# Health Consultation

**HOPEWELL PRECISION AREA**
**GROUNDWATER CONTAMINATION SITE**
**TOWN OF EAST FISHKILL,**
**DUTCHESS COUNTY, NEW YORK**

EPA FACILITY ID: NYD066813064

**Prepared by:**
**New York State Department of Health**

JULY 3, 2012

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

**Health Consultation: A Note of Explanation**

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

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

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

# HEALTH CONSULTATION

## HOPEWELL PRECISION AREA
## GROUNDWATER CONTAMINATION SITE
## TOWN OF EAST FISHKILL,
## DUTCHESS COUNTY, NEW YORK

EPA FACILITY ID: NYD066813064

Prepared By:

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

For additional information about this document, you may contact the:

New York State Department of Health
Center for Environmental Health

Empire State Plaza
Corning Tower
Albany, New York 12237
518-402-7880 or 1-800-458-1158
E-mail beei@health.state.ny.us

## TABLE OF CONTENTS

## SUMMARY

### INTRODUCTION

A New York State Department of Health (DOH) and Agency for Toxic Substances and Disease Registry (ATSDR) priority is to provide the community with the best information available about how contaminants from the Hopewell Precision Area Groundwater Contamination Site might affect their health.

This health consultation summarizes the progress made on the recommendations presented in the 2007 Public Health Assessment (PHA). This includes an evaluation of the additional site data collected during the remedial investigation conducted at the site from January 2006 through August 2007 and a summary of the resulting actions taken by the United States Environmental Protection Agency (EPA) to protect public health.

Between February 2006 and March 2007, the EPA implemented an expanded soil vapor intrusion investigation at the Hopewell Precision Area Groundwater Contamination Site. During the course of the investigation, the EPA collected 208 sub-slab (below building) samples and 14 indoor air (inside building) samples from nearby residences.

The EPA defined the nature and extent of the groundwater and soil-vapor contamination from the Hopewell Precision Area Groundwater Contamination Site through the collection and analysis of groundwater and soil vapor samples. The result of this investigation forms the basis for the conclusions and recommendations by DOH and ATSDR presented in this document. The EPA issued a Record of Decision to bring a public water supply to the study area and a second Record of Decision to use aerobic cometabolic biodegradation to remediate the contaminated aquifer while continuing to monitor for and address any occurrences of soil vapor intrusion. Aerobic cometabolic biodegradation is a technology that accelerates contaminant degradation by enhancing the existing microorganisms in the groundwater.

This health consultation was distributed for public comment from September 11$^{th}$ 2011 until October 14$^{th}$ 2011. DOH received multiple written comments; a summary of these comments and DOH's responses are included in Appendix E.

---

### CONCLUSION 1

DOH and ATSDR conclude that, currently, site-related contamination is not expected to harm people's health from using water from private wells for drinking, bathing and cooking.

### BASIS

This is because treatment systems have been installed on private wells where contaminants were found to be above the DOH's Maximum Contaminant Levels (MCLs). These systems are monitored and maintained to make sure that contaminants remain below the MCLs.

## NEXT STEPS

EPA and the New York State Department of Environmental Conservation (DEC) will maintain the installed treatment systems and monitor the quality of treated water until contaminant levels in the groundwater are below MCLs or until the planned public water supply system is installed and residences have been connected to it. Although all currently known exposures to site-related contaminants above MCLs have been mitigated, if new private wells are installed within the study area, additional treatment systems may be needed.

---

## CONCLUSION 2

DOH and ATSDR conclude that breathing indoor air in buildings potentially affected by soil vapor contaminants is not expected to harm people's health.

## BASIS

This is because actions were taken to reduce exposure. Based on information gathered before and during the remedial investigation, public health actions were needed at the Hopewell Precision Area Groundwater Contamination Site to reduce exposure to site-related volatile organic compounds (VOCs) via inhalation.

## NEXT STEPS

EPA will maintain the soil vapor mitigation systems (sub-slab depressurization systems) until contaminated environmental media have been remediated and an evaluation has been performed to verify that the potential for exposure has been alleviated.

EPA will institute a periodic soil vapor intrusion sampling plan to ensure that all homes in the study area will have been sampled at least once, and that previously sampled homes will be revisited to determine if conditions have changed.

EPA has advised the Town of East Fishkill that anyone building a new home over the contaminant plume should install a sub-slab depressurization system to prevent or mitigate exposure to site-related contaminants.

---

## FOR MORE INFORMATION

If you have questions about the investigation at the Hopewell Precision Area Groundwater Contamination Site, please contact the EPA at 1-212-637-4240. If you have questions about this health consultation or other health concerns about this site, please contact Kristin Kulow (DOH) at 1-607-432-3911.

## BACKGROUND AND STATEMENT OF ISSUES

### A. Site Description and History

The Hopewell Precision Area Groundwater Contamination Site (the site) is in the Hamlet of Hopewell Junction, Dutchess County, New York (Appendix A, Figure 1). The source of contamination is believed to be the Hopewell Precision facility, an active sheet metal fabrication and painting business. The facility, which opened in 1977, originally operated at 15 Ryan Drive but was moved to 19 Ryan Drive in 1981. Since 1981, a moving company has occupied the property at 15 Ryan Drive. The combined size of these two adjacent properties is 5.7 acres. The facility and the associated groundwater and soil vapor contamination plumes are in a semi-rural, mostly residential area.

The waste products associated with the Hopewell Precision Facility included paints, thinners, and degreasing solvents. Allegedly, paint and thinners were dumped directly to the ground outside of the building at 15 Ryan Drive on a daily basis and waste degreasing solvents were dumped on a biweekly basis. Proper disposal of trichloroethene (TCE) used in site operations could not be documented due to missing waste manifest documents. EPA first investigated this site in response to a letter written by a concerned citizen. EPA confirmed the allegations of dumping during a site inspection in November 1979. At that time, several punctured and leaking 55-gallon drums of various chemicals, and empty paint and solvent cans were identified on-site. A removal action was performed, which properly disposed of the identified waste. In March 1980, EPA sampled the on-site process well and found low-level volatile organic compound (VOC) contamination. The site was subsequently referred to DEC for further investigation.

DEC completed an investigation of the site in 1984 and a supplemental investigation in 1987 (DEC 1987). As part of these investigations, DEC installed three on-site groundwater monitoring wells in May of 1985. Subsequent sampling identified one well with 1,1,1-trichloroethane (1,1,1-TCA) at 23 micrograms per liter (mcg/L) and trace levels of other VOCs. In June 1985, the Dutchess County Health Department sampled four private wells (two residential and two businesses, including the Hopewell Precision on-site well). No VOCs were detected in any of the samples.

In April 1993, the site owners completed a limited site investigation which included sampling of the three previously installed groundwater monitoring wells and two residential private wells. DEC collected samples at the same time during this investigation. TCE was only detected in one on-site monitoring well at a level below the New York State Department of Health's MCL for public water supplies. In 1994, based on the results of these investigations, DEC decided to remove the Hopewell Precision Area Groundwater Contamination Site from the New York State Registry of Inactive Hazardous Disposal Waste Sites.

In February 2003, as part of an effort to make decisions about the need for additional actions on former sites, EPA sampled 75 residential wells near the site. Analysis of the samples revealed that five residential wells were contaminated with TCE at levels

ranging from 1.2 mcg/L to 250 mcg/L. At that time DEC, on behalf of the DOH, requested EPA conduct a removal action at the site (i.e., installation of point-of-entry treatment systems on residential wells). A removal action is a short-term measure taken to reduce human exposure.

EPA initiated a second removal action at the site in March 2003. Subsequently, EPA expanded the scope of its investigation to include sampling of sub-slab soil vapor, indoor air, and additional drinking water wells. Prior to 2006, EPA collected sub-slab soil vapor samples from 206 buildings and indoor air samples from 103 buildings (mainly residential) located over the plume. Based on those results, EPA installed sub-slab depressurization systems at 46 buildings that were determined by EPA to be impacted or to have the potential to be impacted by soil vapor intrusion. A sub-slab depressurization system functions by applying a low level of suction or vacuum below the building's foundation. The vacuum created prevents vapors beneath the building from entering the structure and, instead, vents them to the outside.

As of the spring of 2006, 51 treatment systems for private drinking water (37 by EPA and 14 by DEC) had been installed to address the TCE contamination, 1,1,1-TCA contamination, or both. With the exception of one homeowner who has refused the installation of treatment systems to remove 1,1,1-TCA from their drinking water, no known completed exposure pathways to site-related contaminants in excess of the DOH MCLs exist for the site.

The DOH completed a PHA on September 28, 2007 (ATSDR 2007) to evaluate human exposure pathways for contaminants related to the site. This evaluation included data collected from 2003 to the spring of 2006. The DOH and ATSDR recommended that the EPA: 1) finish defining the nature and extent of the groundwater and soil-vapor contamination from the site through the ongoing remedial investigation; 2) maintain the installed sub-slab depressurization systems until the contamination levels are below EPA site-specific target levels; 3) continue monitoring potentially affected private wells, soil vapor and indoor air in the area, with treatment systems or mitigation systems added as appropriate; and 4) consider a permanent, long-term remedy for groundwater users.

In addition, several public meetings have been conducted to answer health concerns raised by residents and to discuss the current activities taking place at the site. DOH and ATSDR also requested resident assistance in identifying their health care providers so that educational outreach to the health care providers could be targeted. Area physicians were informed of the availability of the "Physician Outreach Packet" which contains several informative ATSDR documents and reference material.

The DOH completed a health consultation titled "Health Statistics Review: Birth Outcomes and Cancer" on December 15, 2010 (ATSDR 2010). The health statistics review looked at health outcomes among the population near the site and compared them with expected outcomes based on statewide data. A summary of these results is provided in the health outcome data evaluation section below.

The remedial investigation defined the nature and extent of the contamination at the study site. Based on those data, the EPA issued a Record of Decision in September 2008 (EPA 2008) to bring a public water supply to the study area and issued a July 2009 Record of Decision (EPA 2009) to use aerobic cometabolic biodegradation to remediate the contaminated aquifer while continuing to monitor for and address any occurrences of soil vapor intrusion. Aerobic cometabolic biodegradation is an innovative technology that accelerates contaminant degradation by enhancing the existing microorganisms present in the groundwater.

### B. Statement of Issues

This health consultation summarizes the progress made on the recommendations presented in the 2007 PHA. This includes an evaluation of the additional site data collected during the Remedial Investigation conducted at the site from January 2006 through August 2007 and a summary of the resulting actions taken by the EPA to protect public health.

## DISCUSSION

### A. Environmental Contamination and Exposure Pathways

Private Drinking Water Wells

In August 2006, 48 residential wells in the southern portion of the groundwater contaminant plume were sampled (Appendix B, Table 1). The predominant contaminant in this portion of the groundwater plume is 1,1,1-TCA, which was detected in 25 percent, or 12 of the 48 wells, at levels ranging from 0.11J mcg/L to 2.2 mcg/L ("J" is used to denote an estimated value). Seventeen percent, or 8 of the 48 wells, contained TCE at levels ranging from 0.13J mcg/L to 4.7 mcg/L. The levels of 1,1,1-TCA and TCE detected were below public drinking water standards and public health comparison values (Appendix B, Table 4).

In August 2007, 195 additional residential wells were sampled (Appendix B, Table 1). 1,1,1-TCA was detected in 12 percent, or 23 of the 195 wells, ranging in concentration from 0.5J mcg/L to 3.3 mcg/L. TCE was detected in eight percent, or 16 of the 195 wells, at levels ranging from 0.53 mcg/L to 7.4 mcg/L. The detection of 7.4 mcg/L for TCE was the only sample result above the drinking water standard and public health comparison value (Appendix B, Table 4). A treatment system was subsequently installed at this residence.

Based on the data collected during the Remedial Investigation, the nature and extent of the groundwater contamination from the site has been defined and currently there are no completed exposure pathways to site-related contaminants in drinking water at levels

above public drinking water standards or public health comparison values (Appendix A, Figure 1).

Soil Vapor / Indoor Air

The EPA's general approach for evaluating soil vapor intrusion at the site was to screen using the sub-slab vapor sample results and, where values exceed screening criteria, follow up with indoor air and sub-slab vapor sampling.

In February and March 2006, 73 sub-slab vapor samples were collected by EPA from buildings located over the southern portion of the groundwater plume (Appendix B, Table 2). TCE was detected in two samples, one sample was collected from two homes, one at a concentration of 1.5 micrograms per cubic meter (mcg/$m^3$) and one at 18 mcg/$m^3$. EPA's sub-slab screening criterion for TCE was 2.7 mcg/$m^3$. 1,1,1-TCA was detected at 31 sampling locations, none of which exceeded the EPA screening criterion of 820 mcg/$m^3$. Tetrachloroethene (PCE) was detected in 22 samples, none of which exceeded EPA's sub-slab vapor screening criterion of 100 mcg/$m^3$. Methyl-tert-butyl ether (MTBE) was detected in four sub-slab samples; none exceeded the EPA screening criterion of 3.7 mcg/$m^3$.

In February and March 2007, 135 sub-slab vapor samples were collected by EPA from buildings overlying the groundwater plume (Appendix B, Table 2). TCE was detected in 27 samples; 1,1,1-TCA was detected in 78 samples; and PCE was detected in 53 sub-slab vapor samples.

Later in March 2007, EPA collected concurrent indoor air, sub-slab vapor, and ambient outdoor air samples from 14 buildings that were sampled in February and early March 2007, where results indicated an exceedance of the sub-slab screening criteria in the sampling event or where no sub-slab sample had been taken previously (Appendix B, Table 3). In addition, sub-slab only samples were collected from four other buildings also not previously sampled (not shown on Table 3). TCE was detected in 13 of 18 sub-slab vapor samples (11 in the buildings previously sampled) and in seven indoor air samples. Five of these indoor air TCE levels were higher than levels found in a DOH study of indoor air levels in homes, which were general below 1 mcg/$m^3$ (DOH 2005). One (Building 5) exceeded the DOH air guideline value and the health comparison value with in indoor air concentration of 20 mcg/$m^3$ (Appendix B, Table 5).

1,1,1-TCA was detected in 11 sub-slab vapor samples (all in the buildings previously sampled). 1,1,1-TCA was detected in four indoor air samples; none exceeded indoor air background levels (3 mcg/$m^3$) or the health comparison value.

PCE was detected in five sub-slab vapor samples (all in the buildings previously sampled) and was detected in five indoor air samples. PCE in indoor air exceeded indoor air background levels in one sample (98 mcg/$m^3$ in Building #7), however, this concentration is below DOH's air guideline value for PCE of 100 mcg/$m^3$. A sub-slab depressurization system was not installed at Building #7 because it was found to contain

a maintenance area within the single family residence that used PCE, which subsequently impacted soil vapor beneath the property. Guidance was presented to the owner on how to reduce exposure to PCE in indoor air.

Based on the sampling conducted in March 2007, site-related contaminants were identified in the indoor air of the following Buildings: 2, 5, 7, 8, 9, 11 and 12. The EPA installed sub-slab depressurization systems in three residential buildings that were determined to be impacted or have the potential to be impacted by vapor intrusion: Buildings 2, 8 and 9 (Appendix B, Table 3). Building 7 had TCE in indoor air at a level slightly higher than generally found in indoor air in homes. The TCE did not appear to be attributed to soil vapor intrusion since the sub-slab vapor sample did not contain TCE. Additionally, one homeowner (Building 11) was offered a system, but refused installation; and one home (Building 5) was determined to have an indoor source contributing to elevated TCE levels in indoor air. The EPA did not offer a system to the responsible party (Building 12) since they were the source of the site-related contamination and are currently an active manufacturing facility. The EPA will continue to sample buildings within the site study area and maintain the sub-slab depressurization systems it has installed.

## B. Public Health Implications - Adult and Children's Health Concerns

To evaluate the potential health risks from contaminants of concern associated with the exposure pathways identified for the site, DOH assessed the risks for cancer and non-cancer health effects. The risks for health effects depend primarily on contaminant concentration, exposure route, exposure frequency and exposure duration. There are two primary potential routes of exposure for the site: 1) past ingestion, dermal contact, and inhalation of volatile organic contaminants in private water supply wells; and 2) past inhalation of volatile organic contaminants in indoor air via soil vapor intrusion. Based on the analytical data collected during the initial site Remedial Investigation, the theoretical cancer risks associated with past exposure to site-related contaminants detected in private water supply wells and indoor air range from low to moderate, and the non-cancer health risks range from minimal to moderate (Appendix C). Levels of contaminants and exposures found by EPA during the phase of the investigation reported in this health consultation are less than or the same as those evaluated by the DOH in the 2007 PHA. A detailed evaluation of health risks is presented in the 2007 PHA (ATSDR 2007).

Since the time the public health assessment was written, the EPA revised its TCE and PCE toxicity values and its guidance for estimating TCE cancer risks (EPA, 2011, 2012). Using these revised toxicity values and guidance to evaluate contamination in indoor air and drinking water near the Hopewell Precision Area Groundwater Contamination Site would result in slightly different quantitative estimates of cancer and noncancer health risks compared to those estimated with the previous toxicity values and guidance. However, the revised toxicity values and guidance would not change the overall conclusions of the health consultation. This is because public health actions were taken to reduce exposure to site-related volatile organic compounds in drinking water and in

indoor air. Treatment systems were installed on private wells where contaminants were found to be above the New York State and US EPA public drinking water standards (i.e., maximum contaminant levels), and soil vapor mitigation systems (sub-slab depressurization systems) were installed in homes that were determined to be impacted or to have the potential to be impacted by soil vapor intrusion. Since the exposures were mitigated, the DOH and ATSDR concluded that site-related contamination is not expected to harm people's health.

### C. Health Outcome Data Evaluation – Health Statistics Review of Cancer and Birth Outcomes

The health consultation that DOH and ATSDR released in December 2010 included a birth outcomes review and a cancer review (DOH 2010). The birth outcomes review showed that the number of premature births and male births (sex ratio) in the Hopewell study area were similar to expected numbers. The low birth weight and growth restriction outcome categories, which largely overlap, all showed deficits (fewer than expected numbers); the small for gestational age category showed a statistically significant deficit. The number of birth defects in the study area was similar to the number expected. There was no evidence of elevations of major heart defects or cleft palate, which are birth defects found in excess in some other studies of VOC exposures. The pattern of specific types of birth defects did not appear to be unusual. The total number of cancers diagnosed among residents of the study area was similar to the number expected and no specific type of cancer showed a statistically significant excess or deficit. This review found no excesses of lymphoma or kidney cancer, two types of cancer associated with VOC exposure in some other studies. Esophageal cancer, associated with VOC exposures in some studies, was elevated in the study area, but the elevation was not statistically significant.

Responses to public comments and additional information about the geographic distribution of cancer cases within the Hopewell study area, an issue brought up at the public meeting in the Fall of 2009 and in comments on the draft report, are included in an appendix to the final report. In response to public comments, DOH conducted additional analyses of cancer with respect to distance from both the site and the area of groundwater contamination. We compared the location of households where an individual was diagnosed with cancer to the location of households without a diagnosis of cancer. By comparing these locations, we could determine if there was an unusual spatial pattern of households with cancer diagnoses. No statistically significant difference was observed between households with a cancer diagnosis and households without a cancer diagnosis with respect to distance from either the Hopewell Precision Area Groundwater Contamination Site or the area of groundwater contamination. For more information on the study area, timeframe, and limitations of this type of review, see the full report and information sheet (DOH 2010).

## CONCLUSIONS

DOH and ATSDR conclude that current ingestion of water from private water supply wells on the site or breathing indoor air within structures built on the site is not expected to harm people's health (Appendix D). Based on the additional information gathered during the Remedial Investigation, public health actions were needed at the site to reduce exposure to site-related VOCs, primarily TCE and 1,1,1-TCA. Exposure to TCE and 1,1,1-TCA was occurring via contaminated private well water and via soil vapor intrusion impacts to indoor air. Actions have been taken to reduce exposures to site-related contaminants (except for the individual that declined a system or had an indoor source). If new construction of buildings or installation of private wells occurs in areas overlying the contaminant plume, additional actions may be needed.

## RECOMMENDATIONS

1. Maintain installed treatment systems and monitor the quality of the treated water until contamination levels in groundwater are below DOH MCLs or until the planned public water supply system is installed and residences are connected to it.

2. Maintain and operate the soil vapor mitigation systems (sub-slab depressurization systems) until contaminated environmental media have been remediated and an evaluation has been performed to verify that the potential for exposure has been reduced or eliminated.

3. Continue EPA's periodic soil vapor intrusion sampling plan so that all homes in the study area will have been sampled at least once and that previously sampled homes will be revisited to determine if conditions have changed.

## PUBLIC HEALTH ACTION PLAN

The purpose of the Public Health Action Plan is to provide a plan of action designed to outline measures to be taken to mitigate exposure and reduce the potential for adverse human health effects resulting from past, present, and/or future exposure to hazardous substances at or near the site. Included is a commitment on the part of DOH and/or ATSDR to follow up on this plan so that it is implemented. The Public Health Action Plan for the Hopewell Precision Area Groundwater Contamination Site describes actions to be taken by DOH and/or ATSDR following completion of this health consultation. Please refer to the Background section of this health consultation for actions already taken at the site. The recommended public health actions to be implemented are as follows:

1. The EPA and DEC will continue to monitor and maintain the individual treatment systems installed on affected private wells until the planned public water supply system is installed and residences are connected to it.

2. The EPA will continue to monitor and maintain the sub-slab depressurization systems installed on affected homes.

## REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry) 2007. Public Health Assessment Hopewell Precision. U.S. Department of Health and Human Services. Atlanta, Georgia: U.S. Public Health Service.

ATSDR (Agency for Toxic Substances and Disease Registry) 2010. Health Consultation; Health Statistics Review: Birth Outcomes and Cancer, Hopewell Precision Contamination Site. U.S. Department of Health and Human Services. Atlanta, Georgia: U.S. Public Health Service.

DEC (New York State Department of Environmental Conservation), 1987. Engineering Investigations at Inactive Hazardous Waste Sites in the State of New York Phase II Investigations – Hopewell Precision Site. Wehran Engineering P.C.

DOH (New York State Department of Health), 2005. Study of Volatile Organic Chemicals in Air of Fuel Oil Heated Homes. Troy, NY: Center for Environmental Health, Bureau of Toxic Substance Assessment.

DOH (New York State Department of Health), 2006. Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York. Troy, NY: Center for Environmental Health, Bureau of Environmental Exposure Investigation.

EPA (United States Environmental Protection Agency), 2008. Record of Decision, Hopewell Precision.

EPA (United States Environmental Protection Agency) 2009. Record of Decision, Hopewell Precision.
http://www.epa.gov/superfund/sites/rods/fulltext/r2009020003713.pdf

EPA (United States Environmental Protection Agency). 2011. Integrated Risk Information System. Trichloroethylene. Accessed (March 1, 2012) on line at http://www.epa.gov/iris/subst/0199.htm

EPA (United States Environmental Protection Agency). 2012. Integrated Risk Information System. Tetrachloroethylene. Accessed (March 1, 2012) on line at http://www.epa.gov/iris/subst/0106.htm

## AGENCY INFORMATION

### New York State Department of Health Authors

Kristin Kulow
Public Health Specialist
Bureau of Environmental Exposure Investigation

Thomas Johnson, Ph.D.
Research Scientist
Bureau of Toxic Substance Assessment

Nathan M. Walz
Public Health Specialist
Bureau of Environmental Exposure Investigation

Don Miles
Public Health Specialist
Bureau of Environmental Exposure Investigation

### ATSDR Technical Project Officer

Gregory V. Ulirsch, Ph.D.
Environmental Health Scientist
Division of Community Health Investigation

### ATSDR Regional Representatives

Leah Graziano, R.S.
Regional Director - Region 2
Division of Community Health Investigation

Elena Vaouli
Lieutenant Commander, US Public Health Service
Regional Representative, Region 2

# APPENDIX A

# FIGURES

## FIGURE 1. SITE LOCATION AND GROUNDWATER PLUME MAP

### Hopewell Precision Area Groundwater Contamination Site
### Hopewell Junction, Dutchess County, New York

# APPENDIX B

# TABLES

Table 1: Summary of EPA 2006/2007 Private Well Sampling Results for TCE and 1,1,1-TCA in 243 Homes in the Hopewell Precision Area Groundwater Contamination Site

*All values in micrograms per liter (mcg/L).*

| | August 2006 | | August 2007 | |
|---|---|---|---|---|
| **Chemical** | **Detections** | **Concentration Range** | **Detections** | **Concentration Range** |
| TCE | 8/48 | 0.13J - 4.7 | 16/195 | 0.53 - 7.4 |
| 1,1,1-TCA | 12/48 | 0.11J - 2.2 | 23/195 | 0.5J - 3.3 |

J - estimated value

Table 2: Summary of EPA 2006/2007 Sub-slab Soil Vapor Results for TCE and 1,1,1-TCA in Homes in the Hopewell Precision Area Groundwater Contamination Site

*All values in micrograms per cubic meter (mcg/$m^3$).*

| | Feb/March 2006 Sub-slab | | Feb/Mar 1st Round 2007 Sub-slab | |
|---|---|---|---|---|
| **Chemical** | **Detections** | **Concentration Range*** | **Detections** | **Concentration Range*** |
| TCE | 2/73 | 1.5 - 18 | 27/135 | 1 - 280 |
| 1,1,1-TCA | 31/73 | 0.88 - 270 | 78/135 | 0.76 - 120 |

* levels shown are for detected concentrations only

Table 3: Summary of EPA March 2007 Soil Vapor Intrusion Investigation for TCE, 1,1,1-TCA, and PCE in Homes where Indoor Air was Sampled in the Hopewell Precision Area Groundwater Contamination Site

*All values in micrograms per cubic meter (mcg/m³).*

| **Homes** | | **Analyte** | | |
|---|---|---|---|---|
| | | **TCE** | **1,1,1-TCA** | **PCE** |
| Building 1 | Sub-slab | 19 | 18 | ND |
| | Indoor Air | ND | ND | ND |
| Building 2* | Sub-slab | 6.4 | 42 | 6.3 |
| | Indoor Air | 2.3 | ND | ND |
| Building 3 | Sub-slab | 33 | 21 | ND |
| | Indoor Air | ND | ND | ND |
| Building 4 | Sub-slab | 0.24 | 3.2 | 8.3 |
| | Indoor Air | ND | 2.6 | 1.5 |
| Building 5** | Sub-slab | 1.4 | 31 | ND |
| | Indoor Air | 20 | 2.3 | ND |
| Building 6 | Sub-slab | ND | 11 | ND |
| | Indoor Air | ND | ND | 1.6 |
| Building 7*** | Sub-slab | ND | 5.9 | 560 |
| | Indoor Air | 1.5 | 1.5 | 98 |
| Building 8* | Sub-slab | 150 | 51 | ND |
| | Indoor Air | 0.89 | ND | ND |
| Building 9* | Sub-slab | 27 | 30 | ND |
| | Indoor Air | 1.0 | 0.86 | 1.1 |
| Building 10 | Sub-slab | ND | ND | 1.5 |
| | Indoor Air | ND | ND | 5.9 |
| Building 11+ | Sub-slab | 9.3 | 21 | 4.4 |
| | Indoor Air | 1.8 | ND | ND |
| Building 12++ | Sub-slab | 12 | ND | ND |
| | Indoor Air | 3.5 | ND | ND |
| Building 13 | Sub-slab | 4.9 | 51 | ND |
| | Indoor Air | ND | ND | ND |
| Building 14 | Sub-slab | 2 | ND | ND |
| | Indoor Air | ND | ND | ND |

Shaded areas indicate data where actions were taken. See below for specific buildings and actions.
* Buildings that received sub-slab depressurization systems.
**Indoor source identified; no sub-slab depressurization system installed
***PCE used on the property; no sub-slab depressurization system installed, but owner advised on ways to reduce exposures.
+Owner refused sub-slab depressurization system.
++ - Building was source of contamination and no sub-slab depressurization system offered.
ND - Not detected

**Table 4: Water Quality Standards and Public Health Comparison Values**
**Hopewell Precision Area Groundwater Contamination Site**
*All values in micrograms per liter (mcg/L)*

| | Water Quality Standards | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | New York State | | | EPA | Comparison Values* | | | |
| **Contaminant** | **Ground Water** | **Surface Water** | **Drinking Water** | **Drinking Water** | **Cancer** | **Basis**** | **Noncancer** | **Basis**** |
| 1,1,1-trichloroethane | 5 | 5 | 5 | 200 | - - | - - | 1960 | EPA RfD |
| trichloroethene | 5 | 5 | 5 | 5 | 6 | NYS CPF | 10 | Health Canada RfD |

* 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 cancer risk of one-in-one-million after a lifetime (70 years) of exposure. Non-cancer comparison values assume a relative source contribution of 20% of the RfD from drinking water.

** Health Canada RfD: Health Canada Reference Dose
NYS CPF: New York State Cancer Potency Factor
EPA RfD: U.S. Environmental Protection Agency Reference Dose (Region 3)

**Table 5: Indoor Air Background Levels and Public Health Comparison Values**
**Hopewell Precision Area Groundwater Contamination Site**
*All values in micrograms per cubic meter ($mcg/m^3$)*

| | | | Comparison Values* | | | |
|---|---|---|---|---|---|---|
| **Contaminant** | **Indoor Air** Background Level** | **NYS Air Guidelines** | **Cancer** | **Basis*** ** | **Noncancer** | **Basis*** ** |
| 1,1,1-trichloroethane | 3 | - - | - - | - - | 2200 | EPA RfC |
| trichloroethene | <1 | 5 | 0.3 to 7.8 | DOH UR | 10 | DOH RfC |
| tetrachloroethene | <10 | 100 | 1 | DOH UR | 100 | DOH RfC |

* The cancer comparison values is the air concentration corresponding to an increased lifetime (70 years) cancer risk of one-in-one-million. The range of cancer comparison values is based on the range for several estimates of cancer potency for TCE derived by the New York State Department of Health (DOH, 2006). Estimated health risks are based on the highest of these estimates of cancer potency for TCE.

** From: http://www.nyhealth.gov/environmental/indoors/air/contaminants/

*** DOH UR: New York State Department of Health Unit Risk
DOH RfC: New York State Department of Health Reference Concentration
EPA RfC: U.S. Environmental Protection Agency Reference Concentration (Region 3)

# APPENDIX C

## DOH Procedure for Evaluating Potential Health Risks for Contaminants of Concern

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

To evaluate the potential health risks from contaminants of concern associated with the Hopewell Precision Area Groundwater Contamination Site, the DOH assessed the risks for cancer and non-cancer health effects.

Increased cancer risks were estimated by using site-specific information on exposure levels for the contaminant of concern and interpreting them using cancer potency estimates derived for that contaminant by the EPA or, in some cases, by the DOH. The following qualitative ranking of cancer risk estimates, developed by the 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:

Qualitative Descriptors for Excess Lifetime Cancer Risk

| Risk Ratio | Qualitative Descriptor |
|---|---|
| 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 may be judged acceptable. An increased lifetime cancer

risk of one in one million or less is generally considered negligible and not a public health concern. The level of risk is typically used as a "target level," "screening level," or "goal", which when exceeded does not necessarily imply that risk reduction measures should be pursued but will trigger more careful evaluation of the situation. Cancer risks greater than one in ten thousand ($10^{-4}$), on the other hand, typically trigger actions to lower exposures. When cancer risk estimates are between one in one million ($10^{-6}$) and one in ten thousand ($10^{-4}$), a risk management decision must be made on a case-by case basis whether or not to pursue risk reduction measures. The one in one million ($10^{-6}$) risk level is used as a starting point for analysis of remedial alternatives which reflects a preference for managing risks at the more protective end of the risk range, all other things being equal. The ultimate risk management decision should consider judgments on not only the strength of the scientific evidence regarding carcinogenicity, but also the actual potential for chronic or lifetime exposure, other sources and levels of everyday exposure, our ability to detect the chemical, the availability and costs of risk reduction options, the societal benefits of the regulated activity, compliance with existing regulations, and, in many cases, the risks, benefits and costs of alternatives.

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

Qualitative Descriptors for Non-carcinogenic Health Risks

| Ratio of Estimated Contaminant Intake to Risk Reference Dose | Qualitative Descriptor |
|---|---|
| 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 |

Non-carcinogenic 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 that 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 sub-populations (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 non-cancer 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 non-cancer 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

## Conclusion Categories and Hazard Statements

## Conclusion Categories and Hazard Statements

ATSDR has five distinct descriptive conclusion categories that convey the overall public health conclusion about a site or release, or some specific pathway by which the public may encounter site-related contamination. These defined categories help ensure a consistent approach in drawing conclusions across sites and assist the public health agencies in determining the type of follow-up actions that might be warranted. The conclusions are based on the information available to the author(s) at the time they are written.

**1. Short-term Exposure, Acute Hazard "ATSDR concludes that...could harm people's health."**

This category is used for sites where short-term exposures (e.g. < 1 yr.) to hazardous substances or conditions could result in adverse health effects that require rapid public health intervention.

**2. Long-term Exposure, Chronic Hazard "ATSDR concludes that...could harm people's health."**

This category is used for sites that pose a public health hazard due to the existence of long-term exposures (e.g. > 1 yr.) to hazardous substance or conditions that could result in adverse health effects.

**3. Lack of Data or Information "ATSDR cannot currently conclude whether...could harm people's health."**

This category is used for sites in which data are insufficient with regard to extent of exposure and/or toxicologic properties at estimated exposure levels to support a public health decision.

**4. Exposure, No Harm Expected "ATSDR concludes that ... is not expected to harm people's health."**

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.

**5. No Exposure, No Harm Expected "ATSDR concludes that ...will not harm people's health."**

This category is used for sites that, because of the absence of exposure, are not expected to cause any adverse health effects.

# APPENDIX E

# RESPONSE TO PUBLIC COMMENTS

Hopewell Precision Area Groundwater Contamination Site
Health Consultation
Summary of Response to Public Comments

This summary was prepared to address comments and questions on the public comment draft of the Hopewell Precision Area Groundwater Contamination Site Health Consultation. The public was invited to review the draft during the public comment period, which ran from September 11, 2011 to October 14, 2011. Some statements were reworded for clarity and brevity. If you have any questions about the summary, you can contact the New York State Department of Health's (DOH's) project manager Kristin Kulow at (607) 432-3911.

COMMENT 1: Summary Section - Nice summary, I am curious about the Anaerobic Cometabolic Biodegradation (ACB) technology approach dealing with micro-organisms, because at one of the earlier (Town Hall) meetings we were told that the contamination will never clear itself out and return to normal.

RESPONSE 1: Further details on the use of Anaerobic Cometabolic Biodegradation (ACB) can be found in the 2009 EPA Record of Decision for the Hopewell Precision Groundwater Area Contamination Site. The Record of Decision is available at the Town of East Fishkill Community Library and on the EPA's website.
http://www.epa.gov/superfund/sites/rods/fulltext/r2009020003713.pdf

COMMENT 2: Recommendations Section - Is there a time table as to when the "Public Water Supply" system might begin?

RESPONSE 2: An exact time frame for when the public water supply will be extended has not be reached yet, negotiations are on-going.

COMMENT 3: Other - It's true that there may not have been any specific guidelines at the beginning of this total disregard of the environment, but someone should still be held responsible for their lack of common sense, if only to serve as a warning to others.

RESPONSE 3: Comment acknowledged.

COMMENT 4: General comment - Has testing been performed in other areas surrounding the site to determine whether contamination has spread to more areas?

RESPONSE 4: During the remedial investigation, multiple rounds of sampling of all media were conducted to delineate the contamination. Sampling is conducted in a step-wise manner expanding out from contaminated areas and continuing until contamination is no longer detected. Monitoring wells are currently in place and are routinely sampled to track the contamination in the groundwater. Figures providing locations of the monitoring wells,

outlining the study area, and showing the extent of contamination are available in the Record of Decision - Operable Unit 1 on the EPA's website and at the Town of East Fishkill Community Library.
http://www.epa.gov/superfund/sites/rods/fulltext/r2009020003713.pdf

COMMENT 5: General comment - The report is informative from an overview perspective. However, from a family perspective it doesn't help me understand our exposure, i.e., is it safe to drink my well water and breathe the air in my residence? These are the answers I'm looking for.

RESPONSE 5: DOH and ATSDR conclude that, currently, site-related contamination is not expected to harm people's health from using water from private wells for drinking, bathing and cooking. Furthermore, breathing indoor air in buildings potentially affected by soil vapor contaminants is not expected to harm people's health. For discussion of individual results from your home, please contact Kristin Kulow at (607) 432-3911.

COMMENT 6: Background section – A complaint was filed in 1980. Several limited investigations were conducted over the years. In 2003, the EPA conducted a more comprehensive investigation in scope, which resulted in 43 sub-slab depressurization systems and 51 water treatment systems to be installed. Why did it take over 20 years to reach this finding? Only range of TCE is provided; will the actual data be included in the final document?

RESPONSE 6: The full extent of the contamination was not understood early on in the investigation of the site. Initial investigations found only low-levels of contamination in the Hopewell Precision on-site well and no contamination in the four nearby private drinking water wells that were sampled. This health consultation contains data for the primary contaminants of concern: TCE, PCE and 1,1,1-TCA. The specific sampling data are presented in the June 2008 Remedial Investigation Report and can be viewed at the Town of East Fishkill Community Library.

COMMENT 7: Discussion section - Do the samples collected in 2006 and 2007 include homes with active water treatment systems? If so, what were the before and after levels of 1,1,1-TCA and TCE?

RESPONSE 7: There were two types of samples collected from homes in the 2006-2007 time period; water samples and soil vapor samples. Homes where water treatment systems have been installed have also been sampled for soil vapor intrusion. Water treatment systems maintained by the EPA or DEC are sampled every three months. Concentrations of 1,1,1-TCA and TCE before the water systems were installed are presented in Table 1. The range of 1,1,1-TCA in August 2006 samples was (0.11J – 2.2 mcg/L), August 2007 (0.5J – 3.3 mcg/L). The range of TCE in August 2006 samples was (0.13J – 4.7 mcg/L), August 2007 (0.53 – 7.4 mcg/L). Typically, concentrations of contaminants of concern in drinking water after the treatment systems were not detectable.

COMMENT 8: Is there a map of all the properties that were tested and their individual results?

RESPONSE 8: Figures with soil vapor and drinking water sample results collected from the study area are available in the 2008 Remedial Investigation Report which can be viewed at the Town of East Fishkill Community Library document repository and on the EPA's website. http://www.epa.gov/region2/superfund/npl/hopewell/

COMMENT 9: Were secondary sources of exposure considered; such as evaporation of TCE and 1,1,1-TCA from shower water, boiling water, dishwashers, etc.?

RESPONSE 9: Exposures to trichloroethene and 1,1,1-trichloroethane by non-drinking pathways (e.g., inhalation, dermal exposure routes) were taken into account in the health consultation. To account for exposures via these routes, we assumed that the concentrations of these contaminants were two-fold higher than measured in drinking water. The basis for this assumption comes from several studies that evaluate non-ingestion volatile organic contaminant exposures from drinking water (e.g., Jo et al., 2004; Wallace, 1997; Weisel and Jo, 1996; Jo et al., 1990a,b) and suggest that under some conditions, exposure by the inhalation and dermal routes may approach the same level as exposure by ingestion.

COMMENT 10: Were the risk assessments for the chemicals of concern considered in the aggregate; accounting for additive or synergistic effects of chemical mixtures?

RESPONSE 10: We considered the possibility of chemical interactions (e.g., synergy or antagonism) when evaluating the risk for exposure to chemicals at the Hopewell Precision Area Groundwater Contamination Site. We did not find studies that directly evaluate dose-response relationships for exposure to mixtures containing the chemicals that were selected for further evaluation (trichloroethene, 1,1,1-trichloroethane, tetrachloroethene, MTBE). We therefore have no specific experimental evidence that suggests synergy or antagonism occurs among these chemicals. Assuming there is general similarity among the chemicals with respect to toxic endpoints and mode of action, we considered the health effects and health risks to be additive. This approach is consistent with the approach recommended in a recent Interaction Profile published by ATSDR on three of the four chemicals selected for further evaluation (trichloroethene, 1,1,1-trichloroethane, tetrachloroethene (ATSDR, 2004a)). Based on the ATSDR guidance for evaluating the health risks of mixtures (ATSDR, 2004b), significant interactive effects among these chemicals are unlikely to result in a health hazard, because at most of the properties, the individual chemical exposures are less than one-tenth of each chemicals' reference concentration or reference dose. This means that most of the exposures at the site are well below exposure levels associated with adverse health effects.

COMMENT 11: Were the degradation by-products of TCE, 1,1,1-TCA and PCE tested for (e.g., vinyl chloride)? If so what were these results? If not, why not?

RESPONSE 11: Yes, the private well samples, indoor air and sub-slab vapor samples were analyzed for for volatile and semi volatile organic compounds, which includes all the breakdown products of the contaminants of concern. Concentrations of the associated breakdown products were not found at levels of concern. The results of the sampling are presented in the June 2008 Remedial Investigation Report which can be viewed at the Town of East Fishkill Community Library.

COMMENT 12: The epidemiological and health risk assessment noted that there is likely to be some misclassification given that individuals that moved out of the study area were not tracked for cancer, nor were individuals who moved into the study area with cancer separated from the analysis. The study authors dismiss this as insignificant because they claim that those with cancer that move out are likely to be replaced by those who move into the study area with cancer (or develop cancer) with a similar frequency. Theoretically, this is true, provided that the null hypothesis is true (e.g., that the plume has no effect on the development of cancer in the study area). However, if the plume does have an effect on the development of cancer (the effect that is being studied), then the frequency of those moving out of the study area that have or develop cancer would be higher than those moving into the study area with cancer (or those who develop cancer in too short a time frame to be related to any exposures from the plume). This misclassification would result in a lower observed cancer rate and consequently, a lower odds ratio. Given the relatively lower numbers of expected cancer cases in the study population, a few more cancer cases of a particular type would likely change the conclusions, and possibly suggest that the plume is associated with an increased risk for cancer of certain type(s). This limitation should be noted and highlighted in the report. The full health report notes that not all VOC-related health effects (e.g., neurological) were followed in this study due to limitations in the coding. This should be noted and highlighted in the report.

RESPONSE 12: This pertains to methodology used in a study reported in another health consultation. There are a number of limitations of Health Statistic Reviews including the one listed in the comment above, which is a valid concern. However, it is not within the scope of the responses for *this* health consultation to address all of the limitations of a Health Statistics Review contained in another document. The full Health Statistics Review can be found at
http://www.health.ny.gov/environmental/investigations/hopewell/docs/final_birth_outcomes_and_cancer.pdf

COMMENT 13: The EPA recently updated its toxicological profile for trichloroethene (TCE). This information should be included in the report and the risk levels adjusted accordingly. For example, the IRIS one in a million inhalation risk is 0.2 ug/$m^3$, much less than guidelines published in the report.

RESPONSE 13: The DOH air guideline for trichloroethene was used to evaluate the sampling results and to make decisions about measures to reduce exposure. It was not used to make quantitative estimates of trichloroethene risk because the guideline takes

into account considerations other than risk assessment, including background levels and analytical capability. The DOH evaluated health risks using trichloroethene toxicity values available at the time the public health assessment was written. Since that time, the EPA has revised its trichloroethene toxicity values and its guidance for estimating trichloroethene cancer risks (EPA, 2011). Using the revised toxicity values and guidance, the following air and drinking water concentrations and the corresponding risk descriptors would be used for long-term exposure to trichloroethene at the Hopewell Precision Area Groundwater Contamination Site:

**Air and Drinking Water Concentrations and Qualitative Risk Descriptors for Hopewell Precision Area Groundwater Contamination Site Based on the EPA Revised Cancer Potency Estimates Trichloroethene**

| Air Concentration Range (mcg/$m^3$) | Qualitative Descriptor for Inhalation Cancer Risk | Drinking Water Concentration Range (mcg/L) | Qualitative Descriptor for Drinking Water Cancer Risk |
|---|---|---|---|
| less than 0.23 | very low | less than 0.15 | very low |
| 0.23 to less than 23 | low | 0.15 to less than 15 | low |
| 23 to less than 230 | moderate | 15 to less than 150 | moderate |
| 230 or greater | high | 150 or greater | high |

**mcg/L: micrograms per liter**
**mcg/$m^3$: micrograms per cubic meter**

Using the EPA values and guidance to estimate the risks would not change the overall conclusions of the health consultation. This is because public health actions were taken to reduce exposure to site-related volatile organic compounds in drinking water and in indoor air. Treatment systems have been installed on private wells where contaminants were found to be above the New York State and US EPA public drinking water standard (i.e., Maximum Contaminant Levels). Soil vapor mitigation systems (sub-slab depressurization systems) were installed in homes that were determined to be impacted or to have the potential to be impacted by soil vapor intrusion.

COMMENT 14: Recommendations section - What is the on-going monitoring program?

RESPONSE 14: The EPA and DEC will continue to monitor and maintain the individual water treatment systems installed on affected private wells on a semi-annual basis until the planned public water supply system is installed and residences are connected to it. The EPA will continue to monitor and maintain the sub-slab depressurization systems installed on affected homes.

COMMENT 15: How can we be sure the plume will not migrate outside current boundaries?

RESPONSE 15: The remedial investigation defined the nature and extent of the contamination at the study site. However, ongoing sampling to monitor plume movement will continue. If concentrations of contaminants of concern are detected above applicable standards, criteria or guidance, measures will be taken to reduce exposure.

COMMENT 16: Esophageal cancer, associated with VOC exposures in some studies, was elevated in the study area, but the elevation was not statistically significant. How much was it elevated?

RESPONSE 16: The standardized incidence ratio for esophageal cancer among males and females combined was 3.3 (95% CI 0.7 - 9.7) meaning that there are slightly more than three times the expected number of esophageal cancers in the area. However, since the incidence ratio is based on very few cases, (<6 total and thus the exact number cannot be reported for confidentiality reasons) the confidence interval is very wide and the results are inconclusive.

COMMENT 17: Figure 1 – Difficult to decipher. Need the plume boundaries defined more clearly. What does the white area in the middle represent (5 – 50 mcg/L)? What does the white perimeter line represent <5 mcg/L?

RESPONSE 17: The smaller inner plume represents 50 mcg/L of TCE, the larger plume represents 5 mcg/L of TCE. Captions have been added to aid in deciphering Figure 4. Additional figures are available in the 2008 Remedial Investigation Report available at the Town of East Fishkill Community Library document repository and on the EPA's website. http://www.epa.gov/region2/superfund/npl/hopewell/relateddocs.htm

COMMENT 18: The table prints very small and with no definition.

RESPONSE 18: The font size has been increased in an effort to make the tables more legible.

References for the Summary of Response to Public Comments:

ATSDR (Agency for Toxic Substances and Disease Registry). 2004a. 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.

ATSDR (Agency for Toxic Substances and Disease Registry). 2004b. Guidance Manual for the Assessment of Joint Toxic Action of Chemical Mixtures. Atlanta, GA: Division of Toxicology, Agency for Toxic Substances and Disease Registry, Public Health Service, US Department of Health and Human Services.

Jo WK, K-D Kwon, J-I Dong, et al. 2004. Multi-route Trihalomethane Exposure in Households Using Municipal Tap Water Treated with Chlorine or Ozone–Chlorine. Sci. Tot. Environ. 339: 143-152

Jo WK, CP Weisel and PJ Lioy. 1990a. Routes of Chloroform Exposure and Body Burden from Showering with Chlorinated Tap Water. Risk Anal. 10: 575-80.

Jo WK, CP Weisel and PJ Lioy. 1990b. Chloroform Exposure and the Health Risk Associated with Multiple Uses of Chlorinated Tap Water. Risk Anal. 10: 581–585.

EPA (United States Environmental Protection Agency). 2011. Integrated Risk Information System. Trichloroethylene. Accessed (November 17, 2011) on-line at http://www.epa.gov/iris/subst/0199.htm.

Wallace, L. A. 1997. Human Exposure and Body Burden for Chloroform and Other Trihalomethanes. Crit. Rev. Environ. Sci. Technol. 27: 113–194.

Weisel, CP, and WK Jo. 1996. Ingestion, Inhalation, and Dermal Exposures to Chloroform and Trichloroethene From Tap Water. Environ. Health Perspect. 104: 48-51.

## REPORT PREPARATION

This Health Consultation for the Hopewell Precision Area Groundwater Contamination Site was prepared by the New York State Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented.

**Author**
Kristin Kulow
Public Health Specialist
Center for Environmental Health
New York State Department of Health

**State Reviewer**
Donald Miles
Principal Investigator
Center for Environmental Health
New York State Department of Health

**Technical Project Officer**
Gregory V. Ulirsch
Eastern Branch
Division of Community Health Investigations (proposed)
ATSDR