Health Consultation

PLYMOUTH MGP SITE

PLYMOUTH, LUZURNE COUNTY, PENNSYLVANIA

NOVEMBER 24, 2004

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

Health Consultation: A Note of Explanation

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

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

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HEALTH CONSULTATION

PLYMOUTH MGP SITE

PLYMOUTH, LUZURNE COUNTY, PENNSYLVANIA

Prepared by:

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

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Executive Summary

The Pennsylvania Department of Health (PADOH) prepared this health consultation of the Plymouth manufactured gas plant (MGP) site at the request of the Pennsylvania Department of Environmental Protection. It was conducted to determine whether residents near the site were exposed to volatile organic compounds (VOCs) through inhalation of the indoor air of their homes at levels that would harm their health. PADOH developed this report under a cooperative agreement with the Agency for Toxic Substances and Disease Registry.

PADOH determined that children and adults living in the homes discussed in this health consultation would not currently experience a health risk from exposure to the contaminants detected in their indoor air. Relatively low levels of acetone, ethylbenzene, toluene, xylenes, and other VOCs were detected in residents' basement air. These concentrations were below levels of health concern and did not require further evaluation. Benzene was also detected in basement air in residences on the Plymouth MGP Site and further evaluated, because concentrations of this chemical were above a relevant health-based screening value. Propene also was detected in the basement indoor air of these residences and further assessed because no relevant health-based screening value was available for this chemical. After completing the public health evaluation, however, PADOH concluded that none of the chemicals detected in indoor air of homes at this site represent a health threat for children or adults living in the sampled homes. Potential past exposure to these chemicals in the homes is an indeterminate health hazard because information is not available regarding possible historical levels.

The interpretation, conclusions, and recommendations regarding the Plymouth MGP site are site-specific and do not necessarily apply to any other site.

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Background and Statement of Issues

Site Description and History

The Plymouth manufactured gas plant (MGP) site comprises approximately 3 acres in a commercial/industrial section of Plymouth, Luzurne County, Pennsylvania (Figures 1–3). Smith Lane and the rear portions of the commercial properties along Main Street border the site along its northern edge. An athletic field used for recreational purposes borders the site to the east. Wadhams Creek borders the western edge of the site. The property along the western bank of Wadhams Creek is a vacant field overgrown by low-lying vegetation. The southern edge of the site is flanked by a levee (floodwall), constructed to control water overflow from the Susquehanna River. Two occupied residential structures are on the site. These properties have basements and are situated close to the preexisting foundations of the gas tanks of the former MGP facility. These on-site residences use the municipal water supply for potable water and do not receive their drinking water from the site aquifer.

Relatively little information is available about the history of the site. Historical fire insurance maps indicated that coal gas was manufactured on the site from 1896 up to approximately 1925 [1]. According to these maps, the two former coal gas tanks were demolished some time between 1925 and 1946. The 1946 map shows two residences on-site near the former coal gas holders.

Large quantities of complex mixtures of coal tar, sludges, oils, and other chemicals were by-products of the production of coal gas. Coal tar and other waste products from the gasification plants were commonly disposed of on-site in unlined pits or, in some cases, injected underground through injection wells. These practices have left behind subsurface coal tar contamination at many former MGP sites. Coal tar is the most common contaminant at MGP sites. About 300 chemicals have been identified in coal tar creosote, but as many as 10,000 other chemicals may be in this mixture [2]. The composition of coal tar varies, but it is usually a mixture of the following:

1. polycyclic aromatic hydrocarbons (PAHs), such as benzopyrene, naphthalene, anthracene, acenaphthene, and phenathrene;
2. phenolic compounds, including phenol and methylphenols;
3. light aromatic compounds, such as benzene, toluene, ethyltoluene, and xylenes, which are also referred to as volatile organic compounds (VOCs);
4. miscellaneous organics, such as debenzofuran; and
5. small quantities of inorganic compounds, such as iron, lead, copper, zinc, sulfides, cyanides, and nitrates.

Coal tar is somewhat denser than water. It tends to migrate downward in the subsurface until it reaches an impermeable stratum. It remains there in an immobile state or spreads slowly, continuously contributing to groundwater contamination as the PAHs and other constituent compounds in the coal tar are slowly solubilized [3].

Until the most recent site characterization [4], conducted under Pennsylvania Department of Environmental Protection (PADEP) guidance in the fall of 2003, no environmental studies have been performed at the Plymouth MGP site to evaluate the potential for soil and/or groundwater contamination from the former coal gas site. Because of the lack of historical sampling data, past exposures to VOCs on the site cannot be determined.

Sampling performed as part of the site characterization study identified coal tar contaminants such as VOCs, semivolatile organic compounds (SVOCs), and heavy metals in the soils and shallow groundwater at the site. Elevated concentrations of the coal tar-related VOCs were identified at greater than 12 feet below ground surface. To determine potential human exposure to the identified VOCs, indoor air samples were collected from both residential locations on the site.

For this health consultation, the Pennsylvania Department of Health (PADOH), at the request of PADEP, evaluated the results of indoor air samples collected at the site. The samples were collected from the basements of the on-site residences and analyzed for the presence of VOCs. PADOH's objective through this report is to determine whether exposures to these contaminants are at levels that would be considered a health hazard.

Site Visits

On April 27, 2004, two PADOH staff visited the site with the PADEP project officer. They delineated the extent of the coal tar contamination and discussed the results of the site characterization. PADOH staff took notes and photographs and discussed site background information with the PADEP project officer. PADOH also attempted to contact residents during the site visit, but none were available to interview.

Sample Events

On March 10, 2004, PADEP's contractor sampled indoor air at the two private residences on the site. The indoor air samples were collected to determine whether VOCs were entering the indoor air of the residence through vapor intrusion at detectable concentrations. PADEP consultants used summa canisters to collect air samples from inside and outside each residential location for a sampling period of 8 hours. These air samples were submitted to an independent laboratory and analyzed for VOCs using U.S. Environmental Protection Agency (EPA) Method TO-14A.

Sample Results

In the March 2004 sampling event, low levels of acetone, benzene, ethylbenzene, propene, toluene, xylenes, and other VOCs were detected in residents' basement air (Table 1) [5]. Benzene was detected at a maximum concentration of 1.3 parts per billion by volume (ppbv) in the basement air of an on-site residential location. The maximum concentrations of acetone (40 ppbv), propene (93 ppbv), toluene (2.9 ppbv) and total xylenes (0.6 ppbv) were all detected in the basement air of the residences. Ethylbenzene also was detected at one residence at an

estimated concentration of 0.5 ppbv, which is below the quantitation limit for the instrument used to analyze the sample. PADOH evaluated these indoor air sampling results and determined the public health significance of the data.

Quality Assurance and Quality Control

In preparing this health consultation, the Agency for Toxic Substances and Disease Registry (ATSDR) and PADOH are limited to the credibility of the information provided in the referenced documents. Adherence to adequate quality assurance and quality control (QA/QC) measures was expected regarding data gathering, chain of custody, laboratory procedures, and data reporting. To ensure high quality data and best applicable science, extreme care was taken during all aspects of sample collection, analyses and reporting. ATSDR and PADOH expect that the laboratory used only certified, clean-sample collection devices. Once samples were collected, we expect they were stored according to the method protocol and were delivered to the analytical laboratory within the limits of method protocol. Finally, we expect that laboratory standard operating procedures and other procedures and guidance for sample analysis, reporting, and chains of custody were followed. If ATSDR and PADOH believe the laboratory data to be erred in any way, further evaluation of the QA/QC procedures were followed. The analyses, conclusions, and recommendations in this HC are limited to the completeness and reliability of the referenced documents.

Discussion

PADOH evaluated the indoor air data to determine whether the residents are being exposed to harmful levels of the VOCs detected in the indoor air of their homes. PADOH considers how occupants contacted the VOCs and the frequency of exposure. PADOH also considers whether the contaminants were present at harmful levels.

To determine the likelihood of possible health effects of site-specific chemicals, ATSDR developed health-based comparison values (CVs). These CVs include minimal risk levels (MRLs) for noncancerous health effects, cancer risk evaluation guides (CREGs) for cancerous health effects, and environmental media evaluation guides (EMEGs).

ATSDR established MRLs through an evaluation of the toxicological literature for a given substance. MRLs are not established as thresholds of toxicity but as screening tools, below which noncancer adverse health effects are unlikely. In that framework, a lifetime of exposure below a chronic MRL would not be expected to result in adverse health effects. However, exposure to levels above the MRL may not necessarily lead to adverse health effects. A wide range of uncertainty exists between levels known to cause adverse health effects and the MRLs. Therefore, the MRL does not establish the maximum “safe” level, nor is it intended to imply that exposure is not likely to be harmful. If environmental exposures occur at concentrations exceeding the MRL, further evaluation is necessary to determine the health risks of those exposures.

Contaminant Evaluation

Sample results indicated that exposures to acetone, benzene, ethylbenzene, toluene, and total xylenes in the indoor air were below their corresponding MRLs for chronic or intermediate exposure [6]. Exposures would not be expected to cause noncancerous effects to the residents at the levels detected (Table 1). Therefore, these contaminants, with the exception of benzene, will not be further addressed in this health consultation. Benzene is a known carcinogen [7] and was detected in concentrations that exceeded the chronic CREG for benzene (0.03 ppbv), which necessitates further evaluation. Propene also was selected for further evaluation because ATSDR does not have an MRL to serve as a screening value for this contaminant.

This evaluation of potential exposures to these contaminants is based on current levels. No sampling data were available to evaluate for past exposures to VOCs. The potential for future exposures to VOCs that migrate from the subsurface soils, impacted by coal tar contaminants, is not expected to increase because of the relatively low levels of VOCs and depth to contamination that exceeds a depth of 12 feet. In addition, no continuing source exists for the VOC contamination, and levels would be expected to decrease even more over time.

Benzene

Benzene is common in the environment. Industrial processes are the main sources of benzene in the environment. Benzene levels in air can increase from emissions from burning coal and oil, benzene waste and storage operations, motor vehicle exhaust, and evaporation from gasoline service stations. Tobacco smoke, which contains high levels of benzene, is another source of benzene in air. Benzene that contaminates water and soil surfaces can also pass into the air. Once in the air, benzene reacts with other chemicals and breaks down within a few days [8].

The concentration of benzene (1.3 ppbv) detected in one of the homes is below a level that ATSDR and PADOH consider a threat to health. The range of detected benzene concentrations also falls within the normal background concentrations (0.02–34 ppbv) that have been reported for ambient air [8]. Exposure to benzene at levels in the indoor air would not be expected to cause noncarcinogenic adverse health effects in residents.

PADOH estimates that the maximum theoretical excess cancer risk for lifetime exposure (24 hours per day) to benzene at 1.3 ppbv is one additional cancer per 100,000 people or a no apparent increased risk. Our calculation is based on the assumption that there is no safe level of exposure to a chemical that causes cancer. However, the calculated risk is not exact and tends to overestimate the actual risk associated with exposures that may have occurred. Also assuming that residents spend less than 24 hours per day in their homes, the overall cancer risk would further decrease. In comparison to studies that associated benzene to leukemia [9], the maximum detected concentration of benzene (3 ppbv) at this site was relatively low. Because of that, and given the intermittent residential exposure environment, it is unlikely that the estimated exposure would result in increased cancer.

Propene

Propene's release into the environment is widespread. It is a ubiquitous product of incomplete combustion. Propene is released into the atmosphere in emissions from the combustion of gasoline, coal, wood, and refuse. Propene can be naturally released into ambient air by germinating beans, corn, cotton, and pea seeds. Another common source of propene is from cigarette smoke [10]. Varying concentrations have been reported for propene in ambient air. In one study, propene was detected in outdoor air in Tulsa, Oklahoma, at concentrations of 27.5–109.9 ppbv. In another study, the atmospheric concentration of propene in ambient air in rural Rio Blanco County, Colorado, was 0.5–8 ppbv [10]. The concentration of propene detected in the ambient samples collected on the Plymouth MGP site and evaluated in this health consultation are consistent with background levels in other rural areas.

The National Institute for Occupational Safety Health of the Centers for Disease Control and Prevention and the Occupational Safety and Health Administration have not established guidelines for occupational exposures to propene. The American Conference of Governmental Industrial Hygienists classifies this chemical only as a simple asphyxiant. Propene has an overall low toxicity, but at very high levels, it will displace oxygen in the blood. Exposure to propene at the levels detected in the basement air would not be expected cause adverse health effects in residents.

Child Health Considerations

PADOH and ATSDR recognize that infants and children may be more vulnerable than adults to chemical exposure. PADOH and ATSDR are committed to evaluating children's special interests. Considering exposure to indoor residential air near the Plymouth MGP site, children may have an increased vulnerability because of many factors, including the following:

1. Children weigh less than adults, resulting in higher doses of chemical exposure relative to body weight.
2. Children have higher rates of respiration.
3. Metabolism and detoxification mechanisms differ in very young (as well as very old) people and may increase or decrease susceptibility.
4. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

PADOH and ATSDR considered child-specific doses in the analysis for this health consultation document and do not expect children living in the homes to be at an increased risk for adverse health effects.

Conclusions

PADOH and ATSDR conclude that the benzene, propene, and other VOCs detected in indoor air at this site represent *no apparent health hazard* for children or adults living in the homes discussed in this health consultation. Past exposures to VOCs in the residential locations on the site represent an *indeterminate health hazard* because historical data are lacking. Given the

levels and depths of contamination identified in the site characterization, future concentrations of VOCs are unlikely to increase in the indoor air from the coal tar contamination.

Recommendations

No further public health action is needed at this time.

Public Health Actions Completed

1. PADOH and PADEP contacted the affected residents identified in this health consultation and discussed the public health significance of their exposure to VOCs in their indoor air. PADOH and PADEP encouraged proper use, storage, and disposal of household products containing VOCs. PADOH will continue to be available to answer residents' health questions.

2. PADEP fully characterized the site, with special emphasis on defining the groundwater contamination plume to determine whether VOCs or other contaminants are present in groundwater. PADEP identified and sampled residences that were potentially affected through indoor air vapor intrusion. PADOH evaluated the public health significance of the sampling results for these residences in this health consultation.

Public Health Actions Planned

1. ATSDR and PADOH will make this health consultation available to the residents at the Plymouth MGP site.

2. At the request of PADEP, PADOH will review and evaluate any future indoor air-quality analysis data for this site.

References

1. Baker Environmental, Inc. Final site characterization work plan for the Plymouth MGP Site, Plymouth, Luzurne County, Pennsylvania, prepared for the Pennsylvania Department of Environmental Protection. Coraopolis, Pennsylvania. July 31, 2003.

2. Agency for Toxic Substances and Disease Registry. Toxicological profile for creosote. Atlanta: US Department of Health and Human Services; 2002.

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7. Agency for Toxic Substances and Disease Registry. ToxFAQs for benzene. Atlanta: US Department of Health and Human Services; 1997. Available at URL: http://www.atsdr.cdc.gov/tfacts3.html.

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9. Rinsky RA, Alexander BS, et al. Benzene and leukemia: an epidemiologic risk assessment. N Engl J Med 1987;316:1044–50.

10. National Library of Medicine. Hazardous substances data bank (HSDB®, online database), National Toxicology Information Program. Bethesda, Maryland. Available at URL: http://toxnet.nlm.nih.gov/. Accessed May 11, 2004.

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Certification

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

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

Roberta Erlwein

Lead, Cooperative Agreement Team, SPS, SSAB, DHAC, ATSDR

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Appendix A

Table 1

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Table 1. Summary of Data for Selected Vocs Detected In Air Samples Collected at the Plymouth MGP Site (All Units Are in Parts per Billion By Volume)

Compound	Sampling Event	Sample Location	Frequency of Detection	Range of Concentrations	ATSDR CV	CV Source(s)
acetone	March 2004	Basement	2/2	9–40	13,000	Chronic EMEG/MRL
	March 2004	Ambient	2/2	5.1–5.4		
benzene	March 2004	Basement	1/2	**0.2 (U)–1.3**	0.03	Chronic CREG
	March 2004	Ambient	2/2	**0.3 (J)–0.6 (J)**	4	Intermediate MRL
ethylbenzene	March 2004	Basement	1/2	0.2 (U)–0.5 (J)	1,000	Intermediate EMEG/MRL
	March 2004	Ambient	0/2	0.2 (U)		
propene	March 2004	Basement	2/2	1.2–93	n/a	n/a
	March 2004	Ambient	2/2	1.2–2.3		
toluene	March 2004	Basement	2/2	0.5 (J)–2.9	80	Chronic EMEG/MRL
	March 2004	Ambient	2/2	0.5 (J)		
xylenes (total)	March 2004	Basement	2/2	0.1 (J)–0.6	100	Chronic EMEG/MRL
	March 2004	Ambient	0/2	0.1 (U)		

TABLE KEY

Intermediate	Contact with a substance that occurs over a 14–365-day period
CV	Comparison value
Chronic	Contact with a substance that occurs over a long time (>365 days)
CREG	Cancer Risk Evaluation Guide for 1 X 10^{-6} excess cancer risk
EMEG	Environmental Media Evaluation Guide
MRL	Minimal Risk Level
U	Compound was undetected at the specified quantitation limit
J	Compound was detected, but below quantitation limit
n/a	Not available

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Appendix B

Figures

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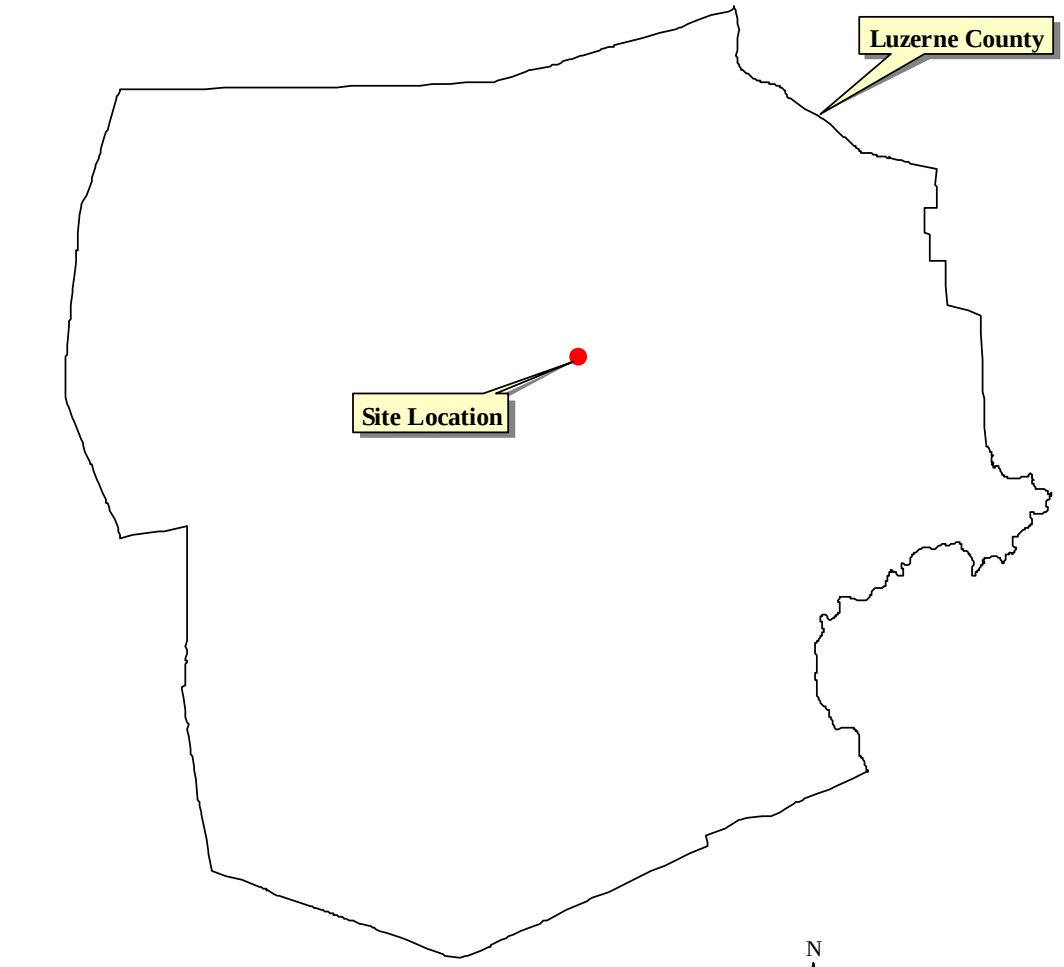
Figure 1

Plymouth MGP Site Location Map



Legend

Site Location

Luzerne County

5 0 5 10 15 Miles

N

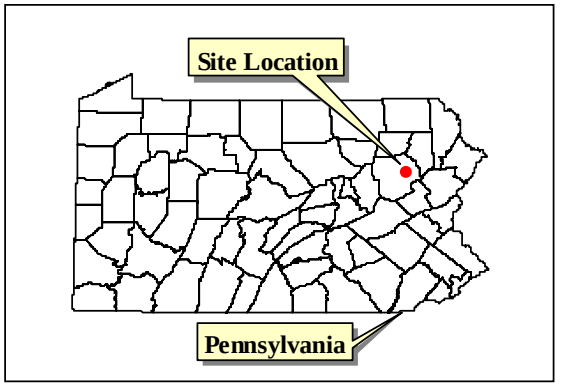


Figure 2

Plymouth MGP Site Topographic Map
1947, Photorevised 1990

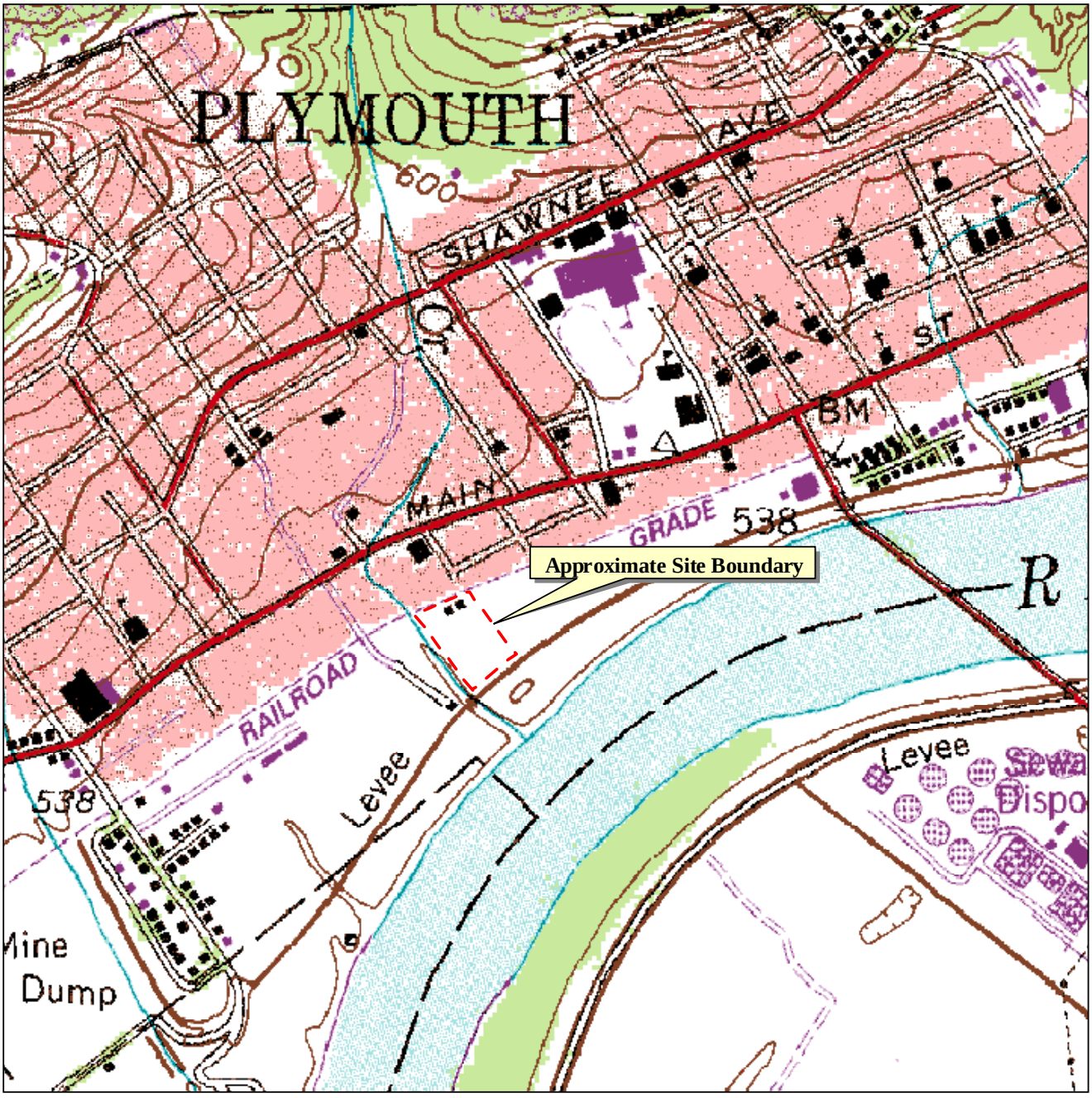


Figure 3

Plymouth MGP Site
From Aerial Photograph (April, 1993)