Public Health Assessment for

FRANKLIN SLAG PILE (MDC) SITE
PHILADELPHIA, PENNSYLVANIA
EPA FACILITY ID: PASFN0305549
MAY 24, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment 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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PUBLIC HEALTH ASSESSMENT

FRANKLIN SLAG PILE (MDC) SITE
PHILADELPHIA, PENNSYLVANIA

EPA FACILITY ID: PASFN0305549

Prepared by:

The Pennsylvania Department of Health
under cooperative agreement with the
Agency for Toxic Substances and Disease Registry

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund law*. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-60), Atlanta, GA 30333.

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EXECUTIVE SUMMARY

The Franklin Slag Pile (MDC) Site (FSP) is located in the Port Richmond section of Philadelphia, Pennsylvania, at 3110 Castor Avenue. It is adjacent to and east of the Franklin Smelter and Refining Corporation (FSRC) Site's North Yard, and bordered to the North by the Philadelphia Water Department's (PWD) Northeast Treatment Facility, which includes a lagoon to the north and east. Delaware Avenue and Tioga Marine Terminal (TMT) also border the site to the southeast, Castor Avenue and Philadelphia Gas Works (PGW) to the southwest, and the former FSRC to the northwest. The site consists of a slag pile that was generated from the secondary copper smelting process at the neighboring FSRC. The site is currently abandoned, and the slag is capped and secured to prevent trespasser access.

MDC Industries' operations, which included crushing, drying, and sizing smelter slag from the adjacent FSRC, began in the 1950s. It ceased operations on December 30, 1999, without stabilizing the slag pile. While MDC operated, material from the slag pile was observed to have migrated beyond the property borders on all four sides of the facility.

At various times between 1988 and 2001, U.S. Environmental Protection Agency (EPA) Region 3 and the Pennsylvania Department of Environmental Protection (PADEP) collected various on-site and off-site environmental media and had them tested primarily for metals. Samples of slag/soil contained high levels of lead, and an analysis of surface waters (stormwater runoffs) migrating off of the MDC property to the Delaware River revealed high levels of copper, lead, and zinc. Additionally, slag was observed being carried by wind off the property. Employees of surrounding facilities reported observing airborne releases from the MDC facility and 10-15 mile-per-hour (mph) winds carrying large black dust clouds of the material off-property to the northeast. Historical air sampling, conducted between 1997 and 1999 by Philadelphia Air Management Services at stations surrounding MDC, recorded high ambient lead levels. Possible contributors to the elevated levels of lead detected in the air in the past (and possibly soil currently) are two former smelters that used to be active in the Port Richmond area of Philadelphia.

The purpose of this public health assessment is to evaluate public health concerns, on- and off-site contamination, physical hazards, environmental and human exposure pathways and associated public health implications. In preparing this public health assessment (PHA), the Agency for Toxic Substances and Disease Registry (ATSDR) and the Pennsylvania Department of Health (PADOH) reviewed available data from EPA and PADEP, formerly known as the Pennsylvania Department of Environmental Resources (PADER). Additionally, ATSDR and PADOH conducted site visits in September 2001 and April 2003, and met with other government officials and community residents during public meetings held in September 2001 and November 2003 to gather more information about the site as well as to identify community health concerns. During the site visits, it was noted that the slag pile was capped in place and was surrounded by an 8-foot chain-link fence.

The completed and potential exposure pathways by which the community might have been exposed to the contaminants in the past from the FSP include soil/slag, stormwater (surface water) runoff, and air. There is no exposure through the groundwater, as all residents and businesses in the area receive public water drawn from the Delaware River at a surface intake believed to be unaffected by site-related contamination. The selected chemicals of health concern (aluminum, antimony, arsenic, beryllium, cadmium, copper, lead, manganese, nickel, vanadium, and zinc) either exceeded health-based comparison values or had no comparison values and, therefore, warranted further review.

A review of available information led ATSDR and PADOH to conclude that no adverse health effects are expected from current on-site exposures; therefore, current on-site exposures pose no apparent public health hazard. Remediation of the site, capping of the slag pile, and restriction of access to the site in 2000 have reduced or eliminated the risk of exposure and contamination with chemicals in soil/slag, air, and stormwater runoff. On the basis of historical and recent environmental samples, past exposures to lead, in contaminated on-site soil on the Franklin Slag Pile property likely occurred at levels of health concern and therefore, posed a public health hazard. On-site contamination is not expected to pose a public health hazard in the future unless future site use or site condition changes.

Past, current and future off-site exposures to lead, cadmium, and copper in contaminated soil and ambient air pose an indeterminate public health hazard to the off-site receptor population (e.g., workers at nearby industrial facilities, nearby residents, joggers, pedestrians, commuters, and other people visiting the area). The limited available data for off-site soil/slag is not sufficient for making determinations about the impact of past, current and future exposures in the residential areas because the off-site soil/slag samples were collected very close to the site fence line and far from the nearest residential area 1/4 mile away. In addition, the high lead levels in ambient air in the past may not be due to the FSP site alone. In the past, a lead smelting facility nearby was a major contributor of air emission for lead in the Port Richmond area of Philadelphia, and some of those lead particles could still be present in the environment. Because past off-site migration may have occurred to the surrounding community, the off-site receptor population may still be exposed to these contaminants. Therefore, we classify past, current and future off-site exposures as posing an indeterminate public health hazard and recommend additional sampling in nearby residential areas.

BACKGROUND AND STATEMENT OF ISSUES

Demographics and Site Description

The Franklin Slag Pile (FSP) site is located in the Port Richmond section of northeast Philadelphia, Pennsylvania, at 3110 Castor Avenue (Figures 1 and 2). It consists of a large pile of metal slag material situated on an approximately 4-acre lot at Delaware and Castor avenues. The current slag pile is approximately 68,000 cubic yards and is what remains of the by-product from copper smelting conducted at the adjacent facility, Franklin Smelter and Refining Corporation (FSRC).

MDC Industries began operating on site in the 1950s. Its operations included crushing, drying, and sizing smelter slag to be sold in 50-pound bags and by truckload for use as sandblasting grit and in asphalt roofing shingles [1]. Operations ceased and the site was abandoned on December 30, 1999 [2]. The adjacent FSRC facility ceased operations in September 1997.

The slag pile is located on a lot measuring approximately 300 feet by 550 feet surrounded by an 8-foot chain-link fence. The lot is bordered by a Conrail spur to the north; the lagoon area belonging to the Philadelphia Water Department (PWD) Northeast Water Treatment Plant to the north and east; and Delaware Avenue and Tioga Marine Terminal (TMT) to the southeast; Castor Avenue, portions of the former FSRC site, and the Philadelphia Gas Works (PGW) to the southwest; and by FSRC to the northwest. The Delaware River is less than 1/4 mile to the southeast (Figure 2).

The closest residential area is approximately 1/4 mile from the site, to both the north and the east (Figures 2 and 3). Census tract 186 (Figure 4), northeast of the site, is composed of about 2,100 homes with a population of about 4,800 (Census 2000). The residential units of Port Richmond are all served by the city's water supply, although some residents use bottled water. The Philadelphia Water Company supplies water to Port Richmond in Philadelphia County, utilizing three surface intakes to obtain its water. One of the surface intakes is on the Delaware River approximately 5-1/2 miles northeast and upgradient of the FSP site [3]. As shown on Figures 2 and 3, other companies located in the vicinity of the FSP are FSRC, PGW, TMT and PWD.

While MDC was still operational, material from the slag pile would migrate off the property in all directions, through surface water runoff and blowing wind. The particle size of the slag material varied, but winds as low as 5 mph were observed to pick up and carry particles offsite [1]. The gritty black material could be seen on sidewalks and roads, in storm drains, in the lagoon areas, and along two rail lines. EPA reports indicate no private wells in use, and there was no indication that drinking water was contaminated. Pedestrians, joggers, employees of surrounding industries, and local commuters were at high probability of being exposed to these materials. Storm drains along Castor and Delaware Avenue received the majority of off-property drainage and discharge directly into the Delaware River, less than 1/4 mile to the east (Figures 2 and 5). The TMT is located directly across Delaware Avenue to the east of the site where large volumes of traffic flow in and out of the terminal on a daily basis.

Remedial and Regulatory History

Prior to the EPA response action in 2000, the slag pile was not covered but was surrounded by a chain-link fence. Between 1987 and 2000, EPA and PADEP collected samples on-site as well as off-site to determine the levels of contaminants present and the migration of the contaminants to areas outside of the slag pile. EPA Region 3 Water Protection Division issued a Findings of Violations, and Order for Compliance was issued to MDC on September 13, 1999 [4]. According to the order, storm water runoff contained high levels of copper, lead, zinc, and total suspended solids in the storm water [1].

On January 4, 2000, EPA conducted a visual inspection from outside of the facility and noted that materials from the slag pile migrated beyond the site borders on all sides of the facility. In addition, 10-15 mph winds were observed carrying large black dust clouds of the materials off-site. Storm drains observed through the perimeter fence were full of slag material [5].

A removal sampling assessment conducted on January 5, 2000, confirmed lead levels of 5 parts per million (ppm) - 10,000 ppm. MDC indicated to EPA that they did not intend to take action to control or stabilize the threat posed by the lead in the slag pile. Slag was observed to overrun the steel fence between FSP and the PWD at several locations. This fence was also knocked down at many points. An area where the fence was down between FSP and the railroad tracks allowed slag to spill onto the tracks.

On January 10, 2000, an emergency response action was initiated at the site to begin stabilization efforts. The action included capping the slag pile in place with a high-density polyethylene (HDPE) liner; decontaminating and removing equipment stored in the slag pile; removing slag that had spilled from the site onto sidewalks, roads, and adjacent properties; removing visible slag from the lagoon adjacent to the northeastern side of the site; excavating slag and contaminated soil from the active and inactive railroads located southeast and northwest of the site; and cleaning slag from adjacent storm drains [1]. Slag material was excavated from the railroad track area including the active area to the railroad ties and from a lagoon located northeast of the site along Delaware Avenue to the inactive railroad track. Not all of the slag along the active railroad tracks was removed [6]. The subsequent response action on March 31, 2000 included off-site disposal of 78 tons of lead-contaminated hazardous waste from excavated soil and slag.

Surface water collected in the lagoon flows into the overflow boxes and discharges into the Delaware River [7]. Significant quantities of slag that were observed in the lagoon were removed from the interior of and the area surrounding the overflow boxes in the lagoon area. Slag was at a depth of 1 foot below ground surface around the overflow boxes. Not all of the slag from the lagoon was removed, and we do not know how much remains today. Moreover, we do not know if any remaining slag is accessible to anyone nor whether it continues to contaminate the river.

In early September 2000, the permanent 60-millimeter HDPE liner was installed on the slag pile, and a permanent fence was constructed along the perimeter of the pile (Figure 6) [7]. The emergency response action that was begun in January 2000 was completed in October 2000.

The Franklin Slag Pile was proposed for inclusion on EPA's National Priority List on September 13, 2001. EPA then began coordinating plans for a remedial investigation/feasibility study (RI/FS) with other agencies, including ATSDR, PADEP, and PADOH. The RI/FS is currently being undertaken.

Site Visits

On September 25, 2001, PADOH, ATSDR, and EPA officials conducted a site visit to become more familiar with the community and the site. Only three residents attended a public meeting held with government officials and community residents. The purpose of these meetings were to: identify the residents site-related community health concerns, discuss work to be performed by the regulatory agencies, including possible contamination sources, impacted neighborhoods, and remedial investigation feasibility study (RI/FS) sampling points, and update community members on the agencies site-related activities. During the tour of the site, it was noted that the slag pile was capped in place with a high-density liner and was surrounded by an 8-foot chain-link fence. The fence is posted with signs stating that the site contains hazardous substances including lead and cadmium. A residential area located between a 1/4 to 1/2 mile radius north of the site was identified.

On April 16, 2003, PADOH and ATSDR officials visited the site, and the nearby residential areas. It was noted that the condition of the site had not changed compared to the earlier site visit (Figure 6).

Environmental Contamination History

The following section discusses the sampling data collected by EPA, PADEP, or their respective contractors from February 1988 through June 2000. During the investigation, environmental media that were sampled on or near FSP included soil, slag/slag sediment, stormwater (surface water) runoff, and ambient air. The sampling data are divided into on-site and off-site data. The term on-site refers to sample locations within the FSP property and the term off-site refers to sample locations surrounding the Franklin Slag Pile Site.

On-Site Sampling Data

On-site sampling data evaluated in this PHA document include soil, slag, and stormwater (surface water) runoff. Although air monitoring samples were not taken on-site, we assume that FSP on-site workers were also exposed in the past to air contaminants from the slag pile through inhalation because of the contaminant levels found by air monitors placed just outside the Franklin Slag Pile site (Figure 2 and Figure 3).

Soil and Slag

EPA or PADEP sampled soil and/or slag environmental media on April 3, 1995; August 31, 1999; January 5, 2000; March 29, 2000; and April 5, 2000. Most of the samples were from the slag pile, although some samples were taken from the bagged "polygrit materials."

During the March 29, 2000, and April 5, 2000 sampling events, four (4) soil samples were collected at each corner of the perimeter access road: Castor and Delaware Avenues (southeast corner), PWD and Delaware Avenue (northeast corner), PWD and Conrail track (northwest corner), and Castor Avenue and the Conrail track (southwest corner). These samples were collected at the bottom of the excavation area at a depth of 3 feet. The fifth sample was a slag sample and was collected from the western side of the pile [8].

Table 1 shows the summary of on-site soil and slag sampling data for the chemicals of health concern, which includes antimony, arsenic, beryllium, cadmium, copper, lead, nickel, and zinc. The table includes chemical name, maximum concentration, and health comparison values.

Stormwater (Surface Water) Runoff

Storm water runoff refers to the surface water runoff from the slag pile during rain events. This water flows along two separate surface-water migration pathways: one is towards a lagoon located on the northeastern side of the slag pile, and the other is along storm sewers located on Castor and Delaware avenues. Water in the lagoon discharges into the PWD Northeast

Treatment Plant and the storm sewers discharge into the Delaware River [7]. The storm sewers follow Castor and Delaware Avenues and flow approximately 2,000 feet south to the Tioga Marine Terminal and finally to the Delaware River (Figures 2 and 5).

Storm water run-off samples were taken on July 14, 1994; July 18, 1994; October 5, 1995; February 12, 1999; and December 12, 1999. Table 2 summarizes the data for chemicals of health concern: antimony, arsenic, beryllium, cadmium, copper, lead, manganese, nickel, vanadium, and zinc.

Off-Site Sampling Data

The off-site sampling data evaluated in this PHA include soil/slag, and ambient air samples. Offsite stormwater (surface water) data were not available fore review.   Sampling data for each of these environmental media are discussed in detail in subsections below. In summary, the following points are of note:

- Although the soil/slag sampling locations were not from the immediate site area, they were not in residential areas. The off-site soil and slag samples were collected very close to the site fence line and far from the nearest residential area 1/4 mile away.

- The stormwater (surface water) run-off contaminants from the site that presumably discharged to the Delaware River and the water in the river and lagoons most probably diluted the contaminants. Therefore, although surface water sampling data is not available for analysis, the levels of contaminants off-site are expected to be much lower than the stormwater (surface water) run-off levels of the chemicals on-site.

- Additionally, perimeter air monitoring for lead was conducted from 1997-2000; monitoring for beryllium, copper, and lead was conducted on January 18, 2000.

Soil and Slag

EPA or PADEP sampled soil and/or slag environmental media on February 9, 1988; January 5, 2000; and June 27, 2000, to determine the extent of the migration of the contaminants from FSP. On February 9, 1988, PADEP collected two soil samples from the PWD property that borders the MDC Industries' site. One of the samples was a background sample. This was taken 408 to 415 feet from the manhole cover located on the northeast corner of Castor and Delaware avenues. The level of lead detected was less than 0.20 ppm. The other soil sample was taken about 184 feet from the manhole cover on the northeast corner of Castor and Delaware Avenues, and the level of lead detected was 12.3 ppm. Both samples were from a depth of 3-6 inches [9].

On January 5, 2000, an EPA contractor collected five slag sediment samples from five locations: (1) PWD, by the northwest corner of FSP; (2) PWD, central drainage swale; (3) Delaware Avenue, 20 ft. northeast of the MDC/PWD property line; (4) Delaware Avenue storm drain close to Castor Avenue; and (5) railroad tracks near FSRC railroad gate [8]. Off-site samples were collected to document off-site migration of contaminants from the FSP site. The maximum level of lead detected was 5,810 ppm.

On June 27, 2000, EPA collected 20 surface soil samples from an inactive railroad track that parallels Delaware Avenue to the southeast of the slag pile. The maximum level of lead detected in these samples was 5,170 ppm.

In July 2003, EPA took some additional samples for metals in 0-3"surface soil in offsite areas near the site boundary. Unfortunately, the lead results were reported as estimates and the samples were taken offsite, but on the fringes of what might be expected to be residential areas. The copper and cadmium results are discussed later in this document.

Table 3 shows a summary of off-site soil/slag sampling data from 1998 and 2000 for the selected chemicals of health concern. The chemicals of health concern include aluminum, arsenic, copper, lead, vanadium, and zinc.

Ambient Air Data

Historical air sampling data for lead was reviewed for the period 1997-2000. This sampling information was obtained from USEPA's Aerometric Information Retrieval System Data (AIRSData). The AIRSData report was reviewed to determine whether releases occurred from the FSP site during the period of October 1997 (after the closing of the nearby smelter facility, FSRC) through June 2000. All samples were collected over a 24-hour period. Air data from four air monitoring stations located near the site are summarized in Table 4. Review of the data report indicates that releases of lead occurred from the FSP site after the closing of FSRC site in 1997. The sampling locations included the three (3) monitoring stations located within several hundred feet of the slag pile on the PGW property (west of the site), the TMT Property (Castor and Delaware avenues) (south of the site), and the PWD property (NEWPCP Lagoon) (just east of the site). The fourth monitoring station located at Richmond Street and Wheatsheaf Lane was selected as background because it was the farthest from the slag pile (Figure 2).

Additional air samples taken on January 18, 2000, were collected from four sides of the slag pile (Figure 3) as part of the perimeter sampling conducted during the emergency response action [2, 10]. The air samples were collected prior to any intrusive or disruptive response activities. One background sample was collected on the FSRC north yard, northwest of the slag pile because winds were blowing predominantly from the north-northwest on the date of sampling. Three (3) downwind samples were collected: one on the PGW property at Delaware and Castor avenues southwest of the slag pile, one from the TMT property southeast of the slag pile, and one from PWD property northeast of the slag pile [10]. Table 5 summarizes the data showing the levels of beryllium, copper, and lead that were detected during this sampling event.

Quality Assurance and Quality Control

In preparing this PHA, ATSDR and PADOH reviewed and evaluated information provided in the referenced documents. Documents prepared for the CERCLA program must meet standards for quality assurance and control measures for chain-of-custody, laboratory procedures, and data reporting. The environmental data presented in this PHA are from the EPA and PADEP investigations. PADOH assumed that the quality of environmental data available in site-related documents for the Franklin Slag Pile Site is adequate for making public health decisions. The validity of the analysis and therefore the conclusions in this PHA are valid only if the referenced information is complete and reliable.

DISCUSSION

In this section, PADOH evaluates whether members of the community (on-site workers, workers at nearby industrial facilities, nearby residents, joggers, pedestrians, commuters, and other people visiting the area) have been, are, or could be exposed to harmful levels of contaminants in the environment. PADOH considers how individuals might come into contact with contaminated media, as well as the duration and frequency of exposure. There is little information available regarding workers at the Franklin Slag Pile site. We can only theorize about the possible impact of exposure to plant workers; hence, this document should not be construed as a complete assessment of workers in the past.

It is also important to note that the off-site samples were collected very close to the site fence line and far from the nearest residential area 1/4 mile away. The limited available data for off-site soil/slag is not sufficient for making determinations about the impact of past, current and future exposures in the residential areas. It is possible that the community residents, have been or could be exposed to the contaminants in the future as a result of past migration of on-site contaminants.

Pathways Analysis

To determine whether the community has been exposed to contaminants from the site, PADOH evaluates the environmental and human components that lead to human exposure. An exposure pathway consists of five elements: a source of contamination, transport through an environmental medium, a point of human exposure, a route of human exposure, and a receptor population.

PADOH identifies exposure pathways as completed, potential, or eliminated. For a chemical to pose a health risk, a completed exposure pathway must exist. In completed exposure pathways, the five elements may have existed or exist in the future, and so exposure has occurred, is occurring, or will occur. Potential exposure pathways are those where at least one of the five elements is missing, and exposure to a contaminant could have occurred in the past, or could occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present. PADOH assesses a site by evaluating the level of exposure in completed or potential exposure pathways.

Completed Exposure Pathways

On-Site Surface Soil/Slag

Slag from the past 49 years was deposited on the ground, and people working at or visiting the site (on-site) in the past were exposed to contaminants in surface soil and/or slag through incidental ingestion.

Ambient Air

In the past, on-site workers and trespassers were likely exposed to contaminants from the slag through inhalation. There are reports that workers complained of grit in their drinks or glasses, and when winds exceeded 5 miles per hour (mph), airborne releases from the MDC facility were noted. In addition, 10-15 mph winds were observed carrying large black dust clouds of the material off of the property to the northeast [11].

Potential Exposure Pathways

Off-Site Surface Soil/Slag

In the past, material from the slag pile also was observed to have migrated beyond the property borders on all sides of the facility (off-site), which could mean that the off-site receptor population (e.g., workers at nearby industrial facilities, nearby residents, joggers, pedestrians, commuters, and other people visiting the area) were likely to have been exposed to site-related contaminants. Large volumes of traffic flow in and out of TMT were observed to have occurred on a daily basis.

Depending on the wind velocity, the slag particles could have traveled and deposited on residential surface soil. Thus, without additional off-site sampling we cannot rule out the possibility that residents located about 1/4 mile from the site or other people visiting the area were exposed in the past. These contaminants could still be present in the nearest residential and other off-site areas if additional sampling indicates evidence of migration. Therefore, it is still possible that the off-site receptor population could still be exposed to lead and other site-related contaminants.

Ambient air

Even though the FSP site is currently not expected to contaminate the air because the slag pile is capped, the off-site receptor population might still be exposed to site-related contaminants through blowing wind because of past off-site migration of slag pile particles. However, this is not likely to be a significant or major route of exposure.

Storm Water (Surface Water) Runoff

During the emergency response action, slag was removed from the grates and from inside the storm sewers. The presence of slag inside the storm sewers indicates that slag containing beryllium, copper, and lead was released to the storm sewers. Discharges of storm sewers from the slag pile flows to the city of Philadelphia's separate municipal storm sewer system, which discharges directly to the Delaware River. Inspection conducted by PADEP indicated the slag pile was releasing lead and other contaminants to the Delaware River [6].

Trespassers (i.e., unauthorized persons) and others who might have accessed the site before 1986, when the initial phase of site remediation was completed, could have been exposed to on-site stormwater runoff via dermal contact. However, these possible exposures were most likely infrequent in occurrence and probably last for short periods of time. It is not known how many people might have trespassed at the site.

Residual levels of contaminants in surface water from FSP in the Delaware River could have resulted in dermal contact by recreational users. However, the potential for significant contaminant exposure through this pathway is low. In addition, there are high levels of uncertainties with respect to uptake of surface water contaminants by fish and other edible aquatic organisms. Also, exposures are likely to be infrequent in occurrence and for short periods as current recreational uses of the Delaware River are limited due to pollution. Moreover, exposures in the Delaware River from the FSP storm water (surface water) contaminants are likely to be reduced by dilution of storm water by the river. While this pathway might have existed in the past, it is most likely insignificant with respect to any possible public health effects.

Eliminated Exposure Pathways

On-site surface soil

Past remedial actions at the site, including fencing and installation of an impermeable cap, have eliminated the potential for present and future exposures to contaminants in on-site surface soils.

Ambient Air

The site has been remediated and is currently capped and fenced. Capping and other remedial measures that were completed at the site in 2000 have eliminated the potential for an on-site receptor population to be exposed to site-related contaminants in air currently and in the future.

Groundwater

The groundwater pathway is eliminated because the workers and residents have been and currently still are served by public water supply unaffected by the site. Furthermore, there are no known public or private wells used as sources for drinking water in the site area.

Completed and Potential Exposure Pathways

The following Pathway Table summarizes the completed and potential exposure pathways:

PATHWAY TABLE

Pathway Name	Exposure Pathway Elements					Pathway Status and Time Frame
	Source	Environmental Media	Point of Exposure	Route of Exposure	Exposed Population	
Slag/surface soil: On-site	Slag Pile	Soil/slag	Slag pile and soil surfaces on-site	Dermal contact, incidental ingestion	On-site workers, trespassers –>	**Completed** past
Off-site	Slag Pile	Soil/slag	Slag pile and soil surfaces off-site	Dermal contact, incidental ingestion	Employees of –> surrounding industries, pedestrians, joggers, local commuters, nearby residents	**Potential** past current future
Ambient air: On-site	Slag Pile	Air	Air	Inhalation	On-site workers, trespassers –>	**Completed** past
Off-site	Slag Pile	Air	Air	Inhalation	Employees of –> surrounding industries, pedestrians, joggers, local commuters, nearby residents	**Potential** past future
Storm water: On-site	Slag Pile after rain events	Water	Surface water runoff	Dermal contact	On-site workers, trespassers –>	**Completed** past
Off-site	Slag Pile after rain events	Water	Surface water runoff	Dermal contact	Trespassers in –> lagoons, recreational users of Delaware River, accumulation in fish that are caught and eaten by people	**Potential** past current future

Toxicological Evaluation of Past Exposures

The primary public health issues that need to be evaluated are the past on-site and off-site exposures to metals through air, stormwater (surface water) runoff, and soil/slag. As discussed previously, data available for off-site soil/slag is insufficient for making determinations about the impact of past, current and future exposures to nearby residents. The off-site sampling locations were not in residential areas but near the perimeter of the FSP site and therefore the potential health impact cannot be evaluated at this time. In addition, the samples collected were not 0-3" surface soil samples. Some additional samples were taken off-site in 0-3"surface soil by EPA in July 2003, but most of the metal results were not usable. Copper and cadmium results were usable and are discussed later in this document.

To determine which chemicals require further evaluation, ATSDR has developed chemical-specific, health-based comparison values (CVs) [12]. To evaluate the potential health hazards from chemicals of health concern associated with soil contaminants at the Franklin Slag Pile Site, the PADOH has assessed the risks for noncancer and cancer health effects. The health effects are related to contaminant concentration, exposure pathway, exposure frequency, and exposure duration. Additionally, PADOH uses minimal risk levels (MRLs) and researches the scientific literature. For additional information on the health effects evaluation process used by PADOH, please refer to Appendix C for a more detailed explanation of this process.

As discussed previously, inhalation and incidental ingestion of contaminated soil/slag are the most likely exposure pathways, although dermal contact of contaminated particles through stormwater (surface water) runoff and contaminated soil/slag can also contribute to total exposure. Food chain events by possible consumption of fish by people in the area could occur, but no data were available for this possible exposure pathway. Human exposures to these contaminants in the Delaware River are likely to be reduced by dilution of this storm water.

To be protective of public health, we specifically use the maximum concentrations in our evaluation. After evaluation of these maximum concentrations against health-based CVs, PADOH determined that the contaminants of health concern selected for further review at this site are aluminum, antimony, arsenic, beryllium, cadmium, copper, lead, manganese, nickel, vanadium, and zinc.

PADOH considered various exposure scenarios in this evaluation. We assumed a worst-case exposure period of 49 years for all possible exposed populations, except for children (who were estimated to be exposed for 6 years). The exposure scenarios we evaluated included: (1) past exposures of on-site workers and trespassers to on-site contaminated slag/soil, contaminated stormwater (surface water) runoff, or contaminated ambient air, (2) past exposures of off-site populations (e.g., workers at nearby industrial facilities, nearby residents, joggers, pedestrians, commuters, and other people visiting the area) to off-site contaminated ambient air or contaminated slag/soil; and (3) potential current exposures of off-site populations to off-site contaminated slag/soil.

We are not certain to what extent the off-site receptor population may have been exposed to contaminated soil/slag. Off-site soil sampling data from the nearest playground or residential areas are not available and site-related contaminants could still be present on the soil due to past off-site migration of slag pile particles. Soil may present a direct exposure pathway to persons working, playing, or conducting other recreational activities in these potentially contaminated areas. However, we were not able to calculate exposure doses for this scenario, because sufficient off-site soil sampling data are not available.

To evaluate potential health effects for the on-site scenarios, PADOH calculated estimated exposure doses to chemicals of health concern at this site using the following assumptions:

- PADOH conservatively assumed that all maximum levels detected at any depth might also have been found in surface soil and slag samples, where people might have come into contact with them. However, most of the samples were taken at unknown deeper depths or 3 feet deep. Thus, our estimated exposure doses could underestimate or overestimate the calculated exposure doses, if surface concentrations varied greatly from concentrations found at depth.
- PADOH also considered the worst-case scenarios for exposures of on-site workers through incidental ingestion and inhalation of soil for a total exposure duration of 49 years at the maximum levels of the contaminants detected. PADOH assumed that a particular 70 kg employee worked for 8 hours a day for 5 days a week in this occupational setting. Furthermore, PADOH assumed that the soil ingestion rate for workers is 50 mg/day.
- PADOH also conservatively assumed that the chemicals in the soil/slag are 100% absorbed by the individuals who contact the soil/slag.
- For ambient air exposure, we assumed that on-site and off-site workers worked 8-hour shifts, 5 days a week, 365 days a year.
- For exposure to on-site stormwater (surface water) run-off, PADOH discussed health effects that could result from dermal exposure. Although the contaminants found in FSP stormwater (surface water) runoff did not affect any drinking water source, the exposure doses were estimated using the conservative assumption that dermal dose is equal to oral dose. ATSDR generally considers dermal exposure to be a minor contributing factor to the overall exposure dose relative to the contributions of ingestion and inhalation exposures. In particular, for metals, dermal absorption is generally insignificant.

- PADOH did not evaluate exposure doses for children for the onsite scenario. PADOH assumed that because this was an occupational setting, children could have been on the site only on a visit or temporary basis.

Past Exposures to On-Site Contaminants

Chemicals in On-site Storm water (surface water) runoff

Exposure to aluminum in storm water (surface water) runoff is not expected to result in adverse health effects because the maximum sample result was lower than the ATSDR CVs. Antimony, arsenic, beryllium, cadmium, copper, lead, manganese, nickel, vanadium, and zinc in storm water (surface water) runoff on-site maximum results were higher than the ATSDR CVs. After evaluation, it was determined that exposures to antimony, arsenic, beryllium, manganese, vanadium, and zinc in storm water (surface water) runoff are not expected to result in adverse health effects because exposure dose estimates were lower than the ATSDR health levels. Exposures to cadmium, copper, nickel, and lead were selected for further evaluation because the maximum concentrations of each of these chemicals were higher than health effect levels or there was no ATSDR CV listed (lead) for surface water and soil.

Chemicals in On-site Soil/Slag

Antimony, arsenic, beryllium, cadmium, copper, lead, manganese, nickel, vanadium, and zinc in soil/slag on-site maximum results were higher than the ATSDR Soil CVs. After evaluation, it was determined that exposures to antimony, arsenic, beryllium, manganese, vanadium, and zinc in soil/slag (surface water) runoff are not expected to result in adverse health effects because exposure dose estimates were lower than the ATSDR health levels. Therefore, these contaminants will not be discussed further. Exposures to cadmium, copper, and nickel were selected for further evaluation because the detected maximum concentrations of each of these chemicals were higher than ATSDR Soil CVs. There are no ATSDR CVs for lead exposures in soil and thus, lead was also selected for further evaluation.

On-site soil/slag exposure

Lead. The on-site workers and trespassers might have been exposed to lead in the slag/soil at the maximum concentration of 27,500 ppm (Table 1). This lead level is above the 400 mg/kg screening level for residential areas and also above the non-residential direct contact level of 1,000 mg/kg used by EPA and PADEP's Act 2 standards.

ATSDR and EPA have not set values for chronic oral MRLs, and there are no chronic oral exposure studies in humans. On the basis of the available intermediate exposure and lowest observed adverse effect levels (LOAELs – see Appendix D) of 0.01 and 0.02 mg/kg/day in human studies [13], respectively, the calculated margin of safety suggests that noncarcinogenic harmful effects (e.g., hematological or blood-related effects and, in particular, profound effects on heme biosynthesis) might occur to the on-site workers exposed to lead-contaminated soil. Therefore, it is possible that adverse health effects would have occurred in on-site workers and trespassers exposed to lead from the contaminated soil and slag.

As discussed previously, PADOH assumed that children could have been on the site only on a visit or temporary basis. Based on this unlikely intermittent exposure, the contaminants on-site do not pose a health concern for children.

Copper. The on-site workers and trespassers might have been exposed to copper in the soil/slag at the maximum concentration of 46,400 ppm (Table 1). Based on the assumptions previously discussed and based on human and animal studies for intermediate oral exposure, the estimated oral exposure dose is about one order of magnitude or less lower that the level at which no observed adverse effect levels (NOAELs – see Appendix D) [14]. Therefore, it is possible that non-carcinogenic health effects would have occurred to on-site workers and trespassers exposed to copper from the soil/slag. The copper levels onsite could be close to levels that might have caused abdominal pains and vomiting from chronic exposure in workers.

Under these conditions, adverse health effects could not be ruled out for on-site workers and trespassers regularly exposed to copper from the contaminated soil/slag. It is possible that hypersensitive individuals might have exhibited allergic reactions after being chronically exposed to the soil/slag.

Cadmium. The on-site workers and trespassers might have been exposed to cadmium in the soil/slag at the maximum concentration of 250 ppm (Table 1). Based on the assumptions previously discussed and based on human studies for chronic oral exposure, the estimated oral exposure dose is about 10 times lower than the level at which no observed adverse effect level (NOAEL – See Appendix D) was observed in humans [15]. This NOAEL is based on studies where effects on the kidneys were found. Since the margin of safety is small, it is possible that noncarcinogenic health effects could have occurred to on-site workers regularly exposed to cadmium from the soil/slag.

Nickel. The on-site workers and trespassers might have been exposed to nickel in the soil/slag at the maximum concentration of 1,300 ppm (Table 1). ATSDR has developed an oral MRL of 0.02 mg/kg/day for noncancerous health effects of nickel [12]. This MRL is based on decreased body and organ weights in animals. The assumptions previously discussed and available animal studies for chronic oral exposure show that the estimated oral exposure dose is about 30 times lower than the ATSDR intermediate oral MRL. This oral exposure dose level suggests that it is possible that noncarcinogenic health effects would have occurred to on-site workers and trespassers exposed to nickel from the contaminated soil. Contact dermatitis in persons is one of the most common effects of exposure to nickel compounds. Immunological studies indicate that the dermatitis is an allergic response to nickel, and significant effects on the immune system have also been noted in some workers exposed to nickel [16]. Therefore, people who are hypersensitive might have developed allergic reactions after being regularly exposed to the nickel-contaminated soil/slag in the past.

No studies were located regarding cancer in animals or humans after oral exposure to nickel-contaminated soil [16].

Potential On-Site Stormwater (Surface Water) Run-Off Exposure

Lead. The on-site workers and trespassers might have been exposed to lead in the stormwater (surface water) runoff at the maximum concentration of 7,000 ppb (Table 2) primarily through dermal contact. On the basis of the extremely conservative assumptions previously discussed in which oral absorption equals dermal absorption, and on the basis of animal studies for chronic noncarcinogenic and carcinogenic health effects, the estimated dermal exposure dose is 24 times less than the noncarcinogenic no observed adverse effect level (NOAEL) and about 1,000 times less than the carcinogenic less serious LOAEL [13]. Since oral exposure doses were used for this dermal exposure assessment and the exposure assessment is extremely conservative, it is unlikely that noncarcinogenic and carcinogenic health effects would have occurred to on-site workers exposed to lead from the stormwater (surface water) runoff through skin contact.

Copper. The on-site workers and trespassers might have been exposed to copper in the stormwater (surface water) runoff at the maximum concentration of 22,000 ppb (Table 2). Based on the assumptions previously discussed and based on human studies for chronic oral exposure, the estimated dermal exposure dose is greater than the lowest level at which observed adverse health effects were observed in humans [14]. Therefore, it is possible that noncarcinogenic health effects might have occurred to on-site workers and trespassers regularly exposed to copper from the surface water run-off in the past. Skin contact with copper-contaminated water may also result in an allergic reaction in some people.

Cadmium. The on-site workers and trespassers might have been exposed to cadmium in the stormwater (surface water) runoff at the maximum concentration of 300 ppm (Table 2). Based on the assumptions previously discussed and based on human studies for chronic oral exposure, the estimated dermal exposure dose is at least two times lower than the level at which no observed adverse health effects were observed in humans [15]. Therefore, it is possible that noncarcinogenic health effects would have occurred to on-site workers and trespassers exposed to cadmium from the surface water run-off.

Additional research is needed to definitely support that eating or drinking cadmium does or does not cause cancer [19]. Unless exposure is over a long duration, at very high concentrations or the skin is damaged, skin contact with cadmium is not known to affect the health of people or animals because virtually no cadmium can enter the body through the skin under normal circumstances [15].

Nickel. The on-site workers and trespassers might have been exposed to nickel in the stormwater (surface water) runoff at the maximum concentration of 711 ppb (Table 2). Nickel applied directly to the skin can be absorbed into the skin where it might remain rather than entering the bloodstream. On the basis of the assumptions previously discussed and on the basis of animal studies for noncarcinogenic effects, the estimated dermal exposure dose (even if it is 100% absorbed) is about eight times lower than the chronic oral RfD. Since oral exposure doses were used for this dermal exposure assessment and the exposure assessment is extremely conservative, it is unlikely that noncarcinogenic health effects would have occurred through skin contact to on-site workers and trespassers exposed to nickel from the stormwater (surface water) runoff. As discussed previously, however, people who are hypersensitive to nickel might have developed allergic reactions after being regularly exposed to nickel-contaminated water from the site in the past.

Past Exposures to Off-Site Contaminants

Soil/Slag

Exposures to off-site receptor populations (e.g., workers at nearby industrial facilities, nearby residents, joggers, pedestrians, commuters, and other people visiting the area) to aluminum, arsenic, beryllium, vanadium, and zinc in soil/slag are not expected to result in adverse health effects. Aluminum, arsenic, beryllium, vanadium, and zinc in soil/slag off-site maximum results were higher than the ATSDR soil CVs, but upon evaluation exposure dose estimates were lower than the ATSDR health levels. Therefore, these contaminants will not be discussed further.

Exposure to lead was selected for further evaluation primarily because soil lead level exceeded EPA and PADEP's Act 2 nonresidential screening levels. As discussed previously, high levels of lead could possibly result in harmful effects to the receptor populations. Exposures to cadmium and copper were also selected for further evaluation because the detected maximum concentrations of each of these chemicals were higher than ATSDR soil CVs. Moreover, hypersensitive individuals are known to exhibit allergic reactions when exposed to copper.

However, because the off-site environmental samples were taken only near the perimeter of the site, and we do not have soil sampling data from the nearest playground or residential areas, we are not certain to what extent the nearby residents might have been exposed to contaminated off-site soil/slag in the past. Site-related contaminants could be present for a long time in the soil due to off-site migration of slag pile particles. Therefore, PADOH has determined that past off-site exposures to lead, cadmium or copper in soil/slag poses an indeterminate health hazard.

Additional sampling in residential areas and the nearby playground would provide us with further information to determine the extent that nearby residents might be exposed to off-site soil/slag contaminated with lead, cadmium and copper. In July 2003, an additional "screening" set of samples was taken off-site by EPA, though some of the data are not useable. In particular, the lead results were not usable. Copper and cadmium results seem to be valid and the maximum amounts of cadmium and copper detected were below ATSDR soil CVs for a child's exposure [20]. PADOH determined that there would not be any likely adverse health effects to children or adults after exposures to these maximum concentrations of cadmium and copper [14,15].

Ambient Air

The only data available for ambient air samples from four sides of the slag pile were for lead, copper, and beryllium (Table 5). Ambient air lead levels may have contributed to blood lead levels in children living near the site. Ambient beryllium levels exceeded the ATSDR Air CV, and ATSDR has not established CVs for copper in air. Thus, these chemicals were also selected for further evaluation of past exposures to off-site contaminants.

Lead. The off-site receptor population might have been exposed to lead through inhalation when the site was not capped. On the basis of the quarterly averages of lead levels taken from four air monitors located around the site during 1997-1999, Table 4 shows that there were 8 quarters from all four stations wherein the quarterly lead levels exceeded the 1.5 ug/m^3 standard value set by the National Ambient Air Quality Standards (NAAQS) with the maximum lead air level of 7 ug/m^3. The NAAQS standard, established in 1978, is often used as a trigger level for corrective action to reduce emissions [17]. The NAAQS for air lead level sets limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly.

As shown in Figure 7, most of these high lead levels occurred during 1997. The nearby Franklin Smelting & Refinery Corporation ceased its operations in September of that year. After 1997, the quarterly averages dropped well below the 1.5 ug/m^3 standard except on two occasions: in 1998 Quarter 2 and in 1999 Quarter 1 (both of these readings occurred at the Castor and Delaware Avenues air monitoring station). Of the four monitoring stations, the only quarterly level that was taken in 2000 was at the Castor and Delaware avenues station during the second quarter, which was a very low level of 0.10 ug/m^3.

Prior to 1997, it seems likely that high ambient air lead levels in the area were largely due to the nearby FSRC or even the further away Anzon smelting operations, but the Franklin Slag Pile Site might have also contributed. Regardless of the source, some of the ambient air lead levels measured near the site in the past exceeded standards protective of public health.

Copper. The off-site receptor population might have been exposed to copper in the ambient air at the maximum concentration of 0.914 ug/m^3 as shown in Table 5. There are no human studies for chronic, intermediate, or acute inhalation exposures to copper. On the basis of animal studies for intermediate inhalation exposure, however, the copper air level is about 600 times less than the NOAEL in animals [14]. Therefore, it is unlikely that noncarcinogenic health effects would have occurred in this potentially exposed population.

Beryllium. The off-site receptor population might have been exposed to ambient air beryllium levels at the maximum concentration of 0.0032 ug/m^3 (Table 5). This level is about 6 times lower than the EPA's RfC, which was derived from the LOAEL with an uncertainty factor to account for the sensitive nature of the subclinical endpoint [21]. Therefore, PADOH concludes that exposure to ambient air beryllium at this level most likely did not pose a health threat to the population. However, some people can become sensitive to beryllium and develop an immune or inflammatory reaction to small amounts that do not cause effects in people who are not sensitive to beryllium.

Based on the limited evidence of carcinogenicity in humans exposed to airborne beryllium and sufficient evidence of carcinogenicity in animals, beryllium is classified as a probable human carcinogen [22]. However, we do not expect carcinogenic health effects from exposure to this maximum concentration of ambient air beryllium.

Current Situation

No additional environmental samples have been tested since the slag pile was covered with the permanent 60-millimeter HDPE liner and a permanent fence was constructed along the perimeter of the pile in early September 2000; hence, there are no environmental data for toxicological evaluation of current exposures. However, it is most likely that there is no on-site completed pathway at this time because the cap has contained the slag pile on-site, and the perimeter fence restricts access to the site.

However, the off-site receptor population could still be exposed to the off-site contaminated soil that might have resulted from past off-site migration of slag particles. It is possible that site-related contaminants are still present in the environment at this time.

Health Outcome Data Evaluation

Currently, there is no way to definitively determine if or how much the FSP site contributed to elevated blood lead levels (BBLs) in children in this area of Philadelphia. There are multiple sources of lead in this community, such as paint from older homes and so forth. Any off-site contamination from the FSP site could be additive to the other sources of lead.

As part of the Philadelphia Childhood Lead Poisoning Prevention Program, blood lead data for children living in census tracts surrounding the site is available for over the 10-year period from 1992 to the present. This data is readily available and includes other relevant information such as date of birth, testing date, race, street address, census tract, and zip code, in addition to the BLLs. This program specifically targets a high-risk population, i.e., children from lower-income families living in houses that were built before 1978 (when lead-based paint was banned for residential use). Therefore, the blood lead data from this program contains information on a biased population. After January 1, 2002, all BLLS are reported to the Philadelphia Childhood Lead Poisoning Prevention Program, whereas before only the elevated cases were reported. Table 6 shows the BLLS for 5 census tracts around this site for 2002 and 2003. In 2002, 11 percent of the BLLs were greater or equal to 10 micrograms lead per deciliter of blood (ug/dl) and in 2003, 17 percent were greater or equal to 10 ug/dl [23]. The total number of children tested was 116 children and 120 children, respectively.

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: (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; (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. Children can sustain permanent damage if these factors lead to toxic exposure during critical growth stages. ATSDR is committed to evaluating children's health concerns at sites such as the FSP site.

After reviewing available information, PADOH determined that past, current and future off-site exposures pose an indeterminate public health hazard for children. Even though the site was remediated in the past and the slag pile covered and contained in 2000, it is still possible for children to be exposed to lead and other site-related contaminants as a result of past off-site migration of slag pile particles.

As discussed previously, the off-site soil/slag samples were taken only near the perimeter of the site, and there are no current or past soil sampling data from the nearest residential areas. Furthermore, the ambient air lead levels may not be due to the FSP site alone. The nearby smelters could have contributed to the blood lead levels among children in the census tracts surrounding the site through historical deposition onto soils in the area. Therefore, off-site areas need to be characterized further.

The city of Philadelphia offers free blood lead testing to children living in Philadelphia, and its efforts have continued and focused on increased childhood lead screening, awareness of lead poisoning, its adverse health effects, and how to reduce exposures, especially for children. PADOH will work with the city in the continued implementation of its childhood lead poisoning prevention program as it relates to the FSP Site.

COMMUNITY HEALTH CONCERNS

The first public meeting PADOH attended was the public meeting organized by EPA on September 25, 2001 at the Samuel Recreation Center located at 3539 Gaul St. in Philadelphia. The purpose of this meeting was to discuss the proposal to add the Franklin Slag Pile (MDC) site to the National Priorities List. Only three (3) residents attended the meeting, and their health questions were nonspecific and related to whether exposure to FSP site-related chemicals could make them sick.

PADOH and ATSDR also hosted a public availability meeting on November 2003, again at the Samuel Recreation Center. The purpose of this meeting was to discuss the Public Comment version of the Franklin Slag Pile PHA. One resident attended the meeting, as well as a representative from the City of Philadelphia's Childhood Lead Poisoning Prevention Program. The resident who attended the meeting represented a local city councilperson as well as the local civic association. She mentioned concerns about black, tissue-paper like debris floating in neighborhood swimming pools on three occasions in 2002. She said community members and workers at the nearby terminal and incinerator all complained about this debris. She noted that she had observed the cover over the pile appearing ripped and blowing at times in the past. PADOH and ATSDR referred these concerns to EPA, who verified that the cover was intact and inspected during periodic site visits by the agency. EPA did not feel it was possible that the debris observed in 2002 originated at the site.

During the public comment period for this PHA, ATSDR and PADOH contacted EPA, PADEP, and local government officials to collect any community health concerns related to this site. No concerns were brought to our attention in this manner. However, a researcher from the EPA-funded Technical Outreach Services for Communities at the University of Maryland inquired about community interest in this site. In 2004, a researcher from Ceisler Jubiler, working with the Clean Air Council, was also interested in including this site in a project for the Clean Air Council. On Friday, April 23, 2004, two staff from EPA and two journalism students from Temple University toured the slag pile site for another research project. Lastly, a newspaper article printed in the Philadelphia Daily News in February 2004 quoted a community leader being concerned about the many children in the neighborhood near the site, and that more than a tarp was needed to resolve the contamination at the site.

CONCLUSIONS

On the basis of a thorough evaluation of currently available environmental information and existing activities, ATSDR and PADOH conclude the following:

1. Past on-site exposures posed a public health threat to workers.

2. Current on-site exposures do not pose a public health hazard. At this time, the slag pile is covered with a high-density polymer and the contaminants are contained on the site. The site is also securely fenced at present.

3. Unless site use or site condition changes in the future, on-site contamination is not expected to pose a public health hazard in the future.

4. It is not clear whether residents living near the FSP site have been exposed to lead released from the site. Past, current and future off-site exposures pose an indeterminate public health threat to children and adults. The limited data available for off-site soil is not sufficient for making determinations about the impact of past, current and future off-site exposures. We do not have usable soil sampling data from the nearest residential area, especially for lead. Exposure to the site-related contaminants from past off-site migration might still be present in the environment. Therefore, additional surface soil sampling may further define the extent of any possible off-site deposition from the site.

RECOMMENDATIONS

1. To determine the extent of off-site deposition, PADOH recommends testing 0-3" surface soil samples for lead from other off-site areas, particularly the nearest residential areas. An additional set of off-site soil samples (lead and other metals) was taken in July 2003. The sample results for lead were reported as estimates during this analysis. Therefore, PADOH recommends additional surface soil sampling. Two conclusions can be made using the July 2003 data even though the concentrations are estimates. These include: 1)

Lead is present in the soil tested and 2) Lead is most likely above EPA screening levels for residential areas for most of the sampled areas.

2. Given the uncertainty regarding offsite exposure from this site and the known existence of other sources of lead contamination in the area (e.g., pre-1978 housing and former smelter operations), PADOH recommends that PADOH and the city of Philadelphia conduct health education activities for both the people in the community and area health care providers. These activities should focus on awareness of lead poisoning and its adverse health effects, how to reduce exposures, and encouraging blood lead testing for children under 6 years of age.

PUBLIC HEALTH ACTION PLAN

The public health action plan (PHAP) contains a description of actions to be taken (or that have been taken) by PADOH and/or other government agencies at and in the vicinity of the site after or before 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 provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment from PADOH to follow up on this plan to ensure that it is implemented.

Completed Actions

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

2. The City of Philadelphia's Childhood Lead Poisoning Prevention Program provides free blood lead screening for children living in the residential neighborhoods surrounding FSP site, and catalogs this information in a citywide database. At the request of PADOH, staff from the City has already analyzed this database for test results from children who lived in the area near the site from 1992 through present.

3. A Public Availability meeting was held on November 19, 2003 in the Port Richmond area of Philadelphia in order to provide the community an opportunity to review and provide comment on the Public Comment version of the Franklin Slag Pile PHA.

4. PADOH recommends that the city of Philadelphia continue monitoring the blood lead levels for children in the nearest residential areas to the FSP site.

Ongoing or Planned Actions

1. A remedial investigation feasibility study (RIFS) is being conducted by EPA. PADOH will continue to evaluate any further data that become available regarding human exposure or contaminants at the site, including identifying additional exposure pathways and evaluating risk reduction and remediation plans. If new data reveal that site conditions are different than previously thought or have changed over time, a re-evaluation of-the conclusions and recommendations stated in this report may be necessary. PADOH, ATSDR, PADEP, and EPA will work together to educate citizens about the meaning of the sample results.

2. PADOH will continue to inform area citizens and health professionals of the public health issues associated with the site. This action will allow the community members to provide input in the public health assessment process and the PADOH team to respond to community health concerns. Moreover, PADOH will update the community on our activities.

3. PADOH will continue to solicit the health concerns of citizens living in the site area through a number of approaches that may include alternatives such as public availability sessions, fact sheets, responses to individual inquiries, and mailings. PADOH may also provide information to EPA's information repository for this site.

4. PADOH will collaborate with the City of Philadelphia Department of Health and its Childhood Lead Poisoning Prevention Program to increase lead poisoning awareness, prevent adverse health effects, and promote routine lead screening among children living near the site.

5. PADOH recommends that the city of Philadelphia continue monitoring the blood lead levels for children in the nearest residential areas to the FSP site.

6. PADOH will release the final version of this document.

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Certification

This Public Health Assessment for the Franklin Slag Pile 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 were initiated.

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Technical Project Officer, CAT, SPAB, DHAC

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

for

Roberta Erlwein

Lead, Cooperative Agreement Team, CAT, SPAB, DHAC, ATSDR

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APPENDICES

APPENDICES

APPENDIX A. FIGURES

Figure 1. Map of the Commonwealth of Pennsylvania Showing the Site Location of Franklin Slag Pile (MDC)
310 Castor Avenue, Philadelphia, PA 19134
(Philadelphia County)

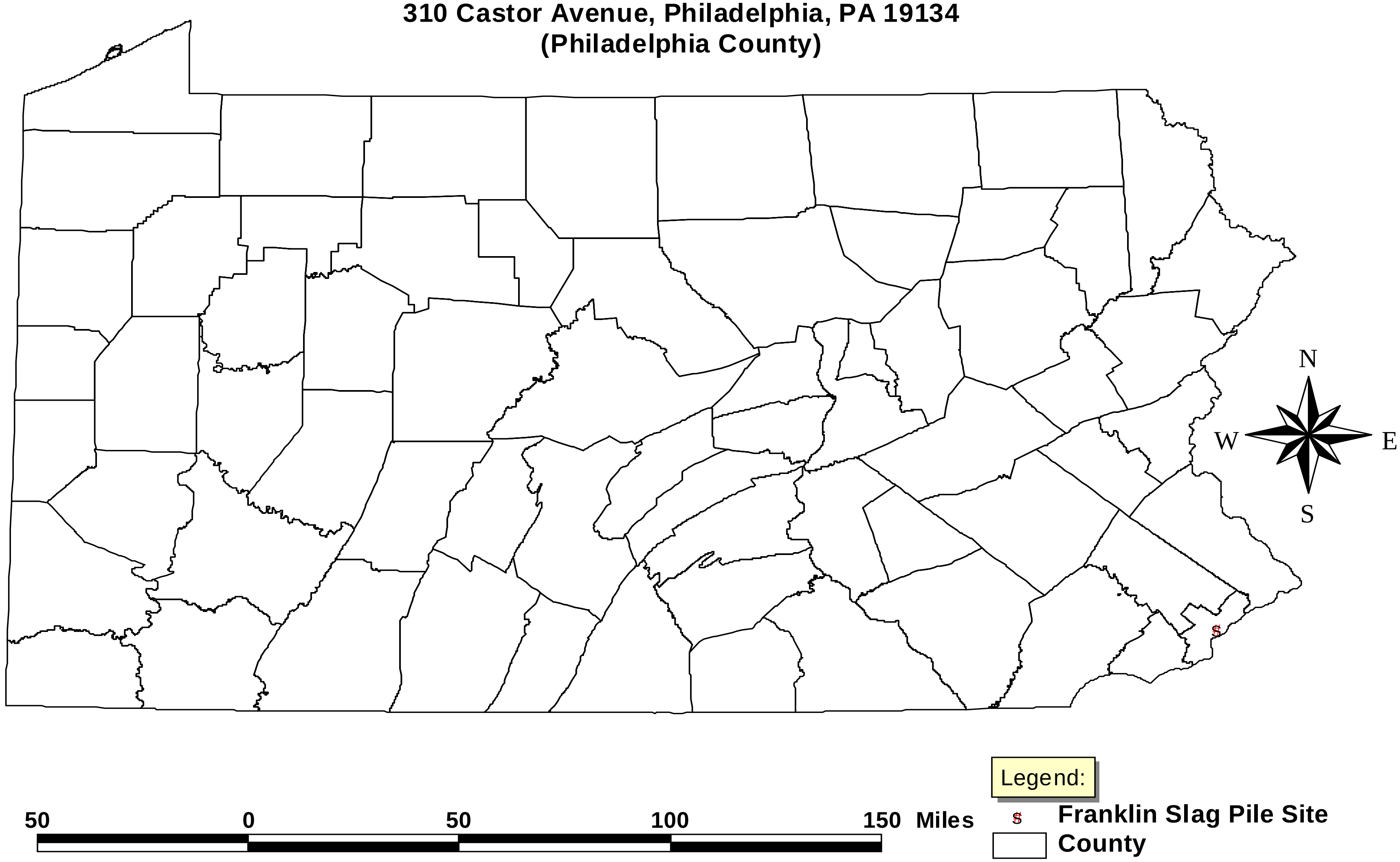


Figure 2

Air Monitoring Locations
Franklin Slag Pile Site, Philadelphia, PA

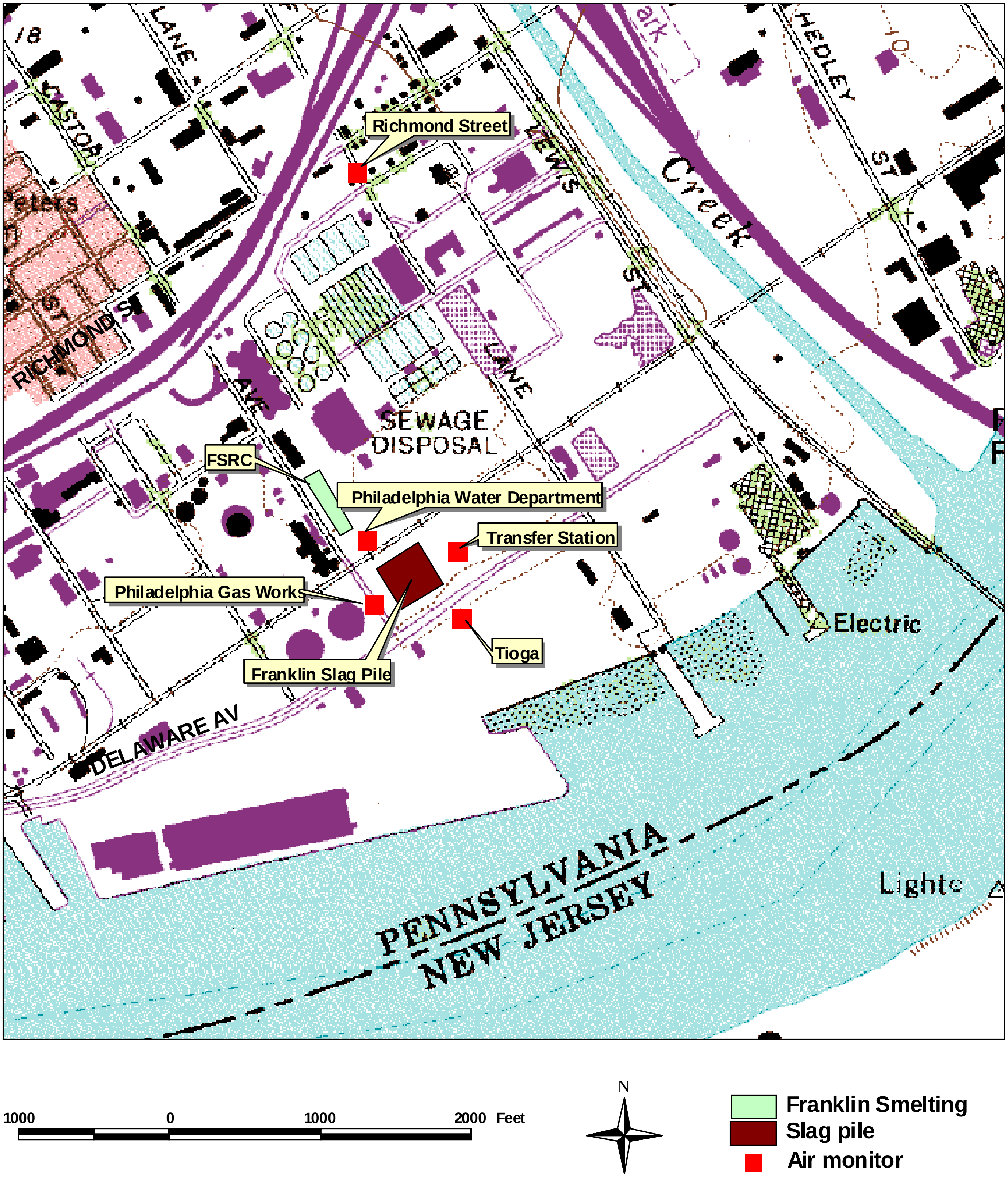


Figure 3

Air Monitoring Locations - January 18, 2000 Air Samples Data
Franklin Slag Pile Site, Philadelphia, PA

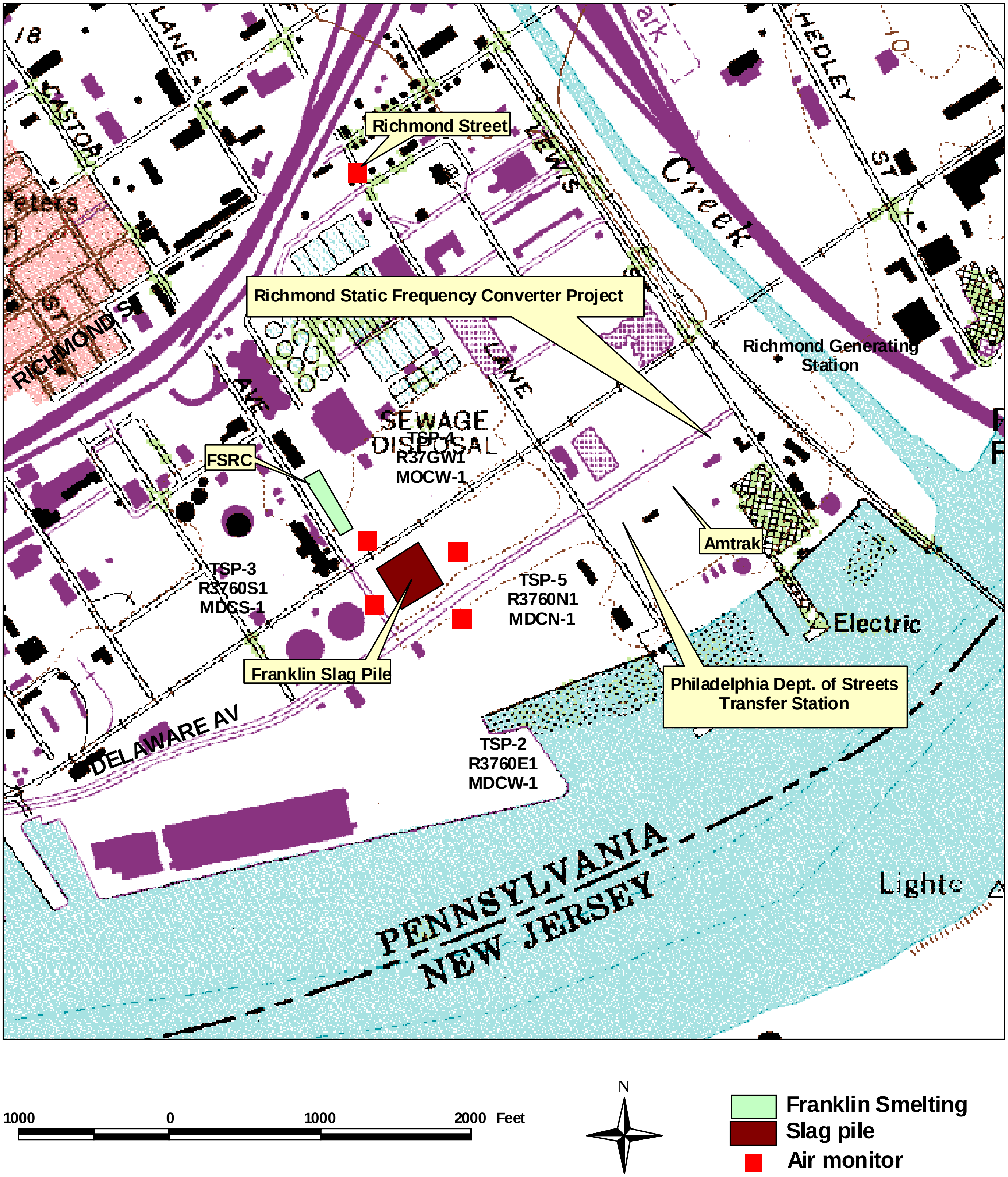


Figure 4. Map Showing the Census Tracts Surrounding the Franklin Slag Pile Site

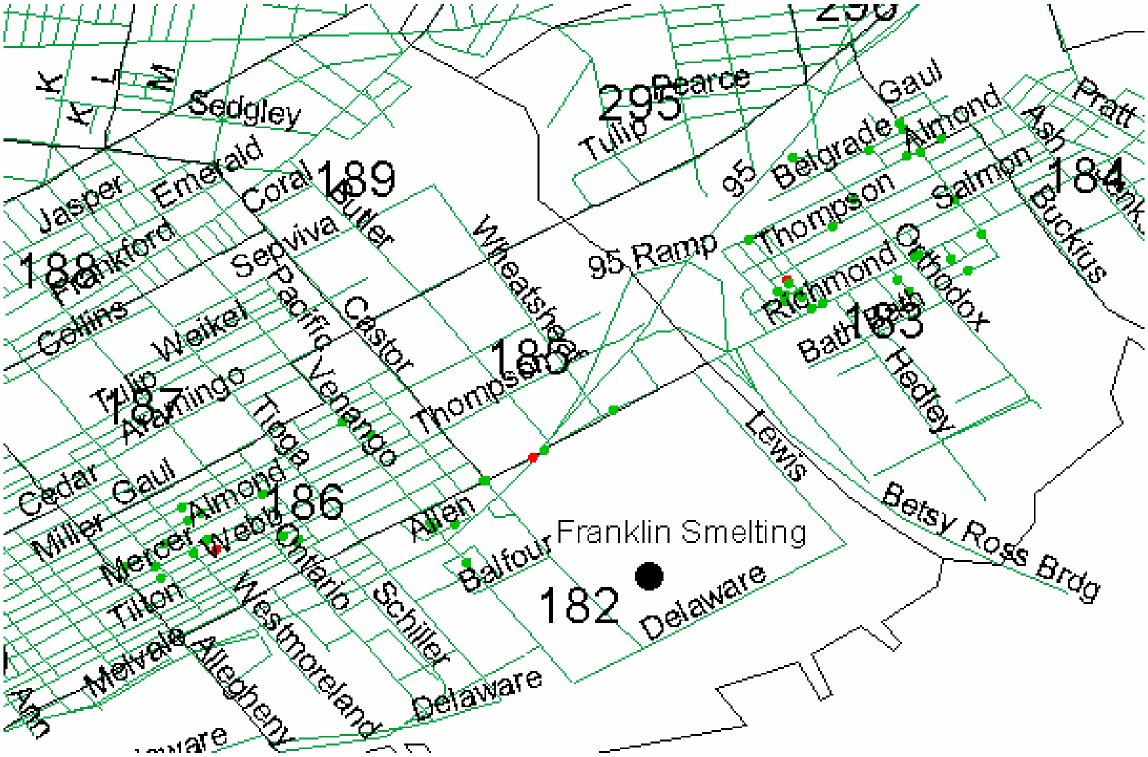


Figure 5. Site Map Showing the Locations of Storm Drains

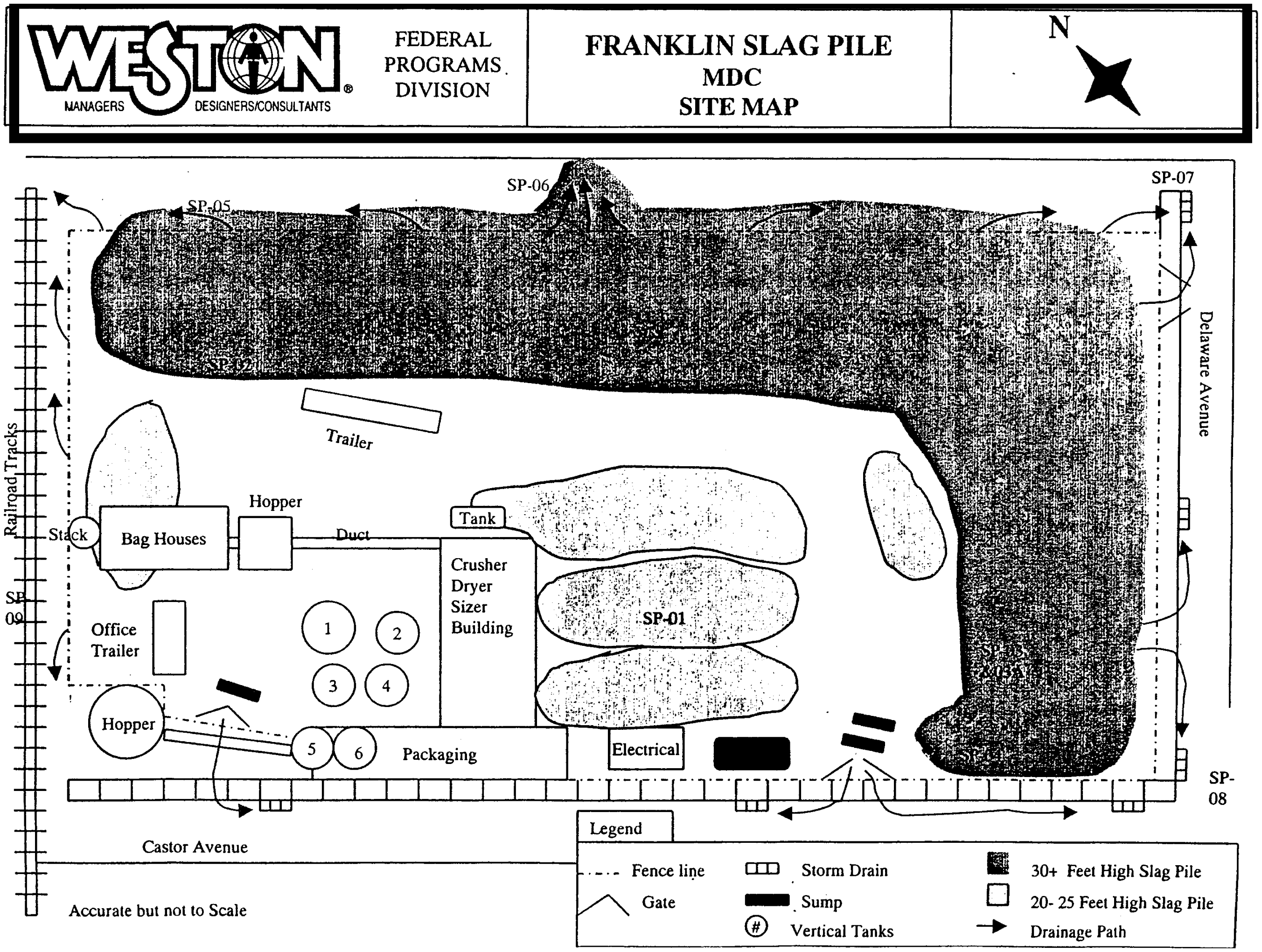
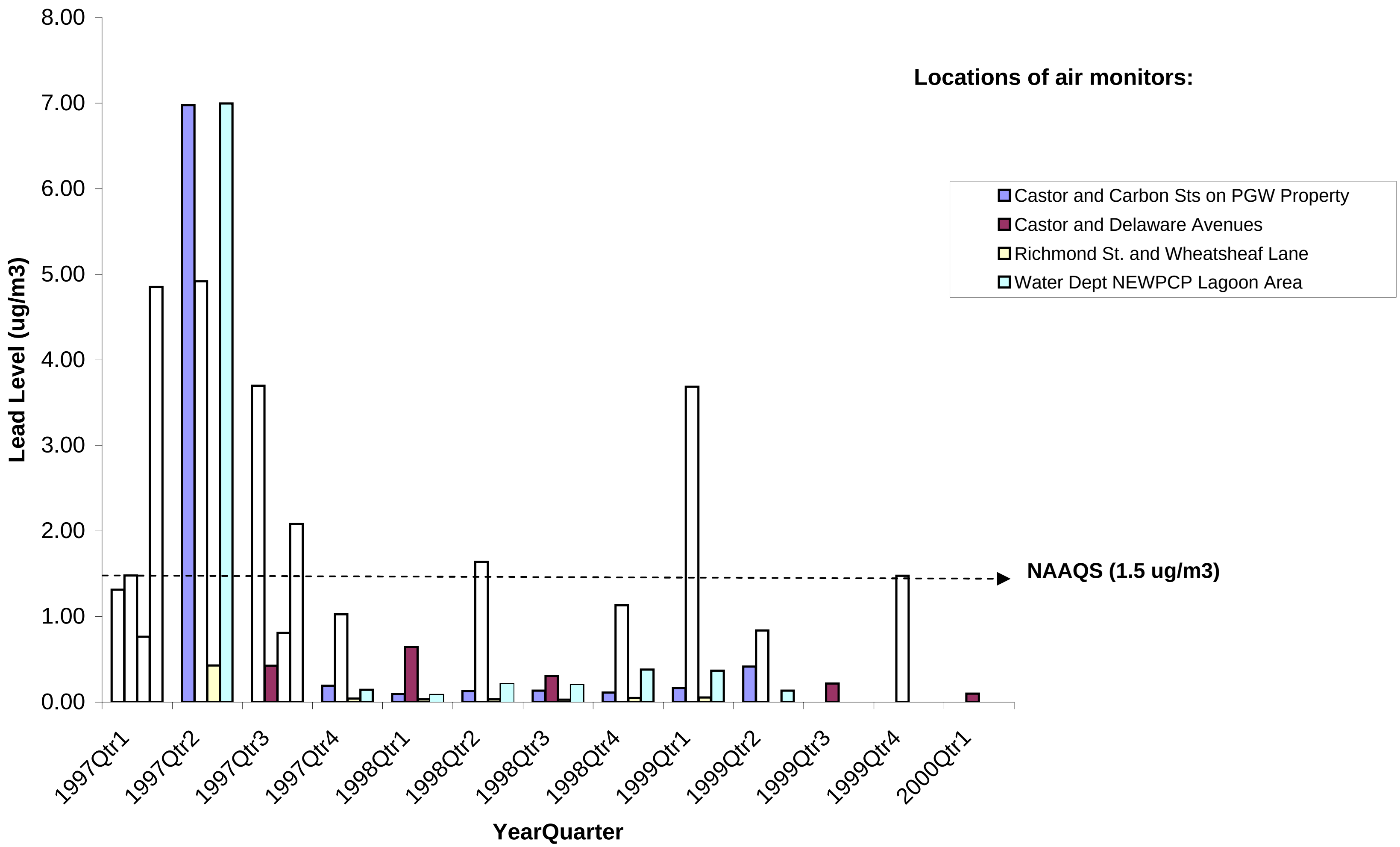


Figure 6. Slag pile covered with permanent 60-millimeter liner

**Figure 7. Graph showing the quarterly averages of lead level from four monitoring locations in relation to the National Ambient Air Quality Standard of 1.5 ug/m3
Franklin Slag Pile Site, Philadelphia, PA
1997-2000**



APPENDIX B. TABLES

Table 1. Summary of on-site soil/slag sampling data for selected chemicals of health concern, Franklin Slag Pile Site, Philadelphia, PA 1995-2000

Contaminant	Sampling Event	Depth	Type of samples	Number of samples	Maximum Concentration (ppm)	Flag	Comparison Value	
							Value (ppm)	Source
Antimony	March 29, 2000	3 feet	Soil	5	572		20	RMEG Child
Arsenic	August 31, 1999	unknown	Slag	5	4.6		0.5	CREG
	January 5, 2000	unknown	Slag	5	40.4			
	April 3, 1995	unknown	Slag	5	45.2			
	March 29, 2000	3 feet	Soil	5	141			
Beryllium	April 5, 2000	unknown	Slag	5	110		100	Chronic EMEG Child
Cadmium	April 3, 1995	unknown	Slag	5	11.1		10	Chronic EMEG Child
	August 31, 1999	unknown	Slag	5	23.9			
	April 5, 2000	unknown	Slag	5	30.6			
	January 5, 2000	unknown	Slag	5	250	L		
Copper	March 29, 2000	unknown	Slag	5	13,300		60	Intermediate EMEG Pica Child
	January 5, 2000	unknown	Slag	5	46,400	J		
Lead	March 29, 2000	3 feet	Soil	5	6,660		n/a	n/a
	August 31, 1999	unknown	Slag	5	8,150			
	January 5, 2000	unknown	Slag	5	22,100	J		
	April 3, 1995	unknown	Slag	5	27,500			
Nickel	March 29, 2000	3 feet	Soil	5	1,300		1,000	RMEG Child
Zinc	April 5, 2000	unknown	Slag	5	56,000		600	Intermediate EMEG Pica Child
	January 5, 2000	unknown	Slag	5	84,100	J		

Sources:
1) Roy F. Weston, Inc. Trip Report , Franklin Slag Pile (MDC) Site, Philadelphia, Pennsylvania. March 14, 2000.
2) EPA. Superfund Chemical Data Matrix (SCDM). June 1996.

ppm = parts per million
RMEG = Reference Dose Media Evaluation Guide
CREG = Cancer Risk Evaluation Guide for 1 X 10E-6 excess cancer risk
EMEG = Environmental Media Evaluation Guide (ATSDR)
n/a = not available
L = Reported value is biased low
J = Estimated values

Table 2. A summary of on-site storm water runoff sampling data for selected chemicals of health concern from five sampling events in 1994, 1995, and 1999

Contaminant	Sampling Event	Maximum Concentration (ppb)	Flag	Comparison Value	
				Value (ppb)	Source
Antimony	02/12/99	42		4	RMEG Child
Arsenic	10/05/95	6.4		0.02	CREG
Berylium	02/09/99	69		4	MCL
Cadmium	07/14/94	300		2	Chronic EMEG Child
Copper	07/18/94	22,000		1,300	MCLG
Lead	07/18/94	7,000		0	MCLG
Manganese	07/18/94	1,300		500	RMEG Child
Nickel	02/09/99	711		100	LTHA
Vanadium	07/18/94	43		n/a	n/a
Zinc	02/12/99	35,700		2,000	LTHA

ppb = parts per billion

n/a = not available

RMEG = Reference Dose Media Evaluation Guide

CREG = Cancer Risk Evaluation Guide for 1 X 10E-6 excess cancer risk

MCL = Maximum Contaminant Level for drinking water (EPA)

MCLG = Maximum Contaminant Level Goal for drinking water (EPA)

LTHA = Lifetime Health Advisory for drinking water

Table 3. Summary of off-site sampling data for selected chemcials of health concern, Franklin Slag Pile Site, Philadelphia, PA 1988 and 2000

Contaminant	Sampling Event	Depth	Type of samples	Number of samples	Maximum Concentration (ppm[a])	Flag	Comparison Value	
							Value (ppm)	Source
Aluminum	June 27, 2000	unknown	Soil*	20	30,800		4,000	Intermediate EMEG Child pica
Arsenic	January 5, 2000	unknown	Soil/grit	5	6.9		0.5	CREG
Arsenic	June 27, 2000	unknown	Soil	20	30.6			
Cadmium	February 9, 1998	3-6"	Soil Sample	1	1,660		10	Chronic EMEG Child
Copper	January 5, 2000	unknown	Soil/grit	5	23,500	J	40	Intermediate EMEG Child pica
Copper	June 27, 2000	unknown	Soil	20	17,700			
Lead	February 9, 1988	3-6"	Soil background**	1	<0.20		n/a	n/a
	February 9, 1988	3-6"	Soil Sample**	1	12.3			
	January 5, 2000	unknown	Soil/grit	5	5,810	J		
	June 27, 2000	unknown	Soil	20	5,170			
Vanadium	June 27, 2000	unknown	Soil	20	57.3		6	Intermediate EMEG Child pica
Zinc	June 27, 2000	unknown	Soil	20	43,000		600	Intermediate EMEG Child pica

* surface soil samples from an inactive railroad track
** two soil samples taken next to the property of MDC (PWD property that borders MDC industries)
J = Estimated values
n/a = not available
EMEG = Environmental Evaluation Guide (ATSDR)
CREG = Cancer Risk Evaluation Guide for 1 x 10 E-6 excess cancer risk

Table 4. Quarterly averages of lead levels taken from four air monitors Franklin Slag Pile Site, 1997-2000

Location of Air Monitor	Year	Quarter	Mean (ug/m3)	Total Number of Readings
Castor and Carbon Sts on PGW Property	1997	1	1.31	13
	1997	2	6.98	13
	1997	3	3.70	12
	1997	4	0.19	15
	1998	1	0.09	15
	1998	2	0.13	15
	1998	3	0.13	15
	1998	4	0.11	15
	1999	1	0.16	13
	1999	2	0.41	13
Castor and Delaware Avenues	1997	1	1.48	14
	1997	2	4.92	11
	1997	3	0.43	12
	1997	4	1.03	15
	1998	1	0.65	15
	1998	2	1.64	12
	1998	3	0.31	15
	1998	4	1.13	13
	1999	1	3.69	6
	1999	2	0.84	12
	1999	3	0.22	12
	1999	4	1.48	7
	2000	2	0.10	9
Richmond St. and Wheatsheaf Lane	1997	1	0.76	15
	1997	2	0.43	14
	1997	3	0.81	13
	1997	4	0.04	13
	1998	1	0.03	15
	1998	2	0.03	8
	1998	3	0.03	11
	1998	4	0.05	14
	1999	1	0.05	12
Water Dept NEWPCP Lagoon Area	1997	1	4.85	11
	1997	2	7.00	13
	1997	3	2.08	11
	1997	4	0.14	14
	1998	1	0.08	12
	1998	2	0.21	14
	1998	3	0.20	10
	1998	4	0.38	14
	1999	1	0.37	12
	1999	2	0.13	11

Quarter:
1=Jan,Feb,Mar
2=Apr,May,Jun
3=Jul,Aug,Sep
4=Oct,Nov,Dec

Sources:
1) EPA. Aerometric Information Retrieval System. Air Quality Subsystem. Raw Data Report - 24-Hour Time Period. Richmond Street and Wheatsheaf lane. November 15, 2000.
2) EPA. Aerometric Information Retrieval System. Air Quality Subsystem. Raw Data Report - 24-Hour Time Period. Castor and Carbon Streets on Philadelphia Gas Works (PGW) Property. November 15, 2000.
3) EPA. Aerometric Information Retrieval System. Air Quality Subsystem. Raw Data Report - 24-Hour Time Period. Castor and Delaware Avenues. November 16, 2000.
4) EPA. Aerometric Information Retrieval System. Air Quality Subsystem. Raw Data Report - 24-Hour Time Period. Water Department NEWPCP Lagoon Area (NEL). November 16, 2000.

Table 5. Background and release air samples from four sides of the slag pile
Franklin Slag Pile, January 18, 2000

Chemical	Release Sample ID	Release Concentration (ug/m3)	Background Concentration (ug/m3)	Comparison Value	
				Value (ug/m3)	Source
Beryllium	PGW	0.00150495	0.00021147	0.0004	CREG
	PWD	0.00141303	0.00021147		
	TMT	0.00325241	0.00021147		
Copper	PGW	0.44345986	0.11736506	n/a	n/a
	PWD	0.65847175	0.11736506		
	TMT	0.91416052	0.11736506		
Lead	PGW	0.18260119	0.05625064	n/a	n/a
	PWD	0.20347650	0.05625064		
	TMT	0.36705810	0.05625064		

ug/m3 = microgram per cubic meter
n/a = not available
PGW = Philadelphia Gas Works
TMT = Tioga Marine Terminal
PWD = Philadelphia Water Department

Source:
U.S. Environmental Protection Agency (EPA). Hazard Ranking System (HRS) Documentation Record, Franklin Slag Pile (MDC) Site, Prepared for USEPA Reg 3 by Tetra Tech EM Inc., EPA Contract No. 68-S3-00-02, August 9, 2001.

Table 6. Blood Lead Levels for the years 2002 and 2003 in three tracts surrounding the FSP site (Source of data: Philadelphia Childhood Lead Poisoning Prevention Program)

CT	*Screened*	*PbB>=10*	*PbB>=20*
2002			
182	9	0	0
183	31	3	2
185	3	0	0
186	41	4	1
187	32	3	0
Total	116	10	3
2003			
182	10	3	0
183	28	4	1
185	1	1	1
186	52	7	0
187	29	3	0
Total	120	18	2

APPENDIX C. Health Effects Evaluation Process Used by PADOH and ATSDR

ATSDR has developed health-based comparison values (CVs), which are chemical-specific concentrations that 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. It is to be emphasized that 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 (RfDs), EPA's cancer slope factors (CSFs), and the NIOSH/OSHA guidelines/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. In many instances, inhalation exposures from a site or in home basement areas might be for less than 24 hours per day. Therefore, the use of air EMEGs based on MRLs to assess these situations provides a conservative approach for identifying air contaminants of potential health concern. RfDs are estimates (with uncertainty spanning perhaps an order of magnitude) of daily oral exposures, in milligrams per kilogram per day (mg/kg/day), to the general public (including sensitive groups) that is likely to be without an appreciable risk of noncancerous harmful effects during a lifetime (70 years).

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. One approach used by health assessors is the use of margins of safety (MOS) calculations 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 toxicologic evaluation is needed. If the MOS is less than 10, harmful effects might be possible, but further toxicologic evaluation might still be advisable.

Health guidelines such as MRLs and RfDs, however, 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, cancer slope factors are used to calculate the exposure dose likely to result in one excess cancer case per one 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 one-in-four 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" (above the background chance) of getting cancer from that particular exposure. In order to take into account the 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, might be zero.

Because children generally receive higher doses of contaminants than adults under similar circumstances, the 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 Considerations section). Also, readers should note that researchers conduct animal studies using doses at levels much higher than those experienced by most people exposed to contaminants originating from hazardous waste sites.

APPENDIX D. ATSDR Plain Language Glossary of Environmental Health Terms

Absorption: How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.

Acute Exposure: Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.

Adverse Health Effect: A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR: The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with those chemicals.

Background Level: An average or expected amount of a chemical in a specific environment; or, amounts of chemicals that occur naturally in a specific environment.

Cancer: A group of diseases that occur when cells in the body become abnormal and grow, or multiply, out of control.

Cancer Slope Factor: An upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg/day, is generally reserved for use in the low-dose region of the dose-response relationship, that is, for exposures corresponding to risks less than 1 in 100.

Carcinogen: Any substance shown to cause tumors or cancer.

Carcinogenicity: Ability of a substance to cause cancer.
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act, also known as Superfund.

Chronic Exposure: A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than 1 year to be chronic.

Completed Exposure Pathway: (See Exposure Pathway) In completed exposure pathways, the five elements exist, and so exposure has occurred, is occurring, or will occur.

Comparison Value: (CV) Concentrations or the amount of substances in air, water, food, and soil that are unlikely, upon exposure, to cause adverse health effects. Comparison values are used by health assessors to select which substances and environmental media (air, water, food, and soil) need additional evaluation while health concerns or effects are investigated.

Concern: A belief or worry that chemicals in the environment might cause harm to people.

Concentration: How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Dermal Contact: A chemical getting onto your skin.

Dose: The amount of a substance to which a person might be exposed, usually on a daily basis. Dose is often explained as (amount of substances(s) per body weight per day.(

Dose/Response: The relationship between the amount of exposure (dose) and the change in body function or health that results.

Duration: The amount of time (days, months, and years) that a person is exposed to a chemical.

Eliminated Exposure Pathway: (See Exposure Pathway) An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present.

Environmental Contaminant: A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in Background Level.

Environmental Media: Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. Environmental Media is the second part of an Exposure Pathway.

U. S. Environmental Protection Agency (EPA): The federal agency that develops and enforces environmental laws to protect the environment and the public's health.

Exposure: Coming into contact with a chemical substance. For the three ways people can come into contact with substances, see Route of Exposure.

Exposure Pathway: A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.

ATSDR defines an exposure pathway as having five parts:

1. Source of contamination;
2. Environmental media and transport mechanism;
3. Point of exposure;
4. Route of exposure, and;
5. Receptor population.

When all five parts of an exposure pathway are present, it is called a Completed Exposure Pathway Each of these five terms is defined in this Glossary.

Frequency: How often a person is exposed to a chemical over time; for example, every day, once a week, twice a month.

Hazardous Waste: Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Health Effect: ATSDR deals only with Adverse Health Effects. (See definition in this Glossary.)

Indeterminate Public Health Hazard: This category is used for sites when a professional judgment on the level of health hazard cannot be made because information critical to such a decision is lacking.
Ingestion: Swallowing something, as in eating or drinking. It is a way a chemical can enter your body.

Inhalation: Breathing. It is a way a chemical can enter your body. (See Route of Exposure.)

LOAEL: Lowest Observed Adverse Effect Level. The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.

MRL: Minimal Risk Level. An estimate of daily human exposure-by a specified route and length of time-to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.

NOAEL: No Observed Adverse Effect Level. The highest dose of a chemical in a study, or group of studies, that did not cause harmful health effects in people or animals.

No Apparent Public Health Hazard: This category is used for sites where human exposure to contaminated media might be occurring, might have occurred in the past, and/or might occur in the future, but the exposure is not expected to cause any adverse health effects.

No Public Health Hazard: This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.

NPL: The National Priorities List (part of Superfund). A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled, or abandoned hazardous waste sites in the country. An NPL site may need to be cleaned-up-or is being looked at to see if people can be exposed to chemicals from the site.

Plume: A volume of air or water containing chemicals that have moved and might continue to move from the source to areas further away. A plume can be a column or clouds of smoke from a chimney, contaminated underground water, or contaminated surface water (such as lakes, ponds, and streams). A plume that has stabilized (boundaries unchanging with time) is said to be in "steady state."

Point of Exposure (exposure point): This is the specific location where people might come into contact with a contaminated medium.

Population: A group of people living in a certain area; or the number of people in a certain area.

Potential exposure pathways: (See Exposure Pathway.) Those pathways where at least one of the five elements is missing, and exposure to a contaminant could have occurred in the past or could occur in the future.

Public Health Hazard: The category used in Public Health Assessments (PHAs) for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects. This category is used for sites that pose a public health hazard due to the existence of long-term exposures (>1 yr) to hazardous substance or conditions that could result in adverse health effects.

Public Health Hazard Criteria: PHA categories given to a site that tell whether people could be harmed by conditions present at the site. Each are defined in the Glossary. The categories are:
. Urgent Public Health Hazard,
. Public Health Hazard,
. Indeterminate Public Health Hazard,
. No Apparent Public Health Hazard, and
. No Public Health Hazard.

Reference Dose (RfD): An estimate, with safety factors (see safety factor) built in, of the daily, lifetime exposure of human populations to a possible hazard that is not likely to cause harm to the person.

Receptor Population: Potentially exposed population or population that might come or might have come in contact with contaminants.

Route of Exposure: The way a chemical can get into a person's body. There are three exposure routes:
. breathing (also called inhalation);
. eating or drinking (also called ingestion); and,
. getting something on the skin (also called dermal contact).

Safety Factor: Also called Uncertainty Factor. When scientists do not have enough information to decide if an exposure will cause harm to people, they use safety factors and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is not likely to cause harm to people.

Source (of Contamination): The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an Exposure Pathway.

Toxic: Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Tumor: Abnormal growth of tissue or cells that have formed a lump or mass.

Urgent Public Health Hazard: This category is used for sites where short-term exposures (<1 year) to hazardous substances or conditions could result in adverse health effects that require rapid intervention.