ATSDR
Public Health Assessment

Jard Company, Inc.
Bennington, VT

July 22, 2025

Public Comment Release
Public Comment Period Ends: Sept 4, 2025

EPA/CERCLA ID: VTD048141741

Cost Recovery: 10L2

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 or ATSDR's Cooperative Agreement Partners 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 or ATSDR's Cooperative Agreement Partners 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. In addition, ATSDR or ATSDR's Cooperative Agreement Partners will utilize this document to determine if follow-up health actions are appropriate at this time. This document has now been released for a 45-day public comment period. After the public comment period, ATSDR will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued as a final document.

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Agency for Toxic Substances and Disease Registry (ATSDR)

Office of Community Health Hazard Assessment

Atlanta, GA 30333

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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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1. Summary

1.1. Introduction

The Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia, is a federal public health agency within the U.S. Department of Health and Human Services (DHHS). 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 coming into contact with harmful toxic substances. This public health assessment presents the findings of ATSDR's health evaluation of the Jard Company, Inc. National Priority List site.

The Jard Company, Inc. (Jard) is an 11.26-acre property located at 259 Bowen Road in Bennington, Bennington County, Vermont. From 1969 to 1989, Jard operated on the property as a manufacturing facility making small capacitors, small non-fluid transformers and small motors. The property has remained vacant since Jard ceased operations in 1989. The U.S. Environmental Protection Agency (EPA) proposed the Jard site in Bennington, Vermont to the NPL in April 2014; it was listed in September 2014.

EPA found polychlorinated biphenyls (PCBs), which were used in the manufacturing process from 1969 to 1978, within the former building structure and soils on the property. EPA also found zinc in surface dust and ductwork inside the building, and bis(2-ethylhexyl) phthalate (BEHP) in building floor trenches prior to removal actions.

EPA remedial investigation (RI) activities conducted through 2024 have confirmed the primary source of impacts to groundwater at the site are contaminants located within the saturated zone in the vicinity of the former Jard building. The highest concentrations of PCBs are at the southern end of the former building where historical activities included the release of PCBs to the surface and subsurface soils. An EPA review of other constituents analyzed in early RI activities indicates that while non-PCB constituents may contribute some risk, PCBs are the main contributors to risk at Jard and ongoing EPA RI activities are focused on PCBs as characterization proceeds. Only PCBs were considered in the Hazard Ranking System (HRS) that resulted in the site being listed on the NPL. Also, the HRS analysis relied on data taken prior to the several removal actions. ATSDR evaluates all the available data in this document using a systematic public health assessment process.

A number of EPA removal actions have addressed PCB, zinc, and BEHP contamination:

- 1991: Removed chemical storage drums, pumped out dry wells, removed contaminated soils, cleaned floor drains and trenches, and secured the building.
- 1999: Removed additional PCB-contaminated surface soils.
- 2007: Demolished the Jard facility building, disposed of PCB-contaminated concrete and soil located under the building, and installed an earthen cap over remaining PCB-impacted areas.
- 2012: Decontaminated basements of two nearby residential homes using a high efficiency particulate air filter vacuum and Lestoil® cleaner that were impacted by flooding from Hurricane Irene in 2011.
- 2013: Installed polyethylene liner on basement walls, floor drains at base of walls, and a sealed sump pump at two nearby residential homes.

Zinc and BEHP were identified in the same on-site soils as PCBs and were removed during EPA removal actions to address PCBs. PCB contamination is still present in a dissolved-phase groundwater plume that begins on the Jard property and extends northwest parallel to the Walloomsac River ("Roaring Branch"), resulting in potential contamination to surrounding deep surface soils and sediments at and below the water table. The groundwater table is shallow (approximately 5 feet) and PCB contamination continues to migrate into the surrounding environment via a non-aqueous phase liquid (NAPL) groundwater plume. NAPLs are liquids that are immiscible in water and will rise or sink in water, depending on the chemical's density and geologic conditions. PCBs are denser than water and are migrating under the water table to the surrounding environment, including below Park Street homes and a ballfield, and discharging into the wetlands west of Park Street.

1.2. Conclusions

Conclusion #1	ATSDR concludes that drinking private well water containing PCBs, prior to 2010 when the town switched all residents to municipal water, is not expected to harm most people's health as PCBs levels in private well water were below levels of health concern. However, based on current data, elevated PCB exposure levels may pose a potential increased cancer risk for children under conservative exposure assumptions.
Basis for Conclusion	ATSDR found that residents of several homes on Park Street in the past (before actions were taken to mitigate their exposures) drank water contaminated with PCBs for an undetermined period (something less than 41 years from when Jard opened to when homes switched to municipal water). ATSDR determined that water ingestion exposures are not likely to result in harmful non-cancer or cancer health effects for most people under most scenarios because these past exposures were below levels shown to cause harmful effect in the scientific literature. However, assuming high-end water consumption (95th percentile of water intake), it is estimated that approximately 3 out of 10,000 additional cancer cases would occur if a child's only source of drinking water for 21 years was the maximum concentration measured in Park Street wells. This is a concern for increased cancer risk.
Conclusion #2	ATSDR cannot conclude whether breathing the indoor air in contaminated homes could have harmed people's health.
Basis for Conclusion	The data needed to make a decision is not available. Indoor air results rely on a single sampling event, and multiple samples in hot and cold weather seasons would be necessary to confirm that indoor air concentrations remain safe over time. Although more data is needed, the results from the only sampling that was conducted showed indoor air levels that are not expected to harm people's health. Additionally, indoor air sampling occurred after Park Street basements were decontaminated, but before water intrusion systems were installed

	to prevent water infiltration into homes. Confirmatory indoor air sampling following the installation of water intrusion systems is not available and is needed to make a conclusion.
Conclusion #3	ATSDR concludes that current levels of PCBs and BEHP in surface soil on the former Jard site and PCBs in neighborhood yards and ballfields are unlikely to harm people's health.
Basis for Conclusion	Exposure to PCB contamination in on-site and off-site surface soil was unlikely since PCBs were under and around the former building foundation. EPA removed the former Jard building in 2007 and the top four to six feet of PCB contaminated soil were removed to the water table and covered with a protective earthen cap. Overall, on-site PCBs are present at low levels (non-detect to <1 mg/kg) in the top 12 inches of soil in most of the study area. However, there were on-site PCB concentrations greater than 1 mg/kg detected at the southern edge of the building footprint slightly outside the earthen cap, on the top of the flood control levee, and along the western edge of the building footprint. EPA remedial investigation activities to date show off-site PCB and BEHP concentrations below soil screening values, which are well below levels of health concern.
Conclusion #4	Excavation, severe erosion, or flooding could raise PCBs and BEHP to the surface or erode subsurface soils, which could result in exposure through direct contact with contaminated soils or contaminated flood waters and potentially harm health in the future.
Basis for Conclusion	PCB contamination is present in deep soils (> 10 feet) and in the groundwater plume that flows northwest away from the site. BEHP was also detected in deep soils at the southern edge of the former building footprint slightly outside the earthen cap. On-site deep soil sampling indicates elevated PCB and BEHP contamination on the southern portion of the former Jard building at and below the water table. Off-site groundwater monitoring well data indicate elevated PCB contamination at and below the water table. PCBs are migrating under the water table to the surrounding environment, including below Park Street homes, and discharging into the wetlands northwest of Park Street. The southern portion of the Jard site is located within a Fluvial Erosion Hazard Zone, classified as an "Extreme Hazard". Severe seasonal or episodic storm events have the potential to further mobilize PCBs and impact the site, Park Street residents, and the Roaring Branch.
Next Steps	To date, only one round of air sampling was conducted at Park Street homes in February 2013. ATSDR recommends that EPA consider conducting additional indoor air sampling during hot and cold seasons for the homes along Park Street that were previously contaminated to make

sure they have not been re-contaminated due to flooding or groundwater infiltration from severe weather or seasonal storms.

ATSDR recommends collection of concurrent indoor air, outdoor air, and subslab gas (if possible) samples to evaluate the full vapor intrusion pathway. To assess if vapor intrusion is active or dormant during sampling, consider using indicators, tracers, and surrogates[1] [ATSDR 2022].

EPA conducted an Engineering Evaluation/Cost Analysis for a Non-Time-Critical Removal Action in 2023 that evaluated alternatives to address the threat of future release of PCBs. The Roaring Branch levee was identified as an inadequate engineering control. EPA is evaluating response actions to improve engineering controls to contain PCBs in deep soils and groundwater from impacting surround areas.

EPA is still in the process of a Remedial Investigation study of the site and continues to characterize the nature and extent of contamination. More information on EPA's actions can be found on the Jard Superfund website: www.epa.gov/superfund/jard

ATSDR is available to review and evaluate additional data upon request as it becomes available.

[1] Temperature Measurement Fact Sheet, Radon Measurement Fact Sheet, Pressure Measurement Fact Sheet

2. Background

2.1. Regulatory History and Site Activities

ATSDR was requested by EPA Region 1, in September of 1991, to provide advice concerning the Jard site. ATSDR indicated concern about PCBs, zinc and BEHP in soil found under the original building's foundation [ATSDR 1991]. Four EPA response actions have since been performed at this site, in 1991, 1997, 2007 and 2013, at the request of VTDEC and in response to ATSDR's original recommendations [EPA 2023].

At the time of this writing, EPA is currently in the process of a RI of the site as a listed Final NPL site. Therefore, ATSDR is basing this public health assessment on available data, which has limitations.

2.1.1. Past Clean-Up Activities

In 1991, the EPA removed chemicals stored in drums and containers on site, removed contaminated sediments, cleaned out floor drains, removed outside contaminated soils with unacceptable levels of PCBs, installed a perimeter fence, and secured the building.

After a fire on March 16, 1997, VTDEC and local officials requested the EPA to look further into conditions at the site. The EPA conducted a second removal action to remove additional contaminated soil, re-secure the building, and repair the perimeter fence.

In 2007, the VTDEC again asked the EPA to look at the site because of continued deterioration of the building and security fencing. At that time, the EPA removed the facility building and some heavily contaminated surface soil and then put a dirt cap over the area of the former building to reduce the risk of direct contact with contaminated surface soil.

In 2012, EPA decontaminated the basements of two Park Street homes closest to the Jard site using a high efficiency particulate air filter vacuum and Lestoil® cleaner.

In 2013, EPA Region 1's On-Scene Coordinator (OSC) was called to investigate PCB levels in indoor air at five private residences along Park Street. PCB levels were above detection levels in four of the homes and elevated in one home. For the two homes with the highest indoor air PCB levels (and closest to the Jard site), EPA installed polyethylene liners on basement walls, inner drain/French drain at the base of walls, and sealed sump pumps to cease PCB exposure.

2.2. Land Use and Natural Resources Information

The 11.26-acre property currently includes an earthen (sand) capped former building footprint, a large pile of excavated material, and an earthen berm that acts as a levee next to the Walloomsac River ("Roaring Branch"). From 1969 to 1989, Jard Company manufactured capacitors, non-fluid transformers, and motors used in household appliances on the property. Hazardous wastes generated during manufacturing processes included PCBs, including Aroclor 1242 from 1969 to 1971 and Aroclor 1016 from 1971 to 1978; BEHP; paints and paint solvents; zinc oxide; methylene chloride; trichloroethylene (TCE); 1,1,1-trichloroethane (1, 1, 1-TCA); varnish and varnish solids; rejected capacitors; and BEHP wastewater. According to a 1976 Agency of Environmental Conservation report, approximately 550,000 pounds of PCBs were used annually between 1971 and 1974. Two dry wells located on the property potentially received PCB and BEHP-contaminated wastewater. The property is listed under Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)

Number (No.) VTD048141741, as the Jard Company. According to reports, no industrial operations have taken place at the property since 1989 and there is no current owner.

The layout of the Jard property is relatively flat with a slight mounded earthen cover over the former building footprint. A large pile (approximately 35,000 cubic yards) is located on the eastern portion of the property and communications with the VTDEC representative indicates that the material was excavated from the southern portion of the property during a floodplain restoration project. In addition, a large earthen berm is located along the southern property boundary following the Roaring Branch river.

The site is currently abandoned, and there are no workers or residents on the property. The earthen cover which is planted with grass is maintained (mowed) during the summer months by State personnel. The nearest residence is located north of the Jard property, approximately 350 feet from the former building footprint. There are no schools or day-care facilities located within 200 feet of source areas located on the Jard property. One pre-school facility, Learning Tree II, is located approximately 2,000 feet south, across the Roaring Branch. The nearest school, Mount Anthony Senior High School, is located approximately 500 feet south, across the Roaring Branch River. Vehicular access to the Jard property is restricted by a concrete Jersey barrier installed across the northern property boundary and a large pile on the eastern portion of the property. Pedestrian access to portions of the property is partially restricted by natural barriers and concrete blockades; however, pedestrian access to the property is generally unrestricted.

The nearest public drinking water supply wells are located within 0.5 and 1 mile up-gradient of the property and are a groundwater source for the Bennington Water Department [Weston 2013]. To date, PCBs have not been detected in Benington's public water supply [Bennington, VT 2025].

3. Site Visit and Community Description

3.1. Site Visit

ATSDR conducted a site visit on November 15, 2017 to walk the former site and see the potentially impacted neighborhood. The site has been capped with a grass covered field after all structures were removed (see Figure 1).

Figure 1. Current State of Former Jard Site (2017)

At the far rear of the site is a large berm that prevents surface runoff from entering the Walloomsac River ("Roaring Branch"). The earthen berm doubles as a nature trail and is used by school children walking to and from the local high school (see Figure 2).

Figure 2. Earthen Berm at Rear (South) of Jard Site (2017)

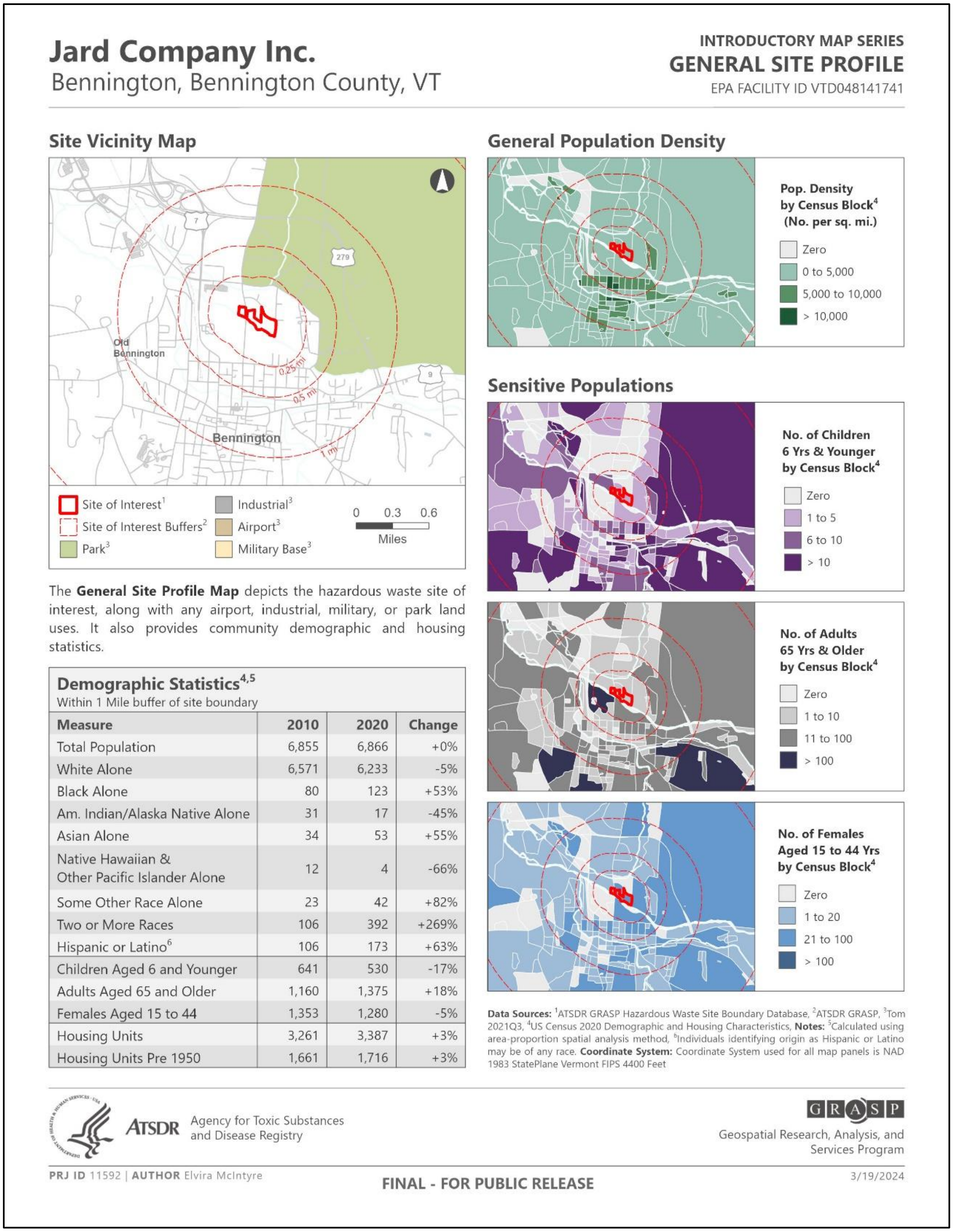
Figure 3 below looks North, down Park Street in Bennington, where some households had contaminated private wells and detectable PCBs in indoor air. All homes in Bennington have been hooked up to the municipal water system since 2010.

Figure 3. Looking North Down Park Street in Bennington, Vermont (2017)

3.2. Community Demographics

The population within one mile of the former facility was 6,866 in 2020, according to the US Census Bureau (see Figure 4). Women of childbearing age comprised 19 percent of the total population. Young children under six years of age were eight percent and seniors made up 20 percent of the population within a one-mile radius.

Figure 4. Population Breakdown Within 1-mile of Jard Site



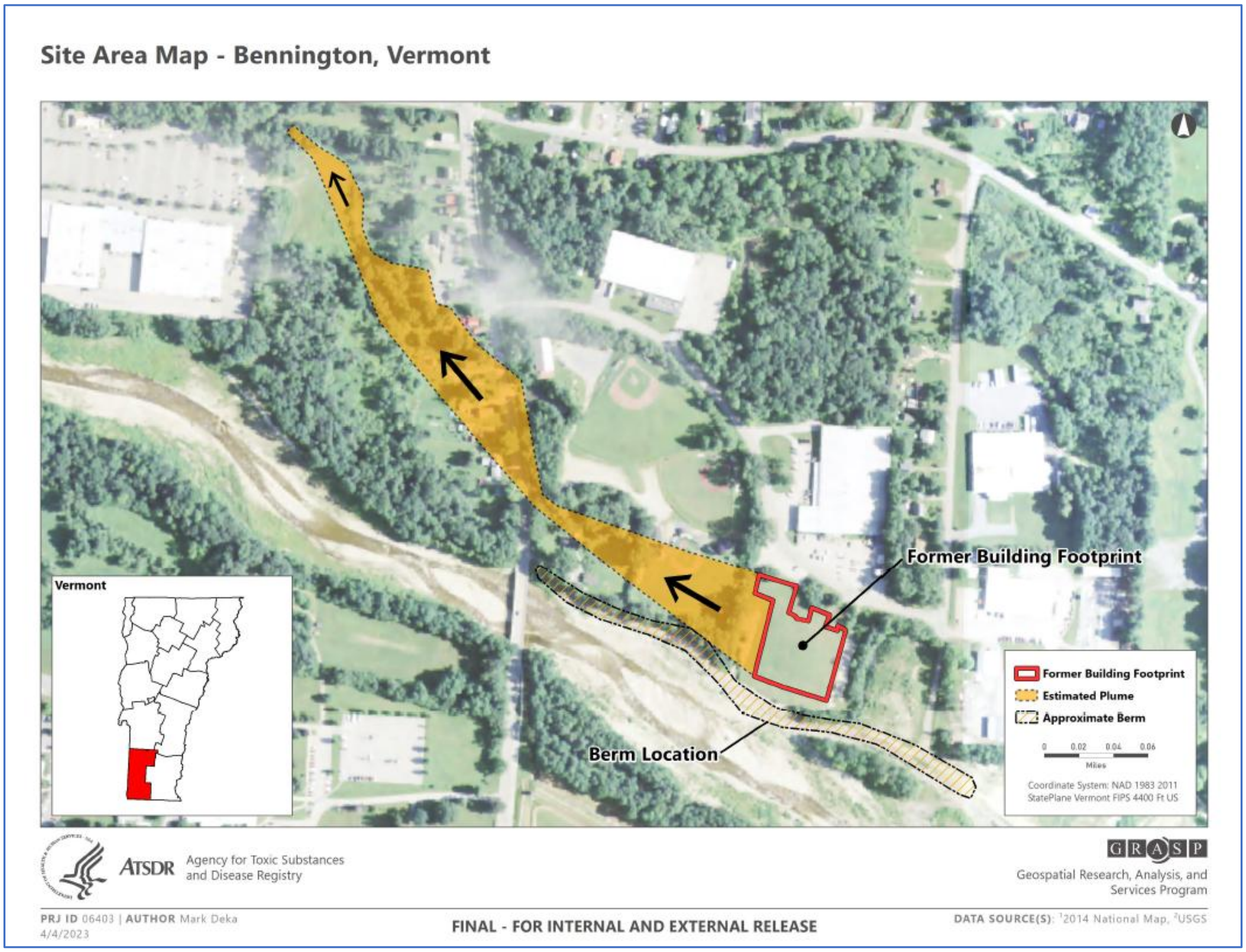
Demographic Statistics[4,5]
Within 1 Mile buffer of site boundary

Measure	2010	2020	Change
Total Population	6,855	6,866	+0%
White Alone	6,571	6,233	-5%
Black Alone	80	123	+53%
Am. Indian/Alaska Native Alone	31	17	-45%
Asian Alone	34	53	+55%
Native Hawaiian & Other Pacific Islander Alone	12	4	-66%
Some Other Race Alone	23	42	+82%
Two or More Races	106	392	+269%
Hispanic or Latino[6]	106	173	+63%
Children Aged 6 and Younger	641	530	-17%
Adults Aged 65 and Older	1,160	1,375	+18%
Females Aged 15 to 44	1,353	1,280	-5%
Housing Units	3,261	3,387	+3%
Housing Units Pre 1950	1,661	1,716	+3%

3.3. Conceptual Site Model

Figure 5 below visually displays a conceptual site model of the approximate PCB plume from the Jard site. The approximate plume is based on EPA groundwater monitoring well data and this conceptual site model is used for approximate visualization purposes. PCB contamination at and below the water table extends from the southern portion of the former Jard building and migrates northwest under Park Street homes and discharges into the wetlands west of Park Street homes. EPA is in the process of characterizing and monitoring the plume as part of their remedial investigation.

Figure 5. Jard Site, Conceptual Site Model



4. Sampling Data

4.1. Groundwater Monitoring

In November 2017, EPA groundwater monitoring wells identified PCBs exceeding ATSDR vapor intrusion comparison values (VI CVs) surrounding Park Street, between the Roaring Branch and Bowen Road (Figure 6 and Table 1). The VI CV exceedances were on both sides of Park Street homes, indicating PCB contamination extends northwest from the Jard site to beneath Park Street homes. These exceedances were approximately 1.3 to 3.4 times greater than the VI CVs. The VI CVs assume that contaminated groundwater is at least five feet deep and may underestimate the risk for shallower groundwater.

Figure 6. Groundwater Monitoring Locations [EPA 2017]

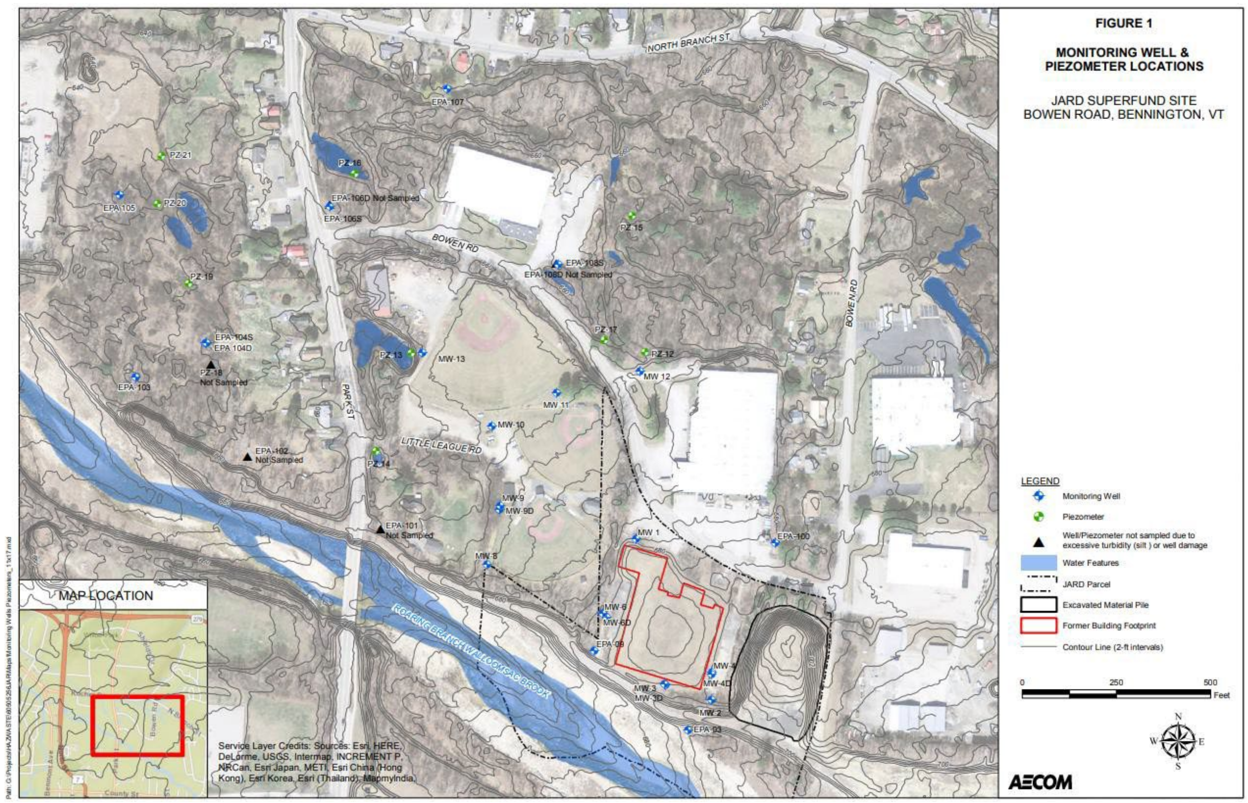


Table 1. Polychlorinated Biphenyl (PCB) Groundwater Plume Characterization

Sample Location	Aroclor-1016 Concentration (µg/L)	Total PCB Concentration (µg/L)	ATSDR Vapor Intrusion Comparison Value (µg/L)
MW-8	0.5 J	1.6 J a	0.59
MW-9	2.0 J a	No value	0.59
MW-10	0.2 J	0.39 J	0.59
MW-11	0.16 J	No value	0.59
MW-13	0.51 J	No value	0.59
PZ-13*	0.46 J and 0.38 J	No value	0.59
PZ-14	1.4 J a	No value	0.59
PZ-19	0.76 J a	No value	0.59
EPA-103	1.0 U	No value	0.59
EPA-104S	0.18 J	No value	0.59
EPA-104D	1.4 a	No value	0.59

Source: [EPA 2017]

Abbreviations: µg/L = micrograms per liter of water; PCB = Polychlorinated biphenyls; ATSDR = Agency for Toxic Substances and Disease Registry; MW: monitoring well; J = analyte was detected but the reported concentration is an estimate due to bias in the sample analysis ;PZ = piezometer; EPA = Environmental Protection Agency; U = analyte was not detected above the reported sample-specific quantification limit; * = duplicate samples were collected

a = Concentration above ATSDR vapor intrusion value.

4.2. Residential Air Sampling

In September 2012, EPA cleaned and decontaminated the basements of the two homes closest to the Jard site that had a history of flooding.

On February 20-21, 2013, EPA retained The Johnson Company to sample indoor air at five homes along Park Street in Bennington, Vermont for PCBs. Air sampling results are shown in Table 2 below.

Following air sampling, from March to May 2013, EPA installed polyethylene liner on basement walls, floor drains at base of walls, and a sealed sump pump at two homes closest to the Jard site and with the highest PCB air sampling results.

Samples were collected by using a personal sampling pump (SKC 224-PCXR8) to draw air through a polyurethane foam (PUF) cartridge provided by the analytical laboratory. Before connecting the sample cartridge, the pump was connected to a flow calibrator (Bios Defender 510M) and a spare PUF cartridge used for calibration and adjusted to a nominal flow rate of 5.0 liters per minute. The calibrator was used to check the flow rate after sampling, and the average flow rate was used for calculating the sample volume.

Sample collection started on February 20, 2013. Except for Home #1, two samples were collected from each residence. Samples were submitted for analysis of PCBs following EPA Method 1668A. PCBs were analyzed as congeners and summed by the laboratory to provide a concentration of PCB homologs and Total PCBs.

Table 2 below presents Total PCB air sampling results from that sampling event.

Table 2. Park Street PCB Air Sampling Results

Sample Date	Sample Location	Total PCB Concentration (ng/m^3)	ATSDR CREG (ng/m^3)
2/20/13 – 2/21/13	Home #1 Living Room	34.5 a	10
2/20/13 – 2/21/13	Home #2 Basement	34.7 a	10
2/20/13 – 2/21/13	Home #2 Dining Room	131.0 a	10
2/20/13 – 2/21/13	Home #3 Basement	4.4	10
2/20/13 – 2/21/13	Home #3 Living Room	4.3	10
2/20/13 – 2/21/13	Home #4 Basement	18.2 a	10
2/20/13 – 2/21/13	Home #4 Living Room	4.9	10
2/20/13 – 2/21/13	Home #5 Basement	10.4 a	10
2/20/13 – 2/21/13	Home #5 Kitchen	14.9 a	10
2/20/13 – 2/21/13	Home #5 Outdoor	0.2	10

Source: [The Johnson Company, Park Street Residential Air Sampling, February 2013]
Abbreviations: PCB = Polychlorinated biphenyls; ng/m^3 = nanograms per cubic meter of air; ATSDR = Agency for Toxic Substances and Disease Registry; CREG = cancer risk evaluation guide
a = Concentration above ATSDR health-based comparison value and selected for further evaluation.

Four out of the five homes measured higher than ATSDR's cancer risk evaluation guide (CREG) value of 10 ng/m^3 (nanograms per cubic meter of air) for total PCBs. CREGs are used by ATSDR to estimate contaminant concentrations that are unlikely to result in no more than one excess cancer in a million persons exposed during their lifetime (78 years). The elevated reading for Home #2 in the dining room was significantly higher than in the basement. This implies that the reading was either not accurate or there were other sources of PCBs in the home.

PCBs are often present in indoor air of typical U.S. homes in areas without environmental contamination. Two literature studies of 26 homes in Massachusetts measured indoor air total PCB concentrations ranging from 5 to 51 ng/m^3 [Vorhees 1997; Casey 2022]. An older study measured indoor air total PCB concentrations ranging from 39 to 580 ng/m^3 [MacLeod 1981]. The greater PCB concentrations in the 1981 study are consistent with the 1977 phase out of PCB production in the U.S. PCB production was phased out worldwide in 1993 [ATSDR 2000].

Indoor air results rely on a single sampling event and multiple samples in multiple seasons (hot and cold weather) would be necessary to accurately characterize health risk; therefore, ATSDR cannot use the February 2013 sampling event alone to determine health risk.

4.3. Residential Drinking Water Sampling

Home #1 and Home #2 were identified in August-September 2010 to have PCBs (Aroclor 1016) in their private drinking water wells at concentrations of 1.3 µg/L (micrograms per liter) and 1.8 µg/L, respectively (see Table 3 below). Both concentrations exceeded ATSDR's reference dose media evaluation guide (RMEG) of 0.49 µg/L and EPA's maximum contaminant level (MCL) of 0.5 µg/L. ATSDR's RMEG is the concentration in a specific medium (e.g., water) at which daily human exposure for a chronic duration is unlikely to result in non-cancer health effects. EPA's MCL is a regulatory limit for water systems that supports 20 or more households. No other PCB Aroclor types were detected above the laboratory reporting limit. Because of this finding, all homes on Park Street with private wells were connected to public water in October 2010.

Table 3. Park Street Private Well Water Maximum Sample Result

Contaminant	Sample Location	Sample Date	Maximum Site Concentration (ppb)	Lowest HBCV (ppb)
Aroclor 1016	Home #2 Private Well	9/20/2010	1.8	0.49 (ATSDR RMEG)

Source: [The Johnson Company, Park Street Drinking Water Sampling, September 2010]
Abbreviations: ppb = parts per billion; HBCV = health-based comparison value; ATSDR = Agency for Toxic Substances and Disease Registry; RMEG = reference dose media evaluation guide

4.4. Soil Sampling

Jard on-site surface soils were known to be contaminated primarily with PCBs attributed to past manufacturing operations prior to the several EPA removal actions. Most of this contamination was located under and around the concrete slab foundation of the former Jard building. The building was removed and the most highly contaminated part of the site was excavated down about 6 feet below grade and capped with clean fill in 2007. BEHP was generally co-located in subsurface soil where the highest concentrations of PCB were detected and removed during PCB removal actions. Zinc was identified as a potential concern during the 1991 initial site characterization, but soil sampling done since 2017 has shown on-site zinc concentrations are similar to concentrations within a nearby area not impacted by the site.

2013 Soil Sampling: Soil samples taken during the 2013 EPA field sampling event consisted of surface soil samples (top 12 inches) and core borings of the top 12 feet of soil. ATSDR considers surface soil to be in the top 3 inches, while EPA classifies the top 12 inches as surface soil. Surface soils were sampled for PCBs both on and off-site, including the adjacent ballfields and neighborhood yards. EPA utilized their mobile analytical laboratory to field screen small aliquots of the soil samples and a subset of soil samples were sent to an accredited contract laboratory for further analysis. There were no detections of PCBs in the top 12 inches of soil and the highest detection limit for PCBs was 0.051 mg/kg (milligrams per kilogram), a factor of four below ATSDR's soil comparison value of 0.19 mg/kg. Surface soil from yards and the ballfields were below EPA's regional screening level of 0.23 mg/kg and not analyzed further. There were no surface samples as defined by ATSDR (i.e., in the top three inches of soil).

Core borings (depth up to 12 feet) were sampled around the former building footprint. The highest levels of PCBs were measured in core borings at the southern perimeter of the old building footprint next to Monitoring Well #3. Consistent with past observations, oily soil was observed, and soil sampling results revealed elevated PCB concentrations ranging from 1,400 mg/kg (8-10 feet) to 11,000 mg/kg (4-6 feet), indicating PCB contamination in deep soils, at and below the water table. Comparison of surface soil and core boring sampling provides further evidence that PCB contamination has impacted deep soils at and below the water table, which could adversely impact the surrounding environment during severe weather events or site excavation.

2018 – 2023 Soil Sampling: Surface soil samples from the 2018 - 2023 EPA RI showed similar results to those from the 2013 soil sampling event. Overall, PCBs are present at low levels (non-detect to <1 mg/kg) in the top 12 inches of soil in most of the study area. The highest concentrations of PCBs in surface soils were collected from soil not covered by a cap or pavement on the former building footprint. PCB concentrations from this area ranged from non-detect to 2 mg/kg. BEHP was also detected in most of the samples collected from the top 12 inches of soil at relatively low concentrations (0.046 mg/kg to 0.95 mg/kg). Impacts to surface soil beyond the Jard property limits are minor. However, there was one sample from the top-12-inches of soil at the flood control levee with a PCB concentration of 71 mg/kg. Additional soil sampling performed in 2023 around this detection showed that the extent of this “hot spot” is limited to the southern edge of the Jard property.

Soil samples collected from borings located on the Jard property show similar results to 2013 sampling, with the most elevated levels of PCBs (>1,000 mg/kg) at the southern edge of the former building footprint and at a depth of at least 4 feet below ground surface. BEHP was also found at high concentrations, co-located with the PCBs. BEHP concentrations over 1,000 mg/kg were detected in deep soil samples from borings near Monitoring Well #3, with concentrations ranging from 1,800 mg/kg to 12,000 mg/kg at depths from 8 to 15 feet below ground surface. Some RI soil borings extended to 40 to 50 feet below grade, into a unit of silty/clayey soil of lacustrine origin that appears to have confined the downward migration of contamination.

5. Evaluation of Exposure Pathways

ATSDR’s public health assessment evaluations focus on exposure to, or contact with, environmental contaminants. Contaminants released into the environment have the potential to cause harmful health effects. Nevertheless, a release does not always result in exposure. People can only be exposed to a contaminant if they contact that contaminant—if they breathe, eat, drink, or come into skin contact with a substance containing the contaminant. If no one is exposed to a contaminant, no health effects could occur. Often the public does not have access to the source area of contamination or areas where contaminants are moving through the environment. This lack of access to these areas becomes important in determining whether people could be exposed to the contaminants.

An exposure pathway has five elements: (1) a source of contamination, (2) an environmental media, (3) a point of exposure, (4) a route of human exposure, and (5) a receptor population. The source is the place where the chemical contaminant was released. The environmental media (such as groundwater, soil, surface water, or air) transport the contaminants. The point of exposure is the place where people come into contact with the contaminated media. The route of exposure (for example, ingestion, inhalation, or dermal contact) is the way the contaminant enters the body. The people exposed are the receptor population.

The route of a contaminant's movement in the environment is the pathway. ATSDR identifies and evaluates exposure pathways by considering how people might come in contact with a contaminant. An exposure pathway could involve air, surface water, groundwater, soil, dust, or even plants and animals. Exposure can occur by breathing, eating, drinking, or by skin contact with the chemical contaminant. ATSDR identifies an exposure pathway as *completed*, *potentially completed*, or *eliminated* from further evaluation.

- **Completed exposure** pathways exist for past, current, or future time periods if exposures to contaminant sources can be linked to a receptor population. All five elements of the exposure pathway must be present. In other words, people contact or are likely to contact site-related contamination at a particular exposure point. As stated above, a release of a chemical into the environment does not always result in human exposure. For an exposure to occur, a completed exposure pathway—contact with the contaminant—must exist.
- **Potential exposure** pathways indicate that exposure to a contaminant might have occurred in the past, might be occurring currently, or might occur in the future. It exists when one or more of the elements are missing but available information indicates possible human exposure. A potential exposure pathway is one that ATSDR cannot rule out, even though not all five elements are identifiable.
- **Eliminated exposure** pathways exist when one or more of the elements are missing. Exposure pathways can be ruled out if the site characteristics make past, current, and future human exposures extremely unlikely. If people are not exposed to contaminated areas, the pathway is eliminated from further evaluation. Also, an exposure pathway is eliminated if site monitoring reveals that media in accessible areas are not contaminated.

5.1. How ATSDR Determines Which Exposure Situations to Evaluate

ATSDR scientists evaluate site conditions to determine if people could have been, are being, or could be exposed in the future (i.e., exposed in a past scenario, a current scenario, or a future scenario) to site-related contaminants. When evaluating exposure pathways, ATSDR identifies whether exposure to contaminated media (soil, sediment, water, air, or biota) has occurred, is occurring, or will occur through ingestion (eating or drinking), dermal (skin) contact, or inhalation (breathing).

If exposure was, is, or could be possible, ATSDR scientists consider whether contamination is present at levels that might adversely affect public health. ATSDR scientists select contaminants for further evaluation by comparing them to health-based comparison values. These are developed by ATSDR from available scientific literature related to exposure and adverse health effects. Comparison values are derived for each of the different media and reflect an estimated contaminant concentration that is not likely to cause non-cancer adverse health effects for a given chemical, assuming a certain exposure rate (e.g., an amount of water or soil consumed or an amount of air breathed) and body weight.

Comparison values are not thresholds for adverse health effects. ATSDR comparison values establish contaminant concentrations many times lower than known levels at which "no" or the "lowest" effect was observed in experimental animal or human studies. If contaminant concentrations are above comparison values, ATSDR further analyzes exposure variables (for example, duration and frequency of exposure), the toxicology of the contaminant, other epidemiology studies, and the scientific weight of evidence for adverse health effects.

Some of the comparison values used by ATSDR scientists include ATSDR's environmental media evaluation guides (EMEGs), RMEGs, and CREGs. ATSDR may also consider EPA's drinking water MCLs. EMEGs, RMEGs, and CREGs are non-enforceable, comparison values developed by ATSDR for screening environmental contamination data to determine if further evaluation is necessary. MCLs are enforceable EPA drinking water regulations and are to be set as close to the maximum contaminant level goals (MCLGs) (Health Goals) as is feasible and are based upon treatment technologies, costs (affordability) and other feasibility factors, such as availability of analytical methods, treatment technology and costs for achieving various levels of removal.

You can find out more about the ATSDR evaluation process by reading ATSDR's Public Health Assessment Guidance Manual at https://www.atsdr.cdc.gov/pha-guidance/index.html.

5.2. How ATSDR Determines if People's Health is Harmed

Exposure does not always result in harmful health effects. The type and severity of health effects (if any) a person can experience because of contact with a contaminant depend on the exposure concentration (how much), the frequency (how often) and/or duration of exposure (how long), the route or pathway of exposure (breathing, eating, drinking, or skin contact), and the exposure to more than one contaminant. Once exposure occurs, a person's characteristics such as age, sex, nutritional status, genetics, lifestyle, and health status influence how the individual absorbs, distributes, metabolizes, and excretes the contaminant. Together, these factors and characteristics determine if adverse health effects may occur.

To account for uncertainty and to be protective of public health, ATSDR scientists typically use worst-case exposure level estimates as the basis for determining whether adverse health effects are possible. These estimates are usually much higher than the levels that people are really exposed to. If the exposure levels indicate that adverse health effects may be possible, ATSDR performs more detailed reviews of exposure and reviews the toxicological and epidemiologic literature for scientific information about the health effects from exposure to hazardous substances.

5.3. Exposure Pathway Analysis

ATSDR obtained information to support the exposure pathway analysis for the Jard Superfund Site from multiple site investigation reports; state, local, and facility documents; and information from communication with local and state officials. The analysis also draws from limited environmental data for groundwater, soil, surface water and sediment that looks only at PCBs. Tables 4 through 6 present evaluation of exposure pathways from site contamination. Table 4 looks at completed exposure pathways. Table 5 looks at potential pathways. Table 6 looks at pathways that were eliminated or not possible. Refer to pages 18 for definitions of *completed*, *potentially completed*, and *eliminated* pathways.

Table 4. Completed Exposure Pathways for the Jard Site

Pathway Name	Contaminant	Environmental Media & Transport	Exposure Point(s)	Route of Exposure	Exposed Population	Time of Exposure	Notes
Past Household Use of Private Well Water	PCBs	Movement of PCBs from source to groundwater	Homes with private drinking water wells	• Ingestion • Inhalation • Dermal Contact	Residents who formerly used private well water	• Past	PCBs were detected in private wells along Park Street in 2010. The wells were decommissioned and all homes in Bennington were connected to the town water.
Past Vapor Intrusion for Remediated Park Street Homes [Homes #1 and #2] (Indoor Air)	PCBs	Movement of PCBs from groundwater through soil and into air inside homes	Indoor air in homes located above contaminated ground water	• Inhalation	Residents on Park Street with groundwater mitigation controls	• Past	PCBs were detected in groundwater and indoor air of several residences along Park Street. Two homes with elevated PCBs (and closest to the Jard site) were decontaminated and had a polyethylene barrier, floor drain and sealed sump pump installed in the basement to prevent future water intrusion.

Table 5. Potential Exposure Pathways for the Jard Site

Pathway Name	Contaminant	Environmental Media & Transport	Exposure Point(s)	Route of Exposure	Exposed Population	Time of Exposure	Notes
Vapor Intrusion for Homes on Park Street Without Groundwater Mitigation Controls	PCBs	Movement of PCBs from groundwater through soil and into air inside homes	Indoor air in homes located above contaminated ground water	• Inhalation	Residents on Park Street without groundwater mitigation controls	• Past • Current • Future	PCB sampling data from monitoring wells around the Jard site and near Park Street indicate a PCB plume as NAPL in the groundwater. Homes that do not have groundwater mitigation controls may have exposure to PCBs during severe weather events.
Disturbance of On-Site Deep Soil	PCBs, BEHP	Disturbance of deep soils for future use	Redeveloped site	• Ingestion • Dermal Contact	Trespassers and Community Members that use Redeveloped Site	• Future	PCBs and BEHP were detected in deep soil core borings around the southern perimeter of the site and could be disturbed by future use of the site or erosion during high-energy storms.
Disturbance of Off-Site Deep Soil	PCBs	Movement of contaminants from on-site soil	Park Street homes and adjacent ballfield	• Ingestion • Dermal Contact	Residents and Community	• Past • Current • Future	Surface soils in the adjacent ballfield were below EPA screening levels; however, off-site groundwater samples indicate a PCB plume under the ballfield and Park Street homes. Off-site deep soils may be contaminated with PCBs and could be disturbed by future use (i.e., redevelopment of ballfields) or rise to the surface if the water table were to rise.

Table 6. Eliminated Exposure Pathways for the Jard Site

Pathway Name	Contaminant	Environmental Media & Transport	Exposure Point(s)	Route of Exposure	Exposed Population	Time of Exposure	Notes
Surface Water from Walloomsac River ("Roaring Branch") into Unnamed Stream	PCBs	Movement of PCBs to surface water	Unnamed stream behind ball fields	• Ingestion • Inhalation • Dermal Contact	Persons wading in stream	• Past • Present • Future	**NO EXPOSURE**: The unnamed stream is too small for swimming/wading, and the flow is negligible
Private Well Water	PCBs	Movement of groundwater	Homes with private drinking water wells	• Ingestion • Inhalation • Dermal Contact	Residents	• Present • Future	**NO EXPOSURE**: All homes in Bennington were placed on municipal water, at the request of VTDEC in 2010
Vapor Intrusion for Remediated Park Street Homes [Homes #1 and #2] (Indoor Air)	PCBs	Movement of contaminant from groundwater through soil and into air inside buildings	Indoor air in homes that were tested, located above areas of contaminated groundwater	• Inhalation	Residents	• Present	**NO EXPOSURE**: The homes with detectible PCBs were remediated by EPA in 2013, at the request of VTDEC. Vapor barrier and sump pumps were installed in the basements of affected homes.
Off-Site Surface Soil	PCBs	Movement of contaminants from on-site surface soil	None	• None	None	• None	**No Exposure:** PCBs were not detected in off-site surface soils above ATSDR Comparison Values

5.4. Past Exposure

ATSDR concludes that drinking PCB contaminated groundwater (prior to 2010 when the town switched all residents to municipal water) is not expected to have harmed most people's health. ATSDR concludes that children that drank the highest amount of private well water containing PCBs are at an increased cancer risk when incorporating conservative exposure assumptions.

ATSDR considers drinking water exposure for most people as ***no health hazard*** because PCB levels in private drinking water (via groundwater) were below levels of health concern.

Assuming high-end water consumption (95th percentile of water consumption) and conservative exposure assumptions for children, ATSDR considers drinking water exposure for the highest exposed children a ***public health hazard.***

ATSDR cannot conclude whether breathing the indoor air in contaminated homes could harm people's health. Indoor air results rely on a single sampling event and multiple samples in hot and cold weather seasons would be necessary to confirm that indoor air concentrations remain safe over time.

ATSDR considers this as an ***uncertain health hazard*** because the information we need to make a decision is not available.

5.5. Present Exposure

Although on and off-site surface soil samples indicate no PCB contamination in surface soils (except for one sample on the southern edge of the former building footprint), on-site deep soil and groundwater monitoring well data, and off-site groundwater monitoring well data confirm that PCBs are at and below the water table. Currently, Park Street residents are not being exposed to PCBs in groundwater or surface soils since all homes are connected to public water and PCBs were not detected in off-site surface soils.

ATSDR concludes that exposure to PCBs in Park Street homes is not expected to harm people's health as PCB levels in soil are below levels of health concern and all homes are connected to public water.

ATSDR considers this as ***no health hazard*** because exposure to PCBs might have occurred in the past or still be occurring, but not at levels likely to cause harmful health effects.

5.6. Future Exposure

Surface soil sampling indicates PCBs at levels below EPA regional screening levels. However, on-site deep soil and groundwater monitoring results near Park Street homes indicates PCB contamination at and below the water table. Currently, Park Street residents are not being exposed to PCBs in surface soils or drinking water; however, future exposure is possible if PCBs were to migrate to shallower soils during site excavation or severe weather events (e.g., 2011 Hurricane Irene).

The southern portion of the Jard site is located within a Fluvial Erosion Hazard Zone mapped by the Vermont Agency of Natural Resources in 2012 and labeled as an "Extreme Hazard", the highest rating. Severe seasonal or episodic storm events have the potential to further mobilize PCBs and rapidly affect the site, Park Street residents, and the Roaring Branch. The most recent severe weather event occurred on July 10-11th, 2023 when Vermont experienced catastrophic flash flooding due to prolonged heavy rainfall. Although rainfall amounts of 3 to 9 inches were observed across the state within those 48 hours, the Jard site was not compromised.

If site conditions change and new sampling data indicate an issue, ATSDR will reevaluate the sampling data, upon request.

6. Dose Calculations

6.1. Inhalation Cancer Risk Evaluation

Using the maximum PCB level of 131 ng/m^3 from Home #2 for the cancer inhalation risk evaluation, ATSDR calculated the Central Tendency Exposure (CTE) and Reasonable Maximum Exposure (RME) cancer risk for children and adults. The CTE refers to individuals who have average or typical exposure to a contaminant. The RME refers to individuals who have higher than average exposure to a contaminant (95th percentile of exposures); this scenario is intended to assess exposures that are higher than average, but still within a realistic exposure range.

ATSDR assumed a site-specific RME maximum exposure duration for adults of 44 years, with possible inhalation exposure occurring 24 hours per day for 7 days per week. ATSDR used a 44-year exposure duration since it was 44 years from when Jard opened (1969) to when homes were remediated (2013). Table 7 below presents the cancer risk for children and adults from inhalation exposure.

Table 7. PCB Inhalation Cancer Risk Evaluation

Exposure Group	Adjusted EPC (µg/m^3)	CTE Exposure Duration (years)	RME Exposure Duration (years)	CTE Cancer Risk	RME Cancer Risk
Total Child	0.131	12	21	2.0E-06	3.5E-06
Adult	0.131	12	44	2.0E-06	7.3E-06

Source: [The Johnson Company, Park Street Residential Air Sampling, February 2013]
Abbreviations: EPC = exposure point concentration converted to µg/m^3; µg/m^3 = micrograms per cubic meter of air; CTE = central tendency exposure (average); RME = reasonable maximum exposure (high-end);
The calculations in this table were generated using ATSDR's PHAST 2.4.2.0 on August 20, 2024

ATSDR calculated the total increased CTE cancer risk for children and adults of 2 out of 1,000,000 (1 million). This means assuming inhalation exposure of 131 ng/m^3 for 12 years (child and adult), it is estimated that an additional 2 out of 1 million may develop cancer.

ATSDR calculated the total increased RME cancer risk for children and adults of 3.5 and 7.3 out of 1,000,000 (1 million), respectively. This means assuming inhalation exposure of 131 ng/m^3 for 21 years (child), it is estimated that an additional 3.5 out of 1 million may develop cancer. Assuming inhalation exposure at 131 ng/m^3 for 44 years (adult), it is estimated that an additional 7.3 out of 1 million may develop cancer.

The maximum PCB concentration of 131 ng/m^3 that was used to calculate exposure doses is approximately 3.7 time higher than the next highest PCB concentration measured. Given the conservative nature of the cancer risk evaluation for PCBs, this cancer risk is not a concern. Note that this is a theoretical estimate of cancer risk that ATSDR uses as a tool for deciding whether public health actions are needed to protect health—it is not an actual estimate of cancer cases in a community.

6.2. Ingestion Cancer Risk Evaluation

Using the maximum PCB (Aroclor 1016) concentration of 1.8 µg/L from Home #2 for the ingestion cancer risk evaluation, ATSDR calculated the CTE and RME cancer risk for children and adults. ATSDR assumed a site-specific maximum RME exposure duration of 41 years since it was 41 years from when Jard opened

(1969) to when homes were connected to municipal water (2010). Table 8 below presents the cancer risk for children and adults from ingestion exposure of Aroclor 1016.

Table 8. Ingestion Cancer Risk Evaluation

Exposure Group	EPC (µg/L)	Cancer Slope Factor* (mg/kg/day)	CTE Exposure Duration (years)	RME Exposure Duration (years)	CTE Cancer Risk	RME Cancer Risk
Total Child	1.8	2	12	21	8.4E-05	3.4E-04
Adult	1.8	2	12	41	9.1E-06	7.6E-05

Abbreviations: EPC = exposure point concentrations; µg/L = micrograms per liter of water; mg/kg/day = milligrams per kilogram per day; CTE = central tendency exposure (average); RME = reasonable maximum exposure (high-end)
*Upper-bound Cancer Slope Factor of 2.0 was used per EPA's Integrated Risk Information System for oral carcinogenicity
The calculations in this table were generated using ATSDR's PHAST 2.4.2.0 on August 20,2024

ATSDR calculated the total increased CTE cancer risk for children and adults of 8.4 out of 100,000 and 9.1 out of 1,000,000 (1 million). This means assuming ingestion exposure of 1.8 µg/L for 12 years (child and adult), it is estimated that an additional 8.4 out of 100,00 children and 9.1 out of 1 million adults may develop cancer.

ATSDR calculated the total increased RME cancer risk for children and adults of 3.4 and 7.6 out of 10,000 and 100,000, respectively. This means assuming ingestion exposure of 1.8 µg/L for 21 years (child), it is estimated that an additional 3.4 out of 10,000 may develop cancer. Assuming ingestion exposure of 1.8 µg/L for 41 years (adult), it is estimated that an additional 7.6 out of 100,000 may develop cancer.

Given the conservative nature of the cancer risk evaluation for PCBs, the cancer risk for CTE children and adults, and RME for adults is not a concern. The cancer risk for RME (95th percentile for water intake) children is a concern. Note that this is a theoretical estimate of cancer risk that ATSDR uses as a tool for deciding whether public health actions are needed to protect health—it is not an actual estimate of cancer cases in a community.

6.3. Combined Inhalation and Ingestion Cancer Evaluation

To calculate an estimated combined cancer risk from inhalation and ingestion of PCBs, ATSDR added the inhalation and ingestion cancer risks to get a combined CTE and RME cancer risk for children and adult. Table 9 below presents the combined CTE and RME inhalation and ingestion cancer risk for children and adults.

Table 9. Combined Inhalation and Ingestion Cancer Risk

Exposure Group	Inhalation CTE Cancer Risk	Inhalation RME Cancer Risk	Ingestion CTE Cancer Risk	Ingestion RME Cancer Risk	Combined CTE Cancer Risk	Combined RME Cancer Risk
Total Child	2.0E-06	3.5E-06	8.4E-05	3.4E-04	8.6E-05	3.4E-04
Adult	2.0E-06	7.3E-06	9.1E-06	7.6E-05	1.1E-05	8.4E-05

Abbreviations: CTE = central tendency exposure (average); RME = reasonable maximum exposure (high-end)

Using the maximum values from air and water sampling results, the combined CTE cancer risk is 8.6 and 1.1 out of 100,000 for children and adults, respectively. In other words, if 100,000 people were drinking and breathing the maximum levels of contamination found in the homes, there may be 8.6 additional cases of cancer for children and 1.1 additional case of cancer for adults.

Using the maximum values from air and water sampling results, the combined RME cancer risk is 3.4 and 8.4 out of 10,000 and 100,000 for children and adults, respectively. In other words, if 10,000 children were drinking and breathing the maximum levels of contamination found in the homes, there may be 3.4 additional cases of cancer. If 100,000 adults were drinking and breathing the maximum levels of contamination found in homes, there may be approximately 8.4 additional case of cancer for adults.

Given the conservative nature of the cancer risk evaluation for PCBs, the estimated CTE cancer risk for child and adults, and the RME cancer risk for adults is not a concern. The estimated RME cancer risk for children is a concern for increased cancer risk when incorporating conservative exposure assumptions. Note that this is a theoretical estimate of cancer risk that ATSDR uses as a tool for deciding whether public health actions are needed to protect health—it is not an actual estimate of cancer cases in a community.

Cancer risk evaluations are conservative in nature with conservative exposure assumptions that may overestimate exposure. For PCB inhalation exposures, the maximum PCB concentrations across all homes is used and it is assumed that exposures occur over 24-hours per day. Under a CTE scenario, this 24-hour per day exposure is calculated to occur for 12 years as a child and an adult. Under a RME scenario, this 24-hour per day exposure is calculated to occur for 21 years for a child and 44 years for an adult.

For PCB ingestion exposures, it is assumed that 100% of a person's drinking water comes from the private well with the maximum PCB (Aroclor 1016) concentration. Under a CTE scenario, the daily average drinking water intake is assumed to occur for 12 years as a child and an adult. Under a RME scenarios, the 95% percentile drinking water intake is assumed to occur for 21 years for a child and 41 years for an adult.

6.4. Inhalation Non-Cancer Risk Evaluation

No ATSDR inhalation health guidelines exist for evaluating non-cancer health effects from inhalation exposure of total PCBs. In the absence of being able to evaluate inhalation exposure because of the limited number of studies and no inhalation health guideline, ATSDR converted the maximum PCB air concentration of 131 ng/m^3 to an RME dose and compared it to EPAs oral reference dose (RfD) of 0.07 µg/kg/day for Aroclor 1016. An EPA RfD is an estimate of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime, with uncertainty spanning perhaps an order of magnitude.

PCBs are absorbed through ingestion, inhalation, and dermal exposure, after which they are transported similarly through the body [EPA 1997]. This provides a reasonable basis for expecting similar internal effects from inhalation and ingestion exposure; therefore, ATSDR converted the PCB air concentration to an oral dose for comparison to EPAs oral RfD.

It should be noted, the maximum PCB air concentration of 131 ug/m^3 is below a level that is expected to cause health effects. The lowest-observed-adverse-effects-level (n for PCB mixtures in ATSDR's toxicological profile is from a study of rats breathing 9 ug/m^3 of Aroclor 1242 (similar toxicologically to Aroclor 1016) for an intermediate exposure duration. The LOAEL is the lowest dose of a chemical at which adverse health effects are identified between the group exposed to the chemical and the group with no exposure to the chemical. The rats from the study experienced endocrine effects (increased thyroid serum T3 and T4 hormones) and epithelial hyperplasia in the urinary bladder [Casey 1999]. The measured air concentration of 131 ng/m^3 is 69 times lower than the LOAEL and is not expected to cause health effects.

Table 10 below presents the RME inhalation dose and hazard quotient for various exposure groups.

Table 10. Non-Cancer Inhalation Risk Evaluation

Exposure Group	Air EPC (µg/m^3)	Mean Daily Breathing Rate[a] (m^3/day)	Bodyweight[b] (kg)	RME Inhalation Dose (µg/kg/day)	RME Hazard Quotient (Dose/RfD)
Birth to < 1 yr	0.131	5.4	7.8	0.09 a	1.3
1 to < 2 yrs	0.131	8.0	11.4	0.09 a	1.3
2 to < 6 yrs	0.131	9.8	17.4	0.07 a	1.1
6 to < 11 yrs	0.131	12.0	31.8	0.05	0.7
11 to < 16 yrs	0.131	15.2	56.8	0.04	0.5
16 to < 21 yrs	0.131	16.3	71.6	0.03	0.4
Adult	0.131	15.3	80	0.03	0.4
Pregnant Women	0.131	21.1	73	0.04	0.5
Lactating Women	0.131	22.8	73	0.04	0.6

Abbreviations: EPC = exposure point concentration; µg/m^3 = micrograms per cubic meter of air; m^3/day = cubic meter of air per day; kg = kilograms; µg/kg/day = micrograms per kilogram per day; RfD = EPA oral reference dose

[a] ATSDR Guidance on Inhalation Exposures

[b] ATSDR Exposure Dose Guidance for Body Weight

a = equal or exceed EPA's Reference Dose 0.07 µg/kg/day and Hazard Quotient, which ATSDR evaluates further

If a dose exceeds the RfD, this indicates only the potential for adverse health effects. The magnitude of this potential can be inferred from the degree to which the hazard quotient is exceeded. If the estimated exposure dose is only slightly above the RfD or slightly above a HQ of 1, then that dose will fall well below the observed toxic effect level. The higher the estimated dose is above the RfD and the HQ is greater than 1, the closer it will be to the actual observed toxic effect level.

6.5. Ingestion Non-Cancer Risk Evaluation

ATSDR used the maximum PCB (Aroclor 1016) water concentration of 1.8 µg/L from Home #2 to calculate an RME dose and compared it to EPAs oral RfD of 0.07 µg/kg/day for Aroclor 1016.

Table 11 below presents the RME ingestion dose and hazard quotient for various exposure groups.

Table 11. Non-Cancer Ingestion Risk Evaluation

Exposure Group	Water Concentration (µg/L)	RME Dose (µg/kg/day)	RME Hazard Quotient (Dose/RfD)
Birth to < 1 year	1.8	0.26 a	3.6 a
1 to < 2 years	1.8	0.10 a	1.5 a
2 to < 6 years	1.8	0.09 a	1.3 a
6 to < 11 years	1.8	0.07 a	1.0 a
11 to < 16 years	1.8	0.06	0.80
16 to < 21 years	1.8	0.06	0.80
Adult	1.8	0.07 a	1.0 a
Pregnant Women	1.8	0.07 a	1.0 a
Lactating Women	1.8	0.08 a	1.1 a

Abbreviations: µg/L = micrograms per liter of water; µg/kg/day = micrograms per kilogram per day; RfD = EPA oral reference dose

a = equal or exceed EPA's Reference Dose 0.07 µg/kg/day and Hazard Quotient, which ATSDR evaluates further

The calculations in this table were generated using ATSDR's PHAST 2.4.2.0 on August 20,2024

EPA's oral RfD of 0.07 µg/kg/day is based on a study that showed reduced birth weights in monkeys [EPA 1997]. The no-observed-adverse-effects-level (NOAEL) of this study is 7 µg/kg/day [Levin 1998]. The NOAEL is the dose of a chemical at which no adverse health effects are identified between the group exposed to the chemical and the group with no exposure to the chemical. The maximum RME dose (0.26 µg/kg/day) is approximately 27 times less than the NOAEL and is not expected to cause health effects.

6.6. Combined Inhalation and Ingestion Non-Cancer Risk Evaluation

The highest RME-Inhalation Dose + RME-Ingestion Dose (birth to <1 year) gives a combined non-cancer dose of 0.35 µg/kg/day and a HQ of 4.9. The HQ is the ratio of calculated dose to EPA's oral RfD of 0.07 µg/kg/day (0.35 µg/kg/day ÷ 0.07 µg/kg/day). If the combined dose is greater than the RfD, the HQ will be greater than 1.0. A HQ greater than one needs further analysis, which is discussed below.

Since the HQ is more than one for all age groups, ATSDR compared the combined RME to the NOAEL for Aroclor 1016. The combined inhalation and ingestion dose to the most sensitive age group is two orders of magnitude less (100 times less) than the NOAEL. Using the most sensitive population (infants), there should not be any non-cancer health effects from past Aroclor 1016 exposures from air and drinking water combined based on the maximum air and water sampling values used. Combined doses by age group are presented in Table 12 below.

Table 12. Combined Inhalation and Ingestion Doses and Hazard Quotients

Exposure Group	Inhalation + Ingestion RME (µg/kg/day)	EPA RfD (µg/kg/day)	Combined HQ	NOAEL (µg/kg/day)
Birth to < 1 year	0.35	0.07	4.9	7
1 to < 2 years	0.20	0.07	2.8	7
2 to < 6 years	0.16	0.07	2.3	7
6 to < 11 years	0.12	0.07	1.7	7
11 to < 16 years	0.09	0.07	1.3	7
16 to < 21 years	0.09	0.07	1.2	7
Adult	0.10	0.07	1.4	7
Pregnant Women	0.11	0.07	1.6	7
Lactating Women	0.12	0.07	1.7	7

Abbreviations: RME = reasonable maximum exposure (high-end); µg/kg/day = micrograms per kilogram per day; EPA RfD = EPA oral reference dose; HQ = hazard quotient; NOAEL = no observable adverse effect level

The combined exposures from breathing PCBs in indoor air and drinking PCBs in the water are not expected to result in health effects because exposures from each pathway are substantially less than levels that may result in health effects based on the studies available. Additional uncertainty exists because the toxicological profile does not have any studies for chronic inhalation exposure to PCBs.

7. Health Effects Evaluation

Below, ATSDR summarizes cancer and non-cancer health effects related to PCB exposure from various toxicological studies.

7.1. Cancer Health Effects

In 1996, the US EPA classified PCBs as probable human carcinogens. This means that there is sufficient evidence of carcinogenicity in animal studies, but inadequate evidence in human epidemiological studies. In 2014, the National Toxicology Program (NTP) concluded that PCBs may reasonably be anticipated to be carcinogens. In 2016, the International Agency for Research on Cancer (IARC) classified PCBs as carcinogenic to humans.

In animal studies, rats that ate food containing high levels of PCBs for two years developed liver cancer. Studies of PCB workers found increases in rare liver cancers and malignant melanoma. The presence of cancer in the liver in animals and humans across multiple studies adds weight to the conclusion that PCBs are probable human carcinogens.

Current regulatory practice assumes that there is no "safe dose" of a carcinogen and that a very small dose of a carcinogen could give a very small cancer risk. Cancer risk estimates are not yes/no answers but measures of chance (probability). Exposure to carcinogens should be as low as reasonably practical.

Site exposures are not a concern for increased cancer risk for most people. Children that drank the highest amount of private well water containing PCBs from birth to age 21 are at an increased cancer risk when incorporating conservative exposure assumptions.

7.2. Non-Cancer Health Effects

PCBs have been associated with several adverse non-cancer health effects in humans and animals, including liver, thyroid, dermal and ocular changes, immunological alterations, neurodevelopmental changes, reduced birth weight, endocrine, bladder, and reproductive effects. Studies attempting to show the same health effects in humans that have been observed in animals have generally been inconclusive. The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

PCB exposure in children may cause them to learn and grow more slowly and cause behavioral problems. Women exposed to relatively high levels of PCBs in the workplace or who ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. These babies also showed abnormal responses in tests of infant behavior such as problems with motor skills and a decrease in short-term memory, which lasted for several years. The most likely way infants will be exposed to PCBs is from breast milk. However, in most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk. PCBs are not known to cause birth defects.

For more information on health effects from PCBs, please refer to ATSDRs Toxicological Profile for PCBs: https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=142&tid=26 [ATSDR 2000].

Site exposures are not expected to cause non-cancer health effects.

8. Summary of Limitations and Uncertainties

At the time of this report, EPA has not finalized a remedial investigation of the site as a listed Final NPL site. Therefore, ATSDR is basing this public health assessment on limited data. It is unknown to what extent on-site PCB contamination is migrating to off-site groundwater and shallow soils.

- **Timeline**: There is uncertainty regarding how long and at what PCB concentrations residents' drinking water and indoor air exposures occurred. Exposures may have occurred for years, potentially related to PCB movement in groundwater plume via basement flooding or from historical on-site contamination migrating off-site during Jard's operation. In almost every situation, there is uncertainty about the true level of exposure to environmental contamination.
- **Limited Data**: Only one round of drinking water samples were taken before the residents were switched to the public water system. Indoor air results relied on a single sampling event and multiple samples in multiple (hot and cold weather) seasons would be necessary to confirm that indoor air concentrations remain safe over time. Vapor intrusion varies considerably over periods of hours, days, weeks, and seasons. To date, there is no follow-up air sampling to confirm that basements have not been contaminated with PCBs following the installation of water intrusion controls (polyethene barrier on walls, floor drain, and sealed sump pump).
- **Vapor Intrusion Data**: There are no subslab soil gas data or sewer gas data to identify if those may be completed pathways. Functioning of the sealed sumps relies on maintaining vapor-tight seals and integrity of the materials used in the systems.
- **Soil Sampling**: ATSDR considers surface soil to be in the top 3 inches, while EPA classifies the top 12 inches as surface soil. EPA soil sampling and analysis results from the top 12 inches may not accurately represent the top 3 inches if concentrations vary by depth. Also, no subsurface soil contaminant information is available near homes to assure that the source has not migrated close by.
- **Cancer Risk**: ATSDR's cancer risk evaluation is conservative in nature and uses conservative exposure assumptions and maximum exposure concentrations to estimate theoretical cancer risk. Additionally, ATSDR selected EPA's upper-bound cancer slope factor to estimate cancer risk. The EPA upper-bound cancer slope factor refers to a conservative estimate that assumes the highest reasonable level of risk from exposure, considering uncertainties. These theoretical cancer risk estimates are calculated assuming people have the same exposures (e.g., the same water and concentrations, ingestion and breathing rates, and specified duration), and do not represent individual cancer risks or account for variation in exposure or individual behaviors in people living around a site.

9. Conclusions

Conclusion #1	ATSDR concludes that drinking private well water containing PCBs, prior to 2010 when the town switched all residents to municipal water, is not expected to harm most people's health as PCBs levels in private well water were below levels of health concern. based on current data, elevated PCB exposure levels may pose a potential increased cancer risk for children under conservative exposure assumptions
Basis for Conclusion	ATSDR found that residents of several homes on Park Street in the past (before actions were taken to mitigate their exposures) drank water contaminated with PCBs for an undetermined period (something less than 41 years from when Jard opened to when homes switched to municipal water). ATSDR determined that water ingestion exposures are not likely to result in harmful non-cancer or cancer health effects for most people under most scenarios because these past exposures were below levels shown to cause harmful effect in the scientific literature. However, assuming high-end water consumption (95th percentile of water intake), it is estimated that approximately 3 out of 10,000 additional cancer cases would occur if a child's only source of drinking water for 21 years was the maximum concentration measured in Park Street wells. This is a concern for increased cancer risk.
Conclusion #2	ATSDR cannot conclude whether breathing the indoor air in contaminated homes could have harmed people's health.
Basis for Conclusion	The data needed to make a decision is not available. Indoor air results rely on a single sampling event, and multiple samples in hot and cold weather seasons would be necessary to confirm that indoor air concentrations remain safe over time. Although more data is needed, the results from the only sampling that was conducted showed indoor air levels that are not expected to harm people's health. Additionally, indoor air sampling occurred after Park Street basements were decontaminated, but before water intrusion systems were installed to prevent water infiltration into homes. Confirmatory indoor air sampling following the installation of water intrusion systems is not available and is needed to make a conclusion.
Conclusion #3	ATSDR concludes that current levels of PCBs and BEHP in surface soil on the former Jard site and PCBs in neighborhood yards and ballfields are unlikely to harm people's health.
Basis for Conclusion	Exposure to PCB contamination in on-site and off-site surface soil was unlikely since PCBs were under and around the former building foundation. EPA removed the former Jard building in 2007 and the top

	four to six feet of PCB contaminated soil were removed to the water table and covered with a protective earthen cap. Overall, on-site PCBs are present at low levels (non-detect to <1 mg/kg) in the top 12 inches of soil in most of the study area. However, there were on-site PCB concentrations greater than 1 mg/kg detected at the southern edge of the building footprint slightly outside the earthen cap, on the top of the flood control levee, and along the western edge of the building footprint. EPA remedial investigation activities to date show off-site PCB and BEHP concentrations below soil screening values, which are well below levels of health concern.
Conclusion #4	Excavation, severe erosion, or flooding could raise PCBs and BEHP to the surface or erode subsurface soils, which could result in exposure through direct contact with contaminated soils or contaminated flood waters and potentially harm health in the future.
Basis for Conclusion	PCB contamination is present in deep soils (> 10 feet) and in the groundwater plume that flows northwest away from the site. BEHP was also detected in deep soils at the southern edge of the former building footprint slightly outside the earthen cap. On-site deep soil sampling indicates elevated PCB and BEHP contamination on the southern portion of the former Jard building at and below the water table. Off-site groundwater monitoring well data indicate elevated PCB contamination at and below the water table. PCBs are migrating under the water table to the surrounding environment, including below Park Street homes, and discharging into the wetlands northwest of Park Street. The southern portion of the Jard site is located within a Fluvial Erosion Hazard Zone, classified as an "Extreme Hazard". Severe seasonal or episodic storm events have the potential to further mobilize PCBs and impact the site, Park Street residents, and the Roaring Branch.
Next Steps	To date, only one round of air sampling was conducted at Park Street homes in February 2013. ATSDR recommends that EPA consider conducting additional indoor air sampling during hot and cold seasons for the homes along Park Street that were previously contaminated to make sure they have not been re-contaminated due to flooding or groundwater infiltration from severe weather or seasonal storms. ATSDR recommends collection of concurrent indoor air, outdoor air, and subslab gas (if possible) samples to evaluate the full vapor intrusion pathway. To assess if vapor intrusion is active or dormant during sampling, consider using indicators, tracers, and surrogates[2] [ATSDR 2022].

[2] Temperature Measurement Fact Sheet, Radon Measurement Fact Sheet, Pressure Measurement Fact Sheet

EPA conducted an Engineering Evaluation/Cost Analysis for a Non-Time-Critical Removal Action in 2023 that evaluated alternatives to address the threat of future release of PCBs. The Roaring Branch levee was identified as an inadequate engineering control. EPA is evaluating response actions to improve engineering controls to contain PCBs in deep soils and groundwater from impacting surrounding areas.

EPA is still in the process of a Remedial Investigation study of the site and continues to characterize the nature and extent of contamination. More information on EPA's actions can be found on the Jard Superfund website: www.epa.gov/superfund/jard

ATSDR is available to review and evaluate additional data upon request as it becomes available.

10. Public Health Action Plan

ATSDR will share findings of this public health assessment with EPA, Vermont Department of Health, Vermont Department of Environmental Conservation and the public for their comments. ATSDR will revise this public health assessment when new data warrants, if requested.

Ongoing and Planned Actions

EPA is in the process of a remedial investigation/feasibility study (RI/FS) for the site. When EPA conducts additional sampling, ATSDR recommends sampling for a typical full spectrum of contaminants (e.g., RCRA Metals, VOCs, SVOCs, Pesticides, and PAHs) in addition to PCBs in its remedial investigation. ATSDR will review and evaluate additional data upon request.

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Appendix A – Dose Calculations

Inhalation Dose Calculations - Non-Cancer

Table 1A. Inhalation Dose Calculations – Non-Cancer

Exposure Group	Air EPC (ug/m^3)	Daily Breathing Rate (m^3/day)	BW (kg)	Inhalation Dose (ug/kg/day)
Birth < 1 year	0.131	5.4	7.8	0.09
1 to < 2 years	0.131	8.0	11.4	0.09
2 to < 6 years	0.131	9.8	17.4	0.07
6 to < 11 years	0.131	12.0	31.8	0.05
11 to < 16 years	0.131	15.2	56.8	0.04
16 to < 21 years	0.131	16.3	71.6	0.03
Adult	0.131	15.3	80	0.02
Pregnant Women	0.131	21.1	73	0.04
Lactating Women	0.131	22.8	73	0.04

Abbreviations: EPC = exposure point concentration; $\mu g/m^3$ = micrograms per cubic meter of air; m^3/day = cubic meters of air per day; kg = kilogram; ug/kg/day = micrograms per kilogram per day

Equation 1. Inhalation Non-Cancer Dose Equation

$$ID = Air\ EPC \times BR \div BW$$

ID = inhalation dose; EPC = exposure point centration; BR = breathing rate; BW = bodyweight

Inhalation Dose Calculations – Cancer

Table 2A. Inhalation Dose Calculations – Cancer

Exposure Group	Air EPC (µg/m^3)	CTE Exposure Duration (years)	RME Exposure Duration (years)	EPA IUR (µg/m^3)	CTE Cancer Risk	RME Cancer Risk
Birth to < 1 year	0.131	1	1	0.001	-	-
1 to < 2 years	0.131	1	1	0.001	-	-
2 to < 6 years	0.131	4	4	0.001	-	-
6 to < 11 years	0.131	5	5	0.001	-	-
11 to < 16 years	0.131	1	5	0.001	-	-
16 to < 21 years	0.131	0	5	0.001	-	-
Total Child	0.131	12	21	0.001	2.0E-06	3.5E-6
Adult	0.131	12	44	0.001	2.0E-06	7.3E-6

Abbreviations: EPC = exposure point concentration; µg/m^3 = micrograms per meter cubed; CTE = central tendency exposure (average); RME = reasonable maximum exposure (high-end); EPA IUR = US Environmental Protection Agency inhalation unit risk

The calculations in this table were generated using ATSDR's PHAST 2.4.2.0 on August 20,2024

Equation 2. Inhalation Cancer Risk Equation

$$CR = EPC \times IUR \times (ED \div LY)$$

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; LY = lifetime years (78)

*The cancer risks were calculated using the inhalation unit risk of 0.0001 (µg/m^3)

Ingestion Dose Calculations – Non-Cancer

Table 3A. Ingestion Dose Calculations – Non-Cancer

Exposure Group	**PCB EPC (mg/L)**	**RME Intake Rate (L/day)**	**BW (kg)**	**RME Ingestion Dose (mg/kg/day)** (EPC x IR) ÷ BW	**Ingestion Dose (µg/kg/day)** mg*1000
Birth < 1 yr	0.0018	1.106	7.8	0.000255	0.26
1 to < 2 years	0.0018	0.658	11.4	0.000104	0.10
2 to < 6 years	0.0018	0.852	17.4	0.000088	0.09
6 to < 11 years	0.0018	1.258	31.8	0.000071	0.07
11 to < 16 years	0.0018	1.761	56.8	0.000056	0.06
16 to < 21 years	0.0018	2.214	71.6	0.000056	0.06
Adult	0.0018	3.229	80	0.000073	0.07
Pregnant Women	0.0018	2.935	73	0.000072	0.07
Lactating Women	0.0018	3.061	73	0.000075	0.08

Abbreviations: PCB = polychlorinated biphenyls; EPC = exposure point concentration; mg/L = milligrams per liter; RME = reasonable maximum exposure; L/day = liters per day; kg = kilogram; mg/kg/day = milligrams per kilogram per day; IR = intake rate; µg/kg/day = micrograms per kilogram per day

Equation 3. Ingestion Non-Cancer Dose Equation

$$ID = (EPC \times IR \times ER) \div BW$$

ID = ingestion dose (mg/kg/day), EPC = exposure point concentration (mg/L), IR = intake rate (L/day), EF = exposure factor (unitless), BW = body weight (kg)

Ingestion Dose Calculations – Cancer

Table 4A. Ingestion Dose Calculations – Cancer

Exposure Group	PCB EPC (mg/L)	Dose (mg/kg/day)	Non-cancer Hazard Quotient	Cancer Slope Factor (mg/kg/day)	Cancer Risk*	Exposure Duration (yrs)
Birth to < 1 year	0.0018	0.000255	3.6	2	2.60E-04	1
1 to < 2 years	0.0018	0.000104	1.5	2	1.00E-04	1
2 to < 6 years	0.0018	0.000088	1.3	2	3.52E-04	4
6 to < 11 years	0.0018	0.000071	1.0	2	3.55E-04	5
11 to < 16 years	0.0018	0.000056	0.8	2	2.80E-04	5
16 to < 21 years	0.0018	0.000056	0.8	2	2.80E-04	5
Total Child	0.0018	-	-	2		21
Adult	0.0018	0.000073	1.0	2	5.69E-03	78

Abbreviations: PCB = polychlorinated biphenyls; EPC = exposure point concentration; mg/L = milligrams per liter; mg/kg/day = milligrams per kilogram per day; yrs = years

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

The calculations in this table were generated using ATSDR's PHAST 2.4.2.0 on August 20,2024

Equation 4. Ingestion Cancer Risk Equation

$$CR = NCD\ (mg/kg/day) \times CSF \times (ED \div LY)$$

CR = cancer risk, NCD = non-cancer dose, CSF = oral cancer slope factor, ED = exposure duration (years), LY = lifetime years (78 years)