



Public Health Assessment for

**PENINSULA BOULEVARD GROUNDWATER PLUME
TOWN OF HEMPSTEAD, NASSAU COUNTY, NEW YORK
EPA FACILITY ID: NYN000204407
APRIL 24, 2007**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE**

Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

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

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

Agency for Toxic Substances & Disease Registry Julie L. Gerberding, M.D., M.P.H., Administrator
Howard Frumkin, M.D., Dr.P.H., Director

Division of Health Assessment and Consultation..... William Cibulas, Jr., Ph.D., Director
Sharon Williams-Fleetwood, Ph.D., Deputy Director

Cooperative Agreement and Program Evaluation Branch Richard E. Gillig, M.C.P., Chief

Exposure Investigations and Site Assessment Branch Susan M. Moore, M.S., Chief

Health Promotion and Community Involvement Branch Susan J. Robinson, M.S., Chief

Site and Radiological Assessment Branch Sandra G. Isaacs, B.S., Chief

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Additional copies of this report are available from:
National Technical Information Service, Springfield, Virginia
(703) 605-6000

You May Contact ATSDR Toll Free at
1-800-CDC-INFO
or
Visit our Home Page at: <http://www.atsdr.cdc.gov>

PUBLIC HEALTH ASSESSMENT

PENINSULA BOULEVARD GROUNDWATER PLUME

TOWN OF HEMPSTEAD, NASSAU COUNTY, NEW YORK

EPA FACILITY ID: NYN000204407

Prepared by:

New York State Department of Health
Center for Environmental Health
Under a Cooperative Agreement with
The U.S. Department of Health & Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Superfund and Program Assessment Branch
Atlanta, Georgia

TABLE OF CONTENTS

SUMMARY	1
PURPOSE AND HEALTH ISSUES.....	3
BACKGROUND.....	3
A. Site Description and History	3
B. Site Visit	4
C. Demographics	4
DISCUSSION	5
A. Environmental Contamination	5
B. Pathways Analysis	8
C. Toxicological and Epidemiological Evaluation	10
D. Consideration of Interactions Among Chemicals	12
E. ATSDR Child Health Considerations	12
F. Health Outcome Data Evaluation	13
COMMUNITY HEALTH CONCERNS.....	14
CONCLUSIONS.....	15
RECOMMENDATIONS	16
PUBLIC HEALTH ACTION PLAN (PHAP).....	17
CERTIFICATION PAGE	18
AUTHORS, TECHNICAL ADVISORS.....	19
REFERENCES.....	20
APPENDIX A	
Tables	22
APPENDIX B	
Figures	25
APPENDIX C	
New York State Department of Health Procedures for Evaluating Potential Health Risks for Contaminants of Concern	30
APPENDIX D	
Public Health Hazard Categories.....	34
APPENDIX E	
Summary of Public Comments and Responses	36
APPENDIX F	
ATSDR Glossary of Terms	38

SUMMARY

The Peninsula Boulevard Groundwater Plume is an area of contaminated groundwater in the Hamlet of Hewlett, Town of Hempstead, Nassau County, New York. No source of this contaminant plume has been found. The groundwater plume is on the United States Environmental Protection Agency (US EPA's) National Priorities List.

The groundwater plume site is in an area of homes and businesses. The North Woodmere Middle School is to the west, the Long Island American Water Company's Plant 5 wellfield is to the north. A stream that is sometimes referred to as Motts Tributary flows next to the school and the Doxey Brook Drain and Motts Creek flows between the Plant 5 wellfield and the school.

Much of the data for the Peninsula Boulevard Groundwater Plume come from investigations of the nearby Former Grove Cleaners site. Contaminants such as tetrachloroethene, trichloroethene, cis-1,2-dichloroethene and vinyl chloride are found in groundwater, surface water and sediments. Chemicals found in gasoline, such as benzene, toluene, ethylbenzene, xylene and methyl-*tert*-butyl-ether (MTBE) are also in groundwater and surface water.

The Long Island American Water Company has monitoring data for the water from the Plant 5 wellfield starting in 1979. Because of low levels of contaminants, the water from the Plant 5 wellfield is treated (installed in 1991) to remove contaminants before going into the public water system. Before 1991, levels of contaminants were below the public drinking water standards that were in effect at that time. Exposures to contaminants probably occurred in the past, due to drinking and skin contact with low levels of the chemicals in drinking water.

US EPA found limited soil vapor contamination but more investigation is needed. Elevated levels of contaminants were not detected in indoor air samples from the school or homes near the areas of contaminated soil vapor. Data do not suggest on-going exposures to contaminated soil vapors.

Potential exposure pathways include contact with contaminated surface water and sediments in Motts Tributary, Doxey Brook Drain and Motts Creek. A fence restricts access to these.

The New York State Department of Health (NYS DOH) and Agency for Toxic Substances and Disease Registry (ATSDR) conclude that the Peninsula Boulevard Groundwater Plume site poses no apparent public health hazard*. This category is used because exposures are reduced by treatment of the water from the Plant 5 wellfield and fencing restricts access to the creek. However, public health actions are still needed to reduce potential future exposures to the contaminated surface water and groundwater.

Low levels of contaminants were detected in the public water supply wells in the late 1970's, shortly after monitoring began. These contaminants may have been present for up to 30 years or more. To estimate exposures, we use 30 years because it represents the maximum length of time that 95% of people live in one place. NYS DOH estimates that the increased risk of developing cancer is low for people drinking water from public wells containing tetrachloroethene and trichloroethene at the highest levels detected. These estimates are based on the relative toxicity of tetrachloroethene and trichloroethene, and limited sampling data from public wells. The actual

increase in cancer risk for these chemicals in drinking water is difficult to estimate because we have no information on how long or to what levels people were exposed to before the contamination was discovered. Although the risks for noncarcinogenic effects (health effects other than cancer) from past exposures are not completely understood, existing data suggest that they would be minimal to low.

Motts Tributary, Motts Creek, and Doxey Brook Drain have been contaminated with tetrachloroethene, MTBE, *cis*-1,2-dichloroethene and trichloroethene for an unknown amount of time. The highest levels of MTBE and *cis*-1,2-dichloroethene do not exceed cancer and noncancer health assessment comparison values** from skin contact and incidental ingestion. NYS DOH estimates a very low increased risk of developing cancer for children exposed by incidental ingestion and by skin contact for up to 6 years to the highest reported levels of tetrachloroethene. The risk for noncarcinogenic effects would be minimal.

A public meeting was held on April 22, 2004 to address citizens' concerns regarding the Peninsula Boulevard Groundwater Plume site. NYS DOH, Nassau County Department of Health (NC DOH), and US EPA attended the meeting, addressed questions, and provided written information.

In 1982, in response to community concerns unrelated to the site, NYS DOH investigated cancers reported among children in the Hewlett-Woodmere School district. While an excess of leukemia and Ewing's Sarcoma was observed, the number of cases was very small. A detailed review of the case histories and medical records found no unusual conditions that were common to all of the cases, nor was any clustering by residence apparent.

This public health assessment was distributed for public comment on August 14th 2006. The public comment period ended on September 14th 2006. NYS DOH received four comments from one resident; a summary of these comments and NYS DOH's responses are included in Appendix E.

Actions recommended for the site include: US EPA should continue investigations of the site and take remedial actions based on the results, US EPA should maintain the fence that limits access to contaminated surface waters and sediments, and the Long Island Water Company should continue monitoring water from the Plant 5 public wells as per NYS DOH Part 5 Drinking Water Standard requirements.

**No apparent public health hazard* is a category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful effects.

***A health assessment comparison value* is a calculated concentration of a substance in water, soil, or air that is unlikely to cause harmful (adverse) health effects in exposed people. The value is used as a screening level during the public health assessment process.

PURPOSE AND HEALTH ISSUES

This public health assessment (PHA) evaluates past, current and potential future exposures to contaminants and other conditions related to the Peninsula Boulevard Groundwater plume. This PHA fulfills the congressional mandate that requires public health assessment activities for each site proposed to the National Priorities List (NPL). The New York State Department of Health (NYS DOH), under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), conducted this evaluation. More specifically, ATSDR, a federal agency within the U.S. Department of Health and Human Services, and NYS DOH determine whether adverse health effects are possible and recommend actions to reduce or prevent possible adverse health effects. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, authorizes ATSDR to conduct public health assessments at inactive hazardous waste disposal sites proposed for the NPL. The Peninsula Boulevard groundwater plume was proposed for the NPL in March of 2004 and listed on the NPL in July of 2004.

BACKGROUND

A. Site Description and History

The Peninsula Boulevard Groundwater Plume is an area of groundwater in the Hamlet of Hewlett, Town of Hempstead, Nassau County, New York (see Figure 1), that is contaminated with tetrachloroethene (also known as PCE) and other volatile organic compounds (VOC). The source or sources of the contamination have not been identified. Tetrachloroethene is a chemical commonly used to dry clean clothing. It is also used to degrease metal and is found in household products such as spot removers, glues and brake cleaners. The chemicals benzene, toluene, ethylbenzene, xylene (BTEX) and methyl tert-butyl ether (MTBE) were also detected at lower concentrations in the plume area. These compounds are likely attributable to documented petroleum spills in the area.

The site is in a mixed residential-commercial area. The North Woodmere Middle School is west of the plume and the Long Island American Water Plant 5 is to the north. The former Grove Cleaners inactive hazardous waste site is northeast of the plume area and southeast of the public water supply well field. A small unnamed stream (hereafter referred to as Motts Tributary) flows north from the plume area adjacent to the North Woodmere Middle School and joins Doxey Brook Drain and Motts Creek just north of the school grounds. The course of Doxey Brook Drain and then Motts Creek runs north of the plume area and flows west-northwest (see Figure 1).

The plume was discovered by the New York State Department of Environmental Conservation (NYS DEC) during a remedial investigation for the former Grove Cleaners site on Peninsula Boulevard in March 2001. During this investigation, samples of groundwater, surface water, soil, sediment and soil vapor were collected and analyzed for contaminants. NYS DOH and Nassau County Department of Health (NC DOH) also collected indoor air samples for analysis in February 2002. The results of these investigations are discussed further in the Discussion section. The investigation did not produce enough evidence to determine that Grove Cleaners

was solely responsible for the contamination and a “No Further Action” Record of Decision was issued for the site in March of 2003. NYS DEC referred the groundwater plume to US EPA for further investigation. US EPA collected indoor air samples within the school in April 2004 at the request of the teacher’s association, to supplement existing data. Additional investigations by US EPA are planned to determine the source of the groundwater plume.

B. Site Visit

Wendy Kuehner from NYS DOH and Joe DeFranco of NC DOH visited the site on February 21, 2002 and Lani Rafferty from NYS DOH visited the site on April 22, 2004. The proximity of homes, the middle school and Long Island American Water supply well field to the plume were noted. A chain-link fence restricted access to the stream adjacent to the middle school. During the time of the first visit, a small section of fence was absent, allowing access to the creek. This section of fence was closed late in 2003.

C. Demographics

NYS DOH estimated, from the 2000 Census (U.S. Bureau of the Census, 2001), that 23,688 people live within one mile of the center of the Peninsula Boulevard Groundwater Plume site. The age distribution of the area is similar to that of the rest of Nassau County as well as New York State, excluding New York City (NYC), with a slightly higher percentage of individuals 64 years and older living in the area. There were 4,358 females of reproductive age (ages 15-44) within one mile of the site. The area within one mile of the site has a higher percentage of white individuals and has less racial and ethnic diversity than the rest of the county or state (excluding NYC). Based on the 2000 Census (U.S. Bureau of the Census, 2002), a lower percentage of the population is living below the poverty level while the median household income is higher than the rest of the county and state. These comparisons are provided in the following table. In addition, there are 11 schools and one nursing home within a mile of the site.

2000 Census Demographics	New York State excluding NYC	Nassau County	Area within 1 mile of Peninsula Boulevard site
Age Distribution			
<6	8%	8%	7%
6-19	20%	19%	20%
20-64	58%	58%	56%
>64	14%	15%	17%
Race Distribution			
White	85%	79%	90%
Black	8%	10%	2%
Native American	<1%	<1%	<1%
Asian	2%	5%	5%
Pacific Islander	<1%	0%	0%
Other	2%	4%	2%
Multi-Racial	2%	2%	1%
Percent Minority*	18%	26%	14%
Ethnicity Distribution			
Percent Hispanic	6%	10%	6%
1999 Median Income	\$47,517	\$72,030	\$77,964
% Below Poverty Level	10%	5%	4%

* Minority includes Hispanics, African-Americans, Asian-Americans, Pacific Islanders and Native Americans.

DISCUSSION

A. Environmental Contamination

Environmental data available for the Peninsula Boulevard Groundwater Plume include data collected during the February 2000 to January 2002 remedial investigation of the Grove Cleaners site, the February 2002 indoor air sampling by NYS DOH and NC DOH in the residential community near the intersection of Sturlane Place and Hewlett Parkway, and the April 2004 indoor air sampling by US EPA at the Woodmere-Hewlett Middle School. Additional investigations specific to the Peninsula Boulevard Groundwater Plume are planned by US EPA to determine the source of the groundwater plume. There is also routine drinking water monitoring data available from the Long Island American Water Company wellfield north of the site.

During the remedial investigation for Grove Cleaners, samples of subsurface soils, groundwater, soil gas, storm drain and drywell sediments, surface water and sediments from Motts Tributary and Doxey Brook Drain were collected. An inventory of groundwater wells was also prepared at the NYS DEC's request. The results of these sampling events are discussed below.

**Peninsula Boulevard Groundwater Contamination Plume
Groundwater and Surface Water Samples**
(all values in mcg/L)

Contaminant	Groundwater Maximum Value Detected	Drinking Water Standard**	Surface Water Maximum Value Detected	Surface Water Standard or Guidance Value***
tetrachloroethene	5900	5	190	1.0
trichloroethene	240	5	5	40
cis-1,2-dichloroethene	57	5	17	---
vinyl chloride	5	2	Nd	---
1,1,1-trichloroethane	7	5	Nd	---
MTBE*	1500	10	25	---
benzene*	55	5	Nd	10
ethylbenzene*	16	5	Nd	17
xylenes*	26	5	Nd	65
methylene chloride	9	5	Nd	---
acetone	80	50	Nd	---

* gasoline components

**NYS DOH, 2004. State Sanitary Code Chapter 1 (subpart 5-1) Public Water Systems.

<http://www.health.state.ny.us/nysdoh/water/part5/subpart5.htm>

***NYS DEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. <http://www.dec.state.ny.us/website/dow/togs/togs111.pdf>

nd – not detected

--- - No value available

Groundwater

Groundwater samples were collected from several monitoring wells and geoprobe (a compact drilling device used for soil and groundwater investigations) locations near the Peninsula Boulevard Groundwater Plume between February 2000 and January 2002. A groundwater contamination contour map is presented in Figure 2. The highest concentrations of tetrachloroethene were found along Hewlett Parkway, between Webster Street and Sturlane Place, at levels up to 5,900 micrograms per liter (mcg/L). The NYS DEC Class GA groundwater standard and NYS DOH standard for public drinking water supplies is 5 mcg/L.

Tetrachloroethene is the primary contaminant associated with the Peninsula Boulevard Groundwater Plume. However, lesser amounts of other volatile organic compounds were also detected at concentrations above NYS DOH standards for public drinking water (see above table) including compounds such as trichloroethene, cis-1,2-dichloroethene, vinyl chloride, 1,1,1-trichloroethane, MTBE, benzene, ethylbenzene, xylenes, methylene chloride, and acetone. A number of these compounds (e.g. MTBE, benzene, ethylbenzene, and xylenes) are components of gasoline and are often associated with petroleum spills.

Surface Water

Surface water samples were collected in March and October of 2001 from Motts Tributary, Doxey Brook Drain and an upgradient stormwater manhole (labeled Motts South and Motts North, SW-3 and SW-4, and SW-1, respectively, on Figure 3) along Franklin Avenue. The NYS DEC surface water guidance value for tetrachloroethene in class C waters is 1.0 mcg/L.

The highest concentration of tetrachloroethene in surface water (190 mcg/L) was found at 'Motts South,' located in Motts Tributary, adjacent to Peninsula Boulevard, across from Franklin Avenue (See Figure 3). Levels of tetrachloroethene steadily decrease proceeding downstream in the tributary towards Motts Creek. The surface water sampling point in Motts Creek furthest from the groundwater plume contained 32 mcg/L of tetrachloroethene. MTBE was also detected in the surface water samples, ranging from 4 mcg/L to 25 mcg/L. Trichloroethene was detected in surface water at 5 mcg/L (below the level of its Class C surface water standard of 40 mcg/L), and *cis*-1,2-dichloroethene was detected at 17 mcg/L. All other volatile organic compounds detected were below their respective standards and guidance values, and therefore were not further evaluated for this pathway.

Subsurface Soils

Fifty-eight soil samples were collected at a depth of between 2 and 76 feet deep during the Grove Cleaners remedial investigation. There were no exceedences of NYS DEC Soil Cleanup Objectives (also TAGM values) for volatile organic compounds and no source area was identified.

Sediments

Sediment samples were collected in the Motts Tributary and Doxy Brook Drain and analyzed for volatile organic compounds. Levels of tetrachloroethene exceeded the NYS DEC Sediment Criteria of 7 mcg/Kg at a level of 13 mcg/Kg. The location of this sample coincides with the highest surface water detection at Motts South.

Soil Gas

Sixteen soil gas samples were collected in October of 2001, at a depth of four feet or less, over the groundwater plume and between Motts Tributary and the North Woodmere Middle School (See Figure 4). Tetrachloroethene was only detected in one sample, GP-38, at a level of 1,286 mcg/m³ (equivalent to 190 parts per billion, as shown on Figure 4). GP-38 was collected near the intersection of Hewlett Parkway and Sturlane Place. The samples collected between the groundwater plume and the school did not contain detectable levels of tetrachloroethene.

Indoor Air

Based on the elevated level of tetrachloroethene in soil gas detected in one sample in the residential community, NYS DOH and NC DOH collected indoor air samples in three homes near GP-38. The samples were collected in February 2002, using passive organic vapor monitoring badges and analyzed for tetrachloroethene only. All sample results showed levels of tetrachloroethene present but less than the detection limit of 5 mcg/m³. In addition, US EPA conducted an indoor air sampling event in the Woodmere Middle School on April 8 – 9, 2004. A Trace Atmospheric Gas Analyzer (TAGA) was used to screen indoor air for the contaminants of concern, tetrachloroethene and its breakdown products. Levels of tetrachloroethene comparable to background were detected. In addition, samples were collected using evacuated air canisters and analyzed for volatile organic compounds. None of the contaminants in the groundwater plume were detected in these samples above the quantitation limit of 0.5 parts per billion by volume (ppbv) (equivalent to 0.021 mcg/m³ of tetrachloroethene).

Well Survey and Public Water Supply Monitoring Results

NYS DEC's consultant for the site conducted a well survey within a ½ mile radius of the Grove Cleaners site during the remedial investigation. No private supply wells were noted in the plume area during this survey; however, limited responses were received. Several monitoring wells and one extraction well previously used to contain a fuel spill were reported. The extraction well was decommissioned in 1997.

The Long Island American Water Company operates the Plant 5 well field north of the groundwater plume (see Figure 1), which contains approximately 100 shallow (29 to 44 feet) and deep (128 to 159 feet) drinking water supply wells. These wells are monitored quarterly for contaminants as per the NYS DOH Part 5 standards for public drinking water supplies. The shallow wells were taken out of service in June 1995 due to low capacity and high iron and solids content. In early 1991, contamination in the deep supply wells was found at standards, and in response treatment systems were installed in February of 1991. The deep wells are currently treated with two air stripping towers, capable of removing volatile organic compounds and their performance is monitored monthly. The air strippers have been effective in removing contaminants from the water.

In addition to the Long Island American Water Company monitoring data, NC DOH had maintained independent sampling records for these wells since 1977. Low levels of tetrachloroethene have been consistently detected in the deep supply wells since monitoring began in 1977. Prior to installation of the treatment system, the highest level of tetrachloroethene detected in raw water from the well field was 13 mcg/L. The current NYS DOH drinking water standards for tetrachloroethene and the other chlorinated solvents in the plume are 5 mcg/L, with the exemption of vinyl chloride for which the standard is 2 mcg/L. Prior to 1989, the NYS DOH Guideline was 5 mcg/L for vinyl chloride and 50 mcg/L for the other chlorinated solvents. Since treatment began, levels of tetrachloroethene in raw water up to 34 mcg/L have been recorded. The contaminants are effectively removed from the raw water by the air strippers prior to distribution to the public. Trichloroethene is also consistently detected. The highest level detected to-date was 16.0 mcg/L in December 1978, before the treatment system was installed. A follow-up sample collected one week later did not detect trichloroethene. The second highest detection before the treatment system was in place was 4.0 mcg/L in February 1983. The water company also reports that low levels of cis-1,2-dichloroethene (up to 0.7 mcg/L) have been detected periodically since 1995 in raw water samples. The NYS DOH standards for public water supplies have not been exceeded in water distributed to the public since the treatment system was installed.

B. Pathway Analysis

NYS DOH assesses a site by evaluating exposure pathways. An exposure pathway is the way chemicals may enter a person's body. Exposure pathway includes the following five elements:

1. a contaminant source
2. environmental medium (or media) and transport mechanisms
3. a point of exposure
4. a route of exposure
5. a receptor population

Exposure pathways are categorized as completed, potential or eliminated. A completed exposure pathway is one in which all five elements are present, indicating that an exposure has occurred, is occurring or will occur in the future. In a potential exposure pathway, at least one of the pathways elements are missing and are uncertain, indicating that exposure to a contaminant could have occurred in the past, may be occurring or could occur in the future. A pathway is eliminated when one or more elements is missing and is very unlikely to be present. Completed exposure pathways identified below will be further evaluated in the following section, Toxicological and Epidemiological Evaluation for Adult and Children's Health Issues.

Completed exposure pathways

Water containing the contaminants of concern has impacted a public water supply well field. Prior to installation of the air strippers, water likely containing up to 13 mcg/L of tetrachloroethene and 16 mcg/L of trichloroethene was distributed to the public. Low level exposures likely occurred via ingestion, direct contact and inhalation of vapors (e.g. contact and volatilization during showering). These wells serve up to 6400 customers. The levels were below the drinking water guidelines in place at the time. Installation of the treatment system in 1991 reduced these exposures.

Future exposure is possible if levels of contaminants were to increase and exceed the capacity of the treatment system. However, before levels reach levels of concern, the system would be upgraded or the wells taken out of service to reduce exposures.

Potential exposure pathways

People may have come into contact with contaminated surface waters and sediments in Motts Tributary, Motts Creek and Doxey Brook Drain, given its proximity to the school grounds and a residential area. The presence of a fence reduces the accessibility of the creek, so contact has likely been limited. A missing portion of the fence adjacent to the school was replaced in 2003, further limiting the likelihood of contact. Motts Tributary, Doxey Brook Drain and the portion of Motts Creek that is contaminated do not support a population of fish in size or number sufficient to support fishing for consumption; therefore consideration of human exposure due to consumption of contaminated fish has been eliminated from further consideration in this public health assessment. However, the contaminant levels in the creek are still elevated, and a potential for exposure via dermal contact and incidental ingestion remains, and will be further evaluated.

Due to the presence of elevated levels of tetrachloroethene in soil gas at one location in a residential area, a potential for inhalation of impacted vapors exists if vapors were to enter nearby homes. The limited number of indoor air samples analyzed near this location did not detect elevated levels of tetrachloroethene in homes. Additional sampling may be warranted at this location to further evaluate this potential exposure pathway. Soil vapor and indoor air sampling at the Woodmere Middle School did not identify a potential for contaminants to impact indoor air quality.

The well survey conducted in conjunction with the remedial investigation did not identify any private water wells in the area. However, limited responses were received to the survey. If any wells exist or were constructed within the groundwater plume, persons could be exposed to contaminated groundwater via direct contact, ingestion or inhalation, due to the volatile nature of the contaminants. NC DOH restricts installation of groundwater wells in Nassau County for potable or irrigation purposes. Therefore the likelihood of new wells being installed is low.

C. Toxicological and Epidemiological 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 exposure pathways identified for the Peninsula Boulevard site, NYS DOH assessed the risks for cancer and noncancer health effects. The risks for health effects depend primarily on contaminant concentration, exposure route, exposure frequency and exposure duration. For additional information on how NYS DOH determined and qualified health risks applicable to this public health assessment, please refer to Appendix C.

1) Past ingestion, dermal and inhalation exposure to volatile organic contaminants in public water supply wells

For an undetermined period of time, possibly up to 30 years or more, public water supply wells at Plant 5 well field (operated by the Long Island American Water Company) have been contaminated with tetrachloroethene and trichloroethene. Exposure to chemicals in drinking water is possible by ingestion, and also by dermal contact and inhalation from water uses such as showering, bathing, and cooking. Although actual exposure varies depending on an individual's lifestyle, each of these exposure routes can contribute to the overall daily intake of contaminants and, thus, may increase the risk for chronic health effects. Several studies that model non-ingestion VOC exposures from drinking water (Chinery and Gleason (1993), Maxwell et al. (1991), Bogen and McKone (1988), McKone and Knezovich (1991), McKone (1989)) suggest that under some conditions, exposure to VOCs by the inhalation and dermal routes may approach the same level as exposure by ingestion. Therefore, the NYS DOH doubled the exposure from ingesting two liters of water per day in the risk calculations to account for non-ingestion VOC exposures from drinking water.

Studies of workers exposed to tetrachloroethene and/or trichloroethene and other chemicals show an association between exposure to high levels of these chemicals and increased risks of certain forms of cancer (ATSDR, 1997a, b). Cancers associated with workplace exposure to tetrachloroethene include esophageal and bladder cancer, and non-Hodgkins lymphoma, while exposure in workplace air to trichloroethene is associated with kidney, liver and esophageal cancer, and non-Hodgkins lymphoma. These associations are unlikely to be due to chance. However, the role of other factors in causing these cancers, including exposures to other potential cancer-causing chemicals, is not fully known. Thus, these data suggest, but do not prove, that tetrachloroethene and trichloroethene cause cancer in humans. Other studies show that people living in communities with drinking water supplies contaminated by mixtures of chemicals, including tetrachloroethene and trichloroethene, have higher risks of certain types of cancer (e.g., non-Hodgkin's lymphoma) than do people living in communities with

non-contaminated drinking water. These studies are weaker than those of workers largely because we do not know for certain whether the people who got cancer actually drank the contaminated water for long periods of time before they got cancer.

Tetrachloroethene and trichloroethene cause cancer in laboratory animals exposed to high levels over their lifetimes (ATSDR 1997a,b). Chemicals that cause cancer in laboratory animals may cause cancer in humans who are exposed to lower levels over long periods of time. The increased risk for developing cancer for people drinking water from public wells (at the Plant 5 well field) containing tetrachloroethene (13 mcg/L) and trichloroethene (16 mcg/L) at the highest levels detected for a period of up to 30 years is estimated to be low. We use 30 years because it represents the 95th percentile value for residence time, or the amount of time people live in one place (US EPA, 1997). The actual increase in cancer risk for tetrachloroethene and trichloroethene in drinking water is difficult to estimate because we have no information on how long or to what levels people were exposed to prior to the time the contamination was discovered.

Exposure to high levels of tetrachloroethene and trichloroethene is also known to produce noncarcinogenic health effects in humans, primarily on the liver, kidney and central nervous system (ATSDR 1997a,b). In humans, the potential health effects for tetrachloroethene exposures include changes in electrical measurements of nervous system activity, mild and reversible effects on nervous system performance, and effects on the central nervous system (e.g. dizziness) (Stewart, et al., 1970; Hake et al., 1977; Altman et al., 1990, 1992, 1995; Cavalleri, 1994). Human health effects observed after long-term occupational exposure to elevated levels of trichloroethene include reduced scores on tests evaluating motor coordination, nausea, headaches, dizziness, and irritation of the mucous membranes (Rasmussen et al. 1993). Some studies suggest that tetrachloroethene and trichloroethene may increase the risk of reproductive and developmental health effects in humans (see ATSDR Child Health Considerations Section). Although the risks for noncarcinogenic effects from past exposures are not completely understood, the existing data suggest that they were minimal to low for tetrachloroethene (13 mcg/L) and trichloroethene (16 mcg/L) at the highest levels detected.

Potential incidental ingestion and dermal contact exposure to volatile organic contaminants in surface water

Motts Tributary, Motts Creek, and Doxey Brook Drain have been contaminated with volatile organic chemicals (tetrachloroethene, MTBE, *cis*-1,2-dichloroethene and trichloroethene) for an undetermined period of time. People having access to and playing in these surface waters could have been exposed to these chemicals by incidental ingestion and dermal contact. The highest level of tetrachloroethene (190 mcg/L) measured in surface water exceeds its state guideline (1 mcg/L) for Class C surface waters (those suitable for fish propagation and survival, and for primary and secondary contact recreation). None of the levels of these contaminants measured in surface water exceed cancer or noncancer public health assessment comparison values based on dermal and incidental ingestion exposure in children (Table 2). The estimated cancer risk for exposure to tetrachloroethene, trichloroethene and MTBE in surface water is very low. The risks for noncarcinogenic effects for exposure to all the chemicals detected in surface water would be minimal.

D. Consideration of Interactions Among Chemicals

Most hazardous waste sites contain multiple chemical contaminants. Therefore, the possibility for interactions among the chemicals detected at the Peninsula Boulevard site was considered when evaluating the potential health risks. The three types of interactions among chemicals that can take place are additivity, synergy and antagonism. Additivity means that the combined effect of the chemicals of a mixture acting together is equal to the sum of the effects of the chemicals acting alone. Synergy takes place when the combined effect of the chemicals acting together is greater than the sum of the effects of the chemicals acting alone. Antagonism refers to the combined effect of the chemicals acting together being less than the sum of the effects of the chemicals acting alone.

In 2004, ATSDR published a document called an Interaction Profile (ATSDR, 2004), which summarizes the available information on chemical interactions in various mixtures of four chlorinated hydrocarbons, including trichloroethene and tetrachloroethene (the primary contaminants at the Peninsula Boulevard site). According to ATSDR's evaluation, trichloroethene and tetrachloroethene can both cause CNS effects, and additivity for CNS effects is plausible. In addition, studies in laboratory animals show that both chemicals cause effects on the liver and kidney, and cause carcinogenic responses (via reactive metabolites) in these organs. Limited studies of interactions of mixtures of these chemicals on the liver and kidney provide no evidence of greater than additive effects. According to ATSDR, there is also some limited evidence to suggest that tetrachloroethene may inhibit the toxic action of trichloroethene on the liver and kidney. Therefore, assuming there is general similarity between trichloroethene and tetrachloroethene with respect to toxic endpoints and mode of action, we considered the non-cancer and cancer health effects and health risks to be additive.

E. ATSDR Child Health Considerations

ATSDR emphasizes examining child health issues in all of the agency activities, including evaluating child-focused concerns through its mandated public health assessment activities. ATSDR and NYS DOH consider 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 and trichloroethene (the primary contaminants associated with the Peninsula Boulevard site) was taken into account when evaluating the potential health risks associated with the contamination of public water supply wells at the Plant 5 well field. To evaluate this possibility, the estimated exposures to tetrachloroethene and trichloroethene at the site were compared to the exposure levels identified from the scientific literature that cause developmental effects in laboratory animals.

Human studies suggest that exposure to mixtures of chlorinated solvents (including tetrachloroethene and trichloroethene) in drinking water during pregnancy may increase the risk of birth 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 tetrachloroethene and trichloroethene was in the water 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 tetrachloroethene and trichloroethene.

When pregnant animals are exposed by ingestion and/or inhalation to large amounts of tetrachloroethene or trichloroethene, 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 tetrachloroethene by ingestion 10 to 16 days after birth (Fredriksson et al., 1993). In other studies, abnormal fetal heart development was observed in the offspring of rats exposed to trichloroethene in drinking water before and during pregnancy (Dawson et al., 1993), and exposure of rats to drinking water containing trichloroethene before mating, during gestation, and throughout lactation was associated with a significant decrease in the number of myelinated nerve fibers in 21 day old offspring (Isaacson and Taylor, 1989).

The likelihood for site-related tetrachloroethene or trichloroethene exposures to cause developmental health effects (e.g., those on the fetus, infants or children) was evaluated by comparing exposure estimates for these chemicals at the site to levels of exposure known to cause developmental toxicity in the studies described above. The estimated exposures to the highest (13 mcg/L) and average (3.1 mcg/L) detected levels of tetrachloroethene in public water supply wells (Plant 5 well field) near the Peninsula Boulevard site are about 2,000 and 8,000 times lower, respectively, than the lowest exposure levels that cause developmental effects in young laboratory animals shortly after birth. The estimated exposure to the highest level of trichloroethene (16 mcg/L) is about 12,000 to 22,000 times lower than exposure levels that cause adverse effects on the development of laboratory animals. For the average detected level of trichloroethene (1 mcg/L), the estimated exposure is about 180,000 to 340,000 times lower than the levels that cause developmental effects in laboratory animals. Since these margins of exposure are large, it therefore appears unlikely that past site-related exposures to tetrachloroethene or trichloroethene in drinking water would have caused adverse developmental health effects.

F. Health Outcome Data Evaluation

NYS DOH has not previously evaluated health outcome data specifically for the Peninsula Boulevard Groundwater Plume Site. NYS DOH maintains several health outcome databases, which could be used to generate health outcome data for a specific area, if appropriate. These databases include the Cancer Registry, the Congenital Malformations Registry, Vital Records (birth and death certificates) and hospital discharge information.

In 1982, NYS DOH investigated cancers reported among children in the Hewlett-Woodmere School district (North Woodmere Middle School is one school in that district). While an excess of leukemia and Ewing's Sarcoma was observed, the number of cases was very small. A detailed review of the case histories and medical records found no unusual conditions that were common to all of the cases, nor was any clustering by residence apparent.

In 1999, NYS DOH established the New York State Volatile Organic Compounds (VOC) Exposure Registry as a tool for health status assessment and long-term follow-up for communities and individuals 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 analyses, based on VOC Exposure Registry information, may increase understanding of potential health effects from exposures similar to those experienced by residents living near the Peninsula Boulevard Groundwater Plume Site.

For communities with large public water supplies served by multiple wells, information is generally not available for accurately specifying VOC exposures for individual households. In addition, in cases where exposures ended more than ten years ago, it would be difficult now to locate the residents who lived in the area at the time of the potential exposures. For these reasons, residents supplied by public water supplies affected by contamination from the Peninsula Boulevard Groundwater Plume Site are not being considered for inclusion in the VOC Registry. The VOC Exposure Registry may help contribute to knowledge about whether specific health outcomes may be related to exposures to the specific chemicals, particularly tetrachloroethene and trichloroethene that are associated with the site.

COMMUNITY HEALTH CONCERNS

This public health assessment was distributed for public comment on August 14th 2006. The public comment period ended on September 14th 2006. NYS DOH received four comments from one resident; a summary of these comments and NYS DOH's responses are included in Appendix E. NYS DOH also received numerous phone calls from residents when the Peninsula Boulevard site was initially listed as a hazardous waste site.

A public informational meeting was held by Nassau County Legislator Jeffrey Toback on April 22, 2004 to address citizen's concerns regarding the Peninsula Boulevard Groundwater Plume site. Representatives from US EPA, NYS DOH, NC DOH, Long Island American Water Corporation and Woodmere-Hewlett School District were in attendance and addressed questions regarding the site and distributed informational materials. The following questions have been voiced regarding the site:

Concern: Did anyone establish a well inventory to see if private wells exist in the area?

Answer: Yes, a well inventory was conducted during the remedial investigation of the Grove Cleaners site. Limited responses were received. If private wells exist that were not reported in the past, please contact US EPA project manager (Ms. Gloria Sosa, US EPA, (212) 637-4283) to provide this information.

Concern: How deep is the plume?

Answer: Data obtained to-date shows tetrachloroethene up to 75 feet below the ground surface, with the highest levels detected at about 15 feet. Additional data will be gathered in the upcoming remedial investigation to further delineate the extent of contamination.

Concern: Are the streams going to be cleaned?

Answer: Additional investigations are planned for the site to fully delineate the extent of contamination and try to identify a source. Based on the data obtained, remedial options will be evaluated for contamination and a remedy will be selected following a public comment period. We do not know at this time exactly what the remedy will be. However, the remedy chosen will be protective of public health.

Concern: Why is drinking water not obtained from the Lloyd aquifer?

Answer: The Lloyd Aquifer is a layer of very deep groundwater that exists under much of Long Island, beneath the more productive Magothy and Upper Glacial Aquifers. Use of the Lloyd Aquifer is restricted by NYS DEC and may not be used for the public drinking water supply at this location.

Concern: Has the health of people in the area been examined? Is there an increase in cancer in the area?

Answer: NYS DOH has not evaluated health outcome data (e.g. cancer) specifically for the Peninsula Boulevard Groundwater Plume Site. However, in 1982, NYS DOH investigated cancers reported among children in the Hewlett-Woodmere School district (North Woodmere Middle School is one school in that district). While an excess of leukemia and Ewing's Sarcoma was observed, the number of cases was very small. A detailed review of the case histories and medical records found no unusual conditions that were common to all of the cases, nor was any clustering by residence apparent.

CONCLUSIONS

NYS DOH and ATSDR conclude that persons were likely to have been exposed to volatile organic compounds in the past, prior to the installation of treatment systems on the public water supply in 1991. For an undetermined period of time, water from public water supply wells at Plant 5 well field have been contaminated with tetrachloroethene and trichloroethene. Based on the results of animal studies and limited sampling data, people drinking water for a period up to 30 years from public wells containing tetrachloroethene (13 mcg/L) and trichloroethene (16 mcg/L), at the highest levels detected, are estimated to have a low increased risk of

developing cancer. The actual increase in cancer risk for tetrachloroethene and trichloroethene in drinking water is difficult to estimate, in part because we have no information on how long or to what levels people may have been exposed to prior to the time the contamination was discovered. Although the risks for noncarcinogenic effects from past exposures are not completely understood, the existing data suggest that they would be low to minimal. The estimated exposure to tetrachloroethene at the highest levels in public water supply wells are about 2000 times lower than the lowest exposure levels that cause developmental effects in the offspring of animals. The estimated exposure to trichloroethene in public water supply wells is about 12,000 to 22,000 times lower than the lowest trichloroethene exposure levels that are reported to cause developmental effects in the offspring of animals.

People may also have come into contact with surface water and sediments in Motts Tributary, Motts Creek and the Doxey Brook Drain, which are impacted by the groundwater plume. A fence restricts access to these water bodies, which have been contaminated with tetrachloroethene, MTBE, *cis*-1,2-dichloroethene and trichloroethene for an undetermined period of time. Motts Tributary, Doxey Brook Drain and the portion of Motts Creek that is contaminated do not support a population of fish in size or number sufficient to support fishing for consumption. None of the levels of these contaminants exceed cancer and noncancer public health assessment comparison values based on dermal and incidental ingestion exposure in children. Children exposed by incidental ingestion and by dermal contact for up to 6 years to the highest reported levels of tetrachloroethene (the primary surface water contaminant) are estimated to have a very low increased risk of developing cancer. The risks for noncarcinogenic effects would be minimal.

Exposure to contaminants have not been documented in indoor air as a result of the soil vapor intrusion pathway. However, additional data should be gathered to support this finding.

NYS DOH and ATSDR conclude that the site currently poses no apparent public health hazard due to the presence of treatment systems on the public water supply and presence of fencing to restrict access to affected portions of the creeks. However, public health actions are needed to reduce potential future exposures to the contaminated surface water and groundwater. Additional remedial actions may be warranted following the planned remedial investigation.

RECOMMENDATIONS

US EPA should proceed with the planned remedial investigation of the site. The remedial investigation should provide information on the nature and extent of the groundwater contamination plume, potential sources of contamination, surface water quality and the potential for soil vapor intrusion.

Appropriate remedial actions should be taken by US EPA based on the results of the remedial investigation, to reduce the potential for exposures to contamination.

Monitoring of the Plant 5 public water supply wells should continue as per NYS DOH Part 5 requirements.

US EPA should maintain the existing fencing to limit access to contaminated surface waters and sediments.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for the Peninsula Boulevard Groundwater Plume site contains a description of actions to be taken by US EPA, ATSDR and/or NYS DOH following completion of this public health assessment. For those actions already completed at this site, please refer to the Background section of this document. The purpose of the PHAP is to ensure that this health assessment identified public health hazards and provides a plan of action designed to mitigate and prevent adverse human health effects resulting from the past, present and/or future exposure to hazardous substances at or near the site. Included is a commitment on the part of ATSDR and/or NYS DOH to follow up on this plan to ensure that it is implemented. The public health actions planned by US EPA, ATSDR and/or NYS DOH are as follows:

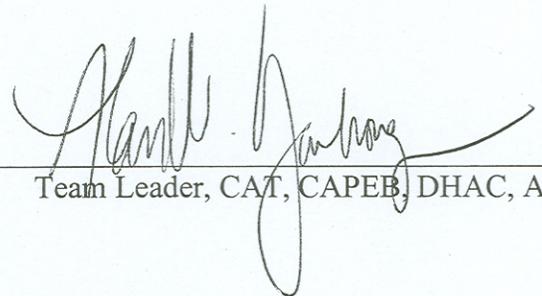
1. NYS DOH and ATSDR will coordinate with the appropriate agencies to implement the recommendations contained in this public health assessment.
2. NYS DOH and ATSDR will make this public health assessment available to the community near the Peninsula Boulevard Groundwater Plume site.
3. US EPA will further investigate the nature and extent of contamination associated with the site. NYS DOH will work with US EPA to ensure sufficient data are collected during the Remedial Investigation to evaluate the potential exposure pathways associated with the site. NYS DOH and ATSDR will evaluate environmental data obtained from this investigation including groundwater, surface water, sediment, soil, indoor air and/or soil gas data as they become available to further evaluate the overall public health implications of the site.
4. ATSDR will reevaluate and expand the PHAP, as needed, outlining the actions completed and those in progress, as well as recommendations for additional actions, if warranted by new environmental, toxicological and/or health outcome data. Follow-up reports will be placed in repositories that contain copies of this public health assessment and will be provided to all persons who request it.

CERTIFICATION

The Public Health Assessment for the Peninsula Boulevard Groundwater Site 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 methodology and procedures existing at the time the public health assessment was initiated. Editorial review was completed by the cooperative agreement partner.


Technical Project Officer, CAT, CAPEB, DHAC

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


Team Leader, CAT, CAPEB, DHAC, ATSDR

AUTHORS, TECHNICAL ADVISORS

New York State Department of Health Authors

Wendy S. Kuehner
Assistant Sanitary Engineer
Bureau of Environmental Exposure Investigation

Scarlett Messier
Research Scientist
Bureau of Environmental Exposure Investigation

Andrea Candara
Research Scientist
Bureau of Toxic Substance Assessment
New York State Department of Health

Donald W.R. Miles
Public Health Specialist
Bureau of Environmental Exposure Investigation

Steven P. Forand
Research Scientist
Bureau of Environmental and Occupational Epidemiology

Steven M. Bates, P.E
Assistant Bureau Director
Bureau of Environmental Exposure Investigation

Agency for Toxic Substances and Disease Registry

Arthur Block
Senior Regional Representative
Region 2
Office of Regional Operations

Gregory V. Ulirsch, Ph. D.
Environmental Health Engineer
Superfund Site Assessment Branch
Division of Health Assessment and Consultation

Leah Graziano
Regional Representative
Region 2
Office of Regional Operations

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Interaction Profile for: 1,1,1-Trichloroethane, 1,1-Dichloroethane, Trichloroethylene and Tetrachloroethylene. Division of Toxicology, Agency for Toxic Substances and Disease Registry, Public Health Service, US Department of Health and Human Services.
- Agency for Toxic Substances and Disease Registry (ATSDR). 1997a. Toxicological Profile for Tetrachloroethylene. U.S. Department of Health and Human Services. Atlanta, Georgia: U.S. Public Health Service.
- Agency for Toxic Substances and Disease Registry (ATSDR). 1997b. Toxicological Profile for Trichloroethylene. U.S. Department of Health and Human Services. Atlanta, Georgia: U.S. Public Health Service.
- Altmann, L., A. Bottger and H. Weigand. 1990. Neurophysiological and psychophysical measurements reveal effects of acute low-level organic solvent exposure in humans. *Int. Arch. Occup. Environ. Health.* 3: 493-499
- Altmann, L., Weigand, H., Bottger, A., F. Elstermeier and G. Winneke. 1992. Neurobehavioral and neurophysiological outcomes of acute repeated perchloroethylene exposure. *Appl. Psych.* 41: 269-279.
- Altmann, L., Florian Neuhan, H., Kramer, U., J. Witten and E. Jermann. 1995. Neurobehavioral and neurophysiological outcomes of chronic low-level tetrachloroethene exposure measured in neighborhoods of dry cleaning shops. *Environ. Res.* 69:83-89.
- Bogen, K.T. and T.E. McKone. 1988. Linking indoor air and pharmacokinetic models to assess tetrachloroethylene risk. *Risk Anal.* 8: 509-20.
- Cavalleri, A., Gobba, F., Palriinieri, M., Fantuzzi, G., E. Righi and G. Aggazzotti. 1994. Perchloroethylene exposure can induce colour vision loss. *Neuroscience Lett.* 179: 162-166.
- Chinery, R.L. and A.K. Gleason. 1993. A compartmental model for the prediction of breath concentration and absorbed dose of chloroform after exposure while showering. *Risk Anal.* 13: 51-62.
- Dawson, V., Johnson, P.D., S.J. Goldberg and J.B. Ulreich. 1993. Cardiac teratogenesis of halogenated hydrocarbon-contaminated drinking water. *J. Am. Coll. Cardiol.* 21:1466-72.
- Fredriksson, A., B.R.G. Danielsson and P. Eriksson. 1993. Altered behavior in adult mice orally exposed to tri- and tetrachloroethylene as neonates. *Toxicol. Lett.* 66:13-19.

Hake, C.L. and R.D. Stewart. 1977. Human exposure to tetrachloroethylene: Inhalation and skin contact. *Environ. Health Perspect.* 21: 231-239.

Isaacson LG, Taylor DH. 1989. Maternal exposure to 1,1,2-trichloroethene affects myelin in the hippocampal formation of the developing rat. *Brain Res.* 488:403-407.

Maxwell, N.I., D.E. Burmaster and D. Ozonoff. 1991. Trihalomethanes and maximum contaminant levels: the significance of inhalation and dermal exposures to chloroform in household water. *Regul. Toxicol. Pharmacol.* 14: 297-312 (review).

McKone, T.E. 1989. Household exposure models. *Toxicol. Lett.* 49: 321-39 (review).

McKone, T.E. and J.P. Knezovich. 1991. The transfer of trichloroethylene (TCE) from a shower to indoor air: Experimental measurements and their implications. *J. Air Waste Manag. Assoc.* 41: 832-7.

Rasmussen K, Arlien-Soborg P, Sabroe S. 1993. Clinical neurological findings among metal degreasers exposed to chlorinated solvents. *Acta Neurol. Scand.* 87:200-204.

Stewart, R.D., Baretta, E.D., H. C. Dodd and T.R. Torkelson. 1970. Experimental human exposure to tetrachloroethylene. *Arch. Environ. Health.* 20: 224-229.

TAMS Consultants, Inc. and GZA Environmental. 2002. Final Remedial Investigation, Grove Cleaners Site No. 130059. New York State Department of Environmental Conservation. Albany, New York.

US Bureau of the Census. 2001. 2000 Census of population and housing summary file 1(SF1). US Department of Commerce.

US Bureau of the Census. 2002. 2000 Census of population and housing summary file 3 (SF3). US Department of Commerce.

U.S. Environmental Protection Agency. 2004. Environmental Response Team. Final Report on Air Sampling at the Peninsula Boulevard Groundwater Plume Site. Hewlett, Nassau County, New York.

U.S. Environmental Protection Agency. 1997. Exposure Factors Handbook. Washington DC: Office of Research and Development. CD-ROM. August 1997.

APPENDIX A
TABLES

Table 1
 Water Quality Standards/Guidelines and Public Health Assessment Comparison Values
 Exceeded by Contaminant Levels Found in Public Water Supply Wells near the Peninsula Boulevard Site
 [All values in micrograms per liter (mcg/L)]

Contaminant	Water Quality Standards/Guidelines				Comparison Values*			
	New York State			US EPA	Cancer	Basis**	Noncancer	Basis**
	Ground Water	Surface Water	Drinking Water	Drinking Water				
tetrachloroethene	5	0.7 ^a	5	5	0.7	EPA CPF	70	EPA RfD Health Canada RfD
trichloroethene	5	5	5	5 ^b	6.1	NYS CPF	10	

* Comparison values determined for a 70-kilogram adult who drinks 2 liters of water per day. The cancer comparison value is the water concentration that provides an intake corresponding to an increased lifetime cancer risk of one-in-one million.

** EPA CPF: U.S. Environmental Protection Agency Cancer Potency Factor
 EPA RfD: U.S. Environmental Protection Agency Reference Dose
 Health Canada RfD: Health Canada Reference Dose
 NYS CPF: New York State Cancer Potency Factor

^aGuidance Value (human health-based value for sources of drinking water).
^bUnder Review

Table 2
Water Quality Standards/Guidelines and Public Health Assessment Comparison
Values Exceeded by Contaminant Levels Found in Surface Water near the Peninsula Boulevard Site
 [All values in micrograms per liter (mcg/L)]

Contaminant	Maximum Detection	Water Quality Standards/Guidelines		Comparison Values*			
		New York State		Cancer	Basis**	Noncancer	Basis**
		Surface Water					
<i>cis</i> -1,2-dichloroethene	17	-	--	--	50,700	US EPA OSRTI RfD	
tetrachloroethene	190	1 ^a	680	EPA CPF	29,400	US EPA IRIS RfD	
trichloroethene	5	40 ^b	9,600	NYS CPF	6,900	Health Canada RfD	
MTBE	25	-	18,400	NYS CPF	176,000	NYS RfD	

* Cancer comparison values for organic chemicals are determined for a 21 kilogram child whose arms and hands are exposed to surface water for 1 hour per day, 2 days per week for 3 months per year for 6 years and who swallows 0.05 liters of surface water per day, 2 days a week, 3 months per year for 6 years. Noncancer comparison values for organic chemicals are determined for a 21 kilogram child whose arms and hands are exposed to shallow surface water for 1 hour per day, 2 days per week for 3 months per year and who swallows 0.05 liters of surface water per day, 2 days a week, 3 months per year. The contact surface area for a 21 kg child (arms and hands) is 1,050 cm².

** EPA CPF: U.S. Environmental Protection Agency Cancer Potency Factor

Health Canada RfD: Health Canada Reference Dose

NYS RfD: New York State Reference Dose

NYS CPF: New York State Cancer Potency Factor

US EPA IRIS: United States Environmental Protection Agency Integrated Risk Information System Reference Dose

US EPA OSRTI RfD: United States Environmental Protection Agency Office of Superfund Remediation and Technology Innovation Reference Dose

NA: None Available

^aGuidance Value for Class C surface waters, based on human consumption of fish.

^bStandard for Class C surface waters, based on human consumption of fish.

APPENDIX B
FIGURES

Figure 1
Peninsula Boulevard Groundwater Plume Site
Hewlett, Nassau County, New York

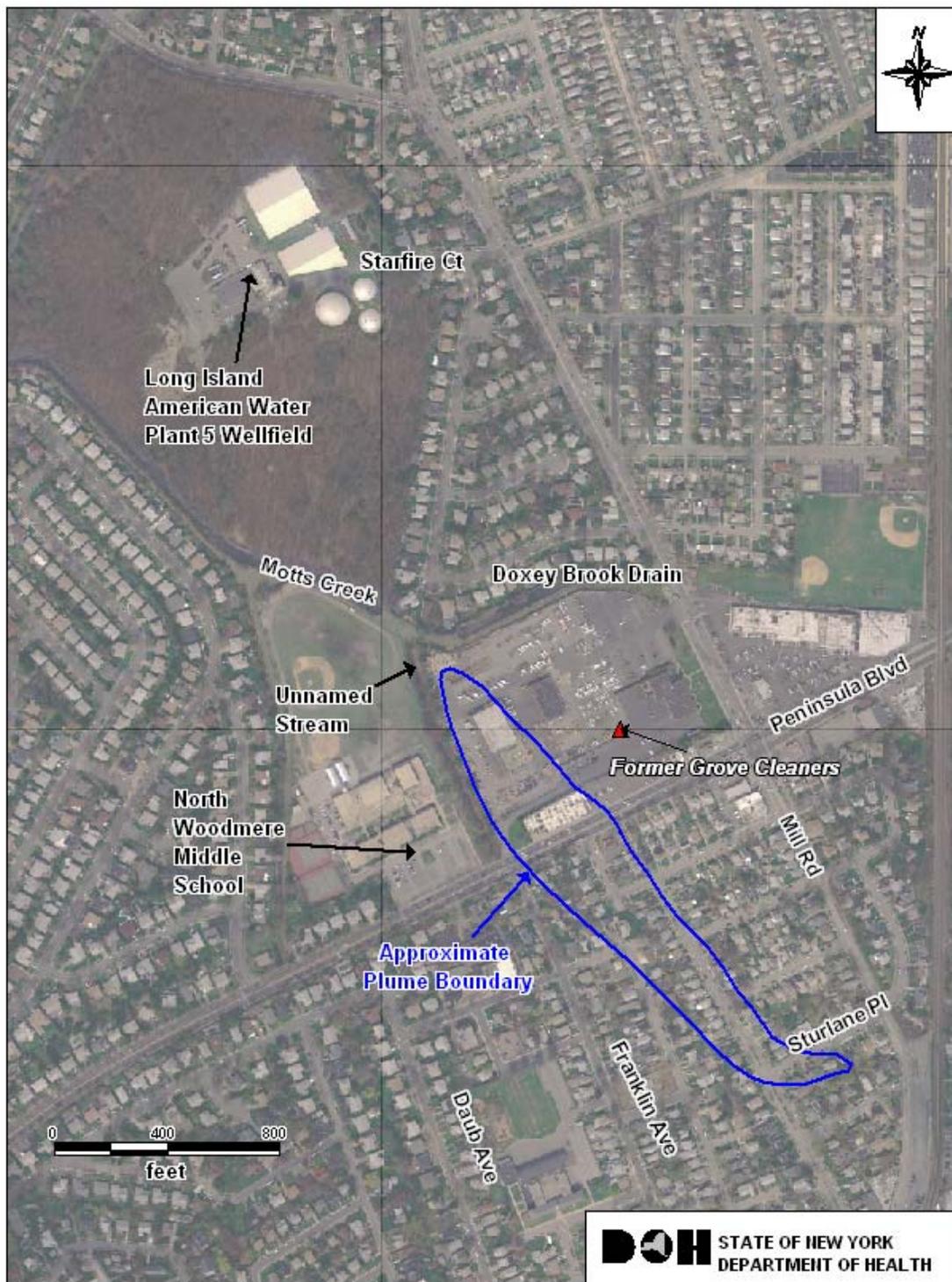


Figure 2
Tetrachloroethene Groundwater Contours
(all values in mcg/L)

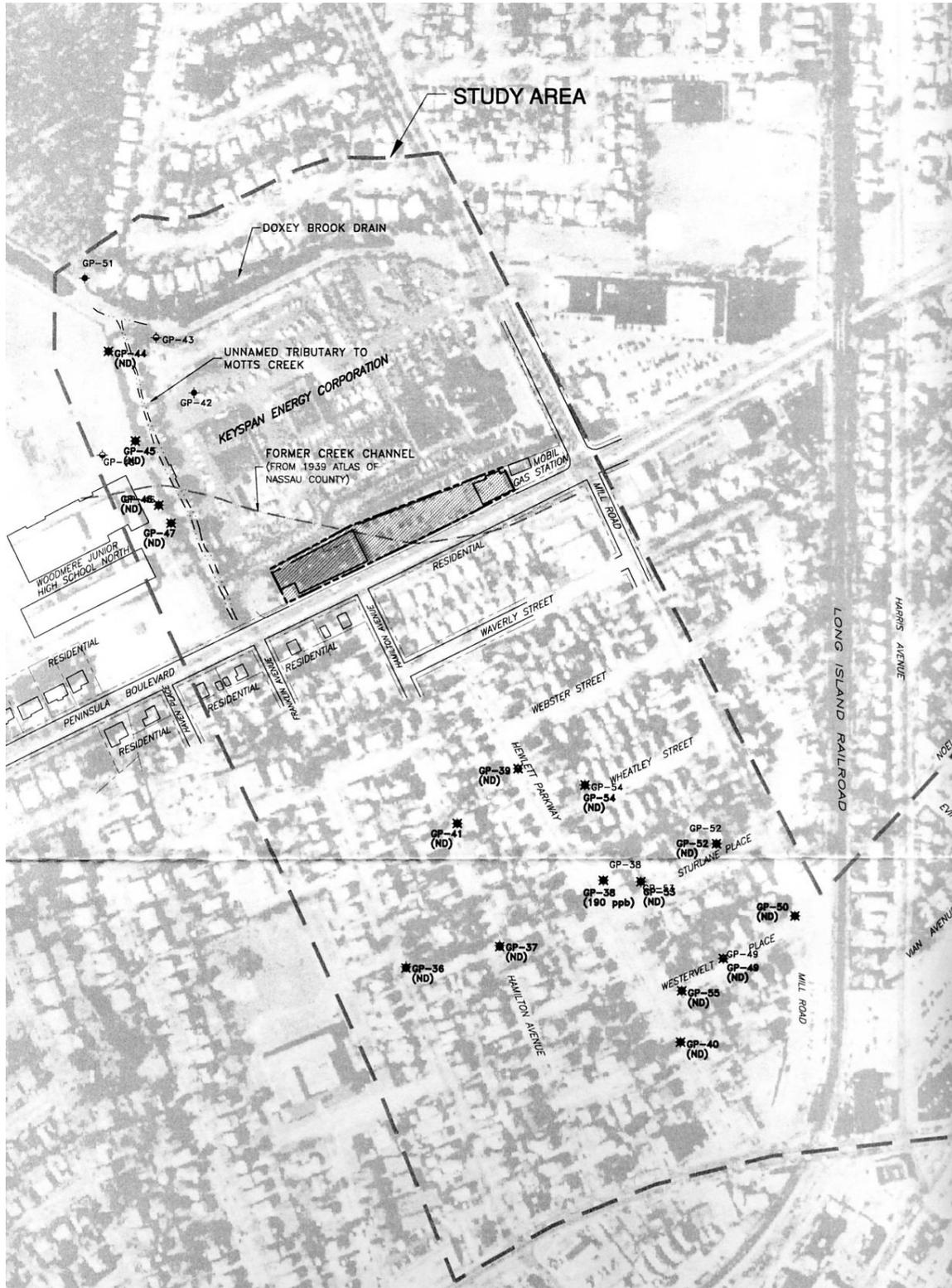


Figure 3
Sample Locations in Study Area



*GZA GeoEnvironmental of New York, February 2002

Figure 4
Soil Gas Sample Locations in Study Area



*GZA GeoEnvironmental of New York, February 2002

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

NYS DOH PROCEDURE FOR EVALUATING POTENTIAL HEALTH RISKS
FOR CONTAMINANTS OF CONCERN

To evaluate the potential health risks from contaminants of concern associated with the Peninsula Boulevard Groundwater Contamination 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 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

<u>Risk Ratio</u>	<u>Qualitative Descriptor</u>
equal to or less than one per million	very low
greater than one per million to less than one per ten thousand	low
one per ten thousand to less than one per thousand	moderate
one per thousand to less than one per ten	high
equal to or greater than one per 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 general consensus among the scientific and regulatory communities on what level of estimated excess cancer risk is acceptable. An increased lifetime cancer risk of 1-in-1 million or less is generally not considered a significant public health concern.

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 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

<u>Ratio of Estimated Contaminant Intake to Risk Reference Dose</u>	<u>Qualitative Descriptor</u>
equal to or less than the risk reference dose	minimal
greater than one to five times the risk reference dose	low
greater than five to ten times the risk reference dose	moderate
greater than ten times the risk reference dose	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. A ratio equal to or less than one is generally not considered a significant public health concern. 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. This level of concern depends upon an evaluation of a number of factors such as the actual potential for exposure, background exposure, and the strength of the toxicologic data.

APPENDIX D
PUBLIC HEALTH HAZARD CATEGORIES

INTERIM PUBLIC HEALTH HAZARD CATEGORIES

CATEGORY / DEFINITION	DATA SUFFICIENCY	CRITERIA
<p>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.</p>	<p>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.</p>	<p>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.</p>
<p>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.</p>	<p>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.</p>	<p>Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radio nuclides) 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.</p>
<p>C. Indeterminate Public Health Hazard This category is used for sites in which “critical” data are <i>insufficient</i> with regard to extent of exposure and/or toxicologic properties at estimated exposure levels.</p>	<p>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.</p>	<p>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.</p>
<p>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.</p>	<p>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.</p>	<p>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.</p>
<p>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.</p>	<p>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</p>	

*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

Summary of Public Comments and Responses

Appendix E

Summary of Public Comments and Responses

This summary was prepared to address comments and questions on the public comment draft of the Peninsula Boulevard Groundwater Plume Public Health Assessment. The public was invited to review the draft during the public comment period, which ran from August 14th, 2006 to September 14th, 2006. NYS DOH received four comments from one resident. Some statements were reworded for clarity. If you have any questions about this summary, you can contact the New York State Department of Health's (NYS DOH) project manager for the site at the toll-free number: 1-800-458-1158, extension 27880.

Comment #1: Is the groundwater contaminant plume moving?

Response #1: Yes, the groundwater contaminant plume moves slowly (approximately 17 feet per year)¹ in a northwesterly direction. The source and extent of groundwater contamination are being investigated as part of the ongoing remedial investigation.

Comment #2: Can public drinking water from another wellfield (other than Plant 5 wellfield) plant be used for this area? If not, why not?

Response #2: Yes, but there is no need. The deep supply wells are currently treated with two air stripping towers to remove volatile organic compounds. Their performance is monitored quarterly as per the NYS DOH Part 5 Standards for Public Drinking Water.

Comment #3: Is there a risk of exposure via ingestion, direct contact, and inhalation of vapors (e.g. contact and volatilization during showering) after the installation of the treatment system?

Response #3: There is minimal risk of exposure because treatment is designed to remove the chemicals before the water is distributed to consumers. Levels below the detection limit and standards may be present, but these levels would be associated with a minimal, non detectable exposure from using distributed water.

Comment #4: How will we know if levels increase?

Response #4: If levels of contaminants in public drinking water increase, it should be caught during routine annual monitoring at the drinking water facility. In the event that drinking water is distributed with contaminants above drinking water standards the utility is required to notify all customers. Recent monitoring data can be found at the water district's website http://www.liwater.com/awpr1/nyaw/newsroom/reports_notifications/index.html

¹ TAMS Consultants, Inc. and GZA Environmental. 2002. Final Remedial Investigation, Grove Cleaners Site No. 130059. New York State Department of Environmental Conservation. Albany, New York.

APPENDIX F
ATSDR Glossary of Terms

ATSDR Glossary of Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health. This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-422-8737.

General Terms

Absorption - The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute - Occurring over a short time [compare with chronic].

Acute exposure - Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect - A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect - A change in body function or cell structure that might lead to disease or health problems

Aerobic - Requiring oxygen [compare with anaerobic].

Ambient - Surrounding (for example, *ambient* air).

Anaerobic - Requiring the absence of oxygen [compare with aerobic].

Analyte - A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study - A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect - A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Background level - An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation - Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study - A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

Biologic monitoring - Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake - The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing - Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota - Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden - The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

Cancer - Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk - A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen - A substance that causes cancer.

Case study - A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study - A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number - A unique number assigned to a substance by the American Chemical Society Abstracts Service.

Central nervous system - The part of the nervous system that consists of the brain and the spinal cord.

CERCLA - [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

Chronic - Occurring over a long time [compare with acute].

Chronic exposure - Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Cluster investigation - A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP) - A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV) - Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway - [see exposure pathway].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) - CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration - The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant - A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect - A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal - Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact - Contact with (touching) the skin [see route of exposure].

Descriptive epidemiology - The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit - The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention - Measures used to prevent a disease or reduce its severity.

Disease registry - A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD - United States Department of Defense.

DOE - United States Department of Energy.

Dose (for chemicals that are not radioactive) - The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals) - The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship - The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Environmental media - Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism - Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA - United States Environmental Protection Agency.

Epidemiologic surveillance - [see Public health surveillance].

Epidemiology - The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure - Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment - The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction - A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation - The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway - The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure registry - A system of ongoing followup of people who have had documented environmental exposures.

Feasibility study - A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS) - A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds - Training sessions for physicians and other health care providers about health topics.

Groundwater - Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Half-life ($t_{1/2}$) - The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard - A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat) - The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste - Potentially harmful substances that have been released or discarded into the environment.

Health consultation - A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education - Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation - The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Health promotion - The process of enabling people to increase control over, and to improve, their health.

Health statistics review - The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard - The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence - The number of new cases of disease in a defined population over a specific time period.

Ingestion - The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation - The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure - Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

In vitro - In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

In vivo - Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

Lowest-observed-adverse-effect level (LOAEL) - The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring - A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism - The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite - Any product of metabolism.

mg/kg - Milligram per kilogram.

mg/cm² - Milligram per square centimeter (of a surface).

mg/m³ - Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration - Moving from one location to another.

Minimal risk level (MRL) - An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

Morbidity - State of being ill or diseased, the occurrence of a disease or condition that alters health and quality of life.

Mortality - Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

Mutagen - A substance that causes mutations (genetic damage).

Mutation - A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL) - EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP) - Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard - A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL) - The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard - A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL - [see National Priorities List for Uncontrolled Hazardous Waste Sites]

Physiologically based pharmacokinetic model (PBPK model) - A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica - A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume - A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure - The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population - A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP) - A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb - Parts per billion.

ppm - Parts per million.

Prevalence - The number of existing disease cases in a defined population during a specific time period.

Prevalence survey - The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention - Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public availability session - An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period - An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action - A list of steps to protect public health.

Public health advisory - A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA) - An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Public health hazard - A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories - Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories

might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement - The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance - The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Public meeting - A public forum with community members for communication about a site.

Radioisotope - An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide - Any radioactive isotope (form) of any element.

RCRA - [see Resource Conservation and Recovery Act (1976, 1984)]

Receptor population - People who could come into contact with hazardous substances [see exposure pathway].

Reference dose (RfD) - An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry - A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

Remedial investigation - The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA) - This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA - RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD - [see reference dose]

Risk - The probability that something will cause injury or harm.

Risk reduction - Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication - The exchange of information to increase understanding of health risks.

Route of exposure - The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor - [see uncertainty factor]

SARA - [see Superfund Amendments and Reauthorization Act]

Sample - A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size - The number of units chosen from a population or an environment.

Solvent - A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination - The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations - People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder - A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics - A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance - A chemical.

Substance-specific applied research - A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund - [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)]

Superfund Amendments and Reauthorization Act (SARA) - In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water - Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Surveillance - [see public health surveillance]

Survey - A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect - A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

Teratogen - A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent - Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile - An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology -The study of the harmful effects of substances on humans or animals.

Tumor - An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor - Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from

animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard - A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs) - Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:

Environmental Protection Agency - <http://www.epa.gov/OCEPAterms/>

National Library of Medicine (NIH) - <http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>

For more information on the work of ATSDR, please contact
NCEH/ATSDR Office of Communication, Information Services Center
1600 Clifton Road, N.E. (MS E-29)
Atlanta, GA 30333
Telephone: 1-888-422-8737