Health Consultation

FINAL RELEASE

Public Health Implications of Exposures to Drinking Water Contaminants at Byram Township Schools from the Mansfield Trail Dump Site

USEPA Facility ID: NJN000206345

Byram Township, Sussex County, New Jersey

Prepared by the

New Jersey Department of Health

May 17, 2024

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Office of Capacity Development and Prevention Services
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from the Agency for Toxic Substances and Disease Registry (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. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

PUBLIC HEALTH IMPLICATIONS OF EXPOSURES TO DRINKING WATER CONTAMINANTS AT BYRAM TOWNSHIP SCHOOLS FROM THE MANSFIELD TRAIL DUMP SITE

BYRAM TOWNSHIP, SUSSEX COUNTY, NEW JERSEY

EPA FACILITY ID: NJN000206345

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Summary

Introduction

The Mansfield Trail Dump site is located in a residential area of Byram Township, Sussex County, New Jersey. The site was used as a waste dump for septic and industrial wastes from the late 1950s to the early 1970s. The site includes several waste disposal trenches in a wooded area that contaminated the groundwater in the shallow and deep bedrock aquifer. The United States Environmental Protection Agency (USEPA) added the site to the National Priorities List (NPL) in March 2011.

The primary contaminants associated with the Mansfield Trail Dump site are volatile organic compounds (VOCs), including trichloroethylene (TCE). These contaminants migrated from the site through the groundwater into a residential neighborhood, impacting residential drinking water wells and indoor air at some of the homes in the neighborhood.

Under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), the New Jersey Department of Health (NJDOH) completed a public health assessment in September 2013. The assessment evaluated the potential for harmful health effects from exposures to the drinking water contaminants found in the residential wells near the site. A health consultation was released in December 2016. The consultation evaluated the potential for health effects from vapor intrusion in the residential properties near the site [NJDOH 2016, 2013]. During this time, NJDOH and ATSDR attended Community Advisory Group (CAG) meetings hosted by USEPA to address community concerns.

In February 2023, USEPA requested that NJDOH and ATSDR evaluate the potential for health effects from exposures to drinking water contaminants at the Byram Lakes Elementary School and Byram Township Intermediate School located near the Mansfield Trail Dump site. This health consultation was prepared in response to USEPA's request.

The public comment period for this health consultation was from February 22, 2024, to March 22, 2024. This document was shared with the USEPA to distribute to school staff and parents. The USEPA shared this document with the community advisory group (CAG) for the Mansfield Trail Dump site. This document was also provided to the Sussex County Division of Health. No public comments were received.

Conclusion

NJDOH and ATSDR conclude that past and current exposures to contaminants detected in the drinking water wells serving the Byram Lakes Elementary and Intermediate schools are not expected to harm people's health.

Basis for Conclusion	Based on the drinking water data provided by USEPA for the wells serving the Byram Lakes Elementary and Intermediate schools, the calculated exposure doses for students and adults at the school were below noncancer health guidelines. The estimated cancer risk calculations also show no increased cancer risks above the background risk of cancer expected in the New Jersey population.
Next Steps	NJDOH and ATSDR recommend that USEPA continue monitoring the school drinking water wells to ensure that the drinking water supply remains safe for the school's students and staff.
For More Information	Copies of this report will be made available at the Sussex County Library and on the Internet. Questions about this health consultation should be directed to the NJDOH at (609) 826-4984.

Background and Purpose

This health consultation was prepared by the New Jersey Department of Health (NJDOH) through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). This document was prepared in response to the United States Environmental Protection Agency's (USEPA's) request to evaluate the possible public health implications of exposures to drinking water contaminants at Byram Lakes Elementary School and Byram Township Intermediate School located near the Mansfield Trail Dump site.

Site Description and Timeline

The Mansfield Trail Dump site is located in a residential area of Byram Township, Sussex County, New Jersey (Figure 1). The site appears to have been used as a waste dump for septic and industrial wastes from the late 1950s to the early 1970s. The site includes various waste disposal trenches in a wooded area. These wastes contaminated the groundwater beneath the site. The groundwater contamination extends beyond the dump areas into an adjacent residential neighborhood (See Figure 2).

In 2005, the Sussex County Department of Health and Human Services and the New Jersey Department of Environmental Protection (NJDEP) became aware of trichloroethylene (TCE) contamination in a private drinking water well. The contamination was discovered during well testing related to a routine real estate transaction [CDM Smith 2019]. NJDEP then completed extensive sampling of potable wells in the area and found TCE contamination in other residential private wells in the neighborhood located to the west of the site. NJDEP installed point of entry treatment systems (POETs) in affected homes. POETs remove contamination and ensure safe drinking water for area residents.

Between 2006 and 2008, NJDEP also collected indoor air samples from homes throughout the affected neighborhood. The samples were used to investigate the possibility of vapor intrusion. Vapor intrusion occurs when volatile organic compounds (VOCs) such as TCE move from contaminated groundwater into the indoor air of overlying buildings. Vapor intrusion mitigation systems were installed, or existing radon systems were modified in five homes where vapor intrusion was occurring. In 2009, while trying to determine the source of contamination, NJDEP discovered the former waste disposal trenches at the site. In 2010, USEPA began investigating the site and in March 2011, they added the site to the National Priorities List (NPL). USEPA excavated contaminant source areas during clean-up activities. The clean-up activities were completed in 2012.

In September 2013, NJDOH and ATSDR completed a public health assessment. They evaluated the potential for harmful health effects from exposures to drinking water contaminants found in the residential wells near the site [NJDOH 2013]. In December 2016, a health consultation was released. It described the potential for health effects from vapor intrusion in the residential properties near the site [NJDOH 2016]. During this time, NJDOH and ATSDR attended Community Advisory Group (CAG) meetings hosted by USEPA to address community concerns.

Since 2014, USEPA has been sampling groundwater underneath the site for TCE and other contaminants. All residential drinking water wells impacted by the site have POET systems to remove contaminants from drinking water. The POET systems are a temporary measure to protect residents until they can be connected to the community water supply. The design and construction of a water line to connect impacted residential homes is underway.

In March 2022, elevated 1,4-dioxane concentrations above NJDEP's groundwater quality standard were detected in some monitoring wells at the site. The levels and locations of the 1,4-dioxane elevations were inconsistent with historical results. Specifically, prior to the March 2022 sampling event, exceedances of 1,4-dioxane had been isolated to monitoring wells in the source area.

Out of an abundance of caution, based on the March 2022 results, USEPA provided bottled water to residents and to the nearby Byram Lakes Elementary and Byram Township Intermediate schools until all potentially affected potable wells were investigated. The results of several rounds of subsequent sampling events found that potable wells were not impacted by 1,4-dioxane detected above the New Jersey Groundwater Quality Standard, and as a result, bottled water service was discontinued in early 2023. NJDOH was requested by USEPA to provide an independent review of the evaluation data for the drinking water wells supplying the two schools to support USEPA's decision to discontinue bottled water for the schools. NJDOH evaluated water sampling data collected between August and November 2022, as part of the data review.

Geology and Hydrogeology

The site is in the Highlands physiographic province. The Highlands include rugged terrain and mountainous uplands with erosion-resistant rocks in northeast-southwest trending ridges. The geology along the top and flanks of the ridge at the site consists of a thin (five feet or less) surficial layer of unconsolidated soil (overburden) overlying bedrock. Overburden deposits cover most of the site. The deposits consist of a non-stratified, loose, dry brown to gray sand/silt mix with varied amounts of gravel and cobbles [CDM Smith 2019].

Beneath the overburden, the upper five to 10 feet of the bedrock is extremely weathered. The deeper bedrock is consolidated, fractured metamorphic and igneous rock with low primary porosity. Therefore, there is a low potential for diffusion of contaminants into the rock matrix. The depth to bedrock at the site ranges from near the surface to approximately 25 feet below the ground surface.

The overburden in the residential area below the ridge north of the site is thicker with a maximum thickness of 40 feet. The bedrock underlying the overburden in this area is also fractured igneous and metamorphic rock [USEPA 2019]. The bedrock elevation in the residential area drops approximately 300 feet from the ridge north toward Cowboy Creek (see Figure 2).

Along the ridge, the overburden and the shallow bedrock is mostly unsaturated, with the depth to groundwater approximately 60 to 80 feet below ground surface. In the residential area north and west of the site, the depth to groundwater ranges from approximately 12.5 feet below ground surface near the ridge to 15.5 feet below ground surface toward the west northwest [USEPA 2019].

Groundwater flow occurs primarily in the weathered shallow bedrock and through interconnected fractures in the deeper consolidated bedrock aquifer. Groundwater moves from the higher-elevation former dump areas to the north-northwest and discharges to surficial seeps and the overburden in the lower areas or flows deeper into the bedrock system.

Shallow groundwater may discharge from seeps in the exposed bedrock face along the downward slope toward the northeast. Groundwater at intermediate depths may discharge in seeps further downgradient or into the wetland area. Bedrock groundwater continues to flow toward the northwest as the fracture network becomes more confined. The hydraulic conductivity of the bedrock measured at the site ranges from less than 0.001 feet/day to 23 feet/day (or a transmissivity of 345 square feet per/day) [USEPA 2019].

At the site, contamination from the former waste disposal trenches entered groundwater through the bedrock. Based on the topography and the detections of volatile organic compounds in the residential potable wells, it is likely that shallow groundwater flows beneath the former dump areas in a northwest direction toward the Brookwood and Ross roads neighborhoods (Figure 2). However, the geology makes it difficult to predict the groundwater flow definitively.

According to USEPA, the groundwater flow at this site varies due to the complex geology in the area. Groundwater generally flows from the site in a northwest direction toward Cowboy Creek (Figure 2). However, fractured bedrock conditions make the speed and flow patterns of groundwater variable.

The Byram Lakes Elementary School and Byram Township Intermediate schools are adjacent to each other. Both are located in the general direction of groundwater flow about 2,300 feet northwest of the site. However, based on the site data collected to date, USEPA does not expect that the school wells will be affected due to the well depths and distance from the site. Several monitoring wells are located between the site and the schools. Monitoring wells help USEPA detect contamination before the school wells are affected (Figure 2). At this time, USEPA states that groundwater impacts to the schools from the site are not a concern and continues to sample the school wells and tap water as a courtesy and at the request of the Byram Township Schools.

The schools are located approximately 0.25 miles from the closest residential property and 0.4 miles from the site. Three wells serve both schools. Water from these wells is blended and disinfected prior to supplying the schools with potable water. The information on these wells is provided in Table 1**.**

Table 1. Byram Township Schools – Potable Well Summary

Well Number	Well Location	Well Depth (feet)	Well Pump Depth (feet)	Pump Rate (gallons per minute)
1	Behind intermediate school	612	300	20
2	Near elementary school entrance	500	350	25
3	Near elementary school playground	700	350	15

Scientific Evaluation

NJDOH used ATSDR's standard method for assessing whether a community is at risk for a health hazard [ATSDR PHAGM 2022]. The scientific evaluation has the following steps:

1. Exposure pathway evaluation
2. Screening analysis
3. Exposure Point Concentrations (EPCs) and exposure calculations
4. In-depth toxicological effects analysis – noncancer health effects
5. In-depth toxicological effects analysis – cancer health effects

The first assessment step is to determine whether there is a completed exposure pathway. An exposure pathway is the link between an environmental release, or source of contamination, and the point where a population might come into contact with, or be exposed to, the environmental contaminant. Exposure pathways are used to evaluate specific ways in which people were, are, or will be exposed to environmental contamination in the past, present, and future.

1. Exposure Pathway Analysis

An exposure pathway is a series of steps starting with the release of a contaminant in environmental media and ending with contact with the human body. A completed exposure pathway has the following five elements:

1) Source of contamination (Mansfield Trail Dump Site);
2) Environmental media and transport mechanisms (groundwater/drinking water);
3) Point of exposure (school wells);
4) Route of exposure (ingestion); and
5) Receptor population (school students and staff).

Generally, ATSDR considers the following three exposure pathway categories:

1) Completed exposure pathways — all five elements of a pathway are present;
2) Potential exposure pathways — one or more of the elements is absent, but information is insufficient to eliminate or exclude the element; and
3) Eliminated exposure pathways — one or more of the elements is absent and will never be present.

For the past, current, and future, there is a completed exposure pathway for school students and staff ingesting contaminated drinking water from wells serving the Byram Lakes Elementary School and the Byram Township Intermediate School. A completed exposure pathway does not necessarily mean that harmful health effects will occur. It simply indicates that all five elements are present, and that further evaluation and screening of contaminants is necessary.

The likelihood of health effects depends on specific exposure conditions such as the exposure duration, contaminant toxicity and concentration, and exposure frequency. In other

words, how long the exposure occurs, how toxic the contaminants are, how much contamination is present, and how often the exposure occurs. To determine whether health effects are possible, NJDOH will further evaluate this completed exposure pathway.

2. Screening Analysis

A screening analysis involves comparing maximum concentrations of detected substances to media-specific screening levels. These screening levels help us understand what exposure levels of contaminants are safe. These screening levels can be ATSDR comparison values (CVs) or other non-ATSDR values including those established by NJDEP or USEPA. If concentrations meet or exceed the CV, these substances, referred to as potential contaminants of concern, are selected for further evaluation. Concentrations that meet or exceed ATSDR CVs or non-ATSDR screening levels do not mean that health effects are likely, but they do help health assessors prioritize which contaminants to evaluate further [ATSDR PHAGM 2022].

Comparison Values

Many CVs are available for screening contaminants. CVs help identify potential contaminants of concern. CVs include ATSDR environmental media evaluation guides (EMEGs) and reference media evaluation guides (RMEGs). EMEGs represent estimated contaminant concentrations below which humans exposed during a specific timeframe (acute, intermediate, or chronic) are not expected to experience harmful noncancer health effects. RMEGs are based on USEPA's reference doses. RMEGs represent the concentration in water or soil at which daily human exposure is unlikely to result in harmful noncancer health effects.

If the substance is a known or a probable carcinogen and has cancer toxicity values, health assessors also consider ATSDR's cancer risk evaluation guides (CREGs) for comparison values. CREGs are estimated contaminant concentrations in soil or water that would be expected to cause no more than one excess cancer in a million (10^{-6}) people exposed during their lifetime.

For some contaminants, NJDEP's maximum contaminant levels (MCLs) might be used when no other CVs are available. MCLs are established by USEPA. MCLs are used to determine whether municipal water supplies are safe to drink. MCLs are set to protect public health.

Between August and November 2022, USEPA collected four rounds of water samples from the drinking water wells supplying the Byram Lakes Elementary School and the Byram Township Intermediate School. For each sampling round, three pre-treatment samples were collected from the school wells and one post-treatment sample was collected from the kitchen sink of the intermediate school. Samples were analyzed for

- 1,4-dioxane (a semi-volatile organic compound (SVOC)),
- volatile organic compounds (VOCs), and
- per-and polyfluoroalkyl substances (PFAS).

PFAS were analyzed during one sampling event in September 2022.

Table 2 summarizes the detected contaminants and compares them to the lowest applicable comparison value. As noted in Table 2, the maximum concentrations for 1,4-dioxane

and TCE were approximately equal to the detection limit and therefore were not evaluated further, even though TCE exceeded its CV. Bromodichloromethane and dibromochloromethane exceeded CVs. These contaminants were selected for further evaluation to determine their potential for harmful health effects.

The next step in the health evaluation is to determine exposure point concentrations (EPCs) for these two contaminants. The remaining contaminants were below applicable CVs and thus were not evaluated further. No harmful effects are likely from contaminants that did not exceed the CVs.

Table 2. Summary of Detected Drinking Water Contaminants (August - November 2022)

Contaminant	Number of samples ^	Number of detections	Minimum concentration (µg/L)	Maximum concentration (µg/L)	Laboratory Detection Limit (µg/L)	Comparison value (µg/L or ng/L)	Exceed comparison value
SVOCs/VOCs (µg/L) [a]							
1,4-Dioxane	17	3	ND	0.24**	0.20	0.24 (CREG) [c]	No
Trichloroethylene (TCE)	17	1	ND	0.52**	0.50	0.43 (CREG)	**Yes**
Bromodichloromethane	17	2	ND	0.95	0.50	0.39 (CREG)	**Yes**
Dibromochloromethane	17	4	ND	2.0	0.50	0.29 (CREG)	**Yes**
Bromoform	17	4	ND	2.3	0.50	3.1 (CREG)	No
PFAS (ng/L) [b]							
Perfluorooctanoic Acid (PFOA) *	4	1	ND	4.3	1.8	14 (MCL) [d] 21 (EMEG)	No

^ Number of samples includes both pre- and post- treatment samples; [a] SVOCs/VOCs = semi-volatile organic compounds/volatile organic compounds; [b] PFAS = per- and polyfluoroalkyl substances; [c] CREG = ATSDR cancer risk evaluation guide; [d] MCL = New Jersey Department of Environmental Protection's maximum contaminant level, EMEG = ATSDR environmental media evaluation guide ; ND = not detected; µg/L = micrograms of contaminant per liter of water; ng/L (PFOA only) = nanograms of PFOA per liter of water; * Samples were analyzed for PFAS in September 2022 only; ** the limit of detection is 0.2 µg/L for 1,4-dioxane and 0.5 µg/L for TCE, which are about equal to the maximum detected concentrations. Therefore, these contaminants were not carried through in the evaluation.

3. Exposure Point Concentrations for Contaminants of Concern

When assessing the public health implications of exposure to a contaminant of concern, ATSDR recommends using the 95% upper confidence limit (UCL) of the arithmetic mean to determine the exposure point concentration (EPC) [ATSDR 2019]. The 95% UCL is considered a conservative estimate of average contaminant concentrations in an environmental medium.

Using ATSDR guidance, the 95% UCL is used for contaminants with at least eight samples and for samples with at least 20% detections [ATSDR 2019]. Maximum concentrations are used as EPCs for contaminants with less than eight samples and less than 20% detections.

EPCs were calculated for bromodichloromethane and dibromochloromethane using the data from the post-treatment tap water samples since these data represent actual exposures. The

maximum concentrations were used because there were fewer than eight samples. These contaminants are byproducts of drinking water disinfection and are not related to the Mansfield Trail Dump site. Table 3 shows the EPCs used for each contaminant of concern.

Table 3. Exposure Point Concentrations for Contaminants of Concern

Contaminant	Number of samples representing exposures **	Number of detections	EPC (µg/L)	EPC type
Bromodichloromethane *	4	2	0.95	Maximum
Dibromochloromethane *	4	4	2.0	Maximum

* These contaminants are byproducts of drinking water disinfection and are not related to the Mansfield Trail Dump site; ** These samples represent post-treatment at the Intermediate School kitchen tap; µg/L = micrograms of contaminant per liter of water; EPC = exposure point concentration represents the maximum concentration of post-treatment samples.

The EPCs for bromodichloromethane and dibromochloromethane will be used to calculate exposure doses for students and staff at the Byram Township schools. Exposure doses are compared to established health guidelines to determine whether a further in-depth toxicological analysis is needed to determine the potential for harmful health effects.

Health Evaluation

Exposure Dose Assumptions and Scenarios – Ingestion of School Drinking Water

ATSDR's exposure dose guidance for water ingestion was used to calculate exposure doses [ATSDR 2023]. Exposure doses were calculated for full and part-time staff and students ingesting drinking water while at school.

Exposure doses can be calculated for two water ingestion scenarios using the ATSDR Public Health Assessment Site Tool (PHAST). For people with typical (average) drinking water ingestion rates, a central tendency exposure (CTE) scenario can be used. For people with above average ingestion rates, a reasonable maximum exposure (RME) scenario is used. The RME refers to people with above average exposures but still within a realistic daily water intake.

The age of students at the Byram Lakes Elementary School and the adjacent Byram Township Intermediate School ranges from 3 years old (pre-kindergarten) to less than 14 years old (8th grade). The age for full and part-time staff is age 18 years and older. Table 4 shows the exposure parameters for both CTE and RME scenarios. The more conservative RME scenario was used to calculate exposure doses to account for people with above average water ingestion rates. A liter of water is about 33 ounces or about four eight-ounce glasses.

Table 4. Exposure Parameters for Dose Calculations – Water Ingestion at Byram Schools

Age range	School grade/population	Average ingestion rate (CTE) L/day	Above average ingestion rate (RME) L/day	Body weight (kg)
3 to < 5 years	Pre-Kindergarten	0.32	0.87	17.2
5 to < 6 years	Kindergarten	0.36	1.0	20.6
6 to < 11 years	1st through 5th	0.46	1.3	31.8
11 to < 14 years	6th through 8th	0.55	1.7	50.6
18 to ≤ 67 years	Full/part-time staff	1.3	3.3	80.6

CTE = central tendency exposure (average ingestion rate); RME = reasonable maximum exposure (above average ingestion rate); L/day = liters of water per day; kg = kilograms

The exposure duration for students at the Byram Township schools is 11 years, assuming students attend both schools from pre-kindergarten through 8th grade. Staff are assumed to work at the school for 30 years.

4. In-Depth Analysis - Noncancer Health Effects

For health effects other than cancer, exposure doses and health guidelines are used to calculate hazard quotients (HQs). The hazard quotient is defined as the exposure dose divided by the appropriate health guideline value. When the hazard quotient exceeds 1.0 and approaches effect levels seen in toxicological literature, the potential for harmful effects increases. Noncancer health effects are not expected for hazard quotients below 1.0.

ATSDR developed health guidelines called minimal risk levels (MRLs) for contaminants that are commonly found at hazardous waste sites. An MRL is an estimate of the daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk for adverse, noncancer health effects. MRLs are developed for a route of exposure, such as swallowing or breathing, over a specified period. Exposure periods are classified as follows:

- acute (less than 14 days),
- intermediate (15 – 364 days), or
- chronic (365 days or more).

MRLs are based largely on toxicological studies in animals and on reports of human workplace exposures. MRLs are usually extrapolated doses (with safety factors applied) from effect levels reported in animal toxicological studies or occupational studies. In toxicological literature, effect levels are usually reported as follows:

- no-observed-adverse-effect level (NOAEL) and
- lowest-observed-adverse-effect level (LOAEL).

A NOAEL is the highest dose of a substance from a study that has been reported to have no harmful health effects on people or animals. A LOAEL is the lowest dose of a substance from a study that has been reported to cause harmful health effects in people or animals. Based on current ATSDR guidance, calculated exposure doses are compared to effect levels (LOAELs)

when determining the potential for health effects. As the exposure dose increases beyond the MRL to the level of the LOAEL, the likelihood of adverse health effects increases. To ensure that MRLs are sufficiently protective, the extrapolated values can be several hundred times lower than the effect levels reported in experimental studies.

Tables 5 and 6 summarize the calculated exposure doses and hazard quotients for students and staff for the contaminants of concern, bromodichloromethane and dibromochloromethane. The maximum exposure dose for students using the RME scenario is for students ages 3 to less than 5 years old. The maximum exposure dose is shown in Table 5. The RME dose for staff is shown in Table 6. The RME doses for all students and staff at both schools have hazard quotients that are far below 1.0. **This means that the doses are far below ATSDR's chronic oral MRL and that harmful, noncancer effects are not likely**. The calculated exposure doses, hazard quotient formulas, and results for all age groups can be found in Appendix B.

Table 5. Noncancer Health Effects – Byram Township School Students (ages 3 to < 5 years)

Contaminant	EPC [a] (mg/L)	RME dose [b] (mg/kg/day)	MRL [c] (mg/kg/day)	Hazard quotient (HQ) [d]	Potential for health effects
Bromodichloromethane	0.00095	0.000026	0.008	0.003	No (HQ < 1)
Dibromochloromethane	0.002	0.000055	0.09	0.0006	No (HQ < 1)

[a] EPC = exposure point concentration represents the maximum concentration of post-treatment samples; [b] RME dose = reasonable maximum exposure dose representing above average water ingestion rates for students aged 3 to less than 5 years old; [c] MRL = ATSDR minimal risk level; [d] Hazard quotient = RME dose/MRL; mg/L = milligrams of contaminant per liter; mg/kg/day = milligrams of contaminant per body weight per day.

Table 6. Noncancer Health Effects – Byram Township School Staff

Contaminant	EPC [a] (mg/L)	RME dose [b] (mg/kg/day)	MRL [c] (mg/kg/day)	Hazard quotient (HQ) [d]	Potential for health effects
Bromodichloromethane	0.00095	0.000021	0.008	0.003	No (HQ < 1)
Dibromochloromethane	0.002	0.000044	0.09	0.0005	No (HQ < 1)

[a] EPC = exposure point concentration represents the maximum concentration of post-treatment samples; [b] RME dose = reasonable maximum exposure dose representing above average water ingestion rates for students aged 3 to less than 5 years old; [c] MRL = ATSDR minimal risk level; [d] Hazard quotient = RME dose/MRL; mg/L = milligrams of contaminant per liter; mg/kg/day = milligrams of contaminant per body weight per day.

5. In-Depth Analysis - Cancer Health Effects

NJDOH evaluates the potential for cancer health effects by assessing the excess cancer risk from exposure to site-related contaminants that exceeds the background cancer risk. In New Jersey, approximately 45% of women and 47% of men (about 46% overall), will be diagnosed with cancer in their lifetime [NJDOH 2023]. This is referred to as the "background cancer risk."

The term "excess cancer risk" represents the risk on top of the background cancer risk and is referred to as the Lifetime Excess Cancer Risk, or LECR. An LECR of "one-in-a-million" (1/1,000,000 or $1x10^{-6}$ cancer risk) means that if 1,000,000 people are exposed to a cancer-causing substance at a certain level for a specified period of time, then one cancer above the

background number of cancers may develop in those 1 million people over the course of their lifetime. A lifetime is considered to be 78 years.

To put the LECR of $1x10^{-6}$ in context of New Jersey's background cancer risk, the number of cancers expected in one million people over their lifetime is 460,000 (46%) in New Jersey. If these one million people are all exposed to a cancer-causing substance for a specific duration, then 460,001 people might develop cancer instead of the expected 460,000 over the course of their lifetime [ATSDR 2014].

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. This theoretical cancer risk is not a prediction that cancer will occur. NJDOH considers estimated cancer risks of less than one additional cancer case among one million persons exposed as an unlikely increased cancer risk (expressed exponentially as $1x10^{-6}$).

According to the United States Department of Health and Human Services (U.S. DHHS), the cancer class of contaminants can fall into the following three categories:

- Known human carcinogen;
- Reasonably anticipated to be a carcinogen; and
- Not classified

Bromodichloromethane. The U.S. DHHS considers bromodichloromethane as reasonably anticipated to be a human carcinogen. In laboratory studies, animals exposed to high levels of bromodichloromethane had tumors in the large intestine, kidney, and/or liver. The levels of bromodichloromethane used in these animal studies were higher than levels usually found in the environment. In addition to the U.S. DHHS, USEPA considers bromodichloromethane to be a probable human carcinogen based on sufficient evidence of carcinogenicity in animals.

Dibromochloromethane. The U.S. DHHS does not have information on the carcinogenicity of dibromochloromethane. There is no conclusive evidence that dibromochloromethane causes cancer in humans. This is because no cancer studies of humans exposed exclusively to this chemical are available. Studies in animals indicate that long-term exposure to dibromochloromethane can cause liver and kidney cancer. In addition to the U.S. DHHS, USEPA considers dibromochloromethane to be a possible human carcinogen based on inadequate human data and limited evidence of carcinogenicity in animals.

Cancer risks for students and staff were calculated using the same exposure parameters that were used for noncancer health effects. The LECR was calculated by multiplying the cancer exposure dose and the exposure duration by USEPA's cancer slope factor (CSF). The CSF is defined as the slope of the dose-response curve obtained from animal and/or human cancer studies. It is expressed as the inverse of the daily exposure dose as follows: $(mg/kg/day)^{-1}$.

The LECRs for each contaminant of concern were summed to get a total LECR for students and staff. As shown in Table 7, the total LECR for students is less than one- in one-

million people. The total LECR for staff is approximately two in one million people. **Both LECRs represent no concern for increased cancer risk.**

Table 7. LECRs for Students and Staff – Byram Township Schools

Exposed Population	Contaminant of Concern	EPC [a] (mg/L)	Exposure Duration (years)	CSF [b] (mg/kg/day) $^{-1}$	LECR [c]	Total LECR
Students	Bromodichloromethane	0.00095	11	0.062	1.9×10^{-7}	7×10^{-7}
Students	Dibromochloromethane	0.002	11	0.084	5.3×10^{-7}	----------
Staff	Bromodichloromethane	0.00095	30	0.062	5.0×10^{-7}	2×10^{-6}
Staff	Dibromochloromethane	0.002	30	0.084	1.4×10^{-6}	----------

[a] EPC = exposure point concentration represents the maximum concentration of post-treatment samples; [b] CSF = cancer slope factor; [c] LECR = lifetime excess cancer risk; mg/L = milligrams of contaminant per liter of water; mg/kg/day = milligrams of contaminant per kilogram body weight per day.

Public Comment

The public comment period for this health consultation was from February 22, 2024, to March 22, 2024. This document was shared with the USEPA to distribute to school staff and parents. The USEPA shared this document with the community advisory group (CAG) for the Mansfield Trail Dump site. This document was also provided to the Sussex County Division of Health. No public comments were received.

Conclusion

The NJDOH and ATSDR conclude that past and current exposures to contaminants detected in the drinking water wells serving the Byram Lakes Elementary and Intermediate schools are not expected to harm people's health.

Based on the drinking water data provided by USEPA for the wells serving the Byram Lakes Elementary and Intermediate schools, calculated exposure doses for students and adults at the school were below noncancer health guidelines. The estimated cancer risks also show no concern for increased cancer risks above the background risk of cancer expected in the New Jersey population.

Recommendation

NJDOH and ATSDR recommend that USEPA continue monitoring the school drinking water wells to ensure that the drinking water supply remains safe for school students and staff.

Public Health Action Plan

The purpose of a public health action plan is to ensure that this health consultation not only identifies public health hazards, but also provides a plan of action. The plan of action is designed to reduce and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included in this health consultation is a commitment from NJDOH to follow-up on this plan to ensure that it is implemented.

Public Health Actions Taken

NJDOH has taken the following actions:

1. Reviewed information provided by USEPA to evaluate the potential health implications of exposures to drinking water contaminants for students and staff at the Byram Lakes Elementary and Intermediate schools.

2. Attended Community Advisory Group meetings between May 2012 and October 2017 to address community concerns regarding possible exposures to site contaminants from the Mansfield Trail Dump site.

3. Prepared a public health assessment in 2013 and a health consultation in 2016 to evaluate the potential public health implications of exposures to site contaminants for residents near the Mansfield Trail Dump site.

Public Health Actions Planned

NJDOH plans to take the following actions:

1. Provide copies of this health consultation to USEPA and to the local health department. This document will also be provided to NJDEP and made available to the public via the Sussex County Library, the NJDOH website, and ATSDR's website.

2. Assist community members in understanding the findings of this report upon request.

3. Continue to review and evaluate data upon request.

Report Preparation

The New Jersey Department of Health prepared this health consultation for the Byram Township School potable wells in relation to the Mansfield Trail Dump site, located in Byram Township, Sussex County, NJ. This publication was made possible by a cooperative agreement [program #CDC-RFA-TS23-0001] with the federal Agency for Toxic Substances and Disease Registry (ATSDR). The New Jersey Department of Health evaluated data of known quality using approved methods, policies, and procedures existing at the date of publication. ATSDR reviewed this document and concurs with its findings based on the information presented by the New Jersey Department of Health.

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Appendix A – Figures

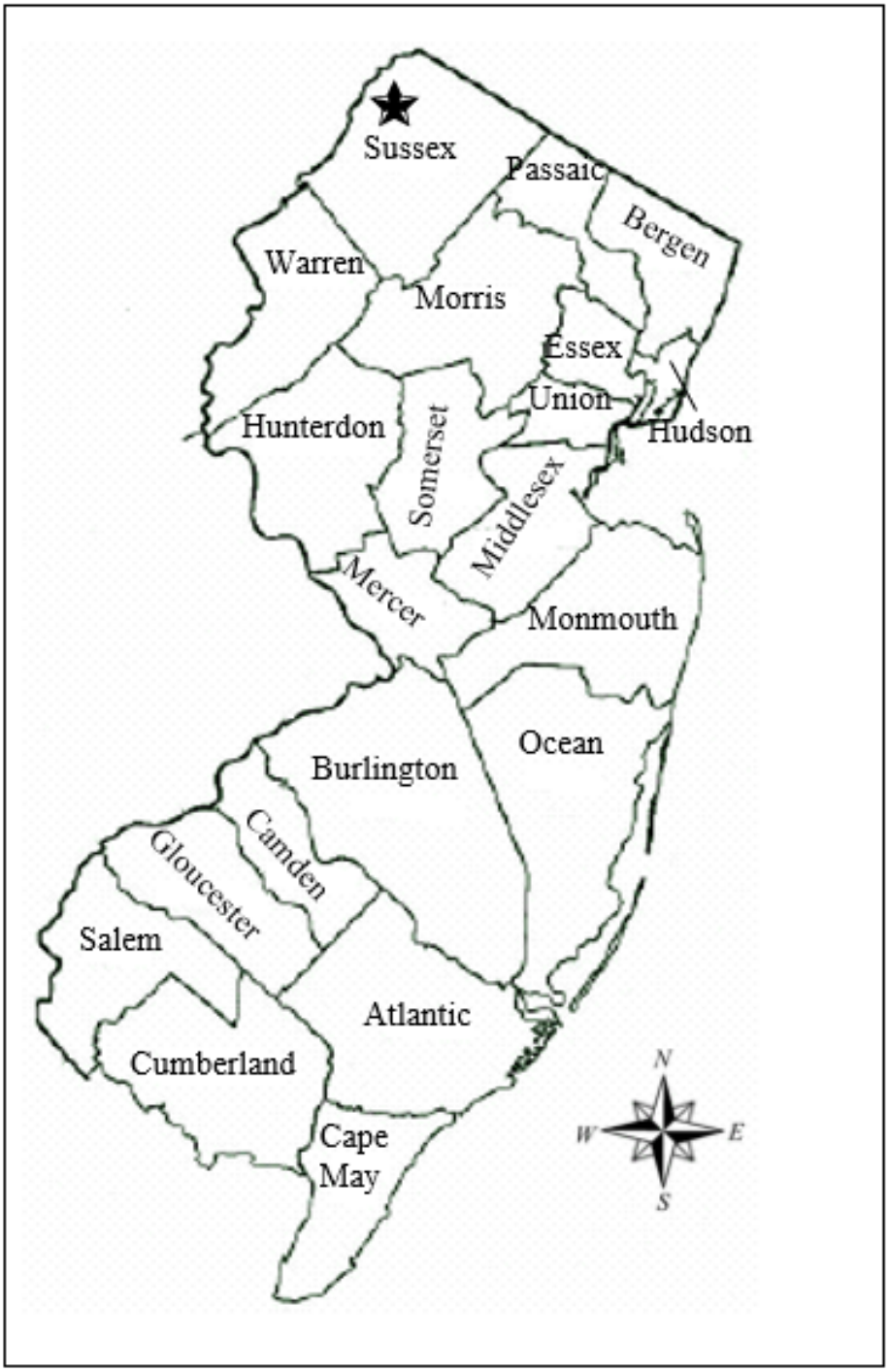

Figure 1. Location of the Mansfield Trail Dump Site

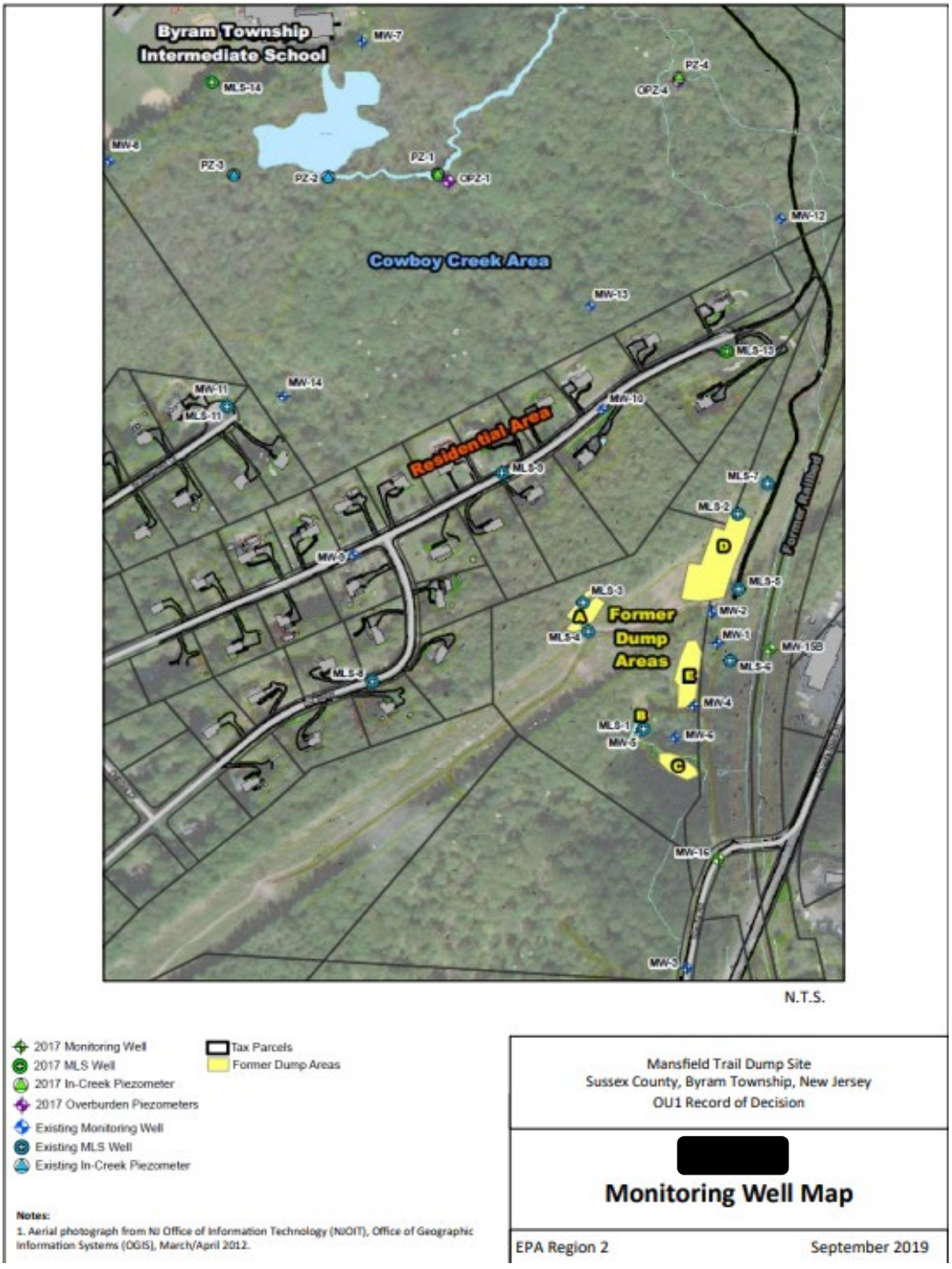

Figure 2. Mansfield Trail Dump Monitoring Well and Area Map

Source: United States Environmental Protection Agency. 2019. Record of Decision – Mansfield Trail Dump Superfund Site Operable Unit 2 – Contaminated Groundwater and Residual Soil Contamination. Byram Township, Sussex County, New Jersey. September 2019. Available from: semspub.epa.gov/work/02/541229.pdf

Appendix B – PHAST Results

PUBLIC HEALTH ASSESSMENT SITE TOOL
PHAST

PHAST Report, v2.2.1.0

Equations

Water Ingestion Exposure Dose Equation

$$D_{noncancer} = (C \times IR \times EF_{noncancer}) \div BW \quad \textbf{Equation 1}$$

$D_{noncancer}$ = dose (mg/kg/day), C = contaminant concentration (mg/L), IR = intake rate (L/day), $EF_{noncancer}$ = exposure factor (unitless), BW = body weight (kg)

Hazard Quotient

$$HQ = D_{noncancer} \div HG \quad \textbf{Equation 2}$$

HQ = hazard quotient, $D_{noncancer}$ = dose (mg/kg/day), HG = health guideline (e.g., oral MRL, RfD)

Cancer Risk Equations

$$CR = D_{noncancer} \times CSF \times (ED \div LY) \quad \textbf{Equation 3}$$

$$\text{ADAF-adjusted CR} = (D_{noncancer} \times CSF) \times (ED \div LY) \times ADAF \quad \textbf{Equation 4}$$

$$\text{Total CR} = \text{Sum of the CR for all exposure groups} \quad \textbf{Equation 5}$$

CR = cancer risk (unitless), $D_{noncancer}$ = dose, CSF = oral cancer slope factor [$(mg/kg/day)^{-1}$], EF (cancer) = exposure factor (cancer) calculated as follows: EF (noncancer; unitless) x exposure group specific exposure duration (years) ÷ lifetime of 78 years, ADAF = age-dependent adjustment factor (unitless), ED = exposure duration (years), LY = lifetime years (78 years)

School Exposure Factors

Duration Category	Days per Week	Weeks per Year	Years	Exposure Group Specific $EF_{noncancer}$	Exposure Group Specific* EF_{cancer}
Acute	-	-	-	1	-
Intermediate	5	40	-	0.71	-
Chronic	5	40	30	0.55	= $EF_{noncancer}$ x Exposure Duration for $Cancer_{Exposure\ Group}$ (years) ÷ 78 years

Abbreviations: EF = exposure factor; NC = not calculated

*Cancer risk is averaged over a lifetime of exposure (78 years).

School Exposure Parameters

Exposure Group Age	Body Weight (kg)	Exposure Duration (years)	CTE Intake Rate (liters/day)	RME Intake Rate (liters/day)	Custom Intake Rate (liters/day)	Notes
3 to < 5 (Pre-Kindergarten)	17.2	2	-	-	0.87	RME scenario
5 to < 6 (Kindergarten)	20.6	1	-	-	1	RME scenario
6 to < 11 (Grades 1-5)	31.8	5	-	-	1.3	RME scenario
11 to < 14 (Grades 6-8)	50.6	3	-	-	1.7	RME scenario
Total Child (all age groups)	-	11	-	-	-	-
Staff	80.6	30	-	-	3.3	RME scenario

Abbreviations: CTE = central tendency exposure (typical); kg = kilograms; RME = reasonable maximum exposure (higher)

School Contaminant Information

Contaminant Name	Entered Concentration	EPC Type	Converted Concentration*
Bromodichloromethane	0.95 µg/L	Maximum	0.00095 mg/L
Dibromochloromethane	2 µg/L	Maximum	0.002 mg/L

Abbreviations: µg/L = micrograms per liter; EPC = exposure point concentration; mg/L = milligram chemical per liter water; UCL = upper confidence limit
* Contaminant concentration converted to standard unit for calculating exposure.

Drinking Water Ingestion Chronic Exposures

Table 1. School exposure doses for chronic exposure to bromodichloromethane in drinking water at 0.00095 mg/L along with noncancer hazard quotients and cancer risk estimates for custom groups*

Exposure Group Age	Dose (mg/kg/day)	Noncancer Hazard Quotient	Cancer Risk	Exposure Duration (yrs)
3 to < 5 (Pre-Kindergarten)	2.6E-05	0.0033	4.2E-8	2
5 to < 6 (Kindergarten)	2.5E-05	0.0032	2.0E-8	1
6 to < 11 (Grades 1-5)	2.1E-05	0.0026	8.2E-8	5
11 to < 14 (Grades 6-8)	1.7E-05	0.0021	4.1E-8	3
Staff	2.1E-05	0.0026	5.0E-7	30

Source: [USEPA 2022]
Abbreviations: mg/kg/day = milligram chemical per kilogram body weight per day; mg/L = milligram chemical per liter water; yrs = years
* The calculations in this table were generated using ATSDR's PHAST v2.2.1.0. The noncancer hazard quotients were calculated using the chronic (greater than 1 year) minimal risk level of 0.008 mg/kg/day and the cancer risks were calculated using the cancer slope factor of 0.062 $(mg/kg/day)^{-1}$.

Table 2. School exposure doses for chronic exposure to dibromochloromethane in drinking water at 0.002 mg/L along with noncancer hazard quotients and cancer risk estimates for custom groups*

Exposure Group	Dose (mg/kg/day)	Noncancer Hazard Quotient	Cancer Risk	Exposure Duration (yrs)
3 to < 5 (Pre-Kindergarten)	5.5E-05	0.00061	1.2E-7	2
5 to < 6 (Kindergarten)	5.4E-05	0.00059	5.8E-8	1
6 to < 11 (Grades 1-5)	4.3E-05	0.00048	2.3E-7	5
11 to < 14 (Grades 6-8)	3.6E-05	0.00040	1.2E-7	3
Staff	4.4E-05	0.00049	1.4E-6 ‡	30

Source: [USEPA 2022]

Abbreviations: mg/kg/day = milligram chemical per kilogram body weight per day; mg/L = milligram chemical per liter water; yrs = years

* The calculations in this table were generated using ATSDR's PHAST v2.2.1.0. The noncancer hazard quotients were calculated using the chronic (greater than 1 year) minimal risk level of 0.09 mg/kg/day and the cancer risks were calculated using the cancer slope factor of 0.084 $(mg/kg/day)^{-1}$.

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