

Health Consultation

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

(FORMER) WHITE SWAN LAUNDRY AND CLEANER, INCORPORATED
(a/k/a MAGNOLIA AVENUE GROUNDWATER CONTAMINATION SITE)

WALL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

EPA FACILITY ID: NJSFN0204241

SEPTEMBER 25, 2002

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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Exposure to Tetrachloroethylene (PCE) in Residential Indoor Air

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EPA FACILITY ID: NJSFN0204241

Prepared by:

New Jersey Department of Health and Senior Services
Hazardous Site Health Evaluation Program
Consumer and Environmental Health Services
Division of Epidemiology, Environmental, and Occupational Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
CREG	Cancer Risk Evaluation Guide
CSF	Cancer Slope Factor
EMEG	Environmental Media Evaluation Guide
EPA	United States Environmental Protection Agency
HCV	Health-based Comparison Value
LECR	Lifetime Excess Cancer Risk
MCHD	Monmouth County Health Department
MRL	Minimal Risk Level
ND	Not Detected
NJDEP	New Jersey Department of Environmental Protection
NJDHSS	New Jersey Department of Health and Senior Services
PCE	Perchloroethylene (tetrachloroethylene)
RBC	Risk-Based Concentration
RfC	Reference Concentration
RfD	Reference Dose
RMEG	Reference Dose Evaluation Guide
TCE	Trichloroethylene
VOC	Volatile Organic Chemical

Summary

This Health Consultation has been prepared in response to a request that was submitted in April 2002 by the U.S. Environmental Protection Agency (EPA) Region II to the Agency for Toxic Substances and Disease Registry (ATSDR) to assist in evaluating the public health implications of exposure to tetrachloroethylene (PCE) that was detected in indoor air sampling of about 220 residences in Wall Township, Monmouth County, New Jersey. Specifically, this Health Consultation provides a public health interpretation of the tetrachloroethylene (perchloroethylene), *i.e.*, PCE action levels in air that were proposed by the EPA and the New Jersey Department of Environmental Protection (NJDEP). Concern has been raised about possible exposure, by inhalation, to chemicals that have been found in the ground water in the vicinity of the (former) White Swan Laundry and Cleaner, Inc. (aka Magnolia Avenue Ground Water Contamination) site, also located in Wall Township, Monmouth County, New Jersey.

It is known that a shallow ground water plume of trichloroethylene, *i.e.*, TCE, and tetrachloroethylene (perchloroethylene), *i.e.*, PCE, exists that extends in an easterly direction from sources located in Wall Township, Monmouth County, New Jersey. Concern has been raised regarding the potential for exposure to these contaminants via inhalation of vapors that may have been transported from the ground water into residences and other structures, and subsequently volatilized in indoor air.

Based on the action levels proposed by the EPA and the NJDEP, ATSDR and the NJDHSS have provided the following public health interpretation of the levels of PCE that were found as a result of sampling the indoor air in about 220 residences in Wall Township in conjunction with the on-going investigation of the White Swan site:

- All exposures to PCE concentrations that are above $60 \mu\text{g}/\text{m}^3$ represent a lifetime risk of cancer greater than that due to background concentrations;
- All exposures to PCE concentrations between 6 and $60 \mu\text{g}/\text{m}^3$ represent a cancer risk that is slightly greater than that due to background levels; and,
- All exposures to PCE concentrations that are less than $6 \mu\text{g}/\text{m}^3$ represent little or no lifetime cancer risk greater than that due to background levels.

EPA has installed ventilation systems at all homes with PCE concentrations of $60 \mu\text{g}/\text{m}^3$ and above, and the NJDEP, in accordance with their mandate to reduce exposures to background levels, is working with the homeowners who have slightly elevated levels and are interested in undertaking remedial measures.

ATSDR and the NJDHSS consider exposures to PCE at concentrations of $60 \mu\text{g}/\text{m}^3$ and above to be a “Public Health Hazard”. Actions taken by EPA to mitigate these exposures are

protective of public health. Although exposures to concentrations between 6 and 60 $\mu\text{g}/\text{m}^3$ represent a slightly increased risk of cancer beyond the background risk, ATSDR and the NJDHSS consider that remedial actions taken by NJDEP to mitigate exposures in this range to also be protective of public health. Taking into consideration typical indoor background levels in U.S. homes and the very low risk of cancer, ATSDR and the NJDHSS consider all exposures to PCE below 6 $\mu\text{g}/\text{m}^3$ to represent **“No Apparent Public Health Hazard”**. No remedial actions are necessary.

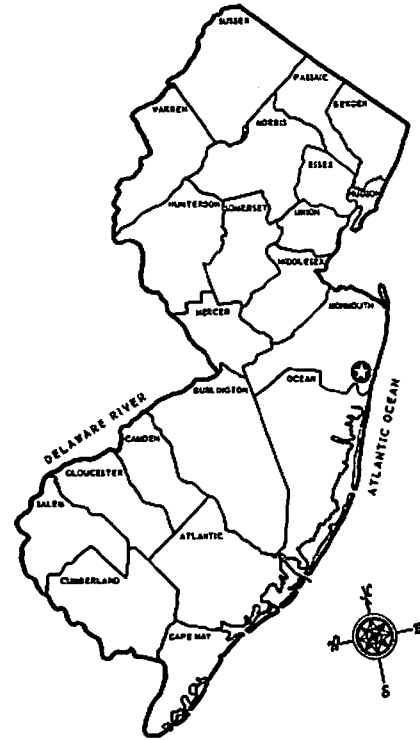
ATSDR and the NJDHSS have also evaluated the likelihood of an adverse non-cancer effect from the PCE air exposures in the 220 residences that were sampled in Wall Township. All but one sample were below ATSDR’s Minimal Risk Levels (MRL) for short-term non-cancer health effects. The one sample that was above the short-term MRL was from a sump at a residence on Laurel Street. Because this sample was taken from an enclosed sump, only short-term intermittent exposures are likely to have occurred. Based on further evaluation of potential health effects from the short-term exposures to the levels of PCE found in the air in the sump area, it is not likely that exposure to any residents would result in any serious non-cancer adverse health effects.

Soil gas and ground water investigations in the vicinity of the (former) White Swan Laundry and Cleaner, Inc. site should be continued in order to determine the extent and contribution of site-related contaminants that infiltrate from ground water into the indoor air of homes and businesses. If these or other investigations provide additional information on local background levels of PCE in residential indoor air, the conclusions of this Health Consultation may be re-evaluated.

The above conclusions are based on a residential exposure scenario and do not apply to the evaluation of the public health implications of indoor air exposures under non-residential situations (e.g., schools and commercial buildings).

Background and Statement of Issues

The U.S. Environmental Protection Agency (EPA) Region II requested that the Agency for Toxic Substances and Disease Registry (ATSDR) assist in evaluating the public health implications of exposure to tetrachloroethylene (PCE) that was detected in indoor air sampling of about 220 residences in Wall Township, Monmouth County, New Jersey. The sampling was conducted in conjunction with the on-going investigation of releases of hazardous substances from the (former) White Swan Laundry and Dry Cleaner, Inc. site. Specifically, this Health Consultation provides a public health interpretation of the PCE action levels in air that were proposed by the EPA and the New Jersey Department of Environmental Protection (NJDEP). The New Jersey Department of Health and Senior Services (NJDHSS), under a cooperative agreement with ATSDR, and working jointly with the Superfund Site Assessment Branch, Division of Health Assessment and Consultation, ATSDR, will address EPA's request in this Health Consultation.



In 1997, the Monmouth County Health Department (MCHD) became aware of tetrachloroethylene (PCE) contamination of irrigation wells on Magnolia Avenue in Wall Township, Monmouth County, New Jersey. Between 1999 and 2000, the MCHD and the New Jersey Department of Environmental Protection (NJDEP) performed a joint study of shallow ground water that mapped a plume of PCE and trichloroethylene (TCE) contamination about 2.5 miles long and one mile wide. The contamination plume extends from Wall Township into the Boroughs of Manasquan and Sea Girt and continues to the coastline (NJDEP, 2001).

In October 1999, at the request of the MCHD and EPA, ATSDR was asked to review the information related to the ground water contamination, and to advise the community about the usage of the irrigation wells. ATSDR determined that the concentrations of PCE that were found in the irrigation wells posed no public health concern, providing the water was used for non-potable purposes only (ATSDR, 1999).

During the period from 1998 to 2000, the NJDEP conducted site investigations at three facilities that were identified as potential sources. Soil and ground water samples collected at the three sites confirmed that a release of volatile organic compounds (VOCs) had occurred at each of the sites. The (former) White Swan Laundry and Cleaner (aka: Fleet Bank or Summit Bank)

property, a Gulf Service Station, and Sun Cleaners were identified as contributing sources to the Magnolia Avenue ground water contamination site (NJDEP, 2001).

On February 23, 2001, the owners of the (former) White Swan Laundry and Cleaner, Inc. property entered into a memorandum of agreement with the NJDEP to conduct a site investigation and remedial investigation at the site. During the remedial investigation, the NJDEP determined that a ground water plume of contamination might be adversely affecting the indoor air quality of nearby residential properties (NJDEP, 2001).

Sampling by Fleet Bank at its branch office on Sea Girt Avenue found high levels of PCE contamination in shallow ground water. Based on these results, on October 25, 2001, the NJDEP conducted indoor air quality testing of three residential properties and one commercial property located near to the Fleet Bank property. The NJDEP provided the residents and the owners of the commercial property with fans for ventilating the basements of each of these buildings where PCE was detected. The NJDEP conducted additional sampling of various residences in October through December, 2001.

At the request of the NJDEP, the EPA announced plans on December 5, 2001, to take over the investigation of the contaminated ground water plume that underlies portions of Wall Township and the Boroughs of Sea Girt and Manasquan. The EPA also announced that they agreed to evaluate the site for listing on the National Priorities List (NPL), *i.e.*, Superfund. Since that time, EPA has collected about 300 indoor air samples from at least 220 residential and business locations. The sampling has also included various educational facilities within the area, including Sea Girt Elementary School, Old Mill School, and Brookside School (EPA, 2002).

In accordance with their mandate to protect public health under the National Contingency Plan (NCP), EPA has installed ventilation systems at all homes with PCE levels above $60 \mu\text{g}/\text{m}^3$ and the NJDEP, in accordance with their mandate to reduce exposures to background levels, is working with the homeowners who have slightly elevated levels and are interested in undertaking remedial measures (EPA, 2002). In April 2002, the EPA sent the results of indoor air sampling of the 220 residences to individual homeowners. Included with this letter, ATSDR and NJDHSS provided a public health interpretation of air exposures to PCE based on EPA's and the NJDEP's proposed action levels [Appendix A shows the fact sheet on PCE that was distributed to individual homeowners].

Discussion

Health Assessment Methodology

In the course of creating Public Health Assessments (PHA) and Health Consultations (HC), ATSDR evaluates the environmental and human components that lead to human exposure to a

release of hazardous substances from a given site. A pathways analysis consists of five elements: (1) a source of contamination; (2) transport through an environmental medium; (3) a point of human exposure; (4) a route of human exposure; and (5) a receptor population. ATSDR categorizes exposure pathways into three groups: (1) “completed pathways”, that is, those in which exposure is reasonably expected to have occurred, to be occurring, or to occur in the future; (2) “potential pathways”, that is, those in which exposure might have occurred, may be occurring, or may yet occur, and (3) “eliminated pathways”, that is, those that can be eliminated from further analysis because at least one of the five elements listed above is missing and will never be present, or in which no contamination of concern can be identified.

After the pathways are designated as “completed”, “potential”, or “eliminated”, ATSDR follows a two-step methodology to comment on public health issues related to exposure pathways at hazardous waste sites. First, ATSDR obtains representative environmental monitoring data for the site of concern and compiles a list of site-related contaminants. ATSDR compares this list of contaminants to health-based values (health comparison values or HVCs) (definitions of HVCs are shown in Appendix B) to identify those contaminants that do not have a realistic possibility of causing adverse health effects. Second, for the remaining contaminants, ATSDR evaluates site-specific conditions to determine what exposure scenario is realistic for a given exposure pathway. Given this exposure scenario, ATSDR determines an exposed dose and compares this dose to scientific studies to determine whether the extent of exposure indicates a public health hazard.

The health-based comparison values used in this report are concentrations of contaminants that the current public health literature suggest are “safe” or “harmless”. These comparison values are quite conservative because they include ample safety factors that account for the most sensitive populations. ATSDR typically uses HCVs as follows: if a contaminant is never found at levels greater than its comparison value, ATSDR concludes the levels of corresponding contamination are “safe” or “harmless”. If, however, a contaminant is found at concentrations that are greater than its HCV, ATSDR designates the pollutant as a contaminant of concern and examines it further in the assessment. Because HCVs are based on extremely conservative assumptions, the presence of concentrations greater than an HCV does not necessarily suggest that adverse health effects will occur among the exposed population.

Exposure Pathways and Contaminant of Concerns

The pathway of concern evaluated in this Health Consultation is exposure to ground water contaminants that off-gas or volatilize from ground water to soils and then infiltrate into the air of various homes. It has been assumed that ground water beneath the White Swan site (and possibly other sources) is contaminated with PCE, that the PCE has off-gassed to soils beneath nearby homes, and, finally, that the PCE has infiltrated into these homes through cracks in the foundation or directly from soils into homes.

In addition to the site-related PCE that may have infiltrated homes from off-gassing from ground water, it is possible that some of the PCE may be coming from indoor sources. Studies by the EPA have shown that most homes in the U.S. have measurable levels of organic chemicals in indoor air. While outdoor air contains these organic chemicals, a surprising finding from the EPA studies is that indoor levels of organic chemicals are usually higher than outdoor air. These higher indoor air levels of VOCs presumably come from consumer products that are brought into the homes, from off-gassing of home building materials, and from personal activities. EPA studies showed that certain human activities were associated with having increased levels of chemicals in indoor air. Examples of these activities are (EPA, 1987):

- smoking indoors increases benzene, xylene, ethyl benzene, and styrene levels in indoor air;
- bringing dry cleaning home causes higher PCE levels in indoor air;
- using hot water in the home increases chloroform levels in indoor air; and
- using room air fresheners, toilet bowl deodorizers, and moth crystals leads to higher levels of para-dichlorobenzene in indoor air.

Additional studies by EPA are underway to determine the contribution of site-related contaminants found in the ground water (including PCE) to the levels of chemicals detected in residential air samples.

PCE is a solvent that is commonly used in the commercial dry cleaning industry and in some household products. Studies have shown that background levels in U.S. homes, in areas similar to Wall Township, average about 3 - 6 $\mu\text{g}/\text{m}^3$ (micrograms per cubic meter) (EPA, 1987). Reported values are the ranges of medians for background concentrations found in several U.S. cities, as reported by EPA's TEAM Study, 1987. However, these are not site-specific background concentrations for the White Swan Laundry and Cleaner site, but are presented to provide perspective. If the concentration of PCE in a household sample is within this range, it does not necessarily indicate that the PCE is entirely due to non-site related sources. Moreover, there are many uncertainties related to applying the estimates of background from the EPA TEAM Study to Wall Township. That is, there may be differences due to the types of homes in the study versus Wall Township (e.g., basements, age, and construction) and differences in other factors that may effect local indoor background levels of PCE. Because PCE is considered a site-related contaminant of concern, all exposures above typical background levels are considered to be an exposure that may be related to the site; therefore, ATSDR and NJDHSS consider this pathway to be a completed, or at least a potential, exposure pathway.

The levels of PCE detected in the over 300 samples of indoor air from 220 residences ranged from not detected (ND) to 223.4 $\mu\text{g}/\text{m}^3$. However, one air sample collected by the NJDEP from the air space of a confined sump located in a basement of a home contained 1,760 $\mu\text{g}/\text{m}^3$ of PCE. In a majority of the homes, PCE was either not detected at all, or the levels of PCE in the air were less than the health comparison value of 0.63 $\mu\text{g}/\text{m}^3$ (based on EPA Region III's Risk-Based Concentration or RBC). The RBC for PCE is based on cancer effects. ATSDR currently does not

have a Cancer Risk Evaluation Guide (CREG) for PCE in air. For non-cancer effects due to long-term exposures to PCE, ATSDR's Minimal Risk Level or MRL (see definition below) is $271 \mu\text{g}/\text{m}^3$. For non-cancer effects due to short-term PCE exposures, ATSDR's MRL is $1,356 \mu\text{g}/\text{m}^3$. Many of the air samples were in the range of what may be considered typical background levels.

Since the available data represent a snapshot in time, ATSDR and NJDHSS cannot definitively determine the concentration or duration of a resident's exposure. However, given that the exposure is likely to persist without any intervention, it is assumed, conservatively, that the exposure duration is 30 years.

Public Health Implications

Tetrachloroethylene (PCE): Chronic Exposure and Non-Cancer Effects

To evaluate non-carcinogenic health effects, ATSDR has developed Minimal Risk Levels (MRLs) for contaminants that are commonly found at hazardous waste sites. The MRL is an estimate of the level of daily human exposure to a contaminant below which non-cancerous adverse health effects are unlikely. MRLs are developed for each route of exposure, *e.g.*, ingestion or inhalation, and for the length of exposure, *i.e.*, acute (less than 14 days); intermediate (15–364 days); and chronic (365 days or more). Because ATSDR has no methodology to determine amounts of chemicals absorbed through the skin, no MRLs have been established for skin exposure. ATSDR presents information on MRLs in its series of Toxicological Profiles on hazardous substances. These chemical-specific profiles provide information on health effects, environmental transport, human exposure, and regulatory status. If ATSDR has not developed an MRL for a contaminant, the EPA Reference Dose (RfD) is used, if available. The RfD is an estimate of the daily exposure of the human population to a potential hazard that is likely to be without risk of a non-carcinogenic adverse health effects during a person's lifetime. To date, none of the air samples from residential living areas were above ATSDR's long-term or short-term MRL. Therefore, adverse non-carcinogenic health effects from either short- or long-term exposures to PCE are not expected. One sample obtained from the sump at a residence on Laurel Avenue did contain PCE above ATSDR's short-term MRL. Exposure to this concentration of PCE is considered to be of short-term duration when the cover over the sump is opened. For this reason, this exposure is further evaluated below. Since the concentrations of PCE in several other homes were above the HCV for cancer effects and typical background levels in U.S. homes, ATSDR and NJDHSS will also evaluate the public health implications of these exposures.

The highest concentration of PCE that was measured ($1,760 \mu\text{g}/\text{m}^3$ in the residential sump) exceeds ATSDR's short-term MRL of $1,356 \mu\text{g}/\text{m}^3$. However, it should be noted that the short-term MRL for PCE is based on a human study of neurological effects (hand-eye coordination) of PCE (Altman et al., 1992), which is considered by ATSDR to be of a less serious nature. Moreover, the short-term MRL for PCE that was determined by the study is 200 times below the Lowest Observed

Adverse Effect Level (LOAEL)—the value of 200 is considered an uncertainty or margin-of-safety factor. Furthermore, the concentration that was measured at the sump is about 40 times less than the No Observed Adverse Effect Level (NOAEL). Moreover, because this sample was taken from an enclosed sump, only short-term intermittent exposures are likely to have occurred. Based on this information, it does not appear likely that the residents would experience any short-term adverse non-cancer effects from their exposures.

Tetrachloroethene (TCE): chronic exposure and cancer

PCE is a common commercial chemical that is used in the dry cleaning industry. Because of the potential for high PCE exposure, a number of epidemiological studies of dry cleaning workers have been conducted. These studies suggest a possible association between long-term PCE exposure and an increased risk of cancer. The cancer types most consistently showing an increased risk are esophageal cancer, bladder cancer, cervical cancer, and non-Hodgkin's lymphoma. Since dry cleaning workers are also exposed to other chemicals, it is difficult to determine whether these cancers are associated with PCE or some other chemical used in the drying cleaning industry. Another study of a community exposed to PCE only through their drinking water showed an increase in leukemia and bladder cancer in the exposed population (Aschengrau *et al.*, 1993; Webler *et al.*, 1993). Adding to the complexity is the contribution that smoking and other life-style variables might have on producing these cancers. One scientist reviewed these studies and concluded that esophageal cancer might have been caused by cigarette smoking and alcohol consumption, and that bladder cancer might have been caused by exposure to other solvents that are used in the dry cleaning industry (Weiss 1995; ATSDR 1997).

Near-lifetime exposure to PCE by inhalation has been shown to cause cancer in rats and mice. In a 2-year study of rats, Mennear *et al.* showed an increase in mononuclear cell leukemia (a cancer of the blood) following exposure to 1,356,000 $\mu\text{g}/\text{m}^3$ PCE for 5 days a week, 6 hours a day. Mennear *et al.* also showed that inhalation of PCE caused an increase in liver cancer in mice exposed at 678,000 $\mu\text{g}/\text{m}^3$ for 5 days a week, 6 hours a day for over 2 years.

Much discussion exists in the scientific community about whether PCE exposure can cause cancer in humans. The EPA is currently reviewing its cancer classification for PCE. The National Toxicology Program (NTP), within the federal Department of Health and Human Services, has reviewed the available cancer information and has determined that there is sufficient evidence that PCE can cause cancer in animals, but that the evidence in humans is inconclusive. The NTP has concluded that PCE may reasonably be anticipated to be a carcinogen (ATSDR, 1997). Overall, the scientific community is uncertain whether PCE causes cancer in humans. However, to be protective of public health, ATSDR and the NJDHSS believe it is reasonable to consider PCE a probable human carcinogen.

Since EPA Region III's Risk Based Concentration (RBC) for PCE is 0.63 $\mu\text{g}/\text{m}^3$, a concentration of 6 $\mu\text{g}/\text{m}^3$ (a typical background concentration found in indoor air) represents a

Lifetime Excess Cancer Risk (LECR) of 1×10^{-5} (1 in 100,000). [A concentration of $60 \mu\text{g}/\text{m}^3$, a factor of 10 greater than the average background concentration, therefore represents a LECR of 1×10^{-4} (1 in 10,000)]. Exposure levels of 6 - $60 \mu\text{g}/\text{m}^3$ represent a slightly increased lifetime excess cancer risk beyond the cancer risk due to background PCE levels. The LECRs were calculated based on EPA's draft provisional cancer reassessment of exposure to PCE by inhalation (EPA, 2002). This determination was based on a study of liver cancer in female mice, an outcome that is considered by many to be the most appropriate when comparing rodent studies to human health effects.

The method used to calculate the LECR is based on EPA's Cancer Slope Factor (CSF), which assumes that high dose animal exposure data can be used to estimate the risk for low dose exposures in humans. The method also assumes that there is no "safe" level for exposure, and that the total duration of past, current, and future exposure could be as much as 30 years – a very conservative assumption. While this calculation may not determine a real-life increase in cancer to those who are exposed to PCE, it is evidence of a potential added risk, suggesting a difference between the cancer incidence under the exposure conditions and the background incidence in the absence of exposure. The actual possibility of any one person (child or adult) getting cancer is probably lower than the calculated risk and is dependent on many factors, for example, lifestyle, nutritional status, genetics, and other exposures at home and in the workplace. Moreover, the actual exposures to the residents are likely to be much lower than those shown to cause cancer in animals, or than exposures to workers at dry cleaning establishments.

Conclusions

Based on the action levels proposed by the EPA and the NJDEP, the public health interpretation of the levels of PCE that were found in the indoor air in about 220 residences in Wall Township that were sampled in conjunction with the on-going investigation of the White Swan site is as follows:

- Exposures to PCE concentrations above $60 \mu\text{g}/\text{m}^3$ represent a lifetime risk of cancer greater than that due to background concentrations;
- Exposures to PCE concentrations between 6 and $60 \mu\text{g}/\text{m}^3$ represent a lifetime cancer risk that is slightly greater than that due to background levels; and
- Exposures to PCE concentrations less than $6 \mu\text{g}/\text{m}^3$ represent little or no lifetime cancer risk greater than that due to background levels.

Taking into consideration the cancer effects associated with PCE air exposures, ATSDR and the NJDHSS calculated Lifetime Excess Cancer Risks (LECR). While this calculation may not be an indication of a real-life increase in cancer to those who are exposed to PCE, it does indicate a potential added risk, suggesting a difference between the cancer incidence under the exposure conditions and

the background incidence in the absence of exposure. The possibility of any one person (child or adult) getting cancer is probably lower than the calculated risk and is dependent on many factors, *i.e.*, lifestyle, nutritional status, genetics, and other exposures at home and in the workplace. Moreover, the actual exposures to the residents are likely to be much lower than those shown to cause cancer in animals or lower than exposures to workers at dry cleaning establishments.

ATSDR and the NJDHSS consider exposures to PCE at $60 \mu\text{g}/\text{m}^3$ and above to be a “**Public Health Hazard**” [See Appendix C for a description of ATSDR’s Public Health Hazard categories]. Actions taken by EPA to mitigate these completed pathway exposures are protective of public health. Although exposures between 6 and $60 \mu\text{g}/\text{m}^3$ represent a slightly increased risk of cancer beyond the background risk, ATSDR and the NJDHSS consider the actions taken by the NJDEP to reduce or eliminate exposures in this range to also be protective of public health. Taking into consideration typical indoor background levels in U.S. homes and the very low risk of cancer, ATSDR and the NJDHSS consider all exposures to PCE below $6 \mu\text{g}/\text{m}^3$ to represent “**No Apparent Public Health Hazard**”.

ATSDR and the NJDHSS have also evaluated the likelihood of an adverse non-cancer effect from the PCE air exposures in the 220 residences that were sampled in Wall Township. All but one sample were below ATSDR’s MRLs for long-term non-cancer health effects; therefore, no adverse non-cancer health effects are likely. The one sample that was above the short-term MRL was from a sump at a residence on Laurel Street. Because this sample was taken from an enclosed sump, only short-term intermittent exposures are likely to have occurred. Based on further evaluation of the exposures and health effects from the short-term exposures to the levels of PCE found in the air in the sump area, it is not likely that exposure to any residents would result in any serious non-cancer adverse health effects.

The above conclusions are based on a residential exposure scenario and do not apply to the evaluation of the public health implications of indoor air exposures under non-residential situations (e.g., schools and commercial buildings).

Recommendations

Soil gas and ground water investigations should be continued in order to determine the extent and contribution of site-related contaminants in ground water that infiltrate into the indoor air of homes and businesses.

Public Health Action Plan (PHAP)

The Public Health Action Plan (PHAP) for the (former) White Swan Laundry and Cleaner, Inc. site contains descriptions of the actions to be taken by ATSDR, NJDHSS and other agencies at or in the vicinity of the site. The purpose of a PHAP is to ensure that this Health Consultation not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. The environmental sampling data and remedial activities that have been conducted have been evaluated within the context of human exposure pathways and other relevant public health factors. Included is a commitment on the part of ATSDR and NJDHSS to monitor this plan to ensure that the plan is implemented. ATSDR will provide follow-up to this PHAP, outlining the actions which have been completed and those actions that are in progress, as needed. The public health actions to be implemented by ATSDR/NJDHSS are as follow:

Actions Undertaken

(1) EPA and the NJDEP have sampled the indoor air of numerous residences and other structures, including several schools in the vicinity of the site property. In addition, the EPA and NJDEP, collectively, have taken actions to reduce PCE exposures to concentrations that are below levels of public health concern.

(2) ATSDR and the NJDHSS have participated in a public availability session with local residents to provide them with a public health interpretation of their individual air sampling results. In addition, ATSDR and NJDHSS have participated in a public meeting to inform the general public of the public health issues of air exposures.

(3) ATSDR and the NJDHSS have prepared a fact sheet for PCE to accompany individual sampling results sent to the residents by the EPA.

Actions Planned

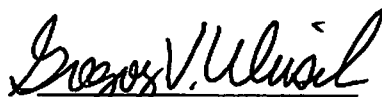
(1) ATSDR and NJDHSS will provide a copy of this document to all concerned residents in the vicinity of the site.

(2) As additional soil gas and ground water data become available, ATSDR and the NJDHSS will, when requested, evaluate the public health implications of indoor air exposures to other chemicals that may be found to be related to the site and provide assistance to residents to reduce their exposures to chemicals found that are not related to the site.

(3) ATSDR and NJDHSS will coordinate as deemed necessary with the appropriate environmental agencies to develop plans to implement the recommendations contained in this document.

Certification

This Health Consultation was prepared by the Division of Health Assessment and Consultation (DHAC), ATSDR, and the New Jersey Department of Health and Senior Services (NJDHSS) under a cooperative agreement with the ATSDR. It has been produced in accordance with approved methodology and procedures existing at the time the Health Consultation was begun.



Gregory V. Ulirsch

Technical Project Officer

Superfund Site Assessment Branch (SSAB)

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ATSDR

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



Roberta Erlwein

Chief, State Program Section (SPS), SSAB, DHAC

ATSDR

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Appendices

Appendix A: Fact Sheet on Perchloroethylene (PCE)

Agency for Toxic Substances and Disease Registry (ATSDR) Fact Sheet

Exposure to PCE in Residential Air Near the (former) White Swan Laundry Site Public Health Implications and Interpretation

General Public Health Issues:

- PCE is a solvent that is commonly used in the commercial dry cleaning industry and in some household products.
- Studies have shown that typical background levels in U.S. homes average 3 - 6 $\mu\text{g}/\text{m}^3$. This range is not a site-specific background level, but is presented to provide perspective.
- Studies of dry cleaning workers suggest a possible link between PCE air exposures and an increased risk of cancer.
- The most consistent cancers shown are esophageal, bladder, cervical, and non-Hodgkin's lymphoma.
- Scientists are uncertain whether these cancers are linked to PCE exposure, exposures from other chemicals used in dry cleaning, or from other risk factors, such as smoking, etc.
- Studies of rats and mice have linked PCE exposure to liver cancer in female mice. As with the human studies, some uncertainty exists, but it appears that the most credible link is with liver cancer in female rodents.
- The scientific community is uncertain whether PCE causes cancer in humans. However, to be protective of public health, ATSDR and the NJDHSS believe it is reasonable to consider PCE a probable human carcinogen.

Perspective on Site-Specific Exposure:

- To be protective of public health, the interpretation of PCE air exposures in the attached table is based on 30 years of exposure. The actual length of exposure to residents is not known, but it is likely to be much shorter than 30 years, so the chance of getting cancer is likely to be lower than stated.
- However, because the actual exposure levels over time are not known, the risk estimates may over- or underestimate the chance of getting cancer.
- The risk of any one person getting cancer is very low and is dependent on many factors, for example, lifestyle, nutritional status, genetics, and other exposures at home and in the workplace.
- The actual exposures to most residents are likely to be much lower than those shown to cause cancer in animal studies or exposure to workers in the dry cleaning business.

**Agency for Toxic Substances and Disease Registry (ATSDR)
Public Health Interpretation of Exposure to Tetrachloroethylene (PCE) in Residences Near the
(former) White Swan Laundry and Dry Cleaner, Inc. Site**

Concentration of PCE in Indoor Air ($\mu\text{g}/\text{m}^3$)	Public Health Interpretation	Background Concentration of PCE in Indoor Air in U.S. Homes ($\mu\text{g}/\text{m}^3$)
Less Than 6	Little to no additional lifetime cancer risk beyond the cancer risk due to background PCE levels (LECR** $<10^{-5}$)	3 - 6
6 - 60	Slightly increased lifetime cancer risk beyond the cancer risk due to background PCE levels ($10^{-4} < \text{LECR}^{**} < 10^{-5}$)	
60 and Above	Increased lifetime cancer risk beyond the cancer risk due to background PCE levels (LECR** $>10^{-4}$)	

*Reported values are the ranges of medians for background concentrations found in several U.S. cities, as reported by EPA's TEAM Study, 1987. These are not site-specific background concentrations for the White Swan Laundry and Cleaner site, but are presented to provide perspective. If the concentration of PCE in a household sample is within this range, it does not necessarily indicate that the PCE is entirely due to non-site-related sources.

**LECR - Lifetime Excess Cancer Risk

Note: The EPA Region III Risk Based Concentration (RBC) for PCE of $0.63 \mu\text{g}/\text{m}^3$ is equivalent to a LECR of 10^{-6} (1 in 1,000,000). ATSDR currently does not have a health-based cancer comparison value for inhalation of PCE.

Appendix B: Description of Comparison Values

Description of Comparison Values

ATSDR's Comparison Values are media-specific concentrations that are considered to be "safe" under default conditions of exposure. They are used as screening values in the preliminary identification of site-specific chemical substances that the health assessor has selected for further evaluation of potential health effects.

Generally, a chemical is selected for evaluation because its maximum concentration in air, water, or soil at the site exceeds one of ATSDR's Comparison Values. However, it cannot be emphasized strongly enough that Comparison Values are not thresholds of toxicity. While concentrations at or below the relevant comparison value may reasonably be considered safe, it does not automatically follow that any environmental concentration that exceeds a Comparison Value would be expected to produce adverse health effects. Indeed, the whole purpose behind highly conservative, health-based standards and guidelines is to enable health professionals to recognize and resolve potential public health problems before they become actual health hazards. The probability that adverse health outcomes will actually occur as a result of exposure to environmental contaminants depends on site-specific conditions and individual lifestyle and genetic factors that affect the route, magnitude, and duration of actual exposure, and not solely on environmental concentrations.

Screening values based on non-cancer effects are generally based on the level at which no health adverse health effects (or the lowest level associated with health effects) found in animal or (less often) human studies, and include a cumulative margin of safety (variously called safety factors, uncertainty factors, and modifying factors) that typically range from 10-fold to 1,000-fold or more. By contrast, cancer-based screening values are usually derived by linear extrapolation with statistical models from animal data obtained at high exposure doses, because human cancer incidence data for very low levels of exposure are rarely available. Cancer risk estimates are intended to represent the upper limit of risk, based on the available data.

Listed and described below are the types of comparison values that the ATSDR and the NJDHSS used in this Health Consultation:

Cancer Risk Evaluation Guides (CREGs) are estimated concentrations of contaminants in an environmental medium (such as drinking water) that are expected to cause no more than one excess cancer case for every million persons who are continuously exposed to the concentration for an entire lifetime (equaling a risk of 1×10^{-6}). These concentrations are calculated from the EPA's cancer slope factors, which indicate the relative potency of carcinogenic chemicals. Only chemicals that are known or suspected of being carcinogenic have CREG Comparison values.

Environmental Media Evaluation Guides (EMEGs) and Reference Dose Media Evaluation Guides (RMEGs) are estimates of chemical concentrations in an environmental medium (such as drinking water) that are not likely to cause an appreciable risk of deleterious, non-cancer health effects, for fixed durations of exposure. These guides may be developed for special sub-populations such as children. EMEGs are based on ATSDR's Minimal Risk Level (MRL) while RMEGs are based on the EPA's Reference Dose (RfD).

Other health-based guides may also be used as Comparison Values, including drinking water Maximum Contaminant Levels (MCLs) established by the EPA or the NJDEP.

Appendix C: ATSDR Public Health Hazard Categories

ATSDR's Interim Public Health Hazard Categories

Category / Definition	Data Sufficiency	Criteria
<p>A. Urgent Public Health Hazard</p> <p>This category is used for sites where short-term exposures (< 1 yr) to hazardous substances or conditions could result in adverse health effects that require rapid intervention.</p>	<p>This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.</p>	<p>Evaluation of available relevant information* indicates that site-specific conditions or likely exposures have had, are having, or are likely to have in the future, an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the presence of serious physical or safety hazards.</p>
<p>B. Public Health Hazard</p> <p>This category is used for sites that pose a public health hazard due to the existence of long-term exposures (> 1 yr) to hazardous substance or conditions that could result in adverse health effects.</p>	<p>This determination represents a professional judgement based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.</p>	<p>Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have in the future, an adverse impact on human health that requires one or more public health interventions. Such site-specific exposures may include the presence of serious physical or safety hazards.</p>
<p>C. Indeterminate Public Health Hazard</p> <p>This category is used for sites in which "critical" data are <i>insufficient</i> with regard to extent of exposure and/or toxicologic properties at estimated exposure levels.</p>	<p>This determination represents a professional judgement that critical data are missing and ATSDR has judged the data are insufficient to support a decision. This does not necessarily imply all data are incomplete; but that some additional data are required to support a decision.</p>	<p>The health assessor must determine, using professional judgement, the "criticality" of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible to select other hazard categories and to support their decision with clear narrative that explains the limits of the data and the rationale for the decision.</p>

Category / Definition	Data Sufficiency	Criteria
<p>D. No Apparent Public Health Hazard</p> <p>This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.</p>	<p>This determination represents a professional judgement based on critical data which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.</p>	<p>Evaluation of available relevant information* indicates that, under site-specific conditions of exposure, exposures to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health.</p>
<p>E: No Public Health Hazard</p> <p>This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.</p>	<p>Sufficient evidence indicates that no human exposures to contaminated media have occurred, none are now occurring, and none are likely to occur in the future</p>	

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