Public Health Assessment for

PETITIONED PUBLIC HEALTH ASSESSMENT
E.I. DU PONT DE NEMOURS
POMPTON LAKES, PASSAIC COUNTY, NEW JERSEY
CERCLIS NO. NJD980771604
JANUARY 26, 1994

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

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Prepared by

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY
DIVISION OF HEALTH ASSESSMENT AND CONSULTATION
ATLANTA, GEORGIA

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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ATSDR and its Public Health Assessment

ATSDR is the Agency for Toxic Substances and Disease Registry, a federal public health agency. ATSDR is part of the Public Health Service in the U.S. Department of Health and Human Services. ATSDR is not a regulatory agency. Created by Superfund legislation in 1980, ATSDR's mission is to **prevent or mitigate adverse human health effects** and **diminished quality of life resulting from exposure to hazardous substances in the environment.**

The Superfund legislation directs ATSDR to undertake actions related to public health. One of these actions is to prepare public health assessments for all sites on or proposed for the Environmental Protection Agency's National Priorities List, including sites owned or operated by the federal government.

During ATSDR assessment process the author reviews available information on

- the levels (or concentrations) of the contaminants,
- how people are or might be exposed to the contaminants, and
- how exposure to the contaminants might affect people's health

to decide whether working or living nearby might affect peoples' health, and whether there are physical dangers to people, such as abandoned mine shafts, unsafe buildings, or other hazards.

Four types of information are used in an ATSDR assessment.

1) **environmental data**; information on the contaminants and how people could come in contact with them

2) **demographic data**; information on the ethnicity, socioeconomic status, age, and gender of people living around the site,

3) **community health concerns**; reports from the public about how the site affects their health or quality of life

4) **health data**; information on community-wide rates of illness, disease, and death compared with national and state rates

The sources of this information include the Environmental Protection Agency (EPA) and other federal agencies, state, and local environmental and health agencies, other institutions, organizations, or individuals, and people living around and working at the site and their representatives.

ATSDR health assessors visit the site to see what it is like, how it is used, whether people can walk onto the site, and who lives around the site. Throughout the assessment process, ATSDR health assessors meet with people working at and living around the site to discuss with them their health concerns or symptoms.

A team of ATSDR staff recommend actions based on the information available that will protect the health of the people living around the site. When actions are recommended, ATSDR works with other federal and state agencies to carry out those actions.

A public health action plan is part of the assessment. This plan describes the actions ATSDR and others will take at and around the site to prevent or stop exposure to site contaminants that could harm peoples' health. ATSDR may recommend public health actions that include these:

- restricting access to the site,
- monitoring,
- surveillance, registries, or health studies,
- environmental health education, and
- applied substance-specific research.

ATSDR shares its initial release of the assessment with EPA, other federal departments and agencies, and the state health department to ensure that it is clear, complete, and accurate. After addressing the comments on that release, **ATSDR releases the assessment to the general public.** ATSDR notifies the public through the media that the assessment is available at nearby libraries, the city hall, or another convenient place. Based on comments from the public, ATSDR may revise the assessment. ATSDR then releases the final assessment. That release includes in an appendix ATSDR's written response to the public's comments.

If conditions change at the site, or if new information or data become available after the assessment is completed, ATSDR will review the new information and determine what, if any, other public health action is needed.

For more information about ATSDR's assessment process and related programs please write to:

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY

The E. I. Du Pont site is in Pompton Lakes, Passaic County, New Jersey. E. I. Du Pont, Pompton Lakes Works (PLW) is an explosives manufacturing operation that has been in operation since 1886. The site has been owned by Du Pont since 1902. Waste management practices during this time have resulted in significant contamination of surface water, soil and sediment, and groundwater contamination both on and off site. Elevated levels of lead and mercury were found in off-site soils in the Acid Brook flood plain, known as the Acid Brook Area. Private wells downgradient from PLW are contaminated with elevated levels of chlorinated solvents. Residents in the Acid Brook Area have been exposed to elevated levels of heavy metals in soil, and residents downgradient from PLW have been exposed to elevated levels of chlorinated solvents in groundwater. Exposures to contaminants in groundwater ceased in 1985, when two residents who had been using their private wells as their drinking water supply were provided alternative water supplies; however, exposures to heavy metals in soils may continue to occur until remediation of Acid Brook Area soils is complete. Therefore, the Agency for Toxic Substances and Disease Registry (ATSDR) concludes that this site was a past public health hazard, and will remain a public health hazard until off-site remediation is complete.

Exposure to lead- and mercury-contaminated soils in the Acid Brook Area may cause adverse health effects. Findings in the scientific literature indicate that chronic low level exposures to lead in soil have been associated with decreased learning ability in children. In addition, long-term exposures to trichloroethylene, tetrachloroethylene, dichloroethylene, and vinyl chloride found in some private wells have resulted in a low to moderate increased risk for cancer for residents who have used the wells as a drinking water supply in the past. Long-term ingestion of those chlorinated solvents in groundwater may also affect the central nervous system, liver, kidneys, and skin.

Health outcome data were available from the State of New Jersey and from Lenox Elementary School. E.I. Du Pont biomonitoring tests of local residents were also reported, which included analyses of lead and mercury from blood and urine samples. However, the health outcome data currently available are inadequate to evaluate the relationship between environmental contamination and adverse health outcome among community members.

Residents of the Acid Brook Area expressed numerous concerns about the lead and mercury soil contamination in their yards, including cleanup levels and migration of contamination into the school water supply. Residents have also raised several health concerns including learning disabilities, blood diseases, multiple sclerosis, cancer, and other unexplained illnesses and deaths. Detailed responses to these concerns appear in the Public Health Implications Section of this public health assessment.

Many public health activities have already taken place under the direction of the New Jersey Department of Environmental Protection and Energy (NJDEPE), the New Jersey Department

of Health (NJDOH) and E.I. Du Pont. Some of these public health activities have included posting health advisories for the Acid Brook Area, and portions of Wanaque River, and Pompton Lake; providing biomonitoring for community members; community meetings; and relocation during remediation of residential properties. ATSDR recommends maintaining existing health advisories for Acid Brook, Wanaque River, and Pompton Lake until monitoring data indicate that exposures to soils, surface water, and fish are not a public health threat. The Agency also recommends continuing to restrict access to the PLW property and to post the Acid Brook Area until remediation is complete. In addition, ATSDR recommends (1) ensuring that all private wells downgradient from PLW are not being used as a drinking water supply; (2) continuing to monitor groundwater at and downgradient from PLW; and (3) conducting a community health investigation for Acid Brook residents to better evaluate health outcomes.

The ATSDR Health Activities Recommendation Panel concurred with these recommendations, and recommended additional public health actions. Based on their recommendations, the public health assessment and the conclusions, ATSDR will implement the following actions: 1) conduct additional health profession education for local health care providers and Lenox Elementary School Learning Disability Staff as needed, and 2) address other public health issues as needed or if new data becomes available. Also, NJDOH is planning to conduct a community health investigation as recommended by HARP.

BACKGROUND

ATSDR will evaluate the public health significance of on- and off-site contamination, will determine whether health effects are possible, and will recommend actions to reduce or prevent possible health effects. ATSDR, headquartered in Atlanta, Georgia, is a federal agency within the U.S. Department of Health and Human Services and is authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) to conduct health assessments at hazardous waste sites.

A. Site Description and History

Pompton Lakes Works

The 600 acre E.I. Du Pont, Pompton Lake Works (PLW) site, an explosives manufacturing operation, is at the north end of Pompton Lakes, New Jersey. The site lies to the south of a rural mountainous area near Wanaque River and north of Pompton Lake. The Acid Brook Area lies to the south of PLW. Acid Brook is a perennial stream running through the center of PLW and then continues south south-east until it empties into Pompton Lake (1). The Acid Brook Area contains Du Pont Village and an additional residential area that borders Acid Brook on the south (2). NJDEPE defined this area for remediation purposes through soil sampling (see Appendix A, Figure 1) (3). The public health assessment will focus on the PLW site and the Acid Brook Area, since environmental contamination has been characterized in both of those areas.

E.I. Du Pont acquired PLW in 1902. PLW had been in operation since 1886. In 1989, Du Pont scaled down operations by 60% (4). During its lengthy history (see the table on the next page) PLW produced black powder, smokeless powder, blasting caps, detonating fuses, mercury fulminate, boosters, primers, rocket igniters, bullets, grenades, and lead azide. Primary substances used on site have been explosives manufactured from salts of lead, mercury, and sodium; organic explosives; metal wire and blasting cap components, and solvents for raw material and product cleaning (3).

Production of those materials generated various wastes. Wastes disposed of on site included lead salts, mercury compounds, explosive powders, chlorinated solvents, waste wire drawing solution, and detonated blasting caps. In 1988, Du Pont identified 119 possible waste disposal areas scattered throughout PLW; however, only 23 were active at the time (3). For a complete history of activities at PLW, see Appendix D (4).

PLW Site Operational Chronology (10)

Operation	Chemicals Involved in Process	Dates of Operation
mercury fulminate production	mercury fulminate powder, ethyl alcohol, nitric acid	1912 - 1950's
lead azide production	sodium azide, lead nitrate, lead carbonate sludge, lead azide powder	1930 - present
powder processing	waste solvents	1906 - present
boron/red lead delays	lead, boron, 1,1,1-TCA, Thiokol, red lead powders, lead tubing	1929 - present
loading operations	solvents	1906 - present
shell production	animal fat lubricants, solvents, metal scrap	1910 - present
wire production	lubricants, spent solvents, scrap iron and copper, scrap wire	1900 - present
cordline production	acetone, hydraulic oil	late 1970's - present
jet tapper production	RDX, pentolite, tetryl, acetone, alcohol	late 1940's - present
rivet production	solvents, degreaser	1937 - 1970
metal cladding	amatol residues, cholorothene, metal waste	1966 - 1973
assembly operations	solvents	1906 - present
control laboratory operation	powder residues, metal waste, waste solvents	unknown - present

On September 15, 1988, Du Pont entered into an Administrative Consent Order with NJDEPE, which required investigation and remediation of all contamination on and emanating from the PLW property (43).

On July 5, 1990, PLW was issued a Resource Conservation and Recovery Act (RCRA) permit by NJDEPE for five on-site areas, including those used for storing and burning wastes. On August 24, 1992, the Environmental Protection Agency ordered corrective actions at all waste management operations throughout the site under the Hazardous Substance and Waste Amendment (41).

Off site and Acid Brook Area

Environmental investigations began for this area in 1984, when Du Pont reportedly suspected that a plume of contaminated groundwater may have migrated off site. In October 1985, Du Pont sampled private wells of nearby residents and connected two residences to the municipal water system later that same year (4). These two homes were the only two using the private well water for drinking water purposes at that time (43). In May 1990, Du Pont discovered other off-site contamination, primarily heavy metals, in the soil and sediments along Acid Brook and the Wanaque River.

The Acid Brook Area residential history dates from 1920 when the first deeds were issued for property along the southern bank. However, development took place primarily from 1940 to the present. The most recent development took place on the northern end of Acid Brook in 1951 (3).

A health advisory was issued jointly by E.I. Du Pont and the Borough of Pompton Lakes advising against eating fish caught in Acid Brook, the Wanaque River or Pompton Lake, and advising against disturbing the soil along the stream beds (5). In December 1990, 5500 soil samples and stream bank samples, taken in and around Acid Brook, indicated elevated levels of lead and mercury (4). Subsequently, a Remedial Action Work Plan for PLW Acid Brook Cleanup became final in March 1991 (3).

On April 1, 1991, based on health concerns of citizens, NJDOH petitioned ATSDR for a health assessment of the Acid Brook Area (6). Also, upon request of the NJDOH, ATSDR issued two health consultations. The first was to evaluate the threat to public health posed by off-site soil and sediment contamination in the Borough of Pompton Lake, and the second was to review the work plan for remediation of the off-site contamination (2, 41). Also, after a request from the NJDOH, ATSDR recommended that some residents temporarily move during clean up of Acid Brook and that criteria be developed to determine who should move and when. Du Pont offered and provided relocation to all residents. On June 4, 1991, following a visit to the Acid Brook site, ATSDR accepted NJDOH's request for a public health assessment of the Acid Brook Area.

B. Site Visits

From April 6 - 10, 1992, ATSDR environmental health scientist, Ms. Lynelle Neufer, and Region II Representative, Mr. Arthur Block, visited the site. They toured the Acid Brook area on April 8, 1992. A Du Pont representative and the county health officer accompanied ATSDR personnel on the site visit.

Acid Brook flows through various yards in a residential area of Pompton Lakes. At some points, the brook is lined by cement block walls about four feet high. These walls are in various stages of disrepair. The following observations were made:

- Warning signs were posted at intervals along the brook and Pompton Lake that read: CAUTION DO NOT ALLOW CHILDREN TO PLAY IN THIS AREA in both English and Spanish. The visitors did not see any "no fishing" signs.

- Evidence of children playing was noted at several locations along Acid Brook. Evidence included toys, a shovel, a ball, and a broken bicycle found in the brook. Bike tracks, food wrappers, and soda cans were noted in the sediment around the banks of the brook. During the site visit, residents with whom ATSDR staff members spoke also reported seeing children playing in the brook despite warnings. One resident found children building a dam in the brook out of rocks found in the nearby sediments. She instructed them not to play there and told them to go home and take showers.

- The Lakeside School is next to the delta of Acid Brook to Pompton Lake. Signs, in both English and Spanish, are posted warning children not to play in the water or around sediments. Access is not restricted.

- ATSDR staff members observed a man fishing on Pompton Lake. He communicated that he fishes for carp for personal consumption; however, he spoke very little English and no Spanish. He was unaware of the fish advisory.

- Residences closest to PLW were older, middle-income homes. Some yards had relatively poor vegetative cover. Yards next to the site were fenced; however, access to the site was available through open gates and broken fences.

- Some residences had already had contaminated soil removed and their yards and landscaping completed. Others were in the soil removal process. Access to these homes was restricted with 24-hour security to prevent theft. Windows were sealed with plastic and tape. Yards were restricted by bright orange snow fencing, signs, and cones.

- Throughout the representatives' tour of Acid Brook, young children were observed playing in yards and in the street.

- A couple of small industries were observed along Acid Brook, including a film developer. Incidents of chemical spills in the brook were reported by residents during the site visit. These spills were accompanied by pungent odors. The residents suspected that the spilled 55-gallon drums on the film developer property may have been the source.

The following observations were made at the PLW site:

- The entrance area to PLW was being remediated extensively. The site abuts the back yards of about ten residences. Access was restricted by six-foot chain link fences, orange snow fences, and signs. The Du Pont representative reported that the contamination has been removed and that the area is being landscaped and restored.

- Access to the site, although restricted by six-foot chain link barbed wire fences and no trespassing signs, is still easy through open gates and breaks in the fence. Guards at the gate checked all visitors. The Du Pont plant manager reported that trespassing is rare to nonexistent, and gates and fences are monitored 24 hours by security guards.

C. Demographics, Land Use and Natural Resource Use

In order to evaluate potential health effects associated with exposure to hazardous substances in the environment, ATSDR obtains information on the population in the vicinity of the site ("demographics"), the types of land use near the site, and natural resource use in the area.

Population information is needed because some types of illnesses and diseases are more common in certain age groups such as the elderly or children, in certain ethnic groups, or in groups of people with low income. In addition, some groups may be more sensitive to the presence of hazardous substances in the environment. Information on education levels provides ATSDR some guidance on what types of health communication programs may be useful near the site in the future. Land use information is important because sensitive groups of people, such as schoolchildren or residents of health care facilities, may be located near the site. Use of some natural resources, such as groundwater, may have an effect on the potential for human exposure to hazardous substances.

<u>Demographics</u>

According to 1990 United States Census data, 10,539 people reside in Pompton Lakes, a community in northwest Passaic County (29). The community is predominantly white (97.2%) with a relatively even distribution of ages (23.2% of residents under the age of 18, and 14% above 65) (29). Census tract 1964 encompasses Pompton Lake. Block groups 2, 3, and 9 are those census block groups that surround Acid Brook (see Figure 3 in Appendix

A). A total of 3013 persons reside within these three block groups. Demographic age data for block groups 2, 3, and 9 appear in the table below.

A survey of homes in the Acid Brook area was given to ATSDR by Du Pont. Du Pont reports that they either spoke in person or over the phone with every family in compiling these data (44). The Acid Brook Area is smaller than the block group area and is contained within it (see Figures 1 and 2 in Appendix A). A total of 418 people reside in the Acid Brook Area. For an age breakdown, see the table below.

Summary Demographic Data for the Acid Brook Area

Age	Number of persons	
	Census Block Groups 2,3, and 9	Survey of Acid Brook Area
under 1	37	10
1 - 6	199	45
7 - 11	152	32
12 up	2625	331

Pompton Lakes is primarily a middle-income community. The median value of homes is about $160,000 in census blocks 2,3, and 9, according to 1990 US Census Data (29).

Land Use

The Acid Brook Area and the surrounding neighborhood are primarily residential areas, concentrated south and southeast of Acid Brook, (see Figure 2 in Appendix A for the definition of the Acid Brook Area). A few residences are located within a mile north of Acid Brook and PLW in a narrow valley. There are approximately 1000 homes within a mile of Acid Brook (1). There are currently 137 properties, both residential and commercial, within the Acid Brook Area.

A mix of commercial businesses and homes is centralized 1000 - 2000 feet southwest and west of the southern end of Acid Brook (see Figure 1 in Appendix B) (1). Twelve businesses lie within the Acid Brook Area on Cannonball Road (8).

PLW is the main industry in Pompton Lakes, located directly north and next to the Acid Brook Area on Cannonball Road. PLW occupies 600 acres in two valleys between Pompton Lake (to the east) and two mountainous ridges (to the west and north). PLW contains approximately 100 buildings on site (see Figure 1 in Appendix A) (1).

Four domestic gardens were tested within the Acid Brook Area. These gardens consisted of carrots, tomatoes, peppers, beans, cucumbers, eggplants, and cabbages (9). Residents report that there were many more gardens present in the area.

Schools are located 1000, 1500, and 2000 feet southeast of the southern end of Acid Brook (1). An elementary school is situated 450 feet from where Acid Brook empties into Pompton Lake (2). The closest hospital is three and a half miles away in Pompton Plains (1), (See figure 1 in Appendix A).

Natural Resources

Pompton Lakes residents receive their water supply from three municipal groundwater wells. The closest is half a mile southwest of PLW near the southern border of Twin Lake; the other two are located three quarters of a mile and a mile and a half south and southwest of Acid Brook respectively (1,10).

Twenty-six private wells were identified south of PLW and sampling began in 1985. Two residences with contaminated wells were connected to the municipal water supply in 1985, and by 1989, all private wells identified in the Pompton Lakes community, whether contaminated or not, were connected to the municipal water supply (10,4).

There are four main surface water bodies in Pompton Lake: Acid Brook, Wanaque River, Pequannok River, and Pompton Lake. First, Acid Brook is a very shallow stream originating in a mountainous ridge north of PLW, flowing south through residential areas, and discharging into Pompton Lake. Acid Brook flows year around and flows through the center of the PLW property (1,9).

Second, Wanaque River is a shallow stream flowing in a southerly direction through the center of Pompton Lakes, parallel to Acid Brook. Wanaque River originates from the large Wanaque Reservoir 2.5 miles due north of Pompton Lake. Wanaque River empties into the Pequannok River at the Riverdale-Pompton Lakes municipal boundary. Wanaque River lies 500 feet east of the current PLW property and through Du Pont property (10,1). The river used to be dammed to form Lake Inez (as pictured in Figure 1 in Appendix A); however, the dam was removed in 1984. PLW plant storage facilities were located along the banks of the former Lake Inez, and reportedly foundations from past PLW operations are still evident (10).

Third, the Pequannok River originates from the Charlotteburg and Oak Ridge Reservoirs west of Pompton Lakes, and flows down the western border of Pompton Lakes through a residential neighborhood (1,9). The Pequannok River is similar in size to the Wanaque River, and is a mile and a half south west of PLW (1).

Finally, Pompton Lake is a small urban lake formed by a dam on the Ramapo River (9). It is approximately two miles long and a half mile wide. Residential areas of the Pompton Lake community border the lake on the west, while rural mountainous areas make up the eastern and southern borders. The lake lies 2000 feet southeast of PLW, with residential areas in between. Acid Brook empties into the western end of the lake at the lakes widest point (1), (see Figure 1 in Appendix A for location of these four water bodies and their relation to the site and the Acid Brook Area).

Currently, health advisories are in effect for Acid Brook, Wanaque River, and Pompton Lake (5). The health advisories were issued jointly by Du Pont and the Borough of Pompton Lakes in 1990. Specifically, these precautionary measures were suggested to the citizens of Pompton Lake:

- Avoid direct contact with soil.
- If contact with soil is unavoidable, wash dirt off as soon as possible.
- Encourage children to play in other areas.
- Do not garden in the area near Acid Brook or the Wanaque River.
- Do not eat fish from Acid Brook, Wanaque River, or Pompton Lake.
- Do not disturb soil adjacent to Acid Brook or Wanaque River.

The extent of community compliance with the health advisory is unknown. During a previous site visit, ATSDR personnel observed children playing and wading in Acid Brook (4). On the most recent site visit, further evidence of noncompliance with warnings was noted, (see the Site Visit section).

D. Health Outcome Data

Government agencies routinely collect information on the health of the population within their areas of jurisdiction. The federal government collects general health information on the entire nation. Many state health departments have developed registries of illnesses and diseases. Some county and local health departments also routinely collect health information. Concerned citizens and citizen action groups may also collect health information in areas of interest. This section identifies the available databases. The Public Health Implications Section evaluates the relevance of these databases to this public health assessment. The following is a list of available databases.

Sources of state and local data for health outcome information include:

1. The NJDOH Cancer Registry
2. Vital Statistics Records
3. Birth Defects Registry
4. Renal Dialysis Network

5. Hospital Discharge Reports

Of relevance to this public health assessment is the New Jersey State Cancer Registry, the Birth Defects Registry, hospital discharge reports, and the Vital Statistics Records.

- The NJDOH Cancer Registry is a population-based incidence registry that includes cancer cases among New Jersey residents diagnosed since October 1, 1978. New Jersey Regulation (N.J.A.C. 8:57-6) requires the reporting of all newly-diagnosed cancer cases (incidence) to the registry within three months of hospital discharge or six months of diagnosis. The basic source of information is the patient's medical records. Demographic data and medical data are abstracted from those records and do not include information on modes of treatment or on survival. The only follow-up information included is the date of death.

Cancer might be possible from long-term exposure to at least one site contaminant. Please refer to the Toxicological Implications subsection of the Public Health Implications section for more information on cancer. Cancer incidence for the E.I. Du Pont site has been requested from the cancer registry and is not available for review and evaluation at the time of the writing of this public health assessment. Data will be reviewed and incorporated into the public health assessment as soon as they become available.

- To address community concerns regarding exposure to environmental lead and mercury, Du Pont funded health screening activities for residents in the Acid Brook area. The University of Medicine and Dentistry of New Jersey (UMDNJ) was subcontracted by Du Pont to provide medical services and counseling to individuals who live on or near a property with elevated levels of lead and mercury in the soil, and guidance to private physicians. The screening consisted of laboratory testing of blood and urine for lead and mercury exposure. Biological investigation included tests for measuring blood and urinary lead, blood and urinary mercury, erythrocyte protoporphyrin, and urinary creatinine. Results of the biological investigations were provided to ATSDR in February 1992, and will be discussed in the health outcome evaluation section.

- Learning disability records are maintained by local schools until a student has been out of the school system for two years; then, these records are either forwarded to the student's family or destroyed. The principal of Lenox Elementary school reported the percentage of children with learning disabilities in his school. District and federal data on learning disabilities were used for comparison (37).

- The Birth Defects Registry established in 1985 is a population-based surveillance registry maintained by the Special Child Health Services Program at the NJDOH. Any infant who is born to a resident of the State of New Jersey, or who becomes a resident of the state before one year of age, and who shows evidence of a birth defect either at birth or any time during the first year of life is reported to the State Department of Health, Special Child Health Services Program. For reporting purposes, Congenital Anomalies (Diagnostic Codes 740.00 through 759.90) in the most recent revision of the International Classification of Diseases, Clinical Modification, and other congenital defects specified by the Commissioner of Health constitute reportable defects.

COMMUNITY HEALTH CONCERNS

ATSDR believes identifying and addressing community health concerns relevant to this site is critically important to the public health assessment. Community concerns were communicated during the several community meetings attended by ATSDR, through phone contact and letters, and informally during site visits. This section identifies community health concerns regarding possible health effects of this site. The Public Health Implications Section will address these concerns.

Residents and officials raised the following health-related concerns:

1. Citizens of Pompton Lake are concerned about the availability of physicians for monitoring lead and mercury exposures during remediation of Acid Brook area yards.

2. Citizens perceive an excess of unexplained illnesses among community members.

3. Citizens worry that their children are not doing well in school and want their children's elementary school health unit educated for signs of learning disabilities.

4. Citizens are concerned about lead contamination of the school water supply. They want the school water tested for lead.

5. Citizens are concerned about exposure to mercury-contaminated soils. They want clean-up levels for mercury to be lower, more surface samples to be taken, and more biomonitoring to be done.

6. NJDOH relayed concerns from residents about the effect that exposure to site contaminants might have on residents' health. Residents are specifically concerned about:

a. the current health status of all of the residents in the affected area;

b. lead and mercury levels of residents and assuring treatment where appropriate, and

c. illnesses or deaths that may have resulted from chronic exposures to environmental contamination (13).

7. Former Mayor John Sinsimer of Pompton Lakes wanted to know if an increase has occurred in multiple sclerosis, learning disabilities, and in such blood diseases as anemia, because of exposure to chemicals at the site.

8. Several residents expressed concern regarding increased rates of some kinds of cancer (breast, interstitial, brain) and learning problems (12).

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

The tables in Appendix B list contaminants in each medium. Those contaminants are evaluated in subsequent sections of the public health assessment to determine whether exposure to them has public health significance. ATSDR selects and discusses contaminants based upon several factors. They include concentrations on and off site, the quality of the field and laboratory data, sample design, comparison of on- and off-site concentrations to background concentrations (if available), comparison of on- and off-site concentrations to public health assessment comparison values for noncarcinogenic and carcinogenic endpoints, and community health concerns.

The listing of a contaminant in the tables does not mean that it will cause adverse health effects if exposure occurs at the specified concentrations. Contaminants included in the tables are further evaluated in this public health assessment. The potential for adverse health effects resulting from exposure to contaminants of concern is discussed in the Public Health Implications Section.

Comparison values for ATSDR public health assessments are contaminant concentrations in specific media that are used to select contaminants of concern for further evaluation. ATSDR and other agencies developed those values to provide guidelines for estimating the media concentrations of a contaminant that are unlikely to cause adverse health effects, given a standard daily ingestion rate and standard body weight, (see Appendix C for a description of the comparison values used in this public health assessment update).

A. On-Site Contamination

Du Pont is currently implementing a Remedial Investigation Work Plan for on-site contamination (43). However, the investigations are not yet complete, so a full characterization of PLW site contamination is not possible at this time. The Remedial Investigation Work Plan was completed in November 1989 by Du Pont, and did provide some environmental monitoring data for on-site surface water. Additional on-site monitoring data were provided by the New Jersey Department of Environmental Protection and Energy (NJDEPE), as well as reports on Du Pont strategies to curb future migration of contamination off site. As more environmental monitoring data become available, an addendum to this public health assessment may be necessary.

<u>Soil</u>

The mercury fulminate area is a 400' by 400' section of PLW in the center of the PLW property. Acid Brook makes up the eastern border. In December 1991, Du Pont took 49 soil samples from the surface (0-6 inches) and depths of 18, 36, and 72 inches throughout the mercury fulminate area and analyzed them for lead and mercury. Surface levels, on the average, were the highest, with an average of about 200 mg/kg for lead and 300 mg/kg for mercury. The maximum level for lead at the surface was 1790 mg/kg. Mercury was 5930 mg/kg (31). See Table 1 in Appendix B. Overall, the highest levels of lead and mercury were in the northern area of the site. Access to the mercury fulminate area itself is unrestricted; however access to PLW is restricted by a gate and 24-hour security, (see Figure 4 in Appendix A).

<u>Surface Water</u>

Three on-site surface water bodies were identified and monitored for hazardous substances between 1984 and 1988 by Du Pont: the plant stream (which makes up the northern end of Acid Brook), the Shooting Ponds, and the lagoon (10). Elevated levels of heavy metals were detected in those areas. Elevated levels of chlorinated solvents were found in the lagoon only (43), (see Table 2 in Appendix B).

NJDEPE reports that the three main sources of off-site contamination have been contained. One of the shooting ponds has been remediated and closed under Resource Conservation and Recovery Act (RCRA) specifications. Sediment from the second shooting pond has been removed down to the bedrock. The third area, the mercury fulminate disposal area, is surrounded by berms to prevent runoff. Contaminated soils were removed and replaced with clean stone. In addition, two retention basins were created for flood control of Acid Brook and to prevent future migration of on-site contamination into residential areas. NJDEPE reports this interim remediation should be sufficient for preventing recontamination of remediated areas downstream from the site (36,37,43). As noted earlier, there a total of about 119 potential areas of concern at the site, and some of these areas could also be potential sources of heavy metal contamination. It should be noted that many of these areas are also in various stages of the remediation process to prevent recontamination of downstream areas (45).

Groundwater

Installation of PLW plant wells began in 1981, when 15 wells were installed on site. Du Pont installed nine more wells in 1984, and six more in 1985. Wells have been sampled quarterly or semiannually and analyzed for volatile organic compounds and metals. Du Pont followed the New Jersey Field Sampling Manual for all groundwater sampling events, (see Figure 5 for location of on-site monitoring wells)(10).

Groundwater monitoring indicated elevated levels of metals in on- site groundwater. Maximum levels found between 1982 and 1989 of lead and mercury were 15 mg/l and .01 mg/l, respectively. Levels of metals have dropped substantially since remediation of the Shooting Pond. Chlorinated solvents including dichloroethylenes, dichloroethylanes, tetra and trichloroethylene, 1,1,1-trichloroethylene, and vinyl chloride were also elevated. Because Du Pont installed these wells for monitoring purposes only and keeps them locked, it is unlikely that on-site groundwater is used for human consumption (10,43).

Air

No monitoring data were available for analysis of on-site air.

B. Off-Site Contamination

ATSDR also reviewed files from state and federal environmental agencies to obtain information on the extent of contaminants that may have migrated from PLW to the Acid Brook Area. ATSDR evaluated these data to help determine whether people beyond PLW may have been exposed to hazardous substances migrating off site in the past, or whether they may be exposed in the present. Off-site exposure to contaminated media will be evaluated in the Exposure Pathway Analyses Section. Available monitoring data are discussed in this section and summarized in the tables in Appendix B.

Acid Brook Area Soils and Sediments

In 1990, approximately 5,000 soil samples were taken in the Acid Brook Area. Each boring was analyzed at depths of 0 - 6, 18, 36, and 60 inches for heavy metals and base/neutral extractable (B/NE) compounds (includes semivolatile organic compounds and polyaromatic hydrocarbons) and acid base/neutral extractable (AB/NE) compounds. VOCs were not analyzed because initial sampling did not indicate a need. Elevated levels of lead and mercury were found at each of the depths, although levels were highest at the surface. Other heavy metals (barium, copper, selenium, and zinc) were elevated at the surface and at various depths, although not to the same degree as lead and mercury. B/NE and AB/NE were detected only at low levels (9). Since surface soil had the highest levels of contamination and is the most likely point of human exposure, surface soil sample results will be the focus of this public health assessment. The surface soil sample results are further categorized by those found in residential yards, gardens, and around Acid Brook, and are summarized in Table 3, Appendix B. The overall degree of lead and mercury contamination in the Acid Brook Area is further characterized in the tables below:

Distribution of Lead Surface-Soil Concentrations (2)

Concentration (ppm)	Number of samples at 0 inch depth
250 - 499	286
500 - 999	159
1000 - 1999	90
2000 - 4999	19
5000 - 9999	6
≥ 10,000	10

Distribution of Mercury Surface-Soil Concentrations (2)

Concentration (ppm)	Number of samples at 0 inch depth
200 - 499	43
500 - 999	20
≥ 1000	6

Results of Acid Brook Area sampling also indicated that soil contamination generally decreased with depth and distance away from the brook. Lead contamination was more widespread than mercury contamination. Mercury contamination was mostly confined to within 50 feet on either side of the brook.

Residential Yard Soils

Based on the sampling results found above, Du Pont developed a Remedial Action Work Plan for the Acid Brook Area. Lead and mercury were used as indicators to develop the remediation plan, since those contaminants were consistently the most elevated. The highest levels found in yards were 62,000 mg/kg lead and 540 mg/kg mercury. Areas with soil lead levels above 250 mg/kg and mercury levels above 14 mg/kg were originally targeted in the work plan. NJDEPE subsequently approved the plan, and remediation of residential areas began in September 1991; however, NJDEPE has since proposed changing the lead clean-up level to 100 mg/kg. This change has not been made final. As of July 1993, 87 homes had been fully remediated with clean soil. Signs are posted warning against contact with soil in the remaining areas (37,44). Remediation of the Acid Brook Area is scheduled for completion by December, 1995 (3,43).

One sample of basement soil from an Acid Brook home was taken. A lead level of 32,100 mg/kg was detected in that sample (9). It is unknown whether the sample was of dust or soil from an unfinished basement floor. Du Pont reports that the owner of the property was a plumber, and the lead contamination was probably related to work activities and not surface soil contamination (43). Du Pont conducted indoor wipe sampling for lead and mercury in basements following remediation of the home. Wipe sampling results are used to determine whether or not lead and mercury contamination is present. Many of the basements did have positive results for lead and mercury contamination, and they were cleaned and retested by Du Pont. Except for a few homes, lead and mercury wipe tests were negative following cleaning. Those homes where additional cleaning was needed had either unexplained or additional sources of lead contamination (46).

The highest levels of lead and mercury were detected along the banks of Acid Brook. They were 119,000 mg/kg for lead, and 8,060 mg/kg for mercury. Remediation of Acid Brook is also included in the workplan, giving top priority to areas with the most severe contamination. Warning signs are posted in areas awaiting remediation.

Garden Soils

Du Pont screened residential garden soil for six primary metals in March 1990. Four residential gardens were identified in the Acid Brook Area, and a total of seven samples were taken (five composite samples and two individual grab samples). Two blind duplicate samples served as controls (9). Background levels are average levels detected by NJDEPE (3). Copper, lead, and zinc all exceeded background soil levels, (see table 3 in Appendix B. These areas are included in the remediation plan).

Food Chain - Garden Vegetables

In the summer of 1990, Du Pont analyzed garden vegetables grown in the Acid Brook area for six heavy metals (barium, copper, lead, mercury, selenium, and zinc) (9). Sampling took place at various intervals during the summer when plants had fully matured so that contaminant levels would be representative of vegetables ordinarily consumed (9). Researchers reported using standard sampling and shipping procedures. A variety of dark green vegetables and tomatoes were collected and analyzed. Monitoring indicated low levels of barium, copper, and zinc in garden vegetables as shown in Table 6 in Appendix B. Selenium, lead, and mercury were not detected (9). Environmental comparison values for concentrations of heavy metals in garden produce do not exist; however, further analysis is found in the Public Health Implications section of this public health assessment.

Food Chain - Fish

Du Pont retrieved nine fish from Acid Brook with a backpack electrofishing unit and then analyzed the fish as whole body homogenates. After the fish were caught, they were labeled, placed in double ziplock bags, and stored on ice in insulated coolers for shipment to a laboratory. Fish were analyzed for six heavy metals; however, Food and Drug Administration (FDA) standards exist only for mercury. One fish exceeded the FDA standard of 1.0 mg/kg for mercury (1.3 mg/kg). Table 7 in Appendix B summarizes the monitoring data for fish tissue (9).

Twenty-four fish samples were caught from the Wanaque River with a backpack electrofishing unit and were transported the same way as Acid Brook fish. Analyses were performed for heavy metals, extractable organics, and dioxins/furans. Three rock bass showed mercury levels at or above the FDA level of 1.0 mg/kg (1, 1.1, and 1.3). Other heavy metal monitoring data for fish are found in Table 7 in Appendix B (9).

Fourteen fish samples were taken from the Pequannok River using a backpack electrofishing unit and were transported in the same way as the Acid Brook fish. Aside from heavy metals, no additional chemicals were tested. The heavy metal monitoring data for fish are found in Table 7 in Appendix B (9).

Fifty-five fish samples were collected in Pompton Lake through a variety of methods, but primarily through use of boat-mounted electrofishing gear. Methods for transporting fish were the same as those described above. Analyses were performed for heavy metals, extractable organics, and dioxins/furans, (see Table 7 in Appendix B for other results)(9).

Surface Water

Du Pont conducted surface water sampling for Acid Brook, Wanaque River, and Pompton Lake. The sampling is described below. Maximum concentrations for all these surface water bodies are found in Table 4 in Appendix B.

Du Pont conducted surface water sampling of Acid Brook in June 1990. Eleven surface water samples were hand-drawn just below the surface at well-mixed areas of flow. Samples were collected at relatively equal increments between the Du Pont plant boundary and the Pompton Lake delta. Samples were analyzed for six heavy metals; however, selenium was not detected (9).

NJDEPE collected and analyzed four surface water samples of Acid Brook in October 1990 for volatile organic compounds (VOCs), semivolatiles, polychlorinated biphenyls (PCBs), and metals. No contaminants were detected except for a mercury level of 0.0002 mg/L in one sample (38).

Du Pont sampled the Wanaque River in June 1990. Three samples were collected just below the water's surface in areas of well-mixed flows, and analyzed for six heavy metals and four VOCs. Copper, selenium, and the VOCs were not detected. No metals that were detected exceeded comparison values (9).

Du Pont conducted surface water sampling of Pompton Lake in June 1990. Two sampling locations were chosen and sampled at depths of one to two feet above the bottom, and half-way between the bottom and the surface. Two additional single grab samples were taken at shallower locations just below the surface. Samples were collected for both filtered and unfiltered metal analysis, and measurement of VOCs. Field parameters were also performed. No VOCs were detected. Among the heavy metals, mercury and selenium were not detected. No metals detected exceeded comparison values (9).

Groundwater - Private Wells

Water is naturally found in the earth's subsurface in the pore spaces and voids in geologic materials. As geologic materials are categorized into layers or units based upon their water-bearing properties, these units are called aquifers. A shallow aquifer underlies the southern portion of the plant and flow in a southeasterly direction from the Du Pont facility toward the residential section of Pompton Lakes (2). The shallow aquifer is unconfined (which means infiltration from the land surface to the upper portion of the aquifer is possible) and consists of silt, sand, gravel, and cobbles. The source of water supply for this aquifer is most likely direct infiltration of precipitation, and the discharge area is probably Pompton Lake.

Environmental investigations by Du Pont from 1983 to 1986 revealed that groundwater beneath the site was contaminated with solvents used at PLW, and that the contamination had also extended off site into residential areas. In late 1985 and early 1986, Du Pont sampled the wells of homeowners next to PLW, and subsequently paid to disconnect private wells that were contaminated if requested by the homeowner. A total of 28 wells were tested. Figure 5 in Appendix A depicts the sampling locations (10). Private wells were identified by assessment of billing records at the Borough of Pompton Lakes Municipal Utilities Authority (MUA). The depth of private wells was reported to be less than 30 feet by NJDEPE. Only two wells, private well numbers one and seven, were used as sources of drinking water. These wells have not been used for drinking water since 1985. By 1989, all homes with private wells identified through billing records were connected to the Borough of Pompton Lakes municipal water supply, including those that were not contaminated (37). Some private wells are still used for other purposes besides a drinking water supply.

Heavy metals and chlorinated solvents were detected above comparison values. Of the chlorinated solvents, the dichloroethylenes exceed comparison values in two of the private wells, and trichloroethylene and tetrachloroethylene exceed comparison values in over a third of the 28 private wells. Private well number 1, one of the two wells used for drinking water, had the worst contamination out of the 28 wells tested, (see Tables 5A and 5B in Appendix B for a summary of the results of private well monitoring data).

In 1990, Du Pont conducted additional off-site groundwater monitoring which included use of monitoring wells and private wells. Results, again, indicated the presence of chlorinated solvents in off-site groundwater, including chloroethane, 1,1-dichloroethane, 1,1-dichloroethene, tetrachloroethylene, toluene, 1,1,1-trichloroethane, trichloroethylene, and vinyl chloride. Tetrachloroethylene, trichloroethylene, and vinyl chloride were found at higher levels than originally found in 1985 and 1986, (see Table 5B in Appendix B)(43,10).

Municipal Water Supply

Three municipal wells, built by the MUA, are located approximately one half mile, three quarters of a mile, and a mile and a half south of the Acid Brook Area. Wells were tested in the fourth quarter of 1985 for volatile organics, metals, and other ions (10). Manganese was the only contaminant found slightly above comparison values. Municipal wells are tested routinely by MUA for bacteria, VOCs, heavy metals, pesticides, and herbicides. The MUA reports that water quality meets all state and federal standards (38). Recent water quality reports retrieved from the MUA confirms that no contaminants exceed ATSDR's comparison values (38).

Air in the Acid Brook Area

In July 1990, residential air sampling was conducted by Du Pont contractors to determine the presence of particulate-bound heavy metals in air. Sampling was completed by using low-flow pumps calibrated to obtain a flow rate of approximately three liters per minute. Investigators compared the sample tubes to blank tubes to ensure proper sampling. Residential areas with high levels of heavy metals in soils were chosen as monitoring stations. In addition, a busy roadway and residential area six blocks away were included. Screening for six primary metals was conducted. Mercury and selenium were not detected (9). The maximum barium level detected was lower than the comparison value for barium by a factor of eight. The maximum copper level was compared to an occupational standard for copper. Although that standard is set for a ten-hour worker exposure, copper is not a contaminant of concern, because the maximum concentration was about 53 times lower than the occupational standard. Lead was also not considered a contaminant of concern, because the maximum concentration was over 72 times lower than the National Ambient Air Quality Standard for lead. No comparison value was available for zinc; however, it is noted that the maximum concentration was less than measured background levels for the area, (see Table 8 in Appendix B for a summary of maximum concentrations and comparison values).

During remediation of yards and Acid Brook, dust monitoring is conducted by Du Pont. The monitor will alarm if ambient dust levels exceed half the state regulatory level for dust in air. Du Pont reports that this alarm has never gone off (44).

C. Quality Assurance and Quality Control (QA/QC)

All surface water monitoring reported by Du Pont followed EPA protocol. Fish, soil, and vegetation sampling procedures were described and are acceptable; however, no QA/QC reports were provided. Air sampling was consistent with the National Institute of Safety and Health (NIOSH) Method 7300. All analytical methods followed EPA methodology and are assumed to be adequate (9). NJDEPE evaluated the quality of the soil sample data provided by Du Pont in March 1991. "Several deficiencies were noted in the procedures used for the analysis of the data; for example, the failure to run any spikes or blanks of the samples." However, NJDEPE felt that the data were adequate for ATSDR to use in the development of a health consultation (2). Soil sample data are limited to that reported by Du Pont, so given NJDEPE's previous recommendation for the health consultation, ATSDR will use the available soil data for the public health assessment. No QA/QC data for groundwater or surface water data were reported; however, NJDEPE reports that past groundwater and surface water samples have been filtered for analyses. NJDEPE has recently required that Du Pont use unfiltered samples for analyses. NJDEPE reports that, overall, Du Pont has practiced adequate QA/QC in collection practices, and had only minor QA/QC problems with analyses practices (41).

D. Physical and Other Hazards

Physical Hazards

There are physical hazards on the PLW site, especially during remediation. Large bulldozers and other equipment were operating next to residential backyards. Access is restricted in this area by orange snow and chain link fences. No evidence of trespassing was noted during ATSDR site visits. Du Pont reports that they have not observed any trespassing.

Other physical hazards were noted by residents. One resident reported that following washing down of streets after removed soil was transported off site, the wet streets froze and created a driving hazard. Another resident complained about the large trucks driving through residential neighborhoods frequently.

Toxic Chemical Release Inventory

A search of the EPA Toxic Chemical Release Inventory (TRI) for PLW was conducted and the following information was obtained. No other industries reported releases in the area. Recorded below are the highest releases reported by PLW in the four year period of 1987 - 1990:

Summary of TRI Releases (lbs/year)

Contaminant	non-point air	point air	water	land
copper	0	5	750	5600
lead	30	60	1500	18000
1,1,1-TCA	7400	7400	7	0

Du Pont reports that they have modified processes so that water may be used, rather that 1,1,1-TCA (43).

PATHWAYS ANALYSES

To determine whether nearby residents are exposed to contaminants migrating from the site, ATSDR analyzes the environmental and human components that lead to human exposure. This pathways analysis consists of five elements: (1) a **source** of contamination; (2) transport through an **environmental medium;** (3) a **point of human exposure**; (4) **route of human exposure**, and (5) an **exposed population**. When these five elements are present simultaneously, they form an exposure pathway.

ATSDR classifies exposure pathways into three groups: (1) "**completed pathways**," that is, those in which exposure has occurred, is occurring, or will occur; (2) "**potential pathways**," that is, those in which exposure might have occurred, may be occurring, or may yet occur, and (3) "**eliminated pathways**," that is, those that can be eliminated from further analysis because one of the five elements is missing and will never be present, or in which no contaminants of concern can be identified. A summary of all the pathways for the Acid Brook Site and the contaminants of concern are summarized in Appendix B, Table 9.

A. Completed Exposure Pathways

Residential Surface Soil Pathways

Past and current exposures to lead and mercury contamination in residential surface soils in the Acid Brook Area have occurred for children or adults who work or play in these soils. Future exposures are also possible until remediation of the Acid Brook Area is completed.

PLW identified over 100 potential waste disposal areas on site (4). Migration of wastes from PLW disposal areas into the Acid Brook Area most likely occurred via Acid Brook. Acid Brook Area residences with contaminated surface soils generally correlate with the 100-year flood plain for Acid Brook. Therefore, periodic flooding in past years probably transported and deposited contamination from Acid Brook banks into residential yards (3). Currently, soil monitoring indicates that elevated levels of lead and mercury exist up to 60 inches below surface in the Acid Brook Area (see Figure 2 in Appendix A) (9); however, the highest levels are found at the surface. Since that is the most likely point of exposure, exposure assessment for that pathway will focus on surface soils.

Lead and mercury are both known to persist in soils for long periods of time, since both stick to dirt particles (23,25). Migration of contaminated soils to ambient air in the form of dust is possible, although given the moist climate and heavy vegetation, that is unlikely to be significant at this site. Elemental mercury forms mercury vapor at room temperature; however, the mercury found in the soil is not elemental, thus migration of mercury from soil to air is not a likely pathway (25).

Residential surface soil lead levels were highly variable, ranging from non-detect (the levels were so low the instruments could not measure the level) to 62,000 mg/kg. Three residential properties had soil lead concentration in excess of 10,000 mg/kg (2). Remediation levels for the Acid Brook Area were set at 250 mg/kg lead in soil, which is a commonly used clean-up level for lead in many areas of the country. NJDEPE proposed changing the level to 100 mg/kg lead in soil, but this has not been finalized, and may be subject to change (46). However, past chronic exposures to lead contaminated surface soils via ingestion represent a significant exposure pathway.

For lead- and mercury-contaminated residential yards, soil ingestion is the most significant route of exposure, especially for children between the ages of one and six. Although incidental soil ingestion occurs at any age, children under the age of six exhibit greater hand to mouth activity, and may ingest up to 200 mg soil per day. Infants (children less than one year old) may ingest 50 - 100 mg per day. Children who exhibit pica behavior (the tendency to eat non-food items such as dirt) are at special risk since they may ingest up to 5000 mg soil/day (16). Children playing in areas of poor grass cover may also be more exposed than children who play in areas with good grass cover. Grass cover in the Acid Brook Area yards was somewhat variable, although the yards generally had good grass cover. Adults at higher risk for exposure to contaminated soils are those that remain at home or in the community during the day (rather than going to a place of work), and those who garden or frequently work outdoors. Adults who smoke are also at increased risk, because of increased hand-to-mouth activity.

Exposure to elevated soil levels of other heavy metals via ingestion likely occurred. Elevated levels of barium, copper, selenium, and zinc were detected in soils near Acid Brook, although levels were not elevated to the same degree as mercury and lead. The data provided for these contaminants did not distinguish between residential and nonresidential soils (3).

<u>Acid Brook Surface Soil/Sediment Pathway</u>

In areas around Acid Brook and next to yards, past and present exposures to elevated levels of heavy metals in surface soils via ingestion have occurred, and may continue to occur in the future until remediation is completed. Incidental ingestion of soil by children is probable during play through normal hand-to-mouth activities (17). Children have been observed playing in and around Acid Brook, despite posted warning signs and health advisories (2).

Soil sampling results from nonresidential areas of Acid Brook showed the most severe heavy metal contamination. Although quite variable, lead and mercury soil levels were as high as 119,000 mg/kg and 8060 mg/kg, respectively (9). The widespread distribution of lead and mercury soil contamination around the Acid Brook Area (discussed in the previous section) indicates that exposures to elevated levels of mercury and lead were highly probable whenever children played outdoors. Elevated levels of barium, copper, selenium, and zinc were also detected.

Since this area of contamination is not located directly on residential properties, chronic exposures to nonresidential Acid Brook surface soils would not be expected. However, children who occasionally play in and around Acid Brook have been exposed to elevated levels of heavy metals in the soil on an acute or intermediate basis. Parents report that children have indeed played in these areas, especially the field next to the north end of Acid Brook, and in the brook itself. ATSDR observed toys and bike tracks along the banks of Acid Brook during the site visit.

Acid Brook Area surface soil exposures are not expected in the future, because the entire area is being remediated with clean soils. Therefore, this is a past completed exposure pathway, and will be considered a completed exposure pathway until remediation is completed.

Garden Soil and Vegetable Pathway

Exposure via ingestion to elevated residential garden soil levels of lead has occurred in the past, and may continue to occur until remediation takes place. Garden soil lead levels detected during monitoring ranged from 266 - 4120 mg/kg (9). Incidental ingestion of soil is probable during normal gardening activities, although the amount of soil ingested is difficult to estimate and likely to be very individualized. Other heavy metals (copper and zinc) were also slightly elevated above background soil levels expected for the area (9).

Uptake of heavy metals into garden produce may be possible, although in the case of lead, uptake is highly unlikely. Contamination of garden produce is more likely through deposition of lead contaminated soils on the surface of vegetation. Uptake and bioaccumulation of other heavy metals in garden produce is possible, too; however, results of testing of garden produce (dark green, leafy vegetables and tomatoes) in the Acid Brook Area found only low levels of barium, copper, and zinc.

Surface Water - Acid Brook

Past exposures to elevated levels of lead and mercury in Acid Brook surface water have occurred. Continued current and future exposures are possible until remediation is completed. Children have been observed wading and playing in Acid Brook in areas of known surface water contamination in the past, despite posted warning signs and health advisories (2). Incidental ingestion of Acid Brook surface water by children is possible during recreation (17). Surface water exposure pathways for Pompton Lakes, Pequannok River, and Wanaque River have been eliminated since the level of contamination in these surface waters does not exceed comparison values.

Acid Brook surface water was analyzed for six heavy metals; however, only lead and mercury were slightly elevated above EPA standards (9). PLW is the likely source of Acid Brook heavy metal contamination. Acid Brook originates north of PLW, flows directly through the PLW site, and discharges into Pompton Lake (1). Lead and mercury contamination on site probably migrated off site into Acid Brook via the plant stream. However, mercury, and especially lead, are heavy molecules that are prone to settling into sediments rather than remaining suspended in surface water (19). These physical properties may explain why soil and sediment contamination is much more severe than surface water contamination.

NJDEPE reports that Du Pont continues to institute interim measures to eliminate potential sources of recontamination downstream. Future exposures to elevated levels of heavy metals in Acid Brook are unlikely once remediation is completed (37).

Chronic exposures to Acid Brook surface water would not be expected because surface water exposures would vary seasonally. However, children who occasionally play in and around Acid Brook may have been intermittently exposed via ingestion of Acid Brook water containing elevated levels of lead and mercury.

Private Well Pathways

Residents who drank water from contaminated private wells were chronically exposed to contaminants in those wells (see Table 5 in Appendix B). The actual length of exposure to those contaminants depends on when the off-site groundwater became contaminated, which is unknown at this time. Ingestion exposures ceased in 1985, when private well numbers one and seven were connected to the municipal water supply (10).

Du Pont suspects that groundwater contamination is not the result of any single, identifiable source and suspects multiple sources (4). Du Pont previously stated that solvent contamination of groundwater apparently resulted from operations dating from World Wars I and II (38); however, they now believe that the solvent contamination occurred later (43). Groundwater contamination is downgradient from PLW with only a rural, sparsely populated area upgradient from the area of contamination, indicating that PLW was probably the most significant source of solvent contamination (1). In addition, several of the chlorinated solvents detected in on-site groundwater were also detected off-site in private wells and monitoring wells. These solvents include tetra and trichloroethylene, 1,1,1-trichloroethylene, 1,1-dichloroethane, 1,1-dichloroethylene, and vinyl chloride.

On-site groundwater solvent contamination probably resulted from leaching of surface contamination at the PLW site. Solvents identified in private wells are highly mobile in soil, and therefore, are prone to leaching to groundwater. The aquifer beneath the site is unconfined, which means there are no hydraulic barriers between the site surface and the shallow aquifer. On-site surface contamination can easily filter through the soil and into the groundwater. Many of the solvents found will persist for long periods of time in groundwater, especially trichloroethylene (TCE) and tetrachloroethylene (PCE) (19).

Investigations in 1984 by Du Pont identified contamination in the shallow, unconfined aquifer directly below PLW. Contamination consisted primarily of elevated levels of solvents at the south end of the PLW property, and heavy metals under the Shooting Pond. In 1985, Du Pont completed a hydrogeologic investigation and found that the aquifer generally flows in a southeasterly direction. Later, Du Pont monitored private wells in residential areas southeast of PLW, and detected elevated levels of solvents and heavy metals (4).

Twenty-eight private wells were tested, and some were found to be contaminated with solvents and heavy metals. Very few exposure data were available to ATSDR; however, community members report that some private well water was not used for household consumption, but rather for watering lawns or filling pools. Du Pont reports that two of the private wells tested were used for drinking water, and those were private wells numbers one and seven (38,43). The total exposed population is estimated to be approximately 5 people (43).

Exposure to elevated levels of solvents occurred via ingestion, inhalation, and skin contact. Since some solvents tend to volatilize into the air from contaminated water during showers and baths, persons become exposed to solvents as they breathe the air in their bathrooms. In addition, solvents tend to absorb through the skin during showers and baths, thus increasing exposure. Absorption of solvents while swimming in pools filled with private well water is also possible, although unlikely to be significant, since these solvents will volatilize from an open pool. Generally, ingestion of contaminated drinking water is the most significant exposure route for both solvents and heavy metals (19).

Food Chain - Fish

Past exposure pathways were possible, and current and future exposure pathways are possible through consumption of contaminated fish caught in Acid Brook, Pompton Lake, Wanaque River, and Pequannok River.

The source of contamination evident in fish is difficult to pinpoint. Pompton Lake is fed by rivers that flow throughout the county, and both the Wanaque and Pequannok rivers also meander for long distances (1). Fish could have been exposed to contamination at various points and then migrated into Pompton Lakes. This theory is supported by the presence of various pesticides in fish tissue, and the fact that PLW operations generally did not involve the use of pesticides (9). However, it is possible that PLW has contributed to mercury contamination of fish, especially those found in Acid Brook.

The form of mercury in fish is predominantly methylmercury, which occurs because mercury in the water ecosystem is converted to methylmercury by bacteria. As smaller animals that are contaminated with methylmercury are eaten by larger animals, methylmercury moves up the food chain. This is called bioaccumulation. Thus, those residents that have consumed fish contaminated with methylmercury and other contaminants have bioaccumulated methylmercury.

However, since many of these substances are suspected carcinogens and are known to bioconcentrate in fish tissue (especially heptachlor, lindane, and PCBs), heavy metal and pesticide contamination of fish tissue will be discussed further in the Public Health Implications Section (19).

NJDEPE reports that local residents have been frequently observed fishing in all four water bodies. In addition, subsistence fishing may have taken place, resulting in a chronic exposure to elevated levels of contaminants in fish, assuming that fish are consumed regularly. No fishing signs were posted in May, 1991 and reposted in 1993; however, the Fish and Game Commission continues to stock lake for fishing. Residents report people still continue to fish in the area, and ATSDR staff observed a resident fishing during their site visit. NJDEPE plans to coordinate with the State Game and Fish Commission on this advisory (46).

B. Potential Exposure Pathways

Indoor Dust Pathway

Heavy metal contamination of residential soils has been identified. The potential exists for outdoor soil particles with heavy metal contamination bound to them to have migrated indoors through various routes, such as through tracking indoors on shoes. Chronic exposure to heavy metal-contaminated indoor dusts via ingestion and inhalation is possible, although at the time of this writing there are no monitoring data to substantiate the possibility of exposure through this pathway.

In the case of lead, recent research has shown that outdoor soil contamination may be an important source of indoor dust contamination (33), although current research is limited. Contaminated residential soils may be migrating indoors through transportation on shoes and clothing, or seeping into houses through doors and windows. Several studies have shown a relationship between workplace dust inadvertently brought home by lead battery plant workers, household contamination, and elevated blood lead levels in children (32). These studies support the theory that contaminated soils may be tracked in by children and adults from yards after playing or working in the yards, and may result in significant indoor dust contamination. Du Pont is cleaning all the basements on contaminated properties and conducting post cleaning sampling to ensure that no future exposures to indoor lead or mercury contaminated dust occur (43, 46). The extent of past indoor contaminated dust exposure is unknown at this time.

Indoor dust exposure has also been identified as a significant exposure point, since dust can either be inhaled or ingested. Results of recent lead exposure studies have found significant correlations between indoor lead contaminated dusts and lead on the hands of children (32). Some studies have identified indoor lead-contaminated dusts as one of the most significant sources of exposure for children (31,32). However, without historical monitoring data, it is impossible to fully assess the significance of the indoor dust pathway.

PLW Surface Water Pathway

Acute exposure via ingestion of and dermal contact with elevated levels of heavy metals and methylene chloride in the plant stream, lagoon, or Shooting Pond at PLW may have occurred. Future exposures are also possible until environmental remediation at PLW is completed. If children are gaining access to the site and playing around the plant stream, Shooting Pond, or the lagoon, incidental ingestion of contaminated surface water during play is possible. Workers may also incidentally ingest this surface water accidentally while working around these areas. However, the extent to which children or workers may have been exposed to PLW surface water is unknown, but Du Pont reports that they have found no evidence of trespassing. Currently, remedial workers have been provided with a health and safety plan for working on PLW remediation, and Du Pont reports that workers are complying with that plan. Residents report that the lagoon and shooting pond are a sufficient distance into the PLW property to make trespassing by children highly unlikely.

PLW Surface Soil Pathway

Workers and children trespassing may have had acute exposures via ingestion to elevated levels of mercury fulminate and lead containing compounds within the mercury fulminate area. Future exposures are also possible until remediation takes place. Children playing or employees noncompliant with the health and safety plan and who work in this area may incidentally ingest soils through normal hand-to-mouth activity. Access to this area is restricted, although trespassing is still possible through gates next to residential areas or by climbing the fence. The extent to which children may be exposed in these areas is unknown. Again, this pathway is probably unlikely since 24-hour security is enforced at the PLW property and workers have been in compliance with the worker safety plan (43).

PUBLIC HEALTH IMPLICATIONS

A. Toxicological Evaluations

The preceding section has indicated that exposure to contaminants has probably occurred (through several completed exposure pathways) for some people residing in the Pompton Lakes Works (PLW) area. Before residences using private well numbers one and seven were connected to city water supplies in 1985, exposure to low levels of several contaminants occurred through drinking water, most notably to chlorinated solvents. Other important pathways of exposure include exposure to metals (e.g., barium, copper, lead, and mercury) in soils in both the residential yards and the Acid Brook Area. In addition, people who regularly consume fish from the Wanaque River or from Acid Brook have probably been exposed to contaminants, mainly methylmercury. Contaminants were also found at levels of concern in surface water on the PLW property, in Acid Brook water, and in soil on the PLW property. However, those exposures would not be significant from a public health standpoint, unless Acid Brook water or PLW plant surface water were to be used as a source of drinking water or unless children were to wade there regularly.

The toxicological evaluations that follow are concerned with possible illness and disease in persons exposed to identified contaminants of concern. These evaluations are accomplished by estimating the amount (or dose) of those contaminants that a person might come into contact with on a daily basis. This estimated exposure dose is then compared to established health guidelines. People who are exposed for some crucial length of time to contaminants of concern at levels above established health guidelines are more likely to have associated illnesses or diseases.

Comparison values and health guidelines are developed for contaminants commonly found at hazardous waste sites, see Appendix C. Examples of health guidelines are the ATSDR Minimal Risk Level (MRL) and the EPA reference dose (RfD). When exposure (or dose) is below the MRL or RfD, then non-cancer health effects are unlikely to occur. MRLs are usually generated for each route of exposure (e.g., ingestion and inhalation), and for the length of exposure (i.e., 14 days or fewer for acute exposure; 15-364 days for intermediate exposure, and 365 days or more for chronic exposure). ATSDR presents many of those health guidelines in Toxicological Profiles, which also provide chemical-specific information on health effects, environmental transport, and human exposure. ATSDR Toxicological Profiles were consulted for the following toxicological evaluations.

Mercury and Lead

Lead and mercury are particularly toxic to children because those metals affect physiological systems important to children's development and maturation (23,25). Exposure to high levels of lead and mercury in soil can result in elevated concentrations in the blood and urine. Exposure of children and adults to mercury and lead has occurred through contact with soils. Exposure to methylmercury may also have occurred through the ingestion of contaminated fish.

In order to estimate possible exposures to residents, we assume that for residential soils and soils from the Acid Brook Area, adults ingest 50 mg of soil per day, children ingest 200 mg of soil per day, and children with pica behavior (excessive ingestion of non-food items) ingest 5000 mg soil per day. For consumption of fish, we assume that one 13-ounce fish meal per week (or up to 54 grams of fish per day) are consumed (subsistence fishing or regular fishing for nourishment would increase exposure several fold) (16). More than 80% of the mercury in freshwater fish occurs as methylmercury. Therefore, we will assume that the total mercury measurement for fish consists of methylmercury. Although information in human beings is limited, it is important to point out that inorganic mercury compounds are not readily absorbed in the gut after ingestion (less than 30%). On the other hand, organic mercury compounds, such as methylmercury, are readily absorbed (more than 80%) (25).

Assuming the exposure patterns described above, past exposure to lead and mercury of people residing in the PLW area may result in unfavorable health effects. Those health effects are more likely in children, especially children with pica behavior, who may be exposed to the high levels of lead and mercury found in soil in residential yards and/or soils in the Acid Brook Area. Adverse health effects are also possible, if fish contaminated with mercury from the Wanaque River or Acid Brook are consumed on a regular basis. Fish advisories and soil remediation activities that are currently in place or underway should limit current and future exposure to lead and mercury.

Mercury. At exposure levels above health guidelines, organic or inorganic mercury can damage the brain, liver, kidneys, and developing fetuses. Chronic exposure to high levels of inorganic mercury (as may be possible with pica behavior seen in some children) can cause loss of appetite, abdominal cramps, damage to the stomach lining, and liver disease. Over time, the mercury concentrates in the kidneys, resulting in reduced kidney function (e.g., degeneration of the convoluted tubules, reduced filtration, and edema). Neurologic signs may be irreversible, and may include tremors, insomnia, decreased motor function, decreased muscular reflexes, headaches, lowering of peripheral nerve conduction velocities, and loss of short-term memory (25).

Methylmercury. The major toxicity of chronic organic mercury exposure is degeneration of nerve cells in the brain. This nerve damage can be observed as tingling of extremities, tunnel and impaired vision, altered senses of taste, hearing, and smell, slurred speech, muscle weakness and incoordination, irritability, memory loss, and depression. Kidney damage may result from long-term, chronic exposure to organic mercury, and could include tubular necrosis, fibrosis, and inflammation. Organic mercury can also be toxic to a developing fetus, affecting basic central nervous system development, possibly resulting in a reduction of fetal survival rates. In addition, postnatal development of the eyes can be impaired, as can learning ability and hearing (25).

Lead. Lead primarily affects the peripheral and central nervous systems, blood cells, and vitamin D and calcium metabolism. Effects of lead on the nervous system include decreased nerve conduction speeds, lowered IQ, and lowered coordination and motor skills. At high lead exposures, kidney damage can occur, with proximal tubular impairment, leading to a gout-like condition. Lead affects reproduction by reducing sperm counts and motility. Lead crosses the placenta, possibly increasing the number of miscarriages and stillbirths, and affects the viability and development of the fetus. Lead affects the blood, producing anemia, hypertension, and reduced hemoglobin synthesis. It also affects vitamin D hormonal activities regulating calcium storage and mobilization. During times of stress (e.g., sudden weight loss or pregnancy) lead that has accumulated in bones over time can be released into the blood stream (23).

It is critical to point out that the development of toxicity and its effects depend upon the amount or dose received, the duration of exposure (acute, intermediate or chronic), and individual variation. The severe toxic effects from exposure to mercury, methylmercury, and lead described above are only relevant for the most elevated exposure scenarios, as is possible in children who may consume unusually large amounts of soil (pica behavior). Because Acid Brook area soil was extensively contaminated with elevated levels of mercury and lead, serious concern for the most susceptible group in the affected population is warranted. Finally, there is growing public health concern that chronic low-level exposure to lead and mercury could have significant behavioral effects on children, such as delayed or impaired learning (23).

Chlorinated Solvents

Exposure to chlorinated solvents through inhalation, skin contact, and ingestion has occurred in PLW residents who used contaminated private well water before 1989. For drinking water ingestion, exposure to those chlorinated solvents (i.e., 1,1-dichloroethylene, 1,2-trans-dichloroethylene, trichloroethane, trichloroethylene, tetrachloroethylene, and vinyl chloride) has occurred at levels above health guidelines. Several other chlorinated compounds were found in the private well samples, but at levels below public health concern.

Tables 5A and 5B (in Appendix B) present the levels of contaminants found in residential private wells. The results for private well 1 are highlighted because it was the only well that appeared to be contaminated with vinyl chloride. Although private well 1 is clearly the most severely affected, it is evident from Table 5B that several private wells are contaminated with a number of solvents. In fact, trichloroethane, trichloroethylene, and tetrachloroethylene were detected at elevated levels in several of the wells tested.

In general, the levels of chlorinated solvents found in the private wells do not appear to be of public health concern for short-term (14 days or fewer) ingestion exposure, but this may not be the case for intermediate (15-364 days) or long-term (365 days or more) ingestion exposures. Exposure to relatively high doses of chlorinated solvents (ethanes and ethenes) has been shown to have adverse effects on the central nervous system, liver, kidneys, skin, and on reproduction (26, 27, 28, 29). It should be noted that intermediate and long-term exposures are only a concern for the ingestion exposure route, exposures through showering and washing with this contaminated water are only of public health concern if these exposures are concurrent with a drinking water exposure (45).

Tetrachloroethylene and 1,1-dichloroethylene are currently classified by the EPA as probable and possible human carcinogens, respectively. These classifications indicate there is evidence in studies with rats and mice that the compounds cause leukemia (cancer of the white blood cells) and liver and kidney cancer, but evidence in humans is inadequate or not yet available. Based on the available evidence in animal studies, and if it is assumed that water from the contaminated private wells was consumed for 10-20 years, there may be a low to moderate increased risk of cancer for residents whose drinking water was supplied by the contaminated private wells (27, 28).

Vinyl chloride, which is classified by the EPA as a known human carcinogen, was found at a relatively high level in one private well. The liver appears to be the most sensitive organ to the long- and short-term effects of vinyl chloride. Vinyl chloride has received special attention because of the convincing evidence that chronic exposure of both human workers and animals results in a rare liver cancer (i.e., angiosarcoma). Chronic consumption of water contaminated with vinyl chloride and other solvents from this specific well could result in a significant elevated risk of cancer (29).

<u>Heavy Metals</u>

Some private well samples contained somewhat elevated levels of copper and zinc, and one private well sample contained cadmium. At low levels, copper and zinc are essential elements in the human diet. The levels of zinc and copper in private wells were higher than those typically expected in drinking water, but were not above levels of public health concern (22, 30). On the other hand, cadmium is not known to have any beneficial nutritional effects, and the level in the one well (0.29 mg/L) exceeded the ATSDR chronic oral MRL for cadmium (0.0002 mg/kg/day) based on dose calculations. Long-term exposure to cadmium at this level could produce kidney damage that, although not life threatening, could lead to some health problems (e.g., kidney stone formation) (21).

B. Health Outcome Data Evaluation

UMDNJ has reported summary results (39,40) of the biological investigation for a total of 65 adult and 22 child (less than 12 years) blood and urine samples. All samples were collected and analyzed according to standard laboratory practices by the Roche Diagnostic Laboratory.

Screening for Lead

Blood lead (PbB) is considered a primary measure of current lead exposure. PbB is not an accurate measure of cumulative, chronic- duration lead exposure, half of the lead in human blood will be gone 28-36 days after exposure (23). All PbB levels reported by UMDNJ were below 15 micrograms per deciliter (μg/dL) with the exception of one individual with a value of 19 μg/dL. The average PbB for 65 adults was 6.7 μg/dL with a standard deviation of 3.9 μg/dl (i.e. plus or minus about 4 μg/dL). The average PbB for 22 children was 6.04 μg/dL with a standard deviation of 3.44 μg/dL. A standard deviation is the square root of the variance of a given set of values. Four of the PbB values in children were above 10 μg/dL but none exceeded 14 μg/dL. According to the guidance provided in the Centers for Disease Control document," Preventing Lead Poisoning in Young Children", no additional testing is needed if a blood lead level below 10 μg/dL is found (32). However, cognitive and developmental deficits, a low Intelligence Quotient (IQ), and an increase in blood pressure have been reported at blood lead levels of 6 to 35 μg/dL in populations who have had long-term exposures of more than a year. Two blood lead screenings, within a period of six months are required to make a conclusion regarding the possibility of adverse health effects in the screened population. Current Centers for Disease Control (CDC) guidelines recommend that children with PbB values in the range of 10-14 μg/dL be screened more frequently (32).

Review of erythrocyte protoporphyrin (EP) levels indicated that all levels seen in children and adults in Acid Brook were in the normal range. The only exception was one elderly woman with an EP level of 59 μg/dL. The EP level reflects the inhibitory effect of lead on enzymes that convert protoporphyrin to heme and ultimately to hemoglobin, which is a part of the red blood cells. In other words, the EP test is not a direct measure of blood lead content, but a measure of an effect that lead has on red blood cells. Only 23 adults and 12 children were able to provide twenty-four-hour urine samples for estimation of urinary lead. The reported mean lead excretion for adults was 13.1 μg/24 hours, and for children 13.8 μg/24 hours. The maximum reported value for an adult was 29 μg/24 hours, and for a child it was 44 μg/24 hours. That child had a PbB of 11 μg/dL. Urinary lead shows the ability of the body to excrete lead, and is not a measure of lead exposure. Ninety-five percent of the lead in the body is stored in the bones and is mobilized periodically. Lead is released from the bones and then excreted in the urine. Hence, we cannot determine if the lead in urine came from recent exposure or from the bones. Additionally, there are no guidelines for interpreting the values.

The screening is indicative of current exposures to lead up to a period of six weeks. Blood lead testing occurred between April, 1990 and August, 1992. Sixty-two percent of these tests occurred during colder months (October to March) (44). Screening performed during these months may not represent exposures which are likely to occur during the summer months and therefore maybe an underestimation. In addition, this self-selected volunteer population is not representative of the entire community, and a large percentage of these tests happened several months after the advisory, so residents may have already taken action to mitigate exposures.

Screening for Mercury

Summary results for blood mercury (B-Hg) and urinary mercury (U-Hg) were reported for 79 members (including adults and children) of the Pompton Lakes community. Results for children were not reported separately.

Urinary mercury results:

In non-occupationally exposed individuals, a value above 20 μg/L of U-Hg is evidence of excessive exposure, and for occupational exposure 50 μg/L of U-Hg is considered excessive. Urinary mercury was in the 0-6 μg/L (low-normal) range for all individuals including those reported to have above-average B-Hg.

Studies have reported an increased prevalence of slight tremor and of biological signs of renal dysfunction in workers excreting more than 50 μg/L of U-Hg (42). The screened urinary mercury levels in this population do not indicate current exposure. In addition, an urinary mercury level by itself is not considered an useful index of exposure to environmental mercury.

Blood mercury results:

The average B-Hg was 0.29 μg/dL with a standard deviation of 0.59 μg/dl. Levels of B-Hg in the range of 0-2 μg/dL are considered normal(42). Levels above 2.8 μg/dL are considered significant by the NJDOH, and indicate repeated testing and follow up.

Of the 79 people screened, 3 had B-Hg levels above the normal ranges. One person had themselves retested within 6 weeks and the results were < 2 μg/dL, the other two declined to have repeat testing. Several studies have indicated that on a group basis there is a correlation between the intensity of recent exposure to mercury vapor and the concentration of mercury in blood, urine, and saliva. Such a relationship holds only when exposure lasts for at least for one year (42). We have no quantitative information on the duration of exposure of this screened population, and none on the intensity of exposure to mercury. With urinary mercury results indicating no evidence of current exposure and a repeat B-Hg level for the individual who had a B-Hg level greater than 3 μg/dL showing B-Hg level less than 2 μg/dL upon repeat testing, it is difficult to make conclusions regarding possible health effects at the B-Hg levels observed in this population. Please refer to the toxicological evaluation section for more information on the toxicity of mercury.

Birth Defects Registry

Birth defects information for the Acid Brook Area for the years 1986 through 1989 has been requested from the New Jersey State Birth Defects Registry. Data will be reviewed and incorporated into the public health assessment, as soon as they are available.

Learning Disabilities

The Lenox Elementary School was targeted to assess current rates of learning disabilities since it serves many of the children in the Acid Brook area, and elementary-age children are highly vulnerable to health effects related to lead exposure. The Director of Special Services for Lenox Elementary School reported that approximately nine percent of the student population receives special education services, which is below the district average of 11.8% and the federal average of 12% (32). The most common classification of learning disabilities at the Lenox school are defined as being perceptually impaired and neurologically impaired.

Learning disabilities have been associated with exposure to both methylmercury and lead during fetal development. Mercury exposure can also result in other neurologic effects. Even though the percentage of the student population receiving special education services is below both the district and federal average, at this time and with inadequate data, we are unable to determine the cause of the existing learning disabilities in Lenox Elementary School, or whether rates of learning disabilities have historically been elevated.

C. Community Health Concerns Evaluation

We have addressed each of the community concerns about health as follows:

1. Citizens of Pompton Lake are concerned about the availability of physicians for monitoring lead and mercury exposures during remediation of the citizens yards.

Du Pont has a program to provide biomonitoring for residents concerned about environmental exposures to contaminants during remediation through the New Jersey University of Medicine and Dentistry. ATSDR encourages residents to take advantage of those services, or consult their family physician. Any physician in the area who needs additional information about hazardous substances discussed in this public health assessment may contact ATSDR for further information.

2. Citizens perceive an excess of unexplained illnesses in the community.

ATSDR is unable to evaluate this concern until cancer and registry data are provided and analyzed. ATSDR will continue to work with the New Jersey Department of Health to better evaluate this concern, (see the Public Health Action Plan in the Recommendation Section).

3. Citizens worry that their children are not doing well in school and want their children's elementary school health unit educated for signs of learning disabilities.

The Pompton Lakes School System employs a specialist in learning disabilities who thoroughly evaluates all children referred to him by using the most recent methods of assessing learning disabilities. Teachers are trained and kept up-to-date on new information regarding assessment of learning disabilities. ATSDR will inform the school specialist of any new findings on the relationship between environmental health and learning disabilities through the Division of Health Education.

4. Citizens are concerned about lead contamination in the school water supply. They want the school water tested for lead.

The school receives its water from the Pompton Lakes municipal water supply. This water supply is not connected with the contaminated groundwater at PLW. The municipal water supply meets all current federal and state standards for lead (.015 mg/L, EPA Action Level).

The Pompton Lakes Borough Municipal Utilities Authority (MUA) reports that the Lenox Elementary School was last tested at five locations in 1991. Any citizen still concerned about the lead content of school water can request assistance from ATSDR in arranging to have the school water tested. The school principal of Lenox Elementary reports that custodians run all tap water for ten minutes every morning, as a precautionary measure to flush out any residual lead that might leach into the water overnight or over the weekend.

5. Citizens are concerned about exposure to mercury-contaminated soils. They want cleanup levels for mercury to be lower, more surface samples to be taken, and more biomonitoring to be done.

Controversy surrounds cleanup levels for lead and mercury for this site. Part of this controversy is due to a proposed change in the clean up level for lead in soil from 250 mg/kg to 100 mg/kg by the NJDEPE. Setting clean-up levels is difficult for lead for at least two reasons. First, natural soils in the eastern United States have lead levels that range between

< 10 mg/kg to 300 mg/kg (16). Second, the element of lead serves no useful purpose in the human diet and may be harmful to children even at relatively low levels (10 ug/dl in blood) (32). In other words, the more lead removed from the environment, the better protection for public health.

Both levels of 250 and 100 mg/kg fall within the range of lead levels naturally occurring in soils, and both are unlikely to present a health hazard in residential areas. Of course, the advantage of cleaning up to 100 mg/kg of lead in soil is that, at least theoretically, risks to public health are further minimized. The disadvantage is that it also increases the chance for confusion as to whether this level of lead is naturally occurring or the result of pollution, and this can cause further confusion in determining the boundaries for clean-up activities. ATSDR will stay in contact with NJDEPE about the clean-up level for lead in soil for this site. Residents of the Acid Brook Area should continue to maintain good grass cover to minimize lead exposure as they have in the past.

ATSDR has concurred with a mercury cleanup level of 14 mg/kg. A previous ATSDR consultation addressed concerns about the appropriate cleanup levels for mercury (2).

In regards to the number of surface soil samples taken, it is always helpful to have as much environmental data as possible to best characterize an area. ATSDR received enough data on the contaminated media to make public health conclusions and recommendations for this site, see the Public Health Action Plan in the Recommendations Section for further information about follow-up activities to address health concerns).

6. NJDOH relayed concerns from residents about the effect that exposure to site contaminants might have on residents' health. Residents are specifically concerned about:

- **a. the current health status of all of the residents in the affected area.**
- **b. lead and mercury levels of residents, and about assuring treatment where appropriate.**
- **c. illnesses or deaths that may have resulted from chronic exposures to environmental contamination (13).**

The current and past health status of community members cannot be fully evaluated at this time. ATSDR will continue to collaborate with the New Jersey Department of Health in studying rates of disease among Acid Brook Area residents, see the Public Health Action Plan in the Recommendations Section.

7. The Mayor of Pompton Lakes said that people are concerned that increased incidence of multiple sclerosis, learning disabilities, and blood diseases such as anemia is the result of exposure to chemicals at the site (14).

The Lenox Elementary School reports that the rate of learning disabilities is currently about 9% of the school population, which is below district and federal averages. However, even though the percentage of student population receiving special education services is below both the district and federal averages, at this time and with inadequate data, we are unable to determine the cause of the existing percentage of learning disabilities. However, learning problems have been associated with exposure to lead contaminated soil at levels similar to those found in the Acid Brook area. Any associated illness or disease depends on the extent to which exposures occurred, and for how long. For more information, see the Health Outcome Data Evaluation and Toxicological Evaluations Sections of this document. For follow-up activities related to this concern, see the Public Health Action Plan in the Recommendation Section.

ATSDR does not have data or information on rates of blood diseases or multiple sclerosis for Pompton Lakes; however, current information has never indicated that the contaminants at this site could cause leukemia or multiple sclerosis in humans. This concern can not be addressed further without information on these rates.

8. Several residents expressed concern regarding increased rates of some kinds of cancer (breast, interstitial, brain) and learning problems (12).

During the public health assessment process, ATSDR investigated the percentage of children with learning disabilities at Lenox Elementary, and found that, at present, the percentage is lower than the district and federal level as stated in response to Question 7. However, ATSDR recognizes that this information is a preliminary assessment of the health status of this community, and does not consider historical information. ATSDR recommended that a health study is needed, and NJDOH will be following up on this recommendation in the future.

As far as increased rates of cancer, it is possible that there is an increased risk of cancer related to exposure to certain chlorinated solvents found in private well water, depending on the extent to which exposure occurred, and for how long. Again, ATSDR has recommended a health study to investigate health outcomes in this community. For more information, see the Toxicological Evaluations and Recommendations Section.

CONCLUSIONS

1. The E.I. Du Pont, Pompton Lake Works Site is a public health hazard because of human exposure to contaminants in soil, sediment, surface water, groundwater and fish in the Acid Brook area. Remedial efforts currently underway are designed to reduce or eliminate the public health hazard.

2. There are or have been completed exposure pathways via ingestion of elevated levels of lead and mercury in Acid Brook Area soils and sediments. Future exposures are possible until remediation is completed. Ingestion of lead and mercury at levels found in soils at this site could result in reduced kidney function, gastrointestinal problems, neurological, reproductive, and hematological effects.

3. There have been completed past exposure pathways, via ingestion, to elevated levels of metals and solvents in Acid Brook Area private wells. Future exposures are possible if residents use their private well water for drinking water. Past ingestion exposures to solvents at levels found in private well water could adversely influence the normal function of the liver, kidney, central nervous system and skin. In addition, there is a low to moderate increased risk of cancer if long-term ingestion of contaminated well water occurred.

4. Workers and trespassers may have been exposed to mercury and other metals found in soils and surface water on PLW property via ingestion. Exposure to mercury and other contamination on PLW property could result in reduced kidney function, gastrointestinal problems, neurological, reproductive, and hematological effects. However, exposures are unlikely since workers currently have a health and safety plan for remediation, and access to the PLW property is monitored continuously.

5. Potential pathways of exposure to lead- and mercury-contaminated house dust existed via ingestion and inhalation. Lead and mercury found at high levels in outdoor soils may have migrated indoors.

6. Environmental monitoring data from Pompton Lakes, Wanaque River, and Pequannok River indicate that exposures to chemical contamination in these surface waters via ingestion does not present a public health hazard.

7. Vegetable tissue sampling data from vegetables grown in the Acid Brook Area indicate that consumption of these vegetable does not present a public health hazard. Residents are advised to clean vegetables thoroughly before consumption.

8. Off-site air monitoring data indicate that lead in the air is not at elevated levels.

9. Fish tissue sampling results from fish taken from Acid Brook, Wanaque River, Pequannok River, and Pompton Lake indicate that consumption of fish from Acid Brook and Wanaque River may present a public health hazard. Data on fish caught from the Pequannok River and Pompton Lake do not indicate a public health hazard.

10. Monitoring data for the municipal water supply for Pompton Lakes indicate that use and consumption of municipal water do not present a public health hazard.

11. A plume of groundwater contamination exists under the PLW property and extends into residential areas. Contaminated groundwater beneath PLW and Acid Brook is not hydrogeologically connected to groundwater used for the municipal water supply. It is unlikely that the plume of contamination will effect the municipal water supply.

12. The primary sources of Acid Brook Area lead and mercury contamination still exist on the PLW property. Interim remediation of those areas is sufficient to curb future migration of contamination to the Acid Brook Area. PLW plans full remediation of the PLW property.

13. The health outcome data provided on medical testing are inadequate to evaluate the relationship of environmental contamination to body burden of lead and mercury from the site, particularly in children.

14. The health outcome data on learning disabilities are inadequate to evaluate the relationship between lead and mercury exposure and neurological health effects.

RECOMMENDATIONS

A. Recommendations and the Health Activities Recommendations Panel (HARP) Statement

Cease/Reduce Exposure Recommendations

1. Maintain existing health advisories for Acid Brook, Wanaque River, and Pompton Lake until monitoring data indicate that exposures to soils, surface water, and fish are not a public health threat. Maintain restricted access to areas currently or awaiting remediation.

2. Ensure that all private wells downgradient of PLW are not being used as a source of drinking water, and that alternative water supplies have been provided.

3. Continue to maintain and enforce access restriction to PLW property until remediation is completed. Continue to encourage workers at PLW to comply with health and safety plan.

Site and Exposure Characterization Recommendations

1. Continue to monitor groundwater at and downgradient of PLW.

2. Conduct a community health investigation (including exposure histories and medical histories) for Acid Brook Residents to better evaluate possible health outcomes. A community health investigation is a medical or epidemiologic evaluation of descriptive health information about a population in order to evaluate and determine health concerns and to assess the likelihood that those concerns may be linked to exposure to hazardous substances.

HARP Statement

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended, ATSDR and the State of New Jersey evaluated the E. I. Du Pont Site for appropriate health follow-up activities. ATSDR's HARP offers the following recommendations:

> The data and information developed in the E.I. Du Pont Petitioned Public Health Assessment have been evaluated by the Health Activities Recommendation Panel for appropriate public health actions. Exposures to contaminants from E.I. Du Pont via contact with groundwater and soil (as discussed in this document), pose a public health threat and indicate the need for several follow-up actions. First, a community health investigation is recommended to evaluate health concerns and their linkage to exposure to lead and mercury contaminated soils. The investigation may include neurobehavioral testing of children. Second, the panel recommends a case series to evaluate the health status of those few residents who consumed contaminated groundwater. Third, the exposed population and their local health care providers may need assistance in understanding the public health implications of exposure to soil and groundwater contamination. Therefore, the panel recommends conducting community health and health professions education as health follow-up actions. Finally, the panel will inform the ATSDR Trichloroethylene Subregistry that residents have consumed groundwater contaminated with this chemical and should be considered for the Subregistry.

B. Public Health Actions

The Public Health Action Plan (PHAP) for the E.I. Du Pont site contains a description of actions to be taken by ATSDR and/or NJDOH at and in the vicinity of the site subsequent to the completion of this public health assessment. The purpose of the PHAP is to ensure that this public health assessment not only identifies public health hazards, but 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 on the part of ATSDR/NJDOH to follow up on this plan to ensure that it is implemented.

Actions Undertaken

E.I. Du Pont had offered biomonitoring of urine and blood for lead and mercury content for residents during remediation. Some community members have utilized this service. Some limitations exist when using this information as a measure of exposure as discussed in the public health implication section.

ATSDR has conducted community health education informally during past site visits and community meetings. ATSDR has been available to meet with concerned community members, and has addressed their questions as thoroughly as possible during these meetings.

ATSDR had also conducted health professions education in December, 1991 in response to a previous health consultation. Local health professionals were provided information about lead and mercury exposure.

ATSDR has conducted a public meeting and public availability session in June, 1993 as part of the public comment review process. NJDEPE and Du Pont also participated in the public availability meeting.

ATSDR contacted those homeowners in June, 1993, who may have consumed groundwater with chlorinated solvents south of Du Pont, but these homeowners did not desire any follow-up activities at this time.

Actions Planned

1. NJDOH will conduct additional health professions education for local health care providers as needed.

2. NJDOH is planning to conduct an exposure study for residents of the Acid Brook Area. The Acid Brook Area community will be notified as part of the planning process of the investigation.

3. NJDOH will continue providing community health education as needed and in conjunction with other public health activities.

4. ATSDR will coordinate with NJDOH to help address other public health issues as needed or if new data become available. Please contact Arthur Block, ATSDR Region II Representative at (212)264-7662 or Lynelle Neufer, ATSDR Environmental Health Scientist at (404)639-0600 for any additional concerns or questions regarding public health issues at this site.

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APPENDIX A - FIGURES

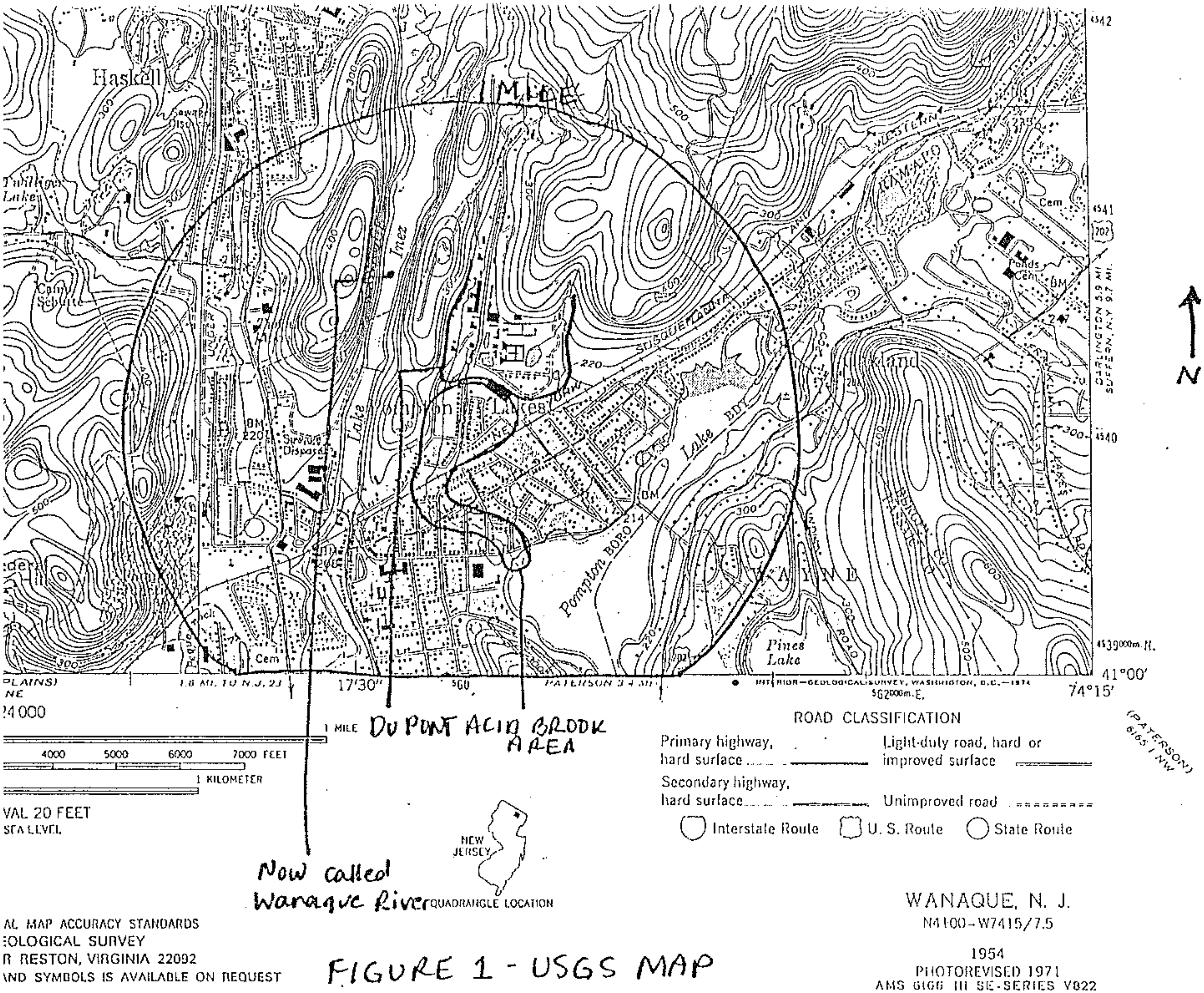
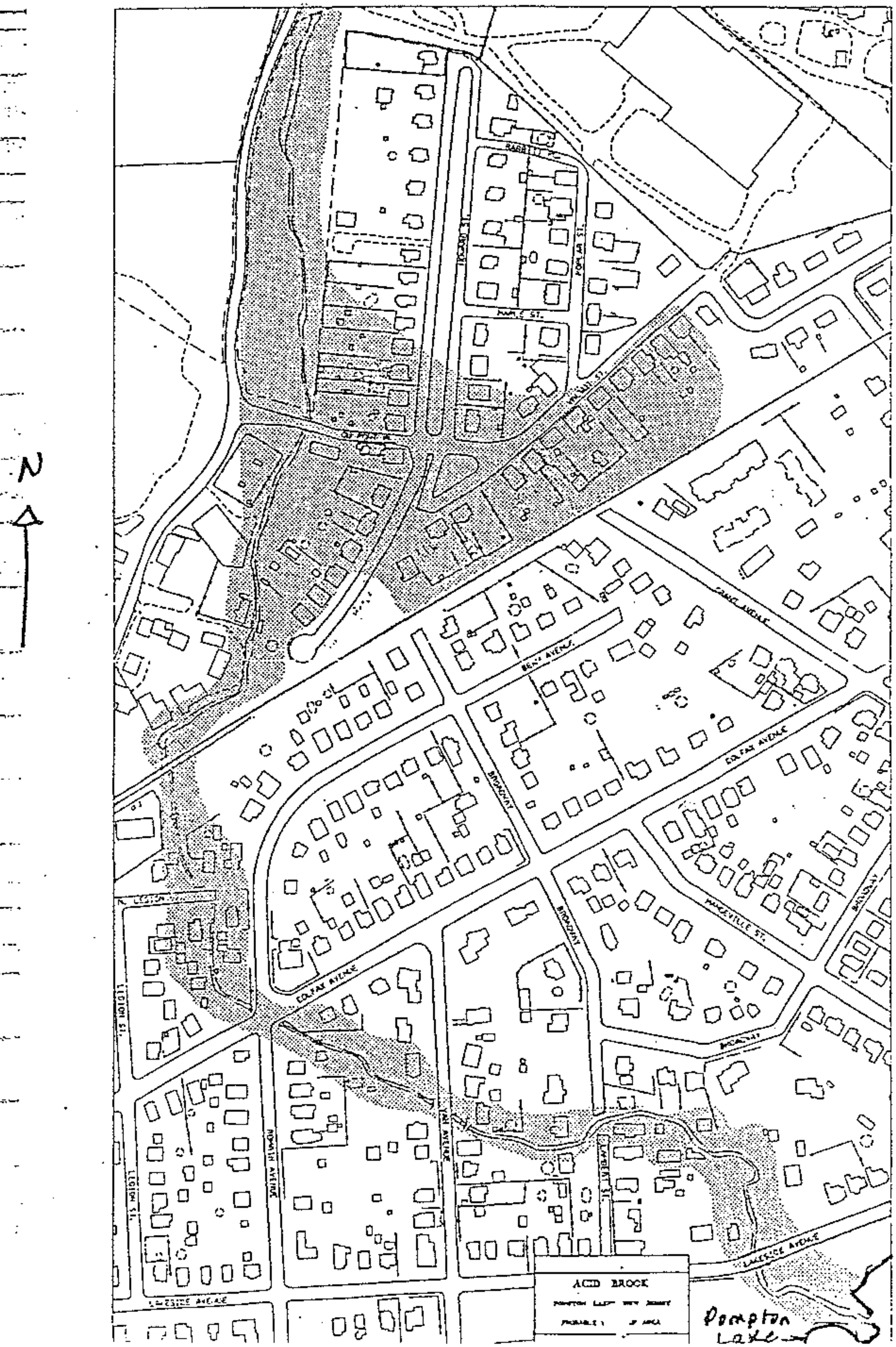


FIGURE 1 - USGS MAP

FIGURE 2
ACID BROOK AREA



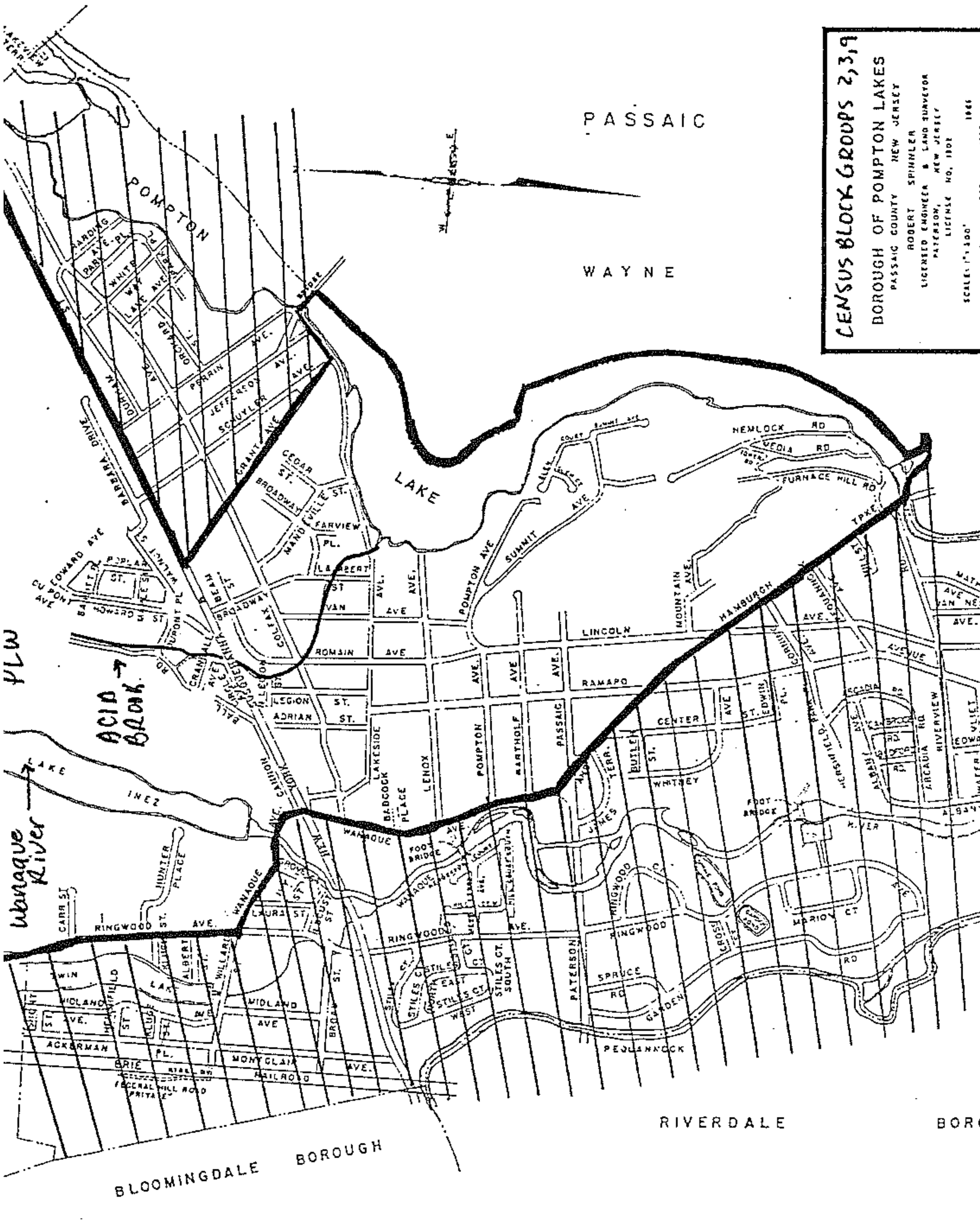

CENSUS BLOCK GROUPS 2,3,9
BOROUGH OF POMPTON LAKES
PASSAIC COUNTY NEW JERSEY
PASSAIC
WAYNE
POMPTON
LAKE
LAKE INEZ
RIVERDALE
BLOOMINGDALE BOROUGH
ACID BROOK
Wanaque River
PLW
LINCOLN
RAMAPO
HAMBURGH TPKE.
RINGWOOD AVE.
WANAQUE AVE.
MIDLAND AVE.
ACKERMAN PL.
MONTCLAIR AVE.
PEQUANNOCK
FURNACE HILL RD
HEMLOCK RD
SUMMIT AVE.
POMPTON AVE.
PASSAIC AVE.
LENOX
LAKESIDE
CEDAR ST.
BROADWAY
PERRIN AVE.
JEFFERSON AVE.
SCHUYLER AVE.
GRANT AVE.

FIGURE 3

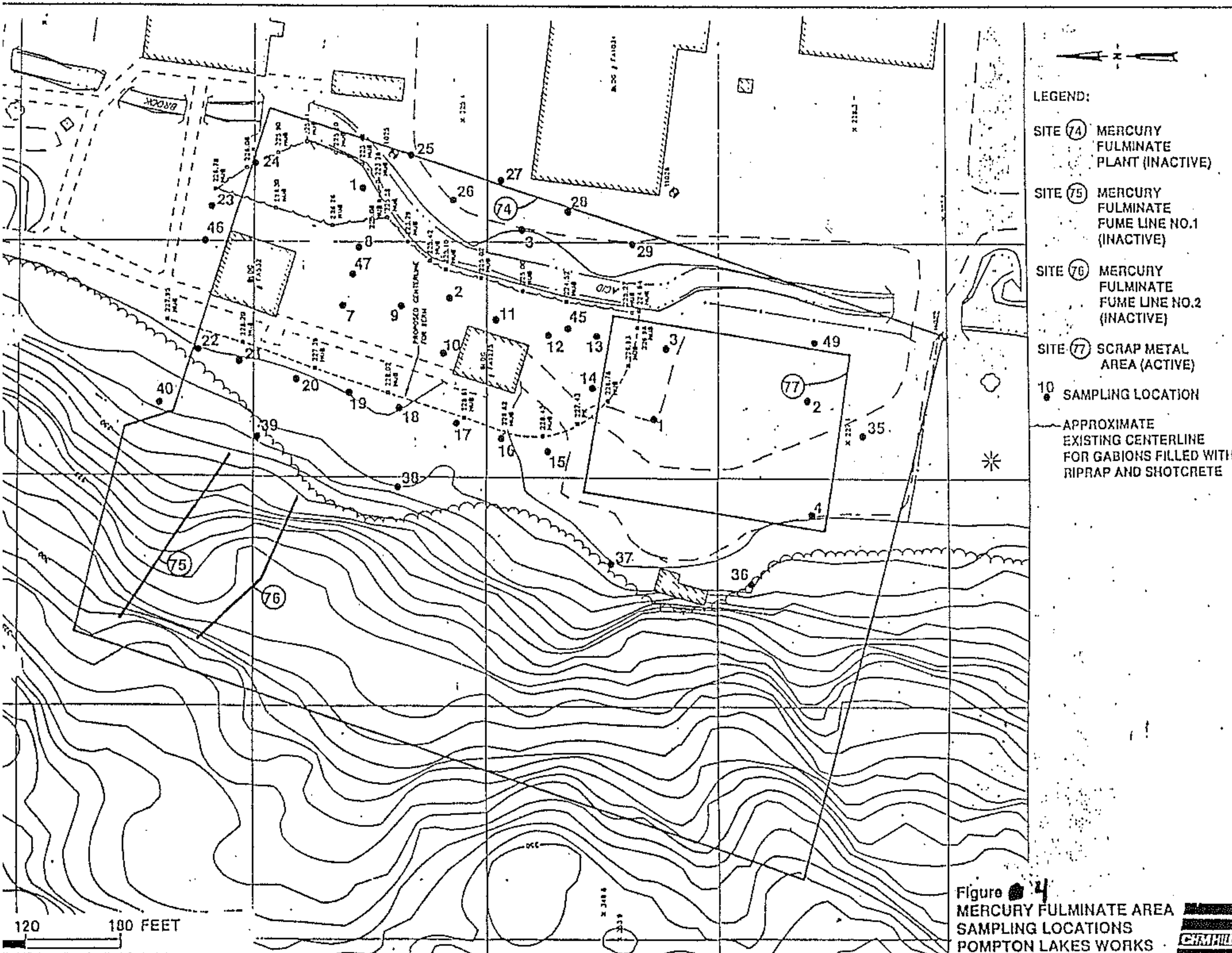
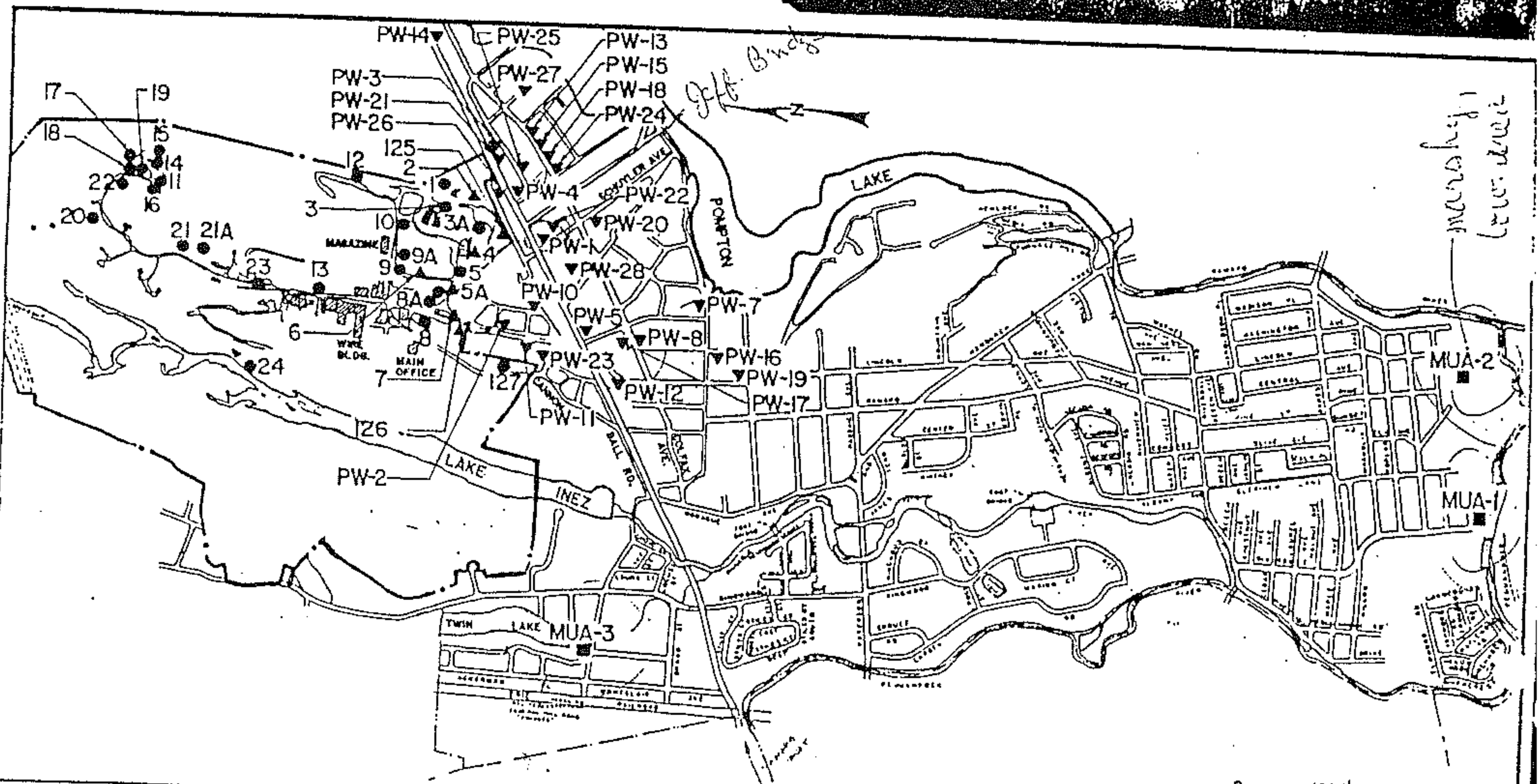


Figure 4
MERCURY FULMINATE AREA
SAMPLING LOCATIONS
POMPTON LAKES WORKS

CH2M HILL

Attachment 2



SCALE 0 1000'

EXPLANATION

- ● 1 DU PONT MONITORING WELL
- ▲ 7 DU PONT MONITORING WELL CLUSTER
- ▼ PW-1 DOMESTIC WELL
- ■ MUA-3 POMPTON LAKES MUNICIPAL WELL
- DU PONT PLANT BOUNDARY

FIGURE 5

WELL LOCATION MAP: DUPONT, RESIDENTIAL, MUNICIPAL

E.I. DU PONT DE NEMOURS & COMPANY
POMPTON LAKES, NEW JERSEY

Geraghty & Miller Inc.

APPENDIX B - TABLES

TABLE 1: CONTAMINANTS IN ON-SITE SOILS AND SEDIMENTS (1992)

CONTAMINANT	MAXIMUM CONCENTRATION (mg/kg) 0 - 6"	18 - 24"	36 - 42"	72 - 78"	COMPAR. VALUE mg/kg
lead	1790	1450	271	77.6	na
mercury	5930	1520	1880	2500	na

TABLE 2: CONTAMINANTS IN ON-SITE SURFACE WATER (1989)

CONTAMINANT	MAXIMUM CONCENTRATION (mg/L) LAGOON	SHOOTING POND	PLANT STREAM	COMPAR. VALUE mg/L	REFERENCE	COMPAR. VALUE EXCEEDED?
ammonia	nd	nd	0.13	3	EMEG	No
barium	0.093	nd	nd	0.7	RfD	No
chloroform	nd	nd	0.455	*2	EMEG(acute)	No
chromium	0.06	nd	nd	0.1	MCLG	No
copper	5.92	nd	0.035	1.3	MCLG	Yes
1,2-DCA	0.00339	nd	nd	*0.05	EMEG(acute)	No
trans-1,2-DCE	0.0448	nd	0.00236	0.1	LTHA	No
iron	38.7	nd	nd	0.3	MCL	Yes
lead	0.7	8000	0.0094			Yes
manganese	1.25	0.038	nd	1	RfD	Yes
mercury	0.0009	nd	nd			na
methylene chloride	0.0224	0.127	0.723	0.0047	CREG	Yes
nitrate	0.00025	nd	0.7	16	RfD	No
selenium	nd	50	nd	0.03	EMEG	Yes
1,1,1-TCA	nd	nd	1.17	0.2	LTHA	Yes
TCE	nd	nd	0.00416	*1	EMEG(inter)	No
trichloroflouromethan	nd	0.034	0.0349	3	RfD	No
vinyl chloride	0.0111	nd	nd	0.0002	EMEG	Yes
zinc	7.95	nd	nd	2.1	LTHA	Yes

key:
na – no value available
nd – contaminant not detected
nr – not reported
nt – not tested
* derived comparison values based on acute or intermediate MRLs

TABLE 3: CONTAMINANTS IN OFF-SITE SOILS (1991)

CONTAMINANT	MAXIMUM CONCENTRATION (mg/kg)			COMPAR. VALUE (mg/kg)	REFERENCE	COMPAR. VALUE EXCEEDED?
	RESIDENTIAL GARDENS	YARDS	ACID BROOK SOIL			
barium	419	nr	6860	3500	RfD	Yes
copper	95	nr	25400			na
cyanide *	690	nt	nt	1000	RfD	No
lead	4120	62000	119000			na
mercury	6.4	540	8060	15	RfD	Yes
selenium *	1.6	nr	100	150	EMEG	No
zinc	623	nr	17000			na

* cyanide and selenium do exceed comparison values for the pica child. See discussion in Pathways Section.

TABLE 4: CONTAMINANTS IN OFF-SITE SURFACE WATER (1990)

CONTAMINANT	MAXIMUM CONCENTRATION (mg/L)			COMPAR. VALUE (mg/L)	REFERENCE	COMPAR. VALUE EXCEEDED?
	ACID BROOK	POMPTON LAKE	WANAQUE RIVER			
barium	0.044	0.079	0.01	0.7	RfD	No
copper	0.094	0.018	nd	1.3	MCLG	No
lead	0.054	0.012	0.007			na
mercury	0.0067	nd	0.0002			na
zinc	0.075	0.062	0.035	2.1	LTHA	No

key:

na – not available
nd – not detected
nr – not reported
nt – not tested

TABLE 5A: CONTAMINANTS IN OFF-SITE GROUNDWATER (1985 - 1986)

CONTAMINANT	MAXIMUM CONCENTRATION (mg/l)		COMPAR. VALUE (mg/l)	REFERENCE	COMPAR. VALUE EXCEEDED?
	ALL WELLS	PRIVATE WELL #1			
arsenic	0.011	nd	0.003	RfD	Yes
barium	0.062	0.02	0.7	RfD	No
cadmium	0.29	nd	0.002	CREG	Yes
chlorobenzene	0.0217	nd	0.2	RfD	No
chloroethane	0.0211	0.021			na
chromium	0.007	0.005	0.1	MCLG	No
1,1-DCA	0.0547	0.0547			na
1,1-DCE	0.253	0.253	0.000058	CREG	Yes
trans-1,2-DCE	0.4	0.4	0.1	LTHA	Yes
lead	0.008	0.002			na
manganese	0.48	0.18	1	RfD	No
methylene chloride	0.026	0.0038	0.0047	CREG	Yes
nitrate	0.00311	nd	16	RfD	No
selenium	0.002	nd	0.03	EMEG	No
tetrachloroethylene	0.408	0.408	0.0007	CREG	Yes
toluene	0.0233	nd	1	LTHA	No
1,1,1-TCA	3.72	3.72	0.2	LTHA	Yes
TCE	0.167	0.167	0.005	MCL	Yes
vinyl cloride	0.565	0.565	0.0002	EMEG	Yes
zinc	1.6	0.41	2.1	LTHA	No

TABLE 5B: CHARACTERIZATION OF SOLVENT CONTAMINATION AMONG 28 PRIVATE WELLS (1985 - 1986) AND OFF-SITE MONITORING WELLS (1990)

CONTAMINANT	DETECTION FREQUENCY	FREQUENCY OVER HEALTH COMPARISON VALUE	COMPAR. VALUE (mg/l)	REFERENCE	CONTAMINANT FOUND IN OFF-SITE MONITORING WELL (1990)
chlorobenzene	1/28	na	0.2	RfD	nd
chloroethane	1/28	na			Yes
1,1-DCA	1/28	na			Yes
1,1-DCE	2/28	2/28	0.000058	CREG	Yes
trans-1,2-DCE	5/28	2/28	0.1	LTHA	nd
methylene chloride	8/28	7/28	0.0047	CREG	Yes
tetrachloroethylene	15/28	15/28	0.0007	CREG	Yes
toluene	1/28	1/28	1	LTHA	Yes
1,1,1-TCA	16/28	1/28	0.2	LTHA	Yes
TCE	10/28	8/28	0.005	MCL	Yes
vinyl cloride	1/28	1/28	0.0002	EMEG	Yes

key:

na - not available
nd - not detected
nr - not reported
nt - not tested

TABLE 6: CONTAMINANTS IN OFF-SITE GARDEN VEGETABLES (1990)

CONTAMINANT	MAXIMUM CONCENTRATION (mg/kg)		
	DARK GREEN VEGETABLES	TOMATOES	COMPAR. VALUE
barium	3.7	3.7	na
copper	1.6	2.4	na
zinc	9.2	7.9	na

TABLE 7: CONTAMINANTS IN OFF-SITE FISH TISSUE (1990)
(no comparison values available)

CONTAMINANT	MAXIMUM CONCENTRATION (mg/kg)			
	ACID BROOK	WANAQUE RIVER	POMPTON LAKE	PEQUANNOK RIVER
barium	2.3	4.7	9.4	1.7
cadmium	nt	0.084	0.031	0.4
chromium	nt	0.62	0.49	0.26
copper	6	19.1	6.1	2.2
4,4-DDE	nt	nd	0.034	nt
heptachlor	nt	nd	0.2	nt
lead	2.3	0.94	2.1	12.1
lindane	nt	nd	0.039	nt
mercury	1.3	1.3	1	0.52
PCBs	nt	0.36	0.41	nt
selenium	1.2	0.62	0.68	0.43
dioxins	nt	0.00000151	2.00E-06	nt
zinc	23.3	33.3	0.027	31.8

TABLE 8: CONTAMINANTS IN OFF-SITE AMBIENT AIR (1990)

CONTAMINANT	MAXIMUM CONCENTRATION (mg/m^3)	COMPARISON VALUE (mg/m^3)	REFERENCE	COMPARISON VALUE EXCEEDED?
barium	0.000059	0.0005	CRFC	No
copper	0.00381	0.2	REL	No
lead	0.000668	0.05	NAAQS	No
zinc	0.00251			na

key:
- na – no value available
- nd – not detected
- nr – not reported
- nt – not tested

TABLE 9: E.I. DU PONT PATHWAYS SUMMARY

COMPLETED PATHWAYS

Pathway:	RESIDENTIAL SOIL	PRIVATE WELL	PRIVATE WELL
Source:	Du Pont	Du Pont	Du Pont
Environmental Medium:	soil	groundwater	groundwater
Exposure Point:	residential yards	private wells	private wells
Exposure Route:	ingestion	ingestion	dermal absorption inhalation
Receptor Population:	children, adults	private well users	private well users
Exposure Duration:	chronic	chronic	chronic
Time Period:	past, present	past	past
Contaminants of Concern:	lead, mercury barium, copper zinc	arsenic, cadmium, chloroethane, 1,1-DCA, 1,1-DCE, trans-1,2-DCE, iron, manganese, methylene chloride, PCE, 1,1,1-TCA, TCE, vinyl chloride	chlorinated solvents
Estimated number exposed currently:	Adults: 331 (8) Children: 87 (8)	2 private wells(10) Approx. 5 people	28 private wells(10) Approx. 70 people

Pathway:	ACID BROOK SOIL	ACID BROOK	GARDEN SOIL
Source:	Du Pont	Du Pont	Du Pont
Environmental Medium:	soil/sediments	surface water	garden soil
Exposure Point:	soil at banks of Acid Brook	Acid Brook	residential gardens
Exposure Route:	ingestion	ingestion	ingestion
Receptor Population:	children	children	children, adults
Exposure Duration:	acute	acute	acute
Time Period:	past, present	past, present	past, present
Contaminants of Concern:	barium, copper, lead, mercury, zinc	lead, mercury	lead, copper, zinc
Estimated number exposed currently:	Unknown	Unknown	Approx. 10 people (9)

Pathway:	FISH	VEGETABLE
Source:	Du Pont	garden soils
Environmental Medium:	food chain, fish	food chain, vegetables
Exposure Point:	Acid Brook, Pompton Lake, Wanaque River	residential gardens
Exposure Route:	ingestion	ingestion
Receptor Population:	consumers	consumers
Exposure Duration:	chronic	seasonal
Time Period:	past, present, future	past, present future
Contaminants of Concern:	mercury, heavy metals, pesticides	barium, copper, zinc
Estimated number exposed currently:	Unknown	Approx. 10 people (9)

POTENTIAL PATHWAYS

Pathway:	INDOOR DUST	PLW SURFACE WATER	PLW SOIL
Source:	contaminated residential soils	Du Pont	Du Pont
Environmental Medium:	indoor dust	surface water	soil
Exposure Point:	residential homes	Shooting Pond, lagoons, Plant Stream	mercury fulminate area
Exposure Route:	ingestion/inhalation	ingestion, dermal	ingestion
Receptor Population:	children, adults	children, workers	children, workers
Exposure Duration:	chronic	acute, intermediate	acute, intermediate
Time Period:	past, present, future	past, present	past, present
Contaminants of Concern:	lead, mercury barium, copper zinc	copper, iron, lead, manganese, methylene chloride, selenium, 1,1,1-TCA, vinyl chloride, zinc	mercury lead
Estimated number exposed currently:	Up to 418 people (8)	Unknown	Unknown

ELIMINATED PATHWAYS

Pathway:	SURFACE WATER	AIR	MUNICIPAL WATER
Source:	Du Pont	wind erosion of contaminated soils	unknown
Environmental Medium:	surface water	air	groundwater
Exposure Point:	Pompton Lakes, Wanaque River,	residential areas	municipal water supply
Exposure Route:	ingestion	inhalation	ingestion
Receptor Population:	children	adults, children	children, adults
Exposure Duration:	acute	chronic	chronic
Time Period:	past, present, future	past, present, future	past, present, future
Contaminants of Concern:	*	*	*

Pathway:	MONITORING WELLS
Source:	Du Pont
Environmental Medium:	groundwater
Exposure Point:	on-site monitoring wells
Exposure Route:	--
Receptor Population:	--
Exposure Duration:	--
Time Period:	--
Contaminants of Concern:	solvents and metals

* no contaminants of concern were identified

APPENDIX C - COMPARISON VALUES

APPENDIX C - COMPARISON VALUES

Comparison values for ATSDR public health assessments are contaminant concentrations in specific media that are used to select contaminants for further evaluation. The values provide guidelines used to estimate a dose at which health effects might be observed. Comparison values used in the Environmental Contamination and Other Hazards and in the Public Health Implications sections of this public health assessment are listed and described below.

CREG = Cancer Risk Evaluation Guides
DWEL = Drinking Water Equivalent Level (μg/L)
EMEG = Environmental Media Evaluation Guides
MCL = Maximum Contaminant Level (μg/L)
MCLG = Maximum Contaminant Level Goal (μg/L)
MRL = Minimal Risk Level (mg/kg/day)
IMRL = Intermediate Risk Level
CMRL = Chronic Risk Level
PEL = Permissible Exposure Limit (mg/m^3)
REL = Recommended Exposure Limit (mg/m^3)
RfD = Reference Dose (mg/kg/day)
RfC = Reference Concentration (mg/m^3)
ppm = milligrams per liter (mg/L water)
milligrams per kilogram (mg/kg soil)
ppb = micrograms per liter (μg/L water)
micrograms per kilogram (μg/kg soil)
kg = kilogram
mg = milligram
μg = microgram
pg = picogram
L = liter
m^3 = meters cubed
NAAQS = National Ambient Air Quality Standards

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10E-6) persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors.

The drinking water equivalent level (DWEL) is a lifetime exposure level specific for drinking water (assuming that all exposure is from that medium) at which adverse, noncarcinogenic health effects would not be expected to occur.

Environmental Media Evaluation Guides (EMEGs) are based on ATSDR minimal risk levels (MRLs) and they factor in body weight and ingestion rates.

Maximum Contaminant Levels (MCLs) represent contaminant concentrations that EPA deems protective of public health (considering the availability and economics of water treatment technology) over a lifetime (70 years) at an exposure rate of two liters of water per day (for an adult).

Maximum Contaminant Level Goals (MCLGs) are drinking water health goals set at levels at which no known or anticipated adverse effect on the health of persons occurs, and which allow an adequate margin of safety. Such levels consider the possible impact of synergistic effects, long-term and multi-stage exposures, and the existence of more susceptible groups in the population. When there is no safe threshold for a contaminant, the MCLG should be set at zero.

A Minimal Risk Level (MRL) is an estimate of human exposure to a chemical (in mg/kg/day) that is likely to be without an appreciable risk of deleterious but noncarcinogenic effects (noncarcinogenic) over a specified duration of exposure. MRLs are based on human and animal studies and are reported for acute (< 14 days), intermediate (15-364 days), and chronic (> 365 days) exposures. MRLs are published in ATSDR's Toxicological Profiles for specific chemicals.

The Occupational Safety and Health Administration's Permissible Exposure Limit (PEL) in air is an 8-hour, time-weighted average developed for the workplace. The level may be exceeded, but the sum of the exposure levels averaged over eight hours must not exceed the limit. The National Institute for Occupational Safety and Health recommends exposure limits (RELs) for the workplace. RELs are based on time-weighted average (TWA) concentrations for up to a 10-hour workday during a 40-hour work-week.

EPA's Reference Dose (RfD) and Reference Concentration (RfC) are estimates of the daily exposure to a contaminant that is unlikely to cause adverse health effects. However, RfDs and RfCs do not consider carcinogenic effects.

The Clean Air Act of 1990 established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants. Concentrations exceeding NAAQS in ambient air may endanger public health.

EPA classifies the carcinogenic potential of contaminants based on the weight-of-evidence of toxicological data. There are five classes of carcinogenicity as shown below:

A. Carcinogenic in humans
B. Probably carcinogen in humans
C. Possibly carcinogenic in humans
D. Not classifiable as to human carcinogenicity
E. Evidence of noncarcinogenicity in humans

Further, the B1 classification is based on sufficient human evidence, while the B2 classification is based on sufficient animal evidence, but insufficient human evidence.

COMPARISON VALUE REFERENCES

1. Agency for Toxic Substances and Disease Registry. Health Assessment Guidance Manual. Atlanta: ATSDR, October 1990.

2. National Institute of Safety and Health. Pocket Guide to Chemical Hazards. Washington D.C.: Department of Health Human Services, June 1990.

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APPENDIX D - E.I. DU PONT SITE HISTORY

SITE HISTORY – E.I. DUPONT POMPTON LAKES WORKS	
Date	Event
1802	E.I. Dupont founded by Eleuthere Irenee Du Pont.
1886	H. Julius Smith builds spark-fired blasting cap (filled with mercury fulminate) plant one-half mile from PLW entrance.
	Dam built across Wanaque River creating Lake Inez.
1888	American Manufacturing and Supply Company, Ltd. built black powder mill on present Du Pont PLW site.
1891	Black powder mill sold to Metallic Cap Manufacturing Company, who dismantled the mill and built a plant to load caps.
1894	American Smokeless Powder company purchased land from H. Julius Smith and built a smokeless powder plant (known as the Haskell Plant) on the west side of Lake Inez.
1898	Haskell Plant purchased by Laflin & Rand.
	Explosion at Haskell Plant and severly damaged.
	Laflin & Rand purchased additional land from Smith and built a new plant having a daily capacity of 6000 pounds (lb) of smokeless powder and 1000 lb of gun cotton.
1902	Du Pont acquires control of Laflin & Rand Powder Company.
	Electric Exploder company (owned by Du Pont) began operations at the newly constructed plant on the west side of Lake Inez.

1906	James Macbeth and Company cap plant moved to Pompton Lakes from Jamaica, New York, and became part of Du Pont's Electric Exploder Company. The consolidation resulted in plant emplotment of 155 workers and production of 35,000 E.B. caps per day.
1907	Du Pont acquired Metallic Cap Manufacturing Co. and property (now the center of the PLW site).
1908	Du Pont purchased Smith Electric Fuse Co. and moved plant equipment to the Electric Exploder Co. plant on the west side of Lake Inez. This became known as Du Pont Fuse Works. The old Metallic Cap Manufacturing Co. plant became the Du Pont Cap works.
1917	Du Pont produces huge quantities of powder for World War I Allies. Work force at Cap and Fuse works increases to 7500 employees.
November, 1918	Production capacity: 1.5 MM ordinary blasting caps, 60 M electric blasting caps, 4.5 M lb of mercury fulminate, 200 M detonating fuses, 40 M boosters, 100 M primers, 100 M tracer and incendiary bullets, and An unknown quantity of hand rifle grenades. Housing boom occurs, many homeowners converted residences to rooming houses for workers. Du Pont built a dormitory colony (near the current site of Pompton Lakes High School).
1926	Du Pont discontinued operations on the west side o Lake Inez and consolidated with the current plant site on the east side of the lake.
1928	A lead azide plant was built at PLW site.
1930	Production at the lead azide plant began.

1938	Innovations in production methods occurred, when plastic wire insulation was introduced and replaced cotton insulation.
1939	the first plastic extruder was introduced at PLW.
1941	World War II increased employment to more than 3000. Activities included production of massive quantities of E.B. caps, all types of military detonators and fuses, rocket igniters, and pull-wite detonators.
1950	Du Pont introduced the Auto Loader.
1951	Du Pont introduced copper wire tinning.
1952	The first E.B. cap assembly machine began operations on a production basis.
1953	Pompton Lakes Process Laboratory (PLDL) was established.
1954	The AM Building was completed.
1962	The Delay Loader became operational.
1963	The metal cladding facilities started operations.
1965	Coin Clad production began.
1978	Plantwide conversion from mechanical relay to solid-state programmable controllers was initiated.
1980	Detaline system facilities and the new powerhouse began operations.
April 29, 1983	New Jersey Department of Environmental Protection (NJDEP) requires Du Pont to implement a hydrogeologic investigaion of the site to assess the impact of waste disposal areas on the quality of groundwater at the site and to submit a report on the findings of the investigation.

July 19, 1984	Du Pont submitted Ground Water Assessment Report. The report concluded that groundwater on site was contaminated with heavy metals and volatile organic chemicals (VOC) and may be migrating off site in a southerly direction.
January 4, 1985	NJDEP required Du Pont to conduct a suplementary hydrogeologic investigation.
June 26, 1986	Du Pont submits the supplementary hydrogeologic investigation report. Based on this report NJDEP concluded tha Du Pont had discharged pollutants in violation of the New Jersey Water Pollution Control Act (NJWPCA).
1987	Du Pont sold the commercial Explosives Business to Canadian Investment Capital, Ltd., (CIC) including certain equipment associated with manufacture of explosives.
	Du Pont continues to produce detonators on contract for CIC.
July 16, 1987	CIC isgned letters of intent with E.I Du Pont de Nemours & Co. and Du Pont Canada Ltd. to acquire Du Pont's industrial explosives businesses in Canada and the United States. these two businesses combined to form Explosives Technologies International (ETI).
September, 1988	Du Pont entered into an Administrative Consent Order (ACO) to conduct the necessary RI/FS studies for the PLW site.
	A public meeting was held to present Du Pont's plans for remediation.
November 7, 1988	Use of the Shooting Pond for the destruction of waste detonators was discontinued.
March, 1989	Du Pont submitted a Remedial Investigation Work Plan (RIWP) to NJDEP that presented proposed methods to investigate contamination at PLW.

April 12, 1989	ETI announced the termination of the contract with Du Pont for production of commercial detonators, resulting in a phase-down of operations at PLW.
May 15, 1989	Public hearing conducted. Du Pont states plans to locate off-site monitoring wells and take borings for soil characterization. Also, they planned to take water samples from private wells located between the southern plant boundary and Pompton Lake.
August, 1989	Layoffs began; workforce of 220 workers reduced 60%.
October, 1989	Du Pont installs monitoring wells off site. Du Pont paid to connect homeowners to municipal water systems where tests indicated the wells were contaiminated.
November, 1989	NJDEP approved Du Pont's RIWP.
July 5, 1990	Resource Conservation and Recovery Act permit issued by NJDEPE for five areas at PLW. These included those used for storing and burnign wastes.
August 24, 1992	EPA ordered corrective actions at all waste management operations throughout the site under the Hazardous Sustance and Waste Amendment Regulations.

APPENDIX E - RESPONSES TO PUBLIC COMMENTS

RESPONSES TO PUBLIC COMMENTS

ATSDR received many comments on the Public Release of this Public Health Assessment. Several of the comments have been addressed by making changes or additions in the public health assessment text or tables. Some of the comments were related to issues other than health, such as real estate issues. Other issues that would be better answered by another agency such as NJDEPE have been referred to these agencies. The remaining questions and comments have been addressed by ATSDR separately in this Appendix.

Comment: *Is there some environmental cause possibly related to cases of children with autism among families where the mother grew up in the Acid Brook Area?*
Response: To date, no linkage has been established between autism and any environmental contaminant, and there are no experimental data available because there is no animal model for autism. Lead is one contaminant at this site which is associated with subtle (subclinical) effects on neuropsychologic behavior. The reported effects of low level exposure to lead do not; however, include autism. Furthermore, the neurochemistry of lead intoxication is inconsistent with that of autism. While the most consistent biochemical finding in autism has been elevated blood levels of serotonin, it has been shown in lead-exposed rats that levels of serotonin actually decrease.

Comment: *Could these health effects be related to exposure to contaminated soils in our yards or private wells?*

hypertension
uterine/ovarian tumors
pituitary tumor
endocrine problems
leg swelling
dizziness
chest pain
numbness in extremities
urine incontinence
arteriosclerosis
heart attack
kidney stones
glaucoma
hemorrhoids
stomach ulcers
fatigue
sinus trouble
eye irritation
cancer (e.g. breast, brain, prostate, lung, liver)
neurological problems
diarrhea
stomach aches
peripheral neuropathy
renal tumor
"shadow on liver" (x-ray report)
enlarged kidney (hydronephrosis?)
fibrocystic breast disease
above normal mercury level
insomnia
short-term memory loss
endometriosis
bladder infections
Crone's disease
hiatal hernia
respiratory problems

Response: The listed health effects by themselves are not specific for any particular chemical exposure. Many are subjective complaints (e.g., dizziness, fatigue, stomach aches, insomnia, short-term memory loss) that can be early signs of poisoning (see the Public Health Implications Section), but are usually caused by something else. The results of blood and urine screening in this neighborhood did not indicate current lead and mercury toxicity in the individuals tested.

In regards to cancer, some of the contaminants identified in private yards or wells near this site (i.e., lead, TCE, PCE, DCE, and vinyl chloride) have caused cancer in laboratory animals, but the results of human studies have been generally negative (with the exception of vinyl chloride). With some of these contaminants (i.e., lead, TCE, and PCE) the induction of cancers in experimental animals has occurred only at extremely high (i.e., cytotoxic) doses and/or has involved species-specific mechanisms that are considered irrelevant to humans. In other cases (e.g., DCE), the results of most animal cancer studies have been statistically insignificant and have shown no dose-effect relationship. By contrast, vinyl chloride, which was found in the off-site shallow aquifer, is a known carcinogen in humans as well as in animals. In humans, however, vinyl chloride-induced cancer (i.e., angiosarcoma of the liver) has occurred almost exclusively as a result of the heaviest occupational exposures (i.e., in cleaners of vinyl chloride reactor vessels in polymerization plants). Unfortunately, there is still very little information about the possible carcinogenic effects of long-term exposure to these chlorinated solvents in combination or at low levels.

While there is no conclusive evidence of existing health problems attributable to environmental contamination at this site, the possibility of future problems should be still avoided. Prudence would dictate (a) not using any contaminated well as a drinking water supply, and (b) not allowing children to play in areas known to be contaminated with high levels of lead or mercury.

Comment: *Other areas of the town should be checked, including Hill Court and West Lenox Ave, since the [Wanaque] river flooded these areas twice.*
Response: When soil sampling around Acid Brook and Wanaque River was first conducted, the samplers began at the edge of the river and brook and moved outward until lead and mercury soil levels were similar to background levels. In this way, they hoped to capture the areas where flooding and possible contamination had occurred, and where lead and mercury were above expected levels. It may be possible that, even though an area flooded, the flooding had either diluted the contamination, or was insufficient to transport contamination, so soil lead and mercury levels were not elevated in areas that had been flooded previously. However, ATSDR did report the concern about flooded areas not being tested to NJDEPE for further investigation.

Comment: *What are the public health implications of a basement dust level of 2010 ppm [lead]?*
Response: To evaluate this concern, it is important to consider not only the level of lead in the basement, but also the level of exposure to basement dust. For instance, if this basement is or was used frequently as a play area for a young child (1 to 6 years old), this level of lead is very much a concern, and your family physician should be consulted about a blood

lead test. Children are particularly susceptible to lead. Although lead is not absorbed through the skin, children ingest small quantities of dust from playing. This area should be properly remediated to prevent further exposure. If this basement is used for storage only and is not used as a living area, then this level of lead in the basement was unlikely to be a problem. Please see the Public Health Implications Section for more information about the health implications of lead exposure.

Comment: *Concerned that kids play right next to clean up [areas] and people living right next door to clean up [areas].*
Response: This Public Health Assessment advises minimizing exposure to soil and dust contaminated with high levels of either lead and/or mercury. Children who play right next to or on areas being remediated may have increased exposure to lead and mercury, and may be at risk for injury from heavy equipment that may be in the area. For these reasons, children should be discouraged from playing near remediation sites, as well as areas awaiting remediation.

If children have been playing in these areas, some simple interventions may reduce exposure, such as assuring that the child washes their hands and face before eating, brushing dirt and dust off or changing clothes, leaving shoes outside to avoid tracking dirt inside the house, etc. If children have been playing in these areas on a daily basis, you may want to consult your child's family physician for a blood lead and urine mercury test.

Lead or mercury contaminated dust is also a pathway of exposure. Du Pont reports using several methods to reduce dust generation at remediation sites. The CDC Guide to Preventing Lead Contamination in Children recommends cleaning with detergents high in phosphate to assure removal of lead-contaminated dust from homes. There are also inexpensive instant lead testing kits for testing whether surfaces may be contaminated with lead. These two interventions will help identify and minimize indoor lead exposures quickly. ATSDR staff have also reported this concern about dust generation to NJDEPE.

Comment: *Dust accumulated in house duct work: is this dust contaminated? Can the dust be removed without harm to the residents or the contractor? Will the contractor remove the dust without being advised of possible dangers?*
Response: First, testing of house duct work is needed to determine whether it is contaminated. Again, instant lead testing kits are available.

Second, if lead or mercury is present in duct work dust, the Department of Housing and Urban Development have specific guidelines for when remediation is needed, and for safety guidelines for workers involved in this remediation.

Comment: *Lead accumulation in the bone marrow--Exactly under what stressful or traumatic conditions can it be released into the bloodstream? Could I endanger someone else by being a blood donor? Am I endangering myself since the blood will come from the bone marrow to replenish my system?*
Response: Lead accumulates in the bone proper, not in the bone marrow. In adults, about 94% of the total body burden of lead is sequestered in bone where it has an elimination half-life of 20 years or more. Thus, accumulation of lead in bone tissue is a protective

mechanism that keeps lead levels low in the soft tissues (e.g., liver, kidney, blood, brain, and nerves) where lead exerts its toxic effects. Any condition that promotes demineralization of bone (e.g., pregnancy, sudden weight loss, old age, and osteoporosis) will increase blood lead levels and, hence, the potential for toxic effects.

Unless your blood lead levels are significantly above normal, it is probably safe for you to give blood, since your blood would only be replacing the blood (and blood lead) lost by the person receiving your blood. Blood banks do not routinely test donor blood for lead or other environmental contaminants; they are primarily concerned about infectious disease agents and drugs. If you are still concerned, you should have your doctor determine your blood lead level and tell you whether or not you should give blood.

Comment: *What quality assurance was done to ensure that Du Pont's medical tests were accurate? Did your office do any verification of these tests?*
Response: Du Pont's medical tests were conducted through the University of Medicine and Dentistry of New Jersey (UMDNJ) and Roche Laboratories. ATSDR has assumed that this university and lab used proper protocol in testing blood and urine for lead and mercury. However, ATSDR did need to verify the blood mercury test results with UMDNJ staff, because there was confusion about the units (ug/L) used in reporting these results. The blood mercury units have since been verified with UMDNJ and there are some significant changes to the Health Outcome Data Evaluation Section. Please see this section for further information about blood and urine screening results.

Comment: *Why did the Du Pont Dr. say you were o.k. if you were over 2.9 blood mercury when the NJDOH says 2.9 is high?*
Response: This question also highlights the confusion surrounding the units used in interpreting the results of the blood mercury screening. I am not sure by your question if the value of 2.9 was expressed in units of ug/dL or ug/L. If the result was 2.9 ug/L, then that is the same as 0.29 ug/dL, and that is a safe result and also the average of all the test results from the Acid Brook Area residents. If the result was 2.9 ug/dL, then this is an elevated level and indicates the need for repeat testing and follow-up, especially if the urine mercury level was also elevated. There has been some confusion regarding units used in blood mercury result interpretation in the past and, there may have been some misinterpretation, (see the Health Outcome Data Evaluation for more description of the blood mercury results).

Comment: *What impact could soil lead contamination have on our water supply? ATSDR's analysis of the impact of the lead in our soil should also include the impact of the lead in our water supply.*
Response: Lead in soil normally does not tend to rapidly migrate to groundwater, but rather, stays bound to soil for many years. Even though there was high levels of lead in surface soil in the Acid Brook Area, it is unlikely that the lead contamination has significantly affected off-site groundwater quality in the past. In fact, groundwater under PLW showed the only elevated lead levels, and only trace amounts of lead have been found in private wells off-site. Unfortunately, this propensity for lead to bind with soil has also resulted in the high accumulation of lead found in soil in the Acid Brook Area.

However, several other contaminants have affected private well water off-site. These are chlorinated solvents, which do not bind to soil well, and do tend to migrate rapidly to groundwater from land surfaces. Because the presence of elevated levels of chlorinated solvents have been detected in off-site private wells, these wells should not be used as a drinking water supply, (see the Pathway Analysis and Public Health Implications Section for more information).

Comment: *If the aquifer drainage area is Pompton Lake and it has been draining into here for years, what section of the lake does it drain in? How many people have been contaminated by eating fish and swimming and swallowing lake water since 1906?*
Response: As discussed above, the chlorinated solvents that have contaminated the groundwater have completely different properties than other hazardous substances, such as mercury and lead. Chlorinated solvents tend to evaporate from open water bodies, like Pompton Lake or swimming pools. The reason they tend to accumulate in groundwater is because groundwater is underground and in a closed space. Also, even if low levels of chlorinated solvents are in surface water, they do not tend to accumulate in fish. Therefore, it is not surprising that the data from Pompton Lake and Pompton Lake fish do not indicate elevated levels of chlorinated solvents, even though the nearby aquifer did. For these reasons, exposures to chlorinated solvents from swimming in Pompton Lake or eating fish in the past are probably minimal.

However, there is signs recommending against consuming fish from Pompton Lake. One reason was because mercury was detected in the fish above the FDA level for mercury. The source of the mercury may be from Acid Brook, since elevated levels were found in the sediments throughout the length of the brook, (see the Pathways Analyses Section for more information).

Comment: *The EPA has set forth guidelines by which you can estimate a person's blood lead level by the amount of lead that is in the air, water and soil. Why did the ATSDR make no effort to use this formula to verify the clinical results?*
Response: The technique EPA uses to estimate blood lead levels by levels in air, water, and soil is called modeling. Modeling is used in the absence of clinical or monitoring results. Sometimes, modeling is the next best tool to actual results for making decisions, but it is, again, only an estimation. Actual results supercedes any modeling data. In fact, actual results are sometimes used to verify estimated results, but modeling is rarely ever used to verify actual results.

Comment: *Where is your health study you have promised for three years?*
Response: ATSDR began the petitioned public health assessment process in 1991. At that time, ATSDR was not sure if a health study would be useful at this site, so would not have committed to a health study at this time. One of the purposes of the public health assessment is to assess all the available data from involved agencies and community members, and evaluate whether a health study and/or other interventions would be appropriate. This public health assessment has recommended a health study, and ATSDR has funded NJDOH to

conduct the study. This study will be much more specific than the public health assessment and will probably take several years, (see the Recommendations for more information).

Comment: *If this report has been in the works for more than 2 years, why is there still no information on birth defects and cancer figures from the registry?*
Response: Health outcome data are often the most difficult data to retrieve and analyze at many sites. ATSDR has now received this health data for the public health assessment. NJDOH will also be conducting a health study, and that will be much more focused then simply reviewing available health statistics from the state. However, ATSDR will work with NJDOH in incorporating this data into their health study activities as needed.

Comment: *We were told clean up would be 250 ppm lead and 14 ppm for mercury. Since lead standards have been dropped to 100 ppm do all the "cleaned up" areas have to be redone?*
Response: No, the areas that were "cleaned up" actually had soil replaced. The new soil is clean fill, and is virtually free of lead and mercury.

It should be noted that NJDEPE proposed 100 ppm as the new clean-up level for lead. This proposed change is not final, (see the Community Health Concerns Evaluation Section for more information on the lead clean-up level issue).

Comment: *Won't the Acid Brook be a completed exposure pathway until Du Pont cleans up all 600 acres?*
Response: Cleaning up the Acid Brook Area (see Figure 1 in Appendix A) should prevent future exposures to lead and mercury contaminated soils, even if clean-up of the PLW site is not entirely complete until after the Acid Brook Area is finished. One reason is that interim remediation efforts have curbed migration of lead and mercury from the PLW site to the Acid Brook Area. Secondly, although lead and mercury contamination may temporarily remain at PLW, PLW is restricted and residents should not be going on site.

Comment: *The report, in several places, used language that confuses two separate concepts -- whether an exposure pathway exists and whether individual exposure actually occurred or is occurring. We understand that ATSDR has simply concluded that an exposure pathway exists that creates the opportunity for exposure.*
Response: ATSDR's conclusion is not simply that an exposure pathway exists that creates the opportunity for exposure. ATSDR concluded both that plausible exposure pathways exists and that exposures have actually occurred. The basis for concluding that a plausible exposure pathway exists is based on environmental data. ATSDR ultimately concluded that exposures have actually occurred based on observations during site visits to the Acid Brook Area, and numerous interactions with community members including meetings, phone conversations, letters, surveys, and comments to this public health assessment. Please see the Background and Pathway Analyses Sections for more information.

Comment: *This report improperly characterizes the Pompton Lakes Works Site as a public health hazard [because]...actual exposure has not been demonstrated,... and [there is] not any demonstrated connection between site contamination and adverse health outcomes.*
Response: It is ATSDR's opinion that our conclusion (this site was a past public health hazard, and will remain a public health hazard until off-site remediation is complete) is not improper. The public health hazard categorization has two criteria: 1) Evidence exists that exposures have occurred, are occurring, or are likely to occur in the future; and 2) the estimated exposures are to a substance or substances at concentrations in the environment that, upon long-term exposures, can cause adverse health effects to any segment of the receptor population. ATSDR believes both these criteria were met, (see the Pathway Analysis and Public Health Implications Sections).

An additional consideration, that community-specific health outcome data indicate that the site has had an adverse impact on human health, is not required but may be included. ATSDR did not have data to fulfill this additional consideration; however, ATSDR recommended a health study which will be conducted through NJDOH. This study will help evaluate possible adverse impacts on human health in this community.

Comment: *The report uses maximum contaminant values inappropriately--the report uses without qualification maximum concentration values.*
Response: In regards to use of maximum contaminant values, the public health assessment follows guidelines as stated in the Public Health Assessment Guidance Manual.

> "To determine whether a contaminant is a contaminant of concern, the maximum media concentration should be compared to an appropriate health assessment comparison value".

Using maximimum concentrations allows for a conservative analysis of the environmental data, which is in the interest of protecting public health. ATSDR also believes that the public has a right to know what health effects may be associated with exposure to the maximum concentrations of hazardous substances in their environment. However, the report does not *only* report the maximum concentrations, and does qualify maximum concentrations on several occasions. A distribution table of lead and mercury in surface soil and a discussion of trends is in the Environmental Contamination and Other Hazards Section, and see also discussions in the Pathway Analysis Section, the Public Health Implications Section, and Table 5B in Appendix B.

Comment: *The ATSDR Guidance Manual requires comparison values to determine whether a contaminant is of concern...the reports failure to use any comparison values taints all of its conclusions about possible health risks of lead and mercury in soils and surface water.*
Response: The Public Health Assessment Guidance Manual does not state that comparison values are required for determining whether a contaminant is of concern, in fact it clearly states just the opposite.

> "To determine whether a contaminant is a contaminant of concern, the maximum media concentration should be compared to an appropriate health assessment comparison value. If the maximum medium concentration exceeds a comparison value, the contaminant should be selected for further evaluation. If a comparison

> value is not available, the contaminant should be selected [as a contaminant of concern]."

Also, Table 5.2 in the Public Health Assessment Guidance Manual clearly outlines when to list a contaminant as a contaminant of concern.

It is ATSDR's opinion that our conclusions about possible health risks of lead and mercury in soils and surface water are appropriate. Although comparison values were not available for these contaminants, ATSDR qualitatively discussed the public health implications of exposure at length in the Public Health Implications Section. This discussion was based on information in the Toxicological Profiles for Lead and Mercury (23, 25).

If any community members have any additional questions or concerns regarding public health issues at this site, please feel free to call ATSDR staff Lynelle Neufer at (404) 639-0600 or Artie Block at (212) 264-7662.