ATSDR
Public Health Assessment

PCE Former Dry Cleaner Site
Atlantic, Cass County, Iowa

Evaluation of Volatile Organic Compounds in Indoor Air and Public Drinking Water

June 16, 2026

EPA/CERCLA ID: IAD039954300

Cost Recovery: 7A2Q

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

The ATSDR Public Health Assessment: A Note Of Explanation

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate. This document represents the agency's fulfilment of statutory criteria set out in CERCLA section 104 (i)(6) within a limited time frame based on currently available information. To the extent possible, it presents an assessment of potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. The revised document was released for a 45-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment 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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About ATSDR

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency of the U.S. Department of Health and Human Services (HHS). ATSDR works with other agencies and tribal, state, and local governments to study possible health risks in communities where people could come in contact with dangerous chemicals. For more information about ATSDR, visit the ATSDR website at www.atsdr.cdc.gov.

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Summary

The Agency for Toxic Substances and Disease Registry's (ATSDR's) mission is to protect communities from harmful health effects related to exposure to natural and man-made hazardous substances. ATSDR's purpose is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent people from contacting harmful toxic substances.

The PCE Former Dry Cleaner Site is in the city of Atlantic, Cass County, Iowa. The site includes the contamination source of the chemical tetrachloroethylene (PCE) and the associated chemical breakdown products at 1205 East 7th Street and adjacent soil, soil gas, indoor air, and downgradient groundwater areas extending north one mile, in an oval shape. The source property includes a former dry cleaner that operated from 1961 until 1972 and an Iowa Department of Transportation (IDOT) laboratory that operated from 1976 to 1986.

The site was discovered in 1982 when the Iowa Department of Natural Resources (IDNR) surveyed the water quality and discovered PCE, a volatile organic compound (VOC), in the Atlantic Municipal Utilities (AMU) wells of the public water system (PWS). PCE, used as a dry-cleaning solvent, likely spilled or drained onto soil beneath the building via floor or sink drains in the building. Once in the soil, PCE moved into the groundwater and into the air of nearby buildings. PCE continued to move with the groundwater under additional businesses and homes and moved into indoor air above the groundwater plume.

The U.S. Environmental Protection Agency (EPA) added the site to its National Priorities List (NPL) of hazardous waste sites in 2016 because PCE contaminated two of the city's public drinking water wells (AMU-7 well in 1982 and AMU-6 well in 2003). AMU-7 was taken offline 6 days after samples were collected at the well, but it is unknown whether people were exposed before the initial sampling event in 1982 occurred. Routine water sampling at the public water distribution plant began in 1993. PCE was found at the distribution plant taps on and off between May 2015 and October 2016 at maximum levels within EPA's Safe Drinking Water Standards. AMU-6 was taken offline in October 2016.

ATSDR conducts public health activities at NPL sites. The purpose of this public health assessment is to evaluate the public health significance of exposures to contaminants in drinking water and indoor air in homes and commercial buildings in this community. ATSDR used groundwater, drinking water, and air data (including sub-slab soil gas, crawl space, and indoor air) collected by IDNR, AMU, and EPA (contractors) collected between 1982–2019 to make the conclusions and recommendations contained within this report.

We answered the following question:

- Could contamination from the site put people living or working nearby at risk for health problems?

Key Findings

- People who work in buildings above or adjacent to the PCE groundwater plume are not likely to be harmed by breathing low levels of PCE in indoor air from the groundwater plume.
- People who live above or adjacent to the PCE groundwater plume are not likely to be harmed by breathing low levels of PCE in indoor air from the groundwater plume.
- People who have used the public drinking water from 1993 to the present day are not likely to be harmed by contaminants from the PCE Former Dry Cleaner Site. In August 1982, PCE was found in one of several wells that provided water to the public system. It is unclear what levels of PCE people were exposed to or how long those exposures lasted before
    - PCE was found,
    - the well was taken out of service, and
    - an unknown amount cleared the distribution system.

Finding 1: Workers—No Health Hazard

People who work in buildings above the groundwater plume or adjacent to the former dry cleaner are not likely to have adverse health effects from breathing low levels of PCE or associated breakdown chemicals in indoor air.

Basis for Finding 1

- In February 2013, PCE was detected in the indoor air of the Professional Services Building at a maximum level of 76 micrograms per cubic meter ($\mu g/m^3$).
- Shortly after the sampling results were known, the landlord installed a vapor mitigation system to provide additional protection for workers by further reducing the potential for exposure to VOCs in air inside the building.
- The exposure point concentration of PCE after adjusting for occupational use (8.5 hours per day, 5 days per week, for 20 years) is 18 $\mu g/m^3$ which is less than ATSDR's noncancer comparison value for PCE (reference media evaluation guide [RMEG] chronic 40 $\mu g/m^3$) and therefore, not expected to result in harmful health effects.
- ATSDR calculated cancer risks using the inhalation unit risk of 2.6E-07 $(\mu g/m^3)^{-1}$ for PCE to be between 1 and 2 excess cancer cases in one million people (1.2E-06). ATSDR considers the excess lifetime cancer risks for the PCE as low, not a concern for increased risk, and not likely to harm people's health.

Finding 2: Residents—No Health Hazard

People who live above or adjacent to the PCE groundwater plume are not likely to have adverse health effects from breathing low levels of PCE or associated breakdown chemicals in indoor air from the groundwater plume.

Basis for Finding 2

- In March 2015, PCE was detected at a maximum level of 16 µg/m^3 in indoor air of one home downgradient of the source area.
- The PCE exposure point concentration is 16 µg/m^3 which is less than ATSDR's noncancer comparison value for PCE and therefore, not expected to result in harmful health effects.
- ATSDR calculated cancer risks using the inhalation unit risk of 2.6E-07 (µg/m^3)$^{-1}$ for PCE to be between 1 and 2 excess cancer cases in one million people (1.1E-06–1.8E-06). ATSDR considers this excess lifetime cancer risks for the PCE as low, not a concern for increased risk, and not likely to harm people's health.
- In June 2018, TCE was detected at a maximum level of 1.0 µg/m^3 in the indoor air of the same home downgradient of the source area. However, because TCE was not detected in the sub-slab soil gas, the investigation determined TCE was not likely site related, but TCE was likely from products used in the home.
- ATSDR calculated cancer risks using the inhalation unit risk of 4.1E-06 (µg/m^3)$^{-1}$ for TCE to be between 1 and just over 2 excess cancer cases in one million people (1.7E-06–2.3E-06). ATSDR considers this excess lifetime cancer risks for the TCE as low, not a concern for increased cancer risk, and not likely to harm people's health. Combined risk of TCE and PCE was not calculated because TCE was determined not to be site related.

Next Steps

- ATSDR recommends that residents store and use all products that emit vapors (e. g., paint thinners, gasoline) in well-ventilated areas to prevent vapor accumulation in indoor air and potential harmful health effects.
- ATSDR plans to provide health education to make the community aware of strategies to reduce exposures to common household chemicals.
- EPA and IDNR are encouraged to keep the community updated on site conditions and cleanup.

Finding 3: Public Water Users—No Current Health Hazard, Indeterminate Past Health Hazard

People who used the public drinking water from 1993 to the present day are not likely to be harmed by PCE or associated breakdown chemicals from the PCE Former Dry Cleaner Site. In August 1982, PCE was found in one of several wells that provided water to the public system. It is unclear what levels of PCE people were exposed to or how long those exposures occurred before PCE was found. Trichloroethylene (TCE), an associated breakdown chemical of PCE, was not detected.

Basis for Finding 3

- A dry cleaner operated from 1961 to 1972, and an Iowa Department of Transportation (IDOT) lab operated from 1976 to 1986. Although the dry cleaner is the likely source of contamination, it is also possible that the contamination began with the IDOT lab. Therefore, the exact timing of when the contamination started remains unknown. One or both of these operations is likely the source of the contamination.
- In August 1982, PCE was found at 170 micrograms per liter (µg/L) at the wellhead of AMU-7, one of several public drinking water wells. Within six days of collecting the sample, the well was taken offline. It is not known to what level of PCE people were exposed to or how long those exposures lasted before PCE was found. It is also unknown what the amount was in the system before or after the well was taken out of service, or how long it took the PCE to clear through the distribution system.
- In 1993, Atlantic Municipal Utilities began sampling for PCE. In 1995, EPA required public water systems to test for PCE and associated breakdown chemicals. EPA established the Maximum Contaminant Level for PCE at 5 µg/L.
- In 2003, PCE was found at 7.9 µg/L at the wellhead of public water well AMU-6. The well continued to be used off and on until 2016 when levels of PCE were found to be increasing at the water distribution plant.
- Drinking water taps at the water plant found PCE intermittently between May 2015 and October 2016. Maximum detected levels (1.1 µg/L) were within EPA's safe drinking water standard and below levels of health concern.

Next Steps

- ATSDR recommends the Atlantic Municipal Utilities (AMU) to monitor wells and the drinking water system according to EPA's Safe Drinking Water Act regulations.

For More Information

The report explains these conclusions. A report summary is available at https://www.atsdr.cdc.gov/HAC/pha/PCECleaner/PCE-Former-Drycleaner-final-508.pdf. If you have questions or comments, call ATSDR's toll-free number at 1-800-CDC-INFO and ask for information on the PCE Former Dry Cleaner Site.

About the Site

The PCE Former Dry Cleaner Site is in the rural midwestern city of Atlantic in Cass County, Iowa. Norge Dry Cleaning Village operated at the site from 1961 to 1972. A laboratory for the IDOT operated there from 1976 to 1986 [EPA 2020a]. One or both of these operations is likely the source of the contamination.

The site consists of three areas of investigation: 1) the **source area** where the chemical tetrachloroethylene (PCE) and the associated chemical breakdown products likely spilled into floor drains at the former Norge Dry Cleaning Village which emptied onto the ground, 2) a **groundwater plume** where these soil chemicals moved into the groundwater and flowed with the groundwater below the ground surface, this groundwater is also part of the municipal well system used for drinking water after treatment, and 3) the **vaporization** of these chemicals from the groundwater into the indoor air of buildings above the plume.

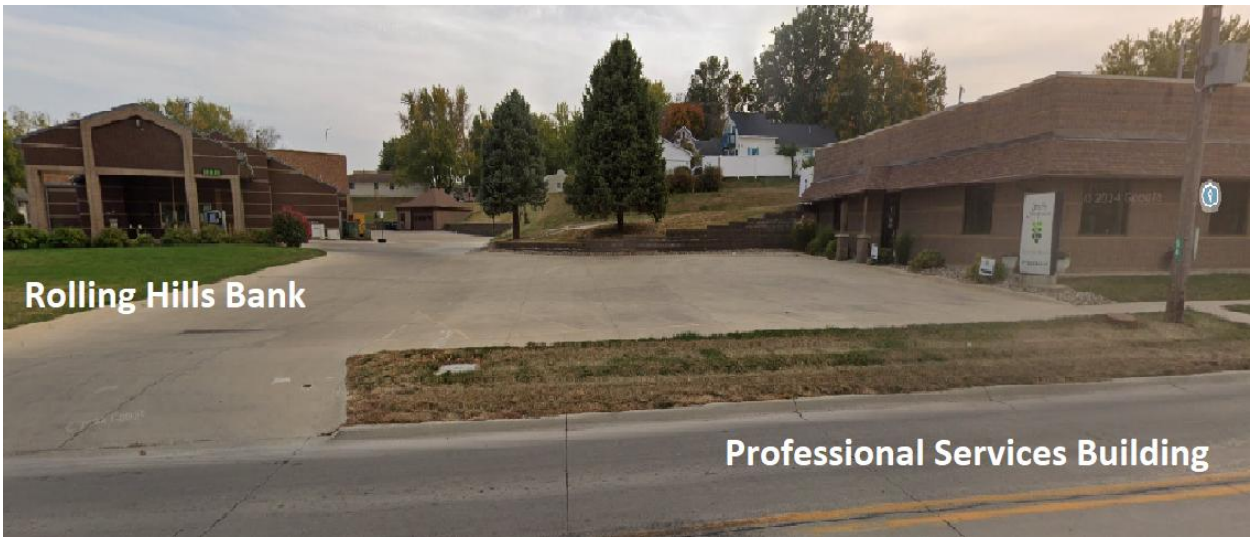

Figure 1. Norge Dry Cleaning Village is now a parking lot at 1205 E. 7th Street (Google Earth Dec 2019).

Currently, a 75 x 100-foot concrete paved parking lot that serves an adjacent commercial business sits on the former source area where the dry cleaner once stood (see Figure 1). A groundwater plume extends downgradient north-northwest for about 0.45 miles from the source area [Tetra Tech 2020].

PCE found in a public well

In August 1982, the Iowa Department of Natural Resources (IDNR) tested wells in the Atlantic Municipal Utilities (AMU) drinking water wellfield system as part of a water quality survey. IDNR detected PCE at 170 micrograms per liter (µg/L) in a sample from public water supply well AMU-7 which is above EPA's Maximum Contaminant Level (MCL), from the Safe Drinking Water Act (SDWA), drinking water standard of 5 µg/L for PCE, though this sample was not of the finished blended water that was distributed in the public water system. The level of PCE or associated breakdown products in finished tap water at that time was unknown. AMU-7 is about 0.27 miles north and downgradient of the site [EPA 2025, Tetra Tech 2020].

Contamination investigation

Following the discovery of PCE in AMU-7 in 1982, the EPA and IDNR conducted numerous investigations at the site and found that a dry-cleaning facility was most likely the major contributor but could not rule out the DOT lab as an additional source. PCE was used as a dry-cleaning solvent and likely drained or spilled onto the ground from floor or sink drains contaminating the soil beneath the building. PCE then moved from the soil into the air of nearby buildings and leached into groundwater flowing to public drinking water wells one half mile away. In addition, PCE moved with the soil gas and groundwater to other locations. PCE vapors then moved from groundwater into the air of businesses and homes built above the polluted groundwater—a process called vapor intrusion.

In 1986, the EPA entered the site into their Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) database to complete a preliminary assessment. The site name at the time was the Atlantic Water Supply site which did not score high enough in the hazard ranking scheme to be included on EPA's National Priorities List (NPL). However, in 2014, new data on potential impacts to the public water system and potential for vapor intrusion provided sufficient results for EPA to list the site on the NPL. During the listing process the site name was changed to PCE Former Dry Cleaner Site [Tetra Tech 2020].

The building used by Norge Dry Cleaning Village and IDOT was demolished between 1991 and 1994. The site was turned into a parking lot for the adjacent bank. In 2011, a residential building adjacent to the 1.2-acre site was removed [Tetra Tech 2020]. ATSDR could not obtain additional details about the residential building. No sampling data at the residential building appears to have been collected.

In 2003, water from a second public water well, AMU-6, showed PCE at 7.9 µg/L which is above the drinking water standard from the SDWA for PCE. The AMU has used a varying number of wells pumping at the same time that are blended to supply the water system. In 2012, PCE levels in AMU-6 began to increase to a maximum of 32 µg/L in September 2016. The well continued to be used off and on until 2016 when levels of PCE were found to be increasing at the water plant. Drinking water taps at the water plant found PCE intermittently between May 2015 and October 2016 with a maximum level of PCE at 1.1 µg/L. Although this level is within EPA's MCL from the SDWA, drinking water standard of 5 µg/L for PCE, the well was removed from service [Tetra Tech 2020]. Detected levels were below levels of health concern.

Atlantic public water system

AMU provides the city and surrounding rural area with electric and water service. This not-for-profit company has operated in the Atlantic community since July 1890. AMU serves approximately 3,300 water customers, mostly within the city limits of Atlantic. Currently, there are eight wells used in the system and four wells pump at any given time to provide sufficient water for users (about 900 gallons per minute). Previously, there were nine wells that rotated among three wells blending at any time. Well depth ranges from 82 to 120 feet. Each well pumps water from below ground to a detention tank where water from all other wells is blended, aerated, and treated with permanganate. The water then moves to another tank where it is filtered to remove iron and manganese. Chlorine and fluoride are then added. The

water is then pumped into water towers where it is stored before being released or distributed to customers throughout the service area. Two water towers store approximately 750,000 gallons of water, which provides drinking water and fire protection for the entire community [IDNR 2021, ATSDR 2024, ATSDR 2025, AMU 2023].

Water is tested at several points along the system. AMU monitors the water quality at the well, the treatment plant, and the distribution system to ensure water quality meets all guidelines and standards enforced by the Iowa Department of Health, IDNR, and EPA. Several wells have been removed from service due to various reasons, such as lower flow volume or cracked casing. Wells AMU-7 and AMU-6 were removed from service because of contamination with PCE [AMU 2022, AMU 2023, ATSDR 2024, EPA 2025].

Although public water at the distribution system taps was being routinely testing for PCE and associated breakdown products in accordance with the SDWA in 1993 (before the required deadline of 1995), ATSDR does not have blended tap water data before 1993. PCE was found in wells AMU-7 in 1982 and AMU-6 in 2003, however testing of the pooled water at the treatment plant after 1993 did not detect PCE at levels that exceeded the SDWA level of 5 µg/L. Several factors protect the drinking water system and people from being exposed when contamination of a well is found. These factors include the following:

- **early detection** of contamination at the wellhead allows operators to quickly remove the well from the system,
- **blending of large volumes** of uncontaminated water from multiple wells reduces the concentration of PCE for the contamination that may come from one or two wells.

No one currently is exposed to drinking water contaminated with PCE or other associated break down products at a level that would pose a health concern. There are data gaps prior to 1993 that result in an indeterminate public health risk for drinking water before 1993 [Tetra Tech 2020, ATSDR 2024, ATSDR 2025].

Geological features show aquifer susceptible to contamination

The AMU water supply comes from the groundwater of the Dakota aquifer. Municipal wells tap the Dakota aquifer from 82–120 feet deep. The Dakota aquifer is highly susceptible to contamination because of the aquifer's characteristics and overlying materials. The overlying materials are mostly fine- to medium-grained sand and provide little protection from contamination at the land surface [AMU 2023, ATSDR 2024].

Geological clays occur to about 35–40 feet deep near the source and about 15–25 feet deep in the Troublesome Creek valley near AMU-7. About 10–15 feet of alluvial silts, sands, and gravels are below the clays, and overlie poorly cemented Cretaceous-aged Dakota Sandstone of the Dakota Formation. The top of the Dakota Sandstone occurs at approximately 45 feet deep at the site and at 32 feet deep near Troublesome Creek [Tetra Tech 2020].

The Dakota aquifer is recharged by percolation of rain that runs down through deposits and by lateral groundwater inflow from southwest Minnesota. Locally, groundwater flows from south to north. The groundwater contamination plume flows from the sources to the north-northwest. Troublesome Creek, at the northern portion of the site is the only year-round surface water feature of the site [Tetra Tech 2020].

Local land use and demographics

Most of the site is within the city limits of Atlantic, Cass County, Iowa. The former Norge Dry Cleaner property is about one mile east of downtown Atlantic, along U.S. Highway 6, in a commercial corridor. The former dry cleaner parcel measures about 70 feet by 60 feet. A retaining wall and grassy area are present at the southern third of the property. The northern two-thirds of the area is a concrete parking lot for a 5,400-square-foot office building at 1201 E. 7th Street, directly west of the lot. Figure 1 shows the lot and the office building known as the Professional Services Building which are owned by Anita Bancorporation. Anita Bancorporation is the parent company of the Rolling Hills Bank and Trust (1307 E. 7th Street). The lot and building are immediately southeast of the former dry cleaner property.

Land use throughout the site is predominantly light industrial/commercial and residential. Cass County Memorial Hospital and most of the stores, motels, and restaurants are east of the site. Residences closest to the site are about 125 to 200 feet south (upgradient) or about 500 feet north (downgradient). A portion of the site includes Troublesome Creek and one of its intermittent tributaries, Buttermilk Creek [Tetra Tech 2020]. A privately owned agricultural field is north of Buttermilk Creek and south of the AMU wellfield.

Based on 2020 census data, there were 6,792 people living in 3,379 housing units within a 4-mile radius from the former Norge Dry Cleaning Village [Census 2020]. Most residences above the groundwater plume are within a 20.4-acre mobile home park called Sycamore Village. The mobile homes are elevated off the ground and have aluminum or composite skirts that block wind, snow, and rain. Other residences downgradient of the plume are single family homes built on concrete slabs without basements or crawl spaces.

Cleanup, treatment, and removal of soil contamination source completed

EPA contractors completed several removal actions at the site. On May 15, 2015, EPA issued an action memorandum that initiated cleanup. Between September 2016 and November 2017, EPA's contractor treated a volume of 12,500 cubic yards of soil using heat to vaporize the VOCs. The treatment removed an estimated 1,007 pounds of VOCs at the source in the parking lot, under the east side of the Professional Services Building. This EPA Time Critical Removal system was shut down on November 8, 2017, when the PCE concentration detected in soil at that point post treatment was less than 4.9 µg/kg. The 2017 concentration was considered a safe level [Tetra Tech 2020]. Contractors excavated the top 5 feet of contaminated soils from the northwest corner of the parking lot and under U.S. Highway 6 to the north totaling 1630 tons [EPA 2015, 2019].

Treatment and cleanup of groundwater

EPA signed an action memorandum in 2016 to construct an interceptor well. The new well hydraulically contains PCE from moving in groundwater and protects other municipal supply wells downgradient. Two extraction wells (AMU-18 and AMU-19) pump and treat groundwater using a low-profile air stripper to remove PCE. Treated water can be reused by the municipal utility or discharged to surface water through a groundwater extraction and treatment system

(GETS). The system became operational in 2018 [Tetra Tech 2020].

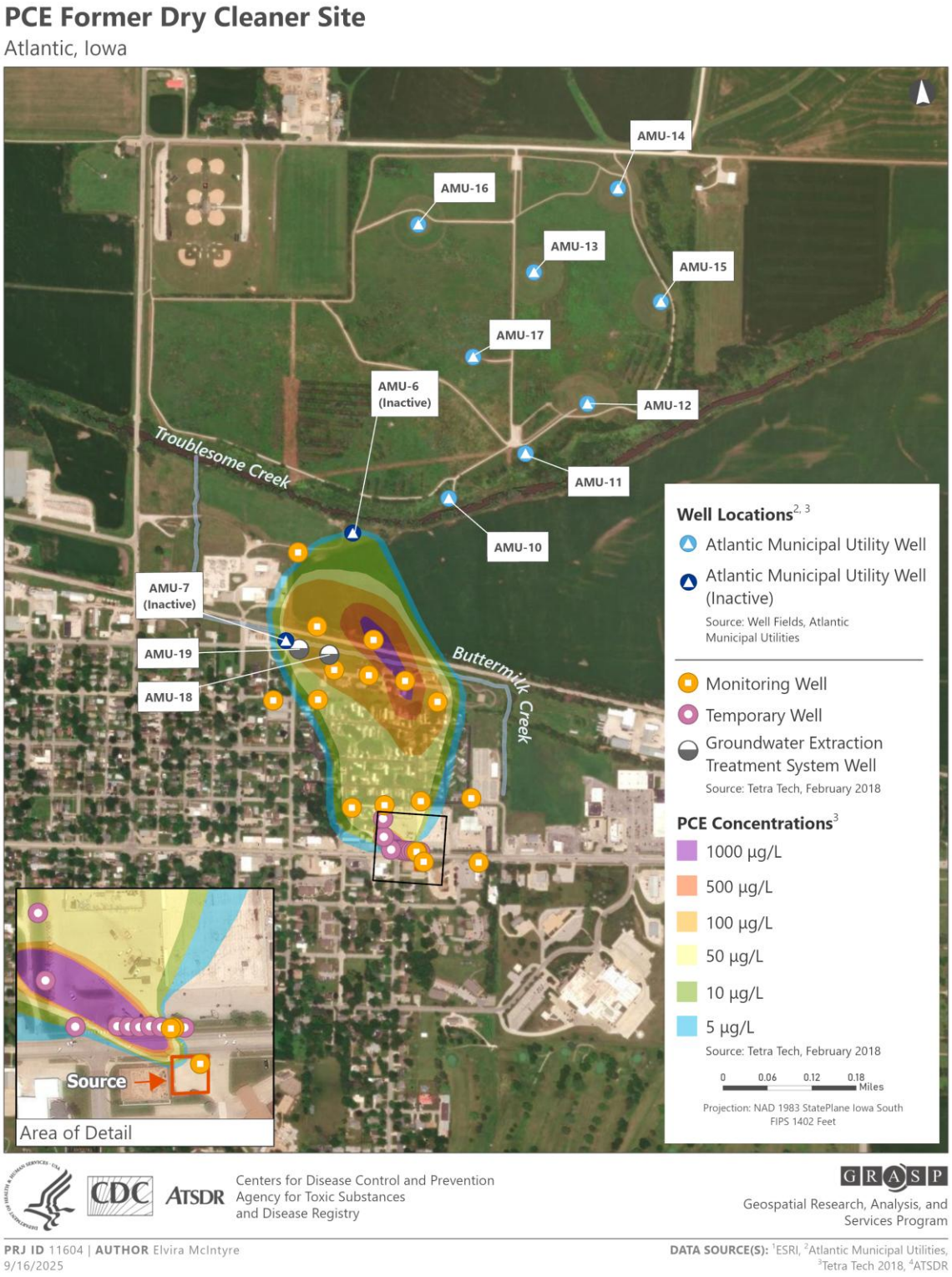

Figure 2. PCE Former Dry Cleaner source area and plume map.

Community Concerns

EPA held public availability sessions and community meetings to present status updates and provide sampling data and results to the community. A general concern was raised about the safety of the city drinking water. No other concerns were reported during meetings and interviews with the community, but members did request future updates [EPA 2016]. EPA and IDNR will continue to provide information regarding site activities to the public through the Administrative Record file for the site and announcements published in The Atlantic News Telegraph newspaper [EPA 2020b].

Timeline

Table 1. Timeline of site events.

Year	Event
1961–1972	Norge Dry Cleaning Village operated at this site.
1976–1986	The IDOT materials testing lab operated at the site.
1982	IDNR reported elevated levels of PCE in AMU-7 well from testing of wells in the AMU well field. AMU took the well off-line six days after samples were collected and began monthly testing.
1986	EPA entered the site into the CERCLA database under the name “Atlantic Water Supply” site, and completed a Preliminary Assessment.
1987–1988	EPA’s Site Inspection identified the former Norge Dry Cleaner as the likely source.
1991–1994	The former dry cleaner building was demolished.
1993	Routine public drinking water testing for chemicals such as PCE began.
1998	IDNR further investigated to better define the source and extent of contamination.
2001	IDNR petitioned the EPA for support to conduct a removal action at the site.
2002–2012	EPA completed additional sampling and investigations of soil, groundwater, soil gas, indoor air, and drinking water.
2003	AMU found PCE at 7.9 µg/L in AMU-6 well. Tap water from public water system showed PCE level within EPA’s Safe Drinking Water Act standard.
2013	EPA indoor air sampling showed PCE in the Professional Services Building.
2015	EPA began site cleanup including soil excavation. Indoor air sampling at 10 nearby residences showed PCE levels below residential screening levels.
2016	EPA added the site to its NPL of hazardous waste sites, this time under the name “PCE Former Dry Cleaner” site. PCE found at AMU-6 well at 32 µg/L and at the distribution plant taps at 1.1 µg/L within Safe Drinking Water Act standards and below a level of health concern. AMU-6 was removed from service.

Year	Event
2017	Thermal treatment of source area soil, groundwater extraction, and air stripping began.
2018	EPA installed two wells and a GETS to extract and treat groundwater to draw the plume away from the public water wells.
2020	EPA completed the Remedial Investigation and Feasibility Study (RI/FS) and issued the Proposed Plan. ATSDR began work on the Public Health Assessment.

Exposure Overview

We evaluated how people's locations and activities could put them in contact with contamination. ATSDR has ruled out soil as there is no direct contact with contaminated soil. VOCs including PCE and TCE are not currently found in finished drinking water. There are data gaps prior to 1993 for drinking water exposures. There are no private wells in the area.

Table 2. Summary of how people could come in contact with chemicals from the PCE Former Dry Cleaner Site, health risks, and next steps

Who	Doing what	Where/When	What	Health risk	Next steps
People who worked in buildings adjacent to the former dry cleaners before vapor mitigation system installed	Breathing indoor air	Buildings above or adjacent to contaminated soil, soil gas, or groundwater plume before 2013	PCE 0.34U–76 µg/m^3 (2013) TCE 0.2U–5.1U µg/m^3 (2013)	**No Hazard:** People are not being exposed to indoor vapors at levels of health concern.	**ATSDR:** • Provide health education to make the community aware of strategies to reduce common household chemicals that can pollute indoor air. **The EPA and IDNR:** • Continue to keep the community updated on site conditions and cleanup.
People living in homes or working in buildings that overlay the groundwater plume with potential vapor intrusion	Breathing indoor air	Homes above or adjacent to contaminated soil, soil gas, groundwater plume or areas where vapors could enter buildings	PCE 0.34U–16 µg/m^3 (2018) TCE 0.27U–1.0 µg/m^3 (2018)	**No Hazard:** People are not being exposed to indoor vapors at levels of health concern.	**ATSDR:** • Provide health education to make the community aware of strategies to reduce common household chemicals that can pollute indoor air. **The EPA and IDNR:** • Continue to keep the community updated on site conditions and cleanup.
People living in homes or working in buildings	Drinking water	Homes and buildings serviced by AMU public water system	PCE 1.1 µg/L (2016) TCE and other associated breakdown products not detected	**No Current Hazard:** People are not being exposed to PCE or associated breakdown productsin drinking water at levels above MCLs. **Indeterminate Hazard:** It is not known what level of PCE people were exposed to or how long those exposures lasted before PCE was found, the well was taken out of service, and an unknown amount cleared the distribution system.	**AMU:** • Continue to monitor drinking water wells and public water.

Data Sources [Tetra Tech 2020]

Abbreviations: µg/m^3 – micrograms per cubic meter air (unit of measure); µg/L– micrograms per liter; U – not detected at this reporting limit.

Data Review

Data review process

As part of our environmental health assessment process, we review data provided by EPA and other agencies and compare it to health-based screening values to find out which chemicals could potentially harm people's health. For chemical levels that are higher than our screening values, we estimate the amount of contact people could have with the chemical at the site. Then we compare that estimate with the health effects levels from scientific studies. In this section, we present data for chemicals that we evaluated further after screening [ATSDR 2022].

RMEG – ATSDR's Reference Media Evaluation Guides (RMEGs) are estimated contaminant concentrations not expected to result in adverse non-carcinogenic health effects.

PCE: RMEG = 40 µg/m^3 (noncancer)

TCE: RMEG = 2.0 µg/m^3 (noncancer)

ATSDR's Cancer Risk Evaluation Guides (CREGs) are used to screen substances that are known or probable carcinogens. CREGs are estimated levels that would be expected to cause no more than one excess cancer in a million (expressed exponentially as E-06) persons exposed over their lifetime (78 years).

PCE: CREG 3.8 µg/m^3 (cancer)

TCE: CREG 0.21 µg/m^3 (cancer)

ATSDR vapor intrusion screening values differ from EPA's screening values. ATSDR's values are health-based, non-regulatory, and are not linked to cleanup.

ATSDR soil gas screening values* for potential vapor intrusion over a lifetime are:

PCE: CREG 130 µg/m^3 (cancer) and RMEG = 1300 µg/m^3 (noncancer)

TCE: CREG 7.0 µg/m^3 (cancer) and RMEG = 67 µg/m^3 (noncancer).

*Exposures are considered chronic if they last longer than one year.

Volatile Organic Chemicals at Former PCE Dry Cleaner Site

Tetrachloroethylene—PCE

- Also called perc or tetrachloroethene
- A nonflammable colorless liquid
- Used to dry-clean clothes
- Evaporates quickly from shallow soils or groundwater into air
- Generally slow to break down in soil, groundwater, or air

Trichloroethylene—TCE

- Also called trichloroethene
- A nonflammable colorless liquid
- A breakdown product of PCE
- Used to clean metal parts
- Evaporates quickly from shallow soils or groundwater into air and breaks down quickly in air
- Generally slow to break down in soil and groundwater

Source: [ATSDR 2019a, 2019b, 2013]

Vapor intrusion indoor air sampling

2013 Sampling event and key results

In 2013, EPA sampled the indoor air and air beneath the slab foundation (sub-slab) of the Professional Services Building, Rolling Hills Bank, and of an insurance office building at 1106 E. 7th Street, northwest of the former dry cleaner [Tetra Tech 2020].

Indoor air levels were as follows.

- PCE levels in three indoor air samples from the Professional Services Building ranged from 50 to 76 µg/m^3.
- No PCE was detected in an indoor air sample collected from the basement of the bank.
- Indoor air sampled at the bank one month later found PCE at 5.1 µg/m^3.
- Indoor air samples from the insurance building of PCE did not exceed ATSDR's indoor air screening value of 3.8 µg/m^3 (CREG).
- TCE was not detected in indoor air samples collected in any of the three buildings (1.1 to 5.1 µg/m^3 reporting limit) [Tetra Tech 2020].

The three sub-slab soil gas samples collected below the Professional Services Building were the only sub-slab soil gas results during any sampling event that exceeded ATSDR soil gas vapor intrusion screening levels for PCE (130 µg/m^3 CREG, 1300 µg/m^3 RMEG) and TCE (7.0 µg/m^3 CREG, 67 µg/m^3 RMEG).

- PCE levels in sub-slab soil gas below the Professional Services Building ranged from non-detect (1.4 µg/m^3 reporting limit) to a maximum of 2,261 µg/m^3.
- TCE levels in sub-slab soil gas below the Professional Services Building ranged from non-detect (0.27 µg/m^3 reporting limit) to a maximum of 72 µg/m^3.

Although levels of VOCs in the sub-slab soil gas and indoor air were below EPA's screening values for non-residential properties, the landlord installed a vapor mitigation system at the Professional Services Building soon after PCE was detected [Tetra Tech 2020]. No installation date is identified in the references. EPA began soil excavation beneath 7th Street in 2015 and followed up with in-situ thermal remediation in 2017 to address this source area [EPA 2019].

2015 Sampling Event and Key Results

In 2015, after soil excavation removal actions were completed, EPA sampled the indoor air and sub-slab soil gas at 10 residences and businesses near the source or above the plume, some that had not been previously sampled. Indoor air and sub-slab soil gas samples were collected in 6-liter summa canisters equipped with 24-hour regulators.

- Two indoor air samples collected in the Professional Services Building showed PCE levels at 4.3 µg/m^3 and 5.6 µg/m^3, about 10 times lower than the 2013 levels.

- PCE levels in indoor air ranged from non-detect (1.1 to 5.1 µg/m^3 reporting limit) to 16 µg/m^3 in a residential home. Sub-slab soil gas collected from the residential home was non-detect for PCE and TCE, which prompted EPA to suspect the source to be unrelated to the site.
- TCE was detected in one sample at 1.0 µg/m^3 from the home with the PCE level of 16 µg/m^3, though no other air samples from other homes detected TCE. Previously, TCE was not detected in indoor air or sub-slab soil gas samples collected in that home. The source of TCE at that residence is thought to be associated with indoor use of volatile consumer products and not related to the groundwater plume [Tetra Tech 2020].

2017–2018 Sampling event and key results

In 2017 and 2018, EPA collected indoor air and sub-slab samples as part of the Remedial Investigation (RI). In addition, EPA collected additional sub-slab, crawl space, and indoor air samples at residential properties downgradient of the source area.

- Five of the six homes with indoor air samples collected during the RI showed no detection of PCE or TCE.
- PCE levels in indoor air of one home ranged from 4.0 to 12 µg/m^3. Sub-slab soil gas collected from that home showed no detection of PCE or TCE in three out of four samples (detection limits not listed). The fourth sub-slab soil gas sample showed a maximum of 1.3 µg/m^3 PCE, which prompted EPA to suspect the source to be unrelated to the site and most likely associated with indoor use of volatile consumer products.
- Following the 2017 source removal, the highest PCE level in indoor air found during three quarterly sampling events at the Professional Services Building was 0.94 µg/m^3, below the residential screening level (130 µg/m^3)[Tetra Tech 2020].
- Sub-slab soil gas levels of PCE and TCE below the Professional Services Building did not exceed ATSDR vapor intrusion screening values (CREG) of 130 µg/m^3 for PCE and 7.0 µg/m^3 for TCE .

How PCE Can Harm Your Body

- Breathing high levels for a short time can cause dizziness, headaches, coordination issues, and sleepiness.
- Breathing low levels for a longer time can cause changes in mood, memory, attention, reaction time, and vision.
- Studies in animals show liver and kidney effects and changes in brain chemistry. The studies also show cancers of the liver, kidney, and blood system.
- Studies in humans suggest a higher risk of getting bladder cancer, multiple myeloma, and non-Hodgkin's lymphoma.

Source: [ATSDR 2019a]

Public drinking water system sampling

Drinking water distribution plant tap sampling key results

- In 1974, Congress passed the Safe Drinking Water Act to determine safe levels of chemicals in drinking water. In 1995, public water systems were required to test drinking water

systems for PCE and other chemicals. EPA established the Maximum Contaminant Level for PCE at 5 µg/L [EPA Not dated].

- From 1993 through April 2015, testing at the water distribution system taps found no detectable levels of PCE with a 0.5 µg/L detection limit [IDNR 2021].
- Between May 2015 and October 2016, testing of drinking water taps at the Atlantic Municipal Utilities water distribution system tap found PCE intermittently. The maximum detected levels of PCE were 1.1 µg/L at the distribution plant in September and October 2016 [IDNR 2021].
- The maximum level of PCE in the distribution system tap (1.1 µg/L) was lower than ATSDR screening levels for PCE based on the CREG values for drinking water 12 µg/L, inhalation during showering 5.2 µg/L, and dermal absorption during showering 38 µg/L. PCE levels below ATSDR screening values are not a health concern and are not evaluated further [ATSDR 2016a].
- The maximum level of PCE in the distribution system tap is also within EPA's safe drinking water standard of 5 µg/L and well below levels of health concern.
- Well AMU-6 was taken offline 6 days after the October 2016 sampling [ATSDR 2025].

Health Evaluation

For levels of chemicals greater than our screening values, we estimate the amount of contact people could have with the chemical at the site. Then, we compare our estimates to comparison values. Comparison values are based on the health effects levels from scientific studies. We also examine the evidence to determine whether the chemicals could harm people's health.

ATSDR calculated cancer risks for long-term exposures, using the maximum concentration for PCE and TCE. Calculated cancer risks are theoretical estimates that ATSDR uses as a tool for deciding whether public health actions are needed to protect health—they are not actual estimates of cancer cases in a community [ATSDR 2022].

Exposure assumptions

Evaluations of exposure to air contaminants are based on indoor air concentrations. Because there were only a few samples, we estimated exposures using the maximum concentration as our exposure point concentration. When performing the calculations both central tendency exposure (CTE) and reasonable maximum exposure (RME) scenarios were considered. CTE scenarios evaluate average or typical exposures to a contaminant within an exposed population, and RME scenarios evaluate exposures at the high end of the population's exposure distribution, at approximately the 95th percentile. These evaluations were conducted for acute, intermediate, and chronic exposure durations to site contaminants, considering both noncancer and cancer health effects [ATSDR 2022].

- We assumed worker exposure to indoor air of commercial buildings 8.5 hours per day, 5 days a week, 50 weeks per year for 20 years.
- We assumed residential exposure to indoor air of homes for 7 days a week, 52.14 weeks per year for 12 and 21 years for children and 12 and 33 years for adults, the CTE and RME, respectively.

Key results

- In 2013, PCE was detected in indoor air in the Professional Services Building at a maximum of 76 µg/m^3. The exposure point concentration of PCE after adjusting for occupational use (8.5 hours per day, 5 days per week for 20 years) is 18 µg/m^3which is less than ATSDR's noncancer comparison value for PCE (RMEG chronic 40 µg/m^3) and therefore, not expected to result in harmful health effects.
- To estimate cancer risks, we used the maximum concentrations of PCE and TCE detected. ATSDR calculated cancer risks using the inhalation unit risk of 2.6E-07 (µg/m^3)$^{-1}$ for PCE and of 4.1E-06 (µg/m^3)$^{-1}$ for TCE.
- ATSDR considers the lifetime cancer risks for the PCE and TCE concentrations as low, not a concern for increased risk, and not likely to harm people's health. Appendix B provides detail of these estimates.

Table 3. Summary of Chemicals Selected for Further Evaluation in Indoor Air

Chemical	Range (µg/m^3)	Screening Value (µg/m^3)	Selected for further evaluation?	Cancer Risk Range	Does comparison indicate health concern?
PCE (Commercial)	ND–76	3.8 CREG	Yes	1.2E-06	No
TCE (Commercial)	ND	0.21 CREG	No	No exposure	No
PCE (Residential)	ND–16	3.8 CREG	Yes	1.1E-06–1.8E-06	No
TCE (Residential)	ND–1.0	0.21 CREG	Yes	1.7E-06–2.3E-06	No

Data Sources: [Tetra Tech 2020]
Abbreviations: µg/m^3—micrograms per cubic meter air (unit of measure); CREG—ATSDR's Cancer Risk Evaluation Guides; ND—not detected.
Chemicals with maximum values above screening values are selected for further evaluation.
Chemicals with cancer risk range above 1.0E-05 indicate a concern for increased cancer risk.

Limitations and Uncertainty of Conclusions

ATSDR made every attempt to obtain critical environmental information about the site. The purpose of our evaluation is to assess the potential impact that the contamination has on the community's health, but there are limitations in the environmental and operational records that were used in our assessment. When limitations existed, to the maximum extent possible,

ATSDR calculated risks using conversative assumptions to be more protective of the community's health. Actual exposures may have been different (higher or lower) from those described in this document.

Limitations:

- Data obtained by ATSDR from EPA's indoor air sampling was only collected for a limited time frame from 2013 to 2018, yet we assumed exposure to the maximum detected levels 24 hours a day, every day for 78 years for residential exposures even though contamination was likely only present for 56 years.
- There are limited details from the 2013 sampling event, including the sample collection method and the duration/timing of sampling. In addition, the sub-slab soil gas values exceeding the upper quantitation limit of 250 $\mu g/m^3$ are estimated values.
- ATSDR does not know what levels of chlorinated solvents in indoor air existed prior to 2013 as there are no data available to analyze.
- Consumer products thought to be the source of VOCs inside a residential home that had PCE and TCE detections was not investigated since sub-slab soil gas samples from that home were non-detect for PCE and TCE.
- The maximum level of PCE and TCE measured in indoor air may not be the actual maximum indoor air levels. Levels could be higher for various reasons including weather, temperature, and other variables. Additionally, toxicological evidence for TCE is extrapolated from oral exposures of rodents to air exposures to humans, resulting in uncertainties [ATSDR 2019a, 2019b, 2016c].
- ATSDR does not know what levels of PCE were present in the AMU-7 or the drinking water system prior to 1982 as there are no data available to analyze. Additionally, there are data gaps in sampling from 1982 to 1993 at the AMU distribution plant taps.

Health Findings and Next Steps

Finding 1: Workers—No Health Hazard

People who work in buildings above the groundwater plume or adjacent to the former dry cleaner are not likely to have adverse health effects from breathing low levels of PCE or associated breakdown chemicals in indoor air.

Basis for Finding 1

- In February 2013, PCE was detected in the indoor air of the Professional Services Building at a maximum level of 76 micrograms per cubic meter (µg/m^3).
- Shortly after the sampling results were known, the landlord installed a vapor mitigation system to provide additional protection for workers by further reducing the potential for exposure to VOCs in air inside the building.
- The exposure point concentration of PCE after adjusting for occupational use (8.5 hours per day, 5 days per week, for 20 years) is 18 µg/m^3 which is less than ATSDR's noncancer comparison value for PCE (reference media evaluation guide [RMEG] chronic 40 µg/m^3) and therefore, not expected to result in harmful health effects.
- ATSDR calculated cancer risks using the inhalation unit risk of 2.6E-07 (µg/m^3)$^{-1}$ for PCE to be between 1 and 2 excess cancer cases in one million people (1.2E-06). ATSDR considers the excess lifetime cancer risks for the PCE as low, not a concern for increased risk, and not likely to harm people's health.

Finding 2: Residents—No Health Hazard

People who live above or adjacent to the PCE groundwater plume are not likely to have adverse health effects from breathing low levels of PCE or associated breakdown chemicals in indoor air from the groundwater plume.

Basis for Finding 2

- In March 2015, PCE was detected at a maximum level of 16 µg/m^3 in indoor air of one home downgradient of the source area.
- The PCE exposure point concentration is 16 µg/m3 which is less than ATSDR's noncancer comparison value for PCE (130 µg/m3) and therefore, not expected to result in harmful health effects.
- ATSDR calculated cancer risks using the inhalation unit risk of 2.6E-07 (µg/m^3)$^{-1}$ for PCE to be between 1 and 2 excess cancer cases in one million people (1.1E-06–1.8E-06). ATSDR considers this excess lifetime cancer risks for the PCE as low, not a concern for increased risk, and not likely to harm people's health.

- In June 2018, TCE was detected at a maximum level of 1.0 µg/m^3 in the indoor air of the same home downgradient of the source area. However, because TCE was not detected in the sub-slab soil gas, the investigation determined TCE was not likely site related, but TCE was likely from products used in the home.
- ATSDR calculated cancer risks using the inhalation unit risk of 4.1E-06 (µg/m^3)$^{-1}$ for TCE to be between 1 and just over 2 excess cancer cases in one million people (1.7E-06–2.3E-06). ATSDR considers this excess lifetime cancer risks for the TCE as low, not a concern for increased cancer risk, and not likely to harm people's health. Combined risk of TCE and PCE was not calculated because TCE was determined not to be site related.

Next Steps

- ATSDR recommends that residents store and use all products that emit vapors (e. g., paint thinners, gasoline) in well-ventilated areas to prevent vapor accumulation in indoor air and potential harmful health effects.
- ATSDR plans to provide health education to make the community aware of strategies to reduce exposures to common household chemicals.
- EPA and IDNR are encouraged to keep the community updated on site conditions and cleanup.

Finding 3: Public Water Users—No Current Health Hazard, Indeterminate Past Health Hazard

People who used the public drinking water from 1993 to the present day are not likely to be harmed by PCE or associated breakdown chemicals from the PCE Former Dry Cleaner Site. In August 1982, PCE was found in one of several wells that provided water to the public system. It is unclear what levels of PCE people were exposed to or how long those exposures occurred before PCE was found.

Basis for Finding 3

- A dry cleaner operated from 1961 to 1972, and an Iowa Department of Transportation (IDOT) lab operated from 1976 to 1986. Although the dry cleaner is the likely source of contamination, it is also possible that the contamination began with the IDOT lab. Therefore, the exact timing of when the contamination started remains unknown. One or both of these operations is likely the source of the contamination.
- In August 1982, PCE was found at 170 micrograms per liter (µg/L) at the wellhead of AMU-7, one of several public drinking water wells. Within six days of collecting the sample, the well was taken offline. It is not known to what level of PCE people were exposed to or how long those exposures lasted before PCE was found. It is also unknown what the amount was in the system before or after the well was taken out of service, or how long it took the PCE to clear through the distribution system.

- In 1993, Atlantic Municipal Utilities began sampling for PCE. In 1995, EPA required public water systems to test for PCE and associated breakdown chemicals. EPA established the Maximum Contaminant Level for PCE at 5 µg/L.
- In 2003, PCE was found at 7.9 µg/L at the wellhead of public water well AMU-6. The well continued to be used off and on until 2016 when it was taken offline because levels of PCE were found to be increasing at the water distribution plant.
- Drinking water taps at the water plant found PCE intermittently between May 2015 and October 2016. Maximum detected levels (1.1 µg/L) were within EPA's safe drinking water standard and below levels of health concern.

Next Steps

- ATSDR recommends the Atlantic Municipal Utilities (AMU) to monitor wells and the drinking water system according to EPA's Safe Drinking Water Act regulations.

For More Information

The report explains these conclusions. A report summary is available at https://www.atsdr.cdc.gov/HAC/pha/PCECleaner/PCE-Former-Drycleaner-final-508.pdf. If you have questions or comments, call ATSDR's toll-free number at 1-800-CDC-INFO and ask for information on the PCE Former Dry Cleaner Site.

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Appendices

Appendix A: Maps

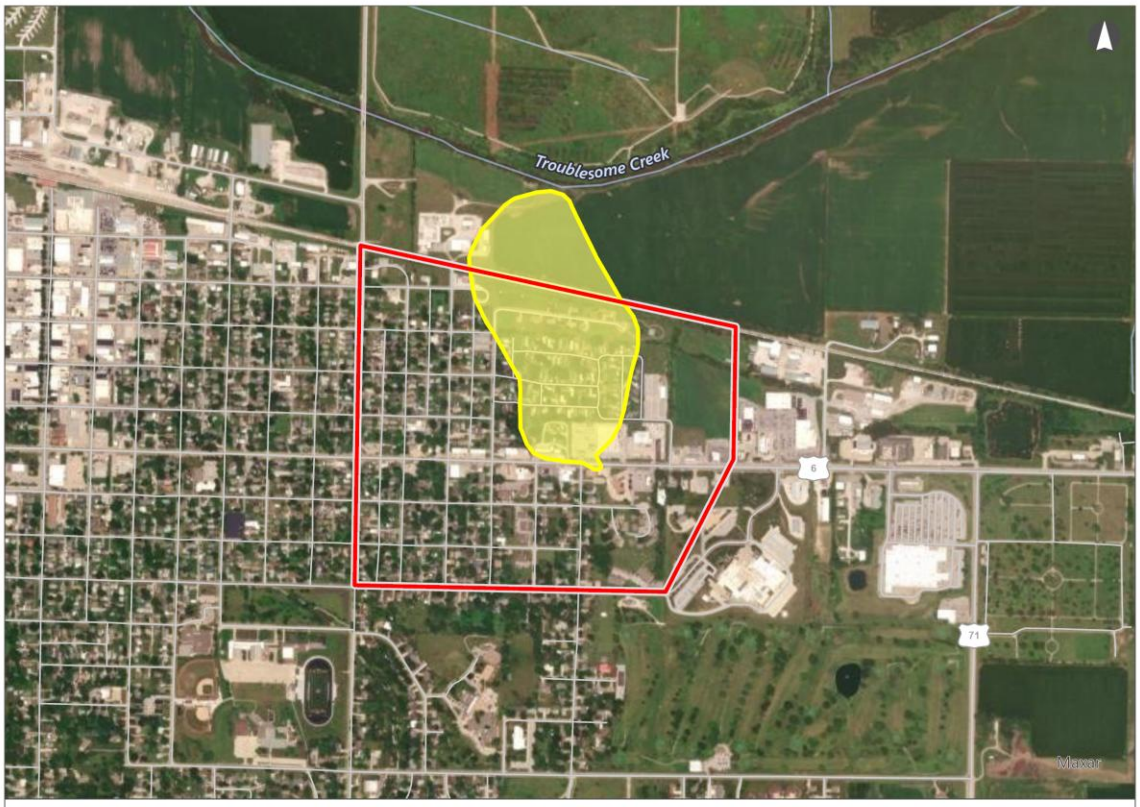
PCE Former Dry Cleaner Site

Atlantic, Cass County, IA

INTRODUCTORY MAP SERIES

SITE & DEMOGRAPHIC SNAPSHOT

EPA FACILITY ID IAD039954300



Site of Interest[1] | Plume Boundary[1,2] | 0 | 0.28 | 0.55 Miles

Demographic Statistics[4,5]

Within 0 Miles buffer of site boundary

Measure	2010	2020	Change	Measure	2010	2020	Change
Total Population	931	838	-9%	Two or More Races	7	21	+200%
White Alone	894	785	-12%	Hispanic or Latino[6]	13	20	+53%
Black Alone	6	1	-83%	Children Aged 6 and Younger	97	71	-26%
Am. Indian & AK Native Alone	2	5	+150%	Adults Aged 65 and Older	157	154	-1%
Asian Alone	4	3	-25%	Females Aged 15 to 44	169	164	-2%
Native Hawaiian & Other Pacific Islander Alone	16	20	+25%	Housing Units	480	456	-5%
Some Other Race Alone	3	4	+33%	Housing Units Pre-1950	21	19	-9%

Data Sources: [1]User Selected Area - Affected Community, [2]ATSDR GRASP, [3]TomTom 2021Q3, [4]US Census 2020 Demographic and Housing Characteristics. **Notes:** [5]Calculated using area-proportion spatial analysis method, [6]Individuals identifying origin as Hispanic or Latino may be of any race. **Coordinate System:** NAD 1983 StatePlane Iowa South FIPS 1402 Feet

ATSDR Agency for Toxic Substances and Disease Registry

GRASP Geospatial Research, Analysis, and Services Program

PRJ ID 11584 | **AUTHOR** Elvira McIntyre 9/16/2025

Appendix B: Chemical Screening, Estimating Doses, and Calculating Cancer Risk

ATSDR Chemical Screening

As part of our environmental health assessment process, we review EPA and other agency's data and screen it to find out which chemical exposures could harm people's health. For chemical levels that are higher than our health-based screening levels, we estimate the amount of contact people could have with the chemical at the site. Then we compare that estimate with the health effects levels from scientific studies.

In this section, we present data for chemicals that we evaluated further. We used the lowest available health comparison value from ATSDR or EPA to determine if we needed to conduct further in-depth evaluation.

Estimating Doses

Estimating an exposure dose requires identifying how much, how often, and how long a person or population might come in contact with some concentration of a contaminant (i.e., the EPC) in a specific medium. ATSDR calculates exposure doses based on acute, intermediate, and chronic exposure durations.

Estimated Cancer Risks

ATSDR calculated the excess lifetime cancer risk from exposure to PCE and TCE from the site. The lifetime excess cancer risk indicates the cancer potential of contaminants. The cancer estimates are usually expressed in terms of excess cancer cases in an exposed population in addition to the background rate of cancer. For remedial decision, the EPA considers estimated cancer risks of less than one additional cancer case among one million persons exposed as insignificant or no increased risk (expressed exponentially as 10^{-6}).

To calculate the lifetime excess cancer risk, ATSDR multiplied the inhalation unit risk (IUR) by the exposure point concentration in air, the appropriate age-dependent adjustment factors (ADAF) for PCE and TCE, and the fraction corresponding to a 78-year lifetime.

If a substance causes cancer by a mutagenic mode of action, there is a greater risk for exposures that occur in early life. 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 exposures taking place from age 2 up to age 16. No adjustment is applied for exposures at age 16 or above.

The EPA concluded that TCE is carcinogenic by a mutagenic mode of action for induction of kidney tumors, so an ADAF was applied for the kidney cancer component of the total cancer risk when estimating age-specific cancer risks. No early-life exposure age adjustments are required for PCE because EPA determined that there is insufficient or equivocal information to characterize the carcinogenic mode of action for tetrachloroethylene as mutagenic.

Default Parameters Table
PHAST Report, v2.3.0.0, database rev 8.3.7, January 29, 2024

Equations

Air Inhalation Exposure Equation

Adjusted EPC = EPC x EF **Equation 1**

EPC = exposure point concentration, $EF_{noncancer}$ = exposure factor (unitless)

Hazard Quotient

HQ = Adjusted EPC ÷ HG **Equation 2**

HQ = hazard quotient, EPC = exposure point concentration (µg/m^3 or ppb), HG = health guideline (e.g., inhalation MRL, RfC)

Cancer Risk Equations

CR = Adjusted EPC x IUR x (ED ÷ LY) **Equation 3**

ADAF-adjusted CR = (Adjusted EPC x IUR) x (ED ÷ LY) x ADAF **Equation 4**

Total CR = Sum of the CR for all exposure groups **Equation 5**

CR = cancer risk (unitless), EPC = exposure point concentration (µg/m^3 or ppb), IUR = inhalation unit risk ((µg/m^3 or ppb)$^{-1}$), ED = exposure duration (years), LY = lifetime years (78 years), ADAF = age-dependent adjustment factor (unitless), EF (cancer) = exposure factor (cancer) calculated as follows: EF (noncancer; unitless) x exposure group specific exposure duration (years) ÷ lifetime of 78 years

Default Exposure Factors

Duration Category	Hours per Day	Days per Week	Weeks per Year	Years	Exposure Group Specific $EF_{noncancer}$	Exposure Group Specific EF_{cancer}
Acute	24	NC	NC	NC	1	NC
Intermediate	24	7	NC	NC	1	NC
Chronic	24	7	52.14	See exposure group specific exposure durations	1	= $EF_{noncancer}$ x Exposure Duration for $Cancer_{Exposure\ Group}$ (years) ÷ 78 years

Abbreviations: EF = exposure factor; NC = not calculated

Cancer EFs are not shown in the table because they are calculated using age-specific durations. The general formula is $EF_{cancer} = EF_{noncancer} \times$ Exposure Duration for $Cancer_{Exposure\ Group}$ (years) ÷ 78 years.

Contaminant Information for Indoor Air Exposures in Residential Homes

Contaminant Name	Entered Concentration	EPC Type	Converted Concentration (µg/m³)	Converted Concentration (ppb)
Tetrachloroethylene	16 µg/m³	Maximum	16	2.4
Trichloroethylene	1 µg/m³	Maximum	1	0.19

Abbreviations: µg/m³ = micrograms per meter cubed; EPC = exposure point concentration

Default Air Residential Results for Chronic, Intermediate, and Acute Duration Exposures
PHAST Report, v2.3.0.0, January 29, 2024

Air Inhalation Chronic (Default)

Tetrachloroethylene

Table 4. Residential default exposure point concentrations for chronic exposures to tetrachloroethylene in air at 16 micrograms per cubic meter (2.4 ppb) along with noncancer hazard quotients and cancer risk estimates*

Exposure Group	CTE Adjusted EPC (µg/m³)	CTE Adjusted EPC (ppb)	CTE Noncancer Hazard Quotient	CTE Cancer Risk	CTE Exposure Duration (yrs)	RME Adjusted EPC (µg/m³)	RME Adjusted EPC (ppb)	RME Noncancer Hazard Quotient	RME Cancer Risk	RME Exposure Duration (yrs)
Birth to < 1 year	16	2.4	0.39	NA	1	16	2.4	0.39	NA	1
1 to < 2 years	16	2.4	0.39	NA	1	16	2.4	0.39	NA	1
2 to < 6 years	16	2.4	0.39	NA	4	16	2.4	0.39	NA	4
6 to < 11 years	16	2.4	0.39	NA	5	16	2.4	0.39	NA	5
11 to < 16 years	16	2.4	0.39	NA	1	16	2.4	0.39	NA	5
16 to < 21 years	16	2.4	0.39	NA	0	16	2.4	0.39	NA	5
Total Child	NA	NA	NA	6.4E-7	12	NA	NA	NA	1.1E-6 ‡	21
Adult	16	2.4	0.39	6.4E-7	12	16	2.4	0.39	1.8E-6 ‡	33
Birth to < 21 years plus 12 years during adulthood §	NA	NA	NA	NA	NA	NA	NA	NA	1.8E-6 ‡	33

Source: [Tetra Tech 2020]
Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; ppb = parts per billion; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher); yrs = years; NA = not applicable
* The calculations in this table were generated using ATSDR's PHAST v2.3.0.0. The noncancer hazard quotients were calculated using the chronic (greater than 1 year) minimal risk level of 41 µg/m^3 and the cancer risks were calculated using the inhalation unit risk of 2.6E-07 (µg/m^3)$^{-1}$.
‡ Indicates that the cancer risk exceeds one extra case in a million people similarly exposed, which ATSDR evaluates further.
§ This cancer risk represents a scenario where children are likely to continue to live in their childhood home as adults.

Trichloroethylene

Table 5. Residential: Default exposure point concentrations for chronic exposure to trichloroethylene in air at 1 µg/m³ (0.19 ppb) along with noncancer hazard quotients*.

Exposure Group	CTE Adjusted EPC (µg/m³)	CTE Adjusted EPC (ppb)	CTE Noncancer Hazard Quotient	CTE Cancer Risk	CTE Exposure Duration (yrs)	RME Adjusted EPC (µg/m³)	RME Adjusted EPC (ppb)	RME Noncancer Hazard Quotient	RME Cancer Risk	RME Exposure Duration (yrs)
Birth to < 1 year	1.0	0.19	0.48	NA	1	1.0	0.19	0.48	NA	1
1 to < 2 years	1.0	0.19	0.48	NA	1	1.0	0.19	0.48	NA	1
2 to < 6 years	1.0	0.19	0.48	NA	4	1.0	0.19	0.48	NA	4
6 to < 11 years	1.0	0.19	0.48	NA	5	1.0	0.19	0.48	NA	5
11 to < 16 years	1.0	0.19	0.48	NA	1	1.0	0.19	0.48	NA	5
16 to < 21 years	1.0	0.19	0.48	NA	0	1.0	0.19	0.48	NA	5
Total Child	NA	NA	NA	1.1E-6 ‡	12	NA	NA	NA	1.7E-6 ‡	21
Adult	1.0	0.19	0.48	6.3E-7	12	1.0	0.19	0.48	1.7E-6 ‡	33
Birth to < 21 years plus 12 years during adulthood §	NA	NA	NA	NA	NA	NA	NA	NA	2.3E-6 ‡	33

Source: [Tetra Tech 2020]

Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; ppb = parts per billion; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher); yrs = years; NA = not applicable

* The calculations in this table were generated using ATSDR's PHAST v2.3.0.0. The noncancer hazard quotients were calculated using the chronic (greater than 1 year) minimal risk level of 2.1 µg/m^3 and the cancer risks were calculated using the inhalation unit risks of 4.1E-06 (µg/m^3)$^{-1}$, 1.0E-06 [liver], 1.0E-06 [kidney] (µg/m^3)$^{-1}$ and age-dependent adjustment factors.

‡ Indicates that the cancer risk exceeds one extra case in a million people similarly exposed, which ATSDR evaluates further.

§ This cancer risk represents a scenario where children are likely to continue to live in their childhood home as adults.

Air Inhalation Intermediate (Default)

Tetrachloroethylene

Table 6. Residential: Default exposure point concentrations for intermediate exposure to tetrachloroethylene in air at 16 µg/m³ (2.4 ppb) along with noncancer hazard quotients*

Exposure Group	Adjusted EPC (µg/m³)	Adjusted EPC (ppb)	Noncancer Hazard Quotient
Birth to < 1 year	16	2.4	0.39
1 to < 2 years	16	2.4	0.39
2 to < 6 years	16	2.4	0.39
6 to < 11 years	16	2.4	0.39
11 to < 16 years	16	2.4	0.39
16 to < 21 years	16	2.4	0.39
Adult	16	2.4	0.39

Source: [Tetra Tech 2020]

Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m³ = micrograms per meter cubed; ppb = parts per billion

* The calculations in this table were generated using ATSDR's PHAST v2.3.0.0. The noncancer hazard quotients were calculated using the intermediate (two weeks to less than 1 year) minimal risk level of 41 µg/m³.

Trichloroethylene

Table 7. Residential: Default exposure point concentrations for intermediate exposure to trichloroethylene in air at 1 µg/m³ (0.19 ppb) along with noncancer hazard quotients*

Exposure Group	Adjusted EPC (µg/m³)	Adjusted EPC (ppb)	Noncancer Hazard Quotient
Birth to < 1 year	1.0	0.19	0.48
1 to < 2 years	1.0	0.19	0.48
2 to < 6 years	1.0	0.19	0.48
6 to < 11 years	1.0	0.19	0.48
11 to < 16 years	1.0	0.19	0.48
16 to < 21 years	1.0	0.19	0.48
Adult	1.0	0.19	0.48

Source: [Tetra Tech 2020]

Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; ppb = parts per billion

* The calculations in this table were generated using ATSDR's PHAST v2.3.0.0. The noncancer hazard quotients were calculated using the intermediate (two weeks to less than 1 year) minimal risk level of 2.1 µg/m^3.

Air Inhalation Acute (Default)

Tetrachloroethylene

Table 8. Residential: Default exposure point concentrations for acute exposure to tetrachloroethylene in air at 16 µg/m³ (2.4 ppb) along with noncancer hazard quotients*

Exposure Group	Adjusted EPC (µg/m³)	Adjusted EPC (ppb)	Noncancer Hazard Quotient
Birth to < 1 year	16	2.4	0.39
1 to < 2 years	16	2.4	0.39
2 to < 6 years	16	2.4	0.39
6 to < 11 years	16	2.4	0.39
11 to < 16 years	16	2.4	0.39
16 to < 21 years	16	2.4	0.39
Adult	16	2.4	0.39

Source: [Tetra Tech 2020]

Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; ppb = parts per billion

* The calculations in this table were generated using ATSDR's PHAST v2.3.0.0. The noncancer hazard quotients were calculated using the acute (less than two weeks) minimal risk level of 41 µg/m^3.

Trichloroethylene

Table 9. Residential: Default exposure point concentrations for acute exposure to trichloroethylene in air at 1 µg/m³ (0.19 ppb)*

Exposure Group	Adjusted EPC (µg/m³)	Adjusted EPC (ppb)	Noncancer Hazard Quotient
Birth to < 1 year	1.0	0.19	NA
1 to < 2 years	1.0	0.19	NA
2 to < 6 years	1.0	0.19	NA
6 to < 11 years	1.0	0.19	NA
11 to < 16 years	1.0	0.19	NA
16 to < 21 years	1.0	0.19	NA
Adult	1.0	0.19	NA

Source: [Tetra Tech 2020]

Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m³ = micrograms per meter cubed; ppb = parts per billion; NA = not applicable

* The calculations in this table were generated using ATSDR's PHAST v2.3.0.0.

Default Parameters Table
PHAST Report, v2.3.0.0, January 29, 2024

Equations

Air Inhalation Exposure Equation

Adjusted EPC = EPC x EF **Equation 1**

EPC = exposure point concentration, $EF_{noncancer}$ = exposure factor (unitless)

Hazard Quotient

HQ = Adjusted EPC ÷ HG **Equation 2**

HQ = hazard quotient, EPC = exposure point concentration (µg/m^3 or ppb), HG = health guideline (e.g., inhalation MRL, RfC)

Cancer Risk Equations

CR = Adjusted EPC x IUR x (ED ÷ LY) **Equation 3**

ADAF-adjusted CR = (Adjusted EPC x IUR) x (ED ÷ LY) x ADAF **Equation 4**

Total CR = Sum of the CR for all exposure groups **Equation 5**

CR = cancer risk (unitless), EPC = exposure point concentration (µg/m^3 or ppb), IUR = inhalation unit risk ((µg/m^3 or ppb)$^{-1}$), ED = exposure duration (years), LY = lifetime years (78 years), ADAF = age-dependent adjustment factor (unitless), EF (cancer) = exposure factor (cancer) calculated as follows: EF (noncancer; unitless) x exposure group specific exposure duration (years) ÷ lifetime of 78 years

Default Exposure Factors

Exposure Group	Noncancer Exposure Factor Chronic CTE	Noncancer Exposure Factor Chronic RME	Noncancer Exposure Factor Intermediate CTE	Noncancer Exposure Factor Intermediate RME	Noncancer Exposure Factor Acute CTE	Noncancer Exposure Factor Acute RME
Full-time worker	0.24	0.24	0.25	0.25	0.35	0.35
Part-time worker	0.15	NA	0.15	NA	0.21	NA

Abbreviations: CTE = central tendency exposure (typical); NA = not applicable; RME = reasonable maximum exposure (higher)
Cancer EFs are not shown in the table because they are calculated using age-specific durations. The general formula is $EF_{cancer} = EF_{noncancer} \times \text{Exposure Duration for Cancer}_{\text{Exposure Group}}$ (years) ÷ 78 years.

Default Exposure Occupational Parameters

Exposure Group	Daily (hours/day) CTE	Daily (hours/day) RME	Weekly (days/week) CTE	Weekly (days/week) RME	Annually (weeks/year) CTE	Annually (weeks/year) RME	Age-Specific Exposure Duration (years) CTE	Age-Specific Exposure Duration (years) RME
Full-time worker	8.5	8.5	5	5	50	50	5	20
Part-time worker	5.1	NA	5	NA	50	NA	3.1	NA

Abbreviations: CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher), NA = not applicable

Contaminant Information for Indoor Air Exposures in Commercial Buildings

Contaminant Name	Entered Concentration	EPC Type	Converted Concentration (µg/m³)	Converted Concentration (ppb)
Tetrachloroethylene	76 µg/m³	Maximum	76	11.2

Abbreviations: µg/m³ = micrograms per meter cubed; EPC = exposure point concentration

Default Air Occupational Results for Chronic, Intermediate, and Acute Duration Exposures
PHAST Report, v2.3.0.0, January 29, 2024

Air Inhalation Chronic (Default)

Tetrachloroethylene

Table 10. Occupational: Default exposure point concentrations for chronic exposure to tetrachloroethylene in air at 76 µg/m³ (11.2 ppb) along with noncancer hazard quotients and cancer risk estimates*

Exposure Group	CTE Adjusted EPC (µg/m³)	CTE Adjusted EPC (ppb)	CTE Noncancer Hazard Quotient	CTE Cancer Risk	CTE Exposure Duration (yrs)	RME Adjusted EPC (µg/m³)	RME Adjusted EPC (ppb)	RME Noncancer Hazard Quotient	RME Cancer Risk	RME Exposure Duration (yrs)
Full-time worker	18	2.7	0.45	3.1E-7	5	18	2.7	0.45	1.2E-6 ‡	20
Part-time worker	11	1.6	0.27	1.1E-7	3.1	NA	NA	NA	NA	NA

Source: [Tetra Tech 2020]
Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m³ = micrograms per meter cubed; ppb = parts per billion; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher); yrs = years; NA = not applicable
* The calculations in this table were generated using ATSDR's PHAST v2.3.0.0. The noncancer hazard quotients were calculated using the chronic (greater than 1 year) minimal risk level of 41 µg/m³ and the cancer risks were calculated using the inhalation unit risk of 2.6E-07 $(\mu g/m^3)^{-1}$.
‡ Indicates that the cancer risk exceeds one extra case in a million people similarly exposed, which ATSDR evaluates further.

Air Inhalation Intermediate (Default)

Tetrachloroethylene

Table 11. Occupational: Default exposure point concentrations for intermediate exposure to tetrachloroethylene in air at 76 µg/m³ (11.2 ppb) along with noncancer hazard quotients*

Exposure Group	CTE Adjusted EPC (µg/m³)	CTE Adjusted EPC (ppb)	CTE Noncancer Hazard Quotient	RME Adjusted EPC (µg/m³)	RME Adjusted EPC (ppb)	RME Noncancer Hazard Quotient
Full-time worker	19	2.8	0.47	19	2.8	0.47
Part-time worker	12	1.7	0.28	NA	NA	NA

Source: [Tetra Tech 2020]

Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; ppb = parts per billion; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher); NA = not applicable

* The calculations in this table were generated using ATSDR's PHAST v2.3.0.0. The noncancer hazard quotients were calculated using the intermediate (two weeks to less than 1 year) minimal risk level of 41 µg/m^3.

Air Inhalation Acute (Default)

Tetrachloroethylene

Table 12. Occupational: Default exposure point concentrations for acute exposure to tetrachloroethylene in air at 76 µg/m³ (11.2 ppb) along with noncancer hazard quotients*

Exposure Group	CTE Adjusted EPC (µg/m³)	CTE Adjusted EPC (ppb)	CTE Noncancer Hazard Quotient	RME Adjusted EPC (µg/m³)	RME Adjusted EPC (ppb)	RME Noncancer Hazard Quotient
Full-time worker	27	4.0	0.66	27	4.0	0.66
Part-time worker	16	2.4	0.39	NA	NA	NA

Source: [Tetra Tech 2020]
Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; ppb = parts per billion; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher); NA = not applicable
* The calculations in this table were generated using ATSDR's PHAST v2.3.0.0. The noncancer hazard quotients were calculated using the acute (less than two weeks) minimal risk level of 41 µg/m^3.