Health Consultation

WESTERN NORRISTOWN STUDY AREA

NORRISTOWN, MONTGOMERY COUNTY, PENNSYLVANIA

EPA FACILITY ID: OAN000305874

FEBRUARY 12, 2004

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

Health Consultation: A Note of Explanation

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

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

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HEALTH CONSULTATION

WESTERN NORRISTOWN STUDY AREA

NORRISTOWN, MONTGOMERY COUNTY, PENNSYLVANIA

EPA FACILITY ID: PAN000305874

Prepared by:

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

Summary

The Pennsylvania Department of Health (PADOH) prepared this health consultation for the Western Norristown study area. The report was prepared at the request of the U.S. Environmental Protection Agency Region 3 (EPA3), under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). In response to EPA3's request and a community resident's health concerns, ATSDR and PADOH reviewed the EPA3 soil sampling data and determined whether exposure to soil contaminants pose a public health threat.

The Western Norristown study area is in Norristown, Pennsylvania. The area of concern, which includes many homes, is southeast of Forest Avenue and may have been part of a dumping site in the past. An EPA3 contractor collected and analyzed soil samples from the site in September 2002 and March 2003. ATSDR and PADOH determined that the chemicals of health concern include polycyclic aromatic hydrocarbons (PAHs) and some inorganic chemicals.

From available information, PADOH concluded that current and past exposures to soil contaminants in the residential area of concern are not expected to cause harmful health effects to the residents. Those exposures, therefore, pose no apparent public health hazard.

Background and Statement of Issues

Site History

The Western Norristown study area is in Norristown, Pennsylvania (Figure 1). The geographic area of concern is southeast of Forest Avenue (Figure 2). About 320 people live in the houses within the area (Figure 3).

EPA3 relied on historical aerial photographs and anecdotal information for its site investigations. A large, partially vegetated area southeast of Forest Avenue was identified as a possible dumping area, in 1945. The area appeared to be relatively inactive through 1959, but small deposits of light- and dark-toned material and possible solid waste were observed. By 1965, multi-family housing units had been built atop the suspected dumping area [1].

Even though no information was found by EPA that pinpointed past activities or chemicals that pose health risks at this site, EPA decided that collection and analysis of samples were essential in order to obtain information regarding possible past contaminations to this site [2].

Site Visit

On January 17, 2002, EPA3, ATSDR, PADOH, and Montgomery County Health Department (MCHD) representatives met with a resident who had contacted PADEP and EPA3 about site concerns. EPA3 explained to the resident the planned environmental sampling and necessary permission required to conduct residential sampling.

During the physical site inspection, it was noted that blocks of homes are now on top of the area proposed as the former Western Norristown dump site. The concerned resident's home is within the area of the alleged dump site. The basement of the house is partially underground at the front of the house, but not in the back, where a garage is located. The house basement appears to be well ventilated. In some areas, the limited ground surface was bare of vegetation.

Site Contamination

We found no evidence of sampling reports or investigations from before September 2002 that indicate contamination of the site. An EPA3 contractor collected and analyzed 11 surface soil samples (0–3 inches deep) and 10 sub-surface soil samples (up to 2 feet deep) in September 2002. Those samples were collected from the residential area of concern, which covers about 8 acres. In addition, two surface soil background samples were obtained from Ackies Field, in the 1300-block of West James Street, Norristown, (about ¼ mile from the area of concern). This 2–3 acre field is about one block northeast from West Beech Street. It is used as a baseball diamond and playground for children. The samples were taken about 50 feet apart, near trees estimated to be 40–50 years old and native to the area [3]. The field is adjacent to another residential area and is separated from the nearest homes by a chain link fence. In March 2003, an EPA3 contractor collected and analyzed additional surface and sub-surface soil samples and soil gas samples from the residential area of concern.

Quality Assurance and Quality Control

In preparing this health consultation, ATSDR and PADOH relied on information from the referenced documents. We assume that adequate quality assurance and quality control measures were followed regarding data gathering, chain-of-custody, laboratory procedures, and data reporting. The analyses, conclusions, and recommendations in this health consultation are valid only if the referenced documents are complete and reliable.

Discussion

The primary public health issues evaluated in this section are past and current exposures to soil contaminants in the geographic area of concern through incidental soil ingestion and inhalation. Chemicals of health concern for this site include PAHs and some inorganic chemicals (Table 1) [4]. Available soil gas data provided insights regarding additional contaminants that might be present in soil, although such data are of limited use in assessing exposures to soil. No significant findings were noted from the soil gas samples.

To evaluate the potential health risks from chemicals of health concern associated with soil contaminants at the Western Norristown study area, PADOH and ATSDR assessed the risks for noncancer and cancer health effects. The health effects are related to contaminant concentration, exposure pathways, exposure frequency, and exposure duration. Additionally, PADOH and

ATSDR used minimal risk levels (MRLs) and researched the scientific literature to assess health risks. (Refer to Appendix C for additional information on the health effects evaluation process used by PADOH and ATSDR.)

In evaluating the exposure to soil contaminants for residents living at the investigation site, PADOH considered the worst-case scenarios for exposures of community residents. We evaluated a total exposure duration of 30 years at the maximum levels of the contaminants detected from the surface soil samples. According to EPA Superfund policy, 30 years represents the 95th percentile (or a conservative upper limit) for U.S. residence durations in any one location. Geometric means were also considered for the contaminants of concern for the same exposure duration.

To evaluate for noncarcinogenic health effects, PADOH assumed that, for the "worst-case" scenarios, a 15-kilogram (kg) child ingests 200 milligrams (mg) of soil particles per day for 350 days per year. Calculation were determined for a child from 1–6 years old. It would also be logical to assume that the exposure dose would be less for adults; an ingestion of 100 mg/day is assumed, for a maximum of 270 days.

Contaminants of Health Concern

Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbons (PAHs) are a group of chemicals present throughout the environment. There are more than 100 different PAHs found in homes, outdoors, and at the workplace [5]. The primary sources of exposure to PAHs for most of the U.S. population are tobacco smoke, wood smoke, ambient air, and food (e.g., charbroiled meat).

The health effects of individual PAHs differ [6]. Studies in animals have shown that short- and long-term exposures to these chemicals can harm skin, body fluids, and internal immune systems for fighting disease. However, these effects have not been reported in people. Of these PAHs, benzo(a)pyrene is the most potent and most extensively studied. The Pennsylvania Land Recycling Program cleanup standard for benzo(a)pyrene is 2.5 mg/kg for residential areas. Benzo(a)pyrene was detected at the site at the concentration range of 0.4 mg/kg to a maximum of 15 mg/kg. The geometric mean of the benzo(a)pyrene results was 2.2 mg/kg. The wide range between the maximum and the geometric mean reflects possible "hot spots"at the site.

ATSDR has not developed a chronic oral MRL for benzo(a)pyrene. However, the estimated oral exposure dose to benzo(a)pyrene, derived from the assumptions discussed previously, results in a margin of safety greater than 1,000. That means that harmful health effects are not expected. In addition, the benzo(a)pyrene levels at this site for children or adults are five to six orders of magnitude less than the (less serious) Intermediate Lowest Observable Adverse Effect Level (LOAEL) listed by ATSDR [5]. Therefore, exposure to benzo(a)pyrene for the scenario described above is not likely to cause any noncancerous adverse health effects for children or adults.

Six other PAHs considered to be probable carcinogens were also evaluated by PADOH for noncarcinogenic effects (e.g., immunotoxic effects or gastrointestinal effects). The six other PAHs include benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indo(1,2,3-cd)pyrene. No chronic or intermediate health effect levels have been determined for these PAHs, so the intermediate (less serious) LOAEL listed by ATSDR for benzo(a)pyrene was used as a conservative substitute. The individual levels at this site for these six PAHs are five to six orders of magnitude less than this (less serious) intermediate LOAEL for benzo(a)pyrene. Therefore, exposure to these six PAHs for the scenario described above is not likely to cause any noncancerous adverse health effects for children or adults.

Other PAHs detected in the surface soil samples are either of low potencies or below other comparison values [5]. For example, the estimated exposure doses for children to acenapthene, anthracene, fluoranthene, fluorene, or pyrene are approximately one to three orders of magnitude less than their corresponding Oral Reference Doses (RfD). (See the discussion later in this document on RfDs.) Moreover, the harmful effects seen in animal studies for these PAHs have not been reported in people, as discussed above. Therefore, ATSDR and PADOH have determined that exposures to the PAH-contaminated soil are not expected to cause harmful health effects to the community residents.

EPA and the International Agency for Research on Cancer have classified benzo(a)pyrene as a “B2” or probable human carcinogen (inadequate or limited human evidence but sufficient carcinogenic evidence in animals). Using EPA’s cancer slope factor (CSF) of 7.3 $(mg/kg/day)^{-1}$ for benzo(a)pyrene, PADOH evaluated whether there was an increased cancer risk for this chemical. There is no apparent increased risk of cancer after considering the maximum result found at the site for an exposure of 30 years. Likewise, the geometric mean (a possible increase of about seven cancers in 1 million people, using calculations that include the geometric mean) indicated no apparent increased risk for an exposure of 30 years. These calculated risks are based on animal exposure studies and are theoretical [5]. Based upon existing data, it can be concluded that the current levels of benzo(a)pyrene do not pose a significant carcinogenic health threat to the residents.

Because the other six “B2” PAHs lack CSFs or the CSFs are the same as for benzo(a)pyrene, the concentrations of these contaminants and benzo(a)pyrene were totaled and the cancer slope factor (CSF) for benzo(a)pyrene was used in the calculation. Assuming an additive effects of the “B2" PAHS and summing the geometric means of the seven “B2” carcinogens, using the assumptions discussed previously, the cancer risk was estimated at a likely increase of about 4 cancers in 100,000 people. However, PADOH determined that the cancer risk would actually be much lower because the six other “B2” PAHs are thought to be less potent than benzo(a)pyrene. The geometric mean of individual “B2” PAHs results ranged from 0.5–2.8 mg/kg. For the individual levels of these “B2” PAHs (using the maximum values), cancer risks were calculated at a likely increase of about 1–5 cancers in 100,000 persons, though it would

not be expected that a person would continuously be exposed to those maximum concentrations. Therefore, ATSDR and PADOH determined that exposure to these PAHs posed no apparent increased risk for cancers.

Inorganic Chemicals/Metals

Aluminum, arsenic, chromium, copper, lead, mercury, vanadium, and zinc were selected as chemicals of health concern because the levels have either exceeded the ATSDR comparison values (CVs) or there are no established CVs [7]. For children and adults, the estimated oral exposure doses for aluminum, arsenic, copper, vanadium, and zinc are lower than the ATSDR's intermediate oral MRL or chronic oral MRL. Therefore, the exposure to these chemicals at these levels are not expected to cause adverse health effects to the community residents.

The estimated oral exposure dose for chromium is about three orders of magnitude less than the level at which no observed adverse health effects were observed in animals [8]. The estimated oral exposure dose for mercury is six orders of magnitude less than the lowest observed adverse effect levels seen in animals [9]. Therefore, the exposure to chromium or mercury at these levels are not expected to cause adverse health effects to the community residents.

The maximum surface soil lead level of 985 mg/kg (sample result range is 84.6–985 mg/kg) detected in the geographic area of concern is above EPA's 400 mg/kg (average) screening level for residential play areas [10]. Generally, in humans, it is thought that blood lead level rises 3–7 micrograms of lead per deciliter of blood (μg/dL) for every increase in 1,000 mg of lead per kilogram soil or dust [11]. Regular contact with the highest levels of lead found in the soil is not expected, even in residential areas, and the geometric mean of all the surface soil results is calculated to be 344.5 mg/kg. We would expect such levels in soil might therefore result in an increase in blood lead levels below the level of concern of 10 μg/dL. The exposure dose (derived from the geometric mean of the sample results) for children is about two times less than the human intermediate LOAEL dose listed by ATSDR. The exposure dose (based on the geometric mean of the sample results) for adults is about 10 times less than the human intermediate LOAEL dose listed by ATSDR [12]. On the basis of this assessment, PADOH concludes that exposure to the maximum detected level in soil is not likely to result in elevated blood lead levels (i.e., greater than 10 μg/dL) that could cause health problems.

However, there are various sources of lead other than soil that could contribute to the blood lead level in children. Those sources range from paint, plumbing, and pottery, to nearby lead smelters and hobbies using lead products.

Community Health Concerns

During the meeting with a resident on January 17, 2002, the resident stated her concerns about cancer in the neighborhood, particularly leukemia. The concerned resident has lived in her home with her family for at least 10 years. She also said other people in the neighborhood had cancer. No contaminants that are known to be associated with leukemia were found above the ATSDR CVs at this site. There are

multiple known or suspected causes of leukemia, according to the National Cancer Institute. Factors such as radiation, solvents (such as benzene), pesticides, and chemotherapy drugs have been suspected. Although no completed exposure pathways were found for chemicals linked to leukemia at this site, to address community concerns the following health outcome data evaluation was conducted on cancer (and specifically leukemia) incidence in the Norristown Borough.

Health Outcome Data Evaluation

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

The number of observed leukemia incidents for Norristown Borough residents was obtained from the Bureau of Health Statistics and Research, Pennsylvania Department of Health. Using 5-year average annual age-specific incident rates for Pennsylvania, the Montgomery County Department of Health calculated the number of expected leukemia incidents for Norristown Borough residents. The observed (actual) number of leukemia cases divided by the population were compared to the expected number of leukemia cases. This comparison is called the Standardized Incidence Ratio (SIR). If the observed (actual) and expected numbers are the same, then the SIR is 1.00. If the ratio is less than 1.00, then the cancer risk for leukemia among Norristown Borough residents was lower than what was expected, compared with state rates. If the ratio is greater than 1.00, then the number of observed leukemia cases for Norristown Borough was more than what was expected [13].

Overall, the cases of leukemia in Norristown Borough had decreased between 1994 and 2000. In the most recent period (1996–2000) that was evaluated, the number of leukemia cases were less than expected, while in the earlier period (1994–1998) the number of cases were greater than expected and statistically significant. The cases from this period (1994–1998) totaled 27 cases and of these 27 cases, further evaluation showed that only two cases were in children and neither of the two cases was in the neighborhood of the Western Norristown study area [13].

Child Health Considerations

ATSDR and PADOH recognize that children are especially sensitive when exposed to many
contaminants. This sensitivity is a result of the following factors:

- 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 generally are more likely to put their fingers and objects into their mouths than are adults.
- Children are shorter than adults, which means they can breathe dust, soil, and vapors close to the ground.
- Children are smaller, therefore childhood exposure results in higher doses of chemicals per body weight.

Children can sustain permanent damage if these factors lead to toxic exposure during critical growth stages. ATSDR is committed to protecting children's health. Mindful that the site is a residential area where children may play, PADOH concluded that past and current exposures to soil contaminants detected in the geographic area of concern pose no public health hazard for children.

Conclusion

After a thorough evaluation of available environmental information and existing activities, PADOH concludes that current and very recent past exposures to residential soil are not expected to cause adverse health effects at this site. Exposures to residential soil are classified as posing no apparent public health hazard to the community residents. Moreover, the evidence evaluated in this health consultation does not indicate that exposure to the levels of the chemicals found in the soil at this site may have caused leukemia among residents in Norristown Borough.

Recommendation

There is no further recommendation at this time.

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 health consultation. The purpose of the PHAP
is to ensure that this health consultation 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

In January 2002, EPA3, ATSDR, PADOH, and MCHD visited the concerned community member and identified her health concerns. Representatives also updated her on the Agencies' site-related activities to address her issues.

In September 2003, PADOH met with the Montgomery County Health Department and nurses from their Childhood Lead Poisoning Prevention program. We verified that children under 6 from the area can obtain free blood lead screening from the county.

In September 2003, PADOH participated in a public availability session with EPA3 and the Montgomery County Health Department. We met with residents and answered their questions during this session.

Ongoing or Planned Actions

PADOH and ATSDR will share the results of their findings with the community and respond to individual requests for health information. They will also provide health education on preventing environmental exposures and health promotion activities as needed in collaboration with the Montgomery County Health Department.

References

4. Environmental Protection Agency. Historical aerial photographic analysis of Western Norristown dump area, Norristown, Pennsylvania. July 2001. (The map series was completed by EPA Environmental Service Division, Los Vegas, Nevada and contained aerial photos from March 1945 to May 1988.)

2. Electronic mail to Anna Johnson-Entsuah, Montgomery County Department of Health, Pennsylvania, from Robert Lausch, US Environmental Protection Agency, Region 3, January 25, 2002. (The e-mail contains discussions of possible past activities at or near the site and EPA3's plans to conduct sampling at the Western Norristown site at that time.)

3. Faxed documents to Geroncio Fajardo, PADOH, from Charlene Creamer, US Environmental Protection Agency, December 11, 2002. (The documents contain information on locations of sampling.)

4. Laboratory results from US Environmental Protection Agency, Environmental Science Center, Fort Meade, Maryland; 2002 Nov.

5. Agency for Toxic Substances and Disease Registry. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta: US Department of Health and Human Services; 1995 Aug. Available from URL: http://www.atsdr.cdc.gov/toxprofiles/tp69.html, last accessed January 2003.

6. Agency for Toxic Substances and Disease Registry. Public health statement for polycyclic aromatic hydrocarbons. Atlanta: US Department of Health and Human Services; 1995 Aug. Available from: URL: http://www.atsdr.cdc.gov/toxprofiles/phs69.html, last accessed January 2003.

7. Agency for Toxic Substance and Disease Registry. Health Guidelines Comparison Values (The tables used had expiration dates of 03/31/2003 and 12/31/2003). Atlanta: US Department of Health and Human Services. This document contains soil, water, and air Comparison Values and oral MRLs.

8. Agency for Toxic Substances and Disease Registry. Toxicological profile for chromium. Atlanta: US Department of Health and Human Services; 2000 Sep. Available from: URL: http://www.atsdr.cdc.gov/toxprofiles/tp7.html, last accessed January 2003.

9. Agency for Toxic Substances and Disease Registry. Toxicological profiles for mercury. Atlanta: US Department of Health and Human Services; 1999 Mar. Available from: URL: http://www.atsdr.cdc.gov/toxprofiles/tp46.html, last accessed January 2003.

10. Lead; identification of dangerous levels of lead, final rule. US Environmental Protection Agency. Federal Register 2001 Jan 5;66:1206–40. Available from: URL: http://www.epa.gov/fedrgstr/EPA-TOX/2001/January/Day-05/t84.pdf, last accessed January 2003.

11. Agency for Toxic Substances and Disease Registry (ATSDR). Analysis paper: Impact of lead-contaminated soil on public health. US Department of Health and Human Services, Public Health Service, Atlanta, Georgia, May 1992.

12. Agency for Toxic Substances and Disease Registry. Toxicological profile for lead Atlanta: US Department of Health and Human Services; 1999.Available from URL: http://www.atsdr.cdc.gov/toxprofiles/tp13.html, last accessed January 2003.

13. Electronic mail to Geroncio Fajardo, PADOH, from Suet Lim, Montgomery County Department of Health, Pennsylvania, regarding incidence of leukemia in Norristown Borough. August 19, 2003.

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Certification

This Health Consultation for the Western Norristown study site was prepared by the Pennsylvania Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

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LCDR Alan G. Parham, REHS, MPH
Technical Project Officer, SPS, SSAB, DHAC

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

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Roberta Erlwein
Section Chief, SPS, SSAB, DHAC, ATSDR

APPENDICES

APPENDIX A. FIGURES

Figure 1. Study area location map. .....Scale 1:3,350

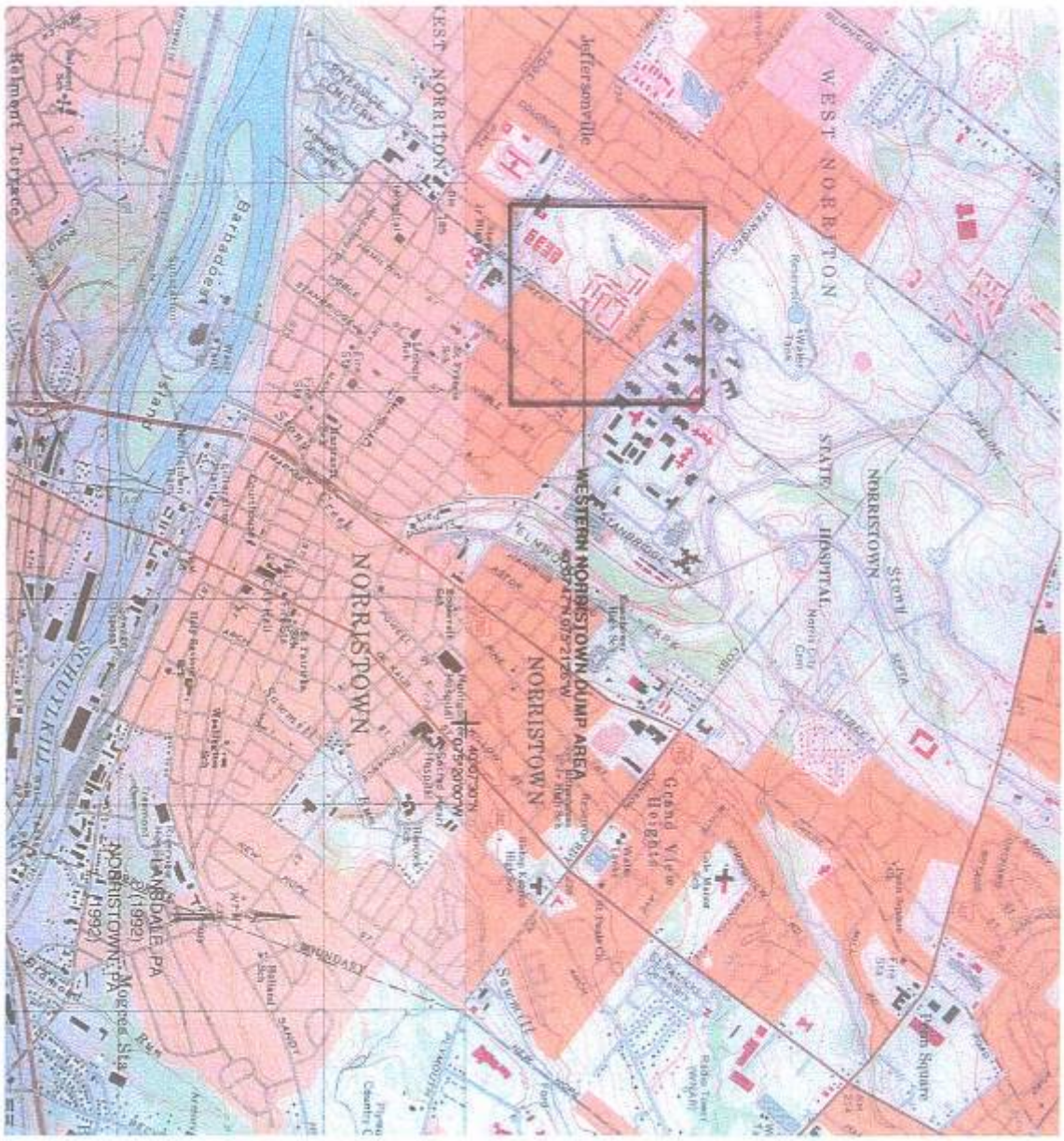

Figure 2. Local Study area location map, Lansdale, Pennsylvania (USGS, 1992). Approximate scale: 1:24,000.

Figure 2. Study area location map. .....Scale 1:3,350

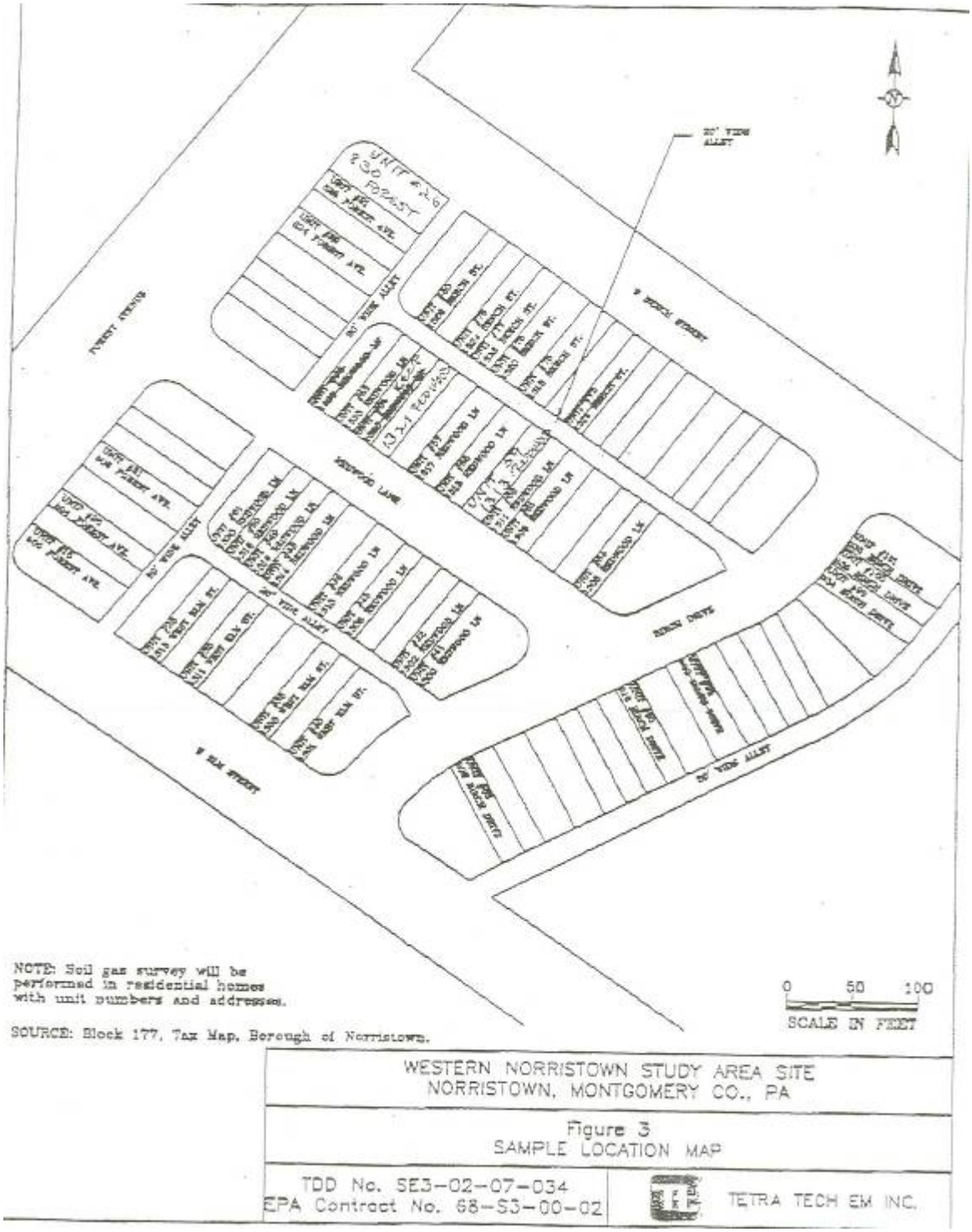

Figure 3. Sample location map. (Tetra Tech EM, Inc)

APPENDIX B. TABLE

Table 1. A summary of selected chemicals of health concern from surface soil samples (0-3 inches), Western Norristown Study Site, September 2002 and March 2003 Data

ANALYTE	Frequency of Detection	LOCATION	RESULT (ppm)	COMPARISON VALUES	
				Value (ppm)	Source
Inorganics/Metals:					
Aluminum	23/23	Residential Area	5,920 - 19,000	4,000	EMEG (I) Pica child
	2/2	Background	16,700 - 16,800		
Arsenic	23/23	Residential Area	2.8 - 9	0.5	CREG
	2/2	Background	20.9 - 104		
Chromium	23/23	Residential Area	13.6 - 32.6	n/a/	n/a
	2/2	Background	21.1 - 24.8		
Copper	23/23	Residential Area	21.4 - 183.0	60	EMEG (I) Pica child
	2/2	Background	11.9 - 16.1		
Lead	23/23	Residential Area	84.6 - 985	n/a	n/a
	2/2	Background	45.3 - 45.6		
Mercury	21/23	Residential Area	0.13 - 0.71	n/a	n/a
	0/2	Background	ND		
Vanadium	23/23	Residential Area	18.9 - 56.3	6	EMEG (I) Pica child
	2/2	Background	34.4 - 34.7		
Zinc	23/23	Residential Area	121 - 632	600	EMEG (I) Pica child
	2/2	Background	89.7 - 172		
PAHs:					
2-Methylnaphthalene	5/18	Residential Area	0.029 - 0.061	n/a	n/a
	0/2	Background	ND		
Acenaphthylene	5/18	Residential Area	0.076 - 0.28	n/a	n/a
	0/2	Background	ND		
Benzo(a)anthracene	18/18	Residential Area	0.45 - 14	n/a	n/a
	1/2	Background	0.15		
Benzo(a)pyrene	18/18	Residential Area	0.4 - 15	0.1	CREG
	1/2	Background	0.18		
Benzo(b)fluoranthene	18/18	Residential Area	0.41 - 14	n/a	n/a
	1/2	Background	0.21		
Benzo(g,h,i)perylene	18/18	Residential Area	0.083 - 6	n/a	n/a
	0/2	Background	ND		
Benzo(k)fluoranthene	18/18	Residential Area	0.37 - 12	n/a	n/a
	1/2	Background	0.2		
bis(2-Ethylhexyl)phthalate	18/18	Residential Area	0.073 - 1.2	n/a	n/a
	0/2	Background	ND		
Butylbenzylphthalate	6/18	Residential Area	0.023 - 0.23	n/a	n/a
	0/2	Background	ND		
Carbazole	14/18	Residential Area	0.073 - 0.55	n/a	n/a
	0/2	Background	ND		
Chrysene	18/18	Residential Area	0.44 - 13	n/a	n/a
	1/2	Background	0.2		
Dibenzo(a,h)anthracene	17/18	Residential Area	0.099 - 2.3	n/a	n/a
	0/2	Background	ND		
Dibenzofuran	10/18	Residential Area	0.036 - 0.31	n/a	n/a
	0/2	Background	ND		
Indeno(1,2,3-cd)pyrene	18/18	Residential Area	0.19 - 5.7	n/a	n/a
	0/2	Background	ND		
Phenanthrene	18/18	Residential Area	0.36 - 12	n/a	n/a
	1/2	Background	0.12		

Raw data taken from "Data Validation Report for Western Norristown Study, USEPA Environmental Science Center, Fort Meade, MD, November 2002." and electronic file data from Charlene Creamer, EPA3 RPM, May 2003.

ppm = parts per million
EMEG (I) = Environmental Media Evaluaion Guide (Intermediate)
CREG = Cancer Risk Evaluation Guide
ND = Non-Detect
n/a = not available
/PADOH, May 2003

APPENDIX C. HEALTH EFFECTS EVALUATION PROCESS

Health Effects Evaluation Process Used by PADOH and ATSDR

The ATSDR has developed health-based comparison values (CVs) that are chemical-specific concentrations, which determine environmental contaminants of health concern. PADOH uses these CVs to determine which contaminants require further evaluation. These values include Environmental Media Evaluation Guides (EMEGs), and Reference Dose Media Evaluation Guides (RMEGs) for noncancerous health effects and Cancer Risk Evaluation Guides (CREGs) for cancerous health effects. If environmental media guides cannot be established because of a lack of available health data, other comparison values may be used to select a contaminant for further evaluation.

CVs are contaminant concentrations that are not likely to cause adverse health effects, even when very conservative exposure scenarios are assumed. However, environmental levels that exceed CVs will not necessarily produce adverse health effects. If a contaminant is found in the
environment at levels exceeding its corresponding CV, PADOH examines potential exposure
variables and the toxicology of the contaminant. Regardless of the level of contamination, a public health hazard exists only if people come into contact with, or are otherwise exposed to, harmful levels of contaminants in site media.

To determine the possible health effects of site-specific chemicals, PADOH researches scientific literature and uses ATSDR's Minimal Risk Levels (MRLs), EPA's Reference Doses (RfD), EPA's Cancer Slope Factors (CSFs), and the National Institute of Occupational Science and Health/Occupational Safety and Health Administration (NIOSH/OSHA) guidelines and standards. MRLs are estimates of daily exposure to contaminants below which noncancerous adverse health effects are unlikely to occur. ATSDR MRLs are derived for continuous, 24-hour-a-day exposures. RfDs are estimates of daily oral exposures to the general public (including sensitive groups) that are unlikely to cause noncancerous harmful effects during a lifetime (70 years). RfDs are measured in milligrams of chemical per kilogram of body weight per day (mg/kg/day), with uncertainty spanning perhaps an order of magnitude.

When RfDs and MRLs are not available, a No Observed Adverse Effect Level (NOAEL) or Lowest Observed Adverse Effect Level (LOAEL) may be used to estimate levels below which no adverse health effects (noncancerous) are expected. Health assessors also use Margins of Safety (MOS) calculations based on LOAELs. In general, when the MOS is greater than 1,000, harmful effects are not expected. When the MOS ranges from approximately 100 to 1,000, further toxicologic evaluation is needed. If the MOS is less than 10, harmful effects might be possible, but further toxicologic evaluation may still be advisable.

Health guidelines, such as MRLs and RfDs, do not consider the risk of developing cancer. To evaluate exposure to carcinogens, EPA has established CSFs for inhalation and ingestion that define the relationship between exposure doses and the likelihood of

an increased risk of cancer, compared with controls that have not been exposed to the chemical. Usually derived from animal or occupational studies, CSFs are used to calculate the exposure dose likely to result in one excess cancer case per 1 million persons exposed over a lifetime (70 years). The potential for exposure to a contaminant to cause cancer in an individual or population is evaluated by estimating the probability that an individual will develop cancer over a lifetime as the result of the exposure. This approach is based on the assumption that there are no absolutely “safe” toxicity values for carcinogens.

Cancer risk is the likelihood, or chance, of getting cancer. The phrase “excess lifetime cancer
risk” is used because individuals have a “background risk” of about 1-in-4 of getting cancer
from all other causes during their lifetime (70 years.) An excess cancer risk of “1-in-100,000” from a given exposure to a contaminant means that each individual exposed to that contaminant, at that level, over his or her lifetime would be expected to have, at most, a 1-in-100,000 chance (above the background chance) of getting cancer from that particular exposure. To compensate for uncertainties in science, the risk numbers used are very conservative. In actuality, the risk is probably somewhat lower than 1-in-100,000, and, in fact, may be zero.

Because 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 (see Child Health Initiative section). Also note that researchers conduct animal studies using much larger doses than those experienced by most people exposed to contaminants originating from hazardous waste sites.