PUBLIC HEALTH ASSESSMENT

JACKSON TOWNSHIP LANDFILL

JACKSON TOWNSHIP, OCEAN COUNTY, NEW JERSEY

CERCLIS NO. NJD980505283

Prepared by:

New Jersey Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

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

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30 day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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FOREWORD

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

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

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

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of health threat, if any, posed by a site and recommends ways to stop or reduce exposure in its public health action plan. ATSDR is primarily an advisory agency, so usually these reports

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

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

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

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

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

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SUMMARY

The Jackson Township Landfill is a former municipal waste landfill located in Ocean County, New Jersey. Site-related contamination currently poses an indeterminate public health hazard since insufficient data exist for some environmental media to which humans may be exposed. However, there is no evidence that humans are currently being exposed to contaminants at levels expected to cause adverse health effects. Environmental data indicate that the former landfill continues to impact underlying ground water quality. Surface water, sediments, and air have been minimally impacted by former landfill activities. Insufficient data exist to determine whether site trespassers are being exposed to contaminated surface soil or whether nearby residences are being impacted by methane gas migration.

The landfill also poses a public health hazard because site information indicates that past human exposure to volatile organic compounds (VOCs) in drinking water has occurred at levels that may result in adverse health effects. The landfill accepted sewage sludge and septic waste from 1972 through 1980. Chemical and industrial wastes were illegally disposed of at the site. In 1978, VOCs were detected in about 100 residential wells near the site. As a result, local residents were provided with an alternate source of potable water.

Residents raised several questions about possible exposure to site-related contaminants through ingestion of garden produce and municipal water supplies. Detailed answers to these questions are found in the Public Health Implications section.

The New Jersey Department of Health (NJDOH) has made recommendations to (1) reduce and prevent exposure to contaminants; (2) better characterize the extent of surface soil contamination on the site; and (3) consider health follow-up and other activities if data become available that suggest human exposure is currently occurring.

The data and information developed in the public health assessment for the Jackson Township Landfill, Jackson Township, New Jersey has been evaluated by ATSDR's Health Activities Recommendation Panel (HARP) for appropriate follow-up with respect to health activities. This site is not being considered for follow-up activities at this time. Specifically, the HARP determined that the previous community health investigation performed by NJDOH and individual evaluations being performed by private physicians are appropriate actions to follow up the past exposure to contaminated drinking water.

BACKGROUND

A. Site Description and History

The Jackson Township Landfill occupies 20 acres of a 135-acre parcel of land located on Homestead Road, in the Legler section of Jackson Township, Ocean County, New Jersey. The site is bordered by Dorathy's Lane and Ollie Burke Road to the north and west, and Lakehurst Avenue and Toms River Road to the south. A sand and gravel pit borders the site to the east (See Appendix A; Figures 1 and 2). In 1972, Jackson Township obtained the property from Glidden Corporation for use as a municipal waste landfill. From 1961 to 1972, Glidden Corporation operated a surface strip mine for ilmenite, an ore of titanium, at the site. Waste materials, such as sand and gravel, and mine tailings resulting from the on-site ore extraction process were disposed of in the excavation pits.

The landfill was operated by the Township from 1972 until its closure in 1980. Liquid and solid sewage sludge and septic tank wastes were accepted at the landfill. Household wastes, construction debris, and chemical and industrial wastes (i.e., solvents from degreasing septic tanks and from decaffeination of coffee) were illegally disposed of at the site. Waste disposal occurred in the unlined trenches of the former mining pits located within the south and southwest portion of the site (See Appendix A; Figure 2).

Septic tank wastes, including chemical wastes, were illegally disposed of at a residential property to the southwest of the site in 1979. This activity was not associated with landfill operations but rather was allegedly engaged in by the property owner.

A chain link fence surrounds most of the site including two locked entrance gates located along Homestead Road. The site contains several mounded areas with elevations as high as 130 to 135 feet above mean sea level, and valleys with elevations as low as 105 to 110 feet above mean sea level. As a result of former mining activities, surface elevations are generally lower at the site than at residential and commercial properties immediately adjacent to the site.

The Long Brook and Ridgeway Branches, two tributaries of Toms River, are located to the north and south of the site, respectively. The Obhanan-Ridgeway Branch, a tributary of the Ridgeway Branch, is located to the south of the site (See Appendix A; Figure 1).

The site is situated in a relatively undeveloped, semi-rural area within the New Jersey Pine Barrens. The Pine Barrens is known for its pine-dominated vegetation and sandy soil. Various oaks are predominantly found in the vicinity of the site with increasing

swamp vegetation in the direction of the Ridgeway Branch. Throughout the site, natural sands and clay have been replaced with backfill material, consisting of sand, mine tailings, and waste, as a result of former mining and landfill operations.

The New Jersey Department of Environmental Protection and Energy (NJDEPE) cited the Township for accepting excessive quantities of septic sludges in August 22, 1972, when residents of the Legler section of Jackson Township began reporting landfill-related odors to local health officials. In early 1974, NJDEPE cited the Township for improper storage of septic sludges.

In late 1977, Legler residents began reporting stomach cramps and nausea from drinking well water to local health officials. Between October and December 1978, about 100 private potable wells in the Legler section were found to contain volatile organic compounds. NJDEPE documented the contamination of five on-site monitoring wells and 26 off-site potable wells with volatile organic compounds (VOCs) including benzene, chloroform, methylene chloride and 1,1,1-trichloroethylene. As a result, NJDEPE ordered the Township to stop disposing liquid wastes in the landfill. In late 1978, the Township instructed residents not to drink well water and began supplying bottled water to residents.

The Concerned Citizens Committee, composed of Legler residents, filed a class action suit against the Township on August 31, 1979 for negligence in the operation of the landfill. The New Jersey Department of Health (NJDOH) conducted a health survey of these residents in 1980. In February 1980, NJDEPE issued an Administrative Consent Order to the Township to close the landfill and required the Township to complete a design for landfill closure, determine the extent of contamination, and develop remediation plans. In 1980, the Township provided residents with a public water supply.

During 1981 and 1982, VOCs were not detected in monitoring wells and potable wells samples collected by the Township and NJDEPE. The landfill was included on the National Priorities List (NPL) issued by the United States Environmental Protection Agency (USEPA) in December 1982. The September 1983 Remedial Action Master Plan (Hart Associates) prepared for USEPA recommended further site investigation.

In November 1983, the New Jersey Superior Court awarded Legler residents about $15.8 million in damages. The Appellate Division of New Jersey Superior Court annulled over $10.4 million of the settlement awarded for emotional distress and medical surveillance in June 1985. In May 1987, the New Jersey Supreme Court reinstated the amount of the 1983 settlement awarded for medical surveillance.

On August 22, 1988, the Township and NJDEPE entered into a Judicial Consent Order agreement requiring the Township to conduct a

Remedial Investigation and Feasibility Study (RI/FS); and to submit and implement the final landfill closure plan based on the findings of the RI/FS. The objectives of the RI/FS were to (1) determine whether the ground-water contamination is still present; (2) determine whether air, soil, or surface water/sediment of local streams have been contaminated; and (3) to develop and evaluate remedial activities, if necessary.

The Remedial Investigation was completed in late 1990. Landfill closure/remediation plans are currently being developed. A human health risk assessment is currently underway to evaluate the risks associated with current and future exposure to site contaminants. Appendix B describes a detailed chronology of events for the site.

B. Site Visit

On March 12, 1992, Laurie A. Pyrch of the New Jersey Department of Health performed a site visit of the Jackson Township Landfill and was accompanied by the Site Manager from NJDEPE, and a Field Representative from the Ocean County Health Department (OCHD).

The site consists of a large, open sandy area covered with sparse vegetation, including grasses, shrubs and pine trees. The site contains numerous mounded areas consisting of mostly gradual changes in elevation; however, there are also several deeper depressions present. A chain link fence surrounds most of the site. A small post and wire fence surrounds a small portion of the site along the western boundary and no fence was present at the western corner of the site boundary. One residential/commercial property, including a family business and home, is located adjacent to the unsecured southwestern section of the site. During the site visit, evidence of site access was observed, including gun shells. In addition, OCHD Officials have observed all-terrain vehicles tracks on the site during their periodic site inspections. OCHD Officials reported that the southern entrance gate had recently been damaged during an automobile collision. During the site visit, both entrance gates were locked and in good condition.

The West End Buck Club, consisting of one small structure, is situated downgradient on a wooded dirt road on the south side of Toms River Road. The OCHD Official reported that the building is used seasonally for deer hunting. The source of water for the building is unknown. During the site visit, two monitoring wells in the area of the hunting club were found to be damaged.

C. Demographics, Land Use, and Natural Resource Use

Demographics

According to the 1990 United States Census, about 433,200 people live in Ocean County. The population is 53% female and 47% male.

About 95% of the population are white, 3% are black, and 2% belong to other races. About 3% of the population are of hispanic origin.

Jackson Township occupies about 100 square miles of Ocean County. Census information of 1990 reveals that about 33,200 live in the Township; about 19,400 of these live inside urban areas of the Township and about 13,800 live within rural areas of the Township. There are about 11,800 housing units located in the Township. According to the 1980 census information, 34% of the population are under 18 years old, 57% are between 18 to 64 years, and 9% are 65 years old and over.

Land Use

The area surrounding the site is used primarily for residential purposes. Residential dwellings are located adjacent to the site along Homestead Road, Dorathy's Lane, Ollie Burke Road, and Lakehurst Avenue. Additional residences are situated near the site along Toms River Road. Most of the nearby homes were built during the 1940's and 1950's; however, steady growth in the area has resulted in many newer residences in the vicinity of the site. The closest residence, including a family business, is located immediately adjacent to the southwestern boundary of the site. Two schools are located along the south side of Toms River Road. Collier's Mills Wildlife Management Area and the Naval Air Engineering Center is situated to the southwest of the site (See Appendix A; Figures 1 and 2).

Natural Resource Use

The site is located on the Cohansey Sand Formation, a water table aquifer which provides an important source of water to the Coastal Plain region of New Jersey. Ground water within the shallow Cohansey aquifer flows to the south and southeast. The water-bearing Kirkwood Formation underlies the Cohansey Formation. The upper Kirkwood aquifer is hydraulically connected to the Cohansey aquifer.

Most of the nearby residences built prior to 1979 received their potable water from shallow wells screened within the Cohansey aquifer. Numerous residences are located downgradient of the site along the north and south sides of Lakehurst Avenue, and along the north side of Toms River Road. A 1988-1989 well survey was performed to identify the location of any downgradient potable wells. The survey found that most of the residents living near the site are currently receiving water from the Jackson Township Municipal Utility Authority (JTMUA) water system. The 1700 foot deep JTMUA well serving Legler residents draws water from a confined aquifer and is located about one-half mile to the southeast of the site. The closest residence to the landfill with a potable well, situated about 1,000 feet downgradient of the site, was found to be severely damaged and uninhabited. There were three

other residences with potable wells located from 2,000 to 3,000 feet downgradient of the site. These residences have since been connected to the JTMUA system. According to JTMUA, shallow Cohansey wells were sealed. Since 1979, homes either have been built with deep potable wells or were connected to the municipal water system.

The shallow Cohansey aquifer discharges into the Ridgeway Branch. The Ridgeway Branch is located about 3,000 feet downgradient of the site. The Toms River and the Ridgeway Branch are used locally for recreational purposes.

D. Health Outcome Data

There are multiple sources of health outcome data in New Jersey. State and local data for health outcome information include the New Jersey State Cancer Registry, Birth Defects Registry, Vital Statistics Records, Renal Dialysis Network, and Hospital Discharge Reports. Federal databases such as those maintained by the agencies within the Department of Health and Human Services (i.e., National Cancer Institute, National Institute for Occupational Safety and Health, and ATSDR) are not site-specific, but may be used for comparison or evaluation purposes.

NJDOH and the Ocean County Health Department (OCHD) collected health outcome data for Legler residents of Jackson Township in 1980. This information is discussed in the Health Outcome Data Evaluation section.

COMMUNITY HEALTH CONCERNS

In order to determine community health concerns, NJDOH spoke with the Chief Inspector from the Ocean County Health Department (OCHD). During the site visit, NJDOH discussed community health concerns with an OCHD Field Representative and the Jackson Township Director of Public Works.

In 1972, residents began complaining of odors associated with the site. In 1977, residents began reporting that they were experiencing health effects, such as stomach cramps and nausea, whenever they drank tap water. In the past, the primary community health concern involved the contamination of private potable wells and surface water near the site.

According to our conversations with local officials, community health concerns have been minimal since the landfill was closed and public water was supplied to area residents. During a NJDEPE public meeting held in Jackson Township on September 5, 1989, the community expressed health concerns about the potential for exposure to contaminants through the ingestion of garden produce

and to contaminated ground water within the municipal water supply. These concerns are addressed in the Public Health Implications section.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

Data tables 1 to 7 list the site contaminants of concern. NJDOH evaluates these contaminants in the subsequent sections of the Public Health Assessment and determines whether exposure to them has public health significance. NJDOH selects and discusses these contaminants based upon the following factors:

1. Concentrations of contaminants on and off the site.
2. Field data quality, laboratory data quality, and sample design.
3. Comparison of on-site and off-site concentrations with background concentrations, if available.
4. Comparison of on-site and off-site concentrations with health assessment comparison values for (1) noncarcinogenic endpoints and (2) carcinogenic endpoints.
5. Community health concerns.

In the data tables that follow under the On-site Contamination subsection and the Off-site Contamination subsection, the listed contaminant does not mean that it will cause adverse health effects from exposures. Instead, the list indicates which contaminants will be evaluated further in the Public Health Assessment. When selected as a contaminant of concern in one medium, that contaminant will be reported in all media.

The data tables include the following acronyms:

* CREG = ATSDR Cancer Risk Evaluation Guide
* EMEG = ATSDR Environmental Media Evaluation Guide
* RfD = USEPA Reference Dose
* LTHA = USEPA Lifetime Health Advisory
* EPA MCL = USEPA Maximum Contaminant Level
* NJ MCL = New Jersey Maximum Contaminant Level
* NJ SAL = New Jersey Soil Action Level
* ppm = parts per million

Comparison values for public health assessments are contaminant concentrations in specific media that are used to select contaminants for further evaluation. These values include Environmental Media Evaluation Guides (EMEGs), Cancer Risk Evaluation Guides (CREGs), and other relevant guidelines. CREGs are estimated contaminant concentrations based on a one excess cancer in a million persons exposed over a lifetime. CREGs are calculated from EPA cancer slope factors. Maximum Contaminant Levels (MCLs) represent contaminant concentrations that the State or Federal regulatory agency deems protective of public health (considering the availability and economics of water treatment technology) over a lifetime (70 years) at an exposure rate of 2 liters of water per day. MCLs are regulatory concentrations. EPA Reference Doses (RfDs) are estimates of the daily exposure to a contaminant that is unlikely to cause adverse health effects.

A. On-Site Contamination

Soil (0 to 24 inches)

Soil samples were collected from soil borings between July 25 and 30, 1990 during the Phase I Remedial Investigation. All samples were collected and analyzed in accordance with NJDEPE procedures. Six soil borings (SL-1/SL-6) were installed in the former landfill areas along the western perimeter of the site, including in the vicinity of three potential liquid disposal pits. One shallow soil sample was collected from each boring at a depth of 0 to 24 inches. Three soil borings (SL-7/SL-9) were installed in the nonactive areas of the landfill to obtain background soil conditions. One soil sample was collected from each boring at a depth of 0 to 24 inches. Samples were analyzed for volatile and semi-volatile organic compounds, pesticides, polychlorinated biphenyls, inorganic compounds, and total petroleum hydrocarbons. Figure 3 (Appendix A) shows all soil boring sampling locations.

Total petroleum hydrocarbons (TPHC) were detected in all shallow soil samples at levels above comparison values. TPHC was detected at levels above those found in background soil samples. Arsenic and chromium were found in shallow soil samples at levels below comparison values. Bis(2-ethylhexyl)phthalate (BEHP) was detected in all shallow soil samples at levels below comparison values; levels were similar to background concentrations. BEHP was also detected in quality control samples (field blanks) suggesting that the presence of BEHP in soil samples may be the result of field or laboratory contamination. Table 1 reports the contaminants of concern and concentration range detected in shallow soil samples.

Insufficient surface soil samples (0 to 3 inches deep) were collected to completely delineate the extent of soil contamination at the site. Thus, a data gap exists in assessing the potential public health impact of exposure to contaminated surface soil.

Table 1. Range of Contaminant Concentrations in On-site Soil Samples (0 to 24 inches)

Contaminant	Concentration Range in parts per million (ppm)	Comparison Value	
		ppm	Source
Benzene	ND	24	CREG
Chlorobenzene	ND	14,000	RfD
BEHP	0.14 - 2.6	50	CREG
Antimony	ND	10	NJSAL
Arsenic	2.4	210	RfD
Chromium	4.3 - 27.7	3500	RfD
TPHC	51.2 - 663	100	NJSAL

ND-not detected
Source: Phase I Remedial Investigation Summary Report for the Jackson Township Landfill, November 1990

Soil (6 inch interval above water table)

Soil samples were collected from soil borings between July 25 and 30, 1990 during the Phase I Remedial Investigation. All samples were collected and analyzed in accordance with NJDEPE procedures. Six soil borings (SL-1/SL-6) were installed in the former landfill areas along the western perimeter of the site, including in the vicinity of three potential liquid disposal pits. One deep soil sample was collected from each boring from the 6-inch interval above the water table. Samples were analyzed for volatile and semi-volatile organic compounds, pesticides, polychlorinated biphenyls, inorganic compounds, and total petroleum hydrocarbons. Figure 3 (Appendix A) shows all soil boring sampling locations.

Total petroleum hydrocarbons (TPHC) were detected in all deep soil samples at levels above comparison values. TPHC was detected at levels above those found in background soil samples. Arsenic and chromium were found in deep soil samples at levels below comparison values. Bis(2-ethylhexyl)phthalate (BEHP) was detected in all deep soil samples at levels below comparison values; levels were similar to background concentrations. BEHP was also detected in quality control samples (field blanks) suggesting that the presence of BEHP in soil samples may be the result of field or laboratory contamination. Table 2 reports the contaminants of concern and concentration range detected in deep soil samples.

Table 2. Range of Contaminant Concentrations in On-site Soil Samples (6 inch interval above water table)

Contaminant	Concentration Range in parts per million (ppm)	Comparison Value	
		ppm	Source
Benzene	ND	24	CREG
Chlorobenzene	ND	14,000	RfD
BEHP	0.36 - 3.4	50	CREG
Antimony	ND	10	NJSAL
Arsenic	1.4 - 4.7	210	RfD
Chromium	9.9 - 73.2	3500	RfD
TPHC	106 - 1210	100	NJSAL

ND-not detected
Source: Phase I Remedial Investigation Summary Report for the Jackson Township Landfill, November 1990

Ground Water - Monitoring Wells

Groundwater samples were collected from twenty-two monitoring wells between August 21 and 29, 1990 during the Phase I Remedial Investigation. All monitoring wells were screened in the shallow Cohansey aquifer at depths ranging from 2 to 70 feet below grade. Twenty-two monitoring well samples were analyzed for volatile and semi-volatile organic compounds, pesticides, polychlorinated biphenyls, and inorganic compounds. Figure 4 (Appendix A) shows all monitoring well sampling locations.

Benzene was detected in two groundwater samples (including a duplicate sample) from one monitoring well location (101R), and chlorobenzene was detected in four groundwater samples (including a duplicate sample) from three monitoring well locations (101R, 206D, 214), at levels slightly above comparison values. Antimony was found in two groundwater samples (GW-202, GW-302S) at levels above comparison values. BEHP was detected in all monitoring well samples at levels above comparison values; however, BEHP was also detected in all corresponding quality control samples (method blanks) suggesting that the presence of BEHP in monitoring well samples may be the result of laboratory contamination. Chromium was detected in 10 monitoring well samples at levels below comparison values. Chromium levels were typical of background groundwater quality found within the Kirkwood-Cohansey Aquifer System. Table 3 reports the contaminants of concern and concentration range detected in monitoring well samples.

Table 3. Range of Contaminant Concentrations in On-site Groundwater Monitoring Wells

Contaminant	Concentration Range in parts per million (ppm)	Comparison Value	
		ppm	Source
Benzene	0.002 - 0.003	0.001	CREG
Chlorobenzene	0.008 - 0.029	0.004	NJMCL
BEHP	0.004 - 0.063	0.0025	CREG
Antimony	0.032 - 0.034	0.004	RfD
Arsenic	ND	0.011	RfD
Chromium	0.006 - 0.031	0.18	RfD
TPHC	NA	none	none

ND-not detected
NA-not analyzed
Source: Phase I Remedial Investigation Summary Report for Jackson Township Landfill, November 1990

Ambient Air

Ambient air monitoring for volatile organic compounds (VOCs) was performed in December 1988 during the Preliminary Remedial Investigation. The air monitoring survey was conducted on a 100 foot by 100 foot grid over the entire site using a photoionization detector. Low depressions and all groundwater monitoring wells were also surveyed. No VOCs were detected during the air monitoring survey.

Additional ambient air monitoring for VOCs and ionizing radiation was performed on June 29, 1990 during the Remedial Investigation. The air monitoring survey was conducted in a grid pattern over the entire site using a photoionization detector, a flame ionization detector, and an ionizing radiation meter. No readings above background levels were obtained in breathing zone locations.

Air monitoring data may not be representative of conditions, such as seasonal and climatic changes, that may occur at the site. Insufficient data exist to evaluate the potential for past exposure to contaminants in ambient air, particularly during the years when the landfill was in operation.

B. Off-Site Contamination

Ground Water - Residential Wells

Residential well sampling was conducted by the OCHD and NJDEPE from March 1978 through February 1982. Potable well samples were collected from about 40 downgradient residential wells (at tap). In most cases, each well was sampled two or more times. Samples were analyzed for volatile organic compounds and inorganic compounds. In 1978 and 1979, VOCs were detected in potable well samples at levels above comparison values. Subsequent sampling data suggest a general decrease in VOC concentrations over time. Table 4 reports the contaminants of concern and concentration range detected in potable well samples.

Residential well sampling was not conducted during the Phase I Remedial Investigation because property access to the four targeted shallow wells was denied and the two targeted deep wells could not be located. Jackson Township officials report that the shallow residential wells were abandoned and sealed when these homes were connected to the public water system in 1980. Those wells which could not be accessed are screened in the deep aquifer at depths of 400 feet and 500 feet.

Table 4. Range of Contaminant Concentrations in Off-site Residential Water Supplies

Contaminant	Date*	Concentration Range in parts per million (ppm)	Comparison Value	
			ppm	Source
Benzene	12-78	0.0004 - 0.22	0.001	CREG
Carbon Tetrachloride	6-80	0.002 - 0.006	0.0003	CREG
Chlorobenzene	10-78	0.0012 - 0.027	0.004	NJMCL
Chloroform	12-78	0.0007 - 0.05	0.0057	CREG
1,1,1-Trichloroethane	12-78	0.0007 - 1.36	0.2	LTHA
1,1,2,2- Tetrachloroethane	11-78	0.0154**	0.00018	CREG
Trichloroethylene	10-78	0.0007 - 1.078	0.0	MCLG
Tetrachloroethylene	6-80	0.0005 - 0.014	0.0007	CREG
Vinyl Chloride	11-81	0.003 - 0.004	0.0007	EMEG

*maximum concentration sampling date
**landfill trailer sample
Source: Remedial Action Master Plan, Jackson Township Landfill Site, Jackson Township, New Jersey, November 1984.

Indoor Air

Indoor air sampling was conducted by NJDOH in Legler area homes in August 1980. A group of 15 homes were randomly selected from those who were included in the 1980 NJDOH health survey. Of those homes, 5 were currently using residential wells for potable water. In February 1981, indoor air samples were collected in 10 randomly selected non-Legler homes located in a section of Jackson Township upgradient of the site. Basement samples were obtained using activated charcoal tubes and were analyzed for VOCs.

No significant differences in VOC concentrations were found between Legler and non-Legler households. However, data comparison is limited since air sampling for Legler and non-Legler homes were conducted during different seasons. Table 5 reports the contaminants of concern and concentration range detected in indoor air samples.

Table 5. Range of Contaminant Concentrations in Off-site Indoor Air

Contaminant	Concentration Range in parts per billion (ppb)		Comparison Value	
	Legler homes	Non-Legler homes	ppb	Source
Benzene	<1.0 - 37.0	<10.0 - 80.0	0.03	CREG
Chloroform	<1.0	ND	0.0086	CREG
Tetrachloroethylene	<1.0 - 13.0	ND	none	none
Toluene	3.0 - 387.0	<10.0 - 80.0	none	none
Xylene (total)	8.0 - 130.0	<10.0 - 50.0	none	none

ND-not detected
< =less than
Source: Evaluation of Air Contamination in Basements of Legler and Non-Legler Residences, October 1981.

Surface Water

Surface water sampling was conducted on August 31, 1990 during the Phase I Remedial Investigation. Three surface water samples were collected from the Ridgeway Branch at one upstream location (SW-1), one downstream location (SW-4), and one location adjacent to the landfill (SW-2). One upstream surface water sample (SW-3) was collected from the Obhanan-Ridgeway Branch. Figure 5 (Appendix A) shows all surface water sampling locations. Samples were analyzed

for volatile and semi-volatile organic compounds, pesticides, and inorganic compounds.

BEHP was detected in all surface water samples at levels above comparison values; however, BEHP was also detected in all corresponding quality control samples (method blanks) suggesting that the presence of BEHP in surface water samples may be the result of laboratory contamination. Chromium was detected in one surface water sample at levels below comparison values. Table 6 reports the contaminant of concern and concentration range detected in surface water samples.

Table 6. Range of Contaminant Concentrations in Off-site Surface Water Samples

Contaminant	Concentration Range in parts per million (ppm)	Comparison Value	
		ppm	Source
Benzene	ND	0.001	CREG
Chlorobenzene	ND	0.004	NJMCL
BEHP	0.02-0.14	0.0025	CREG
Antimony	ND	0.004	RfD
Arsenic	ND	0.011	RfD
Chromium	0.0072	0.18	RfD
TPHC	NA	none	none

ND-not detected
NA-not analyzed
Source: Phase I Remedial Investigation Summary Report for the Jackson Township Landfill, November 1990

Sediment

Stream sediment sampling was conducted on August 31, 1990 during the Phase I Remedial Investigation. Four stream sediment samples were collected from surface water sampling locations at a depth of 0 to 6 inches. Samples were analyzed for volatile and semi-volatile organics compounds, pesticides, and inorganic compounds. Figure 5 (Appendix A) shows all sediment sampling locations.

Antimony was detected at levels slightly above comparison values in three sediment samples (including a duplicate sample) from one upgradient (SD-3) and one sidegradient (SD-2) sediment sampling location. Benzene was detected at levels below comparison values in one upgradient (SD-1) and one downgradient (SD-4) sediment

sampling location. BEHP was detected in all sediment samples at levels below comparison values. BEHP was also found in a quality control sample (field blank) suggesting that the presence of BEHP in sediment samples may be the result of field or laboratory contamination. Chromium was detected in one upgradient location at levels below comparison values. Table 7 reports the contaminants of concern and concentration range detected in stream sediment samples.

Table 7. Range of Contaminant Concentrations in Off-site Sediment Samples

Contaminant	Concentration Range in parts per million (ppm)	Comparison Value	
		ppm	Source
Benzene	0.011 - 0.014	24	CREG
Chlorobenzene	ND	14,000	RfD
BEHP	0.4 - 2.2	50	CREG
Antimony	14.4 - 18.8	10	NJSAL
Arsenic	ND	210	RfD
Chromium	4.3	3500	RfD
TPHC	NA	100	NJSAL

ND-not detected
NA-not analyzed
Source: Phase I Remedial Investigation Summary Report for the Jackson Township Landfill, November 1990

C. Quality Assurance and Quality Control

In preparing this Public Health Assessment, NJDOH relied on the information provided in the referenced documents, and assume that adequate quality assurance and quality control measures were followed with regard to chain-of-custody, laboratory procedures and data reporting. The validity of the analysis and conclusions drawn for this Public Health Assessment is determined by the availability and reliability of the referenced information.

Phase I environmental samples were analyzed under the USEPA Certified Laboratory Program. Analytical data were validated by NJDEPE data-validation personnel. While proper quality assurance and control measures were generally followed during sample collection and analysis, the quality of the data was affected by quality control sample contamination. Acetone and methylene chloride were found in several field, trip and method blanks in all media and may be the result of laboratory or field contamination.

These compounds are not included in the discussion in the Environmental Contamination and Other Hazards section. BEHP was also detected in blank samples in some media; thus its presence in certain media samples may be the result of contamination in the field or laboratory.

The quality of residential well data (1978-1982) was affected by improper sample handling and preparation, data reporting errors, and inadequate information on exact residential well locations. Therefore, data interpretation, including the analysis of trends over time, is limited.

Quality assurance and quality control information was not available for the 1980-1981 indoor air sampling data. Seasonal differences occurred in air sampling episodes in Legler and non-Legler households limiting the comparability of the data.

D. Physical and Other Hazards

Subsurface methane gas monitoring was performed in December 1988 during the Preliminary Remedial Investigation. Methane monitoring was conducted every 50 feet across the former landfill areas and along the site perimeter adjacent to the landfill areas (See Appendix A; Figure 2 for approximate limits of former landfill areas). Positive readings of 10 to 100% of the lower explosive limit (LEL) were obtained along the site perimeter adjacent to the northwestern landfill area. Positive readings of 15 to 100% LEL were recorded adjacent to the southwestern landfill area. Methane monitoring performed adjacent to positive readings does not indicate off-site methane gas migration. Methane gas monitoring was also performed at monitoring wells located within landfill areas. A positive reading of 65 percent of the LEL was obtained from within a damaged monitoring well located near the northwestern corner of the site. The release of methane from the liquid waste disposal areas of the landfill presents a potential explosion or asphyxiation hazard in confined spaces to on-site workers during ground-intrusive remedial activities, such as digging.

Most methane gas migration may be occurring directly into ambient air through the existing porous sandy landfill cover. Although it does not appear that methane gas is migrating to off-site areas through the subsurface soil, the residence located immediately adjacent to the northwestern landfill area may be potentially impacted by methane gas migration. The potential for off-site methane migration may increase under certain weather conditions, such as during periods of heavy rain or extreme cold, when the vertical movement of soil gas is inhibited.

During the site visit, several steep sandy slopes within the mounded areas were observed on the site. These deep depressions present a physical hazard to site trespassers, particularly children.

E. Toxic Chemical Release Inventory Data

To identify possible facilities that could contribute to the contamination of environmental media near the Jackson Township Landfill site, NJDOH conducted a search of the Toxic Chemical Release Inventory (TRI) for 1987 through 1989. TRI is developed by the USEPA from the estimated annual releases of toxic chemicals to the environment (air, water, soil, or underground injection) provided by certain industries. TRI did not list any facilities located near the site that reported emissions of toxic chemicals for 1987 through 1989.

PATHWAYS ANALYSES

To determine whether nearby residents are exposed to contaminants migrating from the site, NJDOH evaluates the environmental and human components that lead to human exposure. This pathways analysis consists of five elements: A source of contamination, transport through an environmental medium, a point of exposure, a route of exposure, and an exposed population.

NJDOH categorizes an exposure pathway as a completed or potential exposure pathway if the exposure pathway cannot be eliminated. Completed pathways consist of the five elements and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. Potential pathways, however, have at least one of the five elements is missing, but could exist. Potential exposure pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present. Table 8 identifies the completed exposure pathways. Table 9 identifies the potential exposure pathways. The discussion that follows these tables incorporates only those pathways that are important and relevant to the site. We also discuss some of those exposure pathways that have been eliminated.

Table 8. Completed Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Residential Well	Jackson Twp. Landfill	Ground Water (Residential Wells)	Residences (taps)	Ingestion, Inhalation, Skin Contact	Legler Residents	Past

Table 9. Potential Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Soil	Jackson Twp. Landfill	Soil	Landfill	Ingestion, Inhalation, Skin Contact	Site Trespassers, Jackson Twp. Residents	Past Present Future
Ambient Air	Jackson Twp. Landfill	Ambient Air	Landfill	Inhalation	Jackson Twp. Residents	Past
Indoor Air	Jackson Twp. Landfill	Indoor Air	Residences	Inhalation	Legler Residents	Past
Sediment	Jackson Twp. Landfill, other unknown sources	Stream Sediment	Ridgeway Branch, Obhanan-Ridgeway Branch	Ingestion, Skin Contact	Jackson Twp. Residents	Past Present Future

A. Completed Exposure Pathways

Residential Well Pathways

Past exposure of Legler residents to VOCs in residential well water are likely to have occurred from 1978 through 1980, and may have occurred as early as 1972. Legler residents may have been exposed by drinking tap water, breathing air in the home that has been contaminated with VOCs released during the use of tap water for purposes such as showers and dishwashing, and through direct contact with VOCs in water during activities such as hand-washing. In the past, VOCs had migrated from the landfill through the shallow groundwater system. Residential well data documented the presence of VOCs in the potable water supply of Legler residents from 1978 through 1979. About 100 homes were found to be contaminated with VOCs. The quality of residential well data (1978-1982) was affected by improper sample handling and preparation, data reporting errors, and inadequate information on exact residential well locations. Therefore, the ability to assess the impact of the site on public health is limited. The Phase I Remedial Investigation indicates that sufficient time has elapsed for groundwater contaminants released during landfill activities to have reached the Ridgeway Branch. Based on Phase I ground-water monitoring, it does not appear that substantial contamination has extended beyond the Ridgeway Branch. Past exposure to VOCs in residential well water is evaluated further in the Public Health Implications section.

Although the Phase I groundwater monitoring results indicates that the landfill continues to be a source of residual contamination to the shallow aquifer, the affected Legler homes were provided with alternate sources of water in 1980. Since residents living near the site are currently receiving potable water from a public water system well screened within a confined deep aquifer, the potential for present or future exposure to contaminated ground water is unlikely. Therefore, NJDOH has eliminated this present and future pathway from further consideration in the Public Health Assessment.

B. Potential Exposure Pathways

Soil Pathways

Total petroleum hydrocarbons (TPHC) was found in soil samples (0 to 24 inches deep) from liquid disposal areas along the western portion of the site at levels above comparison values. Insufficient soil samples exist to determine the extent of surface soil contamination (0 to 3 inches deep) at the site. Although a heavy metal fence surrounds most of the site, the site is accessible along the western boundary adjacent to contaminated areas. Trespassers, particularly young children, are potentially at risk from exposure to contaminated soil on the site through eating soil, breathing in soil and dust, and skin contact.

TPHC readily bind to soil. The presence of sandy soil and limited vegetative cover at the site may result in off-site contaminant migration through airborne soil and dust. However, the potential for exposure of nearby residents to these contaminants through soil and dust generation is minimal since the extent of on-site soil contamination is limited to the northwestern portion of the site. Site contaminants are not likely to migrate to off-site areas through surface water runoff. Surface elevations are generally lower at the site than at residential and commercial properties immediately adjacent to the site, thus minimizing the likelihood of off-site soil migration. In addition, the presence of highly permeable surface soils promotes rapid downward movement of surface water at the site.

On-site workers and nearby residents may be potentially exposed to airborne soil and dust released during landfill closure/remedial activities. The number of people who may be potentially exposed to contaminated soil at or near the site is unknown. About 3,200 residents lived within 3 miles of the site during the late 1980's and U.S. census information reports that about 33,200 lived in Jackson Township in 1990. Since additional surface soil samples are needed to assess the public health impact of soil contamination, the NJDOH has categorized this pathway as a potential exposure pathway.

Ambient Air Pathways

Past exposure of Legler residents to VOCs in ambient air may have occurred prior to 1980. Legler residents may have been exposed in the past by breathing in VOCs in ambient air. Residents began reporting that odors were coming from the land-fill in 1972. The number of people who may have been exposed to contaminants in ambient air in the past is unknown. About 3,200 residents lived within 3 miles of the site during the late 1980's. Since air sampling data were not collected at the site during active landfill operations, the NJDOH has categorized this pathway as a potential exposure pathway.

Indoor Air Pathways

Past exposure of Legler residents to VOCs in indoor air may have occurred prior to 1980. Legler residents may have been exposed by breathing air in the home that had been contaminated with VOCs. VOCs may have been released into indoor air during the use of tap water for purposes such as showers and dishwashing. In the past, VOCs had migrated from the landfill through the shallow groundwater system. Residential well data documented the presence of VOCs in the downgradient potable water supply of Legler residents from 1978 through 1979. About 100 residential wells were found to be contaminated with VOCs. The contaminants detected in indoor air in 1980 were similar to those found in residential wells. Although it

is possible that VOCs may have volatilized from potable water supplies into residential indoor air, it cannot be determined whether the presence of VOCs in indoor air is related to groundwater contamination since residential well samples were not collected from these homes for comparison.

The source of VOCs in indoor air may have been from volatilization of contaminants from the shallow ground water into the residential basements through the soil. However, no soil gas data was collected from residential areas to evaluate the potential for off-site migration of VOCs.

Since indoor air contaminants were detected in upgradient homes at concentrations similar to those found in Legler homes, the presence of VOCs in indoor air may not be the result of groundwater contamination emanating from the landfill. However, air sampling was conducted during different seasons (i.e., under closed house versus open house conditions), thus potentially concealing any significant difference in VOC concentrations in Legler homes as compared to upgradient homes. Past exposure to VOCs in indoor air is evaluated further in the Public Health Implications section.

In 1980, about 100 affected homes were provided with alternate sources of water. Since residents living near the site are currently receiving potable water from the public water system, the potential for present or future exposure to contaminants in indoor air through the household use of water is unlikely. Based on Phase I sampling results, it appears unlikely that VOCs are migrating to off-site areas through the soil gas or through the groundwater system, thus minimizing the potential for present or future exposure to contaminants in indoor air. Therefore, NJDOH has eliminated this present and future pathway from further consideration in the Public Health Assessment.

Sediment Pathways

Antimony was found in stream sediment samples from the Ridgeway and Ridgeway-Obhanan Branches at levels slightly above comparison values. However, antimony was detected in upgradient samples at similar concentrations to those found in sidegradient samples. Antimony was not found in the downgradient sediment sample suggesting that the migration of site contaminants to the Ridgeway Branch through the ground-water system is limited. Antimony was not detected in on-site soil samples or downgradient monitoring wells, thus further indicating a minimal ongoing impact of the site on stream sediment quality.

While it is suspected that the contaminants disposed of in the landfill may have impacted the sediments, the data appears to indicate that the landfill is most likely not a major contributor to sediment contamination. Other sources of contamination, such as the regional use of septic tanks for the disposal of septic and

household wastes, may contribute to such contamination. Near the site, the Ridgeway and Ridgeway-Obhanan Branches are located in a heavily wooded area and is not easily accessible to residents. The number of people who may be potentially exposed to contaminated stream sediment is unknown. About 3,200 residents lived within 3 miles of the site during the late 1980's and U.S. census information reports that about 33,200 lived in Jackson Township in 1990. Since the likelihood of exposure of local residents to antimony in the Ridgeway Branch during recreational use is minimal, NJDOH has categorized this pathway as a potential exposure pathway.

PUBLIC HEALTH IMPLICATIONS

A. Toxicological Evaluation

Introduction

In this section, NJDOH will discuss the health effects in persons exposed to specific contaminants. To evaluate health effects, ATSDR has developed a Minimal Risk Level (MRL) for contaminants commonly found at hazardous waste sites. The MRL is an estimate of daily human exposure to a contaminant below which non-cancer, adverse health effects are unlikely to occur. MRLs are developed for each route of exposure, such as ingestion and inhalation, and for the length of exposure, such as acute (less than 14 days), intermediate (15 to 364 days), and chronic (greater than 365 days). ATSDR presents these MRLs in Toxicological Profiles. These chemical-specific profiles provide information on health effects, environmental transport, human exposure, and regulatory status. In the following discussion, NJDOH used ATSDR Toxicological Profiles for the contaminants of concern at the site. NJDOH will use a USEPA Reference Dose (RfD) as a health guideline when a MRL is not available. The RfD is an estimate of daily human exposure to a contaminant for a lifetime below which (non-cancer) health effects are unlikely to occur.

Residential Well Pathways

Cancer estimates are based on an intake rate of 2 liters of water per day for a 70 kilogram adult for a lifetime (70 years). Since exposure to most Legler residents would most likely have occurred during the period from 1972 to 1980 rather than a lifetime, the risk of developing cancer from ingestion of residential well water for up to 8 years would be less than the risk for a lifetime of exposure. The following discussion of potential health effects does not address the issue of multiple exposure pathways. Legler residents may have also been exposed to VOCs in indoor air through volatilization from residential well water, thus potentially increasing estimated exposure doses and cancer risk.

Benzene and vinyl chloride are classified by USEPA as human carcinogens (cancer causing substances). Oral exposure to benzene at maximum concentrations found in residential well water for a lifetime may result in a low increased cancer risk. Studies show that animals fed low levels of vinyl chloride each day during their lifetime have an increased risk of getting cancer. It is not known whether human exposure to vinyl chloride at levels detected in residential well water will result in an increased cancer risk. The amount of vinyl chloride ingested by Legler residents (adults and children) exceeds the chronic oral MRL of 0.00002 mg/kg/day. Animal studies have shown that chronic oral exposure to low levels of vinyl chloride affected liver structure. Health effects in humans are unknown.

Carbon Tetrachloride is categorized as a probable human carcinogen. Oral exposure to carbon tetrachloride at maximum concentrations found in residential well water for a lifetime (70 years) is associated with a no apparent increased cancer risk. The amount of carbon tetrachloride ingested by Legler residents (adults and children) does not exceed the USEPA oral RfD (Reference Dose) of 0.0007 mg/kg/day. A chronic MRL is not available for comparison.

Chloroform and tetrachloroethylene (PCE) are categorized as probable human carcinogens. Oral exposure to chloroform at maximum concentrations found in residential well water would not be expected to result in an increased cancer risk. Although PCE is a animal carcinogen, it is not known whether PCE causes cancer in humans. Both chloroform and PCE exposure would not be expected to result in non-cancer health effects since ingested amounts do not exceed the chronic oral MRL of 0.01 mg/kg/day for chloroform and the intermediate oral MRL of 0.1 mg/kg/day for PCE.

1,1,2,2-Tetrachloroethane is categorized as a possible human carcinogen. Oral exposure to 1,1,2,2-Tetrachloroethane at maximum concentrations found in residential well water would result in no apparent increased cancer risk. No MRL or RfD comparison value is available to evaluate the potential for non-cancer health effects.

The amount of chlorobenzene ingested by adults and children does not exceed the oral RfD of 0.02 mg/kg/day. No health guideline is available to evaluate the potential for cancer and non-cancer health effects from exposure to trichloroethylene. No MRL or RfD is available for 1,1,1-trichloroethane.

Indoor Air Pathways

Cancer estimates are based on an intake rate of 23 cubic meters of air per day for a 70 kilogram adult for a lifetime (70 years). Since indoor air samples were collected from the basements of Legler and non-Legler households, VOC concentrations may not accurately reflect residential exposure in actual living areas of the home. The risk of developing cancer from inhalation of VOCs in

indoor air would likely be reduced for those residents who spent limited time in the basement. Likewise, indoor air sampling did not account for seasonal and temporal variations in VOC concentrations. As such, VOC concentrations may not represent typical yearly (average) exposure. The following discussion of potential health effects does not address the issue of multiple exposure pathways. Legler residents may have also been exposed to VOCs in residential well water, thus potentially increasing estimated exposure doses and cancer risk.

Benzene is classified by USEPA as a human carcinogen. The effects of long-term exposure to benzene in air comes from studies of workers exposed in the workplace at levels far greater than levels found in Legler and non-Legler basements. Based on these worker studies, inhalation exposure to benzene at maximum concentrations found in basement air near the site for a lifetime may result in a moderate increased cancer risk.

Based on animal studies, chloroform is classified as a probable human carcinogen. Inhalation exposure to chloroform at maximum concentrations found in indoor air for a lifetime may result in a low increased cancer risk.

Tetrachloroethylene (PCE) is categorized as a probable human carcinogen. Although PCE has been shown to cause liver and kidney cancer in animals exposed to levels much higher than those found in Legler and non-Legler basements, it is not known whether PCE causes cancer in humans.

The amount of toluene inhaled by adults and children does not exceed the intermediate inhalation MRL of 1 ppm. A chronic MRL is not available for comparison. Inhalation exposure to toluene at levels found in Legler and non-Legler residences would not be likely to result in non-cancer health effects.

No MRL or RfD is available to evaluate the potential for non-cancer health effects from exposure to xylene. Long-term exposure to low concentrations of xylene has not been well studied in animals. Based on available information, xylene levels found in indoor air would not be expected to cause adverse health effects.

Sediment Pathways

Local residents may potentially be exposed to low levels of antimony through ingestion and direct contact during recreational use of the Ridgeway and Obhanan-Ridgeway Branches adjacent to the site. Oral exposure to maximum concentrations of antimony found in stream sediment samples for a lifetime would not be expected to result in carcinogenic or non-carcinogenic health effects. Rabbits that had small amounts of antimony oxides placed on their skin for less than one day had mild skin irritation. Human health effects from skin contact with low levels of antimony are not known.

B. Health Outcome Data Evaluation

Due to the small size of the exposed population and length of exposure, available health outcome databases could not be used to evaluate an association between exposures and certain health effects.

In January 1980, NJDOH conducted a health survey of 94 Legler households. A self-administered health questionnaire was mailed to each household. Each questionnaire contained a checklist of 148 signs, symptoms and conditions, as well as questions related to medications, occupation, chemical exposure, family history and maternal history. A total of 82 completed surveys were returned and analyzed. The most commonly reported health complaints were skin and eye irritation.

NJDOH and the OCHD conducted a health census of 162 Legler households from August through November 1980 to assess possible associations between reported adverse health effects and exposure to residential well water. A questionnaire was administered in the home by a trained interviewer. Each questionnaire was designed to gather information on all household members, including individual health, reproductive history, and exposure history. Exposure history was evaluated based on location of residence, depth of well, years of well use, and frequency of water usage. A total of 150 questionnaires were completed and analyzed. An association was found between exposure to well water and reports of skin problems, including itching, blisters, redness, and hives.

The relationship found between residential well water exposure and skin symptoms is consistent with the known effects of the contaminants found in Legler wells based on exposure studies of workers. However, the levels of contaminants found in Legler wells are much lower than those found in the workplace studies. Interpretation of the results is limited since past exposures to residential well water were estimated based on questionnaire responses. Since exposed individuals are likely to have a high level of awareness and concern, respondent bias may have resulted in the over-reporting of health effects and may have contributed to the results of the study.

C. Community Health Concerns Evaluation

Community health concerns are addressed as follows:

* What health risks are associated with past exposure to VOCs in residential well water?

Past exposure of Legler residents to VOCs in residential well water are likely to have occurred from 1978 through 1980, and may have occurred as early as 1972, through ingestion, inhalation, and direct contact. However, the ability to

assess the impact of the site on public health is limited due to errors in well sampling procedures. Since residents living near the site are currently receiving potable water from a public water system well located within a confined deep aquifer, the potential for present or future exposure to contaminated ground water is unlikely.

Based on available data and information, the site may have posed a public health hazard in the past since human exposure to VOCs in drinking water may have occurred at levels that may result in adverse health effects. Further details of the public health implications of past exposure to VOCs in residential well water are discussed in the Public Health Implications section.

* What is the potential for exposure to soil contaminants through the ingestion of garden produce?

The primary route of exposure from the landfill is through the ground water. Since area residents receive potable water through the public water system, it is unlikely that garden produce will come into direct contact with contaminated ground water through irrigation.

Contaminant migration to off-site areas through airborne soil and dust is limited since the extent of on-site soil contamination is confined to a small portion of the site. Site contaminants are not likely to migrate to off-site areas through surface water runoff due to site topography and the highly permeable nature of site soils.

* What is the potential for exposure to groundwater contaminants within the municipal water supply?

Legler residents are connected to the Jackson Township Municipal Utility Authority (JTMUA) water system. The 1700 foot deep JTMUA well serving Legler residents draws water from a unaffected confined aquifer located about one-half mile to the southeast of the site. To assure drinking water quality, public water supplies must be sampled on a monthly basis for certain contaminants under the New Jersey Safe Drinking Water Act. Test results can be obtained from the local water company or from NJDEPE, Bureau of Safe Drinking Water at 609-292-5550.

Public Comment Period

The New Jersey Department of Health (NJDOH) conducted a comment period for the Public Health Assessment for the Jackson Township Landfill from July 6, 1993 to August 6, 1993. The Public Health Assessment was placed in local repositories to facilitate commentary and reaction from the public at large. Additionally,

the Public Health Assessment was circulated to the Ocean County Health Department for the purpose of soliciting commentary from local health officials.

A summary of commentary received by the NJDOH and associated responses are contained in Appendix C.

CONCLUSIONS

1. NJDOH has concluded that this site is an indeterminate public health hazard since insufficient data exist for some environmental media to which humans may be exposed. However, available data and information do not indicate that humans are presently being exposed to contaminants at levels expected to cause adverse health effects. This site also poses a public health hazard since information indicates that **past** human exposure to volatile organic contaminants in drinking water has occurred at levels that may result in adverse health effects.

2. Environmental data indicate a minimal ongoing impact of former landfill operations on ground water, surface water, sediments and air quality.

3. Environmental data do not adequately characterize the extent or amount of site contamination that may exist in on site surface soils (0-3 inches). Insufficient data exist to determine whether site trespassers are being potentially exposed to contaminated soil.

4. Indoor air monitoring data is inadequate to determine whether subsurface methane gas is migrating into residences adjacent to the landfill area.

5. In the past, residents reported site-related odors and adverse health effects associated with drinking water. The primary community health concern involved the contamination of private potable wells and surface water near the site. Although community health concerns have been minimal since the landfill was closed and public water was supplied to the area in 1980, residents have more recently expressed concerns about the potential for exposure to contaminants through the ingestion of garden produce and municipal water supplies. Based on available site information, current human exposure to site contaminants through these pathways are not likely. Further discussion of community health concerns is found in the Public Health Implications section.

6. In January 1980, NJDOH conducted a health survey of 94 Legler households. The most commonly reported health complaints were skin and eye irritation. A health census of 162 Legler

households in August through November 1980 evaluated the relationship between reported adverse health effects and exposure to residential well water. An association was found between reports of various skin problems and exposure to well water. Further discussion of health outcome data is found in the Public Health Implications section.

RECOMMENDATIONS

Recommendations to Cease/Reduce Exposure

1. Restrict public access to the site.

2. Implement landfill closure activities.

3. Protect on-site remedial workers from physical hazards, particularly from fire or explosion, due to the release of methane gas during ground-intrusive remedial activities in confined spaces.

4. Provide on-site remedial workers with adequate protective equipment and training, in accordance with 29 CFR 1910.120, and follow appropriate National Institute for Occupational Safety and Health, and Occupational Safety and Health Administration guidelines.

5. Implement optimal dust control measures to protect persons on and off the site from exposure to dusts that may be released during landfill closure/remedial activities.

Site Characterization Recommendations

1. Conduct indoor air monitoring for methane in nearby homes, particularly in the residence located adjacent to the landfill area.

2. Obtain additional data for surface soil (0 to 3 inches deep) in order to adeuately characterize the extent and amount of site contamination that may exist on the site.

3. Conduct monitoring of ambient air and any other appropriate media during landfill closure/remedial activities in order to determine if nearby workers and residents are being exposed.

Health Activities Follow-up Recommendations

The data and information developed in the public health assessment for the Jackson Township Landfill, Jackson Township, New Jersey has been evaluated by ATSDR's Health Activities Recommendation Panel (HARP) for appropriate follow-up with respect to health activities.

This site is not being considered for follow-up activities at this time. Specifically, the HARP determined that the previous community health investigation performed by NJDOH and individual evaluations being performed by private physicians are appropriate actions to followup the past exposure to contaminated drinking water.

PUBLIC HEALTH ACTIONS

The following public health actions for the Jackson Township Landfill site will be taken by NJDOH and/or ATSDR at and around the site subsequent to the completion of this public health assessment. The purpose of these public health actions are 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 substance in the environment. Included is a commitment on the part of NJDOH and ATSDR to follow-up on these actions to ensure that they are implemented.

Public Health Actions Taken:

The NJDOH has conducted a health survey of reported health complaints of 94 Legler residents.

The NJDEPE has revised the methane monitoring program which should be sufficient to detect landfill gases before they pose a threat to nearby residences.

The NJDEPE is constructing a 6-foot perimeter fence which should help mimimize the potential for exposure to any on-site soil cotaminants.

Public Health Action Planned:

NJDOH will coordinate with appropriate environmental agencies to develop plans to implement the cease/reduce and site characterization recommendations contained in this public health assessment. NJDOH will evaluate the need for additional public health actions if data become available that suggest the need for further actions at this site.

ATSDR will re-evaluate and expand the Public Health Action Plan (PHAP) when needed. New environmental, toxicological, health outcome data, or the results of implementing the above proposed actions may determine the need for additional actions at this site.

CERTIFICATION

The Public Health Assessment for the Jackson Township Landfill was prepared by the under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was initiated.

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

Division Director, DHAC, ATSDR

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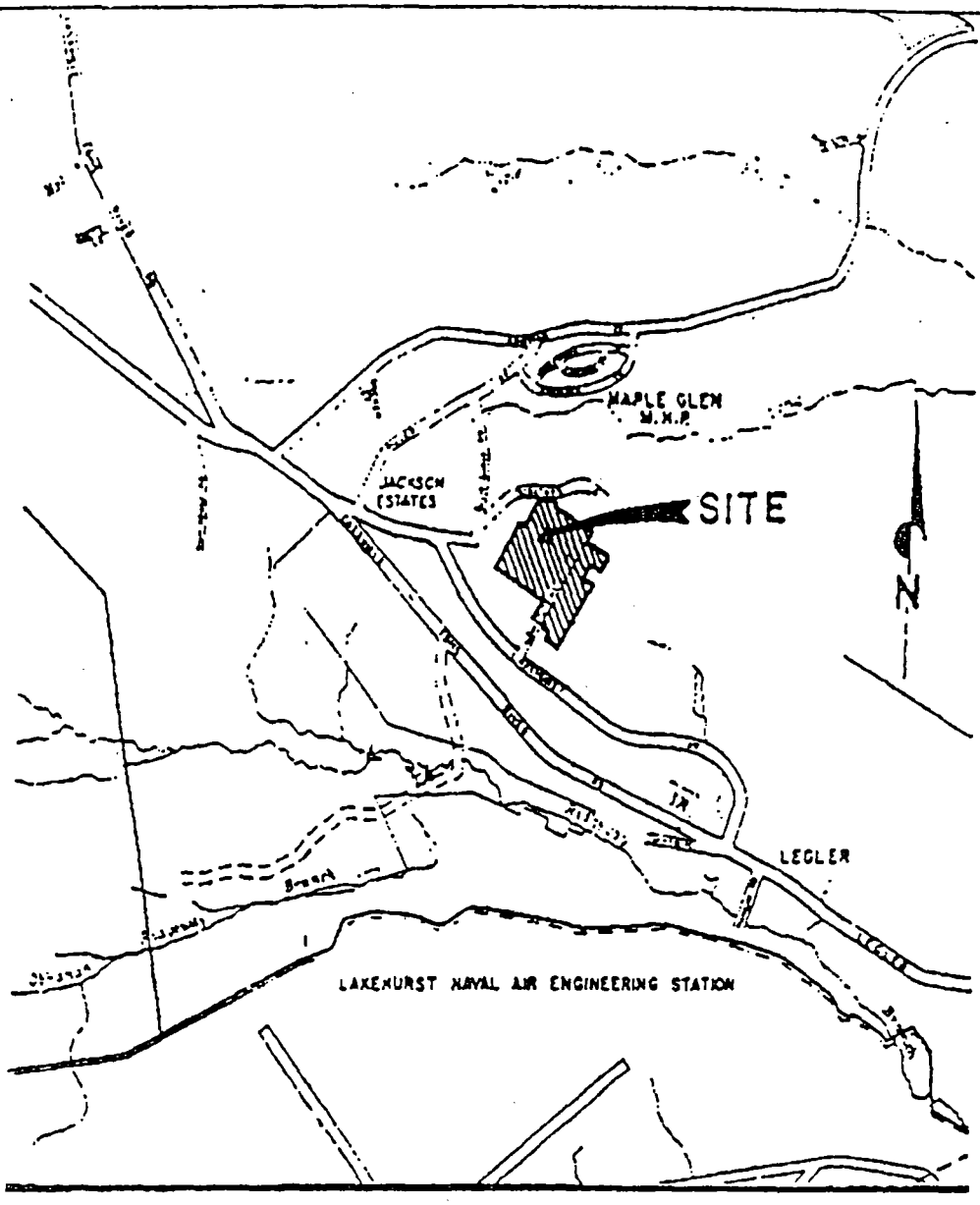
New Jersey Department of Health. A Health Census of a Community with Groundwater Contamination, Jackson Township, 1980. Trenton, New Jersey: New Jersey Department of Health, July 1983.

New Jersey Department of Health. Groundwater Contamination and Possible Health Effects in Jackson Township, New Jersey. Trenton, New Jersey: New Jersey Department of Health, 1980.

APPENDICES

APPENDIX A

FIGURE 1



SITE LOCATION MAP

JACKSON TOWNSHIP LANDFILL
JACKSON TOWNSHIP, NEW JERSEY

0 5,000 10,000Ft

SCALE (APPROX.)

SOURCE:
MAGSTROM MAP OF
OCEAN COUNTY, N.J

FELLOWS, READ & ASSOCIATES INC.

DATE: 11-30-90

FIGURE 2

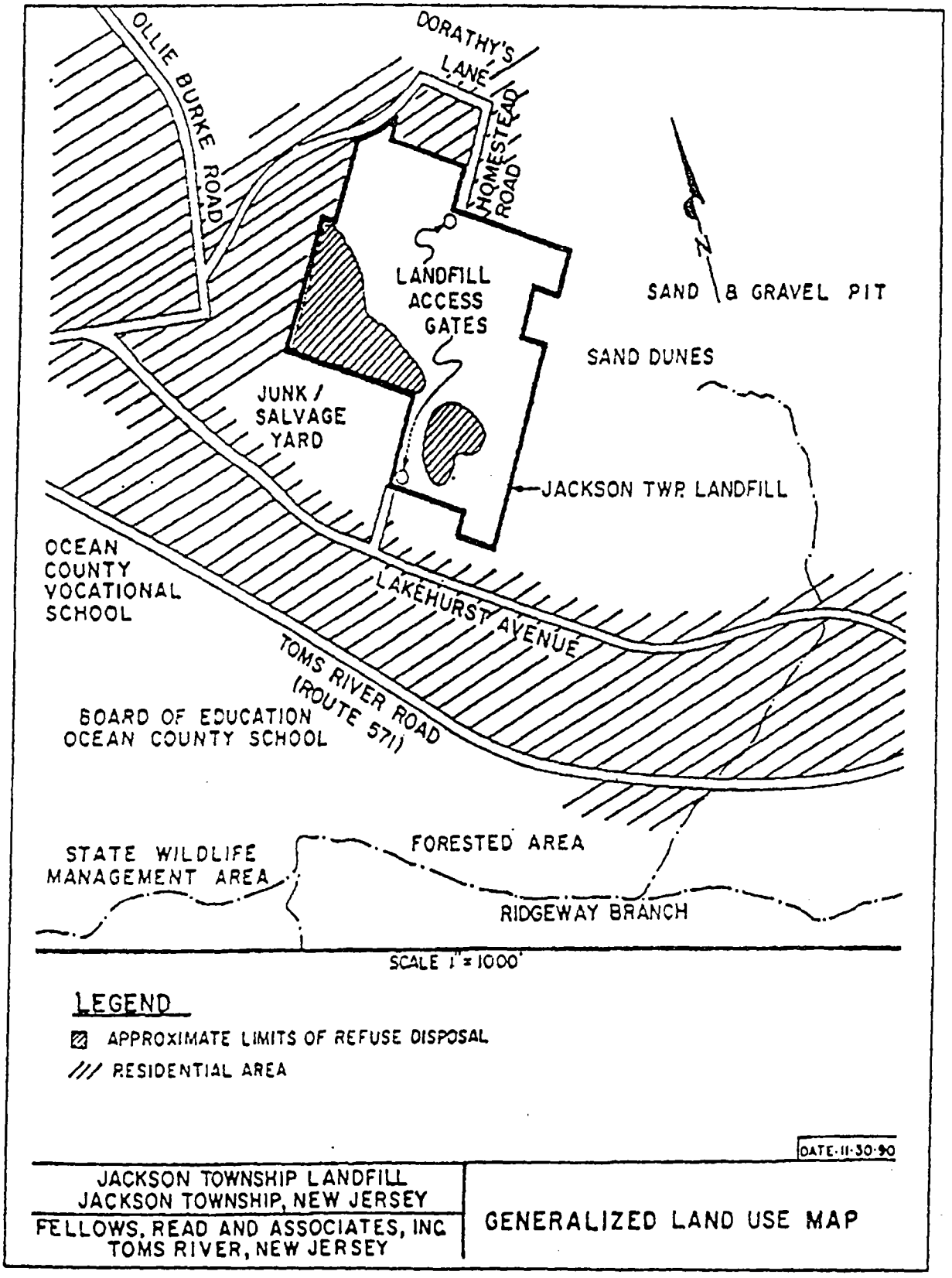

OLLIE BURKE ROAD
DORATHY'S LANE
HOMESTEAD ROAD
N
LANDFILL ACCESS GATES
SAND & GRAVEL PIT
SAND DUNES
JUNK / SALVAGE YARD
JACKSON TWP. LANDFILL
OCEAN COUNTY VOCATIONAL SCHOOL
LAKEHURST AVENUE
TOMS RIVER ROAD (ROUTE 571)
BOARD OF EDUCATION OCEAN COUNTY SCHOOL
STATE WILDLIFE MANAGEMENT AREA
FORESTED AREA
RIDGEWAY BRANCH
SCALE 1" = 1000'
LEGEND
APPROXIMATE LIMITS OF REFUSE DISPOSAL
RESIDENTIAL AREA
DATE-11-30-90
JACKSON TOWNSHIP LANDFILL
JACKSON TOWNSHIP, NEW JERSEY
FELLOWS, READ AND ASSOCIATES, INC.
TOMS RIVER, NEW JERSEY
GENERALIZED LAND USE MAP

FIGURE 3

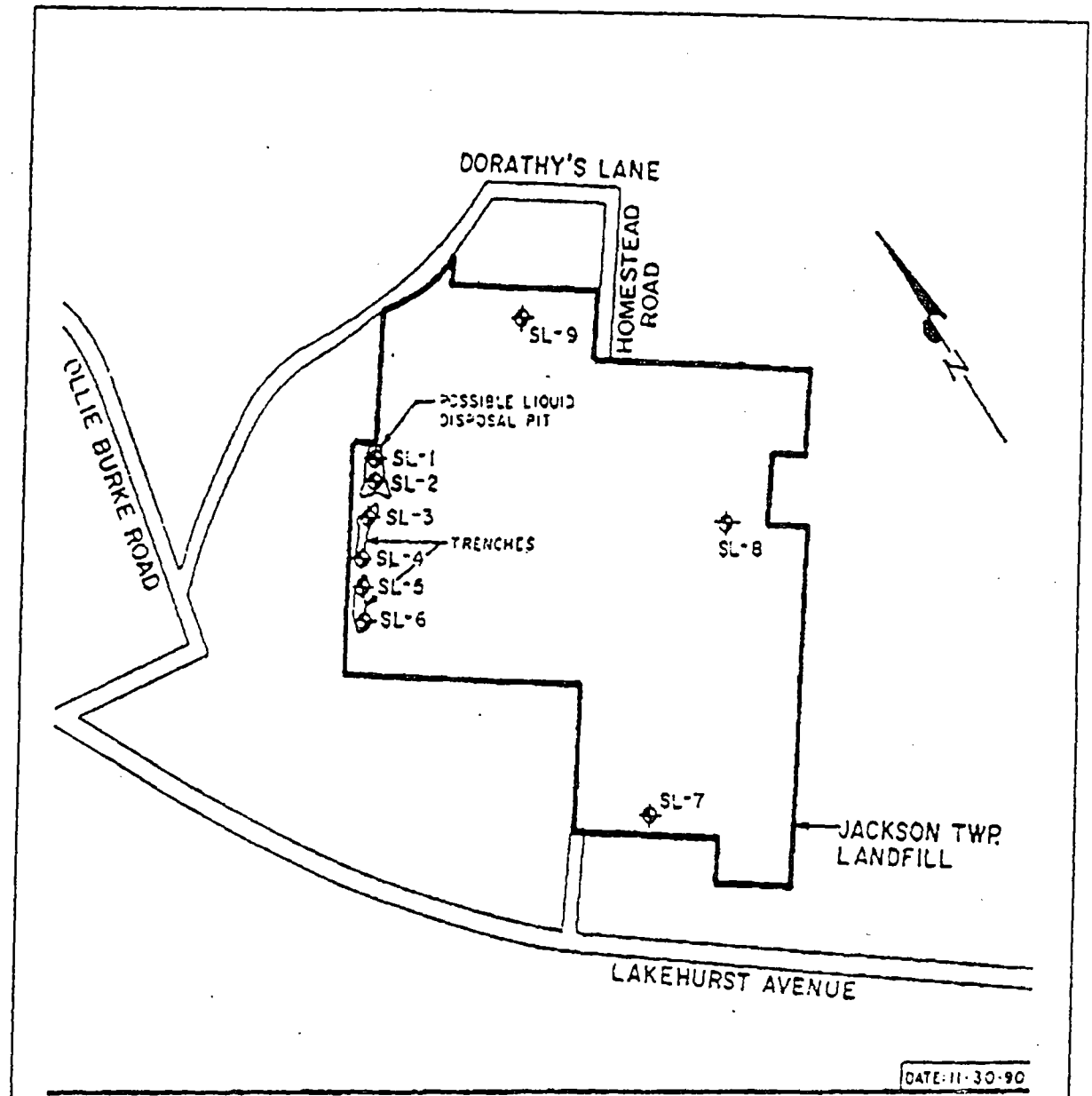

DORATHY'S LANE
HOMESTEAD ROAD
OLLIE BURKE ROAD
SL-9
POSSIBLE LIQUID DISPOSAL PIT
SL-1
SL-2
SL-3
TRENCHES
SL-4
SL-5
SL-6
SL-8
SL-7
JACKSON TWP. LANDFILL
LAKEHURST AVENUE
DATE: 11-30-90
SCALE 1" = 600'
LEGEND
SOIL BORING LOCATION
JACKSON TOWNSHIP LANDFILL
JACKSON TOWNSHIP, NEW JERSEY
FELLOWS, READ AND ASSOCIATES, INC.
TOMS RIVER, NEW JERSEY
SOIL BORING LOCATIONS

FIGURE 4

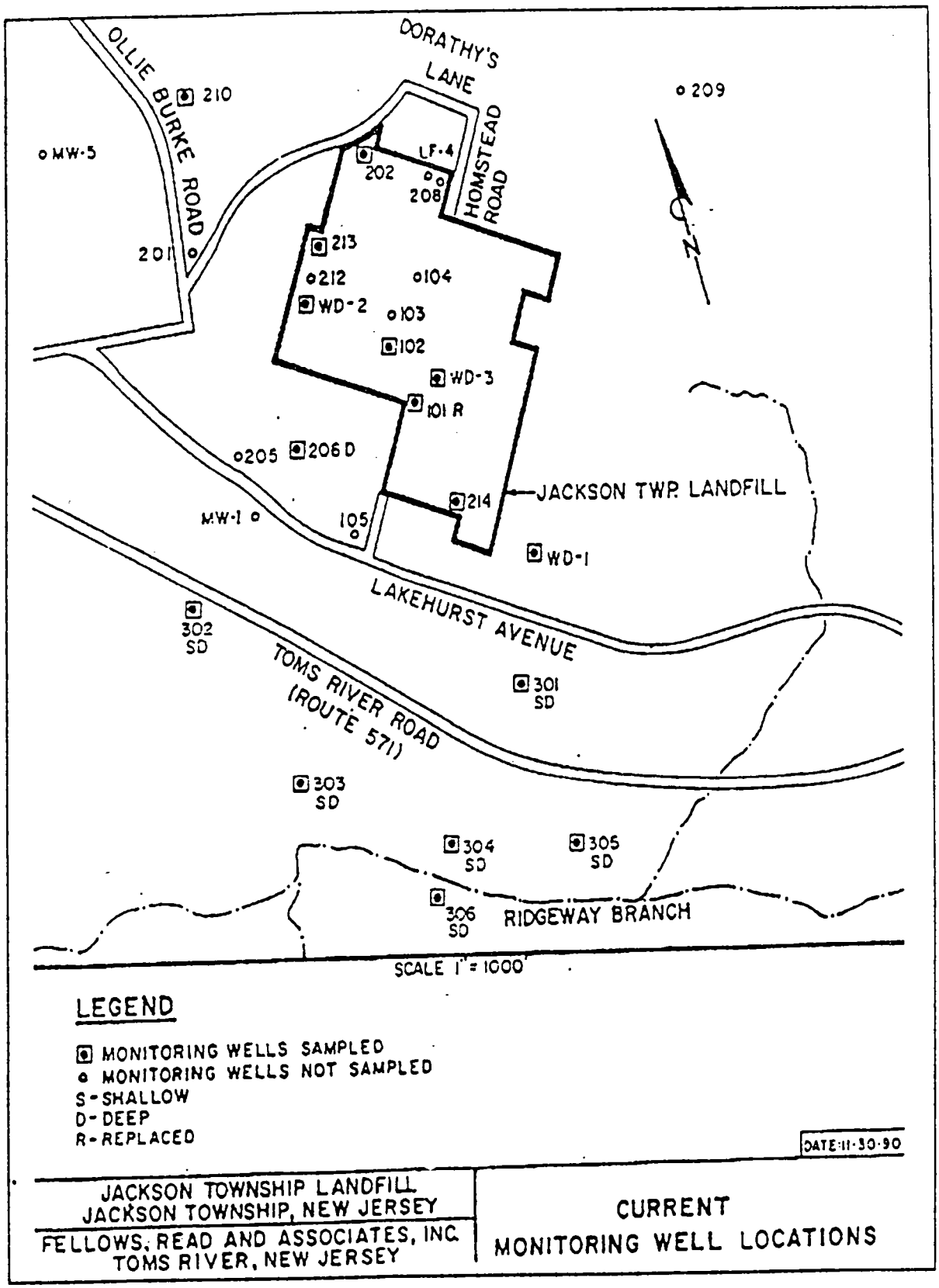
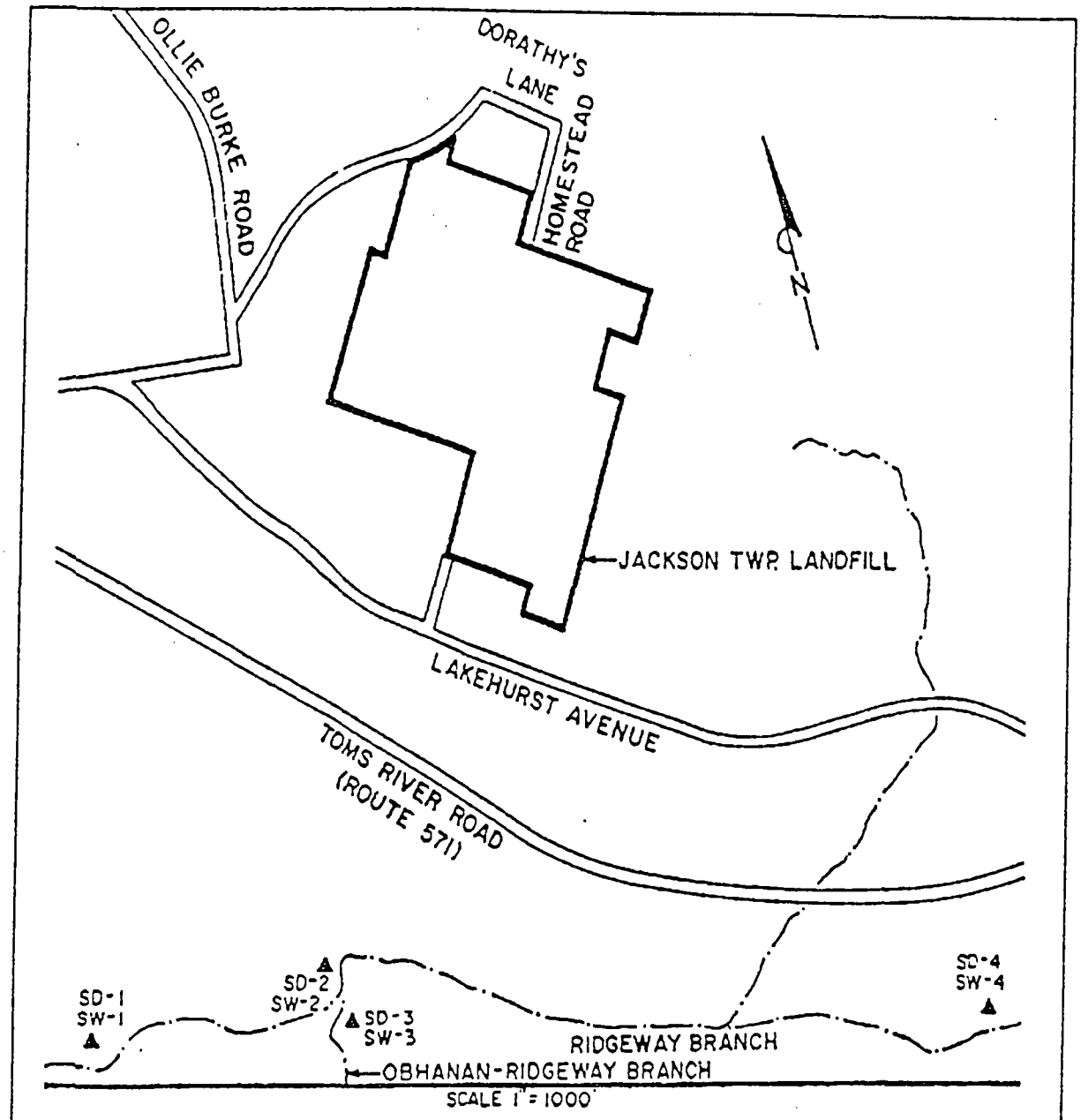

OLLIE BURKE ROAD
DORATHY'S LANE
HOMSTEAD ROAD
210
209
MW-5
LF-4
202
208
213
212
104
WD-2
103
102
WD-3
101 R
201
205
206 D
214
JACKSON TWP. LANDFILL
MW-1
105
WD-1
LAKEHURST AVENUE
302 SD
TOMS RIVER ROAD (ROUTE 571)
301 SD
303 SD
304 SD
305 SD
306 SD
RIDGEWAY BRANCH
SCALE 1" = 1000'
LEGEND
MONITORING WELLS SAMPLED
MONITORING WELLS NOT SAMPLED
S - SHALLOW
D - DEEP
R - REPLACED
DATE: 11-30-90
JACKSON TOWNSHIP LANDFILL
JACKSON TOWNSHIP, NEW JERSEY
FELLOWS, READ AND ASSOCIATES, INC.
TOMS RIVER, NEW JERSEY
CURRENT
MONITORING WELL LOCATIONS

FIGURE 5


OLLIE BURKE ROAD
DORATHY'S LANE
HOMESTEAD ROAD
N
JACKSON TWP. LANDFILL
LAKEHURST AVENUE
TOMS RIVER ROAD (ROUTE 571)
SD-1 SW-1
SD-2 SW-2
SD-3 SW-3
SD-4 SW-4
RIDGEWAY BRANCH
OBHANAN-RIDGEWAY BRANCH
SCALE 1" = 1000'
LEGEND
SURFACE WATER AND SEDIMENT SAMPLE
SD-SEDIMENT SAMPLE
SW-SURFACE WATER SAMPLE
DATE: 11-30-90
JACKSON TOWNSHIP LANDFILL
JACKSON TOWNSHIP, NEW JERSEY
FELLOWS, READ AND ASSOCIATES, INC.
TOMS RIVER, NEW JERSEY
SURFACE WATER & SEDIMENT SAMPLE LOCATIONS

APPENDIX B

CHRONOLOGY OF EVENTS

April 1972	Jackson Township Landfill began its operations.
August 22, 1972	The New Jersey Department of Environmental Protection and Energy (NJDEPE) cited Jackson Township for accepting excessive quantities of septic sludges.
1972	Residents of the Legler section of Jackson Township began reporting that odors were coming from the landfill.
Early 1974	NJDEPE cited the Township for lagooning (i.e., pooling) and failing to cover septic sludges.
Late 1970's	Water level contour maps indicated mounding of the water table at the landfill resulting in ground-water flow in two directions.
Early 1977	Legler residents began reporting medical problems from drinking well water to Township health officials.
May 31, 1977	NJDEPE directed the Township to install monitoring wells throughout the landfill area.
1978	NJDEPE documented the contamination of five on-site monitoring wells and 26 off-site potable wells with volatile organic compounds (VOCs) including benzene, chloroform, methylene chloride and 1,1,1-trichloroethylene.
Late 1978	NJDEPE and local health officials directed area residents not to drink the water from shallow wells. The Township began supplying bottled water to Legler residents.
December 20, 1978	NJDEPE directed the Township to cease accepting liquid wastes at the landfill.
August 31, 1979	The Concerned Citizens Committee filed a class action suit against the Township for negligence in the operation of the landfill.
January 1980	The New Jersey Department of Health (NJDOH) conducted a health survey of 94 Legler households.
February 11, 1980	Jackson Township Landfill ceased its operations. NJDEPE issued an Administrative Consent Order to the Township requiring the Township to complete a design for landfill closure, determine the extent of ground water

	and surface water contamination, and develop site remediation plans.
July 19, 1980	The Township completed the installation of a public water supply system to serve Legler residents.
December 1981	New Jersey Superior Court ordered the Township to submit a landfill closure plan and a New Jersey Pollutant Discharge Elimination System (NJPDES) application for ground-water monitoring to NJDEPE.
December 1981/ February 1982	The Township sampled 22 monitoring wells and 8 private potable wells for priority pollutants. No VOCs were detected.
September 1982	The Township submitted a landfill closure plan to NJDEPE.
December 1982	Jackson Township Landfill was included on the National Priorities List (NPL) issued by the United States Environmental Protection Agency (USEPA).
December 2, 1982	NJDEPE sampled deep monitoring wells for priority pollutants. No VOCs were detected.
March 23, 1983	NJDEPE conditionally approved the landfill closure plan.
July 1983	NJDOH completes a report on the January 1980 health survey of Legler residents.
August 1983	The Township submitted a NJPDES application to NJDEPE.
September 1983	The Remedial Action Master Plan (Hart Associates) prepared for USEPA recommended that further site investigation be performed.
September 1983	New Jersey Superior Court began its hearing of the class action suit against the Township.
November 17, 1983	New Jersey Superior Court found Jackson Township negligent in its landfill operations and awarded Legler residents about $15.8 million in damages for impairment of quality of life, emotional distress, and medical surveillance.
July 1984	NJDEPE drafted a revised NJPDES ground-water discharge permit as a supplement to the landfill closure plan to monitor ground-water quality.

October 10, 1984	NJDEPE held a public hearing to present the revised NJPDES ground-water discharge permit.
1985	NJDEPE sampled four monitoring wells and one residential well for priority pollutants. Chlorobenzene was detected in one monitoring well.
May 20, 1985	NJDEPE issued the revised NJPDES ground-water discharge permit to the Township.
June 1985	Appellate Division of New Jersey Superior Court annulled over $10.4 million of the 1983 settlement awarded for emotional distress and medical surveillance.
November 13, 1987	NJDEPE issued a revised Judicial Consent Order (JCO) to the Township requiring the Township to (1) conduct a Remedial Investigation and Feasibility Study (RI/FS); and (2) submit and implement the final landfill closure plan, and implement the NJPDES ground-water discharge permit requirements, based on the findings of the RI/FS.
May 7, 1987	New Jersey Supreme Court reinstated the amount of the 1983 settlement awarded for medical surveillance.
August 22, 1988	The Township and NJDEPE enter into the JCO issued in November 1987.
April 21, 1989	Fellows, Read & Associates, Inc., completed a Preliminary Investigation (PI) to provide additional site information.
Summer 1989	The Township installed a chain link fence around the site.
March 29, 1990	NJDEPE approved the RI Work Plan.
November 30, 1990	Fellows, Read & Associates, Inc., completed the draft RI Summary Report.

APPENDIX C

Response Summary

This response summary represents those comments and reactions to the Public Health Assessment received during the Public Comment Period described in the Community Concerns Evaluation section. In some cases, similar commentary was received from various sources, while other concerns are specific to individuals or groups. Comments and concerns have been grouped by content where possible and are followed by the consequent response.

Comment:

A respondent felt that the NJDOH request in the Public Health Assessment for additional surface soil sampling (0 to 3 inches) was not necessary. They submitted a recent, July 15, 1993, Risk Assessment for the Jackson Township Landfill site as support for their claim that the soil samples were adequate in number and location to characterize the site related contaminants.

Response:

The NJDOH has reviewed the July 15, 1993 Risk Assessment. The risk assessment is based on data from the 1990 remedial investigation which is included in the data evaluated for this public health assessment. Available environmental data for on-site soils (0-24 inches) do not allow for a complete and comprehensive evaluation of exposure to surface soil from a public health perspective. However, the construction of 6-foot fence around the site should help minimize the potential for exposure to on-site soil contaminants.

Comment:

A respondent felt that the NJDOH request in the Public Health Assessment for additional methane gas monitoring, particularly in the homes located near the landfill, was not necessary. They felt that the methane gas monitoring that has been and is being performed at the site is sufficient to detect any gas that may migrate towards the residences.

Response:

Although the methane monitoring program does not include sampling of residential indoor air, we agree that the revised monitoring program suggested by the NJDEPE should be sufficient to detect landfill gases before they pose a threat to nearby residences. The Public Helath Action Plan has been revised to include this action by NJDEPE.

Comment:

A respondent felt that the NJDOH request in the Public Health Assessment to restrict public access to the site would be satisfied through the installation of a 6-foot chain link fence.

Response:

The NJDOH identified a need to restrict public access to the site. This is currently being addressed by the construction of a perimeter fence. The Public Health Action Plan has been revised to include this action by NJDEPE.

Comment:

A respondent felt that the NJDOH request in the Public Health Assessment for various health and safety issues, which could arise during landfill closure and remediation, would be satisfied by the Site Health and Safety Plan that they prepared in November 1989.

Response:

The NJDOH identified a need for various health and safety and occupational issues to be addressed at the site. These concerns should be satisfied by the Site Health and Safety Plan prepared in November 1989.