Letter Health Consultation

Paden City Groundwater Site

PADEN CITY, WEST VIRIGINIA

Addendum to Health Consultation

EPA FACILITY ID: WVN000304985

August 5, 2024

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

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. 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 or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared By:

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

August 5, 2024

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U.S. Environmental Protection Agency, Region 3
1600 John F. Kennedy Blvd.
Philadelphia, PA 19103

Re: Paden City 2023 Public Drinking Water Event

Dear Ms. Schantz,

On January 17, 2024, the Environmental Protection Agency (EPA), Region 3, requested that the Agency for Toxic Substances and Disease Registry (ATSDR) conduct a public health evaluation of community exposures to contaminants in drinking water following the identification of a water treatment malfunction in August 2023 at the Paden City Groundwater Site in Paden City, Tyler and Wetzel Counties, West Virginia. This malfunction resulted in site-related contaminants entering the public water distribution system at levels above EPA's Maximum Contaminant Level (MCL), which subsequently restricted water use in Paden City. Residents have expressed concerns about the potential for health effects related to exposure to perchloroethylene (PCE) in water. EPA requested that ATSDR evaluate drinking water data from this event to determine its public health significance.

To address EPA's request to determine whether the contamination from the treatment malfunction had the potential to cause adverse health effects to residents, ATSDR used drinking water data from both Paden City Water Department and EPA. ATSDR evaluated whether drinking Paden City public water or using the water for showering and household use could result in harmful health effects. ATSDR evaluated the site following the agency's public health assessment (PHA) process, as summarized in Attachment A, and detailed in ATSDR's Explanation of ATSDR's PHA Process.

Based on our assessment of drinking water data from the 2023 malfunction, ATSDR concludes that drinking water that contained PCE during this time period would not result in harmful health effects. ATSDR also concludes that showering and using household water that contained PCE during this time period would not result in harmful health effects. These conclusions assume the worst-case scenario that residents were exposed to PCE at the maximum concentration detected.

There are multiple limitations to these conclusions. First, samples collected by Paden City Water Department could not be validated to EPA standards. However, ATSDR used the highest value of PCE detected in all drinking water samples, including samples from Paden City Water Department, to show worst-case scenario exposures. Additionally, the specific date of the air stripper malfunction and subsequent introduction of PCE in finished drinking water is not known. ATSDR estimated the exposure duration during this period.

Another limitation that ATSDR notes is that drinking water samples were only analyzed for PCE and did not include its degradation products or associated contaminants. Further, the extent of residential drinking water samples was limited and could not show actual exposures at each residence. Paden City Water Department and EPA took residential samples from two locations in the community and presumed that other non-residential locations could represent concentrations at different points in the distribution system. The exact concentration of PCE at each residence is unknown. Lastly, ATSDR made assumptions that all residents were exposed to the highest concentration detected for the entirety of the 7-week exposure duration as a worst-case scenario. Household use was estimated using ATSDR's default Shower and Household Water-Use Exposure (SHOWER) model assumptions, including household size and shower duration.

ATSDR recommends that Paden City officials continue to operate the air stripper water treatment system and monitor finished drinking water to ensure effectiveness of the treatment system. ATSDR also recommends that Paden City officials develop contingency plans to provide uncontaminated water to consumers if the treatment system malfunctions again in the future.

The remainder of this letter health consultation document details how we arrived at these conclusions and recommendations.

Background

The Paden City Groundwater Site, located in Paden City, Tyler and Wetzel Counties, West Virginia, was proposed to the National Priorities List (NPL) on September 9, 2021. Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Agency for Toxic Substances and Disease Registry (ATSDR) is required to perform a public health evaluation for sites proposed to the NPL. In 2024, ATSDR released a health consultation document, which included a review of environmental data across multiple exposure pathways, including indoor air and drinking water, to comprehensively assess the community's potential environmental public health risks (ATSDR 2024). Additionally, prior to its proposal to the NPL, ATSDR has provided public health technical assistance and health education for specific environmental exposure pathway questions related to this site to the Environmental Protection Agency (EPA), the West Virginia Department of Environmental Protection (WV DEP), the West Virginia Department of Health (WVDH), and community members.

Statement of Issue and Purpose

PCE, also known as tetrachloroethylene, was first detected in Paden City's drinking water source in 2010. After further investigation, Paden City Water Department continued to monitor its drinking water and in 2018 determined that the extent of PCE contamination could not be controlled through basic water treatment. Municipal officials then asked environmental agencies to help further characterize the source and extent of the PCE contamination. In 2020, Paden City Water Department installed an air stripper treatment

system to remove PCE and associated volatile organic compounds (VOCs) from the municipal drinking water supplied to taps.

In August 2023, EPA informed ATSDR that PCE was released into Paden City's treated drinking water due to a malfunction with the air stripper treatment system. This detection of PCE in the drinking water was discovered during a sampling event on July 26-28, 2023. However, information from the Paden City Water Department indicated that the cause of the contamination was a power outage earlier in July. The exact date that PCE entered the distribution system remains unknown. Based on this information, PCE was presumed present in the drinking water from early July 2023 to mid-August 2023. The treatment system malfunction allowed PCE to enter the drinking water supply at levels above EPA's MCL. Because the water system was not in compliance with this regulatory value, Paden City officials issued a cautionary notice to residents. This notice advised residents to avoid drinking public water or using the water to shower during this period to avoid exposures to PCE. Since August 2023, when the malfunction of the air stripper treatment system was corrected, Paden City's drinking water treatment system has effectively lowered PCE concentrations to comply with state and federal standards. ATSDR provides an evaluation of water sampling data from the period that the treatment system malfunctioned within this document.

Site Description and Timeline

PCE had been identified in the Paden City drinking water as early as 2010, and a treatment system was put in place in 2020 to remove the PCE and related contaminants. However, EPA discovered the presence of PCE in treated drinking water after conducting ongoing routine sampling July 26-28, 2023. When the results became available on August 15, 2023, PCE was found above the MCL. This malfunction was traced back to an electrical surge in July 2023 that created a blown fuse in the air stripper's control panel (EPA 2024). When the municipal fire hydrants needed water, the Paden City Water Department bypassed the air stripper to fill the hydrant lines. However, when the bypass valve was turned back to its proper position and the treatment system was back on, the bypass valve didn't seal properly. This faulty seal allowed untreated water to enter the water distribution system (EPA 2024).

As part of its remedial investigation, EPA has been periodically monitoring public drinking water. EPA also received requests from the community to ensure the air stripper's effectiveness (EPA 2024). When the 20 samples of treated drinking water throughout Paden City in July 2023 showed detections of PCE above the MCL, EPA communicated with Paden City Water Department and other municipal officials, West Virginia Department of Environmental Protection (WVDEP), and West Virginia Department of Health (WVDH) to address exposures in the town. WVDH and Paden City municipal officials released a "Do Not Use" notice that advised residents to avoid drinking, using, or showering in public water. This notice was active until September 2023, when confirmatory samples taken in August 2023 showed that the fixes in the valve were effective at reducing PCE to levels below EPA's MCL.

During this event, ATSDR was in the process of evaluating past (pre-2023) exposures to health consultation document on January 31, 2024, detailing exposures prior to this PCE and related contaminants in drinking water and vapor intrusion. ATSDR released its malfunction (ATSDR 2024). ATSDR evaluated drinking water exposures as well as indoor air exposures related to soil vapor intrusion and concluded that drinking water and breathing air contaminated with PCE would not result in harmful health effects. Table 1 details the timeline of these site-related events.

Table 1. Timeline of Significant Actions at Paden City Groundwater Site

Year	Event
2010	PCE first detected in finished drinking water
2018	Paden City officials requested assistance from state and federal officials to respond to PCE contamination
2020	Air stripper treatment system installed to remove PCE from treated drinking water
2023 (July)	PCE detected in finished drinking water
2023 (September)	Finished drinking water samples confirmed PCE was not detected
2024 (January)	ATSDR releases its initial health consultation document

EPA 2024

Community Description and Concerns

Paden City, West Virginia, is a city in Tyler and Wetzel Counties. According to 2019 U.S. census data, approximately 3,100 residents make up the city, with more than 98% of the community identifying as non-Hispanic White, English-speakers. The remaining 2% of Paden City's population is composed of Black residents, multiracial (two or more races) residents, or those of other races. Although income among city residents is similar to the median in Wetzel County and in West Virginia, approximately 20% of the community lives below the poverty level.

The Centers for Disease Control and Prevention (CDC) categorizes Tyler and Wetzel counties as low to moderately vulnerable on the Social Vulnerability Index (SVI) (ATSDR 2022a). SVI is a measure of a community's relative ability to prepare for and recover from a hazardous event (ATSDR 2022b). ATSDR also considered Paden City's ranking on the Environmental Justice Index (EJI) (ATSDR 2022a). The EJI uses environmental, socioeconomic, transportation/infrastructure, and health factors to interpret patterns of vulnerability and burden within communities. Paden City is located in two counties and two census tracts. The EJI suggests that the census tracts comprising Paden City experience

worse effects from social and environmental burden than approximately 80% of all other census tracts in the nation. These factors point to health equity concerns in the Paden City community. ATSDR is committed to ensuring a healthy environment for all, including communities like Paden City that are economically and socially marginalized. Additionally, the Paden City community has expressed concerns about their environmental exposures in relation to their health conditions. ATSDR has addressed some of these questions and concerns in its 2024 health consultation and addresses additional questions within this document.

Sampling Data

EPA provided ATSDR with split drinking water data collected by both Paden City Water Department and EPA between July and November 2023. Twenty locations were sampled across Paden City, including residential locations, schools, town buildings, and other public buildings. Samples were also collected from several locations within the water treatment plant building. Each round of sampling included several different locations throughout the distribution system, but the selection of these locations varied with each sampling event. The samples collected by Paden City Water Department were not validated. Data validation is a process that determines the analytical quality of a specific data set (EPA 2002). EPA Remedial and Removal programs collected separate samples on different occasions, and all EPA-collected samples have been validated.

Scientific Evaluations

Exposure Pathway Analysis

ATSDR begins the evaluation of potential public health hazards by characterizing the exposure pathways in the community. Determining whether residents in the community are exposed or were exposed in the past to contaminants in the environment requires the presence of five exposure factors. Exposure pathways are categorized as completed, potential, or eliminated based on five pathway elements; the category may differ for past, present, or future conditions. A completed exposure pathway is one in which all five elements are present:

1) A contaminant's source
2) The contaminant's environmental fate and transport – how the nature of contaminants might change and where they go end up in environmental media
3) An exposure point
4) A route for human exposure
5) People who might be exposed

In a potential exposure pathway, at least one of the pathways elements is uncertain. A pathway is eliminated when one or more elements are missing or prevented and are unlikely to be present. ATSDR identified a completed exposure pathway via ingestion of contaminants present in water based on past exposure conditions. ATSDR also identified a

completed exposure pathway through household use of water, when residents shower, bathe, and use household water. The completed exposure pathways are summarized in Table 2.

Table 2. Exposure Pathways and Pathway Elements for Contaminants in Drinking Water

Pathway	Element 1: Source	Element 2: Environmental Media	Element 3: Point of Exposure	Element 4: Exposure Route	Element 5: Exposed Population
Drinking water	Band Box Cleaners	Drinking water	Drinking water taps	Ingestion	Children and adults ingesting and cooking with drinking water
Household use	Band Box Cleaners	Household water	Shower, bath faucet, sink	Inhalation and dermal	Children and adults bathing, showering, and using water in home

Drinking Water Exposure Pathway

The drinking water exposure pathway was complete for all residential and non-residential locations. Neither Paden City nor EPA sampled additional residences, but it is likely that PCE was present throughout the distribution system at varying levels at all locations. Since data only exists for one residential location, ATSDR used this level to evaluate all residential exposures. Non-residential locations were evaluated separately.

Household Water Use Exposure Pathway

The household water use exposure pathway was complete for residential locations. Since data only exist for two residential locations, ATSDR used the maximum level detected to evaluate all residential exposures.

Screening Analysis

ATSDR evaluated all available environmental data, including drinking water (ingestion and household use). The data discussed below include results that were detected above ATSDR's health-based screening values. Data below screening values were not retained for further evaluation because the presence of contaminants below health-based screening levels are not expected to result in harmful health effects for any person.

The Public Health Assessment Site Tool (PHAST) and the ATSDR Showering and Household Water Use (SHOWER) model were used to evaluate exposure to contaminants in the water supply through ingestion, inhalation, and skin contact as the result of household use of water (ATSDR 2020). PHAST is an ATSDR tool used to screen contaminants for further assessment, calculate exposure doses and concentrations, compare site doses and

concentrations to relevant toxicological values (such as minimal risk levels [MRLs]) and calculate cancer risks and hazard quotients (HQs).

The water sample results were screened against ATSDR health-based comparison values (CVs). Paden City and EPA samples were both only analyzed for PCE. Several locations exceeded ATSDR's CV for PCE. The maximum value detected in treated water was from an unvalidated Paden City sampling event and was taken from the water treatment building bathroom with a value of 29.4 ppb. This value is higher than the maximum used to evaluate long-term exposures in the 2024 health consultation (17 ppb), but exposures to PCE in 2023 were short-term in nature.

ATSDR categorized exposure into four categories based on the amount of time people typically spend in each location: residential, public; non-residential, public (i.e., gas station, church, convenience store); schools; and water treatment plant. These building types provide different exposure scenarios and were assessed separately.

Table 3. 2023 Air Stripper Malfunction PCE Detections

Location	Maximum Value – Town Sampled (ppb)	Date Sampled - Town	Maximum Value – EPA Sampled (ppb)	Date Sampled – EPA
Residential	24.6	7/26/23	18 J	7/26/23
Public – non-residential	28.2	7/26/23	21 J	7/26/23
Public – high school	25.9	7/26/23	5.5*	8/30/23
Public – grade school	24.1	7/26/23	N/A	N/A
Water treatment plant	29.4	7/26/23	20 J	7/26/23

Recommended CV = 12 ppb (cancer risk evaluation guide)
J = quantity is estimated
*This value exceeded EPA's MCL but did not exceed ATSDR's CV

EPCs and Exposure Calculations

All samples other than one EPA detection, at a Paden City school, exceeded ATSDR's CV. ATSDR retained all location categories, including the school, since at least one sample was detected above ATSDR's CV. The concentration of PCE exceeded the EPA MCL in the raw and finished drinking water in several sampling events. However, the MCL for PCE is lower than ATSDR's health-based screening values. Contaminants that are detected below screening values are not expected to result in harmful health effects. The lowest ATSDR screening value for PCE is the cancer risk evaluation guide (CREG) of 12 ppb. The ATSDR CREG is the contaminant concentration where one in 1 million persons exposed continuously for 78 years are expected to develop cancer. Health-based, non-cancer screening values for PCE

are greater than the CREG. Although the town's samples could not be validated, and several of EPA's samples were estimated results, ATSDR proceeded using the maximum values detected in each scenario for this evaluation as a worst-case scenario.

With its SHOWER model, ATSDR screened household water exposure using the maximum concentration of PCE detected at a residential location of Paden City's water, 24.6 ppb. ATSDR did not evaluate household water use at non-residential locations due to the assumption that the shower exposure scenario does not exist in these locations.

The SHOWER model uses the concentration in water to predict the 24-hour inhalation exposure concentration and the daily skin exposure dose in the household. The SHOWER model can be modified for the number of residents in the home and time spent showering. Without any specific information on household size, ATSDR used the default assumption of four residents and 15-minute showers. The SHOWER model predicted a daily indoor air exposure concentration of 2.6 ppb for the default reasonable maximum exposure (RME) four-person household scenario, which exceeded ATSDR's CREG for indoor air of 0.57 ppb. ATSDR conducted further evaluation of PCE exposures through household use to assess non-cancer and cancer harmful health effects (see: In-Depth Toxicological Effects Analysis section).

In-Depth Toxicological Effects Analysis

Drinking water ingestion

ATSDR assumed based on the estimated power outage date and confirmed non-detect sample dates that the exposure duration was about 7 weeks. ATSDR also assumed that the faulty valve was switched on in early July (exact date unknown) and the last detection above ATSDR's CV occurred on 8/23/23. This time period of approximately 7 weeks can only be categorized as acute or intermediate exposure duration. Chronic exposure doses could not be calculated because chronic exposure is defined as any exposure greater than one year.

While residential exposure concentrations were lower than non-residential, the exposure frequency (i.e., number of days per week) was higher for a residential scenario. Conversely, non-residential exposure concentrations were higher than residential, but the exposure frequency was lower. ATSDR evaluated both of these scenarios.

Table 4. Residential Perchloroethylene Drinking Water Ingestion – Acute/Intermediate Exposure – Max Concentration 24.6 ppb

Exposure Group	Dose – CTE (mg/kg/day)	Dose – RME (mg/kg/day)	HQ CTE	HQ RME
Birth to <1 year	0.0019	0.0035	0.23	0.44
1 to <2 years	0.00053	0.0014	0.066	0.18

Exposure Group	Dose – CTE (mg/kg/day)	Dose – RME (mg/kg/day)	HQ CTE	HQ RME
2 to <6 years	0.00048	0.0012	0.060	0.15
6 to <11 years	0.00035	0.00097	0.044	0.12
11 to <16 years	0.00024	0.00076	0.030	0.095
16 to <21 years	0.00025	0.00076	0.031	0.095
Adult	0.00040	0.00099	0.050	0.12
Pregnant Women	0.00039	0.00099	0.049	0.12
Breastfeeding Women	0.00050	0.0010	0.063	0.13

Abbreviations: CTE = central tendency for exposure; mg/kg/day = milligrams of contaminant per kilogram of body weight per day; RME = reasonable maximum exposure

Using the maximum concentration detected for each exposure scenario, doses were calculated using the Public Health Assessment Site Tool (PHAST) for a typical, or central tendency (CTE), exposure scenario as well as a reasonable maximum exposure (RME) scenario for drinking water consumption. Instead of default scenario assumptions, ATSDR calculated doses using 7-week duration for intermediate and acute dose evaluation. ATSDR then compared the CTE and RME doses to the ATSDR minimal risk level (MRL) of 0.008 mg/kg/day. This MRL is the same for intermediate and acute scenarios.

As shown in Table 4, the highest dose calculated was for the birth to one year age group. This dose of 0.0035 mg/kg/day is below the MRL of 0.008 mg/kg/day. These exposure doses were used to calculate non-cancer hazard quotients (HQs), which represent a comparison of exposure dose to MRL. HQs below 1 indicate that non-cancer health effects are unlikely. HQs were all below 1, including for the highest exposed group. The MRL is based on the Cavelleri et. al 1994 study that determined a lowest observed adverse effect level (LOAEL) of 2.3 mg/kg/day. Uncertainty factors used in the MRL derivation included a factor of 10 for the use of a LOAEL, a factor of 10 for human variability, and a factor of 3 for database insufficiencies. The uncertainty factors ensure that the MRL is well below toxicological effect levels and is protective against noncancer effects. **Based on the available information about drinking water exposures, ATSDR concludes that this worst-case PCE exposure scenario from drinking contaminated water is not expected to result in harmful noncancer health effects**. ATSDR did not calculate cancer risk for acute/intermediate exposure because exposure duration needs to exceed one year to qualify as chronic and for PHAST to calculate cancer risk.

ATSDR also calculated acute exposure doses and hazard quotients for non-residential scenarios, which includes Paden City schools, the drinking water plant, and local public

businesses. ATSDR focused on the acute exposure scenario as the worst-case scenario because intermediate exposures would be lower due to no exposure over the weekend. ATSDR calculated non-residential exposure doses and hazard quotients using the highest concentration found at a non-residential location. This sample was taken from the water treatment plant, which would be used to evaluate an occupational exposure. This scenario assumes 5 days of exposure, versus 7 days for residential. As shown in Table 5, the highest dose calculated was for the full-time worker scenario. This dose of 0.0012 mg/kg/day is still below the MRL of 0.008 mg/kg/day.

Table 5. Non-residential (Water Treatment Plant) Perchloroethylene Drinking Water Ingestion – Acute Exposure – Max Concentration 29.4 ppb

Exposure Group	Dose – CTE (mg/kg/day)	Dose – RME (mg/kg/day)	HQ CTE	HQ RME
Full-time worker	0.00047	0.0012	0.058	0.15
Part-time worker	0.00047	NC	0.058	NC

Abbreviations: CTE = central tendency for exposure; mg/kg/day = milligrams of contaminant per kilogram of body weight per day; RME = reasonable maximum exposure; NC = not calculated

ATSDR proceeded with the analysis of other non-residential locations even though the other locations had lower concentrations than the water treatment plant. Since other exposure factor assumptions would slightly differ, the exposure doses and HQs for these scenarios were also calculated. For non-residential public scenario (i.e., local public businesses), ATSDR calculated occupational exposure doses and hazard quotients using the highest concentration found for this scenario. This sample was taken from an unspecified town test site, and ATSDR assumed the scenario at this location would qualify as a reasonable value to evaluate an occupational exposure. This scenario assumes 5 days of exposure to represent a typical work week. As shown in Table 6, the highest dose calculated was for the full-time worker scenario. This dose of 0.0011 mg/kg/day is still below the MRL of 0.008 mg/kg/day.

Table 6. Non-residential (Public Source) Perchloroethylene Drinking Water Ingestion – Acute Exposure – Max Concentration 28.2 ppb

Exposure Group	Dose – CTE (mg/kg/day)	Dose – RME (mg/kg/day)	HQ CTE	HQ RME
Full-time worker	0.00045	0.0011	0.056	0.14
Part-time worker	0.00045	NC	0.056	NC

Abbreviations: CTE = central tendency for exposure; mg/kg/day = milligrams of contaminant per kilogram of body weight per day; RME = reasonable maximum exposure; NC = not calculated

For school scenarios, ATSDR evaluated the high school and grade school separately. ATSDR calculated exposure doses and hazard quotients using the highest concentration found for

this scenario. ATSDR also focused on the acute exposure scenario as the worst-case scenario because intermediate exposures would be lower due to no exposure over the weekend. The school scenario assumes 5 days of exposure to represent a typical school week. As shown in Table 7, the highest dose calculated was for the full-time educator/worker age group. This dose of 0.0011 mg/kg/day is still below the MRL of 0.008 mg/kg/day.

Table 7. Non-residential (High School) Perchloroethylene Drinking Water Ingestion – Acute Exposure – Max Concentration 25.9 ppb

Exposure Group	Dose – CTE (mg/kg/day)	Dose – RME (mg/kg/day)	HQ CTE	HQ RME
Middle School (6th-8th grades)	0.00028	0.00085	0.035	0.11
High School (9th-12th grades)	0.00026	0.00078	0.032	0.098
Full-time educator	0.00041	0.0011	0.051	0.13
Part-time educator	0.00041	NC	0.051	NC
Full-time worker	0.00041	0.0011	0.051	0.13
Part-time worker	0.00041	NC	0.051	NC

Abbreviations: CTE = central tendency for exposure; mg/kg/day = milligrams of contaminant per kilogram of body weight per day; RME = reasonable maximum exposure; NC = not calculated

For the grade school, ATSDR also calculated exposure doses and hazard quotients using the highest concentration found for this scenario. The school scenario assumes 5 days of exposure to represent a typical school week. As shown in Table 8, the highest dose calculated was for the pre-kindergarten and kindergarten age groups. This dose of 0.0012 mg/kg/day is still below the MRL of 0.008 mg/kg/day.

Table 8. Non-residential (Grade School) Perchloroethylene Drinking Water Ingestion – Acute Exposure – Max Concentration 24.1 ppb

Exposure Group	Dose – CTE (mg/kg/day)	Dose – RME (mg/kg/day)	HQ CTE	HQ RME
Pre-Kindergarten	0.00045	0.0012	0.057	0.15
Kindergarten	0.00043	0.0012	0.053	0.15
Elementary School (1st-5th grades)	0.00034	0.00095	0.043	0.12

Exposure Group	Dose – CTE (mg/kg/day)	Dose – RME (mg/kg/day)	HQ CTE	HQ RME
Full-time educator	0.00038	0.00098	0.048	0.12
Part-time educator	0.00038	NC	0.048	NC
Full-time educator	0.00038	0.00098	0.048	0.12
Part-time worker	0.00038	NC	0.048	NC

As shown in Tables 4-8 above, ATSDR did not identify any age group or scenario where doses exceeded the MRL or HQs were greater than 1. As such, ATSDR does not expect harmful noncancer health effects to occur from drinking water contaminated with PCE during this period.

Household water use

ATSDR used the maximum concentration of PCE detected in finished residential water to run the SHOWER model for inhalation and dermal exposure. Because ATSDR did not have specific household size information, we used the SHOWER model's default assumption of a four-person household. ATSDR evaluated the SHOWER model under a worst-case scenario, with the assumption that all showers were being taken consecutively in the morning. Results were reported for the most highly exposed person, who is assumed to remain at home all day and not use a bathroom fan. Children younger than 1 year of age are not evaluated for shower scenarios because they are unlikely to shower. According to EPA's 2011 Exposure Factor Handbook, 9% of children between the ages of 1 year to less than 2 years and 14% of children ages 2 years to less than 6 years take showers (EPA 2011). For a four-person household, the SHOWER model estimates an average daily exposure concentration of 2.6 ppb PCE in air. This information can be used to determine doses for each person in the four-person household. Table 9 presents the administered dermal doses from contact with water for the target person in this scenario. Table 9 shows the average daily PCE exposure concentration for the target person in each scenario converted to a daily dose in milligrams of PCE per kilogram of body weight per day (mg/kg/day).

Table 9. RME daily administered dermal dose in mg/kg/day for the target person (person 4) in the 4-person household

Exposure Group	RME Administered Dermal Dose
Birth to < 1 year	NC
1 to < 2 years	0.00056
2 to < 6 years	0.00048

Exposure Group	RME Administered Dermal Dose
6 to < 11 years	0.00039
11 to < 16 years	0.00032
16 to < 21 years	0.00029
Adult	0.00029
Pregnant & breastfeeding women	0.00029

Abbreviations: mg/kg/day = milligrams chemical per kilograms body weight per day. NC = not calculated

Table 9 shows that the SHOWER model indicates the 1 to <2 year old group as the highest exposed group. This dermal dose of 0.00056 mg/kg/day can be combined with the residential RME ingestion dose for this group as a worst-case scenario. This combined dose of 0.0041 is below the MRL of 0.008 mg/kg/day.

Table 10. Daily inhalation exposure concentration in ppb in each scenario

Scenario Type	1-Person Household	2-Person Household	3-Person Household	4-Person Household
RME	0.73	1.4	2.0	2.6*
CTE	0.30	0.60	0.89	1.2

Abbreviations: ppb = parts chemical per billion parts air; RME = reasonable maximum exposure; CTE = central tendency exposure

* = Highest inhalation dose for target person in 4-person household

In addition to dermal doses, the SHOWER model also calculates inhalation exposure concentrations. For the target person in the RME scenario, the exposure concentration is 2.6 ppb (see Table 10). For inhalation exposure routes, the exposure concentration is equal to the exposure dose. The air exposure concentration of 2.6 ppb is below the intermediate and acute inhalation MRL of 6 ppb.

Even when assuming a highest likely exposure scenario (i.e., RME for 1 to <2 year old), ATSDR does not expect harmful noncancer health effects to occur from household showering exposure to PCE.

Addressing Community Concerns

The Paden City community has expressed concerns about their environmental exposures in relation to their health conditions and this breakthrough event. ATSDR attended EPA's November 2023 public meeting and noted public health questions that are addressed in this section. Any concerns brought up prior to November 2023 have been addressed in ATSDR's 2024 health consultation document.

Do screening levels consider preexisting conditions?

ATSDR CVs are derived using epidemiological and toxicological data and applying uncertainty or safety factors to ensure that they adequately protect the most sensitive groups exposed. Therefore, contaminants detected at concentrations less than CVs are unlikely to pose a health threat, even to residents who have preexisting health conditions.

We are concerned that any detection of PCE above 0 ppb could still affect our health.

As explained in the health effects section, the screening values and MRLs are developed using multiple safety and uncertainty levels. A PCE concentration below the MRL is not expected to cause harmful health effects.

Are there synergistic effects between PCE and other chemicals in the water, such as chlorine-based disinfectants and fluoride additives?

Adding chlorine to drinking water is a process that provides necessary protection against waterborne disease outbreaks. In the process of procuring water to distribute as drinking water, the source water can be contaminated with germs that may make people sick. These germs can also contaminate water as it travels through Paden City pipes before it gets to your home or other buildings. To prevent contamination with germs, water companies add a disinfectant—usually either chlorine or chloramine—that kills disease-causing germs, parasites, bacteria, and viruses. Different processes can be used to achieve safe levels of chlorine in drinking water. Using or drinking water with small amounts of chlorine does not cause harmful health effects (CDC 2020).

Similar to chlorination, fluoridation is the process of adding a small amount of a chemical with a known public health impact. Fluoridated water prevents cavities and tooth decay by rebuilding and strengthening the tooth's surface (CDC 2023). Further, the available evidence shows that there are no associations of water fluoridation and any unwanted health effects other than dental fluorosis (CDC 2016).

ATSDR is not aware of any synergistic effects between PCE and other drinking water additives or contaminants. However, chlorine and fluoride are important and necessary additives to prevent exposure to bacteria and viruses and prevent tooth decay and cavities.

Summary of Limitations and Uncertainties

There are multiple limitations to this health consultation. First, the specific date of the air stripper malfunction and subsequent introduction of elevated PCE in finished drinking water is not known. ATSDR estimated the exposure duration during this period. The date when the air stripper lost power and switched to bypass operations is unknown but was presumed to be weeks before the first PCE detections on July 26-28, 2023. ATSDR does not have information on the last known sample that showed PCE below the MCL. After PCE was

detected in drinking water and the bypass valve was fixed, EPA took additional samples to ensure that PCE was no longer detected above the MCL. As of September 1, 2023, all treated water samples were below the MCL for PCE with the exception of one exceedance of 8.9 ppb at a residential building on September 19, 2023 (EPA 2024). This sample was not included in ATSDR's analysis because the value of this sample was below ATSDR's health-based screening level. Another limitation that ATSDR notes is that drinking water samples were only analyzed for PCE and did not include analysis for its degradation products or associated contaminants.

Further, the extent of residential drinking water samples was limited and could not show actual exposures at each residence. Paden City Water Department and EPA took residential samples from two locations in the community and presumed that other non-residential locations could represent concentrations at different points in the distribution system. The exact concentration of PCE at each residence is unknown. ATSDR made assumptions that all residents were exposed to the highest concentration detected for the entirety of the 7-week exposure duration as a worst-case scenario. Household water use was estimated using ATSDR's default Shower and Household Water-Use Exposure (SHOWER) model assumptions, including household size and shower duration. Additionally, samples collected by Paden City Water Department could not be validated.

Conclusions

Based on the available information about drinking water exposures, ATSDR concludes that this worst-case PCE exposure scenario from drinking contaminated water is not expected to result in harmful noncancer health effects.

ATSDR did not calculate cancer risk for acute/intermediate exposure because exposure duration needs to exceed one year to qualify as chronic and for ATSDR to calculate cancer risk.

Even when assuming a highest likely exposure scenario (i.e., RME for 1 to <2 year old), ATSDR does not expect harmful noncancer health effects to occur from household showering exposure to PCE.

Recommendations

ATSDR recommends that Paden City officials continue to operate the air stripper water treatment system and monitor finished drinking water to ensure effectiveness of the treatment system. ATSDR also recommends that Paden City officials develop contingency plans to provide uncontaminated water to consumers if the treatment system malfunctions again in the future.

Thank you for allowing ATSDR this opportunity to provide EPA with this public health evaluation. We welcome opportunities to further discuss about exposures in this

community. Please feel free to contact me at qgk3@cdc.gov or by phone at 215-814-2927 if you have any questions.

Sincerely,

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Attachment A: Brief Summary of ATSDR's Public Health Assessment (PHA) Process

ATSDR follows the PHA process to find out:

- Whether people living near a hazardous waste site are being exposed to toxic substances.
- Whether that exposure is harmful.
- What must be done to stop or reduce exposure.

The PHA process is a step-by-step consistent approach during which ATSDR:

- Establishes communication mechanisms, including engaging communities at the beginning of site activities and involves them throughout the process to respond to their health concerns.
- Collects many different kinds of site information.
- Obtains, compiles, and evaluates the usability and quality of environmental and biological sampling data (and sometimes modeling data) to examine environmental contamination at a site.
- Conducts four main, sequential scientific evaluations.
    - Exposure pathways evaluation to identify past, present, and future site-specific exposure situations, and categorize them as completed, potential, or eliminated.
    - Screening analysis to compare the available sampling data to media-specific environmental screening levels (ATSDR comparison values [CVs] and non-ATSDR screening levels). This identifies potential contaminants of concern that require further evaluation for completed and potential exposure pathways.
    - Exposure Point Concentrations (EPCs) and exposure calculations for contaminants flagged as requiring further evaluation in completed and potential exposure pathways. It involves calculating EPCs, using the estimated EPCs to perform exposure calculations, and determining which site-specific scenarios requires an in-depth toxicological effects analysis.
    - In-depth toxicological effects evaluation, if necessary, based on the three previous scientific evaluations. This step looks more closely at contaminant-specific information in the context of site exposures. This evaluation can also help determine if there is a potential for non-cancer or cancer health effects.
- Summarizes findings and next steps, while acknowledging uncertainties and limitations.

- Provides recommendations to site-related entities, partner agencies, and communities to prevent and minimize harmful exposures.

The sequence of steps can differ based on site-specific factors. For instance, health assessors might define an exposure unit before or after the screening analysis.

For more detail on the PHA process, please visit *Explanation of ATSDR's PHA Process Evaluation*. Readers can also refer to *ATSDR's Public Health Assessment Guidance Manual* for all information related to the stepwise PHA process.