Health Consultation

Review of Air Data from January 2007 through April 2012 for

THE NAVY YARD MILLS SITE

DRACUT, MASSACHUSETTS

APRIL 10, 2014

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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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DRACUT, MASSACHUSETTS

Prepared By:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry (ATSDR)
Division of Community Health Investigations
Eastern Branch
Region I

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Foreword

Congress established the Agency for Toxic Substances and Disease Registry, ATSDR, in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the Superfund law. This law set up a process to identify and clean up our country's worst hazardous waste sites. The U.S. Environmental Protection Agency (EPA) is responsible for implementing the law to ensure the investigation and clean-up of the sites.

Since 1986, Superfund law has required ATSDR to conduct a public health assessment for each of the sites proposed for the EPA National Priorities List (NPL). The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR have cooperative agreements. The public health assessment process allows ATSDR scientists and public health assessment cooperative agreement partners' flexibility in document format when presenting findings about the public health impact of hazardous waste sites. The flexible format allows health assessors to convey to affected populations important public health messages in a clear and expeditious way.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high-risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicological, and epidemiologic studies to evaluate the possible health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals, and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the public comments related to the document are addressed in the final version of the report.

Conclusions: The report presents conclusions about the public health threat posed by a site. Ways to stop or reduce exposure will then be recommended in the public health action plan. ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA or other responsible parties. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also recommend health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Manager, ATSDR Records Center
Agency for Toxic Substances and Disease Registry
4770 Buford Hwy, NE, MS F-09
Atlanta, GA 30341

Summary

In July 2012, ATSDR released a Health Consultation for the Navy Yard Mills site that evaluated 12 weeks of indoor air sampling data collected in 2012. As a follow up to that document, EPA took immediate steps to stop or reduce exposure to PCE and TCE in the indoor air in Buildings 1, 4, and 19 at the Navy Yard Mills site to protect the health of children, pregnant women and workers. In addition, a batting cage facility located in Building 19 was relocated to an off-site location in September 2012. The workers in Building 4 were relocated in October of 2012 to Building 6 while Building 4 was remediated.

ATSDR was also asked to evaluate the cancer risk based on all the indoor air data collected on the site from 2007 to 2012 The previous document did not evaluate cancer risk, since we required more data to make that evaluation. The 5-year data set indicates that the range of historic concentrations of PCE and TCE in air were consistent with the twelve weeks of 2012 data; contaminant levels have been elevated for the past five years.

Conditions at the site continue to change for a variety of reasons including EPA's efforts to stop exposures. The conclusions in this health consultation are based on data from January 2007 through April 2012. As conditions in buildings change, possible health impacts from exposures can change.

Main Conclusion	The Former Navy Yard Mills Site is a Public Health Hazard and not safe for workers or frequent visitors.
Basis for Main Conclusion	Five years of data showed for all buildings the average levels of TCE and PCE were above those that may cause harm to people's health. Air levels of PCE and TCE within the buildings have fluctuated in the past and will likely continue to fluctuate. People should not occupy buildings until remediation efforts demonstrate a constant and consistent reduction of contaminant levels over time that are below those of health concern.
Next Step	Continued indoor air testing that is representative of potential exposures is needed to determine if remediation efforts are sufficient for building occupation.
Conclusion 1	Pregnant workers who may have been in Buildings 1,3,4,6, or 19 were exposed, in the past, to levels of TCE in indoor air that might damage the heart of an unborn child
Basis for Conclusion 1	Pregnant workers, in Buildings 1,3,4,6, and 19 were exposed to levels of TCE in indoor air that posed a non-cancer health hazard to their unborn fetus. However, potential harmful exposures might exist in the future if levels are not maintained below levels of concern.

Conclusion 2	Workers in Building 4 and workers, exercising children, and exercising adults in the second room of the batting cage area of Building 19 were, in the past, exposed to PCE above a level of concern for nervous system impairment.
Basis for Conclusion 2	Estimated exposure concentrations in Building 4 and in the second room of the batting cage area of Building 19 were, in the past, several times higher than the health comparison value and approached a health effect level for temporary color blindness.
Conclusion 3	Adults who worked in or visited Buildings 1,3,4,6, or 19 and children who visited or exercised in Building 19 (batting cage area) were exposed to PCE and TCE in indoor air at levels estimated to result in less than one additional case of cancer per 100,000 persons similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.
Basis for Conclusion 3	Combined cancer risks for PCE and TCE were estimated for the batting cage area of Building 19 based on data from January 2007 to April 2012. These estimates included adjustments for the impacts of early life exposures children. The cancer estimates assumed that children were exposed 2 hours per day, 5 days per week, for 5 years. The cancer estimates for adults assumed that workers were exposed for 10 hours per day, 5 days per week for 5 years. The cancer risk estimate was within EPA's target risk range.
Next Steps	1. Conduct representative air sampling to ensure contaminant reduction remedies have consistently (over time) reduced PCE and TCE levels below those of health concern. Once occupied, conduct periodic testing to ensure continued remediation efforts remain effective. 2. Make tenants of the site aware of the site's history, the possible exposure to PCE and TCE in indoor air and the plans to reduce exposures on site. 3. Any occupied indoor spaces need to be sampled regularly to ensure that levels or PCE and TCE remain below a level of concern for occupancy. It is especially important that any space where women of childbearing age may frequent is sampled regularly since TCE can adversely affect a developing fetus. 4. ATSDR will review any additional sampling plans, sample results, and remediation design plans when available.

BACKGROUND AND STATEMENT OF ISSUE

This Health Consultion has been prepared as a follow-up to the Health Consultation entitled: "*Review of Indoor Air Data from January 2012 through April 2012 at the Navy Yard Mills site in Dracut, Massachusetts*", dated July 26, 2012 [ATSDR 2012]. The purpose of this review is to evaluate only tetrachloroethylene (PCE) and trichloroethylene (TCE) in indoor air data from January 2007 through April 2012 and assess potential cancer and non-cancer health implications related to exposures that may have occurred over the last five years.

The Navy Yard Mills site (the Site) is located at 76 through 100 Pleasant Street in Dracut, Massachusetts. The site is located near a mix of commercial and residential buildings. No residential buildings currently exist on the site. The site is bordered by a condominium complex to the northwest, Beaver Brook to the northeast, Pleasant Street to the southeast, and School Street to the southwest. Beaver Brook was formerly used to power mill operations.

The Site consists of a mill complex of ten distinct interconnected mill buildings. The buildings are designated as Building Numbers 1 through 20. Most of the property is paved, and a wooded area is located along the northwestern portion of the site. The buildings have been renovated into commercial spaces, and some are currently occupied by commercial clients.

The site was originally used as a cotton mill and subsequently as a woolen mill. Information regarding potential contamination resulting from mill operations is limited to the former presence of fuel oils, gasoline, sulfuric acid, and unspecified dyes. During the 1960s, mill operations ceased and, beginning in 1971, portions of the Site were rented out to commercial clients. From about 1980 (possibly earlier) to 2000, United Circuits, Inc. manufactured printed circuit boards and occupied portions of Building Numbers 1, 2, 3, and 19. According to EPA records, United Circuits, Inc. was listed as a Large Quantity Generator of hazardous waste, which included the following: various acids and bases; hydrogen peroxide; and Volatile Organic Compounds (VOCs) including tetrachloroethylene (PCE), trichloroethylene (TCE), methylene chloride, 1,1 ,1-trichloroethane, acetone, and isopropyl alcohol. They also handled several different streams of wastewater treatment, plating bath solutions and residues from electroplating operations. The basements of Building Numbers 1 and 2, and later the ground floor of Building Number 2, were used for storage of virgin chemicals and waste materials. In addition, an industrial wastewater treatment plant was located in the basement of Building Number 1. United Circuits, Inc's Massachusetts subsidiary was involuntarily dissolved in 2007.

Currently (as of August 2013), Buildings 1, 4, and 19 are occupied by businesses. One section of Building 19 housed a baseball batting and practice (indoor) area from 2007 to September 2012 and a separate section of Building 19 currently houses a furniture manufacturing business. Buildings 1 and 4 share a common basement (referred to as the *basement of Building 1*). It is our understanding that occupants of Building 1 do not access the basement. The Building Inspector for the Town of Dracut, Massachusetts believes that no tenant on-site has leased space for more than five years. Figure 1 contains a map of Navy Yard Mills Site.

Figure 1. Map of Navy Yard Mills Site, Dracut, Massachusetts

Demographics

No people live on the contaminated property. Most buildings have had tenants in the last seven years except building 20. Two employees work in Building 1 and split a 40 hour work week. About five people work in Building 4, but were temporarily relocated in October 2012 to Building 6 while Building 4 was remediated. Building 19 has one current tenant: a furniture manufacturer which employs ten people. From 2007 to September 2012, a portion of Building 19 had an indoor batting cage that had one full time employee. The facility hosted daily up to 25 children ages 5-18, their parents, and coaches.

Screening and Comparison Values:

The first step of screening the indoor air data involves comparing measured contaminant concentrations to health-based "screening" values also known as comparison values (CVs).

CVs are chemical concentrations in air used by ATSDR health assessors to identify environmental contaminants that require further evaluation. CVs include uncertainty factors to ensure that they are adequately protective of public health.

The results of the screening analysis give health assessors an understanding of the priority contaminants at the site. Health guidelines used to evaluate the potential for non-cancer health effects are ATSDR minimum risk levels (MRLs), EPA reference concentrations (RfCs). Health guidelines are considered safe doses; that is, if the estimated dose is below the health guideline, no adverse effects would be expected. If a dose is above the guideline, it does not necessarily represent a health concern.

Cancer-based CVs are calculated from the U.S. Environmental Protection Agency's (EPA) oral cancer slope factor (CSF) or inhalation unit risk (IUR). CVs based on cancerous effects account for a lifetime exposure (78 years) with a theoretical excess lifetime cancer risk of 1 extra case per 1 million exposed people. When a cancer and non-cancer CV exists for the same chemical, the lower of these values is used in the screening process for public health protectiveness.

Exposure assumptions:
ATSDR's Cancer Risk Evaluation Guide (CREG) for TCE (0.24 µg/m3) and PCE (3.8 µg/m3) were exceeded in every building that was tested. EPA's reference concentration (RfC) and the ATSDR Minimal Risk Level for TCE (2 µg/m3) were exceeded in all buildings over the past five years. The RfC for PCE (40 µg/m3) was exceeded in most buildings.

The site consists of several buildings; three of which were occupied as of August 2013. (Building numbers 1, 4, and 19). The occupants of Building 4 have been temporarily relocated to Building 6 during remediation of Building 4. The batting cage facility of Building 19 was moved to another location in another town. The occupants of the furniture company in Building 19 remain as well as the occupants of Building 1. Each building's evaluation includes the risk of cancer and non-cancer effects.

The exposure duration for office workers was assumed to be 10 hours per day and 5 days a week. When the batting cage area of Building 19 was occupied, it is our understanding that exercising individuals ranged in age from 5 to adult and attended 2 hours per day for five days per week (10 hours a week). For the worker in the former batting cage area of Building 19 the exposure duration was assumed to be 10 hours per day and 7 days per week.

Environmental Sampling

Massachusetts Department of Environmental Protection (MADEP) provided indoor air sample results for numerous buildings on-site as far back as January 2007. ATSDR has evaluated data on 125 samples provided by MADEP along with the more current EPA data.

Although there were 125 indoor air samples collected from January 2007 through April 2012 by MADEP and EPA many of the places where samples were collected are not helpful for determining the health impacts of the site. For example, samples collected in a building basement or at the bottom of an elevator shaft might have high indoor air concentrations of contaminants, but may be an unlikely completed exposure pathway. If people do not spend time in the basement or elevator shaft, then they are not exposed to those contaminants. For this health assessment, ATSDR tried to include sampling data from areas of the buildings where people may have spent time.

Because not every indoor air sample collected from January 2007 through April 2012 can be used to assess health impacts, there are a limited number of samples which can be used to determine if the site is a hazard to human health. We included some indoor air concentrations from locations where air purifying units were installed (some were running, others were turned off).

ATSDR used two approaches to evaluate non-cancer health effects from PCE and TCE exposure: 1) the maximum value was used, if there were fewer than ten samples above the detection limit; 2) otherwise the 95 % Upper Confidence Limit (95% UCL) of the mean concentration was used. The 95 % UCL is a statistical upper bound estimate of the central tendency concentration in the air and is a number which takes into account the variability of the data to ensure exposures are not underestimated. The 95% UCLs were calculated assuming the data follow a gamma distribution.

EPA requested that ATSDR evaluate cancer as a health effect for the 5-year period (January 2007 through April 2012) for which there were sampling data. ATSDR evaluated the cancer risk from PCE and TCE exposure using a 5 year average contaminant levels for Buildings 1, 3, 4, 6, and 19.

Table 1 summarizes the indoor air data collected on April 26, 2012, for PCE and TCE from several buildings located on the Navy Yard Mills Site. EPA performed some mitigation in 2011 and 2012 to try to reduce indoor concentrations of PCE and TCE. TCE concentrations from sampling done by EPA in April 2012 exceeded the 5 year average in Building 19 (and also exceeded the MRL/RfC). This suggests that concentrations did not drop due to mitigation efforts performed before April 2012.

As work continues on the site, site conditions continue to change. The only way to ensure current and future occupants of the site are not exposed to hazardous levels of PCE and TCE is to continue representative indoor air sampling and to implement appropriate actions to mitigate exposures.

Table 1 Summary Indoor Air Data Collected on April 26, 2012, of Tetrachloroethylene (PCE) and Trichloroethylene (TCE) from Buildings Located on the Navy Yard Mills Site

Building	Location	Sample number	TCE Conc. ($\mu g/m^3$)	PCE Conc. ($\mu g/m^3$)
1	Unoccupied Basement 2 ft from ground	D31245	370	680
	Self Storage Reception Area Desk	D31247	56	100
	Self Storage Locker Area Floor	D31241	61	110
3	Southwest Floor	D31242	44	66
4	Catering Company Business Office Hallway Southern End Floor	D31240	54	96
	Catering Company Business Office Offices North End Filing Cabinet	D31239	44	73
6	Center of Main Entrance on Table	D31243	ND	1.4
	Northwest End - waist level	D31244	0.91	2.4
19	Main Room Center of Indoor Baseball Practice Area 2 Feet Off Floor	D31249	15	24
	Indoor Baseball Practice Area Northwest Corner Floor	D31250	15	23
	Indoor Baseball Practice Area Sitting Area in Overflow Room	D31248	22	38
	A Furniture Company North End of Lunchroom 4 feet from floor	D31246	2	4.3

Notes:
All results in micrograms per cubic meter ($\mu g/m^3$).
2- or 8-hr 6L SUMMA canister samples.
EPA's Reference Concentration (RfC) for PCE is 40 $\mu g/m^3$.
EPA's Reference Concentration (RfC) and ATSDR's Minimal Risk Level (MRL) for TCE are 2 $\mu g/m^3$.

Table 2 displays the 95% UCL or maximum level of PCE and TCE calculated from the indoor air data. Also included in that table is the Hazard Quotient for each compound at each sample location.

The Hazard Quotient (HQ) is the ratio of the representative contaminant concentration to its MRL or RfC HQs were corrected for working 10 hours per day, 5 days per week, instead of 24 hours, seven days per week. Any value of HQ less than one means that concentration is below the inhalation guideline and thus health effects are unlikely. If the HQ exceeded 1, ATSDR performed a more detailed analysis of the data to determine if the air concentrations were high enough to cause any potential negative health effects.

The TCE HQ exceeded 1 in all buildings over the past five years, and PCE HQ exceeded 1 in five of the buildings. PCE breakdown products were not elevated in any buildings and therefore not included.

Table 2. The Representative Maximums for PCE and TCE from the Indoor Air Data in Building Locations Where Occupancy Most Likely Occurred and Hazard Quotient for Each Compound.

Location	PCE Representative Maximum ($\mu g/m^3$)	PCE HQ	TCE Representative Maximum ($\mu g/m^3$)	TCE HQ	Number of Samples	Method used to Determine the Representative Maximum
Bldg 1 Office	141	1.05	68	10.12	13	95% UCL base on the Gamma distribution
Bldg 3 1st Floor	133	0.99	51	7.6	3	maximum value since there were fewer than 10 samples
Bldg 4 Conf Rm	242	1.80	116	17.3	10	95% UCL base on the Gamma distribution
Bldg 4 Offices	259	1.93	149	22.2	15	95% UCL base on the Gamma distribution
Bldg 4 Bathrooms	609	4.53	340	50.6	6	maximum value since there were fewer than 10 samples
Bldg 6 Main Floor	95	0.71	35	5.2	12	%95 UCL base on the Gamma distribution
Bldg 6 Offices	192	1.43	58	8.6	6	maximum value since there were fewer than 10 samples
Bldg 19 Former Box Manufacturer 1st Floor	29	0.22	14	2.1	4	maximum value since there were fewer than 10 samples
Bldg 19 Former Indoor Baseball Main Room	62	0.46	16	2.4	14	95% UCL base on the Gamma distribution
Bldg 19 Former Indoor Baseball Second Room	81*	0.60	38*	5.7	3	maximum value since there were fewer than 10 samples
Bldg 19 Furniture Manufacturer	27	0.20	8	1.2	2	maximum value since there were fewer than 10 samples

Notes: The Representative Maximum is either the 95%UCL or the Maximum detected level of TCE and PCE
The Hazard Quotient (HQ) Ratio of the Representative Maximum to the MRL/RfC for TCE or the Ratio of the Representative Maxium to RfC for PCE. HQs were corrected for working 10 hours per day, 5 days per week, instead of 24 hours, seven days per week.
* denotes a grab sample.

Table 3 shows the 5 year average concentrations of TCE and PCE in Building numbers 1, 3, 3A, 4, 6, 7, and 19 and the estimated excess lifetime cancer risk. The average concentration, rather than 95%UCL or the maximum values, was used to calculate cancer risks because cancer risk is most accurately assessed using long term average exposures. Although the period covered in this assessment was from January 2007 to April 2012, not all buildings had measurements taken for

the full five years. ATSDR assumed that the average calculated building concentrations were representative of the entire five year period. The risks within the buildings may change in the future as conditions change inside the buildings.

The estimated lifetime cancer risk is expressed as an estimate of how many people out of 100,000 people with similar exposures may develop cancer during their lifetime. For example, for Building 4 if 100,000 people were exposed to the average concentrations of TCE found in that area for five years, there may be 0.8 (less than 1) additional cases of cancer due to the exposure.

Table 3. Estimated Lifetime Cancer Risk Calculations Based on the Arithmetic Average Concentrations of Tetrachloroethylene (PCE) and Trichloroethylene (TCE) For a 5 Year Exposure to an Adult Worker (and exercising children/adults for the batting cage area of Building 19) by Building at the Navy Yard Mills Site

Location and group exposed	PCE 5-Year Avg ($\mu g/m^3$)	Lifetime Cancer Risk from PCE per 100,000 people	TCE 5-Year Avg ($\mu g/m^3$)	Lifetime Cancer Risk from TCE per 100,000 people	Total Cancer Risk per 100,000 people
Bldg 1 Office For Workers	148	0.07	62	0.5	0.6
Bldg 3 1st Floor For Workers	69	0.03	28	0.2	0.2
Bldg 4 Including Offices, Bathrooms and Conference Rooms For Workers	184	0.09	104	0.8	0.9
Bldg 6 Including Main Floor and Offices For Workers	54	0.03	23	0.2	0.2
Bldg 19 Furniture Manufacturer	10	0.005	5	0.04	0.05
Bldg 19 Former Batting Cage area Children	30	0.01	10	0.9	0.9[1]
19 – Former Batting Cage area- Workers	30	0.01	10	0.08	0.09
19 Former Box Manufacturer area Workers	20	0.01	10	0.08	0.09

Notes:

1. For Building 19 – batting cage area. Doses are higher for children and workers in the batting cage area due to higher breathing rates for those engaged in athletic training. The cancer risk calculation also accounted for age at exposure. Historic data did not differentiate where in each room measurements were taken. The cancer risks are generated based on data collected between January 2007 and April 2012.
2. Lifetime cancer risk is based on 5 years assumed exposure at the building average concentration.
3. Adding the lifetime cancer risk from PCE and TCE in the table does not necessarily equal the total cancer risk. Total cancer risks are added together prior to rounding to one significant figure.

Public Health Implications

Exposure to different chemicals can cause different types of health effects. PCE and TCE are both recognized as human carcinogens and as chemicals that can cause non-cancer health problems. For this health consultation document, the data were examined to determine if there were any cancer and non-cancer health effects from PCE and TCE exposure. PCE and TCE degradation products were not included, since they were all below screening values.

Cancer risk estimation

The estimated risk of developing cancer resulting from exposure to the contaminants was calculated by multiplying the site-specific estimated exposure dose by an appropriate cancer slope factor or inhalation unit risk (EPA values can be found at http://www.epa.gov/iris). The result estimates the increase in risk of developing cancer after a lifetime of continuous exposure to the contaminant.

If a substance causes cancer by a mutagenic mode of action, there is a greater cancer risk for exposures that occur in early life. A current list of substances EPA considers mutagenic can be found at http://www.epa.gov/oswer/riskassessment/sghandbook/chemicals.htm. For these substances, age-dependent adjustment factors (ADAFs) are applied to the risks estimated as follows: An ADAF of 10 is applied for exposures taking place from birth up to 2 years old, and an ADAF of 3 is applied for children's exposures taking place from age 2 up to age 16. No adjustment is applied for ages 16 or above

The actual increased risk of cancer may be lower than the calculated number, which gives an estimated risk of excess cancer. The methods used to calculate cancer slope factors assume that high-dose animal data can be used to estimate the risk for low dose exposures in humans. The methods also assume that no safe level exists for exposure. Little experimental evidence exists to confirm or refute those two assumptions. Lastly, most methods compute the upper 95th percent confidence limit for the risk. The actual cancer risk can be lower, perhaps by several orders of magnitude

Because of uncertainties involved in estimating cancer risk, ATSDR employs a weight-of-evidence approach in evaluating all relevant data. Therefore, the increased risk of cancer is described in words (qualitatively) rather than giving a numerical risk estimate only. Numerical risk estimates must be considered in the context of the variables and assumptions involved in their derivation and in the broader context of biomedical opinion, host factors, and actual exposure conditions. The actual parameters of environmental exposures must be given careful consideration in evaluating the assumptions and variables relating to both toxicity and exposure.

The age dependant cancer risk is the sum of the risk for each age interval "i", the cancer risk for exposure by a specified pathway is computed as:

$$Cancer\ Risk = \sum_{i} \frac{C \times IR_i \times EF_i \times ED_i \times ADAF_i \times SF}{BW_i \times AT}$$

where:

C = Concentration of the chemical in the contaminated environmental medium (soil or water) to which the person is exposed. The units are mg/kg for soil and mg/L for water.

IR_i = Intake rate of the contaminated environmental medium for age bin "i". The units are mg/day for soil and L/day for water.

BW_i = Body weight of the exposed person for age bin "i" (kg).

EF_i = Exposure frequency for age bin "i" (days/year). This describes how often a person is likely to be exposed to the contaminated medium over the course of a typical year.

ED_i = Exposure duration for age bin "i" (years). This describes how long a person is likely to be exposed to the contaminated medium during their lifetime.

AT = Averaging time (days). This term specifies the length of time over which the average dose is calculated. For quantifying cancer risk, five years exposure employs an averaging time of 5 years (i.e., 5 years × 365 days/year).

SF = Cancer slope factor $(mg/kg\text{-}day)^{-1}$

$ADAF_i$ = Age-dependent adjustment factor for age bin "i" (unitless)

Since EPA has characterized both PCE and TCE as carcinogenic to humans, we have calculated estimated excess lifetime carcinogenic risks for a five year exposure. ATSDR could not identify any tenant that leased space on site for more than a five year period, based on discussions with the Town of Dracut's current Building Inspector. The five year averages for indoor air for each building were used to estimate cancer risks (Table 3). The cancer risks presented in Table 3 are based on the exposure that occurred between 2007 and 2012. As conditions change on the site, the amount of PCE and TCE people are exposed to in specific areas of the site could change. This makes it difficult to predict what the cancer risk would be for people who use the site in the future.

PCE Cancer Risk Estimates:

The Department of Health and Human Services, National Toxicology Program classifies PCE as reasonably anticipated to be a human carcinogen, and the International Agency for Research on Cancer (IARC) has determined that PCE is a probable human carcinogen by mutagenic mechanisms. These determinations are based on limited human epidemiological studies suggesting elevated risks for esophageal cancer, non-Hodgkin's lymphoma, and cervical cancer and sufficient animal studies showing that PCE induced leukemia in rats and liver cancers in mice [NTP 2011, IARC 1995]. The Environmental Protection Agency considers PCE a likely human carcinogen based on epidemiological evidence showing associations between PCE and bladder cancer, non-Hodgkin's lymphoma, and multiple myeloma [EPA 2011].

Building 1

Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the arithmetic average concentrations by building in finished spaces from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from PCE in Building 1 was 0.07 cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 3
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the arithmetic average concentrations by building in finished spaces from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from PCE in Building 3 was 0.03 cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 4
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the arithmetic average concentrations by building in finished spaces from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from PCE in Building 4 was 0.09 cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 6
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the arithmetic average concentrations by building in finished spaces from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from PCE in Building 6 was less than 0.03 cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 19 Furniture Manufacturer Area
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the arithmetic average concentrations by building in finished spaces from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from PCE in Building 19 Furniture Manufacturer Area was 0.005 cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 19 - Former Batting Cage Area
Workers were assumed to be working 10 hours a day for 7 days a week for five years. We used the five-year average concentrations by sampling location from Table 3 to estimate the cancer risk. The estimated cancer risk from PCE in the batting cage area of Building 19 for workers is 0.01 cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Children were assumed to be exposed for 2 hours per day for five days per week for five years. We used the five-year average concentrations by sampling location from Table 3 to estimate the cancer risk. The age of exposure was also considered into the cancer calculation. The estimated cancer risk from PCE in the batting cage area of Building 19 for children is 0.01 cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 19 - Former Box Manufacturer Area
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the arithmetic average concentrations by

building in finished spaces from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from PCE in Building 19 Box Manufacturer Area was 0.01 cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

TCE Cancer Risk Estimates

The Department of Health and Human Services, National Toxicology Program classifies TCE as reasonably anticipated to be a human carcinogen by mutagenic mechanisms. In humans, occupational exposure to TCE was associated with excess incidences of several cancers, particularly liver cancer, non-Hodgkin's lymphoma, and kidney cancer [NTP 2011]. Animal studies showed that TCE exposure caused tumors in mice and rats at several different sites, including liver and kidney, by inhalation or oral exposure [NTP 2011]. The International Agency for Research on Cancer (IARC) has determined that TCE is a probable human carcinogen based on epidemiological studies showing increased rates of liver cancer and non-Hodgkin's lymphoma, primarily in workers who were exposed to TCE on the job, and animal studies showing increased numbers of liver and kidney tumors upon oral administration [IARC, 1995]. EPA characterizes TCE as carcinogenic to humans by all routes of exposure [EPA, 2011]. This conclusion is based on human epidemiology studies showing associations between human exposure to TCE and kidney cancer, non-Hodgkin's lymphoma, and liver cancer.

Building 1
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the five year average concentrations by sampling location from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from TCE in Building 1 was 0.5 cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 3
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the five year average concentrations by sampling location from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from TCE in Building 3 was 0.2 case per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 4
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the five year average concentrations by sampling location from Table 3, to estimate the cancer risk. The estimated cancer risk from TCE for occupants of Building 4 exposed to the highest average 5 year concentrations was 0.8 cases if 100,000 people were similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 6
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the five year average concentrations by sampling location from Table 3, to estimate the cancer risk from five years of exposure. The

estimated cancer risk from TCE in Building 6 was 0.2 case per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 19 Furniture Manufacturer Area
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the five year average concentrations by sampling location from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from TCE in the Furniture Manufacturer portion of Building 19 was less than 0.04 case per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 19 - Former Batting Cage Area
Adults were assumed to be working 10 hours a day for 7 days a week for 5 years. We used the five year average concentrations by sampling location from Table 3 to estimate the cancer risk. The cancer risk to all age groups was the similar, assuming an increased breathing rate from exercising by adult workers. The estimated cancer risk to workers from TCE in the batting cage area of Building 19 was 0.08 additional cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Children The children were assumed to be exposed for 2 hours per day for five days per week for 5 years. We used the five year average concentrations by sampling location from Table 3 to estimate the cancer risk. The age of exposure was considered in the cancer calculation. The estimated cancer risk to children from TCE in the batting cage area of Building 19 was 0.9 (less than 1) additional cases per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Building 19 - Former Box Manufacturer Area
Adults were assumed to work 10 hours per day for 5 days per week. We calculated the cancer risk estimations for five years of exposure. We used the five year average concentrations by sampling location from Table 3, to estimate the cancer risk from five years of exposure. The estimated cancer risk from TCE in the Box Manufacturer area of Building 19 was less than 0.08 case per 100,000 people similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime.

Non-cancer Health Effects

In order to evaluate the health implications of exposure to PCE and TCE, we reviewed the current scientific literature for these compounds. After comprehensive reviews, the EPA derives Reference Concentrations (RfCs) that represents a daily exposure considered safe for the long term. The RfC is developed from scientific studies where an observed effect level was identified. An uncertaintyfactor is then applied to take into account inter-individual variability in response and other uncertainties. The reference concentration (RfC) for PCE is 40 $\mu g/m^3$. The chronic MRL/RfC for TCE is 2 $\mu g/m^3$.

The EPA recommends that health risk assessors not use the Occupational Safety and Health Administration (OSHA) workplace standards to evaluate the health risk from vapor intrusion where the vapor intrusion has been identified in commercial/industrial settings and where the chemicals of concern from vapor intrusion are not used in the work place [EPA 2012b].

The non-cancer health risks are based on the exposure that occurred between January 2007 and April 2012. As conditions change on the site, the amount of PCE and TCE people are exposed to in specific areas of the site could change. This makes it difficult to predict what the health risk would be for people who use the site in the future.

PCE Non-Cancer Health Effects

The hazard quotients (HQ) for each building and scenario were calculated and presented in Table 2. Only Building numbers 1, 4, and 6 were evaluated because the HQ exceeded one. In essence, this means the concentration exceeded the RfC of 40 µg/m^3 [EPA, 2012b].

Long-term exposure to PCE can lead to central nervous system, liver, and endocrine effects. Occupants of most building were exposed to levels from 170 to 1,600 times lower than the actual levels that produced these effects in the relevant occupational and laboratory animal studies, and therefore adverse health effects among most workers are unlikely.

Occupational investigations that examined workers exposed to PCE indicate that one of the principle targets of PCE exposure include harmful effects to the visual system, resulting specifically in an inability to distinguish colors in the blue-yellow range. Additional occupational information indicates dizziness and changes in memory may be a target of PCE exposure [EPA 2012a].

Building 1(HQ 1.05)
Workers in Building 1 were not at risk for non-cancer effects from PCE in indoor air, because estimated doses were not above a level of health concern.

Building 4
Occupant exposure prior to April 2012, HQ 1.8 to 1.9. The HQ of 1 is exceeded in Building 4. ATSDR conducted a more detailed analysis of the non-cancer risk estimates. The level of PCE in Building 4 represents a level of concern for occupants who regularly worked or visited building. The non-cancer health effects estimated for Building 4 workers were based on adult workers in that building 10 hours per day for five years. Those are estimations were based on the worst case scenario for workers who may have been that building for 5 years. The Building 4 worker exposures to PCE have been reduced below a level of health concern (since they were temporarily relocated to Building 6). However, while those workers were working in Building 4 they were exposed to levels of PCE that posed a public health concern.

Exposure - since November 2012. The workers who were in Building 4 until November 2012 were temporarily relocated to Building 6 while Building 4 was remediated.

Building 6 (HQ 0.7 – 1.4)
Occupant exposure prior to April 2012. Because the HQ exceeded 1 for Building 6, ATSDR conducted a more detailed analysis of the non-cancer risk estimates. Workers in Building 6 were not at risk for non-cancer effects from PCE in indoor air, because estimated doses were not above a level of health concern.

Occupant exposure since October 2012. Building 6 was temporarily occupied by the workers from building 4, while remediation efforts were under way on building 4. PCE levels were below comparison values during this period. This was not a health risk.

TCE Non-Cancer Health Effects

The hazard quotients (HQ) for each building were calculated and presented in Table 2. In essence, an HQ above 1 means the concentration exceeded the RfC and the MRL of 2 $\mu g/m^3$ [EPA, 2012a, ATSDR, 2013]. Only Building numbers 1, 3, 4, 6 and 19 were evaluated because they are or have been occupied recently.

Inhalation and ingestion studies in animals indicate that the principle targets of TCE exposure include harmful effects to the immune system resulting from damage to the thymus gland. Additional studies in animals indicated that TCE exposure in pregnant mice resulted in developmental problems (fetal heart malformations) in their offspring [ATSDR 1997, EPA 2012a]. A recently released epidemiologic study found an association with maternal residence in areas with soil vapor intrusion of TCE or PCE and cardiac defects [Forand et al., 2012]. Although the study did not evaluate a dose-response relationship, it does support cardiac effects as an appropriate toxicological endpoint in humans and supports the use of the animal studies for the Reference Dose (RfD) and RfC. It also supports the route extrapolation from oral to inhalation in the RfC derivation.

EPA identified two animal studies as the basis of the Reference Concentration (RfC) for noncancerous effects [EPA 2011]. In these studies, where animals were exposed to TCE orally via drinking water, the most sensitive adverse effects involved the immune system and the developing fetus [Johnson et al. 2003, Keil et al., 2009]. EPA used physiologically based pharmacokinetic (PBPK) modeling to convert the oral dose in animals to a human equivalent concentration (HEC) of TCE in air [EPA 2011]. In addition, for one rat study, EPA used the lower confidence limit of the benchmark dose response ($BMDL_{01}$) to model (i.e., estimate) the air concentration that would yield a one percent response rate for fetal cardiac malformations. The result of these transformations is an HEC_{99}, $BMDL_{01}$ of 21 $\mu g/m^3$. The HEC_{99} is the human exposure concentration for which there is a 99% likelihood that a randomly selected individual will have an internal dose less than or equal to, in this case, the $BMDL_{01}$. To summarize, EPA predicts that there is a small risk of fetal heart malformations for pregnant women exposed to TCE at 21 $\mu g/m^3$. EPA used an uncertainty factor of 10 to obtain the RfC of 2 $\mu g/m^3$.

EPA also used a 30-week mouse study and identified decreased thymus weight as a lowest observed adverse effect level (LOAEL). PBPK modeling was used to derive 190 $\mu g/m^3$ as the HEC_{99}, LOAEL. This concentration was divided by an uncertainty factor of 100 to derive the RfC.

Building 1 (HQ 10.1)
The representative maximum TCE concentration for Building 1 is 68 µg/m^3, which is greater than the modeled concentration (21 µg/m^3) where EPA estimates a 1% response for fetal cardiac malformations in rats. Although MRLs/RfCs are generally used to evaluate chronic exposures, it is appropriate to apply the MRL/RfC value to the evaluation of even short-term exposures since the critical effect for TCE is exposure during pregnancy. Also, longer term exposure could result in harmful effects to the immune system resulting from damage to the thymus gland.

Building 3 (HQ 7.6)
The representative maximum Building 3 TCE concentration is 51 µg/m^3 which is greater than the modeled concentration (21 µg/m^3) where EPA estimates a 1% response for fetal cardiac malformations in rats. Although MRLs/RfCs are generally used to evaluate chronic exposures, it is appropriate to apply the MRL/RfC value to the evaluation of even short term exposures since the critical effect for TCE is exposure during pregnancy. Also, longer term exposure could result in harmful effects to the immune system resulting from damage to the thymus gland.

Building 4
*Occupant exposure prior to April 2012 (*HQ 17.3-22.2) The representative maximum for Building 4 is 149 µg/m^3 which is much greater than the modeled concentration (21 µg/m^3) where EPA estimates a 1% response for fetal cardiac malformations in rats. Although MRLs/RfCs are generally used to evaluate chronic exposures, it is appropriate to apply the MRL/RfC value to the evaluation of even short term exposures since the critical effect for TCE is exposure during pregnancy. Also, longer term exposure could result in harmful effects to the immune system resulting from damage to the thymus gland. The non-cancer health effects estimated for Building 4 workers were based on adult workers in that building 10 hours per day for five years. This is a worst case exposure scenario for workers who may have been that building for 5 years.

Occupant exposure since November 2012. The workers who were in Building 4 until November 2012 were temporarily relocated in Building 6 while Building 4 was remediated. Workers are back in building 4 and we don't know what exposures are at this time.

Building 6 (HQ 5.2-8.6)
Occupant exposure prior to April 2012. The representative maximum for Building 6 is 58 µg/m^3 which is greater than the modeled concentration (21 µg/m^3) where EPA estimates a 1% response for fetal cardiac malformations in rats. Although MRLs/RfCs are generally used to evaluate chronic exposures, it is appropriate to apply the MRL/RfC value to the evaluation of even short-term exposures since the critical effect for TCE is exposure during pregnancy. Also, longer term exposure could result in harmful effects to the immune system resulting from damage to the thymus gland. The non-cancer health effects estimated for Building 6 workers were based on adult workers in that building 10 hours per day for five years. Those are estimations were based on the worst case scenario for workers who may have been that building for 5 years.

From November 2012 – April 2013, Building 6 was temporarily occupied by the workers from building 4, while remediation efforts were under way on building 4. TCE levels during this period were below comparison values and not deemed a health risk.

Building 19 - Former Batting Cage Area (HQ 5.7)
Occupant exposure prior to April 2012. At a HQ of 6 and the representative maximum levels of 38 µg/m^3 (baseball practice area second room Building 19), the concentrations are above the modeled concentration (21 µg/m^3) where EPA estimates a 1% response for fetal cardiac malformations in rats. Although MRLs/RfCs are generally used to evaluate chronic exposures, it is appropriate to apply the MRL/RfC value to the evaluation of even short-term exposures since the critical effect for TCE is exposure during pregnancy. Also, longer term exposure could result in harmful effects to the immune system resulting from damage to the thymus gland.

The analysis in this document of 5 years of indoor air TCE data at the site supports the conclusions about PCE found in of the July 2012 ATSDR Health Consultation. The conclusions from that document are included in Appendix A and give very specific conclusions for specific groups of people in specific buildings

Occupant exposure - since September 2012. In September 2012 the batting cage business was relocated. Currently, there is no one using the space.

Building 19 – Furniture Manufacture Area (HQ 1.2)
Occupant exposure prior to April 2012. At a HQ of 1.2 with representative maximum level of 8 µg/m^3, the concentrations are below the modeled concentration (21 µg/m^3) where EPA estimates a 1% response for fetal cardiac malformations in rats.

Building 19 – Former Box Manufacture Area (HQ 2.1)
At a HQ of 2 with a representative maximum level of 14 µg/m^3, the concentrations are below the modeled concentration (21 µg/m^3) where EPA estimates a 1% response for fetal cardiac malformations in rats. Currently no one uses this space for any length of time.

There is uncertainty in drawing conclusions about the potential health impacts from exposure of workers to these levels of TCE in the worker environment. One of the uncertainties is that since no suitable inhalation studies are available, the MRL/RfC is based on animal studies where exposure occurred through drinking water. PBPK modeling was used to convert an oral dose (in mg/kg/day) in animals to a human equivalent concentration in air (in µg/m^3), and bench mark dose modeling was used to estimate the air concentration that equates to a 1% response rate for the fetal cardiac effects. The exposure level associated with a 1% response rate is a model prediction and is below the level that has been evaluated in any experimental study or exposed human population.

The analysis in this document of 5 years of indoor air data at the site supports the conclusions about TCE found in of the July 2012 ATSDR Health Consultation. The conclusions from that document are included in Appendix A and give very specific conclusions for specific groups of people in specific buildings.

Conclusions

Concentrations of PCE and TCE in indoor air have been elevated over the past five years (January 2007 – April 2012). EPA started additional work on the site in October 2012 to try to lower the indoor air concentrations of PCE and TCE. Levels of PCE and TCE in indoor air may continue to change. The conclusions presented are based on the five-years of data reviewed.

Main Conclusion

The Former Navy Yard Mills Site is a Public Health Hazard and not safe for workers or frequent visitors. Five years of data showed for all buildings the average levels of TCE and PCE were above levels that may cause harm to people's health. Air levels of PCE and TCE within buildings onsite have fluctuated in the past and will likely continue to fluctuate. People should not occupy buildings until remediation efforts demonstrate a constant and consistent reduction of contaminant levels over time that are below those of health concern.

Conclusion 1

Pregnant workers that may have been in Buildings 1,3,4,6, or 19 would have been exposed in the past to levels of TCE in indoor air that might damage the heart of an unborn child.

Conclusion 2

Workers in building 4 and workers, exercising children, and exercising adults in the second room of the batting cage area of building 19 were exposed in the past to PCE above a level of concern for nervous system impairment. Estimated exposure concentrations in the second room of the batting cage area of Building 19 were several times the health comparison value and approached a health effect level for temporary color blindness.

Conclusion 3

Adults who worked or visited in Buildings 1,3,4,6, or 19 and children who visited or exercised in Building 19 (batting cage area) were exposed to PCE and TCE in indoor air at levels estimated to result in less than one additional case of cancer per 100,000 persons similarly exposed. This is considered a very low increased risk of developing cancer over a lifetime. Combined cancer risks for PCE and TCE were estimated for the batting cage area of Building 19. These estimates included adjustments for the impacts of early life exposures children. The cancer estimates assumed that children were exposed 2 hours per day, 5 days per week, for 5 years. The cancer estimates for adults assumed that workers were exposed for 10 hours per day, 5 days per week for 5 years.

Recommendations

1. Dissociate people from TCE and PCE exposure.
2. Conduct representative air sampling to ensure contaminant reduction remedies have consistently (over time) reduced PCE and TCE levels below those of health concern before buildings are reoccupied and remediation measures remain effective following re-occupancy.
3. Make tenants of the site aware of the site's history, the possible exposure to PCE and TCE in indoor air and the plans to reduce exposures on site.
4. Ensure town of Dracut officials are made aware of the site history and current conditions.
5. Any indoor spaces on site which may be used need to be sampled regularly to ensure that levels or PCE and TCE remain below a level of concern for occupancy. It is especially important that any space where women of childbearing age may frequent is sampled regularly since TCE can adversely affect a developing fetus.
6. ATSDR will review any additional sampling plans, sample results, and remediation design plans when available.

PUBLIC HEALTH ACTION PLAN

The public health action plan (PHAP) for the Navy Yard Mills Site contains a description of actions taken and those to be taken by ATSDR, the EPA, and MA DEP. The purpose of the PHAP is to ensure that this health consultation not only identifies potential and on-going 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. The public health actions at Navy Yard Mills Site that are completed or ongoing/planned are:

Completed Actions

- The batting cage facility in Building 19 has been relocated to another venue in another town.
- ATSDR attended three public meetings to update the public and with Dracut Town Board of Selectmen.
- ATSDR Staff met privately with building occupants.
- ATSDR created a fact sheet on TCE and distributed it to the public.
- EPA installed an HVAC (Heating, Ventilation, and Air Conditioner) that is expected to improve the indoor air of Buildings 1 and 4.
- Building 6 is no longer occupied.

Ongoing and Planned Actions

- The Massachusetts Department of Environmental Protection has taken the lead for monitoring or remediating the site.
- ATSDR is available to educate and provide health referrals to parents and those who have worked at or exercised on-site.
- ATSDR will present the findings of this report at a public meeting with an associated availability session.
- ATSDR will review any additional sampling plans, sample results, and remediation design plans when available.

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Appendix A Conclusions from the July 2012 Health Consultation

Conclusion tables from July 2012 Health Consultation on Navy Yard Mills

BUILDING 1:

Building 1 Navy Yard Mills Site, Non-Cancer Health Concerns.

Location	Who	Amount of time in this location	Non- Cancer Health Concern
Building 1	Workers	10 hours per day, 5 days per week for several weeks to several months.	May be at risk for developing autoimmune effects (decreased thymus weight) due to TCE exposure.
	Women workers who are pregnant	10 hours per day, 5 days per week for several weeks to several months.	May be at risk of having a child with heart problems due to TCE exposure, and may be at risk for developing autoimmune effects (decreased thymus weight) due to TCE exposure.

BUILDING 4:

Building 4 Navy Yard Mills Site, Non-Cancer Health Concerns.

Location	Who	Amount of time in this location	Non- Cancer Health Concern
Building 4	Workers prior to October 2012	10 hours per day, 5 days per week for several weeks to several months.	May be at risk for developing autoimmune effects (decreased thymus weight) due to TCE exposure.
	Women workers who are pregnant prior to October 2012	10 hours per day, 5 days per week for several weeks to several months.	May be at risk of having a child with heart problems (due to TCE exposure), and may be at risk for developing autoimmune effects (decreased thymus weight) due to TCE exposure.

BUILDING 19:

Building 19 Batting Cage Area (Main Room), Navy Yard Mills Site, Non-Cancer Health Concerns.

Location	Who	Amount of time in this location	Non-Cancer Health Concern
Building 19 Baseball practice area -Main Room -Batting cage area	Exercising children and adolescents Prior to September 2012	More than 8 hours per week for several weeks to several months.	May be at risk for autoimmune effects (decreased thymus weight) due to TCE exposure
Building 19 Baseball practice area - Main Room -Batting cage area and waiting area	Women who are pregnant Prior to September 2012	More than 8 hours per week who exercise for several weeks to several months.	May be at risk of having a child with heart problems due to TCE exposure. No risk for pregnant women who watch family and friends practice sports for less than 35 hours per week
Building 19 Baseball practice area - Main Room Batting cage area	Non exercising adult men and non-pregnant women who watch family and friends practice sports Prior to September 2012	Any length of time	No risk while watching family and friends practice sports
Building 19 (baseball practice areas both rooms) full-time workers	Adult workers Prior to September 2012	More than 20 hours per week for several weeks to several months.	May be at risk for autoimmune effects (decreased thymus weight), and, if pregnant, at risk of having a child with heart problems due to TCE exposure. These workers (more than 30 hours per week in the second room) may also be at risk for neurologic effects (altered color vision) due to PCE exposure.

Building 19 Batting Cage Area (Second Room) Navy Yard Mills Site, Non-Cancer Concerns.

Location	Who	Amount of time in this location	Non-Cancer Health Concerns
Building 19 Baseball practice area - Second Room (exercise bikes and weights)	Exercising children, adolescents and adults prior to September 2012	More than 6 hours (children) or 8 hours (adults) per week for several weeks to several months.	May be at risk for autoimmune effects (decreased thymus weight) due to TCE exposure, and non-adults may be at risk of neurologic effects (altered color vision) due to PCE exposure.
Building 19 Baseball practice area - Second Room (exercise bikes and weights)	Women who are pregnant prior to September 2012	More than 4 hours per week who exercise for several weeks to several months or 10 hours a week for several weeks to several months who watch family/friends practice sports.	May be at risk of having a child with heart problems due to TCE exposure.
Building 19 Baseball practice area - Second Room (exercise bikes and weights)	Non exercising adult men and non-pregnant women who watch family and friends practice sports Prior to September 2012	More than 35 hours per week for several weeks to several months.	May be at risk for autoimmune effects (decreased thymus weight) due to TCE exposure.
Building 19 (baseball practice areas both rooms) full-time workers	Adult workers Prior to September 2012	More than 20 hours per week for several weeks to several months.	May be at risk for autoimmune effects (decreased thymus weight), and, if pregnant, at risk of having a child with heart problems due to TCE exposure. These workers (more than 30 hours per week in the second room) may also be at risk for neurologic effects (altered color vision) due to PCE exposure.