

# Health Consultation

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Public Health Implications and Interpretation of Tetrachloroethylene (PCE)  
Exposure in Indoor Air

**TOPPS CLEANERS SITE  
FAIR LAWN, BERGEN COUNTY, NEW JERSEY**

**EPA FACILITY ID: NJD046346870**

**APRIL 4, 2007**

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

## **Health Consultation: A Note of Explanation**

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

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

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## HEALTH CONSULTATION

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Exposure in Indoor Air

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Prepared By:

New Jersey Department of Health and Senior Services  
Consumer and Environmental Health Services

Under Cooperative Agreement with the  
U.S. Department of Health and Human Services  
Agency for Toxic Substances and Disease Registry

## Summary

The Topps Cleaners site is located at 22-02 Fair Lawn Avenue in Fair Lawn Borough, Bergen County, New Jersey (see Figure 1). Several business owners conducted dry cleaning operations at this facility between 1950 and 2004 using tetrachloroethylene (also called perchloroethylene or PCE) as the cleaning solvent. Recent investigations conducted at the Topps Cleaners site by the New Jersey Department of Environmental Protection (NJDEP) identified several areas of concern related to PCE contamination in soil, soil gas, groundwater, and indoor air. Indoor air samples collected from a total of 21 residences along Plaza Road (east and west sides), Ramsey Terrace, and Ramapo Terrace during the May through September 2006 sampling period indicated the presence of PCE. For the past, there is a completed exposure pathway for inhalation of PCE to children and adults at the sampled residences. For the current and future, the exposure pathway has been interrupted as NJDEP is monitoring indoor air concentrations and requiring mitigation, when necessary, to maintain PCE concentrations to below the Residential Indoor Air Screening Level (RIASL) on a permanent basis and prevent further exposure. There is no other completed exposure pathway evident based on available data.

Maximum and average PCE concentrations detected for sampled residences were used to assess the risk of non-cancer and cancer health effects to residents (including children) for both past and current exposures.

PCE concentrations detected in indoor air for all sampled residences were below the chronic comparison value for PCE for non-cancer health effects. Therefore, non-cancer adverse health effects are not expected to occur for adults and children regarding past and current chronic inhalation exposures to PCE in indoor air. Non-cancer adverse health effects for future inhalation exposures to PCE are not expected to occur to adults and children since NJDEP is monitoring to ensure that PCE concentrations remain below their Residential Indoor Air Screening Level (RIASL) of  $3 \mu\text{g}/\text{m}^3$  on a permanent basis.

Indoor air data indicates there are higher PCE concentrations at residences on the west side of Plaza Road, closest to the source of PCE contamination, when compared to residences on the east side of Plaza Road (including Ramapo Terrace and Ramsey Terrace). As such, for past exposures, the Lifetime Excess Cancer Risks (LECR) were higher for residences on the west side of Plaza Road compared to residences on the east side of Plaza Road (including Ramapo Terrace and Ramsey Terrace). The average LECRs (the likely scenario) to adults and children residing on the west side of Plaza Road were estimated to be 4 in 1,000,000 and 5 in 1,000,000, respectively. The maximum LECRs (an unlikely exposure scenario) to adults and children residing on the west side of Plaza Road were estimated to be 40 in 1,000,000 and 20 in 1,000,000, respectively.

For past exposures, the average LECRs (the likely scenario) to adults and children residing on the east side of Plaza Road, Ramsey Terrace, and Ramapo Terrace were estimated to be 2 in 1,000,000 and 3 in 1,000,000, respectively. The maximum LECRs (an unlikely exposure scenario) to adults and children residing on the east side of Plaza Road, Ramsey Terrace, and Ramapo Terrace were estimated to be 20 in 1,000,000 and 9 in 1,000,000, respectively.

It is noted that the range of average PCE concentrations for each sampled residence is either within or slightly exceeding typical average background concentrations found in US homes and ambient air. In addition, based on the arithmetic mean of average concentrations, the excess cancer risks calculated for past exposures for all sampled residences are low in comparison to the background risk of all or specific cancers. Although the risk for individuals to develop cancer for past exposure to PCE in indoor air is low, remedial actions were required by NJDEP to reduce the inhalation exposure to below the RIASL.

Inhalation exposures to PCE for current and future exposures to individuals at all sampled residences are considered a ***No Apparent Public Health Hazard***. Since the NJDEP is monitoring indoor air, no chronic exposures to PCE in air at concentrations exceeding the RIASL are expected to occur to residents regarding current and future exposure.

Additionally, area residents expressed concern over the potential for Topps Cleaners operations to have contaminated an off-site recreational area known as Archery Plaza. Based on available information, there is no evidence that completed exposures exist in the past or current and there is no potential for future exposures to occur to residents regarding contact with surface soil in the recreational use of Archery Plaza.

Recommendations include continued indoor air monitoring at residences to verify PCE concentrations remain below the RIASL and to ensure the effectiveness of existing mitigation systems; and the delineation of site related PCE contamination (subsurface soil and groundwater) in order to implement a permanent remedy.

## Statement of Issues

In May 2005, the New Jersey Department of Environmental Protection (NJDEP) requested assistance from the New Jersey Department of Health and Senior Services (NJDHSS) to determine whether elevated indoor air concentrations of tetrachloroethylene (also called perchloroethylene or PCE) detected in area residences from contamination originating from the former Topps Cleaners site, located in Fair Lawn Borough, Bergen County, New Jersey, posed a public health concern. Through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), the NJDHSS reviewed environmental data and prepared this health consultation to assess the public health implications associated with elevated PCE concentrations detected in indoor air during the May 2005 through September 2006 sampling period.

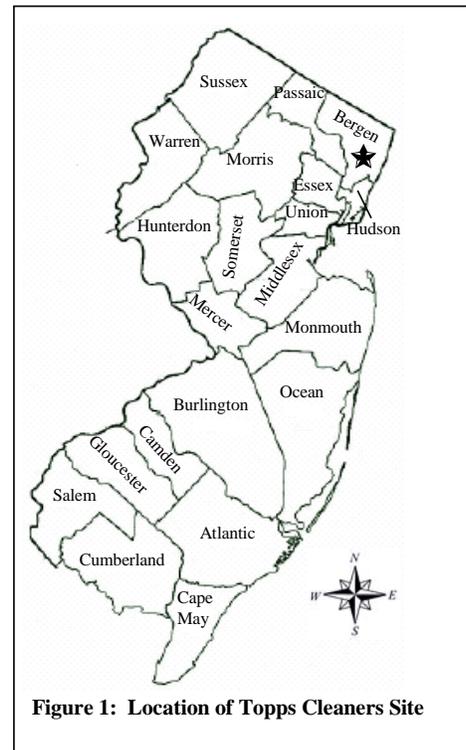
Additionally, at the request of area residents, this health consultation evaluated concerns related to exposure to soil at an off-site recreational area (Archery Plaza) potentially contaminated from Topps Cleaners operations.

## Background

### Site Description

The Topps Cleaners site is located at 22-02 Fair Lawn Avenue in Fair Lawn Borough, Bergen County, New Jersey (see Figure 1, Photograph 1). Several business owners conducted dry cleaning operations at this facility between 1950 and 2004 using PCE as the cleaning solvent. The one-half acre property consists of a vacant lot which formerly contained a one-story building with a sub-basement (former dry cleaning facility) and an asphalt paved parking area. The property is situated in a mixed residential and commercial area. The property is bordered by Fair Lawn Avenue to the north; Archery Plaza (a recreational field for area residents), Haywood Field and residential homes to the south; an Exxon Mobil automobile service station to the east; and the New Jersey Transit (railroad) property to the west (see Figure 2).

Topps Cleaners is one of three sites in the immediate area currently under remedial oversight by the NJDEP. The two additional sites are identified as the Exxon Mobil Corporation No. 35598 (Exxon Mobile site) located at 20-22 Plaza Road and BASF (a.k.a. Cole Engineering Incorporated site) located at 1300 Plaza Road both within Fair Lawn Borough. The BASF site is located within Haywood Field to the south of Topps Cleaners.



## **Site History**

Investigation of the Topps Cleaners site began in 1990, after PCE was detected in groundwater samples collected as part of NJDEP remedial investigation activities for the adjacent Exxon Mobil site. Chlorinated solvents such as trichloroethylene (TCE) and dichloroethylene (DCE), which are breakdown products of PCE, were also detected (NJDEP 2005). NJDEP required additional remedial investigations, however, the owner of the dry cleaners failed to perform these NJDEP directives. In 1998/1999, remedial investigations conducted for the Exxon and BASF sites partially delineated PCE contamination for areas outside of the Topps Cleaners property boundary which lead NJDEP to conclude that the Topps Cleaners property was the source of both on-site and off-site PCE contamination. In August 2003 remedial investigations by NJDEP resumed at the Topps Cleaners site which included groundwater and soil sampling to delineate the extent of chlorinated solvent contamination (primarily PCE) for on-site and off-site areas, including Archery Plaza.

For off-site areas, sub-slab gas and indoor air sampling was initiated in May 2005 for 11 residences along the west side of Plaza Road to investigate if off-site PCE contamination was impacting nearby residences (see Figure 2). Based on these results and the results of several additional rounds of indoor air sampling, PCE concentrations were found to exceed the NJDEP – Residential Indoor Air Screening Level (RIASL) for PCE for three residences. This prompted the installation of sub-slab depressurization systems for these three residences completed by June 2006.

Further groundwater delineation was extended to the east side of Plaza Road and included sub-slab gas and indoor air sampling of six residences on Plaza Road (east side), three residences on Ramapo Terrace and one residence on Ramsey Terrace. Monitoring of all 21 residences will be continued on a quarterly basis by the NJDEP. Mitigation systems will be installed for residences demonstrating two confirmed exceedances of the RIASL. The residential area is depicted in Figure 2.

On- and off-site soil and groundwater contamination is currently being addressed with remedial oversight by the NJDEP. Based on further groundwater delineation of PCE, sub-slab gas sampling has been performed for three additional residences on Ramsey Terrace and seven residences on Townley Road as of November 2006. Several of these residences are scheduled for future indoor air sampling based on the sub-slab gas results.

The property previously contained a one-story building with a sub-basement. This building has been demolished as part of remedial activities in December 2005.

## **Site Visit**

On July 15, 2005 a site visit was conducted at the Topps Cleaners site. Present were Glenn Pulliam, Julie Petix and Steven Miller of the NJDHSS; Leah Escobar of the ATSDR; and representatives from the NJDEP and the Fair Lawn Health Department. Also present were

representatives from Anderson-Mulholland & Associates, Inc. (AMAI – an environmental consultant for Topps Cleaners) and two local residents.

A visual inspection of both on- and off-site areas was conducted. Several groundwater monitoring wells were observed on the Topps Cleaners site and on the neighboring properties including Archery Plaza and the New Jersey Transit Railroad (see Photograph 2). A drainage swale is located on the east side of the New Jersey Transit property which drains a portion of the surface run-off from the Topps Cleaners site and Fair Lawn Avenue (see Photograph 3).

Prior to the December 2005 demolition of the Topps Cleaners facility, an inspection of the facility interior verified the two dry cleaning machines and associated hazardous chemicals were removed from the property as per AMAI. Concrete floor trenches observed were reported to have received non-PCE containing wastewater from the facility's washing machines which drained to the sanitary sewer system (see Photograph 4). Floor staining of varying degree was noted throughout the building interior. Large amounts of scattered debris were noted within the basement of the facility (see Photograph 5). The majority of the site property is paved; however, a small grass covered area to the south of the facility was noted.

The site visit included discussions with NJDEP regarding the neighboring Exxon and BASF sites currently under NJDEP oversight which clarified the historic and current remedial status and identified the contaminants of concern related to these sites. The Exxon site operates a groundwater pump and treat system for treating benzene, toluene, ethylbenzene, and xylenes (BTEX) groundwater contamination at the site. The treatment system is known to influence groundwater flow at the Topps Cleaners site.

The BASF site is located to the south of the Topps Cleaners site. The buildings at this site were demolished in the mid-1980's. The primary site contaminants are non-chlorinated volatile organic compounds (VOCs), semi-VOCs and metals in the soil and groundwater. There is a groundwater pump and treat system at this site from groundwater capture wells within the Haywood Field area (see Photograph 6).

## **Demographics**

Using the 2000 United States Census data, the ATSDR estimates that approximately 20,765 people live within a one-mile radius of the Topps Cleaners facility (see Figure 3).

## **Environmental Contamination**

An evaluation of site-related environmental contamination consists of a two tiered approach: 1) a screening analysis; and 2) a more in-depth analysis to determine public health implications of site-specific exposures. First, maximum concentrations of detected substances are compared to media-specific environmental guideline comparison values (CVs). If concentrations exceed the environmental guideline CV, these substances, referred to as Contaminants of Concern (COC), are selected for further evaluation. This subsequent evaluation is conducted by comparing estimated exposure doses, derived from site-specific exposure

conditions, to dose-based health guideline CVs. Contaminant levels above environmental guideline CVs do not mean that adverse health effects are likely, but that a health guideline comparison is necessary to evaluate site-specific exposures. Once exposure doses are estimated, they are compared with health guideline CVs to determine the likelihood of adverse health effects.

### **Environmental Guideline Comparison**

There are a number of CVs available for the screening environmental contaminants to identify COCs. These include ATSDR Environmental Media Evaluation Guides (EMEGs) and Reference Media Evaluation Guides (RMEGs). EMEGs are estimated contaminant concentrations that are not expected to result in adverse noncarcinogenic health effects. RMEGs represent the concentration in water or soil at which daily human exposure is unlikely to result in adverse noncarcinogenic effects. If the substance is a known or a probable carcinogen, ATSDR's Cancer Risk Evaluation Guides (CREGs) were also considered as comparison values. CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million ( $10^{-6}$ ) persons exposed during their lifetime (70 years). In the absence of an ATSDR CV, other comparison values may be used to evaluate contaminant levels in environmental media.

Substances exceeding applicable environmental guideline CVs were identified as COCs and evaluated further to determine whether these contaminants pose a health threat to exposed or potentially exposed receptor populations.

### **Off-site Indoor Air/Environmental Media Contamination**

Environmental media reviewed as part of this evaluation include indoor air, soil, and groundwater. The primary focus of this evaluation was on indoor air as it has the most direct relationship regarding exposure to area residents.

Indoor air sampling of the residential area originally focused on 11 residences closest to the Topps Cleaners site which are located on the west side of Plaza Road. These investigations expanded to residences located farther away from the Topps Cleaners site, specifically including residences on the east side of Plaza Road, Ramapo Terrace and Ramsey Terrace (see Figure 2).

The data for the indoor air investigation is presented as two separate areas of investigation consisting of 1) residences along the west side of Plaza Road and 2) residences along the east side of Plaza Road, Ramapo Terrace, and Ramsey Terrace. These two areas of investigation were separated since the data indicates there are higher concentrations of PCE in indoor air for residences on the west side of Plaza Road, which is closest to the source of PCE contamination from the Topps Cleaners site.

A total of 21 residences were sampled as part of the indoor air investigation. Indoor air samples were collected in the basement area of the residences. At least one additional indoor air sample has been collected on the first floor (or primary living space) for residences with an

indoor air result exceeding the RIASL in the basement area. All samples were collected using SUMMA<sup>®</sup> canisters and analyzed for VOCs using USEPA Method TO-15.

#### *West Side Plaza Road Residences*

During the period of May 2005 through September 2006, indoor air samples were collected from the basement and first floor areas of 11 residences along Plaza Road as identified in Table 1. PCE concentrations detected in indoor air ranged from 0.8 (estimated) to 20 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). The NJDEP RIASL of  $3 \mu\text{g}/\text{m}^3$  was exceeded in eight residences. Ambient air samples collected during these investigations indicated PCE concentrations ranged from non-detect to  $3.6 \mu\text{g}/\text{m}^3$ .

#### *East Side Plaza Road, Ramapo Terrace and Ramsey Terrace Residences*

In October and November 2005, indoor air samples were collected from the basement area 10 residences along the east side of Plaza Road, Ramapo Terrace and Ramsey Terrace as identified in Table 1. PCE concentrations detected in indoor air ranged from 0.8 (estimated) to  $2.9 \mu\text{g}/\text{m}^3$ , all below the NJDEP RIASL of  $3 \mu\text{g}/\text{m}^3$ . Ambient air samples collected during these investigations indicated PCE concentrations ranged from 1.4 to  $1.8 \mu\text{g}/\text{m}^3$ .

It is noted that the range of average PCE concentrations for each sampled residence is either within or slightly exceeding typical background PCE concentrations. Typical background PCE concentrations within US homes and in ambient air have been documented to range anywhere between 1 to  $5 \mu\text{g}/\text{m}^3$  (ATSDR 1997; NIH 2002). Documentation has also shown that background PCE concentrations generally increase when comparing rural, suburban and urban areas which is likely due to the increase in commercial/industrial operations and consumer products use typical of urban areas (NIH 2002). Various consumer products (e.g. stain removers, lubricants), dry cleaned garments and commercial operations are common sources contributing to background PCE concentrations.

### **Sub-Slab Gas**

#### *Off-site*

A total of 21 residences were sampled as part of the sub-slab gas investigation. Sub-slab gas samples were collected immediately below the basement slab of the residences where the slab interfaces with the underlying soil. All samples were collected using SUMMA<sup>®</sup> canisters and analyzed for volatile organic compounds (VOCs) using USEPA Method TO-15.

#### West Side Plaza Road Residences

During the period of May 9 through 20, 2005 sub-slab gas samples were collected from 11 residences along the west side of Plaza Road. PCE concentrations detected in sub-slab gas ranged from 26 to  $11,700 \mu\text{g}/\text{m}^3$ . PCE concentrations exceeded the NJDEP Residential Soil Gas Screening Level (RSGSL) of  $34 \mu\text{g}/\text{m}^3$  for 10 of the 11 residences sampled (NJDEP 2005). Analytical results are summarized and presented in Table 2.

## East Side Plaza Road Residences

In October 2005, November 2005, and November 2006 sub-slab gas samples were collected from 21 residences along the east side of Plaza Road, Ramapo Terrace, Ramsey Terrace and Townley Road. PCE concentrations detected below in sub-slab gas ranged from non-detect to 9,560  $\mu\text{g}/\text{m}^3$ . PCE concentrations exceeded the NJDEP RSGSL of 34  $\mu\text{g}/\text{m}^3$  for 14 of the 21 residences sampled (NJDEP 2006). It is noted that 11 of the residences had sub-slab gas sampling performed in November 2006 based on groundwater results of the area. Of these 11 residences, six have exceeded the RSGSL and are planned to have indoor air sampling performed. Analytical results are summarized and presented in Table 2.

## **Soil**

Remedial investigations to delineate PCE contaminated soils were conducted on both the Topps Cleaners property and the off-site area known as Archery Plaza (see Figure 2).

### *On-site*

NJDEP investigations were conducted in July 2004, October 2004 and June 2005 to characterize soil below the Topps Cleaners facility (NJDEP 2005). PCE concentrations in soil were detected below the facility at a range of non-detect to 288 milligrams per kilogram (mg/kg) for a depth range of 0.5 to 18 feet below ground surface. No surface samples of 0-6 inches were collected as the majority of the site is covered by asphalt and concrete with the exception of a small area along the southern border of the property. Soil data for the Topps Cleaners site is presented in Table 3. The highest concentration of PCE detected did not exceed the environmental guideline CV of 500 mg/kg for children.

### *Off-site*

Four soil samples were collected in July 2004 along the northern property boundary of Archery Plaza. Based on analytical data, the PCE source material is believed to originate from directly below the Topps Cleaners facility and extend off-site as a subsurface source; therefore, no surface soil sampling (0 – 6 inches) has been conducted in the adjacent off-site and unpaved areas such as Archery Plaza located to the south of the Topps Cleaners site. The shallowest sample was collected from the 0.5 – 1 foot depth interval. Soil data for Archery Plaza is presented in Table 3. The highest concentration of PCE detected was 0.3 mg/kg which is below the environmental guideline CV of 500 mg/kg.

## **Groundwater**

The groundwater table begins at approximately seven feet below ground surface at the area of the site. Topps Cleaners had a 160-gallon PCE tank in the basement of the facility where overflow or spillage from this tank would enter a sump that discharged to the ground surface near the New Jersey Transit rail road tracks to the west of the site (NJDEP 2005).

The most recent groundwater investigations conducted in July 2004 through February 2005 are detailed below and summarized in Table 4.

*On-site*

Groundwater PCE concentrations directly below the Topps Cleaners building indicated a range of concentrations from non-detect to 56,500 micrograms per liter ( $\mu\text{g/L}$ ) and an average concentration of 5,137  $\mu\text{g/L}$  for 28 samples analyzed.

PCE concentrations for 15 of the 28 groundwater samples analyzed exceeded the ATSDR RMEG of 100  $\mu\text{g/L}$  for children. The average PCE concentration exceeded the ATSDR RMEG of 100  $\mu\text{g/L}$  for children.

*Off-site: Archery Plaza Area*

Groundwater PCE concentrations for the Archery Plaza area indicated a range of concentrations from non-detect to 2,400  $\mu\text{g/L}$  and an average concentration of 204  $\mu\text{g/L}$  for 30 samples analyzed.

PCE concentrations for 12 of the 30 groundwater samples analyzed exceeded the ATSDR RMEG of 100  $\mu\text{g/L}$  for children. The average PCE concentration exceeded the ATSDR RMEG of 100  $\mu\text{g/L}$  for children.

*Off-site: Areas within 100 feet of Residences – Plaza Road (West Side)*

Groundwater PCE concentrations for off-site areas within 100 feet of residences along the west side of Plaza Road (east of Archery Plaza) indicated a range of concentrations from non-detect to 385  $\mu\text{g/L}$  and an average concentration of 46  $\mu\text{g/L}$  for 12 samples analyzed.

PCE concentrations for two of the 12 groundwater samples analyzed exceeded the ATSDR RMEG of 100  $\mu\text{g/L}$  for children. The average PCE concentration for the 12 groundwater samples analyzed did not exceed the ATSDR RMEG of 100  $\mu\text{g/L}$  for children.

Topps Cleaners, in cooperation with the NJDEP, is in the process of delineating the PCE plume in groundwater for the area along the east side of Plaza Road.

Based on the sample results, PCE in groundwater is a COC.

**Contaminant of Concern**

The contaminant of concern for the Topps Cleaners site is PCE in air (including sub-slab gas) and groundwater. A toxicological summary for PCE is provided in Appendix A.

## Discussion

The method for assessing whether a health hazard exists to a community is to determine whether there is a completed exposure pathway from a contaminant source to a receptor population and whether exposures to contamination are high enough to be of health concern. Site-specific exposure doses can be calculated and compared with health guideline CVs.

### Assessment Methodology

An exposure pathway is a series of steps starting with the release of a contaminant in environmental media and ending at the interface with the human body. A completed exposure pathway consists of five elements:

1. source of contamination;
2. environmental media and transport mechanisms;
3. point of exposure;
4. route of exposure; and
5. receptor population.

Generally, the ATSDR considers three exposure pathway categories: 1) completed exposure pathways, that is, all five elements of a pathway are present; 2) potential exposure pathways, that is, one or more of the elements may not be present, but information is insufficient to eliminate or exclude the element; and 3) eliminated exposure pathways, that is, one or more of the elements is absent. Exposure pathways are used to evaluate specific ways in which people were, are, or will be exposed to environmental contamination in the past, current, and future.

The evaluated exposure pathways for site-related contaminants are presented in Table 5.

#### *Completed Exposure Pathways*

Inhalation of PCE in indoor air (past). For the past, there is a completed exposure pathway for inhalation of PCE to children and adults at sampled residences. The pathway involves PCE vapor migrating upwards through contaminated subsurface media and entering the indoor air of the residence through intrusion pathways (i.e. basement slab cracks or gaps) where people will inhale PCE vapors and become exposed. PCE concentrations in indoor air exceeded the NJDEP RIASL of  $3 \mu\text{g}/\text{m}^3$  for eight residences currently housing a total of 21 adults and 2 children.

Current and future exposures for inhalation of PCE above the RIASL to children and adults at sampled residences have been interrupted as NJDEP is monitoring indoor air concentrations and requiring mitigation, when necessary, to prevent future exposures.

### *Eliminated Pathways*

Ingestion and Dermal Contact of Off-site Soil (past, current, future). Subsurface soil contamination is present at the 0.5 to 1 foot interval at the northern portion of Archery Plaza. PCE contamination soil at this interval is below the RMEG CVs for adults and children. Additionally, soil at this depth is not considered to have a direct contact potential as it is deeper than the 0 – 3 inch interval considered the direct contact layer.

Based on the PCE concentrations observed at the 0.5 to 1 foot interval, it is not likely that the direct contact soil layer is contaminated with PCE at levels exceeding the RMEG CVs. Available information indicates that discharges of hazardous contaminants related to Topps cleaning operations occurred on the site property and not to the off-site area of Archery Plaza. Therefore, based on available information, there is no evidence that completed exposures exist in Archery Plaza via this pathway.

Ingestion and Dermal Contact of On-site Soil (past, current, future). For the past, the majority of the site has been covered by asphalt and the building slab. In December 2005, the facility was demolished; however, the majority of the site remains asphalt paved along with the former building slab to cover on-site soils. There is a security fence surrounding the site to prevent illegal access. There is no evidence that the site property was used or accessed, other than for business purposes, by area residents. Remediation is planned in the near future for on-site contaminated soils as per NJDEP. Therefore, there is no evidence that completed exposures exist for on-site soils via this pathway.

Ingestion of groundwater (past, current, future). According to information obtained from a well search, NJDEP has concluded that there are no domestic or public supply wells located immediately downgradient of the site (NJDEP 2006). As such, there were no completed exposures via this pathway.

### **Public Health Implications of Completed Exposure Pathways**

Once it has been determined that individuals have or are likely to come in contact with site-related contaminants (i.e., a completed exposure pathway), the next step in the public health assessment process is the calculation of site-specific exposure doses. This is called a health guideline comparison which involves looking more closely at site-specific exposure conditions, the estimation of exposure doses, and evaluation with health guideline CVs. Health guideline CVs are based on data drawn from the epidemiologic and toxicologic literature and often include uncertainty or safety factors to ensure that they are amply protective of human health.

The maximum and average PCE concentrations detected in indoor air were used to assess the risk of non-cancer and cancer health effects to residents (children and adults) for past exposures. Past exposures to area residents were evaluated based on the initiation of Topps Cleaners operations in 1950 to the most recent round of indoor sample results collected in September 2006. The risk of non-cancer and cancer health effects to residents regarding current and future exposures were assessed based on the remedial requirements both monitored and enforced by NJDEP to prevent further exposure to residents.

## *Non-Cancer Health Effects*

To assess non-cancer health effects, ATSDR has developed Minimal Risk Levels (MRLs) for contaminants that are commonly found at hazardous waste sites. An MRL is an estimate of the daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of adverse, non-cancer health effects. MRLs are developed for a route of exposure, i.e., ingestion or inhalation, over a specified time period, e.g., acute (less than 14 days); intermediate (15-364 days); and chronic (365 days or more). The acute and chronic MRL for inhalation exposure for PCE are 1,000  $\mu\text{g}/\text{m}^3$  and 300  $\mu\text{g}/\text{m}^3$ , respectively.

### Indoor Air

Resident Exposures (past, current, future). There were no detected PCE concentrations exceeding the PCE chronic inhalation MRL of 300  $\mu\text{g}/\text{m}^3$  for all sampled residences (Table 1). As such, chronic non-cancer adverse health effects for past, current, and future exposures to PCE in the indoor air to adults and children living at sampled residences are not expected to occur.

## *Cancer Health Effects*

The site-specific lifetime excess cancer risk (LECR) indicates the cancer potential of contaminants. LECR estimates are usually expressed in terms of excess cancer cases in an exposed population in addition to the background rate of cancer. For perspective, the lifetime risk of being diagnosed with cancer in the United States is 46 per 100 individuals for males, and 38 per 100 for females; the lifetime risk of being diagnosed with any of several common types of cancer ranges between 1 in 10 to 1 in 100 (SEER 2005). Typically, health guideline CVs developed for carcinogens are based on one excess cancer case per 1,000,000 individuals. ATSDR considers estimated cancer risks of less than one additional cancer case among one million persons exposed as insignificant or no increased risk (expressed exponentially as  $10^{-6}$ ).

According to the United States Department of Health and Human Services (USDHHS), PCE is reasonably anticipated to be a human carcinogen, based on evidence in experimental animal and occupational studies.

### Indoor Air

The risk of cancer for past exposures was evaluated for occupants of residences sampled during the May 2005 through September 2006 indoor air investigation period. Cancer exposure doses were calculated using the following formula:

$$\text{Cancer Exposure Dose (mg/kg/day)} = \frac{C \times IR \times EF}{BW} \times \frac{ED}{AT}$$

where C = concentration of PCE in air ( $\text{mg}/\text{m}^3$ );

IR = inhalation rate ( $\text{m}^3/\text{hour}$ );

EF = exposure factor representing the site-specific exposure scenario;

ED = exposure duration (year);

BW = body weight (kg); and  
 AT = averaging time (year).

The following site specific assumptions and recommended exposure factors (EPA 2002) were used to calculate the contaminant dose based on maximum and average length of residency:

**Assumptions for Calculating Adult and Child Cancer Exposure Dose**

Exposed Population	IR (m <sup>3</sup> /hour)	EF * (unitless)	ED (years)	BW (kg)	AT (years)
Child	12	1	Variable**	33	70**
Adult	20	1	Variable**	70	70**

\* Exposure factor of 1 equals a continuous exposure frequency of 24 hours per day.

\*\* Tables 6 and 7 specify the maximum and average exposure duration based length of residency for current residents. Assumed potential exposure period is 1950 through 2006. For child the maximum exposure potential is calculated for 18 years.

\*\*\* Represents a lifetime exposure.

The LECR for adults was calculated by multiplying the cancer exposure dose by the cancer slope factor (CSF). The CSF is defined as the slope of the dose-response curve obtained from animal and/or human cancer studies and is expressed as the inverse of the daily exposure dose, i.e., (mg/kg/day)<sup>-1</sup>.

LECRs were separated into two groups, specifically residents on the west side of Plaza Road and residents on the east side of Plaza Road (including Ramapo Terrace and Ramsey Terrace). The investigation area was separated for evaluation as the data demonstrates there is a greater impact to residences on the west side of Plaza Road as they are closer to the source area of PCE contamination from the Topps Cleaners site. The arithmetic mean of average household PCE concentrations and the average length of residency for current residents were used to calculate the average LECR, which represents the likely exposure scenario to adults and children. The maximum of household average PCE concentrations detected and the maximum length of residency for current residents (under the potential exposure period) were used to calculate the maximum LECR, which represents an unlikely exposure scenario to adults and children. The maximum average and the arithmetic mean of average PCE concentrations in indoor air were obtained from the May 2005 through September 2006 sampling events. The potential period for exposure is assumed to be the initiation of dry cleaning operations at the Topps Cleaners site in 1950 to the last sampling event in 2006.

Resident Exposures (past). The calculated LECRs for residents based on the average maximum and the arithmetic mean of average PCE concentrations from available data are presented in Tables 6 and 7.

Based on the arithmetic mean of *average* PCE concentrations detected in the indoor air at each sampled residence (the likely exposure scenario), LECRs were estimated to be 4 in 1,000,000 for adults and 5 in 1,000,000 for children occupying the 11 sampled residences on the west side of Plaza Road (Table 6).

Based on the arithmetic mean of *average* PCE concentrations detected in the indoor air, LECRs were estimated to be 2 in 1,000,000 for adults and 3 in 1,000,000 for children occupying the 10 sampled residences on the east side of Plaza Road, Ramapo Terrace and Ramsey Terrace (Table 7).

Based on the *maximum* of average PCE concentrations detected in the indoor air (an unlikely exposure scenario), LECRs were estimated to be 40 in 1,000,000 for adults and 20 in 1,000,000 for children occupying the 11 sampled residences on the west side of Plaza Road (Table 6).

Based on the *maximum* of average PCE concentrations detected in the indoor air, LECRs were estimated to be 20 in 1,000,000 for adults and 9 in 1,000,000 for children occupying the 10 sampled residences on the east side of Plaza Road, Ramapo Terrace and Ramsey Terrace (Table 7).

The range of average PCE concentrations for each sampled residences is either within or slightly exceeding the typical average background concentrations found in US homes and ambient air. In addition, based on the arithmetic mean of average concentrations, the excess cancer risks calculated for past exposures for all sampled residences are low in comparison to the background risk of all or specific cancers. Although the risk for individuals to develop cancer for past exposure to PCE in indoor air is low, remedial actions were required by NJDEP to reduce the inhalation exposure to below the RIASL.

Resident Exposures (current and future). The installation of mitigation systems for three residences along the west side of Plaza Road has been completed. For these residences, the mitigation system should reduce indoor air PCE concentrations to below the NJDEP RIASL of 3  $\mu\text{g}/\text{m}^3$ . For the remaining residences without mitigation systems, indoor air PCE concentrations have remained below the RIASL. NJDEP will continue to monitor residences to ensure PCE levels are reduced to below the RIASL on a permanent basis.

### **Child Health Considerations**

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination in their environment. Children are at greater risk than adults from certain kinds of exposures to hazardous substances because they eat and breathe more than adults. They also play outdoors and often bring food into contaminated areas. They are shorter than adults, which mean they breathe dust, soil and heavy vapors closer to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care. It should be noted that the most sensitive endpoint for non-cancer health effects is increased reaction time, a less serious neurologic effect, as observed in an adult population working in dry cleaning establishments (ATSDR 1997). The MRL, which is based on this

endpoint, may not be sufficiently conservative in all cases, especially children with developing nervous systems.

The potential health risk from elevated indoor air concentrations of PCE to children living in the vicinity of the Topps Cleaners site was evaluated. As stated previously, the maximum indoor PCE levels were less than the chronic MRL in all residences and, therefore, adverse non-cancer health effects are not expected. Although uncertainty factors are incorporated into the MRL to protect sensitive populations such as children, toxicological data specific to child exposures to PCE were not available to evaluate adverse health effects in children with developing nervous systems.

Concerning cancer effects, for residences on the west side of Plaza Road, the LECR estimate based on the arithmetic mean of average PCE concentrations was determined to be 5 in 1,000,000. For residences on the east side of Plaza Road (including Ramapo Terrace and Ramsey Terrace), the LECR estimates based on the arithmetic mean of average PCE concentrations was determined to be 3 in 1,000,000. Indoor air for all residences is being monitored by NJDEP to ensure PCE levels are reduced to below the RIASL on a permanent basis to protect against future exposures.

## **Conclusions**

Dry cleaning operations, including the last operator Topps Cleaners, were conducted at the site from 1950 through 2004. Recent investigations conducted at the Topps Cleaners site by NJDEP identified several areas of concern related to PCE contamination in soil, soil gas, groundwater, and indoor air. Indoor air samples collected from a total of 21 residences along Plaza Road (east and west sides), Ramsey Terrace, and Ramapo Terrace during the May through September 2006 sampling period indicated the presence of PCE. PCE concentrations were used to assess non-cancer health effects to residents (including children) for past, current and future exposures. The arithmetic mean of average concentrations and the maximum of average PCE concentrations detected for sampled residences were used to assess cancer health effects to residents (including children) for past exposures. For the current and future, the exposure pathway has been interrupted as NJDEP is monitoring indoor air concentrations and requiring mitigation, when necessary, to maintain PCE concentrations to below the RIASL of  $3 \mu\text{g}/\text{m}^3$  on a permanent basis and prevent further exposure.

PCE concentrations detected in indoor air for all sampled residences were below the chronic MRL for PCE. Therefore, non-cancer adverse health effects are not expected to occur for adults and children regarding past and current chronic inhalation exposures to PCE in indoor air. Non-cancer adverse health effects for future inhalation exposures to PCE are not expected to occur to adults and children since NJDEP is monitoring to ensure that PCE concentrations remain below the RIASL on a permanent basis.

Indoor air data indicates there are higher PCE concentrations at residences on the west side of Plaza Road, closest to the source of PCE contamination, when compared to residences on the east side of Plaza Road (including Ramapo Terrace and Ramsey Terrace). As such, for past

exposures, the average LECR was approximately two times greater to residents on the west side of Plaza Road as compared to residents on the east side of Plaza Road. The average LECRs (the likely scenario) to adults and children residing on the west side of Plaza Road were estimated to be 4 in 1,000,000 and 5 in 1,000,000, respectively. The maximum LECRs (an unlikely exposure scenario) to adults and children residing on the west side of Plaza Road were estimated to be 40 in 1,000,000 and 20 in 1,000,000, respectively.

For past exposures, the average LECRs (the likely scenario) to adults and children residing on the east side of Plaza Road, Ramsey Terrace, and Ramapo Terrace were estimated to be 2 in 1,000,000 and 3 in 1,000,000, respectively. The maximum LECRs (an unlikely exposure scenario) to adults and children residing on the east side of Plaza Road, Ramsey Terrace, and Ramapo Terrace were estimated to be 20 in 1,000,000 and 9 in 1,000,000, respectively.

The range of average PCE concentrations for each sampled residence is either within or slightly exceeding typical average background concentrations found in US homes and ambient air. In addition, based on the arithmetic mean of average concentrations, the excess cancer risks calculated for past exposures for all sampled residences are low in comparison to the background risk of all or specific cancers. Although the risk for individuals to develop cancer for past exposure to PCE in indoor air is low, remedial actions were required by NJDEP to reduce the inhalation exposure to below the RIASL.

Inhalation exposures to PCE for current and future exposures to individuals at all sampled residences are considered a *No Apparent Public Health Hazard*. Since the NJDEP is monitoring indoor air, no chronic exposures to PCE in air at concentrations exceeding the RIASL are expected to occur to residents regarding current and future exposure.

Additionally, based on available information, there is no evidence that completed exposures exist in the past or current and there is no potential for future exposures to occur to residents regarding contact with surface soil in the recreational use of the off-site area known as Archery Plaza.

### **Recommendations**

1. The NJDEP should continue indoor air monitoring at the residences to verify indoor PCE concentrations remain below the RIASL and ensure the effectiveness of existing mitigation systems.
2. The delineation of PCE contamination at the site (subsurface soil, groundwater) should be completed by the NJDEP in order that a permanent remedy can be implemented.

### **Public Health Action Plan (PHAP)**

The purpose of a PHAP is to ensure that this Health Consultation not only identifies public health hazards, but also provides a plan of action designed to mitigate and prevent adverse

human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment on the part of the NJDHSS and ATSDR to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by ATSDR and NJDHSS are as follows:

### **Public Health Actions Taken**

1. This health consultation evaluated the health implications associated with exposures to PCE in indoor air to adults and children at sampled residences along Plaza Road, Ramsey Terrace, and Ramapo Terrace and for soil within Archery Plaza.
2. A public meeting held on September 29, 2005 and was attended by the NJDHSS, NJDEP, AMAI, the Radburn Association (property management for residential area) and area residents. The NJDHSS provided a presentation regarding the health consultation process and provided education materials on exposure to PCE and the health consultation process to area residents in attendance.

### **Public Health Actions Planned**

1. Copies of this health consultation will be provided to the Fairlawn Health Department and residents.
2. The NJDHSS and the ATSDR will review and evaluate future indoor air PCE data for sampled residences if requested by area residents and/or NJDEP.

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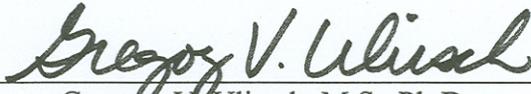
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## CERTIFICATION

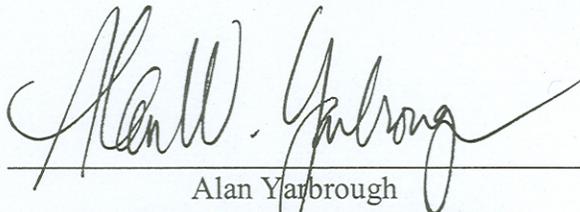
The health consultation for the Topps Cleaners site, Fair Lawn, Bergen County, New Jersey was prepared by the New Jersey Department of Health and Senior Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated. Editorial review was completed by the cooperative agreement partner.



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Technical Project Officer, CAT, SPAB, DHAC  
Agency for Toxic Substances and Disease Registry

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



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Alan Yarbrough  
Team Leader, CAT, SPAB, DHAC  
Agency for Toxic Substances and Disease Registry

**Table 1****TOPPS Dry Cleaners, Fair Lawn, Bergen County****Comparison of Indoor and Ambient Air PCE Concentrations With Health Guideline Comparison Values**

<b>Sample Location</b>	<b>Sample Period</b>	<b>Number of Samples</b>	<b>PCE Concentration Range (<math>\mu\text{g}/\text{m}^3</math>)<sup>(1)</sup></b>	<b>Range of Household Average PCE Concentrations (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>ATSDR Chronic MRL<sup>(2)</sup> (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>NJDEP RIASL<sup>(3)</sup> (<math>\mu\text{g}/\text{m}^3</math>)</b>
Plaza Road (West Side) 11 Residences	May 2005 through September 2006	68	ND - 20	0.6 - 9.0	300	3
Plaza Road (East Side); Ramapo Terrace; Ramsey Terrace 10 Residences	October 2005 through September 2006	30	ND - 12	0.8 - 4.5		
Ambient Air	May 2005 through September 2006	15	ND - 3.6	0.9 <sup>(4)</sup>		NA

Notes:

(1) - micrograms per cubic meter.

(2) - Agency for Toxic Substances and Disease Registry Minimal Risk Level: Chronic = greater than 365 day exposure.

(3) - New Jersey Department of Environmental Protection Residential Indoor Air Screening Level

(4) - average of 15 samples

ND - Not Detected

NA - No Comparison Value Available

**Table 2**  
**TOPPS Dry Cleaners, Fair Lawn, Bergen County**  
**Summary of Residential Sub-Slab Gas PCE Concentrations**

Sample Location	Sample Period	Number of Samples	Number of Samples Exceeding RSGSL	PCE Concentration Range (ug/m <sup>3</sup> ) <sup>(1)</sup>	PCE Concentration Average (ug/m <sup>3</sup> )	NJDEP - RSGSL (ug/m <sup>3</sup> ) <sup>(2)</sup>
Plaza Road (West Side) 11 Residences	May 2005	11	10	26 - <b>11,700</b>	<b>2,975</b>	<b>34</b>
Plaza Road (East Side); Ramapo Terrace Ramsey Terrace Townley Road 21 Residences	October 2005 November 2005 November 2006	21	14	ND - <b>9,560</b>	<b>732</b>	

Notes:

Sample collected below basement floor of residences.

(1) - micrograms per cubic meter of air

(2) - New Jersey Department of Environmental Protection - Residential Soil Gas Screening Level

Bold values exceed RSGSL

ND - Not Detected

**Table 3**

**TOPPS Dry Cleaners, Fair Lawn, Bergen County**

**Summary of PCE Concentration in Soil for On-Site and Off-Site Areas**

**Evaluated Against Environmental Guideline Comparison Value**

**Sample Period: July & October 2004, June 2005**

<b>Sample Location</b>	<b>On-Site/ Off-Site</b>	<b>Sample Depth (feet)</b>	<b>Number of Samples</b>	<b>Range of PCE Concentrations (mg/kg) <sup>(1)</sup></b>	<b>RMEG <sup>(2)</sup> Comparison Value (mg/kg)</b>	<b>Contaminant of Concern</b>
Topps Property	On-Site	0.5 - 18	196	ND - 288	500	No
Archery Plaza	Off-Site	0.5 - 1	4	ND - 0.302		No

Notes:

(1) - milligrams per kilogram

(2) - Reference Dose Media Evaluation Guide

ND: not-detected

**Table 4****TOPPS Dry Cleaners, Fair Lawn, Bergen County****Summary of PCE Concentration in Shallow Groundwater Against Environmental Guideline Comparison Value****Sample Period: July 2004 Through February 2005**

<b>Sample Location</b>	<b>On-Site/ Off-Site</b>	<b>Number of Samples</b>	<b>Number of Samples Exceeding RMEG</b>	<b>Range of PCE Concentrations (<math>\mu\text{g/L}</math>) <sup>(1)</sup></b>	<b>Average Concentration (<math>\mu\text{g/L}</math>)</b>	<b>RMEG Comparison Value (<math>\mu\text{g/L}</math>) <sup>(2)</sup></b>	<b>Contaminant of Concern</b>
Topps Property	On-Site	28	15	ND - <b>56,500</b>	<b>5,137</b>	<b>100</b>	<b>Yes</b>
Archery Plaza	Off-Site	30	12	ND - <b>2,400</b>	<b>204</b>		<b>Yes</b>
Archery Plaza: Within 100 Feet of Plaza Road Residences (West Side)	Off-Site	12	2	ND - <b>385</b>	46		<b>Yes</b>

Notes:

(1) - micrograms per liter

(2) - Agency for Toxic Substances and Disease Registry Reference Media Evaluation Guide for Child Exposure

ND: non-detect results

Bold results indicate an exceedance of the RMEG comparison value

**Table 5**  
**TOPPS Dry Cleaners, Fair Lawn, Bergen County**  
**Evaluated Exposure Pathways**

Source	Pathway	Exposure Pathway Elements				Pathway Classification
		Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population	
Contaminated Subsurface Media	Soil Gas & Groundwater	Indoor Air (Vapor Intrusion)	Residences	Inhalation	Local Residents	Past - Completed Current & Future - Interrupted

**Table 6****TOPPS Dry Cleaners, Fair Lawn, Bergen County****Calculated Lifetime Excess Cancer Risk (LECR) Based on Indoor Air PCE Concentrations****Sampled Residences on West Side of Plaza Road****Sample Period: May 2005 through September 2006**

Sample Location	Exposed Population	Exposure Duration (years) <sup>(1)</sup>	Arithmetic Mean of Household Average PCE Concentrations ( $\mu\text{g}/\text{m}^3$ ) <sup>(2)</sup>	USEPA CSFi <sup>(3)</sup> ( $\text{mg}/\text{kg}/\text{day}$ ) <sup>-1</sup>	Exposure Dose ( $\text{mg}/\text{kg}/\text{day}$ )	LECR average (maximum)
Plaza Road (West Side) 11 Residences	Adult	16 (55) <sup>a</sup>	3.2 (9) <sup>b</sup>	0.02	$2 \times 10^{-4}$ * ( $2 \times 10^{-3}$ ) **	$4 \times 10^{-6}$ ( $4 \times 10^{-5}$ )
	Child	16 (18) <sup>a</sup>			$3 \times 10^{-4}$ *** ( $9 \times 10^{-4}$ ) ****	$5 \times 10^{-6}$ ( $2 \times 10^{-5}$ )

Notes:

3

(1) - Based on the maximum and average length of residency for current residents during potential exposure period of 1950 to 2005. For "Child" 18 years is considered to be the maximum age of a child (USEPA 2002d).

(2) - micrograms per cubic meter.

(3) - Cancer slope factor for human inhalation exposure.

a - Maximum length of residency presented in parenthesis.

b - Maximum of average household values are given presented in parenthesis.

\* Average Adult Exposure Assumptions:  $20 \text{ m}^3/\text{day}$ , 365 days a year exposure frequency, 70 years averaging time, 70 kg body weight (USEPA 2002d)

\*\* Maximum Adult Exposure Assumptions:  $20 \text{ m}^3/\text{day}$ , 365 days a year exposure frequency, 70 years averaging time, 70 kg body weight (USEPA 2002d)

\*\*\* Average Child Exposure Assumptions:  $10 \text{ m}^3/\text{day}$  inhalation rate, 365 days a year exposure frequency, 70 years averaging time, 28.1 kg body weight (USEPA 2002d)

\*\*\*\* Maximum Child Exposure Assumptions:  $12 \text{ m}^3/\text{day}$  inhalation rate, 365 days a year exposure frequency, 70 years averaging time, 32.7 kg body weight (USEPA 2002d)

**Table 7****TOPPS Dry Cleaners, Fair Lawn, Bergen County****Calculated Lifetime Excess Cancer Risk (LECR) Based on Indoor Air PCE Concentrations****Sampled Residences on East Side of Plaza Road, Ramapo Terrace, and Ramsey Terrace****Sample Period: October 2005 through September 2006**

Sample Location	Exposed Population	Exposure Duration (years) <sup>(1)</sup>	Arithmetic Mean of Household Average PCE Concentrations ( $\mu\text{g}/\text{m}^3$ ) <sup>(2)</sup>	USEPA CSFi <sup>(3)</sup> ( $\text{mg}/\text{kg}/\text{day}$ ) <sup>-1</sup>	Exposure Dose ( $\text{mg}/\text{kg}/\text{day}$ )	LECR average (maximum)
Plaza Road (East Side); Ramapo Terrace; Ramsey Terrace 10 Residences	Adult	14 (55) <sup>a</sup>	1.7 (4.5) <sup>b</sup>	0.02	$1 \times 10^{-6}$ *	$2 \times 10^{-6}$
	Child	14 (18) <sup>a</sup>			$(1 \times 10^{-3})$ **	$(2 \times 10^{-5})$
					$1 \times 10^{-4}$ ***	$3 \times 10^{-6}$
					$(4 \times 10^{-4})$ ****	$(9 \times 10^{-6})$

## Notes:

(1) - Based on the maximum and average length of residency for current residents during potential exposure period of 1950 to 2005. For "Child" 18 years is considered to be the maximum age of a child (USEPA 2002d).

(2) - micrograms per cubic meter.

(3) - Cancer slope factor for human inhalation exposure.

a - Maximum length of residency presented in parenthesis.

b - Maximum of average household values are given presented in parenthesis.

\* Average Adult Exposure Assumptions:  $20 \text{ m}^3/\text{day}$ , 365 days a year exposure frequency, 70 years averaging time, 70 kg body weight (USEPA 2002d)

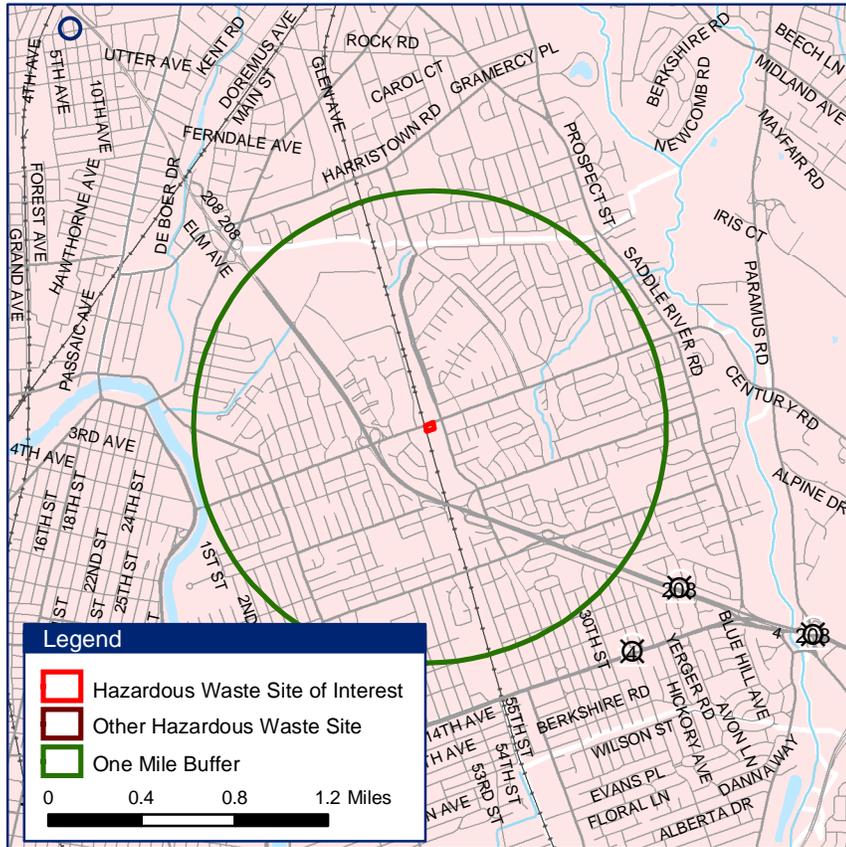
\*\* Maximum Adult Exposure Assumptions:  $20 \text{ m}^3/\text{day}$ , 365 days a year exposure frequency, 70 years averaging time, 70 kg body weight (USEPA 2002d)

\*\*\* Average Child Exposure Assumptions:  $10 \text{ m}^3/\text{day}$  inhalation rate, 365 days a year exposure frequency, 70 years averaging time, 28.1 kg body weight (USEPA 2002d)

\*\*\*\* Maximum Child Exposure Assumptions:  $12 \text{ m}^3/\text{day}$  inhalation rate, 365 days a year exposure frequency, 70 years averaging time, 32.7 kg body weight (USEPA 2002d)



Figure 2: Site location showing Topps Cleaners site and surrounding areas



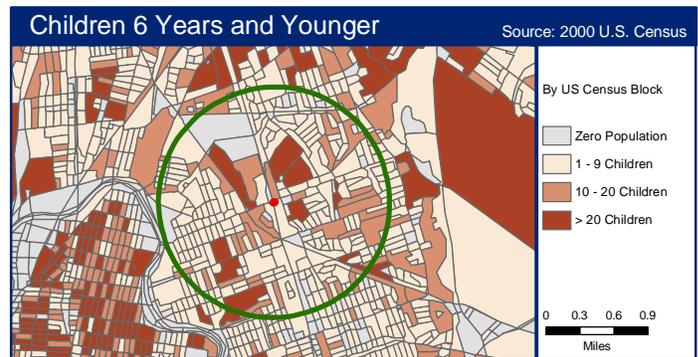
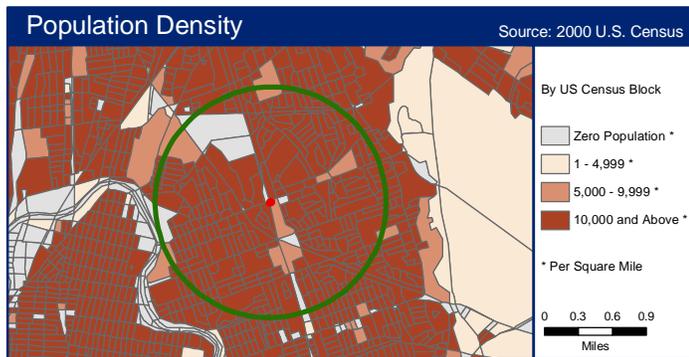
### Demographic Statistics

Within One Mile of Site\*

Total Population	20,765
White Alone	19,099
Black Alone	146
Am. Indian & Alaska Native Alone	11
Asian Alone	983
Native Hawaiian & Other Pacific Islander Alone	1
Some Other Race Alone	235
Two or More Races	290
Hispanic or Latino**	1,046
Children Aged 6 and Younger	1,653
Adults Aged 65 and Older	3,874
Females Aged 15 to 44	3,969
Total Housing Units	8,077

Base Map Source: Geographic Data Technology, May 2005.  
 Site Boundary Data Source: ATSDR Public Health GIS Program, May 2005.  
 Coordinate System (All Panels): NAD 1983 StatePlane New Jersey FIPS 2900 Feet

Demographics Statistics Source: 2000 U.S. Census  
 \* Calculated using an area-proportion spatial analysis technique  
 \*\* People who identify their origin as Hispanic or Latino may be of any race.



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Figure 3: Demographic Information of the Topps Cleaners site based on 2000 U.S. Census



Photograph 1: Former Topps Cleaners facility.



Photograph 2: Groundwater monitoring wells located on the Archery Plaza property.



Photograph 3: Drainage swale along east side of New Jersey Transit property.



Photograph 4: Concrete floor trench within the former Topps Cleaners facility.



Photograph 5: Various debris in basement of former Topps Cleaners facility.



Photograph 6: BASF site located within Haywood Field to the south of Archery Plaza and the Topps Cleaners site.

**Appendix A**  
**Toxicological Summary**

The toxicological summary provided in this appendix is based on ATSDR's ToxFAQs (<http://www.atsdr.cdc.gov/toxfaq.html>). Health effects are summarized in this section for the chemical of concern found in indoor air at residences due to vapor intrusion from contaminated media originating from the Topps Cleaners site. The health effects described in the section are typically known to occur at levels of exposure much higher than those that occur from environmental contamination. The chance that a health effect will occur is dependent on the amount, frequency and duration of exposure, and the individual susceptibility of exposed persons.

**PCE** PCE is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell PCE when it is present in the air at a level of approximately 7,000 micrograms per cubic meter or more, although some can smell it at even lower levels. People are commonly exposed to PCE when they bring clothes from the dry cleaners.

High concentrations of PCE can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been exposed to high concentrations. In industry, most workers are exposed to levels lower than those causing obvious nervous system effects, although more subtle neurological effects are possible at the lower levels. The health effects of breathing in air or drinking water with low levels of PCE are not known. Results from some studies suggest that women who work in dry cleaning industries where exposures to PCE can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that PCE can cause liver and kidney damage. Exposure to very high levels of PCE can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

The U.S. Department of Health and Human Services (USDHHS) has determined that PCE may reasonably be anticipated to be a carcinogen. PCE has been shown to cause liver tumors in mice and kidney tumors in male rats.

**Appendix B**  
**ATSDR Conclusion Categories**

## Summary of ATSDR Conclusion Categories

Category	Definition
1: Urgent Public Health Hazard	Applies to sites that have certain physical hazards or evidence of short-term (less than 1 year), site-related exposure to hazardous substances that could result in adverse health effects and require quick intervention to stop people from being exposed.
2: Public Health Hazard	Applies to sites that have certain physical hazards or evidence of chronic, site-related exposure to hazardous substances that could result in adverse health effects.
3: Indeterminate Public Health Hazard	Applies to sites where critical information is lacking (missing or has not yet been gathered) to support a judgment regarding the level of public health hazard.
4: No Apparent Public Health Hazard	Applies to sites where exposure to site-related chemicals might have occurred in the past or is still occurring, but the exposures are not at levels expected to cause adverse health effects.
5: No Public Health Hazard	Applies to sites where no exposure to site-related hazardous substances exists.

## **Appendix C**

### **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, 1-888-42-ATSDR (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.

**CAP** [see Community Assistance Panel.]

**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 or mixture 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 [contrast with prevalence].

**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/cm<sup>2</sup>**

Milligram per square centimeter (of a surface).

**mg/m<sup>3</sup>**

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. Morbidity is 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 [contrast with incidence].

**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 Center for Environmental Health (CDC)  
(<http://www.cdc.gov/nceh/dls/report/glossary.htm>)

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

For more information on the work of ATSDR, please contact:

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