

Health Consultation

PROVIDENCE BARREL

SMITHFIELD, PROVIDENCE COUNTY, RHODE ISLAND

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Agency for Toxic Substances and Disease Registry

Division of Health Assessment and Consultation

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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

Review of Sampling and Analysis Plan (SAP)
Indoor Air and Soil Gas Survey

PROVIDENCE BARREL

SMITHFIELD, PROVIDENCE COUNTY, RHODE ISLAND



Prepared by:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Background

This health consultation is in response to a technical question pertaining to vapor intrusion from a groundwater plume related to the Providence Barrel site in Smithfield, RI. ATSDR was asked by the US Environmental Protection Agency (EPA) to evaluate whether indoor air action levels specified in a sampling and analysis plan (SAP) are protective of public health [1]. The SAP details indoor air and sub-slab soil gas sampling and analysis, inspection of residential basements for soil gas points of entry, and collection of air samples as needed during the week of May 19, 2008 [2]. The specific contaminants of concern are trichloroethylene (TCE) and tetrachloroethylene (PCE).

December 2007 Soil Gas Survey

The current sampling project is the result of a previous EPA soil gas survey that was performed the week of December 3, 2007, at nine homes selected by the On-Scene Coordinator (OSC). The selected homes were based on whether the contaminated groundwater plume was moving underneath the home or the home was in close proximity to the site, and if access to the property was granted by the home owner. In the December 2007 survey, EPA found PCE levels in indoor air grab samples ranging from non-detect to 64 ppb(v)^a, with a reported limit of detection ranging from 0.3-0.5 ppb(v). Indoor air grab samples of TCE ranged from non-detect up to 3 ppb(v), with a limit of detection ranging from 0.8-1.0 ppb(v). The indoor air grab sampling included samples from both the breathing zone and from cracks and penetrations of the home such as piping. Sub-slab soil gas sampling found PCE ranging from non-detect up to 346 ppb(v), with detection limits ranging from 0.3-0.5 ppb(v). Sub-slab soil gas TCE levels ranged from non-detect up to 226 ppb(v), with limits of detection ranging from 0.8-1.0 ppb(v). The results of the December 2007 survey were used to select homes for this current phase of the project where indoor air and sub-slab soil gas samples will be collected, and additional homes above the groundwater contamination plume will be added if access is granted by the properties' owners.

EPA Sampling Design

According to the SAP, each home will have at least one 24-hour indoor air sample collected in the basement. If the building is a duplex with the basement sectioned off into two separate areas, two 24-hour air samples will be collected. The basement is being selected because it is the first area of the building where soil gases will migrate into and it is also the area where air levels tend to be the highest. Indoor air data will be compared to a 24-hour background outdoor air sample, that will be collected each day indoor air samples are collected. For quality control purposes, a co-located canister sample will be collected each day over a 24-hour period in one of the homes selected for that day's sampling event. The location of the duplicate sample will be selected based on the home with the greatest potential for having the highest indoor air concentrations. Data collected from the previous survey will be used to make this determination. All canister samples will be analyzed for the volatile organic compounds (VOCs) listed on Table 1, with particular focus on the target compounds mentioned above, using EPA method TO-15.

^a ppb(v): parts per billion on a volume basis

Table 1: EPA VOC Target List**EPA METHOD TO15 TARGET VOC LIST**

1,1,1-Trichloroethane	Dibromochloromethane
1,1,2,2-Tetrachloroethane	Dichlorodifluoromethane (F12)
1,1,2-Trichloroethane	Dichlorotetrafluoroethane
1,1-Dichloroethane	Ethyl Benzene
1,1-Dichloroethylene	Heptane
1,2,4-Trichlorobenzene	Hexachloro-1,3-butadiene
1,2,4-Trimethylbenzene	Hexane
1,2-Dibromoethane	Methyl Ethyl Ketone
1,2-Dichlorobenzene	Methyl Isobutyl Ketone
1,2-Dichloroethane	Methyl-t-butyl ether
1,2-Dichloropropane	Methyl Bromide (Bromomethane)
1,3,5-Trimethylbenzene	Methyl Chloride (Chloromethane)
1,3-Butadiene	Methylene Chloride
1,3-Dichlorobenzene	Styrene
1,4-Dichlorobenzene	Tetrachloroethene
2-Hexanone	Tetrahydrofuran
4-Ethyl Toluene	Toluene
Acrylonitrile	Trichloroethene
Allyl Chloride	Trichlorofluoromethane
Benzene	Trichlorotrifluoroethane
Benzylchloride	Vinyl Bromide
Bromodichloromethane	Vinyl Chloride
Bromoform	cis-1,2-Dichloroethene
Carbon Tetrachloride	cis-1,3-Dichloropropene
Chlorobenzene	m,p-Xylene
Chloroethane	o-Xylene
Chloroform	trans-1,2-Dichloroethene
Cyclohexane	trans-1,3-Dichloropropene

Sub-slab soil gas sampling probes will be located through the concrete slab of each home using EPA standard operating procedures. If a home has a basement floor made of dirt, either a slam bar or a manually driven GeoProbe will be used to insert the soil gas sampling probe. A maximum of three soil gas sampling probes will be inserted through the basement floor. EPA staff will collect the soil gas samples and immediately analyzed them on-site using EPA's Mobile Laboratory. One canister confirmation grab sample will be collected from each home and then analyzed at the EPA Regional Laboratory using gas chromatography/mass spectrometry (GC/MS). In addition, grab air samples will be collected by using a glass syringe from areas where soil gases have the greatest potential to migrate into the basement (i.e. openings in the basement walls and floors and drain pipes) and then analyzed on-site in the mobile lab.

Proposed EPA Action Level

Action levels for two chemicals were specified in SAP (Table 2). However, the SAP does not discuss what actions will be initiated by EPA if the proposed action levels are exceeded. ATSDR presumes exceeding the action levels will result in steps that will result in either mitigation of the exposure pathway or further in-depth analysis of the public health implications.

Table 2: Proposed EPA Action Levels

Compound	Soil Gas Action Level (ppb/v)	Indoor Action Level (ppb/v)
Trichloroethylene	140	0.186
Tetrachloroethylene	560	0.737

Discussion

ATSDR has published minimum risk levels (MRLs) for both TCE and PCE (Table 3) and has published Toxicological Reviews of both PCE and TCE [3,4].

Table 3: ATSDR Minimum Risk Levels

Compound	Acute (ppb(v))	Intermediate (ppb(v))	Chronic (ppb(v))
Trichloroethylene	2,000	100	N/A*
Tetrachloroethylene	200	N/A	40

* N/A: Not available

An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. These substance specific estimates, which are intended to serve as screening levels, are used by ATSDR health assessors and other responders to identify contaminants and potential health effects that may be of concern at hazardous waste sites. It is important to note that MRLs are not intended to define clean up or action levels for ATSDR or other agencies.

The National Toxicology Program (NTP) classifies both TCE and PCE as “reasonably anticipated to be a human carcinogen” and their potential to cause cancer is discussed in the 11th Report on Carcinogens [5]. The toxicity and carcinogenicity of TCE is the subject of ongoing evaluation. EPA is currently reviewing its reference dose (RfD) and reference concentration (RfC), and cancer assessment for TCE [6]. EPA proposed a RfC for TCE of 7.4 ppb(v) in 2001

[6]. In 2006, the human health risks of TCE were further reviewed by the National Academies of Science (NAS) [7].

ATSDR notes that the EPA proposed screening levels for the Providence Barrel site are well below existing ATSDR screening levels and are based on Proposed Connecticut Department of Public Health Remediation Standard Regulations, Volatilization Criteria, March 2003 [8]. In both the case of TCE and PCE, the Connecticut Volatilization Criteria were set at estimated background concentrations because the background concentrations were greater than the calculated risk-based concentrations. Connecticut based its calculation of background on two sources, ASTM ES 38-94 “Emergency Standard Guide for Risk Based Corrective Action Applied at Petroleum Release Sites” and Massachusetts Department of Environmental Protection’s (DEP’s) “Background Documentation for the Development of the MCP Numerical Standards” [8].

Targeting background concentrations is a protective approach for reducing risk. However, the use of “background” concentrations is complicated in evaluating groundwater vapor intrusion risks. There are several sources of VOC’s in indoor air, and these sources can be variable from home to home. The Interstate Technical Resources Council (ITRC) guidance on groundwater vapor investigation recommends that multiple lines of evidence be developed to establish if a contaminant is from background sources [9]. Examples of evidence include building construction and current condition, constituent ratios, sub-slab gas data, and spatial correlation [9]. Based on the SAP, it appears that these data are going to be available to EPA, and should be considered in addition to the proposed action levels. Prior to conducting indoor air sampling, a walk through to assess potential sources of indoor contamination should be conducted [9].

Evaluation of groundwater vapor intrusion pathways is a complicated process. In assessing potentially impacted homes and structures, preferential pathways should be noted [9]. Fractured bedrock and site underlying geology could also be influential in creating preferential pathways to structures over and near groundwater vapor plumes [9]. Buried underground utilities may also provide pathways for groundwater vapor contamination to move towards and into structures [9]. Season and weather conditions may also affect indoor air concentrations from groundwater vapor intrusion, with winter generally creating higher levels [9]. Provided that these issues have been considered and evaluated, ATSDR believes that the SAP is a reasonable first step to evaluate the potential for groundwater vapor intrusion into homes that have been impacted by the plume. However, the scope of the sampling effort may need to be expanded to account for the factors discussed above. Overall, ATSDR finds that the proposed action levels for TCE and PCE are protective of public health.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child’s lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are

dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health. ATSDR finds that the proposed action levels for TCE and PCE are protective of public health, including children.

Response to Comments

Prior to the release of this health consultation, a draft document was provided to the EPA OSC for review and comment. The OSC indicated the sampling plan will consider all the other potential sources of VOCs in the residences. The OSC also indicated that EPA has already made notes and observations in those basements to which access was granted.

The OSC stated the "Connecticut numbers" are protective because they are based on background levels. After further consideration, the OSC felt that calling these numbers "action levels" did not accurately describe them. In an update of the SAP, these numbers will be labeled as "background levels". Furthermore, ATSDR's MRLs will be added to the SAP as additional information for comparison purposes. The OSC indicated that if samples collected during the upcoming sampling event exceed the targeted background levels, the data will be evaluated by health agencies (ATSDR and EPA) before any consideration of remedies is made by EPA.

Based on the acknowledged changes to the SAP, ATSDR finds EPA's proposed action to conduct further evaluation if targeted indoor air background levels are exceeded to be protective of public health.

Conclusions and Recommendations

- Provided proper lines of evidence are developed to evaluate trichloroethylene and tetrachloroethylene concentrations, the EPA proposed action with regard to indoor air is protective of public health.
- The sampling and analytic plan is largely guided by a previous study that has not been commented on by ATSDR. While the sampling of the homes identified should proceed, ATSDR notes that there are multiple factors that need to be considered in evaluating groundwater vapor intrusion pathways. If these issues have not been addressed, then the scope of the SAP may need to be expanded.

Public Health Action Plan

The purpose of the public health action plan is to ensure that this evaluation not only identifies potential and ongoing 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. ATSDR will mail this health consultation to the appropriate personnel at EPA to ensure that they are aware of ATSDR's public health conclusions and recommendations.

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