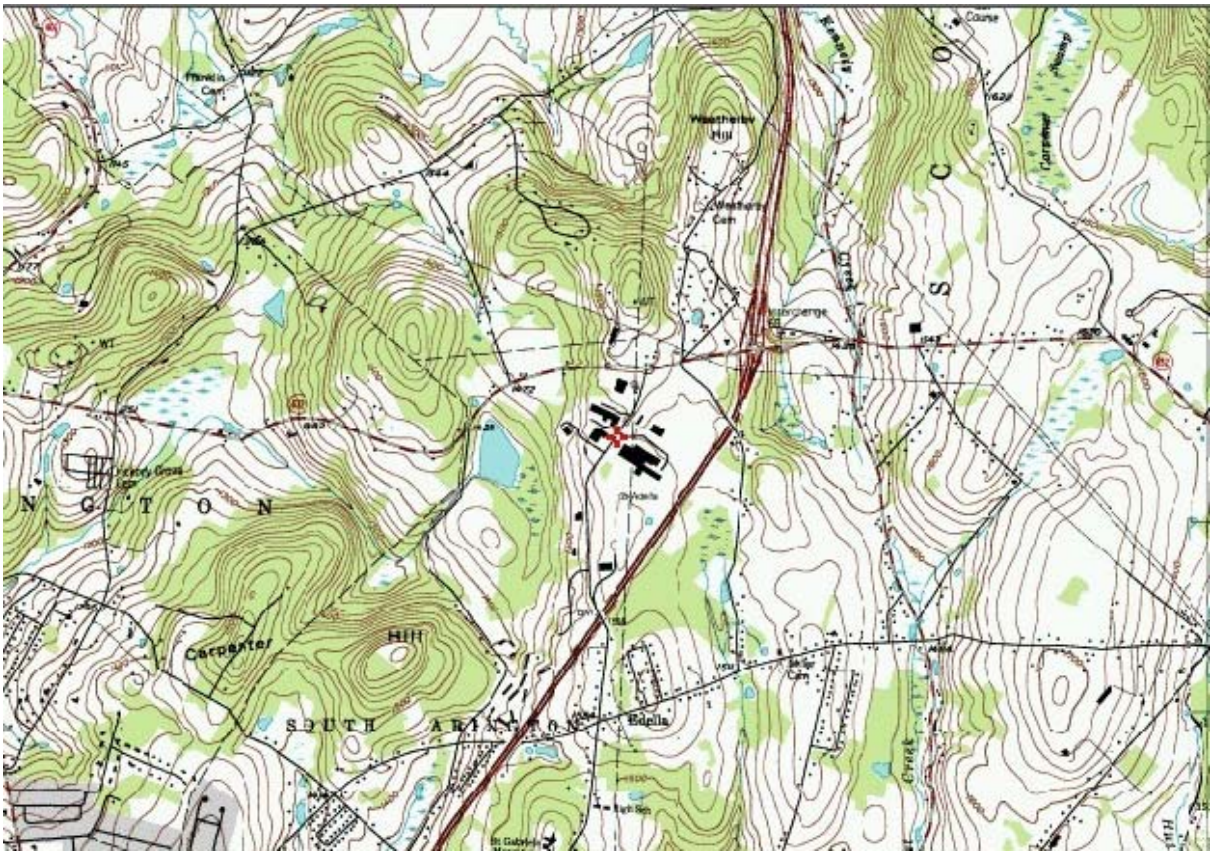


Figure 2 – Ivy Industrial Park Site Location Map and Residential Area



* = Ivy Industrial Park site (Map Source: Topozone)

Figure 3 – Ivy Industrial Park Site Contamination and Off-site VOC Detects
(Source of Map: Pennsylvania Department of Environmental Protection)

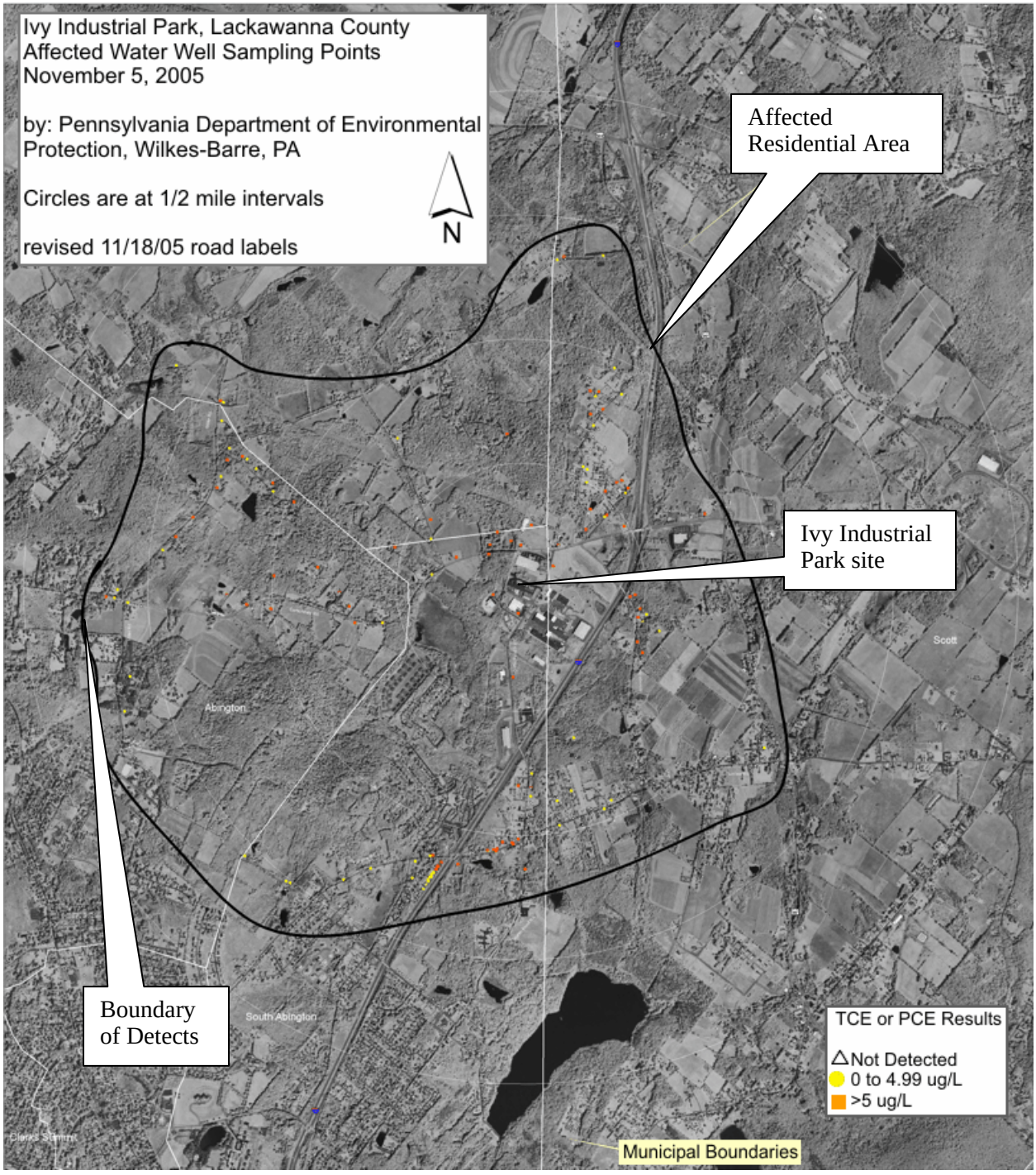
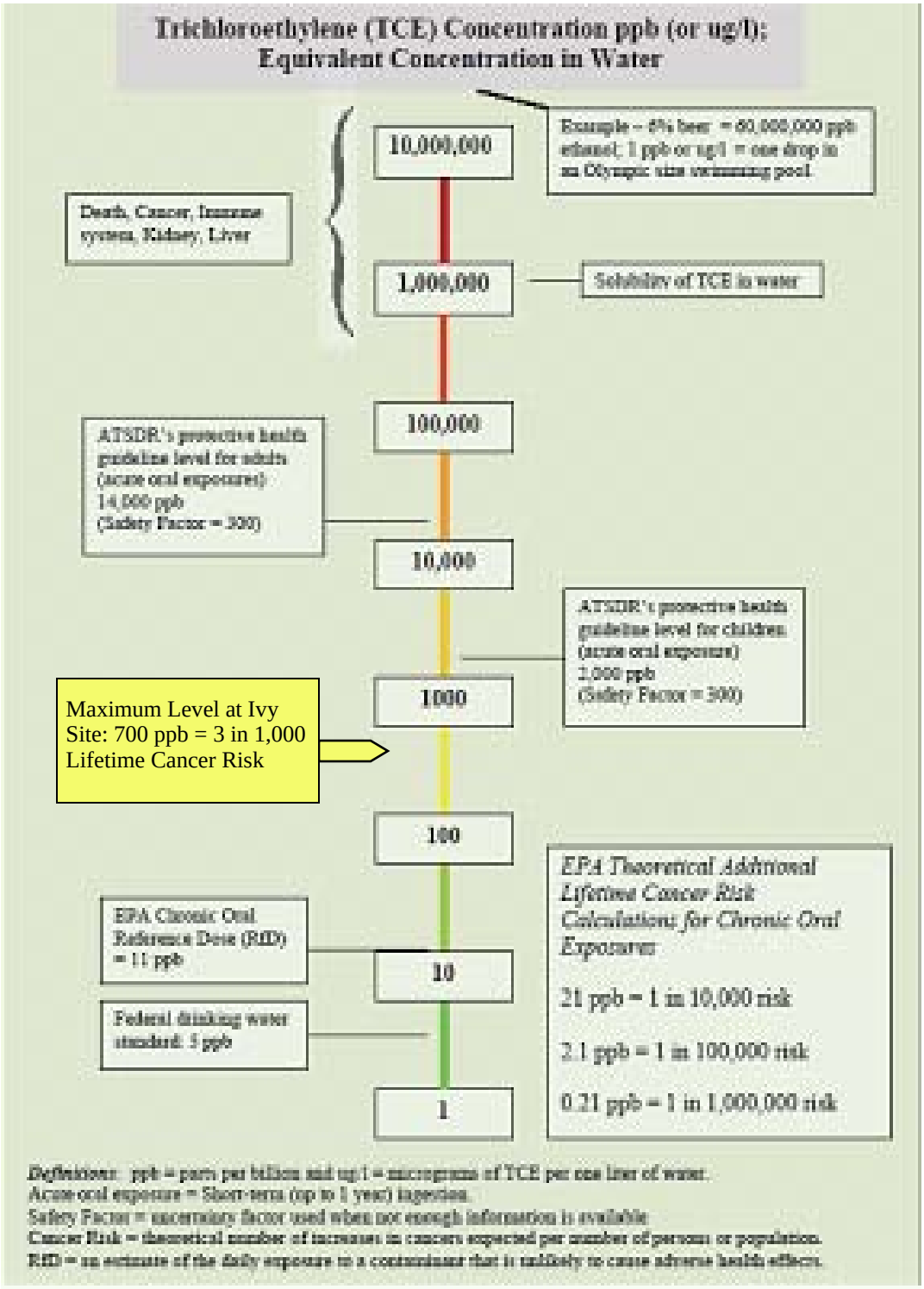


Figure 4 – TCE Toxicity Graph and Levels of Health Concern
(Source of graph: developed by ATSDR based on the most currently recognized data)



Appendix C – Tables

Table 1 – Private Well Water Sample Results and Levels Above Health Screening Values

Chemical	Total Number of Homes		Concentration Range	ATSDR CV	CV Source
	Water Systems Installed	Wells Tested			
Trichloroethylene (TCE) and/or Tetrachloroethene (PCE)	189*	500	ND – 700 (TCE) ND – 383 (PCE)	5	MCL

Units or Concentrations are in parts per billion (ppb)

* - Note: 59 of these systems were installed because TCE and/or PCE concentrations were > 5 ppb; the rest of the systems were voluntarily installed by the companies for any TCE and/or PCE detects

CVs = Comparison Values (CVs) are media-specific concentrations that are used by health assessors to select environmental contaminants for further evaluation.
ND = Chemical was not detected
MCL = EPA's maximum contaminant level for public water systems
Note : Other names for trichloroethylene include trichloroethene
Other names for tetrachloroethene include tetrachloroethylene, perchloroethylene and perchloroethene.

Table 2 – Pennsylvania Public Water System (Waverly Well) Sample Results Levels

Chemical	*Number of Detects (Since 1993)*	*Number of Samples*	*Concentration Range*	*ATSDR CVs*	*CV Source*
1,1,1-Trichloroethane	5	23	ND – 1.1	5 ppb	MCL
Tetrachloroethene (PCE)	2	23	ND – 0.7	5 ppb	MCL
Trichloroethylene (TCE)	9	23	ND – 1.8	5 ppb	MCL

Units or Concentrations are in parts per billion (ppb)

CVs = Comparison Values (CVs) are media-specific concentrations that are used by health assessors to SELECT environmental contaminants for further evaluation.
ND = Chemical was not detected
MCL = EPA's maximum contaminant level for public water systems
Note : Other names for trichloroethylene include trichloroethene
Other names for tetrachloroethene include tetrachloroethylene, perchloroethylene and perchloroethene.

Table 3 – Common Indoor Air Sources of Some VOCs Found in Residential Indoor Air

CHEMICAL	*COMMON USES/SOURCES*
2-Propanol (Isopropyl Alcohol)	Found in household isopropyl alcohol, cleaners, hair coloring, pesticides, odor removers, sealants and adhesives, and "rubbing alcohol".
1,2,4-Trimethylbenzene	Used to make dyes and drugs. It is found in gasoline, certain paints, and cleaners.
1,3,5-Trimethylbenzene	Found in gas treatments, valve cleaners, mark/spot remover, floor wax, varnishes, paints, and pesticides. A diesel exhaust component.
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.
Ethanol	Found in beverages, topical anti-infective, antiseptics, and pharmaceutical aids.
Ethyl Acetate	Found in artificial fruit scents, solvent for varnishes, lacquers, aeroplane glues, artificial leathers, photographic film, and perfumes.
Dichlorodifluoromethane	The same as Freon 12 - Used as refrigerants, aerosol propellants, and solvents.
Heptane	Used when less volatile solvent is desired as in manufacturing of certain adhesives and lacquers, and in the extraction of edible and commercial oils. Found in petroleum products.
Hexane	Found in petroleum products, is often mixed with other solvents, and is often used as a filling for thermometers.
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.
Tetrachloroethene (PCE)	Used in dry cleaning solutions and metal degreasers. Also found in adhesives, glues, insecticides, and rug cleaners.
Trichlorofluoromethane	The same as Freon 11 – Used as refrigerants, aerosol propellants, and solvents.

Table 4 – Chemicals (Determined Not Site Related by PADEP) Detected in Residential Air During Indoor Air Sampling and Exceeding Health Screening Levels

Chemical	*Highest Concentration*	*Comparison Value : Source*
1,2,4-Trimethylbenzene	14	6.2 : EPA RBC
Benzene	35	0.23 : EPA RBC
Methylene Chloride	5.5	3.8 : EPA RBC
Tetrachloroethene (PCE)	4.1	0.31 : EPA RBC

Units are in ug/m^3.

J = Compound detected but below reporting limit; estimated value.
ATSDR CV = ATSDR Comparison Values (See Appendix D 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

Appendix D - 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 micrograms per cubic meter [ug/m3]). Health guidelines are protective of human health and are developed for both noncarcinogenic and carcinogenic effects. Health guidelines for noncarcinogenic 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 noncarcinogenic 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 cancer slope factors (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.

Appendix E - Ivy Industrial Park Site Community Health Concerns

1. *Initially, the community had concerns whether they should be using the water for drinking, showering and bathing, and washing laundry and dishes.*

   RESPONSE:

   PADOH and ATSDR answered these health-related concerns in the official ***PADOH Recommendation*** released in September 2005 and included here: 1) We recommend drinking bottled water instead of the private well water contaminated above the 5 ppb levels of TCE and PCE; 2) We recommend for levels of contaminants above 5ppb that the water can be used as an interim measure for laundry and bathing/showering, using cooler temperature water, ventilating (e.g. opening a window or using a fan which ventilates outdoors) as much as possible and shortening bathing/showering time until remedial measures are taken; and 3) Private well water in the ranges found in the residential wells to date may be safely used for cooking. As an extra precaution, you may consider ventilating while cooking or use bottled water for cooking.

2. *What should be done about exposures by very young children to contaminated water below 5 ppb TCE and/or PCE?*

   RESPONSE:

   Please see the answer to the question above. The TCE and the PCE MCL for public water are 5 ppb, each. PADOH and ATSDR believe it is safe for children to drink the water containing levels below the MCL. Based on the information PADOH and ATSDR have seen to date, we do not anticipate any short term health effects to residents by other uses of the water such as in engaging in normal household activities (showering, bathing, laundry, washing dishes and so forth).

3. *What should pregnant women do if their water has not been tested yet?*

   RESPONSE:

   We responded by advising to drink bottled water as a precaution until the drinking water were tested.

4. *The members of the community had health-related concerns some about specific health conditions or problems and if they might be related to the site contamination (TCE and PCE). These health concerns included:*
   - Headaches especially in young children, hypersensitivity reactions and skin disorders (especially rashes), irritations to eyes and lungs, chronic sore throats in children [levels in water at 14.2 and 5.0 ppb TCE], anxiety, nausea, fatigue, changes in breathing patterns
   - Sinusitis
   - Liver enzymes changes (amounts)

- Diabetes (DM)
- Pancreas (nonfunctioning)
- Peripheral neuropathy
- Multiple Sclerosis (MS)
- Parkinson's Disease
- Miscarriages
- Possible birth defects (particularly congenital problems)
- Lung disorders
    - Depressed immune system (pneumonia)
    - Serious lung disorder
- Depressed immune system related
- Related to other serious problems
- Cancers including:
    - Breast Cancer
    - Leukemia
    - Prostate cancer
    - Colon cancer (malignant polyps)
    - Other Type (resident said not site related)
- Chrohn's Disease
- Parathyroid problems
- Heart problems

RESPONSE:
The following information addresses some of the general community health concerns regarding exposures to TCE by way of contaminated ground water by residents living near the Ivy Industrial Park site. The bulk of the health concerns were addressed by ATSDR's and PADOH's Medical and Environmental Toxicologists and by ATSDR's and PADOH's Environmental Scientists through personal calls to/from the community residents and at the public meetings (*note to the Reader - The following information is very general. Any individual with severe health problems should contact their personal physician for an evaluation*):

- *Headaches* - At this time, there is no known link between TCE exposure at the *levels* found off-site at the Ivy Industrial site and this health effect, though breathing small amounts could cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating [5, ATSDR]. People who are exposed to parts per million levels (one part per million equals one thousand times a ppb concentration) of TCE can become dizzy or sleepy and may become unconscious at very high parts per million levels. People who breathe moderate parts per million levels of TCE may have headaches or dizziness. TCE was once used as an anesthetic for surgery. It is possible that some people who breathe high parts per million levels of TCE may develop damage to some of the nerves in the face. Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage [5, ATSDR]. People have reported health effects when exposed to level of TCE at which its odor is noticeable. The levels of TCE in the indoor

air at the Ivy Industrial site are thousands of times lower than the ones discussed as associated with the health effects above, so *we would not expect headaches at these levels.*

- *Allergy to TCE or PCE and Skin disorders (especially rashes), Irritations to eyes and lungs* - There is no known link between TCE exposure at the levels found off-site and this health effect. Some people who have worked with TCE for long periods of time (*high* parts per million or thousands of parts per billion concentrations) may develop or have developed an allergy to TCE or become particularly sensitive to its effects on the skin. People that were experimentally exposed to 200,000 ppb (or 1,074,000 ug/m3) of TCE vapor for 7 hours experienced dry throats (40% of the subjects), beginning after 30 minutes. The subjects experiencing these symptoms did not experience them when exposed in the same manner on five other consecutive days. These effects are presumed to be due to direct contact with the vapor [5, ATSDR]. These levels are about five (5) orders of magnitude above (or about 100,000 times) the levels seen in the indoor air at this site, so we do not expect to see these symptoms at this site. Eye and skin irritation and rashes have resulted from occupational exposure to TCE. Skin rashes are also one of the most frequently reported health conditions in interviews conducted by the National Registry for TCE Exposures*. The dermal effects are usually the consequence of direct skin contact with concentrated solutions, but occupational exposure also involves vapor contact. Adverse effects have not been reported from exposure to dilute aqueous solutions. Stevens-Johnson syndrome, a serious and potentially fatal skin condition, was seen in five people occupationally exposed to TCE acutely at high levels. The study authors suggested that the disease was caused by a hypersensitivity reaction to TCE [5, ATSDR]. Persons occupationally exposed to TCE have exhibited an exfoliative dermatitis and scleroderma - also thought to have an immune component [5, ATSDR]. Histopathological changes in the skin were not observed in experimental animals exposed to 600,000 ppb (or 3,222,000 ug/m3) TCE, 7 hours per day and 5 days per week for 104 weeks [5, ATSDR]. These levels are about five (5) orders of magnitude above (about

* About the National Exposure Registry: Information gathered by the National Exposure Registry provides further evidence that exposure to TCE and other chemicals might be associated with the higher rates of adverse health outcomes reported by registrants. ATSDR found that, in general, registrants reported some health conditions at a higher rate than the general population. Certain age groups reported some health conditions more frequently, and some had higher rates for only men or only women. Health conditions reported in excess at one or more of the interview time periods included: *Anemia, Diabetes, Hearing Impairment, Hypertension, Kidney Disease, Liver Problems, Skin Rashes, Speech Impairment, Stroke, and Urinary Disorder*. However, other factors--such as other chemical exposures at work or at home, personal lifestyle choices (smoking or drinking alcohol), and complications related to other health conditions-- might have caused the higher rates. The National Exposure Registry is collecting more detailed information on some of the health conditions to better evaluate these results.

100,000 times) the levels seen in the indoor air at the site, so *we do not expect to see these symptoms and especially rashes, at this site.*

- *Sinusitis* - Acute sinusitis is an infection of limited duration in the sinus cavities.

Inflammation that occurs with allergies may block sinus drainage and increase susceptibility to sinusitis. Chronic sinusitis is a prolonged infection or inflammation of the sinus cavities. Inflammation that occurs with allergies may block sinus drainage and increase susceptibility to sinusitis. There is no known link between TCE and sinusitis.

5. *Concerns about the health impact of indoor air from vapor intrusion due to the contaminated ground water underneath homes.*

RESPONSE:

In December 2005 and February 2006, PADEP took soil gas samples and/or indoor air samples from residences they determined could potentially be affected by the contamination based on the ground water sample results. To date no plume related contaminants were found in the indoor air sample results.

6. *Questions whether there is a cancer cluster and if there will be a local epidemiological study.*

RESPONSE:

This question was discussed in the *Ivy Industrial Park site Health Consultation Health Outcome* section. The cancer registry data were evaluated for Clarks Summit, PA and Olyphant, PA by ZIP code. As a response to the Ivy Industrial Park site community's demand and because the site is in a rural area with at least three populated ZIP codes as mailing addresses, PADOH is currently pursuing more specific and refined database searches within the 3.5-mile circumference of the Ivy Industrial Park.

7. *What is being done to ensure that all those who have been exposed to contamination are monitored closely for the illnesses that are linked to the exposure of TCE?*

RESPONSE:

PADOH has no plans, and there is no precedent for, PADOH to perform any sort of this 'medical monitoring' of residents. One thing that PADOH at this point is planning on doing is to review the local cancer data soon, and then to re-review it in 5 years, but this is not medical monitoring. Based on accepted scientific knowledge and guidance at this point, kidney and/or liver cancers are surmised to be the most possible sentinel cancers as potentially possibly associated with TCE exposures at high enough exposure levels long-term (chronic). One topic that has been mentioned is the possibility of a health study conducted by an academic

institution. This is being discussed with various state and federal Representatives and Senators, as well as the Ivy Industrial Park site Unified Command Team. It is important to note that to the best of our knowledge and based upon data that we have evaluated, people are not currently being exposed to levels that would be expected to cause health effects. It is reasonably expected and concluded that continued use of treatment or public water installation will continue to remove or eliminate the exposures to these contaminants. As pertains to potential past exposures, no data has been provided to PADOH for review. We do not have past data to evaluate, nor do we know how long potential exposures might have been. However, it has been determined that it is extremely unlikely that residents were at risk based on current data available.

Appendix F – Questions from the Ivy Park Neighbors Group (Community Concerns) Officially Presented to PADEP and PADOH

(Note to the reader – this document may also be found on-line at the Webpage http://www.DEPweb.state.pa.us/northeastro/cwp/view.asp?a=1226&q=480644, last accessed 2007 January.)

CHEMICAL INFORMATION AND HEALTH EFFECTS

PADOH and ATSDR responded to the Community Concern Health-Related Questions:

Q. What are TCE and PCE?

A. PCE (Tetrachloroethylene) is a manufactured chemical used for dry cleaning and metal degreasing. It is also used to make other chemicals and is used in some consumer products. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. TCE (Trichloroethylene) is a manufactured chemical that does not occur naturally in the environment. It's a pale blue nonflammable liquid with a sweet smell that evaporates easily. It is used as a solvent for cleaning metal parts but is also an ingredient in adhesives, paint removers, typewriter correction fluid, spot removers, and varnishes. Prior to 1977, TCE was used as a general and obstetrical anesthetic; grain fumigant; skin wound, and surgical disinfectant; pet food additive; and extractant of spice oleoresins in food and of caffeine for the production of decaffeinated coffee.

Q. What happens to the contamination as it breaks down? What is the life of the chemicals TCE and PCE? What are the other chemicals and their life?

A. The general chemistry breakdown is as follows: PCE breaks down to TCE, which breaks down into 1,1 DCE or trans DCE or cis 1,2 DCE (depending on the conditions) giving off some carbon dioxide, which then breaks down into vinyl chloride. Vinyl Chloride may then break down into ethane giving way to carbon dioxide and ethane. The breakdown of these chemicals in ground water and soil varies depending on site conditions such as organic content of the soil, soil type, surface to volume ratio, concentration level, etc.

Q. What is a part per billion?

A. A part per billion (ppb) is used to describe the amount of a chemical in a particular media, i.e., soil and water. For water pollution, one ppb is equal to one microgram of a pollutant in one liter of water. A ppb is equivalent to one part pollution to 999,999,999 parts of clean material. One ppb is like one drop of water in an Olympic-sized swimming pool; one penny in $10 million; one sheet in a roll of toilet paper stretching from New York to London; or one second in nearly 32 years.

Q. Lab results have been reported/mapped for PCE, TCE, and cis 1-2 DCE. Assuming that analyses have followed EPA Method 8260, have any other analyses been measured above detection limit (for example vinyl chloride or non-halogenated compounds)?

A. 33 parameters were analyzed under EPA method 8260 B. The only identified breakdown product from TCE identified to date is cis-1, 2 DCE. Vinyl chloride and other non-haologenated parameters have not been identified in any of the test results under EPA method 8260 B.

Q. In Pennsylvania, 5 ppb of PCE and TCE is considered acceptable for drinking water however in other states the level is lower, why?

A. Pennsylvania utilizes the federal Safe Drinking Water Act Maximum Contaminant Level (MCL) of 5 ppb. Maximum Contaminant Levels are established by the federal Environmental Protection Agency. These MCLs historically have been established using very conservative levels. That is to say that if the MCL for TCE is five ppb, then the levels that would impact human health are higher than that number. Each individual state has the option of setting their own levels. The levels established by each state have to be as stringent as the levels established by the EPA or can be more stringent than the levels established by the EPA.

Q. Isn't it true that you can pull two samples and one result could be above five and one below five? Shouldn't everyone therefore in the affected area be placed on bottled water and/or filtration systems?

A. Sample detection in parts per billion can be affected by the physical characteristics of the water. For instance, varying amounts of particulates in the water (to which contaminants can adhere) can affect the result. The Department is initiating a quarterly sampling protocol for all the residential homes in the affected area. This sampling protocol will help to pick up variations in concentrations of contaminants. If an exceedence of the MCL is detected, a treatment system will be installed.

Q. How does rain affect the levels?

A. Rainfall or lack of rain has varying affects on ground water contamination migration. We see the water table rise and fall in response to the rain events. However, there is a lag time between these events. Even the type of rainfall event, amount and intensity will cause varying affects on the ground water table and contamination migration. Ground water in this area moves through the soil and into the fractures within the bedrock. The network of fractures controls the direction and rate of water movement below the surface. Larger fractures will allow for more water and contaminant migration movement than smaller fractures. Seasonal affects can also be seen with contamination levels in ground water. Ground water in deeper bedrock flows relatively slow. The continued characterization of ground water will include adequate definition of ground water flow paths.

Q. I have a baby. Can my baby drink the contamination below the MCL and can you say there will be no health affects because everyone has different immune systems? Shouldn't baby have bottled water and/or a filtration system be placed on my home?

A. Yes, Pennsylvania Department of Health (PADOH) and Agency for Toxic Substances and Disease Registry (ATSDR) believe it is safe for babies to drink water with levels below the MCL. These levels are set to protect every one, including infants, older people, and individuals with challenged immune systems. However, we realize how stressful it is to be uncertain about your drinking water quality and how vitally important it is for parents to take any steps they can to protect their children. For peace of mind, families with detections of TCE and/or PCE below the MCL could purchase inexpensive point of use filtration units for their taps (make sure the unit is certified to remove VOCs) or use bottled water for their children or infants.

Q. What Blood Tests need to be done to detect levels for children?

A. PADOH and ATSDR do not recommend any medical tests for children or adults exposed to chemicals at this site at this time. This kind of testing is not reliable for the levels of TCE and other VOCs found at this site. These tests are typically used when individuals are exposed to higher levels such as in occupational settings. The main problems with blood and urine testing for TCE and PCE exposures are that (1) you need to be exposed to relatively high levels of the chemicals for the tests to measure results above a laboratories' detection limit, (2) the testing needs to be done within a week or so of the exposure, and (3) the test results are not specific to only TCE or PCE (breakdown products detected via these tests may also be present from exposures to other chemicals). However, at least with TCE, it is possible to detect even small amounts of exposure to this chemical in a person's breath, if the test is done with a specialist very soon after the exposure occurred.

Concerned residents may still consult with reputable specialists in environmental medicine and medical toxicology if they would like to discuss this issue with private clinicians. ATSDR and PADOH can facilitate a referral to one of these specialists, but residents will need to have their own insurance cover any costs of a clinical visit. Experts in environmental medicine practice at clinics affiliated with the Association of Occupational and Environmental Clinics (AOEC). Information on the AOEC clinics is available at www.aoec.org. The closest ones to Clarks Summit are at the University of Pennsylvania in Philadelphia, the University of Pittsburgh, or the UMDNJ – Robert Wood Johnson Medical School in Piscataway, New Jersey. A network of medical toxicologists also exists. You may search for ACMT (American College of Medical Toxicology) physicians at www.acmt.net. Pediatricians who specialize in environmental medicine are also available for consultation. Residents may contact pediatricians affiliated with the MidAtlantic Center for Children's Health and the Environment based at the George Washington University for free telephone or e-mail consultations. The center's website is www.health-e-kids.org, and their toll free number is 1-866-622-2431.

Q. Is the public water safe to drink?

A. Yes, PADOH and ATDSR believe public water in compliance with the federal Safe Drinking Water Act regulations is safe to drink.

Q. Has there been any analysis of cancer in our area and its link to these chemicals?

A. PADOH and ATSDR have completed a cancer incidence analysis for the Clarks Summit and Olyphant zip codes. We did not see anything that stood out in this first look at the cancer data, but that we will be evaluating this information in more depth along with the incoming environmental data in the months ahead. Note, although the cancer registry collects very useful information for public health purposes, it is limited in its ability to answer community concerns about cancer rates near hazardous waste sites. We expect to see a variety of cancers in every neighborhood we investigate. It is not unusual to find several cases of cancer on every block. It is very difficult to then correlate these cases with actual environmental exposures. For this site, we will focus on the types of cancers that have been shown to be associated with exposures to TCE or PCE in either human or animal studies. We will then work to refine our review of the relevant cancer data from this area with updated definitions of the population in the site area as we receive this information.

What are the health issues related to these chemicals? Short term/long term.
Being exposed to chemicals from this site does not necessarily mean that you will develop health problems. Or, in other words, even if chemicals from the site have been found in your drinking water, and even if these levels are above 5 ppb of TCE and/or PCE, you and your family may not have any health problems from this exposure. In general terms, the effects of exposure to any chemical depend on: when you are exposed (during pregnancy, in infancy, as an adult), how much you are exposed to, how long you are exposed, how you are exposed (breathing, drinking), and your personal traits and habits (such as diet, smoking history, family history, and exercise).

Breathing small amounts of TCE may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating. Breathing large amounts of TCE may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage. Drinking large amounts of TCE may cause nausea, liver damage, unconsciousness, impaired heart function, or death. Drinking small amounts of TCE for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear. Direct skin contact with undiluted TCE for short periods may cause skin rashes.

High concentrations of PCE (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used PCE to get a "high." In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of PCE are not known. Results from some studies suggest that

women who work in dry cleaning industries where exposures to PCE can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if PCE was responsible for these problems because other possible causes were not considered. Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that PCE can cause liver and kidney damage. Exposure to very high levels of PCE can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

We do not expect anyone to experience the symptoms described above associated with high levels of exposure to TCE or PCE because we have not found high levels of TCE or PCE (i.e., occupational type levels) at this site. Many factors need to be considered when evaluating whether any one is at risk for health problems from exposure to the lower levels of chemicals at this site. We are in the process of evaluating the available environmental data to make a determination about potential short and long-term health effects at this site. We will publish our conclusions and recommendations about this site in a public document called a Public Health Consultation. We plan to publish this document in the next six months. We will share our findings with the community at that time, either by mail and/or in a public forum. In the mean time, on an individual and private basis, PADOH and ATSDR can assist you or your doctor in determining if you may be at risk for any health problems from exposures to the chemicals at this site. Please contact Pauline Risser-Clemens at PADOH at 717-346-3285, or meet with us at the upcoming public meeting to discuss your concerns.

Q. What are the health risks involved with showering, swimming, laundering, cooking, gardening and feeding and bathing pets?

A. Based on the information PADOH and ATSDR have seen to date, we don't anticipate any short-term health effects to residents engaging in these normal household activities (e.g., showering, swimming, laundering, cooking, gardening, feeding/bathing pets) even for those individuals who were exposed to the chemicals from this site prior to when remedial actions were implemented. We are still in the process of evaluating the health implications of long term, low-level exposures at this site.

We can say at this time that private well water with detections of TCE and/or PCE at or below 5 ppb may be safely used for drinking, cooking, and showering/bathing. For homes with TCE or PCE above 5 ppb with properly maintained carbon treatment systems, the treated water is then safe for all household uses at these homes.

PADOH and ATSDR do not discourage residents from consuming their homegrown vegetables. Vegetables or fruit grown in home gardens in this area may safely be eaten as usual, even if the water containing the contaminants TCE and PCE at the levels found to date were used to water the plants and trees.

Q. What are the credentials of the health professionals?

A. There is a mix of public health professionals working on this site. Keith K. Burkhart,

MD is board certified in Emergency Medicine and has special qualifications in Medical Toxicology. He is a Fellow of the American College of Medical Toxicology (ACMT), the American Academy of Clinical Toxicology, and the American College of Emergency Physicians. He is the current President of ACMT and the former medical director of the Penn State Poison Center. Dr. Karl Markiewicz has a PhD and is a senior toxicologist with ATSDR. Lora Werner has a Masters in Public Health and is an Environmental Health Scientist with ATSDR. Dr. Cynthia Goodman is a public health physician with PADOH. Pauline Risser-Clemens is a scientist with a BS and MS with PADOH. Barb Allerton is a Registered Nurse and a health educator with PADOH.

Appendix G – Queries on Pennsylvania Cancer Registry Data for the Clarks Summit and Olyphant areas by ZIP Codes

A. Clarks Summit

CANCER INCIDENCE 1996-2003 FOR PENNSYLVANIA ZIP CODE AREA = 18411 Clarks Summit

POP	CASES	EXPECTED	SMR	ST RATE	CR RATE	ADJ RATE	Z-SCORE
All CANCER SITES							
MALE	11293	492	587.17	.84	632.04	544.59	529.60	-4.17 -
FEMALE	11966	508	571.56	.89	591.22	530.67	525.48	-2.79 -
TOTAL	23259	1000	1158.73	.86	610.93	537.43	527.24	-4.92 -
BUCCAL CAVITY AND PHARYNX							
MALE	11293	10	15.69	.64	16.19	11.07	10.32	-1.68
FEMALE	11966	6	7.05	.85	7.28	6.27	6.19	-.42
TOTAL	23259	16	22.74	.70	11.58	8.60	8.15	-1.60
ESOPHAGUS							
MALE	11293	8	9.46	.85	10.00	8.86	8.46	-.49
FEMALE	11966	1	2.68	.37	2.84	1.04	1.06	-1.70 -
TOTAL	23259	9	12.14	.74	6.30	4.84	4.67	-1.01
STOMACH							
MALE	11293	7	10.88	.64	11.93	7.75	7.67	-1.45
FEMALE	11966	2	6.49	.31	7.00	2.09	2.16	-3.28 --
TOTAL	23259	9	17.36	.52	9.38	4.84	4.86	-2.80 -

COLON AND RECTUM								
MALE	**11293**	**64**	**75.68**	**.85**	**82.63**	**70.84**	**69.88**	**-1.44**
FEMALE	**11966**	**68**	**71.99**	**.94**	**76.98**	**71.03**	**72.71**	**-.50**
TOTAL	**23259**	**132**	**147.67**	**.89**	**79.71**	**70.94**	**71.25**	**-1.37**
LIVER/INTRAHEPATIC BILE DUCT								
MALE	**11293**	**4**	**7.28**	**.55**	**7.65**	**4.43**	**4.20**	**-1.56**
FEMALE	**11966**	**4**	**3.09**	**1.29**	**3.28**	**4.18**	**4.25**	**.46**
TOTAL	**23259**	**8**	**10.37**	**.77**	**5.39**	**4.30**	**4.16**	**-.81**
PANCREAS								
MALE	**11293**	**11**	**12.37**	**.89**	**13.37**	**12.18**	**11.88**	**-.40**
FEMALE	**11966**	**2**	**12.11**	**.17**	**12.94**	**2.09**	**2.14**	**-7.31 --**
TOTAL	**23259**	**13**	**24.48**	**.53**	**13.15**	**6.99**	**6.98**	**-3.18 -**
LARYNX								
MALE	**11293**	**3**	**9.11**	**.33**	**9.46**	**3.32**	**3.11**	**-3.31 --**
FEMALE	**11966**	**2**	**2.34**	**.85**	**2.38**	**2.09**	**2.03**	**-.24**
TOTAL	**23259**	**5**	**11.46**	**.44**	**5.80**	**2.69**	**2.53**	**-2.72 --**
BRONCHUS AND LUNG								
MALE	**11293**	**56**	**91.07**	**.61**	**97.88**	**61.99**	**60.19**	**-4.55 -**
FEMALE	**11966**	**43**	**65.26**	**.66**	**68.28**	**44.92**	**44.99**	**-3.40 -**
TOTAL	**23259**	**99**	**156.33**	**.63**	**82.57**	**53.21**	**52.29**	**-5.66 -**
MELANOMA OF THE SKIN								
MALE	**11293**	**25**	**23.69**	**1.06**	**25.40**	**27.67**	**26.80**	**.25**
FEMALE	**11966**	**16**	**18.04**	**.89**	**18.61**	**16.71**	**16.50**	**-.50**
TOTAL	**23259**	**41**	**41.74**	**.98**	**21.89**	**22.03**	**21.50**	**-.11**

BREAST								
MALE	**11293**	**0**	**1.71**	**.00**	**1.83**	**.00**	**.00**	**-1.29 -**
FEMALE	**11966**	**185**	**186.13**	**.99**	**187.66**	**193.26**	**186.53**	**-.08**
TOTAL	**23259**	**185**	**187.84**	**.98**	**97.94**	**99.42**	**96.46**	**-.20**
CERVIX UTERI								
FEMALE	**11966**	**7**	**9.47**	**.74**	**9.65**	**7.31**	**7.13**	**-.91**
CORPUS/UTERUS, NOS								
FEMALE	**11966**	**31**	**36.19**	**.86**	**36.39**	**32.38**	**31.17**	**-.90**
OVARY								
FEMALE	**11966**	**25**	**19.19**	**1.30**	**19.60**	**26.12**	**25.53**	**1.14**
PROSTATE								
MALE	**11293**	**154**	**169.14**	**.91**	**179.35**	**170.46**	**163.29**	**-1.17**
TESTIS								
MALE	**11293**	**9**	**4.90**	**1.84**	**5.84**	**9.96**	**10.74**	**1.47**
URINARY BLADDER								
MALE	**11293**	**47**	**40.66**	**1.16**	**44.70**	**52.02**	**51.67**	**.92**
FEMALE	**11966**	**13**	**14.45**	**.90**	**15.39**	**13.58**	**13.85**	**-.41**
TOTAL	**23259**	**60**	**55.11**	**1.09**	**29.54**	**32.25**	**32.17**	**.63**
KIDNEY AND RENAL PELVIS								
MALE	**11293**	**16**	**18.39**	**.87**	**19.38**	**17.71**	**16.87**	**-.57**
FEMALE	**11966**	**5**	**11.41**	**.44**	**11.85**	**5.22**	**5.19**	**-2.85 --**
TOTAL	**23259**	**21**	**29.80**	**.70**	**15.49**	**11.29**	**10.92**	**-1.86**

BRAIN/OTHER NERVOUS SYSTEM								
MALE	**11293**	**8**	**7.61**	**1.05**	**8.21**	**8.86**	**8.63**	**.13**
FEMALE	**11966**	**9**	**6.27**	**1.44**	**6.55**	**9.40**	**9.39**	**.91**
TOTAL	**23259**	**17**	**13.88**	**1.22**	**7.35**	**9.14**	**9.00**	**.74**
THYROID								
MALE	**11293**	**4**	**4.56**	**.88**	**4.82**	**4.43**	**4.23**	**-.27**
FEMALE	**11966**	**18**	**14.42**	**1.25**	**14.70**	**18.80**	**18.34**	**.82**
TOTAL	**23259**	**22**	**18.98**	**1.16**	**9.93**	**11.82**	**11.51**	**.63**
NON-HODGKIN LYMPHOMA								
MALE	**11293**	**14**	**22.57**	**.62**	**24.49**	**15.50**	**15.20**	**-2.24 -**
FEMALE	**11966**	**12**	**20.36**	**.59**	**21.42**	**12.54**	**12.62**	**-2.43 -**
TOTAL	**23259**	**26**	**42.93**	**.61**	**22.90**	**13.97**	**13.87**	**-3.30 -**
HODGKIN LYMPHOMA								
MALE	**11293**	**3**	**3.35**	**.90**	**3.83**	**3.32**	**3.43**	**-.21**
FEMALE	**11966**	**3**	**2.77**	**1.08**	**2.98**	**3.13**	**3.23**	**.14**
TOTAL	**23259**	**6**	**6.12**	**.98**	**3.39**	**3.22**	**3.32**	**-.05**
MULTIPLE MYELOMA								
MALE	**11293**	**7**	**6.02**	**1.16**	**6.56**	**7.75**	**7.62**	**.36**
FEMALE	**11966**	**6**	**5.68**	**1.06**	**6.03**	**6.27**	**6.37**	**.13**
TOTAL	**23259**	**13**	**11.70**	**1.11**	**6.28**	**6.99**	**6.98**	**.36**
LEUKEMIAS								
MALE	**11293**	**11**	**14.45**	**.76**	**15.93**	**12.18**	**12.12**	**-1.04**
FEMALE	**11966**	**6**	**11.16**	**.54**	**11.84**	**6.27**	**6.36**	**-2.14 -**
TOTAL	**23259**	**17**	**25.61**	**.66**	**13.81**	**9.14**	**9.17**	**-2.10 -**

MESOTHELIOMIA								
MALE	**11293**	**0**	**2.37**	**.00**	**2.67**	**.00**	**.00**	**-1.55 -**
FEMALE	**11966**	**1**	**.57**	**1.74**	**.61**	**1.04**	**1.07**	**.43**
TOTAL	**23259**	**1**	**2.95**	**.34**	**1.61**	**.54**	**.54**	**-1.97 --**
ALL OTHER SITES								
MALE	**11293**	**29**	**35.50**	**.82**	**39.18**	**32.10**	**32.01**	**-1.20**
FEMALE	**11966**	**42**	**44.01**	**.95**	**46.51**	**43.87**	**44.39**	**-.31**
TOTAL	**23259**	**71**	**79.51**	**.89**	**42.97**	**38.16**	**38.37**	**-1.02**

CANCER INCIDENCE 2001-2003 FOR PENNSYLVANIA ZIP CODE AREA = 18411 Clarks Summit

POP	**CASES**	**EXPECTED**	**SMR**	**ST RATE**	**CR RATE**	**ADJ RATE**	**Z-SCORE**
Polycythemia vera							
MALE	**11293**	**2**	**.70**	**2.85**	**1.98**	**5.90**	**5.65**	**.88 +**
FEMALE	**11966**	**1**	**.43**	**2.34**	**1.21**	**2.79**	**2.82**	**.58 +**
TOTAL	**23259**	**3**	**1.13**	**2.66**	**1.58**	**4.30**	**4.20**	**1.06 +**

+ Screened Higher Rate (SMR greater than or equal to 2.0 OR Z-SCORE greater than or equal to 1.96)
++ Screened Higher Rate (SMR greater than or equal to 2.0 AND Z-SCORE greater than or equal to 1.96)

- Screened Lower Rate (SMR less than or equal to .50 OR Z-SCORE less than or equal to -1.96)
-- Screened Lower Rate (SMR less than or equal to .50 AND Z-SCORE less than or equal to -1.96)

VARIABLE CODES:

POP = 2000 Census Population.
CASES = Number of newly diagnosed cases during the reporting period.
EXPECTED = Number of expected cases if study area had experienced average PA state rates during reporting period.
SMR = Standard Morbidity Ratio (observed/expected cases).
ST RATE = Average annual state rate per 100,000 population during reporting period.
CR RATE = Average annual crude rate per 100,000 population for study area during reporting period.
ADJ RATE = Average annual age-adjusted per 100,000 population for study area during reporting period.
Z-SCORE = Statistical significance of study area compared to state during reporting period (a z-score of 1.96 equates to a 95 % level of statistical significance or a 1 in 20 chance that the results are due to random variation).

B. OLYPHANT

CANCER INCIDENCE 1996-2003 FOR PENNSYLVANIA ZIP CODE AREA = 18447 Olyphant

	POP	CASES	EXPECTED	SMR	ST RATE	CR RATE	ADJ RATE	Z-SCORE
All CANCER SITES								
MALE	**4219**	**277**	**242.89**	**1.14**	**632.04**	**820.69**	**720.79**	**1.80**
FEMALE	**4676**	**274**	**263.70**	**1.04**	**591.22**	**732.46**	**614.32**	**.52**
TOTAL	**8895**	**551**	**506.59**	**1.09**	**610.93**	**774.31**	**664.49**	**1.62**

BUCCAL CAVITY AND PHARYNX								
MALE	**4219**	**3**	**6.07**	**.49**	**16.19**	**8.89**	**8.00**	**-1.60 -**
FEMALE	**4676**	**2**	**3.23**	**.62**	**7.28**	**5.35**	**4.51**	**-.73**
TOTAL	**8895**	**5**	**9.30**	**.54**	**11.58**	**7.03**	**6.22**	**-1.70**
ESOPHAGUS								
MALE	**4219**	**1**	**3.84**	**.26**	**10.00**	**2.96**	**2.61**	**-2.50 --**
FEMALE	**4676**	**1**	**1.32**	**.76**	**2.84**	**2.67**	**2.15**	**-.26**
TOTAL	**8895**	**2**	**5.16**	**.39**	**6.30**	**2.81**	**2.44**	**-1.94 -**
STOMACH								
MALE	**4219**	**10**	**4.64**	**2.15**	**11.93**	**29.63**	**25.69**	**1.47 +**
FEMALE	**4676**	**4**	**3.31**	**1.21**	**7.00**	**10.69**	**8.46**	**.27**
TOTAL	**8895**	**14**	**7.95**	**1.76**	**9.38**	**19.67**	**16.51**	**1.36**
COLON AND RECTUM								
MALE	**4219**	**40**	**32.13**	**1.24**	**82.63**	**118.51**	**102.86**	**1.08**
FEMALE	**4676**	**42**	**36.19**	**1.16**	**76.98**	**112.28**	**89.34**	**.71**
TOTAL	**8895**	**82**	**68.32**	**1.20**	**79.71**	**115.23**	**95.67**	**1.25**
LIVER/INTRAHEPATIC BILE DUCT								
MALE	**4219**	**3**	**2.91**	**1.03**	**7.65**	**8.89**	**7.89**	**.05**
FEMALE	**4676**	**2**	**1.53**	**1.31**	**3.28**	**5.35**	**4.29**	**.27**
TOTAL	**8895**	**5**	**4.44**	**1.13**	**5.39**	**7.03**	**6.07**	**.22**
PANCREAS								
MALE	**4219**	**5**	**5.18**	**.97**	**13.37**	**14.81**	**12.91**	**-.07**
FEMALE	**4676**	**8**	**6.09**	**1.31**	**12.94**	**21.39**	**17.01**	**.54**
TOTAL	**8895**	**13**	**11.26**	**1.15**	**13.15**	**18.27**	**15.17**	**.40**

LARYNX								
MALE	**4219**	**2**	**3.60**	**.56**	**9.46**	**5.93**	**5.26**	**-1.00**
FEMALE	**4676**	**1**	**1.05**	**.95**	**2.38**	**2.67**	**2.26**	**-.04**
TOTAL	**8895**	**3**	**4.65**	**.65**	**5.80**	**4.22**	**3.74**	**-.85**
BRONCHUS AND LUNG								
MALE	**4219**	**46**	**37.91**	**1.21**	**97.88**	**136.29**	**118.75**	**1.04**
FEMALE	**4676**	**19**	**31.60**	**.60**	**68.28**	**50.79**	**41.06**	**-2.34 -**
TOTAL	**8895**	**65**	**69.51**	**.94**	**82.57**	**91.34**	**77.21**	**-.47**
MELANOMA OF THE SKIN								
MALE	**4219**	**8**	**9.57**	**.84**	**25.40**	**23.70**	**21.23**	**-.50**
FEMALE	**4676**	**11**	**7.81**	**1.41**	**18.61**	**29.41**	**26.22**	**.86**
TOTAL	**8895**	**19**	**17.38**	**1.09**	**21.89**	**26.70**	**23.93**	**.33**
BREAST								
MALE	**4219**	**0**	**.70**	**.00**	**1.83**	**.00**	**.00**	**-.79 -**
FEMALE	**4676**	**76**	**81.65**	**.93**	**187.66**	**203.17**	**174.68**	**-.56**
TOTAL	**8895**	**76**	**82.35**	**.92**	**97.94**	**106.80**	**90.39**	**-.62**
CERVIX UTERI								
FEMALE	**4676**	**7**	**3.89**	**1.80**	**9.65**	**18.71**	**17.36**	**1.09**
CORPUS/UTERUS, NOS								
FEMALE	**4676**	**17**	**15.84**	**1.07**	**36.39**	**45.44**	**39.05**	**.24**
OVARY								
FEMALE	**4676**	**16**	**8.51**	**1.88**	**19.60**	**42.77**	**36.83**	**1.61**
PROSTATE								
MALE	**4219**	**88**	**69.24**	**1.27**	**179.35**	**260.73**	**227.94**	**1.75**

TESTIS								
MALE	**4219**	**1**	**1.98**	**.51**	**5.84**	**2.96**	**2.95**	**-.97**
URINARY BLADDER								
MALE	**4219**	**23**	**17.47**	**1.32**	**44.70**	**68.14**	**58.87**	**1.00**
FEMALE	**4676**	**9**	**7.21**	**1.25**	**15.39**	**24.06**	**19.21**	**.48**
TOTAL	**8895**	**32**	**24.68**	**1.30**	**29.54**	**44.97**	**38.31**	**1.10**
KIDNEY AND RENAL PELVIS								
MALE	**4219**	**7**	**7.36**	**.95**	**19.38**	**20.74**	**18.44**	**-.12**
FEMALE	**4676**	**5**	**5.35**	**.93**	**11.85**	**13.37**	**11.08**	**-.13**
TOTAL	**8895**	**12**	**12.71**	**.94**	**15.49**	**16.86**	**14.62**	**-.18**
BRAIN/OTHER NERVOUS SYSTEM								
MALE	**4219**	**1**	**2.99**	**.33**	**8.21**	**2.96**	**2.75**	**-1.84 -**
FEMALE	**4676**	**1**	**2.78**	**.36**	**6.55**	**2.67**	**2.36**	**-1.57 -**
TOTAL	**8895**	**2**	**5.76**	**.35**	**7.35**	**2.81**	**2.55**	**-2.41 --**
THYROID								
MALE	**4219**	**1**	**1.75**	**.57**	**4.82**	**2.96**	**2.75**	**-.70**
FEMALE	**4676**	**6**	**5.79**	**1.04**	**14.70**	**16.04**	**15.24**	**.08**
TOTAL	**8895**	**7**	**7.54**	**.93**	**9.93**	**9.84**	**9.22**	**-.19**
NON-HODGKIN LYMPHOMA								
MALE	**4219**	**11**	**9.32**	**1.18**	**24.49**	**32.59**	**28.92**	**.45**
FEMALE	**4676**	**8**	**9.78**	**.82**	**21.42**	**21.39**	**17.52**	**-.52**
TOTAL	**8895**	**19**	**19.10**	**.99**	**22.90**	**26.70**	**22.79**	**-.02**
HODGKIN LYMPHOMA								
MALE	**4219**	**1**	**1.33**	**.75**	**3.83**	**2.96**	**2.88**	**-.32**
FEMALE	**4676**	**2**	**1.14**	**1.75**	**2.98**	**5.35**	**5.23**	**.59**
TOTAL	**8895**	**3**	**2.47**	**1.21**	**3.39**	**4.22**	**4.12**	**.30**

MULTIPLE MYELOMA								
MALE	**4219**	**1**	**2.54**	**.39**	**6.56**	**2.96**	**2.58**	**-1.34 -**
FEMALE	**4676**	**6**	**2.83**	**2.12**	**6.03**	**16.04**	**12.79**	**1.03 +**
TOTAL	**8895**	**7**	**5.37**	**1.30**	**6.28**	**9.84**	**8.19**	**.51**
LEUKEMIAS								
MALE	**4219**	**6**	**6.01**	**1.00**	**15.93**	**17.78**	**15.89**	**-.01**
FEMALE	**4676**	**10**	**5.28**	**1.89**	**11.84**	**26.73**	**22.42**	**1.25**
TOTAL	**8895**	**16**	**11.29**	**1.42**	**13.81**	**22.48**	**19.57**	**1.02**
MESOTHELIOMIA								
MALE	**4219**	**2**	**1.05**	**1.90**	**2.67**	**5.93**	**5.07**	**.57**
FEMALE	**4676**	**0**	**.29**	**.00**	**.61**	**.00**	**.00**	**-.48 -**
TOTAL	**8895**	**2**	**1.34**	**1.49**	**1.61**	**2.81**	**2.39**	**.40**
ALL OTHER SITES								
MALE	**4219**	**16**	**15.02**	**1.07**	**39.18**	**47.40**	**41.74**	**.22**
FEMALE	**4676**	**21**	**21.03**	**1.00**	**46.51**	**56.14**	**46.45**	**.00**
TOTAL	**8895**	**37**	**36.05**	**1.03**	**42.97**	**52.00**	**44.11**	**.13**

CANCER INCIDENCE 2001-2003 FOR PENNSYLVANIA ZIP CODE AREA = 18447 Olyphant

POP	**CASES**	**EXPECTED**	**SMR**	**ST RATE**	**CR RATE**	**ADJ RATE**	**Z-SCORE**
Polycythemia vera							
MALE	**4219**	**1**	**.28**	**3.58**	**1.98**	**7.90**	**7.09**	**.65 +**
FEMALE	**4676**	**0**	**.21**	**.00**	**1.21**	**.00**	**.00**	**-.41 -**
TOTAL	**8895**	**1**	**.49**	**2.06**	**1.58**	**3.75**	**3.25**	**.45 +**

+ Screened Higher Rate (SMR greater than or equal to 2.0 OR Z-SCORE greater than or equal to 1.96)
++ Screened Higher Rate (SMR greater than or equal to 2.0 AND Z-SCORE greater than or equal to 1.96)

- Screened Lower Rate (SMR less than or equal to .50 OR Z-SCORE less than or equal to -1.96)
-- Screened Lower Rate (SMR less than or equal to .50 AND Z-SCORE less than or equal to -1.96)

VARIABLE CODES:

POP = 2000 Census Population.
CASES = Number of newly diagnosed cases during the reporting period.
EXPECTED = Number of expected cases if study area had experienced average PA state rates during reporting period.
SMR = Standard Morbidity Ratio (observed/expected cases).
ST RATE = Average annual state rate per 100,000 population during reporting period.
CR RATE = Average annual crude rate per 100,000 population for study area during reporting period.
ADJ RATE = Average annual age-adjusted per 100,000 population for study area during reporting period.
Z-SCORE = Statistical significance of study area compared to state during reporting period (a z-score of 1.96 equates to a 95 % level of statistical significance or a 1 in 20 chance that the results are due to random variation).

Cancer Screening Pennsylvania Zip Code Area Summary Tables (Additional Information about the Tables)

ZIP Code area summary tables provides the results of separate statistical analyses for all cancers and 25 specific cancer sites for males, females, and total (males & females combined) where appropriate, and for polycythemia for 2001-2002. The ZIP Code area evaluated is identified in the table title. Columns list the cancer site, 2000 census population (POP), the number of cancer cases diagnosed between 1996-2002 (CASES), and the number of cases expected if the area had the average state cancer incidence rate (EXPECTED). The next column is the standardized morbidity ratio (SMR), which is the ratio of observed-to-expected number of cases (observed/expected cases). A ratio of 1.00 implies that a cancer rate is the same as the state rate. The next columns provide the average annual state rate (ST RATE) and ZIP Code study area average annual crude rate (CR RATE) and age-adjusted rate (ADJ RATE) per 100,000 population. The last column provides an estimate of the statistical significance (Z-SCORE) of finding the observed number of cancer cases in that area when compared to average statewide cancer incidence rates for the 1996-2002 time period. Additional information of the table variables is provided on the last page of the table.

Materials and Methods

Input data for this table comes from three data sources. The PA Cancer Registry provided cancer incidence case records for the seven-year time (1996-2002) for all for all cancer sites except polycythemia which was for (2001-2002). Polycythemia became reportable to the PA cancer registry beginning in 2001. The 2000 census provided the basic population data; however, the census does not provide useful ZIP Code area population estimates. To address this issue, PA DOH purchased more reliable ZIP Code area population estimates from a vendor (Claraitas, Inc; Ithaca, NY). Cancer cases were tabulated in accordance with ICDO-10 site coding definitions used by a PA DOH Bureau of Health Statistic in preparation of their State Cancer Registry Annual Reports. The standard population used for comparison with study County and ZIP Code areas was the 1996-2002 PA State composite population. Statewide sex, age, and site-specific incidence rates were multiplied by age-groups (0-4, 5-14, 15- 24, …, 85+) by County and ZIP Code area populations to calculate the expected number of cases that would have occurred if a given study area had state-wide incidence rates. The statistical significance of the indirectly age-adjusted incidence rates was calculated in accordance with the methodology recommended by Selven et. al.

Cancer Rate Screening

The following PA DOH local area cancer rate screening criteria are used to evaluate and score ZIP Code area cancer rate screening results:

+ Screened Higher Rate (SMR greater than or equal to 2.0 OR Z-SCORE greater than or equal to 1.96).
++ Screened Higher Rate (SMR greater than or equal to 2.0 AND Z-SCORE greater than or equal to 1.96).
- Screened Lower Rate (SMR less than or equal to .50 OR Z-SCORE less than or equal to -1.96).
-- Screened Lower Rate (SMR less than or equal to .50 AND Z-SCORE less than or equal to -1.96).

When conducting cancer risk screening evaluations, a SMR ratio 2.0 or greater is generally regarded as more noteworthy; however, statistical significance should also be found in order to help rule out the possibility of chance variation (z-scores of 1.96 or greater). A z-score of 1.96 equates to a 95 % level of statistical significance or a 1 in 20 chance that the results are
due to random variation. Interpreting this kind of data can be confusing because of the number of comparisons that are made, i.e., the more analyses conducted, the greater the likelihood of finding a statistically significant result; therefore, it is important to look for the presence of a consistent pattern in the cancer rates.

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