Public Health Assessment for

HUNTINGTON LANDFILL
(a/k/a HUNTINGTON TOWN LANDFILL)
HUNTINGTON, SUFFOLK COUNTY, NEW YORK
EPA FACILITY ID: NYD980506844
SEPTEMBER 25, 2002

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

PUBLIC HEALTH ASSESSMENT

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EPA FACILITY ID: NYD980506844

Prepared by:

New York State Department of Health
Under a 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, 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. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

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

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

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

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

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

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 (E60), Atlanta, GA 30333.

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SUMMARY

The Huntington Landfill is in the Town of Huntington, Suffolk County, New York. This site is owned by the Town of Huntington and was operated as a municipal landfill from 1935 to 1989. Due to public concerns related to the landfill, an individual petitioned ATSDR to perform a public health assessment.

Adjoining the 44 acre landfill is the town owned resource recovery facility which includes an incinerator. The 12 acres where the resource recovery facility is constructed (referred to as the leasehold property) was the site of three town owned municipal incinerators. The first incinerator was constructed in 1955 and was followed four years later by a second incinerator. The third incinerator was constructed in 1966. All three incinerators ceased operation and were decommissioned in 1989.

Groundwater downgradient from the landfill is contaminated with chlorinated solvents and metals. From 1973 to 1994 the Suffolk County Department of Health Services (SCDHS) sampled about 180 private drinking water wells downgradient from the landfill. Elevated levels of some volatile organic compounds (VOCs) which may be related to the landfill were detected in about fifty of the wells. To eliminate the potential for exposure to landfill-related compounds in drinking water, the New York State Department of Health (NYS DOH) requested that all homes with private wells contaminated or threatened by the groundwater contaminant plume from the landfill be connected to public water. The Town of Huntington connected homes downgradient from the landfill to public water in three phases. Phase I took place during 1986 and 1987, and Phase II was completed in 1989. Phase III began in 1993 and was completed in 1996.

From early 1989 to 1990, the excavation of land filled garbage from the leasehold property in preparation for construction of the resource recovery facility resulted in a community odor problem. During this period the community expressed concerns about possible health effects, including cancer, caused by the proximity of the Huntington Landfill. In response to community concerns the NYS DOH conducted a cancer incidence study for the area around the site. The cancer study covered the years 1978 through 1987. Although there was a statistically significant elevation of cancer incidence for some types of cancer for the study area as a whole, examination of data for specific census tracts did not point to a geographic link between the areas of cancer incidence and the area where the landfill is located or where groundwater contamination occurs.

Because people were exposed to volatile organic compounds (primarily tetrachloroethene and trichloroethene) in private drinking water at levels above New York State Drinking Water Standards near the Huntington Landfill site, public health actions were needed to reduce or eliminate exposures. Because there is evidence from studies in animals and humans that exposure to elevated levels of tetrachloroethene and trichloroethene can increase the risk of cancer and non-cancer adverse health effects in humans, we evaluated the potential health risk for exposure to these chemicals at the Huntington Landfill. Exposures in the past could pose a low increased risk of cancer and a low risk for non-cancer effects. Furthermore, some private water supply wells

contained the inorganic contaminants nitrate and thallium at levels that could increase the risk of adverse health effects. To eliminate exposure to site-related contaminants in drinking water, the Town of Huntington has connected homes with private wells downgradient from the landfill to public water supplies. Due to the extension of public water and the construction of the landfill cap, which includes landfill gas collection/control systems, this site currently poses no apparent public health hazard.

To reduce the potential for exposure to contaminants from the landfill, at the request of the NYS DOH, the Town of Huntington has provided public water to homes with private wells that were contaminated or threatened by the groundwater plume migrating from the site. The town has also constructed a cap on the landfill which includes gas collection systems. The landfill gas collection systems effectively control soil gas migration and the release of landfill related contaminants to the air in concentrations that represent a health concern.

The NYS DOH has recommended: the installation of a groundwater monitoring well between the groundwater contaminant plume and the Gun Club Road public drinking water supply wells to provide an "early warning" mechanism should the contaminant plume migrate toward these public drinking water supply wells; continued monitoring of surface water in the Sunken Meadow Creek; and institutional controls to restrict future use of the property to reduce exposure to contamination present in the landfill. Residents who were exposed in the past to VOCs in drinking water will be considered for inclusion to the NYS DOH VOC exposure registry.

BACKGROUND

Under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), the New York State Department of Health (NYS DOH) will evaluate the public health significance of the Huntington Landfill site. More specifically, ATSDR and the NYS DOH will determine whether health effects are possible and will recommend actions to reduce or prevent possible health effects.

A. Site Description and History

The Huntington Landfill (also known as the East Northport Landfill) is a 56-acre site located in a residential and light industrial area in the Town of Huntington, Suffolk County, New York. The site is owned and operated by the Town of Huntington. Sand and gravel mining operations, wooded land and residential areas surround the site (Appendix A, Figure 1). The site was originally cultivated as farmland until 1935, when sand mining operations and disposal of municipal solid waste (i.e., land-filling and open burning) began. The landfill, which comprises 44 acres of the site, operated continuously from 1935 to 1989. Three incinerators along with other auxiliary structures used for landfill and incineration activities were on the remaining 12 acres referred to as the leasehold property. The first of three incinerators was constructed in 1955, and was followed four years later by a second incinerator. Both of those units were batch-feed type furnaces. The third incinerator was constructed in 1966 and contained a continuous-feed type furnace. None of the incinerators could separate out recyclable materials. Prior to incinerating refuse, automobile bodies and large bulky metal items were removed and stockpiled by a private party under an agreement with the town. The incinerators ceased operations and were decommissioned in the summer of 1989.

Two surface water bodies on the leasehold property were maintained at the disposal complex during the years the incinerators operated. One was a storm water recharge basin; the second basin was for wastewater from the incinerator's scrubber systems, temperature control processes and ash quenching. A culvert at the eastern end of the wastewater basin discharges to the storm water basin. Discharges to the wastewater basin were eventually halted and the wastewater was treated and recirculated. Discharge was then directed to that basin only during times when the treatment system was backwashed. Direct discharge of untreated wastewater ended in 1986. As of 1986, an estimated 78 million gallons of untreated wastewater from the town's incinerators had been discharged to groundwater.

In June of 1989, the town's consultant completed an investigation of the leasehold property which included sampling of soil, surface water, incinerator ash and sediments. Following this investigation, the leasehold property, on which three incinerators were previously located, was excavated to construct a resource recovery plant, which includes a new incinerator. Areas of soil excavation from the 12-acre parcel of land included the storm water recharge basin and the incinerator wastewater discharge basin. All soil and municipal garbage excavated from the leasehold property were disposed in the landfill. The garbage excavated from the leasehold property to construct the resource recovery facility caused community odor problems from the spring of 1989 through early 1990. During this period odor complaints related to the landfill were received from areas up to five miles away from the site. The resource recovery facility was completed and began operation in 1991.

During its operation the landfill accepted predominantly municipal waste. Other waste reportedly disposed in the landfill includes up to five tons of waste cosmetics containing alcohol, acetone or nitrocellulose, up to 0.05 tons of solvent vapor degreaser sludge, animal carcasses, sewage sludge, tires, wet bag asbestos, incinerator ash and demolition material from the old incinerator.

The landfill rises to a height of about 225 feet above grade, with a depth of at least 50 feet below grade. Since the landfill is unlined, leachate discharges to the groundwater. Leachate is the contaminated liquid produced when water percolates through waste. In 1973, the Suffolk County Department of Health Services (SCDHS) began collecting samples from private wells servicing homes near the landfill. Elevated levels of chlorides, nitrate and some volatile organic compounds (VOCs) were detected in some of the private wells northeast of the landfill. The SCDHS advised residents with wells contaminated above NYS DOH public drinking water guidelines not to drink or cook with their well water and to connect to public water.

In 1979, a groundwater monitoring program initiated by the town determined that groundwater contaminants were migrating from the landfill in a northeast direction. The first regulatory action taken by the New York State Department of Environmental Conservation (NYS DEC) at the East Northport Landfill was a Consent Order issued in 1981. Issued in response to initial water quality sampling data, the Order required the town to investigate and use alternatives for solid waste reduction, to install groundwater monitoring wells, to expand methane controls and to develop a comprehensive closure plan for the landfill. In return, the State agreed to waive an enforcement hearing.

To eliminate the potential for exposure to landfill-related chemicals in drinking water, the town agreed to provide public water to homes with private wells that are or could be contaminated. Public water main extensions and public water hookups in areas affected or threatened by the groundwater contaminant plume were done in three phases (Appendix A, Figure 2). Phase I took place during 1986 and 1987, and phase II was completed in 1989. At the request of the NYS DOH, the town surveyed private wells in the area downgradient from the landfill. As a result of that survey, homes with private wells affected or threatened by the groundwater contaminant plume have been connected to public water.

In 1978, the Town of Huntington installed a venting system to monitor and control off-site migration of methane. Methane is a colorless, odorless gas produced when bacteria decomposes organic waste in an oxygen deprived environment. Methane gas burns and can explode if elevated concentrations become trapped in a confined space, such as a basement. The lower explosive limit (LEL) or the lowest level of methane in air that will ignite is 5% gas by volume, or 50,000 parts per million (ppm). NYS DEC requirements for monitoring landfill gas control systems indicate that the concentration of methane and other explosive gases generated by the facility must not exceed 25% of the LEL (12,500 ppm) inside structures on-site or off-site, and/or the LEL (50,000 ppm) in soil gas at or beyond the property boundary. The methane gas venting system was upgraded and expanded in 1979, 1981 and 1986, to include an active gas collection system and a landfill gas utilization system where collected gas was piped to a combustion engine/electric generator. In addition, soil gas monitoring wells were placed on the perimeter of the site to determine if soil gas is migrating off-site.

In January 1987, the 56-acre site was accepted to the NYS DEC Registry of Inactive Hazardous Waste Disposal Sites as representing a significant threat to the public health or environment. A remedial investigation/feasibility study (RI/FS) is conducted at all such sites. An RI determines the nature and extent of contamination related to a site. The FS uses the information provided by the RI to develop remedial actions that will eliminate the threat to public health or the environment posed by the site. In March 1991, the town signed a NYS DEC Order on Consent which provided for an RI/FS. The RI/FS was completed in 1995.

The RI confirmed the presence of a groundwater contaminant plume migrating in a northeasterly direction from the landfill. Contaminants detected in groundwater include chlorides, VOCs and low concentrations of some metals. Based on surface water samples and groundwater modeling, the plume appears to discharge into the Sunken Meadow Creek about two miles from the landfill. VOCs were also detected in samples taken from the landfill gas collection system and in on-site ambient air samples.

Concurrent with the RI/FS, the town proceeded with an interim remedial measure (IRM) related to the closure and capping of the landfill. In July of 1993, the NYS DEC approved a landfill cap design with construction starting in October 1994. Construction of the cap was completed during the summer of 1996. The cap includes surface water and active landfill gas collection systems. Currenty, the town vents all collected gas to the atmosphere.

In October 1989, the ATSDR received a petition from a local citizen requesting the agency to evaluate the health concerns reported by community residents. The petitioner specifically expressed a concern that exposure to contamination from the landfill may result in serious illnesses (i.e., birth defects and cancer).

In January 1990, representatives from ATSDR met with the NYS DOH, SCDHS, NYS DEC and members of the community, including the petitioner, to conduct a site visit and to gather preliminary information about the landfill. Based on that visit and the additional information provided by concerned agencies, the ATSDR decided to prepare a public health assessment for the Huntington Landfill site.

B. Public Health Actions Implemented

In 1986, the town began providing public water to homes with private wells contaminated or threatened by the groundwater contaminant plume migrating from the landfill.

On March 16, 1992, Dr. James Melius, then Director of the NYS DOH Division of Occupational Health and Environmental Epidemiology met with the public to discuss the cancer investigation study completed in 1991 (Appendix E).

The NYS DEC held a public meeting on June 30, 1993, to discuss the result of the remedial investigation. Representatives of the NYS DOH and SCDHS were present to address health related questions.

In the summer of 1996, the town completed construction of the landfill cap. The landfill gas collection systems included in the cap have eliminated the odor problems associated with the landfill and effectively control soil gas migration.

C. Site Visit

NYS DOH staff (Mr. Joseph Crua and Ms. Carole Ju) and ATSDR personnel (Dr. Mike Allred, Mr. William Nelson and Ms. Brenda Kay Edmonds) visited the Huntington Landfill site in January 1990. Three inactive incinerators and a maintenance garage were on-site. The site was operating as a transfer station for municipal waste to be sent to the nearby Smithtown Landfill. Several workers were observed during the site visit. The site was fenced and access was controlled.

ATSDR observed no evidence of fluid seepage from the landfill during the site visit. Garbage was being excavated from the leasehold property to prepare for construction of the resource recovery facility. The excavation of the garbage produced strong, unpleasant odors which were detected while on the site. Similar odors were reported by residents living up to 5 miles away from the site. During this site visit odors were very noticeable throughout the nearby residential areas. Several public schools are within two miles of the site. The Northport Veterans Administration Hospital is about one mile northwest of the site.

On May 18, 1995, Joseph Crua and Nina Knapp with the NYS DOH and Mike Komoroski with the NYS DEC visited the site. The entire landfill was regraded to stabilize sloped areas and was in the process of being capped. A heavy soil layer with gas vent pipes was in place and the perimeter soil gas collection system was operating. Landfill-related odors were not detectable around the perimeter or at the base of the landfill. A very slight odor was intermittently detectable on top of the landfill. Two recharge basins, one on the leasehold property and one at the eastern base of the landfill, were under construction. The recharge basins will receive surface water runoff from the landfill. The site is totally fenced and access to the site is limited to a guarded gate on Town Line Road.

The NYS DEC visits this site periodically, most recently in May of 2002. They reported that the landfill cap was well maintained and in good condition. No odor was detected at the landfill. The entire site is fenced to prevent unauthorized access.

D. Demographics, Land Use, and Natural Resource Use

Demographics

From the 1990 Census data, the NYS DOH estimates that 8,117 people live within 1 mile of the landfill. The population within 1 mile of the site is 95.9 percent white, 1.5 percent black, and 2.6 percent other races. The age structure is 6.1 percent is under 6 years of age, 19.3 percent is 6-19 years of age, 67 percent is 20-64 years of age and 7.6 percent is 65 years or older. The Huntington Landfill is in census tract 1117.03 where the median household income in 1989 was $51,021 and no families live below the poverty level.

Land Use

Land use in the immediate area around the site is industrial, residential, recreational and commercial (Appendix A, Figure 3). Based on the RI, a fuel oil company and a bus depot are northwest of the former Long Island Lighting Company (LILCO), now Keyspan right-of-way. The Keyspan right-of-way extends along the entire western border of the site and is about 206 feet wide. The remaining area west of the Keyspan right-of-way is residential. North of Pulaski Road is an extensive residential area which includes part of the Towns of Smithtown and Huntington. This residential area in Huntington is characterized by single-family homes on one-acre lots. In Smithtown, the residential area north of Pulaski Road is also zoned for one-acre lots and further east for half-acre lots.

The south side of Pulaski Road in the Town of Huntington is uniformly developed with single-family dwellings, with the exception of one property located on the west of Town Line Road, between the Long Island Railroad (LIRR) property and Pulaski Road, which is zoned as light industrial. The parcels situated south of Pulaski Road and east of Town Line Road in Smithtown are also classified as light industrial. This area is comprised of sand mining facilities, truck yards, sand and gravel operations, and commercial establishments. The area south of the landfill is residential.

The utilities near the East Northport Landfill are maintained by Keyspan and Suffolk County Water Authority. The Keyspan right-of-way property, west of the landfill, contains underground power lines and a natural gas pipeline (known as the Iroquois Pipeline) installed in the spring of 1992 and located west of the Keyspan power lines. The water supply system in the area surrounding the landfill is owned and maintained by Suffolk County Water Authority (SCWA). The system consists of a 6-inch water main on the south side of Pulaski Road and a 12-inch water main to the east of Town Line Road.

Natural Resource Use

Groundwater on Long Island is comprised primarily of the Upper Glacial, Magothy and Lloyd aquifers. The aquifer system has been designated by the U.S. Environmental Protection Agency (EPA) as a Sole Source Aquifer System pursuant to section 1424(e) of the Safe Drinking Water Act. Most water supply wells in the area are in the Upper Glacial and Magothy aquifers, establishing them as aquifers of concern. The Lloyd aquifer is overlain by the relatively impermeable Raritan clay which separates it from the

Upper Glacial and Magothy aquifer. There is no immediate concern that the Lloyd aquifer is subject to contamination from overlying surface activities.

No critical wildlife habitats or historical landmark sites are within three miles of the site.

E. Health Outcome Data

The NYS DOH maintains several health outcome data bases which could be used to generate site specific data, if warranted. These data bases include the cancer registry, the congenital malformations registry, the heavy metals registry, the occupational lung disease registry, vital records (birth and death certificates) and hospital discharge information.

The NYS DOH established the Volatile Organic Compound Exposure Registry (VOC) in 1999. It will be used to evaluate health effects possibly associated with exposure to VOCs in drinking water. People who were exposed in the past to site-related VOCs in drinking water near the Huntington Landfill will be considered for inclusion in the VOC registry.

In October 1991, the NYS DOH completed a cancer incidence study for the area around the landfill. The study was conducted to address community concerns about the possibility of health effects caused by the site. The study focused on the years 1978 through 1987, which was the most recent period for which cancer reporting was complete for small area analysis. Results of the cancer incidence investigation are discussed in the Public Health Implications section of this document.

The Huntington landfill site was included in a cancer incidence study completed by the NYS DOH in July 1998. The study evaluated cancer incidence among people living near a total of 38 landfills with similar potential soil gas migration conditions. Seven types of cancer were evaluated: liver, lung, bladder, kidney, brain, non-Hodgkin's lymphoma and leukemia. For Huntington Landfill, as well as most of the other landfills in the study, people who lived within 250 feet of the landfill (the potential exposure areas) were compared with people living further away in order to see if the people living very close were more likely to have been diagnosed with one of the seven cancers during the time period 1980 to 1989. The study analyzed all the landfills as a group because not enough people lived near any one landfill to conduct landfill-specific analysis. Results of this study are discussed in the Public Health Implications section of this document

COMMUNITY HEALTH CONCERNS

In the past, members of the community living near the Huntington Landfill have reported numerous health concerns to the NYS DOH, SCDHS, NYS DEC and ATSDR. Reported illnesses include headaches, nausea, dizziness, allergy problems, bacterial infections, eye and throat irritation, asthma, sinus and respiratory infections, cancer (e.g., lung, breast and skin) and adverse reproductive outcomes.

Specific health-related concerns are summarized as follows:

1. Some community members believe that there was an increased incidence of cancers in the community near the landfill.

2. Some community members believe that health problems may be associated with exposure to contaminants migrating from the landfill in air and groundwater. Concerns were also expressed about fly ash from the old incinerators and air contamination from the resource recovery facility.

3. During excavation of garbage from the leasehold property in 1989 and 1990, members of the community as far as five miles from the site complained about "sewage like" odors emanating from the landfill. Illnesses, including headaches, nausea, dizziness, eye and throat irritations and bacterial infections were reported by the community during this period.

4. Residents were concerned that during the 1989-1990 school year, school attendance decreased and headaches, nausea, dizziness, and respiratory infections increased in children attending schools near the landfill.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

To evaluate if a site poses an existing or potential hazard to the exposed or potentially exposed population(s), the site conditions are characterized. Site characterization involves a review of sampling data for environmental media (e.g., soil, surface water, groundwater, air) both on- and off-site and an evaluation of the physical conditions of the contaminant sources or physical hazards near the site which may pose an additional health risk to the community or receptor population(s).

Contaminants selected for further evaluation are identified based upon consideration of the following factors:

1. Concentrations of contaminant(s) in environmental media both on- and off-site;

2. Field data quality, laboratory data quality, and sample design;

3. Comparison of on-site and off-site contaminant concentrations in environmental media with typical background levels;

4. Comparison of contaminant concentrations in environmental media both on- and off-site with public health assessment comparison values for (1) noncarcinogenic endpoints and (2) carcinogenic endpoints. These comparison values include Environmental Media Evaluation Guides (EMEGs), Cancer Risk Evaluation Guides (CREGs), drinking water standards and other relevant guidelines. Contaminant concentrations which exceed a comparison value do not necessarily pose a health threat; and

5. Community health concerns.

The selected contaminant(s) are evaluated in the Public Health Implications section (Toxicological Evaluation) of the Public Health Assessment (PHA) to determine whether exposure to these chemicals is of public health significance.

The On-Site Contamination and the Off-Site Contamination subsections include discussions of sampling data for environmental media; summary tables of sampling data are presented in Appendix B. If a chemical is selected for further evaluation in one medium (e.g., soil, sediment, surface water, groundwater, air), that contaminant will also be reported in all other media, if detected. A listed contaminant does not necessarily mean that it will cause adverse health effects from exposure.

For the purpose of evaluating environmental sampling data and site conditions in this public health assessment (PHA), "on-site" refers to the area within the property boundary as indicated in Appendix A on Figure 1 of this PHA and "off-site" refers to all areas outside of the property boundary.

A. On-site Contamination

Groundwater

Depth to groundwater in the Upper Glacial aquifer within the area of the landfill ranges from 60 to 135 feet below grade. The water table is not static but fluctuates in response to changes in groundwater storage. The fluctuations are cyclical and are associated with the seasonal differences in the rates of recharge from precipitation and of discharge by evapotranspiration. Within the study area, the water table slopes gently towards the Long Island Sound and Sunken Meadow Creek at 20 to 30 feet per mile.

Monitoring well CW-5, which was on the northwestern side of the site, was developed in 1987 and was the only on-site groundwater monitoring well. Elevated levels of arsenic (8-20 micrograms per liter [mcg/L]), lead (17-34 mcg/L), and bis(2-ethylhexyl)phthalate (200-360 mcg/L) were detected in samples taken from this well. Groundwater quality up-gradient, and down-gradient from the landfill is discussed in subsection B (Off-Site Contamination) of the "Environmental Contamination and Other Hazards" section of this document.

Landfill Leachate

During the RI, leachate samples were taken from the northern edge of the landfill. Since leachate at this site is not present at the surface, samples were obtained by digging into the fill area, and by accessing an inactive subsurface drain. These samples are not representative of the leachate at the base of the landfill, which is at least 50 feet below ground surface. Leachate samples at the base of the fill area could not be obtained. Acetone and methylene chloride were detected in leachate samples at maximum concentrations of 32 and 3 mcg/L, respectively. Since these compounds were also detected in the laboratory instrumentation blanks, their presence in the samples may be due to laboratory contamination.

Low levels of polycyclic aromatic hydrocarbons (PAHs) (3-15 mcg/L) and trace concentrations of some organochlorine insecticides (0.01-0.12 mcg/L), polychlorinated biphenyls (PCBs) 0.75 mcg/L) and pentachlorophenol (5.0 mcg/L) were also detected in one or more of the leachate samples. Elevated levels of metals including arsenic (85.7 mcg/L), barium (4,210.0 mcg/L), cadmium (33.3 mcg/L), chromium (431.0 mcg/L), lead (4,780.0 mcg/L) and mercury (6.3 mcg/L) were detected in the samples. However, the elevated levels of metals are most likely due to the high concentration of particulates in the samples. When analyzing liquid samples for metals, the sample is preserved in the field by adding acid. When a sample is acidified, contaminants in the particulate fraction of the sample can leach (dissolve) from the particulates into the liquid portion of the samples, thereby increasing the level of contamination in the liquid.

Surface Water

In 1989, several surface water samples were collected from the incinerator quench water discharge basin, and the storm water recharge basin on the leasehold property. The low levels of VOCs and metals detected in these surface water samples did not exceed public health comparison values and/or guidelines.

During the RI, a surface water sample was collected from the recharge basin on the western side of the landfill, within the fenced perimeter of the site. Low levels of three organochlorine insecticides (delta-hexachlorocyclohexane, dieldrin, and endosulfan sulfate) were detected in this sample at concentrations ranging from 0.01-0.02 mcg/L. Lead was also detected in this sample at a concentration of 23 mcg/L. The concentrations of these compounds in surface water did not exceed public health assessment comparison values and/or guidelines.

Sediment

In 1989, several surface sediment samples were collected at a depth of zero to six inches from the incinerator quench water discharge basin and the storm water recharge basin on the leasehold property. The levels of PAHs including benz(a)anthracene (7.2 milligrams per kilogram [mg/kg]), benzo(b)fluoranthene (9.4 mg/kg), benzo(a)pyrene (6.0 mg/kg), and indeno(1,2,3-cd)pyrene (4.8 mg/kg) detected in these samples exceed public health assessment comparison values for these soil contaminants (Appendix B, Table 7).

During the RI, four surface sediment samples were collected at a depth of zero to six inches from the western recharge basin. Two of the sediment samples are a composite of six samples spread over an area of about 200 square feet. This on-site sediment was elevated for the PAHs: benzo(a)pyrene (3.6 mg/kg), benz(a)-anthracene (4.7 mg/kg) and benzo(b)fluoranthene (4.3 mg/kg) at levels that exceed public health assessment comparison values for these soil contaminants (Appendix B, Table 7). Since these samples were collected, soil was excavated from the on-site recharge basins and placed on the landfill prior to construction of the cap.

Incinerator Ash

In 1989 incinerator ash samples were collected from the bottom of the incinerator quench water discharge basin. The ash samples were analyzed for metals only. Lead was detected at a concentration of 12,570 mg/kg which exceeds the public health assessment comparison value for this metal. It is common to detect metals and PAH's in incinerator ash. Since these samples were collected, all ash and potentially contaminated underlying soil was excavated from the incinerator quench water discharge basin and disposed under the landfill cap.

Soil

In 1989, on-site soil samples were collected at the resource recovery facility from 50 test pits and 20 test borings, and 13 surface soil samples (0-6 inches below surface). Soil samples were not available on the landfill area. Lead, arsenic, chlordane, and PAH's were detected in these samples, but at levels that did not exceed background and/or public health assessment comparison values. Municipal garbage, incinerator ash, and all other areas of contamination identified in 1989 were excavated and placed under the landfill cap.

Ambient Air

On-site ambient air samples were collected in 1992 and in 1994. Although VOCs were detected in samples collected in 1992, the presence of these compounds cannot definitely be attributed to the landfill since upwind (background) samples were not collected. The results of the ambient air samples collected in 1994 are provided in Appendix B, Table 1. Based on these results, the landfill may be the source of trichloroethene, tetrachloroethene, 2-butanone and chloromethane, since these VOCs were detected in the on-site or downwind samples but were not present in the background samples. Furthermore, the highest levels of tetrachloroethene and trichloroethene (17 and 12 micrograms per cubic meter, respectively) exceeded levels typical of urban/suburban areas as well as public health comparison values (see Table 6).

As part of the RI in 1996, the Industrial Source Complex (ISC) model was used to evaluate the potential on-site and off-site exposures to site-related contaminants in air. Using the concentration of contaminant measured or estimated at the pollutant source, the ISC model considers meteorological and topographical conditions to predict an annual average concentration of contaminant potentially present at an on-site or off-site receptor location. The sources of volatile organic air contaminants at this site include the passive vents in the landfill cap and the blower station stack where actively collected landfill gas is discharged into the air. The associated health risk can then be calculated using the modeled level of exposure. The health risks associated with exposure to site-related air contaminants are discussed in the Public Health Implications section of this document.

Since collection of landfill gas samples for specific VOC analysis was conducted in 1996 for use in the ISC model, additional rounds of sampling for VOCs were conducted in 1998, 1999, and 2001. The levels of VOCs detected in these subsequent sampling events are comparable to those from 1996.

Indoor Air

Monitoring for methane is conducted on a monthly basis inside the animal shelter on the northwest corner of the site, outside of the active methane collection system. The animal shelter was constructed with a sub-slab ventilation system to prevent the migration of methane into the structure. Although methane was detected on one occasion in a soil gas probe underneath the building, methane has not been detected inside of the structure. A methane alarm system is also present inside the animal shelter. Subsequent monitoring in the soil gas probes beneath the animal shelter has not detected methane.

Soil Gas

Soil gas monitoring well clusters (Appendix A, Figure 4) along the perimeter of the landfill are monitored for methane on a monthly basis to determine if landfill gas is migrating off-site. Since the monthly monitoring program began in 1978, methane was often detected in some of the landfill gas monitoring wells. When methane was detected in perimeter monitoring wells, an investigation was conducted to determine if soil gas was migrating onto neighboring properties. Based on the results of these investigations, methane was not migrating onto residential properties. However, there are no data to determine if landfill gas was migrating onto residential properties prior to 1978.

During the RI, landfill gas samples were collected from the perimeter soil gas monitoring wells and analyzed for VOCs. Methane can facilitate the migration of VOCs which are commonly found in gas samples from municipal landfills. The results of these samples, which are presented in Appendix B, Table 2, indicate that VOCs are present in soil gas.

Since these samples were taken, a cap was constructed on the landfill. The cap includes a gas ventilation layer and an active perimeter soil gas collection system. The 43 perimeter soil gas monitoring wells are monitored on a monthly basis. On occasion methane at levels below the LEL have been detected in 11 of the perimeter soil gas monitoring wells. Since October 1999, the highest level of methane gas detected in a perimeter soil gas monitoring well was 9,000 ppm or 0.9% gas by volume, which is below the NYS DEC regulatory limit of 50,000 ppm or 5.0% gas by volume.

B. Off-site Contamination

Groundwater (monitoring wells)

To characterize groundwater quality near the site, groundwater monitoring wells were placed hydraulically upgradient and downgradient from the landfill (see Appendix A, Figure 5). The lowest and highest concentration of contaminants detected in groundwater samples are presented in Appendix B, Table 3. The results of the RI groundwater study which included sampling of monitoring wells, private wells, and groundwater modeling would indicate that a contaminant groundwater plume is migrating from the landfill in a northeasterly direction.

The contaminant plume extends about 2 miles from the landfill, toward the Sunken Meadow Creek (Appendix A, Figure 5), is about 2,400 feet wide, and is sinking in the Upper Glacial aquifer as it moves downgradient. Near the Sunken Meadow Creek shallow groundwater flows upward and discharges to the creek.

VOCs including total 1,2-dichloroethene (0.7-31 mcg/L), trichloroethene (1.0-40 mcg/L), and tetrachloroethene (0.7-34 mcg/L) were detected in downgradient monitoring wells. The maximum concentrations of these compounds that exceed NYS DOH public drinking water standards and/or public health assessment comparison values are shown in Table 3. In addition, metals detected above NYS DOH public drinking water standards and/or public health assessment comparison values are also identified in Table 3. Since 1996 groundwater samples are collected on a semi-annual basis from 11 downgradient monitoring wells developed in the shallow, middle and deep zones of the upper glacial aquifer. The levels of contaminants detected in these groundwater samples are comparable to those collected during the RI.

Groundwater (private wells)

Since 1973, the SCDHS has sampled about 180 private wells in the area northeast of the landfill. VOCs including 1,1-dichloroethane (0.2-10 mcg/L), 1,1,1-trichloroethane (0.2-62 mcg/L), trichloroethene (0.4-150 mcg/L), tetrachloroethene (0.2-39 mcg/L), and total 1,2-dichloroethene (1-16 mcg/L) have been detected in some of these wells (see Appendix B, Table 4). Metals detected include lead (1.0-41.2 mcg/L) and thallium (2.4-50 mcg/L). Nitrates have also been detected in some of the private wells at concentrations ranging from 300 to 24,900 mcg/L. The maximum concentrations of these contaminants exceed current NYS DOH public drinking water standards and/or public health assessment comparison values (Appendix B, Table 5). To eliminate the potential for exposure to site-related contaminants in drinking water at the request of the NYS DOH, the SCDHS and the NYS DEC, the town connected homes downgradient from the site to public water. Public water was supplied to homes in three phases. Phase I took place during 1986-87 and phase II was completed in 1989. The third phase was completed in 1996.

Groundwater (public drinking water wells)

Groundwater is the exclusive source of public drinking water in Suffolk County. The Gun Club Road public drinking water supply wellfield is the only source of public drinking water supply wells within 1.5 miles of the landfill. The Gun Club Road wellfield includes three wells, and is about 2,800 feet north/northwest of the site. Since early 1980, slightly elevated levels of nitrate (8.3-11.9 milligrams per liter [mg/L]) have been detected in Gun Club Road well #2. The NYS DOH public drinking water supply standard for nitrate is 10 mg/L. Trace concentrations of VOCs including 1,1,1-trichloroethane (0.70-5.0 mcg/L), tetrachloroethene (0.80-2.0 mcg/L), trichloroethene (1.0 mcg/L) and 1,1-dichloroethane (1.0 mcg/L) have also been detected in well #2 since 1988. All VOCs detected in well #2 do not exceed NYS DOH public drinking water standards. Moreover, due to concerns about groundwater quality, well #2 was taken out of service in 1990.

Two drinking water supply wells serving the Sunken Meadow State Park are about 2.7 miles downgradient from the landfill. These wells are classified as community drinking water supply wells and currently meet public drinking water standards. The drinking water at the beach area in Sunken Meadow State Park is supplied by the SCWA. To reduce the potential for exposure to contaminants in groundwater, in the near future all of Sunken Meadow State Park will be connected to public water supplied by the SCWA. The wells at the park will be maintained for irrigation purposes.

Surface Water

Surface water samples were collected from the Sunken Meadow Creek once in 1994 during the RI, then semi-annually starting in 1996. Since collection of surface water samples began, VOCs related to the site have been detected only at low levels of 1.0-6.9 mcg/L. Chloride and sulfates were the only inorganic parameters (landfill leachate indicators) detected at levels exceeding NYS DEC surface water standards. However, the elevated levels of chloride and sulfate are detected in surface water samples collected at a location within the tidal portion of the Sunken Meadow Creek and thus are believed to be present due to the influence of saline surface water.

Sediments

Sediment samples were collected from the Sunken Meadow Creek and analyzed for VOCs. VOCs were not detected in any of these samples.

Ambient Air

In response to community concerns about odors coming from the landfill in November 1989 the SCDHS collected ambient air samples for VOC analysis at several locations on the site border. Benzene and toluene were each detected in concentrations between 1-2 parts per billion (ppb). These concentrations are not elevated above what would be expected for an urban/suburban area (background). A third VOC, Freon 12 was also detected in one sample at a concentration of 19 ppb which is above what would be expected for an urban/suburban area.

Off-site ambient air was sampled at the landfill in 1994. Samples were collected up-wind and downwind from the landfill. Acetone and chloromethane were detected in samples collected downwind from the site (Appendix B, Table 1). However, only chloromethane may be attributable to the landfill since acetone was also detected in samples collected upwind from the site. The ambient air samples collected in 1994 may not represent worst case air quality conditions at the site since sampling was performed when barometric pressure was high. The gas released from a municipal landfill increases with decreasing barometric pressure. As discussed previously in the on-site Contamination section, the ISC dispersion model was used to evaluate potential on-site and off-site migration of site-related air contaminants.

Soil Gas

The town has been monitoring soil gas migration at the landfill on a monthly basis. On occasion methane was detected in off-site soil gas in the Keyspan right-of-way on the northwest side of the landfill.

Since 1978, landfill gas has not been detected within 150 feet of any properties bordering the landfill. Construction of the new perimeter landfill gas collection system in 1996 has effectively controlled the migration of soil gas.

Indoor Air

As part of the town's landfill gas monitoring which began in 1978, basements in as many as 12 homes bordering the landfill were sampled for methane on a monthly basis. Methane gas has never been detected in any of these homes. Monitoring for methane in homes near the landfill was suspended in 1996 when the landfill gas collection systems were completed. Monthly monitoring inside an office building associated with a sand and gravel mine east of the landfill has not detected the presence of methane.

C. Quality Assurance and Quality Control

The analytical data used by the NYS DOH in preparing this PHA are found in the RI. Laboratory data are evaluated with respect to specific quality assurance (QA) and quality control (QC) measures. Data which do not meet certain QA/QC criteria for reasons such as excessive blank contamination or non-reproducible results are not used in the PHA or are qualified as questionable results.

D. Physical and Other Hazards

One hazard associated with the site involves methane in landfill gas. Methane can migrate through porous media as soil gas and enter confined building spaces (basements) through crawl spaces, plumbing holes, other floor holes (e.g., sumps) and foundation cracks. The potential for methane to collect in a confined space is of concern as this condition may result in a flammable/explosive atmosphere and hence be a safety problem. The construction of the landfill cap, which includes active gas collection/control systems, has significantly reduced or eliminated the possibility of methane migration.

There are no other apparent physical hazards to the general public associated with the landfill. The entire site and resource recovery facility are fenced with controlled entry and posted signs.

E. Toxic Chemical Release Inventory (TRI)

The Toxic Chemical Release Inventory (TRI) has been developed by the US EPA from chemical release information provided by those industries that are required to report contaminant emissions and releases annually. The NYS DOH reviewed air emissions data reported to the TRI by industrial facilities identified to be within a 5.0 mile radius of the Huntington Landfill site for the years 1988 through 1993. These data were reviewed to evaluate other sources of contamination that may pose an additional health risk to the exposed population at or near the site.

The NYS DOH has developed a screening model to estimate if potential contaminant concentrations resulting from air emissions at a facility may be contributing to community (receptor population) exposures to contaminants at a site. This model uses information about the facility location (distance from the exposed population) and annual air emission data to calculate annual average air concentration at a distance of 0.5 miles from the site.

Seven industrial facilities which released air emissions were identified within a 5.0 mile radius of the Huntington Landfill site. These facilities are: Polymer Plastics Corp.; Robert Busse and Co., Inc.; Pall Rai, Inc.; LNK International, Inc.; Hazeltine Corp. (Mfg. Plant); Gull Electronic Systems; and Gasser and Sons, Inc. A summary of the TRI-reported air releases by these facilities for the years 1988-1993 is presented in Table 8.

Results of the screening evaluation indicate that TRI-reported air emissions from the facilities identified would not increase contaminant levels in ambient air near the Huntington Landfill site to levels above the screening criterion of 1 mcg/m^3. Based on the results of the screening evaluation, the public health significance of contaminant air emissions from TRI facilities as an additional source of community exposures at the Huntington Landfill site will not be evaluated further in this Public Health Assessment.

PATHWAYS ANALYSES

This section of the PHA identifies potential and completed exposure pathways associated with past, present and future use of the site. An exposure pathway is the process by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: (1) a contaminant source; (2) environmental media and transport mechanisms; (3) a point of exposure; (4) a route of exposure; and (5) a receptor population.

The source of contamination is the source of contaminant release to the environment (any waste disposal area or point of discharge); if the original source is unknown, it is the environmental media (soil, air, biota, water) which are contaminated at the point of exposure. Environmental media and transport mechanisms "carry" contaminants from the source to points where human exposure may occur. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (i.e., ingestion, inhalation, dermal absorption). The receptor population is the person or people who are exposed or may be exposed to contaminants at a point of exposure.

Two types of exposure pathways are evaluated in the PHA; a completed exposure pathway exists when the criteria for all five elements of an exposure pathway are documented; a potential exposure pathway exists when the criterion for any one of the five elements comprising an exposure pathway is not met. A suspected exposure pathway is considered to be eliminated when any one of the five elements comprising an exposure pathway has not existed in the past, does not exist in the present and will never exist in the future.

A. Completed Exposure Pathways

Past Groundwater Exposure Pathways

The groundwater pathway of human exposure was completed in the past. People living downgradient from the landfill in homes serviced by private wells were exposed to site-related contaminants in drinking water. This exposure has now been eliminated by the extension of public water. Based on the RI, contaminants originating from the landfill are migrating from the site in a northeasterly direction and are generally found in the Upper Glacial (shallow) aquifer. Contaminants related to the landfill have been detected in downgradient private drinking water supply wells since the 1970s. VOCs, nitrates and some metals have been detected in private well samples in concentrations exceeding NYS DOH public drinking water supply standards.

Ambient Air

From the early 1989 to 1990 the excavation of land filled garbage from the leasehold property resulted in a community odor problem. Landfill odors were reported up to five miles from the site. During a site visit by ATSDR, NYS DOH, NYS DEC and SCDHS in January of 1990, odors from the landfill were detectable at the site and in the neighboring community. In response to community concerns, the SCDHS, in November 1989, sampled ambient air on the landfill border for contaminants. Benzene and toluene were each detected in these samples at concentrations less than 2 ppb. These concentrations are typical of urban/suburban areas. Freon 12 was also detected in one sample at a concentration of 19 ppb, which is slightly above what may be expected for an urban/suburban area. In response to concerns expressed by the community and state and federal agencies, the town limited excavation of the waste from the leasehold property to colder months of the year and used temporary soil cover during the excavation process to reduce the odor released from the landfill.

In 1994, ambient air samples were collected at several on-site and off-site locations. Off-site samples were collected upwind from the landfill to determine air quality unaffected by the site, and downwind from the landfill to determine if the site may be the source of ambient air contamination. Based on the results of these samples (Appendix B, Table 1) exposure to low levels of VOCs in air from the landfill has occurred on-site and possibly in the community. The level of VOCs migrating from the landfill in air may have been higher in the past, especially during the excavation of the land filled waste to prepare for the construction of the resource recovery facility. Ambient air modeling conducted in 1996 did not indicate that the level of site-related contaminants off-site would represent a health concern.

Past Exposure to Incinerator Ash

Off-site exposure to airborne incinerator ash from the old on-site incinerators has occurred in the past. However, this pathway of exposure cannot be evaluated since the analytical data needed to quantify the associated health risks do not exist.

B. Potential Exposure Pathways

Sediments (On-Site)

During the investigation of the leasehold property sediment samples were collected at a depth of zero to six inches from the incinerator quench water discharge basin and the storm water recharge basin. The levels of several PAHs detected in these samples exceed public health assessment comparison values. Exposure to contaminated sediments in these areas could have occurred between 1955-1989 when the on-site incinerators were in operation. Since 1955, access to this area has been restricted by a fence. Therefore, the potential for exposure to contaminated sediments would have been limited to on-site workers. When the incinerators were decommissioned in 1989, areas of soil contamination were excavated and removed to the landfill which was then capped.

The concentration of several PAHs detected in sediments collected from the western recharge basin during the RI exceeded public health assessment comparison values. Since access to this area of the landfill is restricted by a fence, the potential for exposure to contaminated sediment in the western recharge basin is limited to on-site workers.

Past Potential Exposure to Incinerator Ash (On-Site)

During the investigation of the leasehold property, incinerator ash samples were collected and analyzed for metals only. Lead was detected at a maximum concentration of 12,570 mg/kg. PAHs are commonly associated with incinerator ash and were likely to have been present in the ash samples collected from the leasehold property. However, since these samples were not analyzed for PAHs, the potential health risk associated with possible exposure to these compounds for workers on the leasehold property cannot be evaluated. The potential for exposure to incinerator ash has been eliminated since all areas of contamination identified on the leasehold property were excavated and placed under the landfill cap.

Past Potential Exposure to Soil Gas (Off-Site)

Off-site exposure to site-related contaminants in soil gas may have occurred prior to 1978. However, there are no data to evaluate this potential pathway of exposure. Since 1978, monthly monitoring has not detected the presence of landfill gas within 150 feet of any residential properties. Soil gas has not been detected at consequential levels in any of the perimeter soil gas monitoring wells since the landfill gas collection systems began operation in 1994.

C. Eliminated Exposure Pathways

Groundwater

The investigation of this site concluded that groundwater downgradient from the landfill is contaminated with chlorinated solvents and metals. However, since homes and businesses with private wells contaminated or threatened by the groundwater contaminant plume have been connected to public water, this pathway of exposure has been eliminated.

Surface Water (On-Site and Off-Site)

Surface water samples were collected from the on-site drainage basins during the investigation of the leasehold property and the RI. The level of contamination detected in all on-site surface water samples did not exceed public health assessment comparison values.

The RI concluded that the contaminant plume migrating from the landfill discharges into the Sunken Meadow Creek (off-site). Exposure to site-related contaminants could occur if people use this off-site creek for recreational purposes such as swimming or fishing. However, the low levels of VOCs in the surface water samples taken from the creek do not exceed public health assessment comparison values. Therefore, since the levels of contaminants detected in on-site and off-site surface water samples do not exceed public health assessment comparison values, this pathway of exposure has been eliminated from further discussion in the Toxicological Evaluation section of this PHA.

Surface Soil (On-Site)

In 1989, on-site surface soil samples were collected from the leasehold property. Since the level of contamination detected in these samples does not exceed public health assessment comparison values, this pathway of exposure has been eliminated from further discussion in the Toxicological Evaluation of this PHA.

Sediment (Off-Site)

Exposure to site-related contaminants in the sediments of Sunken Meadow Creek could occur. However, contamination was not detected in sediment samples collected during the RI. Therefore, this pathway of exposure has been eliminated from further discussion in the Toxicological Evaluation of this PHA.

Soil Gas (Future Off-Site)

The Town of Huntington instituted a landfill gas monitoring program in 1978. Monitoring for landfill gas is carried out on a monthly basis. From 1978 to 1996 the basements in as many as 12 homes were monitored on a monthly basis. Monitoring for methane in homes bordering the landfill was suspended in 1996 when construction of the landfill gas collection systems were completed. A monthly landfill gas monitoring report is submitted to the NYS DEC. These reports to date indicate that the landfill gas collection systems effectively control the off-site migration of soil gas. Based on this information, exposure to contaminated soil gas is not likely to occur.

PUBLIC HEALTH IMPLICATIONS

A. Toxicological and Epidemological Evaluation

An analysis of the toxicological implications of the human exposure pathways of concern is presented below. To evaluate the potential health risks from contaminants of concern associated with the Huntington Landfill site, the NYS DOH assessed the risks for cancer and non-cancer health effects. The health effects are related to contaminant concentration, exposure pathway, exposure frequency and duration. For additional information on how the NYS DOH determined and qualified health risks applicable to this health assessment, refer to Appendix C.

1. Past ingestion, dermal and inhalation exposure to volatile organic compounds (VOCs) nitrate and metals in private water supply wells.

For an undetermined period of time, private water supply wells were contaminated with VOCs (Appendix B, Table 4). Since 1973 the SCDHS has sampled about 180 private wells downgradient form the landfill. Contamination which may be related to the landfill was detected in about 50 of the wells sampled. Contaminant levels in drinking water prior to 1973 are unknown. Organic chemicals and metals at concentrations exceeding NYS drinking water standards and/or public health assessment comparison values have been found in private water supplies (Appendix B, Tables 4 and 5). To eliminate exposures to site-related contaminants in drinking water, the Town of Huntington connected homes with private wells downgradient from the landfill to public water in three phases. Phase I took place during 1986 and 1987, Phase II was completed in 1989 and Phase III began in 1993 and was completed in 1996. Therefore, some residents may have been exposed to these contaminants in their drinking water for 23 years (1973-1996) or more. In addition, the Record of Decision for this site will provide for the connection to public water of any home with a private drinking water well contaminated or threatened by the groundwater contaminant plume migrating from the landfill.

Chronic exposure to chemicals in drinking water is possible by ingestion, dermal contact and inhalation from water uses such as showering, bathing and cooking. Although exposure varies depending on an individual's lifestyle, each of these exposure routes contributes to the overall daily uptake of contaminants and thus increases the potential for chronic health effects. The toxicological implications of past exposures to site-related contaminants in private water supplies is discussed below.

Organic Contaminants

Vinyl chloride is a known human carcinogen (ATSDR, 1995c). Vinyl chloride was detected in one private well at an estimated concentration of 0.30 mcg/L. Chronic exposure to drinking water contaminated with vinyl chloride at the highest level (0.3 mcg/L) reported in private water supply wells could pose a low increased cancer risk. However, since the concentration of vinyl chloride detected in this well is below the instrumental detection limit of 0.50 mcg/L and the presence of the compound was not confirmed when the well was resampled on two different occasions, the presence of vinyl chloride is questionable. Other chlorinated organic contaminants detected include: trichloroethene (up to 150 mcg/L), tetrachloroethene (up to 39 mcg/L), 1,1-dichloroethene (up to 0.5 mcg/L), carbon tetrachloride (up to 5 mcg/L), and 1,2-dichloropropane (up to 2 mcg/L). These contaminants have been found to cause cancer in laboratory animals exposed to high levels of these chemicals over their lifetimes (ATSDR, 1989; 1994a,b; 1997a,b). Chemicals that cause cancer in laboratory animals may also increase the risk of cancer in humans who are exposed to lower levels over long periods of time. Based on the results of animal studies and limited data for these contaminants in private water supply wells, chronic exposure to the highest levels of these contaminants for a period of about 23 years (from 1973-1996) could pose a low increased cancer risk. Any increased cancer risk is indeterminate for exposures prior to 1973 because no data on levels of contaminants are available.

The chlorinated organic contaminants selected for further evaluation (Appendix B, Table 4 and 5) can also cause noncarcinogenic effects, primarily to the liver, kidneys and central nervous system. Although, the risks of noncarcinogenic effects from past exposure to these contaminants in drinking water are not completely understood, the existing data suggest that they could have been low.

Metal Contaminants and Nitrates in Private Well Samples

Nitrate was detected in one private well at a concentration of 24,900 mcg/L. Nitrate is toxic when present in excessive amounts in drinking water and in some cases may cause a blood disorder in infants called methemoglobinemia. The red blood cells in infants with methemoglobinemia have a reduced ability to carry oxygen and could result in cyanosis and anoxia (blue baby). No cases of methemoglobinemia have been associated with drinking water containing nitrate at 10,000 mcg/L or less. The health risk to bottle-fed infants at higher levels of nitrate is influenced by a number of factors including the increase in nitrate in infant formula as a result of repeated boiling of water. Some cases of infant methemoglobinemia have been reported when drinking water contained 11,000 to 20,000 mcg/L. There are many examples, however, where nitrate levels up to 20,000 mcg/L have not caused any clinical effects in infants (US EPA, 1995). Drinking water contaminated with nitrate at the highest concentrations found in private well water would pose a high risk of adverse health effects to bottle-fed infants.

Metal contaminants selected for further evaluation in private well water are iron (4,100 mcg/L), lead (41 mcg/L), sodium (60,100 mcg/L) and thallium (50 mcg/L). Although iron is an essential nutrient, ingestion of large amounts can lead to iron toxicity characterized primarily by gastrointestinal effects (Henretig and Temple, 1984). Chronic exposure to drinking water contaminated with iron at the highest concentrations found in private wells (4,100 mcg/L) would pose a minimal risk of adverse health effects. Its presence in drinking water, however, is objectionable primarily due to its affect on taste and staining of laundry and plumbing fixtures (WHO, 1984). Chronic exposure to lead is predominantly associated with neurological and hematological effects and the developing fetus and young children are particularly sensitive to lead-induced neurological effects (ATSDR, 1997). Chronic exposure to drinking water contaminated with lead at the highest concentrations found in private wells (41 mcg/L) would pose a minimal risk of adverse health effects. The main health concern about sodium ingestion is its association with high blood pressure and possibly heart disease (WHO, 1984). Chronic exposure to drinking water contaminated with sodium at the highest concentrations found in private wells (60,100 mcg/L) could pose an increased risk of adverse health effects to people on severely restricted sodium diets. Thallium can adversely affect the respiratory, cardiovascular and gastrointestinal systems, liver, kidneys and male reproductive system (ATSDR, 1992). The risk of adverse health effects from past exposures to low levels of thallium in drinking water is poorly understood. The existing data suggest, however, that chronic exposure to drinking water contaminated with thallium at the highest concentrations (50 mcg/L) found in private wells could pose a risk of adverse health effects.

2. Past inhalation exposure to volatile organic compounds in ambient air.

From early 1989 to 1990, the landfill was the source of a community odor problem. In response to community concerns the SCDHS sampled ambient air at several locations around the landfill. Although chemicals that may have been associated with odor complaints were not identified, benzene, toluene and dichlorodifluoromethane (freon 12) were detected in one or more of the samples at maximum concentrations of 2 ppb, 2 ppb and 19 ppb, respectively. The concentrations of toluene and benzene are typical of background levels for these compounds and the level of Freon 12 does not exceed the public health assessment air comparison value. Therefore, past inhalation exposure to these compounds near the Huntington Landfill site should not result in any significant increased risk of adverse health effects.

When ambient air was sampled during the RI in 1994, tetrachloroethene and trichloroethene were detected only at on-site locations at concentrations as high as 17 mcg/m^3 (2.5 ppb) and 12 mcg/m^3 (2.3 ppb), respectively. Based on very limited measurements made in 1994, it is estimated that neither of these contaminants should be a source of significant increased health risk. Prior to 1994, no air emissions data for tetrachloroethene and trichloroethene are available that can be attributed to the Huntington Landfill, and therefore, the health risk from past exposure to these or other chemicals in ambient air is indeterminate.

As part of the RI, in 1996 the ISC dispersion model was used to evaluate potential exposure to airborne contaminants migrating from the landfill. Based on the ISC modeled data, the excess lifetime cancer risk associated with exposure to air contaminants was very low for employees (on-site workers) and the residents living at the maximally impacted off-site location.

3. Potential past, ingestion, dermal contact and inhalation exposure to on-site sediment and incinerator ash.

In the past, it is possible that workers at the Huntington Landfill site were exposed to contaminants in on-site sediments and incinerator ash. This exposure could have occurred for a period of up to 34 years, that is between 1955-1989 when the on-site incinerators were in operation and before areas of sediment contamination were excavated and removed. The contaminants selected for further evaluation because they exceed public health assessment comparison values (Table 7) are the PAHs: benz(a)anthracene (7.2 mg/kg), benzo(b)fluoranthene (9.4 mg/kg), benzo(a)pyrene (6 mg/kg) and indeno(1,2,3-cd)pyrene (4.8 mg/kg). Another major contaminant was lead at levels as high as 12,570 mg/kg.

These PAHs cause cancer in laboratory animals exposed to high levels over their lifetimes (ATSDR, 1995d). Common cancers associated with exposure to PAHs include skin, respiratory and gastrointestinal tract cancers. Chemicals that cause cancer in laboratory animals may also increase the risk in humans who are exposed to lower levels over long periods of time. Whether or not these chemicals cause cancer in humans is not known. Based on the results of animal studies, it is estimated that chronic past exposure of workers to these carcinogenic PAHs found in on-site sediments at the Huntington Landfill site could pose a low increased cancer risk. In addition, PAHs cause noncarcinogenic effects, primarily to the immune and blood cell-forming systems. Although the risks of noncarcinogenic effects from exposure to PAH-contaminated sediments are not completely understood, the existing data suggest that they would be minimal for worker exposures in the past.

The other contaminant selected for further evaluation is lead found at levels as high as 12,570 mg/kg in incinerator ash. The toxicological properties of lead have already been discussed. Potential past chronic exposure of workers to lead at the highest concentrations found in contaminated on-site incinerator ash would pose a low risk of adverse health effects.

Potential present and future exposures of workers to other on-site sediments contaminated with PAHs (benzo(a)pyrene, 3.6 mg/kg; benz(a)anthracene, 4.7 mg/kg; and benzo(b)fluoranthene, 4.3 mg/kg) that exceed public health assessment comparison values (Appendix B, Table 7) would also pose a low increased cancer risk and a minimal noncancer risk.

The health risks from potential past, present and future exposure to on-site sediments and incinerator ash (see above) could be reduced by wearing gloves and use of appropriate dust suppression methods.

B. ATSDR Child Health Initiative

The ATSDR Child Health Initiative emphasizes examining child health issues in all of the agency activities, including evaluated child-focused concerns through its mandated public health assessment activities. The ATSDR and the NYS DOH considers children when evaluating exposure pathways and potential health effects from environmental contaminants. We recognize that children are of special concern because of their greater potential for exposure from play and other behavior patterns. Children sometimes differ from adults in their susceptibility to the effects of hazardous chemicals, but whether there is a difference depends on the chemical. Children may be more or less susceptible than adults to health effects from a chemical and the relationship may change with developmental age.

The possibility that children or the developing fetus may have increased sensitivity to tetrachloroethene (PCE) and trichloroethene (TCE) (two of the primary contaminants at the Huntington Landfill site) was taken into account when evaluating the potential health risks associated with the groundwater contamination. Human studies suggest that exposure to mixtures of chlorinated solvents (including PCE and TCE) in drinking water during pregnancy may increase the risk of birth defects (e.g., neural tube defects, oral cleft defects, and congenital heart defects) and/or childhood leukemia (ATSDR 1997a,b). In each of these studies, however, there are uncertainties about how much contaminated water the women drank during pregnancy and about how much PCE and TCE was in the water the women drank during pregnancy. Moreover, the role of other factors in causing these effects is not fully known. The most important of the factors was the potential exposure during pregnancy to other chemicals in drinking water. These studies suggest, but do not prove, that the developing fetus may have increased sensitivity to the effects of PCE and TCE. When pregnant animals are exposed by ingestion and/or inhalation to large amounts of PCE and TCE, adverse effects on the normal development of the offspring are observed (ATSDR 1997a,b). In most, but not all of these studies, the high amounts of the chemicals also caused adverse health effects on the parent animal. A study in young mice suggests effects on the central nervous system after transient exposure to PCE by ingestion 10 to 16 days after birth (Fredriksson et al., 1993). In another study, abnormal fetal heart development was observed in the offspring of rats exposed to TCE in drinking water before and during pregnancy (Dawson et al., 1993). The estimated levels of exposure to trichloroethene and tetrachloroethene in private drinking water supplies near the Huntington Landfill were compared to the exposure levels in these animal studies where adverse health effects were observed and were found to be lower. Thus, the possibility that children may have increased sensitivity to trichloroethene and tetrachloroethene was taken into account when evaluating the potential health risks associated with the Huntington Landfill site.

C. Health Outcome Data Evaluation

In October of 1991 the NYS DOH completed a cancer incidence investigation for the areas in East Northport, Commack and Kings Park, New York. The study area was defined to include areas where citizens were concerned about the possibility of health effects caused by the proximity of the Huntington Landfill.

The study focused on the years 1978 through 1987, which was the most recent period for which cancer reporting was complete for small area analysis. In summary, the total number of newly diagnosed cancer cases was similar to expected among females. Among males, a statistically significant excess of cases was observed.

The specific sites of cancer that showed statistically significant elevations were malignant melanoma in males and females, colon cancer among males, leukemia among males, breast cancer among females and lung cancer among females.

Malignant melanoma, breast and colon cancer are known to be more common in areas of higher socioeconomic status. The median household income for the study area is higher than that of Suffolk County and considerably higher than that of New York State as a whole. Although there was a statistically significant elevation of cancer incidence for some types of cancer for the study area as a whole, examination of data for specific census tracts did not point to a geographic link between the areas of highest cancer incidence and the area where the landfill is located or where groundwater contamination occurs. A copy of the study is provided in Appendix E.

In April 1994, the NYS DOH completed a study of the occurrence of breast cancer on Long Island. The study found an association between living near chemical facilities on Long Island and the risk of breast cancer in post-menopausal women. The study found no association between residences near industry and breast cancer for pre-menopausal women. No cause and effect relationship was demonstrated. The study does not link any specific chemical site or industrial pollutant with breast cancer risk. No measurements have been taken of actual air emissions from chemical plants or individual exposure to industrial pollutants. Further investigation is necessary to verify the findings and to attempt to identify the circumstances and potential pollutants that may explain the higher incidence of breast cancer in post-menopausal women who lived near chemical sites between 1965 and 1985. The National Cancer Institute is currently funding a research study of the relationship between environmental factors and breast cancer on Long Island.

The people exposed to site-related contaminants in drinking water will be considered for addition to the NYS DOH Volatile Organic Compounds Registry. The Registry was established in 1999 as a tool for health status assessment and long-term follow-up for communities with documented exposures to VOCs. The Registry is currently evaluating exposures and health status of New York State residents at locations where drinking water or indoor air was contaminated with chemicals such as industrial solvents or petroleum products from landfills, industrial sites, spills, or other sources. Individuals and communities are selected for inclusion in the Registry if potential exposures from the contamination of private wells, public water supplies, or indoor air have been verified by sampling results. Future analysis, based on VOC Exposure Registry information, may increase understanding of potential health effects from exposures similar to those experienced by residents near the Huntington Landfill site.

The Huntington Landfill site was included in a cancer incidence study conducted by the NYS DOH. The study evaluated cancer incidence among people living near a total of 38 landfills with similar potential soil gas migration conditions. Seven types of cancer were evaluated: liver, lung, bladder, kidney, brain, non-Hodgkin's lymphoma and leukemia. For Huntington Landfill as well as most of the other landfills in the study, people who lived within 250 feet of the landfill (the potential exposure areas) were compared with people living further away in order to see if the people living very close were more likely to have been diagnosed with one of the seven cancers during the time period 1980 to 1989. The study analyzed all the landfills as a group because not enough people lived near any one landfill to conduct landfill-specific analyses. The study found no statistically significantly elevated cancers among men living in the potential exposure areas near the 38 landfills. Among women living in the potential exposure areas, statistically significant elevations were found for bladder cancer and leukemia, but not for the other five cancer types.

The data available for this study were limited. There were no data that measured whether individuals were exposed to landfill chemicals. Only a person's address at the time of diagnosis was used for mapping his or her location. The length of time people lived at their homes before being diagnosed with cancer was unknown; a person in the study could have just recently moved to the address. This is important because there is a period of years, called latency, between the beginning of the cancer's growth and its later appearance and diagnosis. For most cancers, the period of latency is thought to be between ten and twenty years. For cancer studies, researchers would like to know where people lived and what they were exposed to at least twenty years before cancer is diagnosed. But this is rarely possible. This study looked back from cancers diagnosed in the 1980's to potential exposures that might have occurred near landfills that were active in the 1960's and 1970's. This type of study cannot prove a direct cause and effect relationship between exposure and disease. However, to investigate these findings further, ATSDR is funding an additional study. The follow-up study will update the original study to include the years 1990 to 1997 or most recent year available, and improve on the original study by using a different comparison group.

D. Community Health Concerns Evaluation

In response to community health concerns about cancer, in October of 1991 the NYS DOH completed a cancer incidence study for the area around the landfill. On March 16, 1992, NYS DOH staff met with the public to discuss the study and to address community concerns about the incidence of cancer for the area near the landfill. The results of the study are summarized in the "Health Outcome Data Evaluation" section of this document. A copy of the study is in Appendix E.

In March 1991, October 1991, June 1993, August 1993 and December 1995, NYS DOH staff held public meetings to address community concerns about exposure to contaminates migrating from the landfill in air and groundwater. At the request of the NYS DOH, SCDHS and NYS DEC, the town has provided public water to homes downgradient from the landfill. To reduce the uncontrolled release of landfill gas, the town has constructed a cap on the landfill which includes gas collection/control systems. In the past community members reported allergy problems, bacterial infections, eye and throat irritation, asthma, sinus and respiratory infections. These maladies/reactions may be due to exposure to a multitude of biological or environmental agents, and may include exposure to site-related airborne particulate matter from the old incinerators which operated from 1955 to early 1989. However, there is no data to evaluate past exposures to fly ash from the on-site incinerators.

In response to concerns about decreased school attendance, and an increase in illness resulting from the odors emanating from the landfill, in 1990, at the request of the petitioner, NYS DOH staff contacted local physicians to determine if there was an increase in the number of patient visits. The physicians interviewed said that they had heard about the odors, but they could not verify that the landfill odors resulted in an increased number of office visits.

CONCLUSIONS

1. Because people were exposed to volatile organic compounds (primarily tetrachloroethene and trichloroethene) in private drinking water at levels above New York State Drinking Water Standards near the Huntington Landfill site, public health actions were needed to reduce or eliminate exposures. Because there is evidence from studies in animals and humans that exposure to elevated levels of tetrachloroethene and trichloroethene can increase the risk of cancer and non-cancer adverse health effects in humans, we evaluated the potential health risk for exposure to these chemicals at the Huntington Landfill. Exposures in the past could pose a low increased risk of cancer and a low risk for non-cancer effects. Furthermore, some private water supply wells contained the inorganic

contaminants nitrate and thallium at levels that could increase the risk of adverse health effects. To eliminate exposure to site-related contaminants in drinking water, the Town of Huntington has connected homes with private wells downgradient from the landfill to public water supplies. Due to the extension of public construction of the landfill cap, which includes landfill has collection/control systems, this site currently poses no apparent public health hazard.

2. The landfill gas collection systems effectively control the off-site migration of landfill gas. Monthly monitoring from 1974 to 1996 in the basements of as many as 12 homes bordering the site did not detect the presence of landfill gas (methane). Monitoring for methane in homes bordering the landfill was suspended in 1996 when the construction of the landfill gas collection systems was completed.

3. The majority of the groundwater contaminant plume migrating from the landfill discharges into the Sunken Meadow Creek. Although exposure to site-related contaminants in surface water could occur, surface water monitoring of the creek indicates that the levels of contaminants do not represent a health concern.

4. Off-site exposure to airborne incinerator ash from the old on-site incinerators has occurred in the past. However, this pathway of exposure cannot be evaluated since the analytical data needed to quantify the associated health risks do not exist.

RECOMMENDATIONS

1. Continue semi-annual monitoring of the groundwater monitoring well in between the groundwater contaminant plume migrating from the landfill and the Gun Club Road public drinking water supply wells. This monitoring well acts as an early warning mechanism should contaminants from the landfill migrate closer to the Gun Club Road wellfield, and thus reduce the potential for exposure to landfill related contamination groundwater.

2. Continue operation of the landfill gas collection systems and continue monitoring the perimeter soil gas collection system on a monthly basis to determine if it remains effective in controlling the off-site migration of soil gas.

3. Maintain the methane alarm systems in the on-site animal shelter and maintenance garage, and continue weekly monitoring of these structures for explosive gases.

4. Continue semi-annual monitoring of surface water in Sunken Meadow Creek to determine if the level of surface water contamination related to the landfill increases.

5. Maintain deed restrictions on affected solids/soils areas to limit excavation and drilling in affected areas. This applies to the landfill property.

6. Maintain land use controls which prohibit well installations near the landfill and consequently limit exposures to contaminated groundwater.

7. Residents who were exposed in the past to VOCs in drinking water should be considered for inclusion to the NYS DOH VOC exposure registry.

PUBLIC HEALTH ACTION PLAN (PHAP)

The Public Health Action Plan (PHAP) for the Huntington Landfill site contains a description of actions to be taken by ATSDR and/or the NYS DOH at and near the site, following completion of this public health assessment. For those actions already taken at the site, please see the Background section of this Public Health Assessment. The purpose of the PHAP is to ensure that this 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 past, present and/or future exposures to hazardous substances at or near the site. Included, is a commitment on the part of ATSDR and/or the NYS DOH to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by ATSDR and/or the NYS DOH are as follows:

1. ATSDR and the NYS DOH will coordinate with the appropriate environmental agencies to develop plans to implement the recommendations contained in this Public Health Assessment.

2. The NYS DEC, NYS DOH and SCDHS will oversee the remediation of this site as indicated in the Recommendations section of this Public Health Assessment.

3. People exposed to VOCs in drinking water in the past will be considered for addition to the NYS DOH VOC exposure registry. Periodically, this registry will be matched with the cancer registry to evaluate possible adverse health outcomes.

ATSDR will reevaluate and expand the PHAP when needed. New environmental, toxicological, or health outcome data, or the results of implementing the above proposed actions may determine the need for additional actions at this site.

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CERTIFICATION

This public health assessment was prepared by the New York State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methods and procedures existing at the time the public health assessment was begun.

Gregory V. Ulirsch

Technical Project Officer, SPS, RPB, DHAC

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment, and concurs with its findings.

for Richard Gillig

Chief, SPS, SSAB, DHAC, ATSDR

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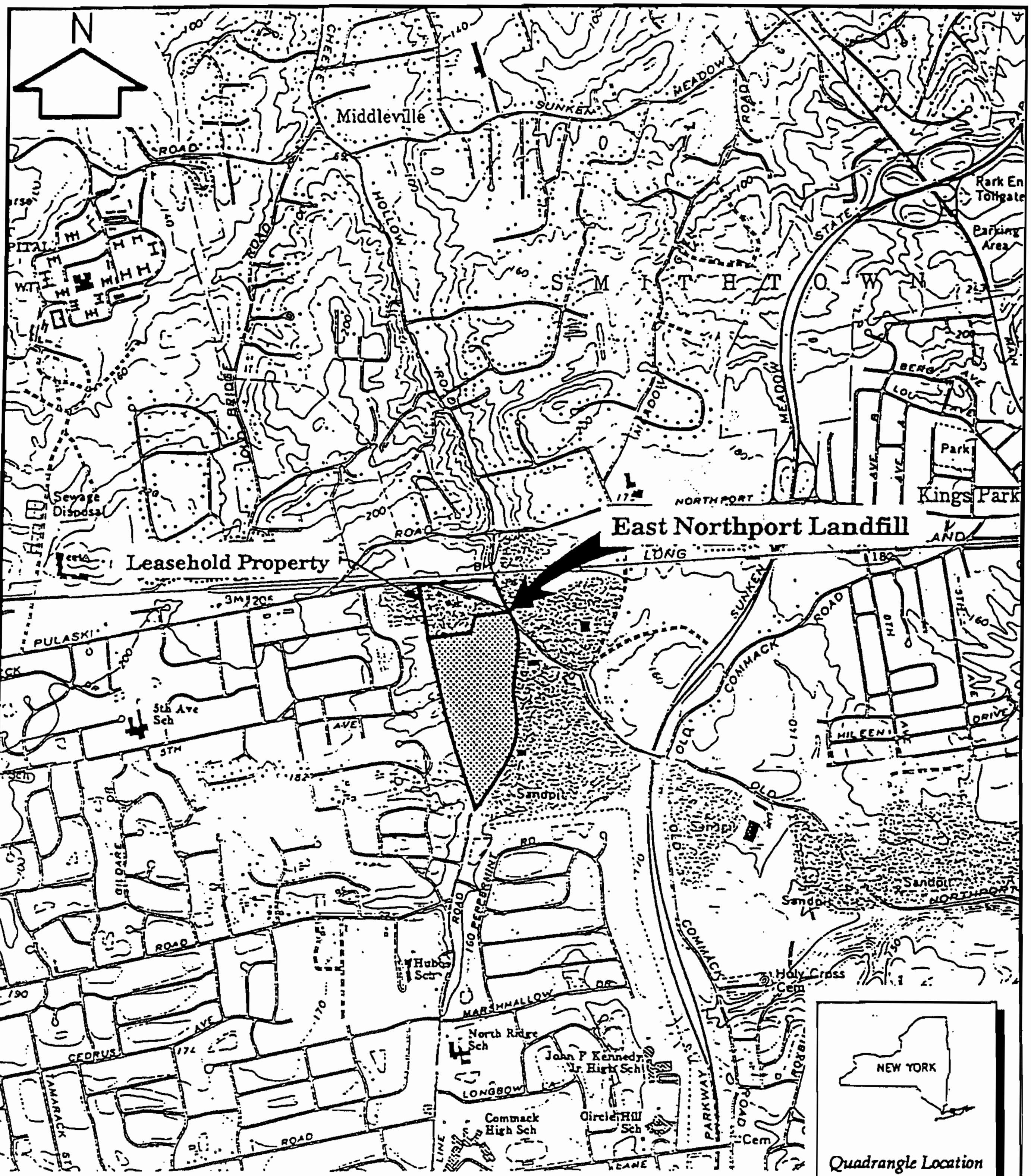
APPENDIX A

FIGURES



1,000 0 1,000 2,000

scale feet

MAP SOURCE: U.S.G.S., Greenlawn, New York Quad, 1967.
U.S.G.S., Northport, New York Quad, 1967.

FIGURE 1

Site Location

Town Of Huntington

Remedial Investigation

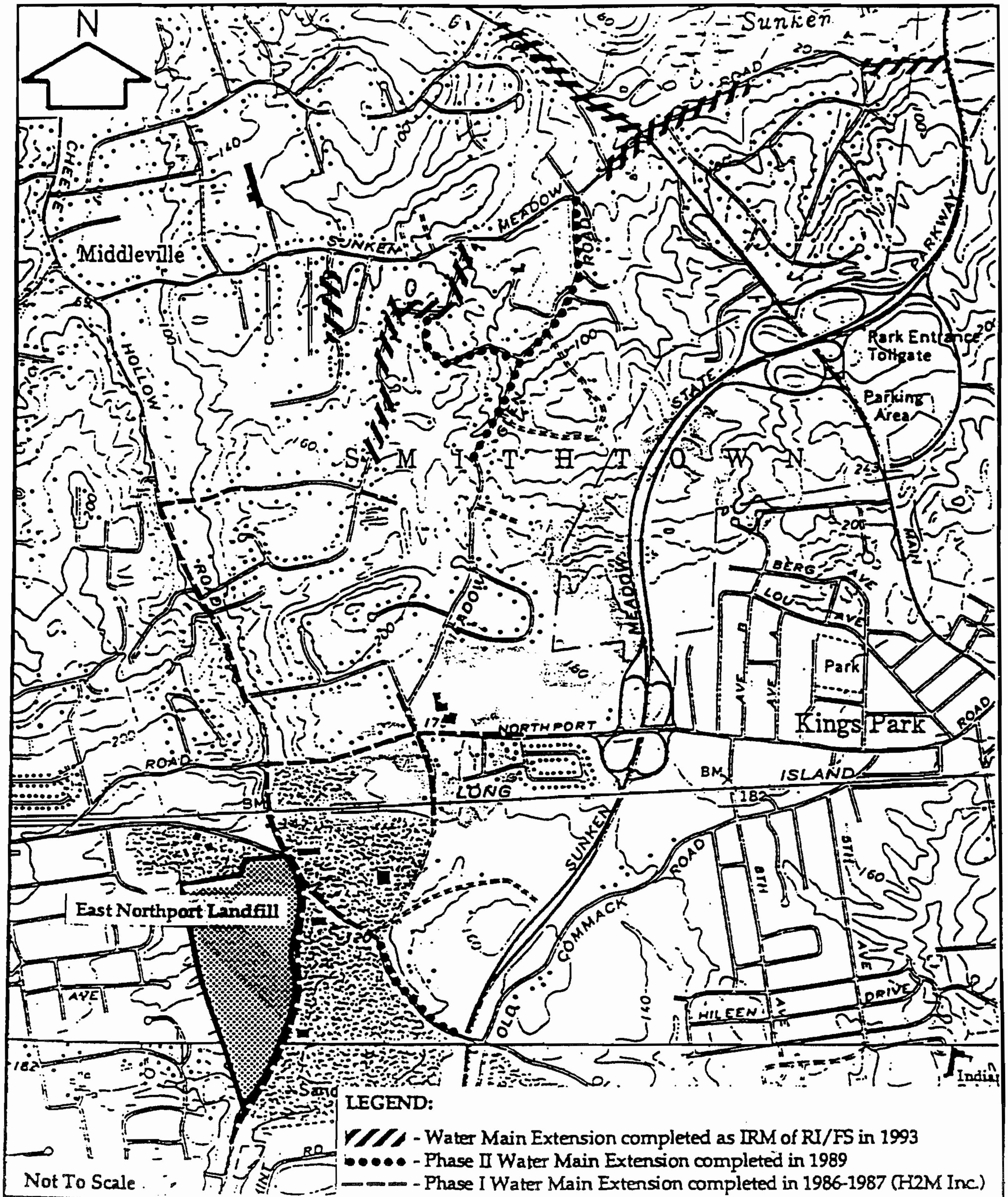


Figure 2

Extension Of Suffolk County Water Mains

Town Of Huntington

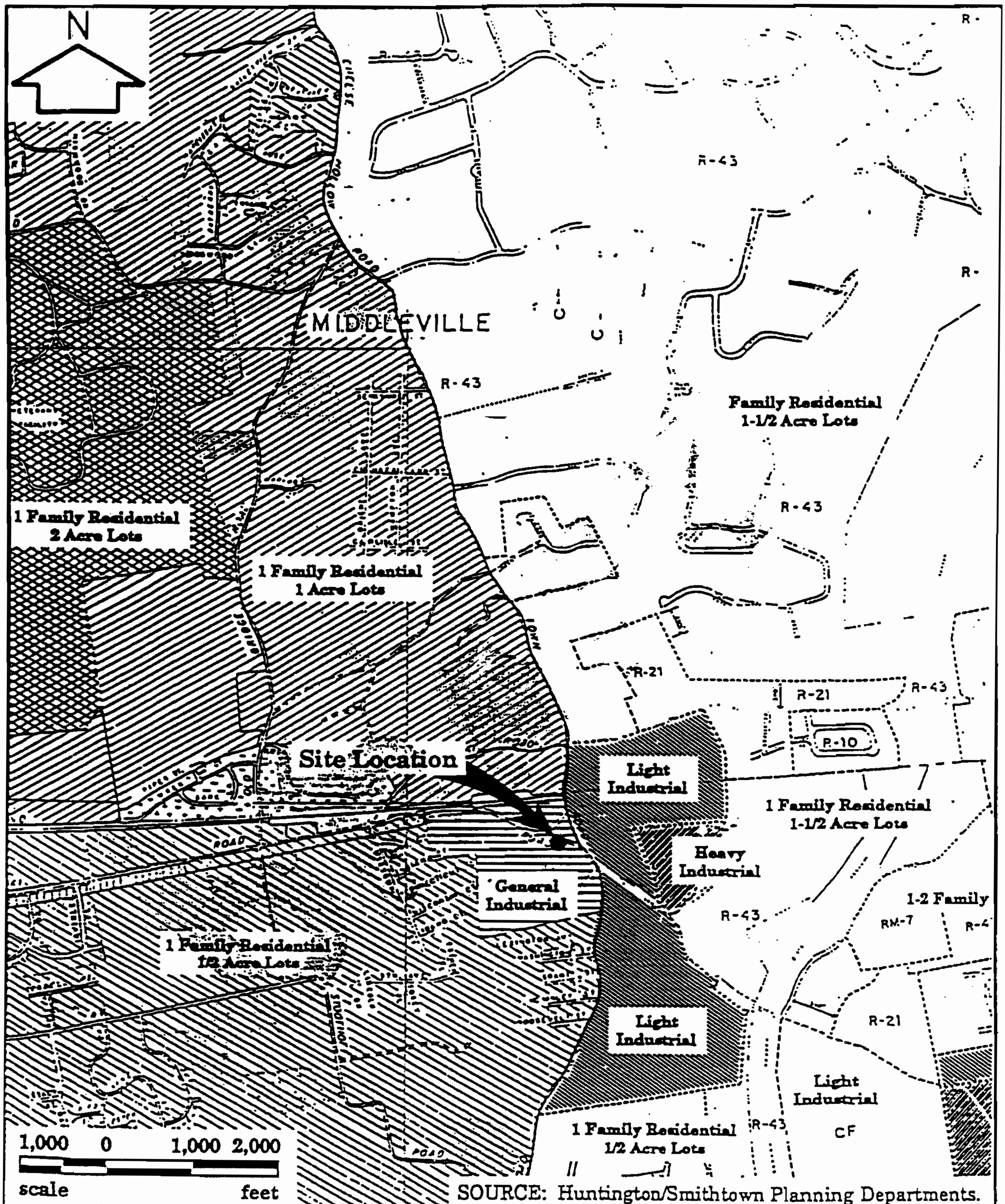
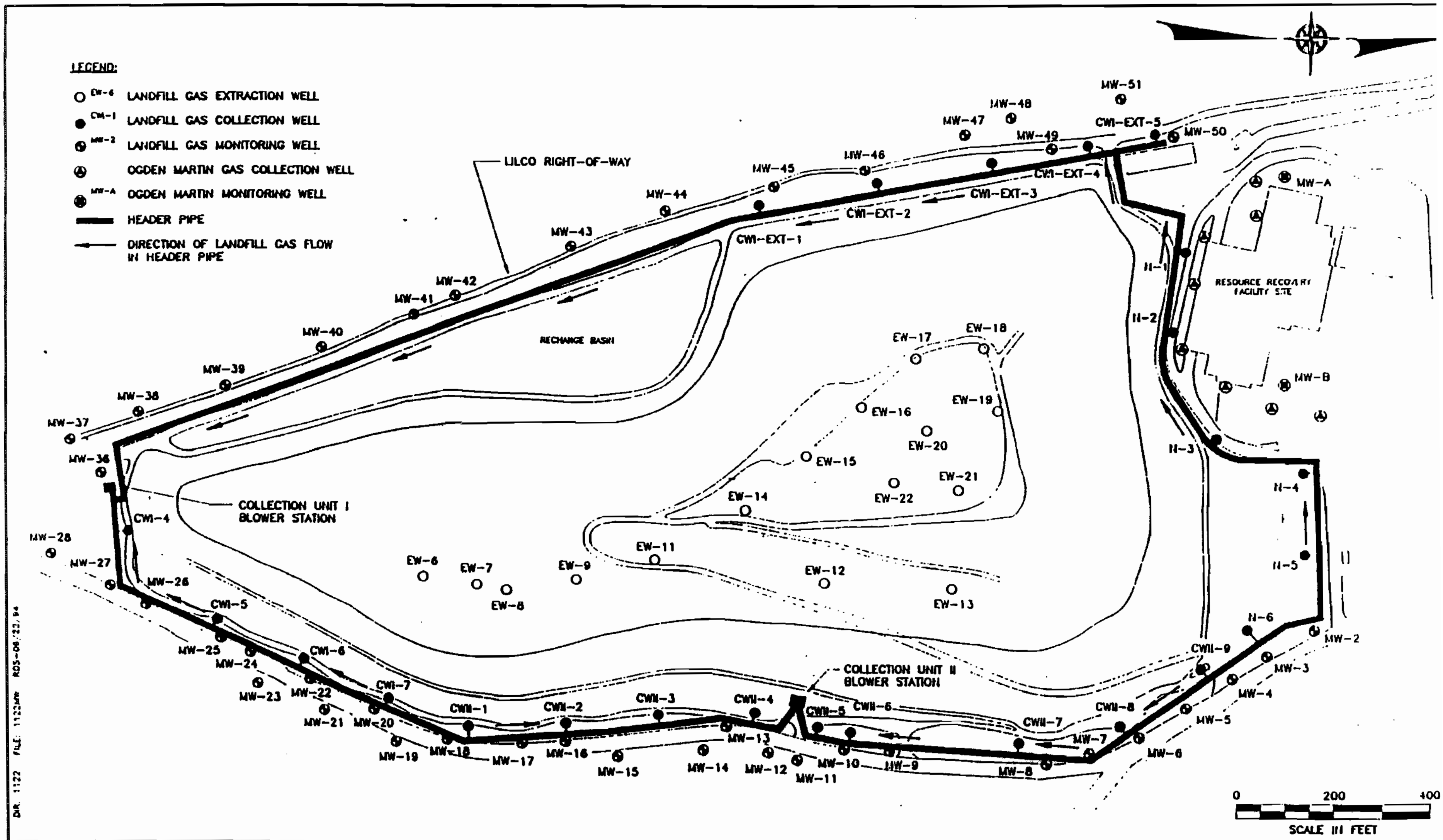


Figure 3

Zoning Map

Town Of Huntington

Remedial Investigation



LANDFILL GAS AND AMBIENT AIR
PHASE II REMEDIAL INVESTIGATION

EXISTING PERIMETER MONITORING AND CONTROL SYSTEM

FIGURE 4

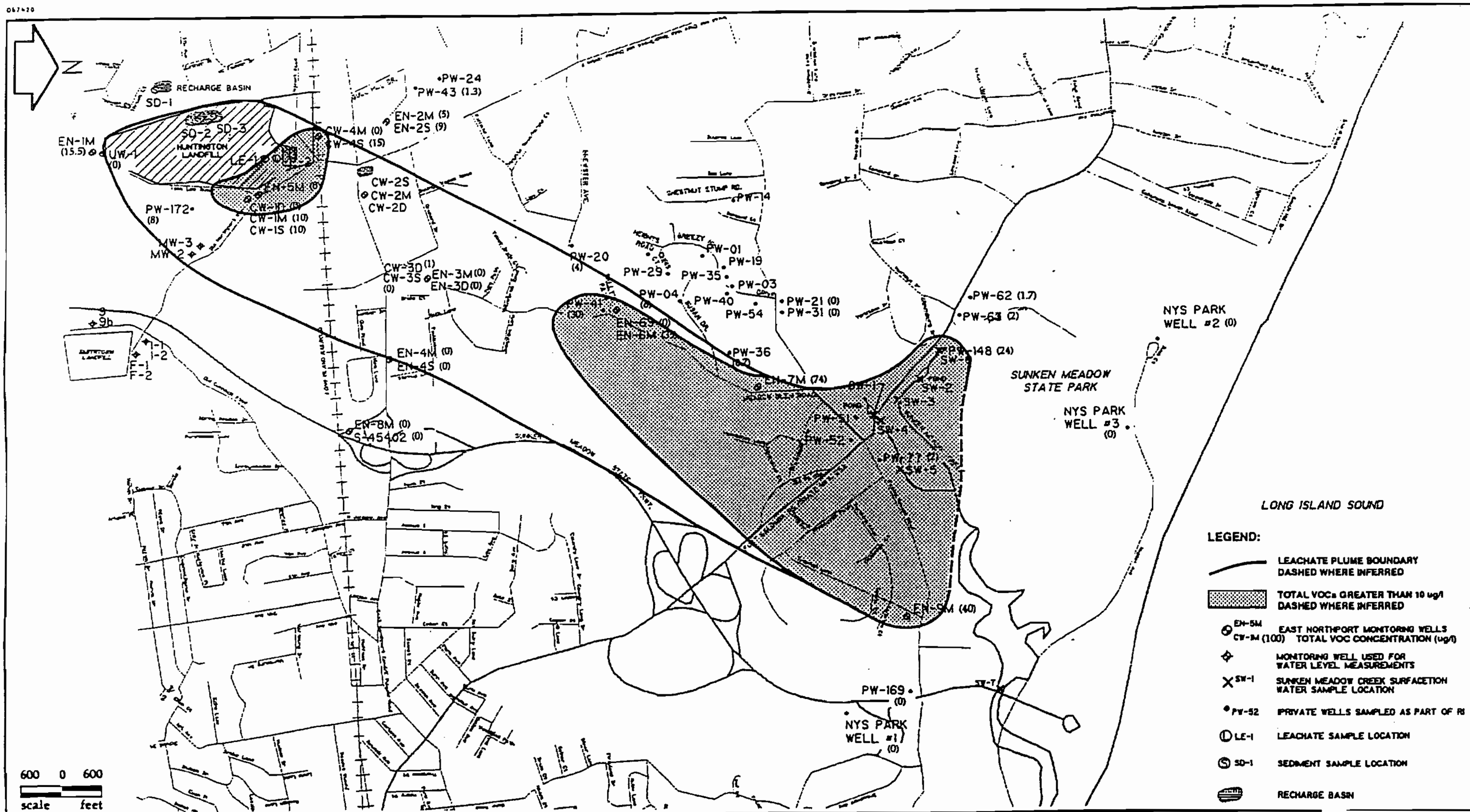
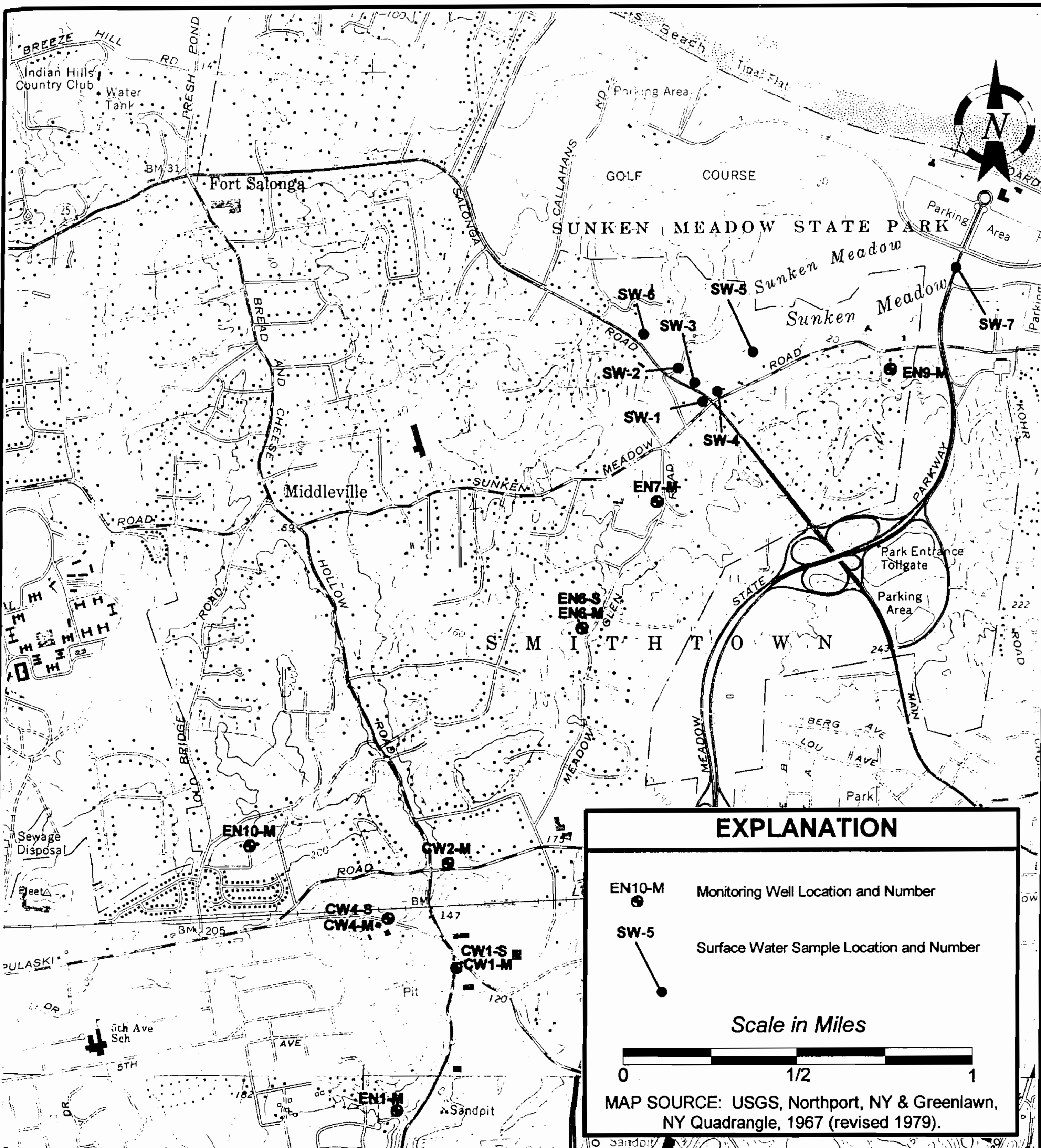


FIGURE 5

Extent Of VOCs Within Leachate Plume (Greater Than 10 µg/l)

APPENDIX B

TABLES



Groundwater and Surface Water Sampling Locations

East Northport Landfill Post Closure Water Sampling	Prepared By:	RDH	Date:	May 1997
	Reviewed By:	RNC	Figure:	1

EN10-M

Historical Analysis of Volatile Organic Compounds
East Northport Landfill, East Northport, NY

Reported in Micrograms per Liter

Parameter Sampling Date	11/96	4/22/97	9/10/97	4/29/98	9/29/98	4/14/99	9/1/99	4/25/00	9/7/00
Chloromethane	ND(10.0)	ND(2.0)	ND(2.0)	ND(10.0)	ND(10.0)	ND(4.6)	ND(2.3)	ND(1.1)	ND(1.1)
Bromomethane	ND(10.0)	ND(1.0)	ND(1.0)	ND(10.0)	ND(10.0)	ND(3.8)	ND(1.8)	ND(0.6)	ND(0.6)
Vinyl Chloride	ND(10.0)	ND(1.0)	ND(1.0)	ND(10.0)	ND(10.0)	ND(1.7)	ND(2.0)	ND(1.0)	ND(1.0)
Chloroethane	ND(10.0)	ND(1.0)	ND(1.0)	ND(10.0)	ND(10.0)	ND(1.8)	ND(1.6)	ND(0.7)	ND(0.7)
Methylene Chloride	ND(5.0)	4.0	ND(3.0)	ND(5.0)	ND(5.0)	ND(2.7)	ND(0.6)	ND(0.4)	ND(0.4)
Trichloroflouromethane		ND(2.0)	ND(2.0)	ND(10.0)	ND(10.0)	ND(1.5)	ND(1.5)	ND(0.4)	ND(0.4)
1,1-Dichloroethene	ND(5.0)	ND(2.0)	ND(2.0)	ND(5.0)	ND(5.0)	ND(1.7)	ND(1.2)	ND(0.4)	ND(0.4)
1,1-Dichloroethane	ND(5.0)	3.0	4.0	4.0 J	3.0 J	ND(1.4)	1.1	ND(0.2)	2.0
* 1,2-Dichloroethene, Total		ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(1.7)	ND(1.0)	ND(0.4)	ND(0.4)
Chloroform	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	1.0 J	ND(1.6)	ND(0.4)	ND(0.3)	ND(0.3)
1,2-Dichloroethane	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(1.9)	ND(0.5)	ND(0.3)	ND(0.3)
1,1,1-Trichloroethane	ND(5.0)	4.0	5.0	5.0 J	5.0	3.0	1.9	4.1	**5.3**
Carbon Tetrachloride	ND(5.0)	ND(2.0)	ND(2.0)	ND(5.0)	ND(5.0)	ND(0.6)	ND(0.4)	ND(0.3)	ND(0.3)
Bromodichloromethane	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(0.6)	ND(0.6)	ND(0.3)	ND(0.3)
1,2-Dichloropropane	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(0.6)	ND(0.8)	ND(0.4)	ND(0.4)
cis-1,3-Dichloropropene	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(0.5)	ND(0.3)	ND(0.3)	ND(0.3)
Trichloroethene	ND(5.0)	ND(2.0)	ND(2.0)	ND(5.0)	1.0 J	ND(0.6)	ND(0.3)	ND(0.4)	0.4
Benzene	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(0.5)	ND(0.6)	ND(0.3)	ND(0.3)
Dibromochloromethane	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(0.6)	ND(0.5)	ND(0.3)	ND(0.3)
trans-1,3-Dichloropropene	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(0.6)	ND(0.5)	ND(0.2)	ND(0.2)
1,1,2-Trichloroethane	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(0.5)	ND(0.9)	ND(0.3)	ND(0.3)
2-Chloroethylvinyl Ether		ND(4.0)	ND(4.0)	ND(10.0)	ND(10.0)	ND(0.6)	ND(1.5)	ND(1.1)	ND(1.1)
Bromoform	ND(5.0)	ND(1.0)	ND(1.0)	ND(5.0)	ND(5.0)	ND(0.8)	ND(0.7)	ND(0.3)	ND(0.3)
1,1,2,2-Tetrachloroethane	ND(5.0)	ND(2.0)	ND(2.0)	ND(5.0)	ND(5.0)	ND(0.5)	ND(1.0)	ND(0.3)	ND(0.3)
Tetrachloroethene	ND(5.0)	ND(3.0)	ND(3.0)	ND(5.0)	0.5 J	ND(0.7)	ND(0.6)	ND(0.3)	ND(0.3)
Toluene	ND(5.0)	ND(2.0)	ND(2.0)	ND(5.0)	ND(5.0)	ND(0.8)	ND(0.5)	ND(0.3)	ND(0.3)
Chlorobenzene	ND(5.0)	ND(2.0)	ND(2.0)	ND(5.0)	ND(5.0)	ND(0.6)	ND(0.5)	ND(0.2)	ND(0.2)
Ethylbenzene	ND(5.0)	ND(2.0)	ND(2.0)	ND(5.0)	ND(5.0)	ND(0.7)	ND(0.5)	ND(0.4)	ND(0.4)
1,2-Dichlorobenzene		ND(2.0)	ND(2.0)	ND(10.0)	ND(10.0)	ND(1.5)	ND(0.2)	ND(0.2)	ND(0.2)
1,3-Dichlorobenzene		ND(2.0)	ND(2.0)	ND(10.0)	ND(10.0)	ND(0.7)	ND(0.4)	ND(0.4)	ND(0.4)
1,4-Dichlorobenzene		ND(2.0)	ND(2.0)	ND(10.0)	ND(10.0)	ND(0.5)	ND(0.3)	ND(0.3)	ND(0.3)

EN10-M (continued)

Parameter Sampling Date	4/24/01	9/19/01	4/8/02	9/10/02					
Chloromethane	ND(1.1)	ND(1.1)	ND(1.1)	ND(1.4)					
Bromomethane	ND(0.6)	ND(0.6)	ND(0.6)	ND(1.7)					
Vinyl Chloride	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.2)					
Chloroethane	ND(0.7)	ND(0.7)	ND(0.7)	ND(1.8)					
Methylene Chloride	ND(0.4)	ND(0.4)	ND(0.4)	ND(1.2)					
Trichloroflouromethane	ND(0.4)	ND(0.4)	ND(0.4)	ND(1.3)					
1,1-Dichloroethene	ND(0.4)	0.7	ND(0.4)	ND(1.0)					
1,1-Dichloroethane	ND(0.2)	1.9	ND(0.2)	ND(1.0)					
* 1,2-Dichloroethene, Total	ND(0.4)	ND(0.4)	ND(0.4)	ND(1.0)					
Chloroform	ND(0.3)	0.8	ND(0.3)	ND(0.8)					
1,2-Dichloroethane	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.6)					
1,1,1-Trichloroethane	4.7	ND(0.3)	4.8	3.2 J					
Carbon Tetrachloride	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.5)					
Bromodichloromethane	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.9)					
1,2-Dichloropropane	ND(0.4)	ND(0.4)	ND(0.4)	ND(0.8)					
cis-1,3-Dichloropropene	ND(0.3)	ND(0.3)	ND(0.3)	ND(1.5)					
Trichloroethene	ND(0.4)	0.6	ND(0.4)	ND(0.9)					
Benzene	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.6)					
Dibromochloromethane	ND(0.3)	ND(0.3)	ND(0.3)	ND(1.4)					
trans-1,3-Dichloropropene	ND(0.2)	ND(0.2)	ND(0.2)	ND(1.5)					
1,1,2-Trichloroethane	ND(0.3)	ND(0.3)	ND(0.3)	ND(1.5)					
2-Chloroethylvinyl Ether	ND(1.1)	ND(1.1)	ND(1.1)	ND(4.8)					
Bromoform	ND(0.3)	ND(0.3)	ND(0.3)	ND(1.5)					
1,1,2,2-Tetrachloroethane	ND(0.3)	ND(0.3)	ND(0.3)	ND(0.8)					
Tetrachloroethene	ND(0.3)	ND(0.3)	ND(0.3)	ND(1.0)					
Toluene	ND(0.3)	ND(0.3)	ND(0.3)	ND(1.0)					
Chlorobenzene	ND(0.2)	ND(0.2)	ND(0.2)	ND(1.0)					
Ethylbenzene	ND(0.4)	ND(0.4)	ND(0.4)	ND(1.2)					
1,2-Dichlorobenzene	ND(0.2)	ND(0.2)	ND(0.2)	ND(1.6)					
1,3-Dichlorobenzene	ND(0.4)	ND(0.4)	ND(0.4)	ND(0.8)					
1,4-Dichlorobenzene	ND(0.3)	ND(0.3)	ND(0.3)	ND(1.4)					

Note:

ND( ): Compound not detected at method detection limit

***1,2-Dichloroethene, Total: Sum of Trans and Cis 1,2-Dichloroethene**

J: Indicates and estimated value; compound is present at a concentration less than specified detection limit

Bold indicates value above NYSDEC Class GA Standard

EN10-M
Historical Analysis of Metals and Leachate Indicators
East Northport Landfill, East Northport, NY

Metals (ug/l) **Sampling Date**	11/96	4/22/97	9/10/97	4/29/98	9/29/98	4/14/99	9/1/99	4/25/00	9/7/00
Aluminum	232	163.0 B	ND(34.8)	ND(26.8)	ND(21.3)	ND(200.0)	30.1 B	ND(25.8)	104.0 B
Arsenic	ND(8.0)	ND(4.5)	ND(2.7)	ND(2.0)	ND(1.5)	ND(4.0)	ND(6.0)	ND(3.0)	ND(3.8)
Cadmium	ND(1.0)	ND(0.50)	ND(0.50)	ND(5.2)	ND(4.7)	ND(5.0)	ND(1.0)	ND(0.5)	ND(0.4)
Calcium	29,800	27,100.0	25,100.0	21,100.0 E	23,400.0	20,500.0	22,400.0	21,800.0	20,600.0
Chromium	1.1 b	4.0 B	2.8 B	ND(8.3)	12.8	6.0	24.2	6.0 B	2.6 B
Iron	310	249.0	ND(22.4)	25.0 B	11.8 B	114.0	**319.0**	ND(30.9)	ND(15.9)
Lead	ND(2.0)	ND(1.6)	ND(1.6)	ND(1.1)	ND(1.5)	ND(4.0)	ND(3.0)	ND(0.6)	ND(2.0)
Magnesium	9,620	10,400.0	9,640.0	8,720.0 E	8,670.0 E	7,840.0	8,490.0	8,090.0	7,650.0
Mercury	ND(0.2)	ND(0.06)	0.04 B	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.1)	ND(0.1)
Potassium	1,570.0 b	2,440.0 BE	1,100.0 B	1,440.0 B	1,640.0 B E	1,300.0	1,190.0 BE	1,100.0 B	1,330.0 B
Sodium	14,400	14,700.0	13,800.0 E	17,400.0 E	15,400.0 E	12,800.0	14,500.0	10,500.0	13,500.0
Leachate Indicators (mg/l)									
Ammonia	1.12	ND(0.05)	ND(0.05)	ND(0.2)	ND(0.1)	ND(0.20)	1.43	ND(0.2)	ND(0.2)
Bicarbonate		19.6	18.3	19.8	21.3	20.5	16.0	22.0	35.0
Chloride	21.3	19.6	21.7	23.5	22.2	23.0	23.0	21.0	23.0
Nitrate	**10.1**	8.40	7.50	7.80	8.20	8.44	3.50	8.10	8.30
Sulfate	44	55.5	19.9	40.0	44.3	39.2	56.1	40.0	46.0
Alkalinity	27	19.6	18.3	19.8	21.3	20.5	17.0	22.0	35.0
TDS	167	184.0	143.0	138.0	28.0	168.0	133.0	140.0	130.0
Hardness	110	110.28	102.0	88.6 E	94.1	82.7	25.5	88.0	83.0

EN10-M (continued)

Metals (ug/l) Sampling Date	4/24/01	9/19/01	4/8/02	9/10/02				
Aluminum	64.3 B	ND(45.7)	ND(7.3)	ND(10.1)				
Arsenic	ND(2.5)	ND(5.0)	ND(2.8)	ND(3.6)				
Cadmium	ND(0.4)	ND(3.0)	ND(0.4)	ND(1.0)				
Calcium	22,200.0	21,500.0	19,900.0	20,100.0				
Chromium	2.6 B	ND(5.0)	3.8 B	6.8 B				
Iron	109.0	16.4 B	ND(17.3)	24.4 B				
Lead	ND(2.5)	ND(3.0)	3.8	9.8				
Magnesium	8,460.0	8,120.0	7,420.0	7,560.0				
Mercury	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)				
Potassium	1,280.0 B	1,110.0 B	1,120.0 B	1,260.0 B				
Sodium	14,000.0	13,500.0	13,500.0	14,400.0				
Leachate Indicators (mg/l)								
Ammonia	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)				
Bicarbonate	19.0	28.0	29.0	18.0				
Chloride	23.0	25.0	34.0	26.0				
Nitrate	7.00	8.20	8.10	9.80				
Sulfate	38.0	40.0	43.0	36.0				
Alkalinity	19.0	28.0	29.0	18.0				
TDS	90.0	130.0	160.0	140.0				
Hardness	90.0	87.0	80.0	81.0				

Note:

ND( ): Compound not detected at method detection limit

B: Reported value less than contract required detection limit but greater than or equal to instrument detection limit

E: Reported value is estimated because of the presence of interference

b: Found in field blank

Table 2A

Summary of Analytical Results-Groundwater
East Northport Landfill, East Northport, NY
Sampled September 10-12, 2002
Metals and Leachate Indicators

Reported in Micrograms per Liter (µg/l) and Milligrams per Liter (mg/l)

Metals (µg/l)	CW1-S	CW1-M	CW2-M	CW4-S	CW4-M	EN1-M	EN6-S	EN6-M	EN7-M	EN9-M	EN10-M	GW-B	NYSDEC Class GA Standard
Aluminum	26.5 B	25.8 B	35.8 B	65.4 B	ND(10.1)	ND(10.1)	51.6 B	ND(10.1)	ND(10.1)	ND(10.1)	ND(10.1)	ND(10.1)	NS/GV
Arsenic	**75.4**	**56.7**	ND(3.6)	ND(3.6)	ND(3.6)	ND(3.6)	ND(3.6)	ND(3.6)	ND(3.6)	ND(3.6)	ND(3.6)	**46.7**	25.0
Cadmium	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	5.0
Calcium	24,700.0	15,800.0	19,400.0	7,210.0	19,300.0	22,500.0	14,400.0	80,600.0	79,900.0	15,500.0	20,100.0	16,000.0	NS/GV
Chromium	5.3 B	5.8 B	8.4 B	6.5 B	7.1 B	4.3 B	46.2	4.6 B	1.6 B	2.6 B	6.8 B	3.4 B	50.0
Iron	**6,580.0**	**7,770.0**	112.0	**398.0**	45.9 B	ND(16.8)	**468.0**	25.9 B	ND(16.8)	29.0 B	24.4 B	**7,720.0**	300.0
Lead	4.3	7.1	5.2	10.6	9.2	9.8	7.9	6.4	7.5	9.8	9.8	9.2	25.0
Magnesium	25,800.0	16,700.0	6,010.0	520.0 B	7,610.0	8,620.0	6,810.0	23,400.0	34,400.0	7,040.0	7,560.0	16,800.0	35,000.0 GV
Mercury	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	0.7
Potassium	150,000.0	72,800.0	7,580.0	3,060.0 B	1,200.0 B	1,280.0 B	1,750.0 B	4,470.0 B	5,240.0	1,350.0 B	1,260.0 B	72,400.0	NS/GV
Sodium	**407,000.0**	**156,000.0**	**22,300.0**	4,210.0 B	11,600.0	15,300.0	**30,100.0**	**71,600.0**	**270,000.0**	19,400.0	14,400.0	**153,000.0**	20,000.0
Leachate Indicators (mg/l)													
Ammonia	**160.0**	**61.0**	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	ND(0.2)	**47.0**	2.0
Bicarbonate	1,300.0	570.0	46.0	20.0	37.0	26.0	13.0	150.0	280.0	32.0	18.0	570.0	NS/GV
Chloride	210.0	95.0	26.0	4.7	23.0	30.0	46.0	100.0	**260.0**	47.0	26.0	93.0	250.0
Nitrate	ND(0.5)	ND(0.5)	1.4	0.9	7.2	9.6	8.3	2.8	0.7	1.2	9.8	ND(0.5)	10.0
Sulfate	2.46	54.0	35.0	4.06	26.0	37.0	28.0	86.0	36.0	17.0	36.0	52.0	250.0
Alkalinity	1,300.0	570.0	46.0	20.0	37.0	26.0	13.0	150.0	280.0	32.0	18.0	570.0	NS/GV
TDS	1,400.0	680.0	140.0	37.0	120.0	160.0	160.0	410.0	790.0	150.0	140.0	720.0	NS/GV
Hardness	170.0	110.0	73.0	20.0	80.0	92.0	64.0	300.0	340.0	68.0	81.0	110.0	NS/GV

Note:
ND( ): Compound not detected at the method detection limit
NYSDEC Class GA Standards: New York State Department of Environmental Conservation Ambient Water Quality Standards for Source of Drinking Water Title 6 Part 703 (per June 1998 revision)
GV: NYSDEC Guidance Value for Source of Drinking Water
NS/GV: No NYSDEC Standard or Guidance Value Established
B: Reported value less than contract required detection limit but greater than or equal to instrument detection limit

Table 2

Summary of Analytical Results-Groundwater
East Northport Landfill, East Northport, NY
Sampled September 10-12, 2002

Volatile Organic Compounds

Reported in Micrograms per Liter

Parameter	CW1-S	CW1-M	CW2-M	CW4-S	CW4-M	EN1-M	EN6-S	EN6-M	EN7-M	EN9-M	EN10-M	GW-B	TB-GW	FB9-12	NYSDEC Class GA Standard
Chloromethane	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	NS/GV
Bromomethane	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	ND(1.7)	5.0
Vinyl Chloride	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	2.0
Chloroethane	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	ND(1.8)	5.0
Methylene Chloride	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	5.0
Trichloroflouromethane	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	ND(1.3)	5.0
1,1-Dichloroethene	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	2.0 J	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	5.0
1,1-Dichloroethane	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	2.4 J	ND(1.0)	ND(1.0)	2.3 J	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	5.0
trans-1,2-Dichloroethene	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	5.0
Chloroform	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	7.0
1,2-Dichloroethane	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	5.0
1,1,1-Trichloroethane	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	1.4 J	4.6 J	1.6 J	ND(0.8)	ND(0.8)	ND(0.8)	3.2 J	ND(0.8)	ND(0.8)	ND(0.8)	5.0
Carbon Tetrachloride	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	5.0
Bromodichloromethane	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	50.0 GV
1,2-Dichloropropane	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	5.0
cis-1,3-Dichloropropene	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	0.4*
Trichloroethene	ND(0.9)	ND(0.9)	1.0 J	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	2.5 J	**7.2**	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	ND(0.9)	5.0
Benzene	**2.2 J**	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	ND(0.6)	1.0
Dibromochloromethane	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	50.0 GV
trans-1,3-Dichloropropene	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	0.4*
1,1,2-Trichloroethane	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	1.0
2-Chloroethylvinyl Ether	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	ND(4.8)	NS/GV
Bromoform	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	ND(1.5)	50.0 GV
1,1,2,2-Tetrachloroethane	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	5.0
Tetrachloroethene	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	**9.5**	**24.0**	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	5.0
Toluene	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	5.0
Chlorobenzene	**7.0**	3.4 J	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)	3.0 J	ND(1.0)	ND(1.0)	5.0

Table 2 continued

Contaminant	CW1-S	CW1-M	CW2-M	CW4-S	CW4-M	EN1-M	EN6-S	EN6-M	EN7-M	EN9-M	EN10-M	GW-B	TB-GW	FB9-12	NYSDEC Class GA Standard
Ethylbenzene	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	ND(1.2)	5.0
1,2-Dichlorobenzene	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	ND(1.6)	3.0
1,3-Dichlorobenzene	2.0 J	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	ND(0.8)	3.0
1,4-Dichlorobenzene	2.0 J	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	ND(1.4)	3.0

Note:

ND( ): Compound not detected at the method detection limit

NYSDEC Class GA Standards: New York State Department of Environmental Conservation Ambient Water Quality Standards for Source of Drinking Water Title 6 Part 703 (per June 1998 revision)

GV: NYSDEC Guidance Value for Source of Drinking Water

NS/GV: No NYSDEC Standard or Guidance Value Established

J: Indicates an estimated value; compound is present at a concentration less than specified detection limit

*Standard of 0.4 applies to sum of cis and trans 1,3-Dichloropropene

Table 1.

Huntington Landfill Site
1994 Ambient Air Sampling from the Remedial Investigation[1]
(All values in micrograms per cubic meter [mcg/m^3])

Compound	Up-wind		On-Site		Downwind	
	High	Low	High	Low	High	Low
Acetone	17	13	21	11	26	7.9
2-Butanone	ND	ND	4.6	ND	ND	ND
Chloromethane	ND	ND	ND	ND	0.7	ND
Toluene	4.9	1.2	1.9	1.3	ND	ND
*Tetrachloroethane	ND	ND	17	ND	ND	ND
*Trichloroethene	ND	ND	12	ND	ND	ND
1,1,1-Trichloroethane	4.7	ND	ND	ND	ND	ND

[1]Refer to Table 6 for Public Health Assessment Comparison Values for contaminants in ambient air.

*Contaminant selected for further evaluation.

Table 2.

Huntington Landfill
1992 Landfill Gas Monitoring Well
Sampling Data From the Remedial Investigation
(All values in micrograms per cubic meter [mcg/m^3])

Compound	High	Low
acetone	23,000	4.2
benzene	2.8	ND
1,3-butadiene	3.2	ND
2-butanone	950,000	5.8
carbon disulfide	62	12
carbon tetrachloride	1.4	ND
chlorobenzene	100	0.6
chloroethane	1.2	ND
chloroform	740	20
chloromethane	11	0.5
1,2-dichlorobenzene	56	ND
1,3-dichlorobenzene	39	ND
1,4-dichlorobenzene	8.6	ND
1,1-dichloroethane	1.5	ND
dichloromethane	26	ND
ethylbenzene	2.7	ND
4-methyl-2-pentanone	9.2	ND
tetrachloroethene	26	1.3
toluene	850	1.2
1,1,1-trichloroethane	330	1.2
trichloroethene	37	0.6
trichlorofluoromethane	12	1.4
vinyl chloride	0.9	ND
xylenes (total)	150	1

ND = not detected

Table 3.
Summary of Compounds Detected in Off-Site Groundwater Monitoring Wells at the Huntington Landfill From the Remedial Investigation[1]
(All values in micrograms per liter, mcg/L)

	High	Low	Up-gradient High	Up-gradient Low
aluminum	2,680	104	718	136B
antimony	69	ND	ND	ND
arsenic	85J	1.2B	2.3UW	1.1B
cadmium	38	4.7B	8.1	4.1B
chromium	737	7.2B	5.4B	ND
iron	30,000	132N	804	190
lead	643J	1.5B	31.2	3BNW
magnesium	85,900	839B	8,100	3,750
manganese	15,000	6.1B	3,740J	26.2
mercury	17	0.25	ND	ND
sodium	957,000	6,470E	21,800	8,030E
thallium	18.3UN	ND	ND	1.8UNW
vanadium	36	19.8B	ND	ND
vinyl chloride	2J	ND	ND	ND
methylene chloride	12B	1J	ND	ND
1,1-dichloroethene	ND	ND	ND	0.7J
1,2-dichloroethene (total)	31	0.7J	ND	ND
1,2-dichloropropane	2J	1J	2J	1J
trichloroethene	40J	1J	2J	ND
benzene	4J	1J	ND	ND
tetrachloroethene	34	0.7J	2J	ND
chlorobenzene	7	ND	ND	ND
ethylbenzene	6	2J	ND	ND
alpha-hexachlorocyclohexane	0.04J	ND	ND	ND
gamma-hexachlorocyclohexane	0.04J	ND	ND	ND
heptachlor epoxide	0.11J	ND	ND	ND
dieldrin	0.01J	ND	ND	ND
Aroclor 1254	ND	ND	2.5	0.76J
bis(2-ethylhexyl)-phthalate	3J	ND	ND	ND

[1]This table includes only those contaminants at levels in groundwater that exceed NYS DOH drinking water standards and/or public health assessment comparison values (refer to Table 5).

N = Matrix spike recovery outside of required quality control (QC) limits

E = Reported value is estimated due to the presence of interference

U = Result less than contract required detection limits (CRDL) or analyte not detected due to qualification through method or field blank.

B = Result between instrument detection limit and CRDL

J = Estimated due to variance from quality control limits

W = The recovery of the analytical control sample was not within the allowable QC limits of 85-115%.

Table 4.

Results of the Private Wells Sampled Downgradient from the Huntington Landfill by the Suffolk County Department of Health Services from 1973-1994 (All values in micrograms per liter)

Compound	High	Low
aluminum	300	60
barium	67B	5B
cadmium	4.0J	3.90
calcium	70,300	5,100
chromium	5UJ	ND
cobalt	6.8B	5B
copper	210	4.7B
*iron	4,100	91B
*lead	41.2	1.0
magnesium	25,600	430
manganese	142J	4.6B
mercury	0.33	0.2UJ
nickel	24.6B	11UJ
potassium	2,800	904B
selenium	2.1 UNW	2.2UJ
silver	3UJ	ND
*sodium	60,100	5,400
*thallium	50	2.3B
vanadium	20	ND
zinc	1,800	4.8B
*nitrate	24,900	300
*dichlorodifluoro-methane	8	1J
*vinyl chloride	0.3J	ND
*1,1-dichloroethene	0.5	ND
methylene chloride	2.0	ND
*1,1-dichloroethane	10	0.2J
*1,2-dichloroethene(total)	16	1.00
chloroform	8	0.3J
*1,1,1,-trichloroethane	62	0.2J
*carbon tetrachloride	5	0.7
*trichloroethene	150	0.4J
*tetrachloroethene	39	0.2J
*1,2-dichloro-propane	2	ND

*Contaminant selected for further evaluation

[1]Refer to Table 5 for comparison to existing New York State and United States Environmental Protection Agency (US EPA) standards/guidelines and public health assessment comparison values. There were no standards for these chemicals in 1978-1980; the NYS DOH guideline for these compounds in 1980 was 50 micrograms per liter except for vinyl chloride which was 5 mcg/L.

N = Matrix spike recovery outside of required quality control (QC) limits
E = Reported value is estimated due to the presence of interference
U = Result less than contact required detection limits (CRDL) or analyte not detected due to qualification through method or field blank.
B = Result between instrument detection limit and CRDL
J = Estimated due to variance from quality control limits
W = The recovery of the analytical control sample was not within the allowable QC limits of 85-115%.

Table 5.

Water Quality Standards/Guidelines and/or Public Health Assessment Comparison Values that are Exceeded by Contaminants Found in Private Wells near the Huntington Landfill Site.
(All values in micrograms per liter)

	Standards/Guidelines			Comparison Values			
	New York State		US EPA				
Compound	Ground Water	Drinking Water	Drinking Water	Cancer*	Basis**	Noncancer*	Basis**
Organics							
carbon tetrachloride	5	5	5	0.35	NYS DOH CPF	4.9	EPA RfD
1,1-dichloroethane	5	5	--	--	--	700	EPA HEAST
1,1-dichloroethene	5	5	7	0.058	EPA CPF	7	EPA LTHA
1,2-dichloroethene	5	5	70	--	--	63	EPA HEAST
1,2-dichloropropane	5	5	5	0.51	EPA HEAST	630	ATSDR, 1989
dichlorofluoromethane	5	5	--	--	--	--	--
tetrachloroethene	5	5	5	0.67	EPA CPF	10	EPA LTHA
1,1,1-trichloroethane	5	5	200	--	--	200	EPA LTHA
trichloroethene	5	5	5	3.3	EPA RBC	42	EPA RBC
vinyl chloride	2	2	2	0.018	EPA CPF	21	EPA RfD
Inorganics							
thallium	0.5g	2	2	--	--	0.5	EPA LTHA
iron	300	300	300s	--	--	2100	EPA RBC
lead	25	15***	15***	--	--	--	--
sodium	20,000	****	--	--	--	--	--
nitrate	--	10,000	10,000	--	--	11,000	EPA RfD

g = guidance value

*Comparison value determined for a 70 kilogram adult who drinks 2 liters of water per day.

**EPA CPF = EPA Cancer Potency Factor
EPA RBC = EPA Risk-Based Concentration Table
EPA RfD = EPA Reference Dose
EPA HEAST = EPA Health Assessment Summary Tables
EPA LTHA = EPA Lifetime Health Advisory
ATSDR, 1989 = ATSDR Toxicological Profile for 1,2-Dichloropropane, ATSDR/TP-89/12

***There is a maximum contaminant level goal (MCLG) of zero for lead and an action level of 15 mcg/L at the tap.

****no designated limit; water containing more than 20,000 mcg/l should not be used for drinking by people on severely restricted sodium diets; water containing more than 270,000 mcg/l should not be used for drinking by moderately restricted sodium diets.

+Under review

Table 6.

Public Health Assessment Comparison Values that are Exceeded by Contaminants in Ambient Air at the Huntington Landfill Site.
(All values in parts per billion [ppb] and micrograms per cubic meter [mcg/m^3]).

	Typical Background Range*		Comparison Values					
			Cancer**			Noncancer**		
Compound	ppb	mcg/m^3	ppb	mcg/m^3	Basis***	ppb	mcg/m^3	Basis***
Tetrachloroethene	0.24-1.63	1.7-11.2	0.25	1.7	EPA HEAST	15	100	NYS RfC
Trichloroethene	0.03-0.59	0.2-3.2	0.11	0.60	EPA HEAST	4.8	26	EPA, 1987

*Reference: Brodzinsky and Singh (1982)

**Comparison value determined for a 70 kilogram adult who breathes 20 cubic meters per day.

***NYS RfC = NYS Risk Reference Guideline
EPA HEAST = US EPA Health Effects Assessment Summary Tables
EPA, 1987 = US EPA. Trichloroethene. Drinking Water Health Advisories. Office of Drinking Water.

Table 7.

Public Health Assessment Comparison Values that are Exceeded by Contaminants Found in Soils and Sediments at the Huntington Landfill Site.
(All values in milligrams per kilogram [mg/kg]).

Contaminant	Typical Background Range	Comparison Values Industrial Setting*			
		Cancer	Basis**	Noncancer	Basis**
Semi-Volatile Organics					
benzo(a)pyrene	+	0.3	NYS DOH CPF	89,000[c]	EPA RfD
benz(a)anthracene	+	3.0[a,b]	NYS DOH CPF	89,000[c]	EPA RfD
benzo(b)fluoranthene	+	3.0[a,b]	NYS DOH CPF	89,000[c]	EPA RfD
indeno(1,2,3-cd)pyrene	+	3.0[a,b]	NYS DOH CPF	89,000[c]	EPA RfD

*Comparison values for cancer risk are determined for a 70 kg adult who ingests in the workplace 50 mg soil per day, 5 days per week, 8 months per year and assuming that exposure occurs for 40 working years out of a 70 year lifetime; comparison values for noncancer risk are determined for a 70 kg adult who ingests in the workplace 50 mg soil per day, 5 days per week for 8 months per year.

**EPA RfD = US EPA Reference Dose
NYS DOH CPF = NYS DOH Cancer Potency Factor

+Based on reported background levels for total polycyclic aromatic hydrocarbons (PAHs) of 1 to 13 mg in soil (Edwards, 1983).

[a]Comparison value adjusted according to US EPA's interim relative potency factors for PAHs (US EPA, 1993).

[b]Used oral CPF for benzo(a)pyrene.

[c]Used oral RfD for pyrene.

Table 8.

Summary of Total Contaminant Air Emissions and Releases for the Years 1988-1993 at Toxic Chemical Release Inventory (TRI) Reporting Facilities Near the Huntington Landfill Site.

Facility Name	Approximate Distance From Site[1] (miles)	Chemical Name	Contaminant Emissions (lbs/yr)[2] 1988	1989	1990	1991	1992	1993
Polymer Plastics Corp.	4.4	xylene	119	99	99	99	99	99
Robert Busse Co., Inc.	5.0	dichlorodifluoromethane	-	-	-	53,010	30,010	-
Pall Rai Inc.	4.8	methylene chloride	61,200	60,471	69,899	126,699	84,600	63,072
		tert-butyl alcohol	-	-	998	110	9,510	30,731
		acrylic acid	-	-	998	20	20	3,442
		toluene	400	350	8,329	998	5,699	12,315
LNK International Inc.	4.2	methanol	27,000	26,468	-	-	-	-
		methylene chloride	76,800	72,390	-	-	-	-
Hazeltine Corp. (Mfg. Plant)	4.2	Freon 13	4,227	-	28,452	28,768	36,361	28,727
		tetrachloroethene	-	11,819	-	-	-	-
Gull Electronic Systems	4.4	Freon 113	25,700	18,000	14,300	8,500	11,000	10,500
Gasser & Sons, Inc.	5.0	trichloroethene	19,590	23,000	20,600	16,600	18,235	22,440

[1]Refer to Figure 6 (Appendix A) for facility location.
[2]The numbers listed are upper maximum totals of both stack (point source) and fugitive (non-point) emissions at each facility.

APPENDIX C
PROCEDURE FOR EVALUATING POTENTIAL HEALTH RISKS FOR CONTAMINANTS OF CONCERN

PROCEDURE FOR EVALUATING POTENTIAL HEALTH RISKS FOR CONTAMINANTS OF CONCERN

To evaluate the potential health risks from contaminants of concern associated with the Huntington Landfill site, the New York State Department of Health assessed the risks for cancer and noncancer health effects.

Increased cancer risks were estimated by using site-specific information on exposure levels for the contaminant of concern and interpreting them using cancer potency estimates derived for that contaminant by the US EPA or, in some cases, by the NYS DOH. The following qualitative ranking of cancer risk estimates, developed by the NYS DOH, was then used to rank the risk from very low to very high. For example, if the qualitative descriptor was "low", then the excess lifetime cancer risk from that exposure is in the range of greater than one per million to less than one per ten thousand. Other qualitative descriptors are listed below:

Excess Lifetime Cancer Risk

Risk Ratio	Qualitative Descriptor
equal to or less than one in a million	very low
greater than one in a million to less than one in ten thousand	low
one in ten thousand to less than one in a thousand	moderate
one in a thousand to less than one in ten	high
equal to or greater than one in ten	very high

An estimated increased excess lifetime cancer risk is not a specific estimate of expected cancers. Rather, it is a plausible upper bound estimate of the probability that a person may develop cancer sometime in his or her lifetime following exposure to that contaminant.

There is insufficient knowledge of cancer mechanisms to decide if there exists a level of exposure to a cancer-causing agent below which there is no risk of getting cancer, namely, a threshold level. Therefore, every exposure, no matter how low, to a cancer-causing compound is assumed to be associated with some increased risk. As the dose of a carcinogen decreases, the chance of developing cancer decreases, but each exposure is accompanied by some increased risk.

There is no general consensus within the scientific or regulatory communities on what level of estimated excess cancer risk is acceptable. Some have recommended the use of the relatively conservative excess lifetime cancer risk level of one in one million because of the uncertainties in our scientific knowledge about the mechanism of cancer. Others feel that risks that are lower or higher may be acceptable, depending on scientific, economic and social factors. An increased lifetime cancer risk of one in one million or less is generally considered an insignificant increase in cancer risk.

For noncarcinogenic health risks, the contaminant intake was estimated using exposure assumptions for the site conditions. This dose was then compared to a risk reference dose (estimated daily intake of a chemical that is likely to be without an appreciable risk of health effects) developed by the US EPA, ATSDR and/or NYS DOH. The resulting ratio was then compared to the following qualitative scale of health risk:

Qualitative Descriptions for
Noncarcinogenic Health Risks

Ratio of Estimated Contaminant Intake to Risk Reference Dose	Qualitative Descriptor
equal to or less than the reference dose or minimal risk level	minimal
greater than one to five times the reference dose or minimal risk level	low
greater than five to ten times the reference dose or minimal risk level	moderate
greater than ten times the reference dose or minimal risk level	high

Noncarcinogenic effects unlike carcinogenic effects are believed to have a threshold, that is, a dose below which adverse effects will not occur. As a result, the current practice is to identify, usually from animal toxicology experiments, a no-observed-effect-level (NOEL). This is the experimental exposure level in animals at which no adverse toxic effect is observed. The NOEL is then divided by an uncertainty factor to yield the risk reference dose. The uncertainty factor is a number which reflects the degree of uncertainty that exists when experimental animal data are extrapolated to the general human population. The magnitude of the uncertainty factor takes into consideration various factors such as sensitive subpopulations (for example, children or the elderly), extrapolation from animals to humans, and the incompleteness of available data. Thus, the risk reference dose is not expected to cause health effects because it is selected to be much lower than dosages that do not cause adverse health effects in laboratory animals.

The measure used to describe the potential for noncancer health effects to occur in an individual is expressed as a ratio of estimated contaminant intake to the risk reference dose. If exposure to the contaminant exceeds the risk reference dose, there may be concern for potential noncancer health effects because the margin of protection is less than that afforded by the reference dose. As a rule, the greater the ratio of the estimated contaminant intake to the risk reference dose, the greater the level of concern. A ratio equal to or less than one is generally considered an insignificant (minimal) increase in risk.

APPENDIX D

ATSDR PUBLIC HEALTH HAZARD CATEGORIES

INTERIM PUBLIC HEALTH HAZARD CATEGORIES

CATEGORY / DEFINITION	DATA SUFFICIENCY	CRITERIA
A. Urgent Public Health Hazard This category is used for sites where short-term exposures (< 1 yr) to hazardous substances or conditions could result in adverse health effects that require rapid intervention.	This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicates that site-specific conditions or likely exposures have had, are having, or are likely to have in the future, an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the presence of serious physical or safety hazards.
B. Public Health Hazard This category is used for sites that pose a public health hazard due to the existence of long-term exposures (> 1 yr) to hazardous substance or conditions that could result in adverse health effects.	This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have in the future, an adverse impact on human health that requires one or more public health interventions. Such site-specific exposures may include the presence of serious physical or safety hazards.
C. Indeterminate Public Health Hazard This category is used for sites in which "*critical*" data are *insufficient* with regard to extent of exposure and/or toxicologic properties at estimated exposure levels.	This determination represents a professional judgement that critical data are missing and ATSDR has judged the data are insufficient to support a decision. This does not necessarily imply all data are incomplete; but that some additional data are required to support a decision.	The health assessor must determine, using professional judgement, the "criticality" of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible to select other hazard categories and to support their decision with clear narrative that explains the limits of the data and the rationale for the decision.
D. No Apparent Public Health Hazard This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.	This determination represents a professional judgement based on critical data which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicates that, under site-specific conditions of exposure, exposures to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health.
E: No Public Health Hazard This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.	Sufficient evidence indicates that no human exposures to contaminated media have occurred, none are now occurring, and none are likely to occur in the future	

**Such as environmental and demographic data; health outcome data; exposure data; community health concerns information; toxicologic, medical, and epidemiologic data; monitoring and management plans.*

APPENDIX E

1991 CANCER STUDY

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Corning Tower The Governor Nelson A. Rockefeller Empire State Plaza Albany, New York 12237

Lorna S. McBarnette
Executive Deputy Commissioner

OFFICE OF PUBLIC HEALTH
Linda A. Randolph, M.D., M.P.H.
Director
Sue Kelly
Executive Deputy Director

October 3, 1991

Enclosed is a copy of the report describing the recently completed cancer investigation for census tracts 1117.03, 1117.04, 1118.02, 1118.03, 1351.01, 1351.02, 1347.01, 1347.02 and 1108.02 in East Northport, Commack and King's Park, NY. The study area was defined to include areas where you indicated that citizens were concerned about the possibility of health effects caused by the proximity of Huntington Landfill.

The study focused on the years 1978 through 1987, which is the most recent period for which cancer reporting is complete for small area analysis. In summary, the number of newly diagnosed cancer cases was similar to expected among females. Among males, a statistically significant excess of cases was observed.

The specific sites of cancer that showed statistically significant elevations were malignant melanoma in males and females, colon cancer among males, leukemia among males, breast cancer among females and lung cancer among females.

Malignant melanoma, breast and colon cancer are known to be more common in areas of higher socioeconomic status. The median household income for the study area is higher than that of Nassau County and considerably higher than that of New York State as a whole. When cancer cases for those sites showing a statistically significant excess were plotted on a map, no obvious spatial clustering was seen around the landfill or in the area of groundwater contamination. Risk factors for these cancers are discussed in the report and the summary.

If you have any questions about this report, please contact Carole Ju of my staff at (518) 458-6212.

Sincerely,

James M. Melius, ~~M.D.,~~ Dr. P.H.
Director
Division of Occupational Health and Environmental Epidemiology

NEW YORK STATE DEPARTMENT OF HEALTH

CANCER INCIDENCE
IN CENSUS TRACTS 1117.03, 1117.04, 1118.02, 1118.03, 1351.01, 1351.02, 1347.01, 1347.02, 1108.02, EAST NORTHPORT, SUFFOLK COUNTY, NEW YORK, 1978-1987

METHODS

•The **expected** number of newly-diagnosed cancer cases, by sex and location of cancer in the body, was calculated based on the age and sex distribution of persons in the study area.

•The actual **observed** number of newly-diagnosed cancer cases, by sex and location of cancer in the body, was counted from New York State Cancer Registry records.

CONCLUSION

•Among males overall, a statistically significant excess of cases was observed for newly-diagnosed cancer cases (634 cases observed, 563 cases expected). Among females, there was no statistically significant difference between the overall observed number of newly-diagnosed cancer cases and the number expected (674 cases observed, 633 cases expected). Specific cancer sites where differences were observed are identified below.

SPECIFIC FINDINGS

Male Cancer Cases

•A statistically significant excess of cases was observed for cancer of the colon (87 cases observed, 62 cases expected); for malignant melanoma (31 cases observed, 16 cases expected); and for leukemia (30 cases observed, 18 cases expected).

•The excess in colon cancer found in males was not present in females. Colon cancer incidence increases with age. Persons with a family history of polyps or a personal history of inflammatory bowel disease are at increased risk of developing colon cancer. A high intake of dietary fat has been linked with increased incidence, while diets rich in fruits, vegetables and dietary fiber appear to reduce colon cancer risk. Increased colon cancer incidence has also been reported among more affluent persons.

•Malignant melanoma of the skin is known to be related to sun exposure and is more common among individuals with light skin. The anatomic distribution of malignant melanoma cases demonstrates the influence of exposure to sunlight, with cases in males most frequently occurring on the head, neck and trunk and on the leg in females. Among both males and females in the study area, the anatomic distribution of cases was consistent with this pattern. Malignant melanoma occurs more often among higher socioeconomic groups.

•The excess of leukemia among males was not observed in females. No excess was found in either males or females for any single age group. A number of risk factors have been identified for the leukemias. These include certain genetic conditions, exposure to ionizing radiation, benzene and other solvents, and certain anti-cancer drugs. No obvious spatial clustering around the landfill or in any other location was apparent. Only one of the thirty cases resided in the census tract containing the landfill, and only one case resided in the area of groundwater contamination, in an adjoining census tract.

(continued)

(EAST NORTHPORT) - continued

•With the exception of those noted above, no other type of cancer among males was found to demonstrate a significant excess or deficit of cases.

Female Cancer Cases

•A statistically significant excess of cases was observed for malignant melanoma (23 cases observed, 14 cases expected); for cancers of the breast (217 cases observed, 184 cases expected) and for cases of lung cancer (78 cases observed, 59 cases expected).

> •Risk factors for breast cancer include age, family history of breast cancer, age over 30 at first childbirth, never carrying a pregnancy to term, personal history of fibrocystic breast disease, obesity, urban residence, white race and high socioeconomic status. Consistent with increases seen at the County, State and National level, the number of breast cancer cases diagnosed in the last five years of the study was higher than the number of cases diagnosed during the first five years. However, the increase in breast cancer cases in the latter five year period can be accounted for, almost entirely, by an increase in the numbers of breast cancers detected at the localized or "early" stage. This may be indicative of the increased level of breast cancer screening in this area.
>
> •Lung cancer among males and females was greater than expected. Only among females was this difference statistically significant. Risk of lung cancer is greatly increased among smokers, with about 85% of all lung cancers attributable to cigarette smoking. Among those diagnosed with lung cancer, 50% of males and 53% of females were smokers at the time of diagnosis. An additional 39% of males and 21% of females were former smokers at diagnosis. The smoking rates of those diagnosed with lung cancer is much higher than that observed in the general population.

•With the exception of those noted above, no other type of cancer among females was found to demonstrate a significant excess or deficit of cases.

DISCUSSION

•Of the cancers found to be in excess, malignant melanoma, breast and colon cancer are known to be more common in areas of higher socioeconomic status. Based on estimates from the 1980 US Census the median household incomes for all census tracts in the study area were higher than the Suffolk County median household income and considerably higher than the New York State median household income.

•Observed and expected numbers of cases of those cancer sites in excess were computed for the individual census tracts. No unusual patterns were observed in any census tract, with the exception of Census Tract 1347.02, where statistically significant excesses were observed in numbers of lung cancer cases among both males and females. This census tract does not contain the landfill, and it has not been found to show groundwater contamination. It is, however, the census tract with the lowest median family income of the nine tracts included in this investigation. Lung cancer incidence is often observed to be greater in areas of lower socioeconomic status, due to a high prevalence of cigarette smoking.

For further information on the occurrence of cancer or for additional questions regarding this investigation, please contact Dr. Philip C. Nasca or Ms. Mary Chris Schultz, New York State Department of Health, Cancer Surveillance Program, at (518)-474-2354.

CANCER INCIDENCE IN CENSUS TRACTS 1117.03, 1117.04, 1118.02, 1118.03, 1351.01, 1351.02, 1347.01, 1347.02, AND 1108.02, EAST NORTHPORT, SUFFOLK COUNTY, NEW YORK

Prepared by the:

Cancer Surveillance Program
Bureau of Cancer Epidemiology
New York State Department of Health

with the assistance of
New York State Cancer Registry staff

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Philip C. Nasca, Ph.D.
Director, Cancer Surveillance Program

9/91

CANCER INCIDENCE
IN CENSUS TRACTS 1117.03, 1117.04, 1118.02, 1118.03, 1351.01, 1351.02, 1347.01, 1347.02 AND 1108.02, EAST NORTHPORT, SUFFOLK COUNTY, NEW YORK

Background

In January of 1990, the Cancer Surveillance Program of the New York State Department of Health received a request from the Department's Bureau of Environmental and Occupational Epidemiology to conduct a study of cancer incidence in the area of the Huntington Landfill in East Northport, Suffolk County. The Bureau of Environmental and Occupational Epidemiology had been made aware of a number of health concerns among residents living near the site. In addition, the federal Agency for Toxic Substances and Disease Registries has been compiling a health assessment for the population residing in the vicinity of the landfill. This report presents the findings of the Cancer Surveillance Program of the Bureau of Cancer Epidemiology with regard to cancer incidence in nine census tracts surrounding the landfill.

Methods

Study Area: The study area was defined as Census Tracts 1117.03, 1117.04, 1118.02, 1118.03, 1351.01, 1351.02, 1347.01, 1347.02, and 1108.02 in Suffolk County, which includes persons residing in East Northport, Northport, Commack, and Kings Park (see attached map). The time period for the investigation of cancer incidence was selected as 1978 through 1987, the most recent period for which cancer reporting was considered complete for analysis within small geographic areas at the time this study was initiated.

Identification of Observed Incident Cancers: In order to proceed with this investigation it was necessary to identify all cases of cancer diagnosed among residents of the study area between 1978 and 1987. The source for these data was the New York State Cancer Registry. The Cancer Registry contains information on all cases of cancer reported to the New York State Department of Health, as mandated by law.

Variation in cancer incidence among different geographic areas reflects not only true differences in cancer incidence, but also the practices of diagnosing, treating, and recording cancers in various areas in the state. The completeness and accuracy of the Cancer Registry depend upon reporting from hospitals. It is estimated that over 95% of all cancer cases are reported to the Registry (1).

The computerized Cancer Registry files are continuously updated to reflect multiple reports on the same cancer; to eliminate metastatic cancers which spread from a primary site; to identify true multiple primary cancers; and to determine correct dates of diagnosis. Cancer incidence data presented in this report represent cancer cases diagnosed from 1978 through 1987 with information updated as of August 1990.

A listing of cases by street name was obtained for the East Northport area. The address of each case was examined to determine whether the person resided in the study area at the time of diagnosis. All cases with a street address located within the study area were grouped by tumor site, sex, and age. These are referred to as "observed" cases.

Calculation of Expected Incident Cancers: In order to determine whether the number of observed cases was unusual, it was necessary to calculate the number of cancer cases that would be expected in an area with the same population size, and age and sex composition as the study area. Since cancer incidence varies between urban and rural areas, this calculation also considered the population density (the number of residents per square mile) of the study area. This was accomplished using standard cancer rates based on population density categories to generate expected numbers of cancer cases.

All of the cities and towns of New York State, exclusive of New York City, have been assigned to one of five population density categories based on the number of residents per square mile in 1980. Group I (urban) contains areas with the highest population density, while areas with the lowest population density comprise Group V (rural). The towns containing the study area are in Group III (suburban).

According to the 1980 United States Census, the total population of the study area was 40,632 persons, with 19,824 males and 20,808 females. Cancer incidence rates by age and sex for suburban areas of New York State, exclusive of New York City, for the years 1978-1982 were used to calculate the expected numbers of cases for the more common cancer sites and for all sites combined. This procedure allowed the calculation of expected numbers of cancer cases after adjustment for differences in sex, age, and population density among residents of the study area.

Sixteen of the most common cancer sites were examined among males, including lung, colon, rectum, prostate, and bladder, and lymphomas and leukemias. Eighteen of the most common sites were examined among females. In addition to the aforementioned sites (except prostate), cancers of the breast and female reproductive organs were also included.

Statistical Testing: The Poisson model was used to determine the probability that chance alone could explain an increase or decrease in the observed number of cancer cases compared to the expected number (2). If the probability of observing an excess or deficit was 0.025 or less for any cancer site, it was considered to be statistically significant. Non-significant excesses or deficits were considered to represent random variations in observed patterns of disease.

Results

A total of 1308 cancers were observed among males and females residing in the study area during the 1978-1987 study period. In males, 634 cancer cases were observed and 563 cases were expected, while among females 674 cancer cases were observed and 633 cases were expected for all anatomic sites combined. Among males, the excess in numbers of observed cancer cases compared with the expected number was statistically significant. Numbers of observed cancer cases were not significantly different from expected numbers among females. These results are summarized in Table 1.

Common cancer sites among males included lung with 127 cases observed (121 cases expected); colon, 87 cases observed (62 cases expected); prostate, 62 cases observed (67 cases expected); bladder, 48 cases observed (45 cases expected); rectum, 35 cases observed (30 cases expected); malignant melanoma of the skin, 31 cases observed (16 cases expected); leukemias, 30 cases observed (18 cases expected); lymphomas, 29 cases observed (28 cases expected); stomach, 26 cases observed (18 cases expected); oral cavity, 23 cases observed (21 cases expected); brain, 17 cases observed (11 cases expected); pancreas, 14 cases observed (17 cases expected); kidney, 12 cases observed (17 cases expected); testis, 10 cases observed (9 cases expected); and liver, 6 cases observed (5 cases expected). Fewer than six cases were observed for other common sites of cancer. (For cancer sites with fewer than six observed cases, the specific number of observed cases has not been indicated to protect patient confidentiality.)

Common cancer sites among females included breast with 217 cases observed (184 cases expected); lung, 78 cases observed (59 cases expected); colon, 56 cases observed (71 cases expected); rectum, 32 cases observed (25 cases expected); uterus, 31 cases observed (43 cases expected); lymphomas, 27 cases observed (25 cases expected); malignant melanoma of the skin, 23 cases observed (14 cases expected); ovary, 21 cases observed (28 cases expected); pancreas, 20 cases observed (18 cases expected); stomach, 19 cases observed (13 cases expected); bladder, 19 cases observed (16 cases expected); oral cavity, 14 cases observed (12 cases expected); leukemias, 14 cases observed (15 cases expected); uterine cervix, 12 cases observed (15 cases expected); kidney, 11 cases observed (9 cases expected); thyroid gland, 11 cases observed (10 cases expected); and brain, 10 cases observed (10 cases expected). Fewer than six cases were observed for several other cancer sites.

Within specific anatomic sites of cancer, significant excesses were observed among males for cases of colon cancer (87 cases observed, 62 cases expected), malignant melanoma of the skin (31 cases observed, 16 cases expected) and leukemias (30 cases observed, 18 cases expected) and among females for cases of lung cancer (78 cases observed, 59 cases expected), malignant melanoma of the skin (23 cases observed, 14 cases expected) and breast cancer (217 cases observed, 184 cases expected). With the exception of the excesses noted above, no other cancer site among males or females was found to demonstrate a significant excess or deficit of cases.

Discussion

In drawing conclusions from these data, several aspects of the methodology need to be addressed. First, since there were 36 individual tests of significance (16 among males, 18 among females and 1 each among males and females overall), it was anticipated that one or two results might appear statistically significant even though the differences between observed and expected events were due entirely to random fluctuations in the data.

The second aspect is the power of the statistical test, that is, the probability that a true departure from the expected number can be detected by significance testing. The power of a significance test varies with the number of expected cases. For example, using the statistical test described above, the probability of detecting a true doubling in cancer incidence over the expected value will be 90 percent or higher when the expected number is at least 16. For this investigation, the power of detecting a doubling was high for the total number of cancer cases for each sex and for most common cancer sites.

An additional limitation is the fact that cancer cases were identified among persons who both resided in the study area and were diagnosed with cancer during the period 1978-1987. Migration into and out of the study area could not be taken into account. As a secondary data source, US Census information for 1980 was used to review patterns of migration in the study area, as well as in all of Suffolk County, based on the length of time residents had reported residing at their 1980 residence. About 76% of study area residents over the age of 5 have resided in the same house for at least five years. This compares to 67% of Suffolk County residents over the age of 5 who have resided in the same house for at least five years. Although a somewhat greater proportion of study area residents than residents of the county as a whole had resided in the same house for at least five years, a sizeable proportion were still recent arrivals, suggesting that the population continues to be mobile and indicating that migration may be an issue for this area. Census data are not available to measure more recent migration occurring between 1980 and 1987, the most recent year included in this study.

Malignant melanoma The present study found significant excesses in numbers of malignant melanomas of the skin among both males (31 cases observed, 16 cases expected) and females (23 cases observed, 14 cases expected). One of the strongest risk factors for malignant melanoma of the skin is sun exposure. As with other skin cancers, malignant melanoma of the skin is more common among light-skinned people, and incidence is greatest in regions closest to the equator. The incidence of malignant melanoma has been observed to be greater in persons of higher socioeconomic status, with some indication that the disease may be more common among persons who work indoors than among persons who work outdoors. Some melanomas can develop from abnormal changes in moles on the skin, and in some families this tendency appears to be hereditary (3,4). When detected at an early stage, malignant melanomas of the skin are highly curable.

The incidence of malignant melanoma of the skin in both males and females has been rising steadily in recent years, both in the nation as a whole (5) and in New York State (6), although in the study area numbers of cases were approximately equal in the first and the last five years of the study period. It has been reported (4) that malignant melanomas occur more frequently on the head and neck and trunk among males, and on the leg in females. The anatomic distribution of malignant melanoma cases among males and females in the study area was consistent with expected.

Colon cancer Among males in the study area, a significant excess was found in cases of colon cancer (87 cases observed, 62 cases expected). This excess was not present in females (56 cases observed, 71 cases expected). The risk of colon cancer is influenced by personal, genetic, and dietary factors. Colon cancer incidence increases with increasing age (3,7). Persons with a family history of polyps of the colon are at increased risk of developing colon cancer; incidence is also increased among persons with a history of inflammatory bowel diseases such as ulcerative colitis and Crohn's disease (3,7). In addition, a high intake of dietary fat has been linked with increased colon cancer incidence, while diets rich in fruits, vegetables, and dietary fiber appear to reduce colon cancer risk (3,7). Increased colon cancer incidence has also been reported among more affluent persons (7).

Early detection of colon cancer is generally considered to be beneficial in improving chances for survival, although there are at present no firm recommendations regarding the use of specific colon cancer screening procedures. Information on stage of disease at time of diagnosis was available for 79 of the 87 cases of colon cancer among males. Of these, 49% were diagnosed at a localized stage, 20% were diagnosed at a regional stage, and 30% were diagnosed at a distant stage. (Localized disease is confined to the colon, regional disease has spread beyond the colon to nearby organs, while distant disease has spread throughout the body.) Among males in New York State, exclusive of New York City, for 1976-1987, the respective staging proportions were 36%, 34%, and 30%, indicating a more favorable experience among men in the study area, at least with regard to localized and regional disease. This suggests that men in the study area may be undergoing screening procedures or recognizing early symptoms of the disease more frequently.

Leukemias A significant excess was also found in cases of leukemias among males (30 cases observed, 18 cases expected) but not among females (14 cases observed, 15 cases expected). There are both chronic and acute forms of leukemia, each with unique disease patterns. Acute forms of leukemia commonly occur among persons of all ages, while chronic forms of leukemia are most commonly diagnosed among persons over age 50. The incidence of the acute forms of leukemia generally shows two peaks with age: one in children under the age of 5 and the second, larger peak in the elderly (3,8). The patterns of leukemia in the study area were generally consistent with expected, with no excess in any single age group in either males or females.

A number of risk factors have been identified for the leukemias. Among these are genetic conditions (e.g. Philadelphia chromosome, Down's syndrome), exposure to ionizing radiation, and exposures to benzene and other solvents and to certain anti-cancer drugs (3,8). At least one rare type of leukemia has been associated with a virus (3).

To further explore the distribution of leukemia cases within the study area, cases of leukemia among males and females were plotted on a map. A plume of contaminated groundwater extends from the Huntington Landfill to the northeast. Several private drinking water wells had been found to be contaminated with organic solvents, resulting in extension of the public water supply to these areas. No obvious spatial clustering of cases around the landfill or in any other location was apparent. Only one of the thirty cases resided in the census tract containing the landfill, and only one other case resided in the area of groundwater contamination, in an adjoining census tract.

Many of the known and suspected risk factors for leukemia may be encountered in an occupational setting. To address this issue, cancer case reports and, where available, death certificates, were examined for male and female leukemia cases for information on occupation. Of the 33 cases for whom such information was available, eight had occupations which put them at risk for possible occupational exposures to petrochemicals, organic solvents, or ionizing radiation.

Breast cancer Among females in the study area, a significant excess of breast cancers was observed (217 cases observed, 184 cases expected). Breast cancer is the most common form of cancer among women in the United States. Risk of breast cancer increases as a woman grows older, and it is now estimated that about 1 out of every 10 women will develop breast cancer at some time in her life (5).

Breast cancer has been widely studied. Current knowledge suggests that many variables act together in determining one's risk for the disease. Aside from age, breast cancer has been associated with a family history of breast cancer, being older than age 30 at the birth of the first child or never having carried a pregnancy to term, a personal history of fibrocystic breast disease, obesity, living in an urban area, and white race. The incidence of breast cancer is also greater in more affluent areas (9). Based on estimates from the 1980 US Census, the median household income in 1979 for the nine census tracts in the study area ranged from $22,950 to $33,360, with seven of the tracts having median incomes above $28,000. Median incomes for all tracts were higher than the Suffolk County median household income of $22,359 and the New York State median household income of $16,647.

Examination of age at breast cancer diagnosis showed statistically significant excesses of cases among women in the 25-34 and the 55-64 age groups. A total of 96 cases were diagnosed during the first five years of the study period, while 121 cases were diagnosed during the last five years. In Suffolk County, the average annual age-adjusted breast cancer incidence rate has increased from 84 per 100,000 females during the period 1978 through 1982 to 97 per 100,000 females for 1983 through 1987. In New York State excluding New York City, rates increased from 85 to 95 per 100,000 over these two periods.

Stage of breast cancer at the time of diagnosis can have important implications for long-term survival. Staging information was available for 207 of the 217 breast cancer cases identified in this investigation. Of these, 52% were diagnosed at a localized stage, 14% at a regional stage, and 35% at a distant stage. These figures are somewhat less favorable than the overall stage distribution for breast cancer cases diagnosed 1978-1987 in New York State, excluding New York City, where the respective staging proportions were 52%, 31% and 17%. The increase in breast cancer cases in the study area from 96 cases in 1978-1982 to 121 cases in 1983-1987 can be accounted for almost entirely by an increase in numbers of breast cancers detected at the localized stage, which rose from 39 to 68. This may be indicative of an increased level of breast cancer screening among some women in the area, since screening tends to detect cancers at an earlier stage, while others may be delaying diagnosis as evidenced by the high incidence of distant disease.

Early detection of breast cancer, through a combination of clinical breast examination and mammography, followed by prompt treatment, can aid in improving the chances for survival. A number of studies from Europe and this country have consistently demonstrated reduced mortality in populations of women screened with routine mammography, a low-level X ray of the breast. Guidelines for breast cancer screening among women not exhibiting symptoms include 1) monthly breast self-examination after age 20; 2) "baseline" mammography at age 40 or earlier on the advice of a physician; 3) mammography and clinical examination every second year between ages 40 and 50; 4) annual mammography and clinical examination after age 50; and 5) individualized, more intensive screening for women who are at high risk of contracting the disease.

Lung cancer Among females, a significant excess of lung cancer cases was also observed (78 cases observed, 59 cases expected). Lung cancer among males was also greater than expected (127 cases observed, 120 cases expected), but this excess was not statistically significant. The risk of developing lung cancer is greatly increased among smokers, with about 85% of all lung cancers attributable to cigarette smoking (3).

Lung cancer cases in the study area may be related to smoking habits among individuals with this malignancy. Information on smoking status is reported to the New York State Cancer Registry as part of the standard cancer case report. This information is more complete during more recent years. Among individuals in the study area who developed lung cancer between 1978 and 1987 for whom smoking status could be ascertained, 50% of males and 53% of females were identified as current smokers and an additional 39% of males and 21% of females were former smokers at the time of diagnosis. The smoking rates observed among the lung cancer patients are much higher than those observed in the general population. Data from a 1987 national survey indicated that 31% of males and 26% of females were current smokers and an additional 29% of males and 17% of females were former smokers (10).

Although all major lung cancer cell types have been associated with cigarette smoking, certain lung cancer cell types have been observed to be more strongly associated with cigarette smoking than others (11). For the 139 male and female lung cancer cases for which a specific cell type was reported, 117 (84%) were one of the types most strongly associated with cigarette smoking, and 16 (12%) other cases were of cell types thought to be less strongly associated with cigarette smoking. The remaining six cancers were distributed among four less common cell types.

Brain cancer Although not statistically significant, an excess of cases was observed for brain cancer in males (17 cases observed, 11 cases expected). Numbers of cases were not elevated in females (10 cases observed, 10 cases expected). Since brain cancer has been associated with (occupational) exposures to vinyl chloride and vinyl chloride has been detected in the methane gas collection system for the Huntington landfill, these observed cases were also examined in some detail.

The incidence of primary brain tumors typically is slightly greater in males than females. Incidence generally exhibits a small peak in childhood, followed by a higher peak between the ages of 60 and 80 years (12). The observed incidence of brain cancer in the study area is consistent with this pattern, with the exception of a statistically significant excess in numbers of cases among males age 25-34. No other age group in males or females showed a statistically significant excess or deficit of cases. When the addresses of the brain cancer cases were plotted on a map of the study area, there was no obvious spatial clustering of cases around the landfill. Three of the 27 cases resided in the census tract containing the landfill, although these were all at the other end of the tract in an area upstream of groundwater flow. None of the brain cancer cases resided in the area of groundwater contamination downgradient of the landfill.

Comparatively little is known about the causes of brain tumors. They have been associated with certain hereditary conditions, as well as occupational exposures including vinyl chloride, petroleum products, and rubber manufacturing. There is also some evidence for a viral origin of nervous system tumors, as well as associations with head trauma (in women) and lead and X-ray exposures in children (12). Examination of the cancer case reports and, where available, death certificates from cases of brain cancer in this study showed that, of the 24 cases for whom an occupation could be determined, four worked in occupations with potential exposures to agents that have been linked with brain cancer.

As an additional check on the possible relation of the observed cancer excesses with the Huntington landfill, observed and expected numbers of cases of those cancer sites in excess were computed for the individual census tracts. No unusual patterns were observed in any census tract, with the exception of Census Tract 1347.02, where statistically significant excesses were observed in numbers of lung cancer cases among both males and females. This census tract does not contain the landfill, and it has not been found to show groundwater contamination. It is, however, the census tract with the lowest median family income of the nine tracts included in this investigation. Lung cancer incidence is often observed to be greater in areas of lower socioeconomic status, due to a higher prevalence of cigarette smoking. Although the income for this census tract is close to the county average, income levels may not be such a reliable indicator of socioeconomic status in areas, such as Long Island, with a higher cost of living relative to the remainder of the state. Investigation into this excess is continuing, however it is not likely that the excess is related to the landfill.

General cancer information: Cancer may result from either genetic or environmental influences or an interaction of both genetics and environment (e.g. diet, social habits, occupation, air, water). Furthermore, it appears that for some cancers, the development of disease may depend upon two kinds of exposures. First, a cancer initiating agent must transform a previously normal cell into a cancerous cell. Subsequently, a cancer promoting agent must be present, allowing uncontrolled growth of this cell. For many cancers, it has been observed that exposures to cancer-causing agents only affect cancer incidence following a relatively long latency period. (In cancer, latency refers to the time between the initiation of the disease process and the onset of clinically recognizable symptoms.) Cancer-causing agents believed to act as initiators often exhibit latencies on the order of at least 10 and sometimes 20 or 30 years. Latency may be shorter, however, if the agent were to act as a cancer promoter.

Cancer, unfortunately, is a common disease. One of every three persons will develop cancer during his/her lifetime, and it eventually affects three of every four families (5). The number of people with cancer is increasing in most communities because more people are living to the older ages, where cancer is more common.

Much more research is necessary before the causes of cancer are well understood. Current knowledge, however, suggests that the leading preventable cause of cancer is cigarette smoking. Dietary practices such as excessive alcohol consumption and the eating of high fat foods are also believed to be important. In fact, tobacco and diet may account for as many as two-thirds of all cancer deaths (13). Other avoidable risk factors include excessive exposure to sunlight, ionizing radiation, and various occupational exposures to cancer-causing agents.

It is important to realize that many cancers can be effectively treated if they are diagnosed at an early stage. Screening for cancers of the breast, cervix, rectum, colon, and prostate, for example, helps to identify these diseases before the onset of symptoms and at a time when they are usually the most curable. Many persons could reduce their chances of developing or dying from cancer by adopting a healthier lifestyle and by visiting their physician for a cancer-related checkup.

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Table 1.

BUREAU OF CANCER EPIDEMIOLOGY
NEW YORK STATE DEPARTMENT OF HEALTH

Observed and Expected Numbers of Incident Cancer Cases, All Sites (140-208), Census Tracts 1117.03, 1117.04, 1118.02, 1118.03, 1351.01, 1351.02, 1347.01, 1347.02, 1108.02, Suffolk County, New York, 1978-1987

Quintile III (Suburban), 1978-1982 Standard

	Males		Females	
Site (ICD-9)[a]	Obs.[b]	Exp.[c]	Obs.[b]	Exp.[c]
All Sites (140-208)	634[d]	563	674	633
Oral Cavity (140-149)	23	21	14	12
Stomach (151)	26	18	19	13
Colon (153)	87[d]	62	56	71
Rectum (154)	35	30	32	25
Liver (155)	6	5	e	3
Pancreas (157)	14	17	20	18
Lung (162)	127	121	78[d]	59
Melanoma (172)	31[d]	16	23[d]	14
Female Breast (174)	-	-	217[d]	184
Uterus (179, 182)	-	-	31	43
Cervix (180)	-	-	12	15
Ovary (183)	-	-	21	28
Prostate (185)	62	67	-	-
Testis (186)	10	9	-	-
Bladder (188)	48	45	19	16
Kidney (189)	12	17	11	9
Brain (191)	17	11	10	10
Thyroid (193)	e	4	11	10
Lymphoma (200-202)	29	28	27	25
Leukemias (204-208)	30[d]	18	14	15
All Other Sites	77[f]	73	59[f]	63

[a] Classification of site based on International Classification of Diseases, ninth revision.

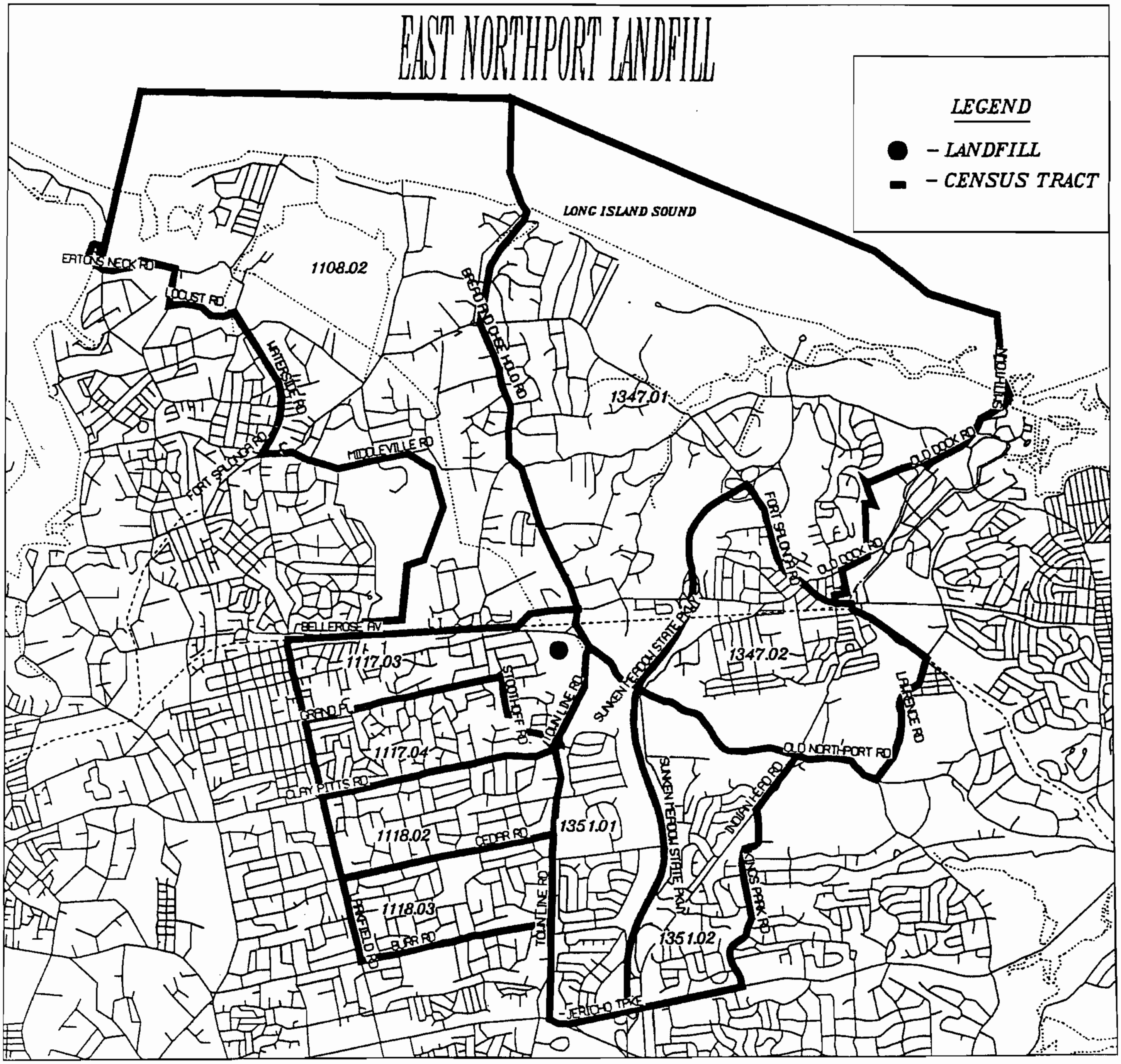
[b] Data obtained from the New York State Cancer Registry (database as of August 1990).

[c] Expected numbers based on cancer incidence rates by age and sex for suburban areas of New York State exclusive of New York City, 1978-1982, applied to the 1980 population ofCensus Tracts 1117.03, 1117.04, 1118.02, 1118.03, 1351.01, 1351.02, 1347.01, 1347.02, 1108.02 in Suffolk County. Individual sites may not sum to total due to rounding.

[d] $p < 0.025$.

[e] Number of cases not shown to protect patient confidentiality.

[f] Includes cases not shown above.


EAST NORTHPORT LANDFILL
LEGEND
- LANDFILL
- CENSUS TRACT
LONG ISLAND SOUND
1108.02
1347.01
1347.02
1117.03
1117.04
1118.02
1118.03
1351.01
1351.02
EATONS NECK RD
LOCUST RD
WATERSIDE RD
FORT SALONGA RD
MIDDLEVILLE RD
BELLEROSE AV
GRAND PL
STOOTHOFF RD
TOWN LINE RD
CLAY PITTS RD
CEDAR RD
PINEFIELD RD
BURR RD
JERICHO TPKE
SUNKEN MEADOW STATE PKWY
OLD NORTHPORT RD
INDIAN HEAD RD
KINGS PARK RD
LAWRENCE RD
OLD DOCK RD

APPENDIX F

RESPONSE TO PUBLIC COMMENTS

Summary of Public Comments and Responses
Huntington Landfill Public Health Assessment

This summary was prepared to address comments and questions on the public comment draft of the Huntington Landfill Public Health Assessment. The public was invited to review the draft during the public comment period which ran from September 1 to November 15, 2000. We received 10 written comments from residents and a concerned public agency. Similar comments may be consolidated or grouped together and some statements reworded to clarify the comment. If you have any questions about this summary, you may contact the New York State Department of Health's (NYS DOH) Outreach Unit at the toll-free number: 1-800-458-1158.

Comment #1 - A resident would like the sediment and fish samples collected on a quarterly basis from the Sunken Meadow Creek.

Response #1 - Surface water samples were collected from the Sunken Meadow Creek once in 1994, then semi-annually starting in 1996. Since collection of surface water samples began, volatile organic chemical (VOC) contaminants related to the site have been detected at levels of 1.0-6.9 micrograms per liter (mcg/L). Chloride and sulfates were the only inorganic parameters (landfill leachate indicators) detected at levels exceeding New York State Department of Environmental Conservation surface water standards. However, the elevated levels of chloride and sulfate are detected in surface water samples collected within the tidal portion of the Sunken Meadow Creek and thus are believed to be affected by saline water. Sediment samples were collected from Sunken Meadow Creek in 1994. Contamination related to the site was not detected. Since the level of site-related contaminants detected in surface water is sufficiently low so as not to represent an exposure concern for potential bathers or for people eating fish, further monitoring of sediments and monitoring of fish from the creek are not warranted.

Comment #2 - A resident would like the upper glacial aquifer to be monitored on a quarterly basis.

Response #2 - Since 1996, groundwater samples have been collected on a semi-annual basis from eleven monitoring wells developed in the shallow, middle and deep zones of the upper glacial aquifer. The results of the most recent sampling event in April of 2002 detected volatile organic compounds and inorganic parameters above New York State Department of Health public drinking water standards/guidelines in nine of the eleven monitoring wells. Sodium was the only parameter exceeding NYS DOH guidelines in three of these nine wells. In review of the monitoring well data, contaminant levels in the groundwater monitoring wells have not increased over time. Exposure to site-related contaminants in drinking water is unlikely since homes and businesses with wells contaminated or threatened by the contaminant plume migrating from the landfill have been connected to public water. Considering the existing groundwater monitoring well data and the elimination of potential drinking water exposures through connection to public water, an increase in the frequency of groundwater monitoring of the Upper Glacial Aquifer is not necessary.

Comment #3 - A concerned public agency and a resident requested monitoring of the landfill gasses and ambient air to determine if site-related contaminants are migrating off-site in concentrations that represent a health concern.

Response #3 - During the investigation of this site, the industrial source complex (ISC) dispersion model was used to evaluate potential exposure to airborne contaminants migrating from the landfill. Using the concentration of a contaminant measured at the pollutant source, the ISC model considers meteorological and topographical conditions to predict annual average concentrations of a contaminant potentially present at an on-site or off-site receptor location. The maximum annual contaminant levels predicted were below background ambient air concentrations reported in US EPA's "National Ambient Volatile Organic Compounds (VOCs) Data Base." Based on the ISC modeled data, non-cancer health risks are minimal, and the excess lifetime cancer risk associated with exposure to air contaminants are very low (equal to or less than one in a million) for employees (on-site workers) and residents living at the maximally impacted off-site location.

In 1996, landfill gas samples for specific volatile organic compound (VOC) analysis were collected for use in the ISC model. Additional rounds of landfill gas samples were analyzed for VOCs in 1998, 1999 and 2001. The level of VOCs detected in these subsequent sampling events are comparable to those from 1996, and indicates that additional landfill gas control measures are not necessary. Collection of landfill gas samples for VOCs will be conducted on an annual basis. The results of these samples will be reviewed by the NYS DOH and the NYS DEC to determine if there is an increase in contaminant levels and if additional control measures are necessary.

Comment #4 - A resident would like to know the rate at which the contaminant plume is traveling per year, if residential wells are within the path of the plume and if the plume has reached Long Island Sound.

Response #4 - The contaminant plume migrating from the landfill is traveling northeast essentially at the rate of groundwater flow which was determined during the groundwater investigation to be between 0.7 to 1.0 feet per day in the Upper Glacial aquifer. Northeast of the site, Sunken Meadow Creek serves as a zone of shallow groundwater discharge. Based on groundwater model simulations, leachate impacted groundwater will discharge to Sunken Meadow Creek. Field data support this conclusion. If, however, any contaminants did reach Long Island Sound, the dilution factor would be significant and thus minimize any effect of plume discharge. All residences downgradient from the landfill with wells contaminated or threatened by the contaminant plume have been connected to public water.

Comment #5 - A public agency is concerned that ammonia was not included in the sampling program and that there is no discussion of dioxins and furans in the report.

Response #5 - Groundwater and the surface water in Sunken Meadow Creek are sampled on a semi-annual basis for organic and inorganic parameters including ammonia. Although ammonia has been detected in elevated levels in some of the groundwater monitoring wells downgradient from the landfill, exposure to ammonia or other site-related compounds in drinking water is not likely since homes and businesses downgradient from the landfill are connected to public water. Ammonia has not been detected in elevated levels in surface water samples from the Sunken Meadow Creek. Dibenzodioxins (DBDs) and dibenzofurans (DBFs) can be produced as byproducts of incomplete incineration. While we recognize that DBDs and DBFs were most likely present in the incinerator ash placed in the landfill, samples were not specifically analyzed for these compounds. When the former area of ash disposal was remediated in 1989, all ash and soil potentially contaminated with DBDs and DBFs were excavated and placed under the landfill cap.

Comment #6 - A concerned public agency believes that additional leachate samples should have been collected to determine if the elevated level of metals detected in the samples were attributable to site activities or to sample acidification as indicated in the PHA.

Response #6 - As indicated in the PHA under the "Environmental Contamination and Other Hazards" Section, sub-section A, "On-site contamination", Landfill Leachate, since surface outbreaks of leachate were not evident at the time of the investigation, samples were obtained by digging into the fill area to expose an inactive subsurface drain. Due to the high turbidity of the resulting samples, it is likely that acidification of the samples for preservation leached (dissolved) some fraction of the metals from the particulates into the liquid phase of the sample, thus increasing the level of contamination. Filtration of the sample to remove particulates before preservation would have helped to determine actual levels of metals dissolved in the liquid, however, this was not done.

The cap constructed on the landfill controls the generation of leachate and prevents the possibility of direct exposure to leachate on-site. Since homes and businesses downgradient from the landfill have been connected to public water, exposure to leachate contaminated drinking water is not expected.

Comment #7 - One resident was concerned about the quality of their drinking water since a plumber working in the residence found holes in some of the copper water lines.

Response #7 - NYS DOH staff called the homeowner and determined the residence in question was connected to public water. Staff explained that since the residence was connected to public water when the home was constructed, exposure to site-related contaminants in drinking water is unlikely. The SCDHS was asked to contact the homeowner so that any concerns about the public drinking water supply could be addressed. The homeowner was provided with SCDHS contact names and telephone numbers and the NYS DOH toll-free telephone number should they have further concerns or questions.

Comment #8 - Two residents have concerns about the higher then expected rate of some cancers observed in 1978 - 1987 for the census tracts including and surrounding the landfill and would like to know the 1987 - 1997 cancer specific rates for the study area.

Response #8 - The cancer study for the years 1978 through 1987 for the area near the landfill evaluated cancer rates in census tracts (Appendix E). For the more recent time period 1987 to 1997, this information is not routinely available at the census tract level. However, the NYS DOH Cancer Surveillance Improvement Initiative has produced maps showing comparative cancer incidence in ZIP codes for the four most frequently diagnosed types of cancer; breast, lung, colorectal, and prostate for five recent years. The ZIP codes that contain the census tracts used in the earlier study are 11768, 11754, 11731 and 11725. These maps are available at the NYS DOH website, www.health.state.ny.us.

The ZIP code level cancer maps show that for lung cancer, the observed number of cases among females in the 11754 ZIP was 15-49% above the expected number. For the other ZIP codes, the lung cancer rates for males and females were below or within 15% of expected. The expected number is calculated using the population size and age distribution in each ZIP code and applying it to the age-specific rate for that type of cancer in the state as a whole. The observed number is the number of cases diagnosed among residents of the ZIP code. (Information on cancer diagnoses is mandated by law to be reported to the NYS Cancer Registry.)

The colorectal maps show that males and females in 11725, and males in 11731, showed rates that were 15 to 49% above expected. The rates for colon and rectal cancers for the other ZIP codes were below or within 15% of expected. For breast cancer, one ZIP code, 11768 showed a 15 to 49% elevation of observed cases compared to the expected number of cases. The other three ZIP codes showed breast cancer diagnoses within

15% of the expected numbers. For prostate cancer, ZIP code 11768 had a 15 to 49% elevated incidence, while the other three ZIP codes had an occurrence of within or below 15% of expected numbers.

The ZIP code cancer incidence patterns were evaluated statistically to find out if there were areas in the State with elevated cancer incidence, most likely not due to chance alone. These areas are shown by slanted lines, crossed lines, or double-crossed lines on the maps. As part of the Cancer Surveillance Improvement Initiative, follow-up evaluations will be conducted for areas identified as having elevated incidence, not likely due to cancer. For one type of cancer only, colorectal cancer among females, one ZIP code among the group being considered here, 11725, was identified as part of an area of elevated incidence.

Comment #9 - One resident would like to know if residents exposed to site-related volatile organic compounds (VOCs) in their private wells will be included in the NYS DOH VOC exposure registry.

Response #9 - To date, residents from this area have not been included in the New York State Volatile Organic Compounds (VOC) Exposure Registry. This site will continue to be considered for inclusion in the Registry. If this site is selected in the future, residents of households who were exposed in the past to VOCs from private well drinking water supplies will be asked by the NYS DOH to participate. The exposure registry allows long-term follow-up on the health status of persons with documented exposures to VOCs. An exposure registry such as this one is a resource for research that may help us learn whether exposures to VOCs are related to health effects. Future analysis based on VOC Exposure Registry information may increase understanding of potential health effects from exposures similar to those experienced by residents in the area affected by the Huntington Landfill site. People who are enrolled in the Registry will be kept informed of any research results that come from the Registry data.

Comment #10- A resident would like other sources of pollution near the site, including but not limited to the past incinerators, Ogden Martin incinerator, medical waste incinerator at the VA hospital and the electrical generation plant in Northport, evaluated along with the Huntington Landfill to determine the associated "accumulated effect" on the health of the community.

Response #10- While we understand that exposure to other sources of pollution may contribute to the overall risk of an adverse health outcome, the focus of this Public Health Assessment is to evaluate the exposure and associated human health risks from contaminants related to the Huntington Landfill.

APPENDIX G

ATSDR GLOSSARY

ATSDR Plain Language Glossary of Environmental Health Terms

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

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

Additive Effect: A response to a chemical mixture, or combination of substances, that might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

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

Antagonistic Effect: A response to a mixture of chemicals or combination of substances that is **less** than might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

ATSDR: The **A**gency for **T**oxic **S**ubstances and **D**isease **R**egistry. ATSDR is a federal health agency in Atlanta, Georgia that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

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

Biota: Used in public health, things that humans would eat – including animals, fish and plants.

CAP: See **C**ommunity **A**ssistance **P**anel.

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

Carcinogen: Any substance shown to cause tumors or cancer in experimental studies.

CERCLA: See **C**omprehensive **E**nvironmental **R**esponse, **C**ompensation, and **L**iability **A**ct.

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

Completed Exposure Pathway: See **Exposure Pathway**.

Community Assistance Panel (CAP): A group of people from the community and health and environmental agencies who work together on issues and problems at hazardous waste sites.

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

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): **CERCLA** was put into place in 1980. It is also known as **Superfund**. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

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

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

Contaminant: See **Environmental Contaminant.**

Delayed Health Effect: A disease or injury that happens as a result of exposures that may have occurred far in the past.

Dermal Contact: A chemical getting onto your skin. (see **Route of Exposure**).

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

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

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

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

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

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

Epidemiology: The study of the different factors that determine how often, in how many people, and in which people will disease occur.

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

Exposure Assessment: The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

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

ATSDR defines an exposure pathway as having 5 parts:

1. Source of Contamination,
2. Environmental Media and Transport Mechanism,
3. Point of Exposure,
4. Route of Exposure, and
5. Receptor Population.

When all 5 parts of an exposure pathway are present, it is called a **Completed Exposure Pathway**. Each of these 5 terms is defined in this Glossary.

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

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

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

Indeterminate Public Health Hazard:
The category is used in Public Health Assessment documents for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.

Ingestion: Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (See **Route of Exposure**).

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

LOAEL: **L**owest **O**bserved **A**dverse **E**ffect **L**evel. The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.

Malignancy: See **Cancer**.

MRL: **M**inimal **R**isk **L**evel. An estimate of daily human exposure – by a specified route and length of time -- to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.

NPL: The **N**ational **P**riorities **L**ist. (Which is part of **Superfund**.) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

NOAEL: **N**o **O**bserved **A**dverse **E**ffect **L**evel. The highest dose of a chemical in a study, or group of studies, that did not cause harmful health effects in people or animals.

No Apparent Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at levels expected to cause adverse health effects.

No Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where there is evidence of an absence of exposure to site-related chemicals.

PHA: **P**ublic **H**ealth **A**ssessment. A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Plume: A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).

Point of Exposure: The place where someone can come into contact with a contaminated environmental medium (air, water, food or soil). For examples:
the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

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

PRP: **P**otentially **R**esponsible **P**arty. A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.

Public Health Assessment(s): See **PHA**.

Public Health Hazard: The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria: PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each are defined in the Glossary. The categories are:
1. Urgent Public Health Hazard
2. Public Health Hazard
3. Indeterminate Public Health Hazard
4. No Apparent Public Health Hazard
5. No Public Health Hazard

Receptor Population: People who live or work in the path of one or more chemicals, and who could come into contact with them (See **Exposure Pathway**).

Reference Dose (RfD): An estimate, with safety factors (see **safety factor**) built in, of the daily, life-time exposure of human populations to a possible hazard that is <u>not</u> likely to cause harm to the person.

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

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

SARA: The **S**uperfund **A**mendments and **R**eauthorization **A**ct in 1986 amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from chemical exposures at hazardous waste sites.

Sample Size: The number of people that are needed for a health study.

Sample: A small number of people chosen from a larger population (See **Population**).

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

Special Populations: People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Statistics: A branch of the math process of collecting, looking at, and summarizing data or information.

Superfund Site: See **NPL**.

Survey: A way to collect information or data from a group of people (**population**). Surveys can be done by phone, mail, or in person. ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.

Synergistic effect: A health effect from an exposure to more than one chemical, where one of the chemicals worsens the effect of another chemical. The combined effect of the chemicals acting together are greater than the effects of the chemicals acting by themselves.

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

Toxicology: The study of the harmful effects of chemicals on humans or animals.

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

Uncertainty Factor: See **Safety Factor**.

Urgent Public Health Hazard: This category is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.