

HEALTH CONSULTATION

DWR Chemical Site

Pennsboro, Ritchie County, West Virginia

EPA Facility No.: WVD0002303360

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Prepared by
West Virginia Department of Health and Human Resources
Bureau for Public Health
Office of Environmental Health Services
Charleston, WV 25301
Under Cooperative Agreement With the
Agency for Toxic Substances and Disease Registry

Statement of Issues

At the request of the United States Environmental Protection Agency, the West Virginia Department of Health and Human Resources (WVDHHR) investigated public health concerns about chemical releases at the DWR Research Company (the site) near Pennsboro, Ritchie County, West Virginia. Specifically, this health consultation evaluated available on-site and off-site environmental data to assess the potential health effects of arsenic and lead contamination in a private well. The well supplies drinking water for a private home and a church near the site. WVDHHR also assessed the potential for off-site contaminant migration and direct exposure of nearby residents (children, adolescents, and adults) to contaminated off-site residential soil. This site was investigated under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

Background

Ownership and Operations History

The site area was originally a portion of a large tract that was used for agricultural and residential purposes. Cattle were raised on the land where the Pennsboro Apostolic Church now stands. According to former land owners, before 1966 the site was privately owned and operated as a small automobile dealership.

From 1996 to June 1999, DWR Research Company operated as a one-man specialty organic chemical manufacturing facility on a 1-acre plot of land. DWR Research Company manufactured 4-phenylpyridine and 2,3-dimethylhexane. Other chemicals used and stored at the facility included methylene chloride (dichloromethane), benzene, chlorobenzene, tetrahydrofuran, acetyl chloride, oxidizers (nitrates, dichromates, chlorates), acids (hydrochloric acid, crotonic acid, acetic acid, nitric acid, perchloric acid, and sulfuric acid), and base potassium hydroxide [1]. The facility originally included seven structures: six storage sheds and the main production building. Two of the sheds no longer exist on the premises, and the remaining four are not being used. Until early 2002, the site remained inactive and abandoned. The former main production building is now leased as an automobile detailing shop.

Chemical and Waste Storage and Disposal

According to the 2001 Preliminary Assessment/Site Investigation (PA/SI) report, effluent from the main production building in the southwestern corner of the site was released onto the ground and allowed to drain into a ditch on the southern edge of the site [2]. This ditch discharged into a nearby culvert, which flowed into an unnamed tributary of the North Fork of the Hughes River.

Flammable materials were stored in a shed formerly located at the southern boundary nearest to the drainage ditch. An abandoned chemical storage shed is located in the northeastern corner of the site next to the unnamed tributary. Just west of this shed is an abandoned equipment storage shed, also near the unnamed tributary. Contaminated soil excavated in March 1997 is piled

immediately south of the main production building and adjacent to a portion of the North Bend Rail Trail State Park.

Site Visit

Representatives from state and local health departments visited the site and surrounding area on July 28, 2003. Their goal was to better understand the physical and geographical setting of the facility and its relationship to the people living and working nearby.

The site is located about 0.5 mile east of Pennsboro. The site is adjacent to a small scrap yard and Old U.S. Route 50 on the north. A portion of the North Bend Rail Trail State Park—a former railroad bed that was converted to a hiking and biking path—borders the site on the south and is upgradient of the site. The western boundary of the site borders the junction of Old U.S. Route 50 and the Rail Trail area. An unnamed tributary of the North Fork of the Hughes River flows northeast across the site toward a culvert. The culvert connects to a drainage ditch that borders the eastern perimeter of the site. An occupied trailer and church are also located to the east of the culvert. A second drainage ditch and culvert are located on the southern edge of the site, between the main production building and the unnamed tributary. Both culverts are overgrown with vegetation.

Soils at the site are of the Upshur-Gilpin complex and are characteristically well-drained. Upshur soils have moderately slow permeability in the surface layer, subsoil, and substratum. Gilpin soils have a moderate permeability [3]. Depth to bedrock ranges from 32–54 inches [2].

Figure 1 depicts the location of the site on a map. Figure 2 identifies the surrounding land uses on an aerial photograph of the site. Figure 3 shows the general features of the site.

Demographics, Land Use, and Natural Resource Use

Demographics

According to 2000 Census data, there are 10,343 residents in Ritchie County. Within that population, 5.5% are under 5 years old; 15.2% are 65 years and older; approximately 17.5% are between 5 and 18 years; and an estimated 61.8% are between 18 and 64 years old. The city of Pennsboro has a population of 1,199, comprising approximately 515 residences and a progressively aging populace [4, 5]. Based on the population of Ritchie County, approximately 23 people live within 1 square mile of the site; of those, six live within 0.25 mile of the site [2].

Off-Site Land Use

The two single family trailer homes, a church, and a highway are approximately 500 feet from the site. The property immediately north of the site was formerly used as a small glass manufacturing operation. The area is characteristically rural-residential, with very limited agricultural and commercial use of the land. There are no industrial establishments within 0.5 mile of the site.

Surface Water Drainage and Fishing

The DWR chemical site is located within the Little Kanawha watershed. An unnamed tributary flows approximately 0.25 mile east of the site toward the North Fork of the Hughes River, a popular recreational spot for swimming, boating, and fishing. There is no documented use of surface water for domestic, industrial, or agricultural purposes within 15 miles downstream of the site [1, 6].

Drinking Water Supply

Residents of a trailer adjacent to and east of the site and a nearby Apostolic Church (east of the trailer) receive drinking water from an untreated groundwater well behind the church [6]. Other residents in the area receive potable water from the neighboring Community of Pennsboro water system. The water supply for the automobile detailing shop located on site is unknown. However, the presence of a portable toilet behind the facility may indicate that no potable water supply is available at this business. This public water system serves 1,665 persons [7] and obtains raw surface water from the Reservoir Run Dam, which is located northeast of Pennsboro and approximately 2 miles upgradient of the site [1].

Health Concerns

The objective of this report is to determine the potential exposure to contaminated groundwater of residents of the single-family trailer and the Apostolic church adjacent to the site. The report also evaluates whether that exposure, via a residential well shared between the family and church, would be expected to cause adverse health effects. The family, which includes two adolescent children (12–14 years), uses private well water for all domestic purposes, such as showering, bathing, and drinking. Preliminary sampling of water from this source showed elevated levels of arsenic.

Previous Investigations

The West Virginia Department of Environmental Protection (WVDEP) conducted a compliance evaluation inspection of the site on March 11, 1997. Inspectors cited DWR for six violations of WVDEP's hazardous waste management regulations under the Resource Conservation and Recovery Act (RCRA). In addition, volatile organic chemical concentrations around 110 parts per million (ppm) were detected in the air during field screening. These violations resulted in an enforcement referral to the United States Environmental Protection Agency (U.S. EPA) Criminal Investigation Division [1].

On March 28, 1997, WVDEP's Office of Waste Management (OWM) Sampling Inspection and Spill Response Team responded to a reported spill at the site. Approximately 1 pound of 4-phenylpyridine had spilled onto the hillside behind the main production building adjacent to the Rail Trail area. The site owner had excavated a spill area comprising about 60 square feet of surface soil before their arrival. Inspectors collected one surface soil sample from the spill area

and one sediment sample from the unnamed tributary at its confluence with the on-site culvert. They also collected one surface water sample and one sediment sample from the drainage ditch behind the main production building. Methylene chloride concentrations of 150 parts per billion (ppb) were found above acceptable levels (4.1 ppb) in surface water from the drainage ditch behind the main production building [1].

On February 18, 1998, the U.S. EPA Criminal Investigation Unit and WVDEP executed a federal criminal search warrant on the facility [1]. They collected 12 hazardous waste drum samples and two surface water samples from the unnamed tributary. There is no indication that remedial actions have been performed at the site.

Preliminary Assessment/Site Inspection (PA/SI) field sampling activities were performed at the site from December 17–18, 2001 under the WVDEP-approved Sampling and Analysis Plan (SAP) dated November 27, 2001. The collection included 15 soil and sediment samples and eight water samples. A tap water sample was collected from the Apostolic Church tap water spicket location. The well is located behind the church. [2, 6]. The investigation identified several metals and polycyclic aromatic hydrocarbons (PAHs) for which the maximum concentration exceeded available screening levels for the environmental media sampled.

Discussion

During the current investigation, available surface soil, surface water, surface water sediment, Geoprobe[®] groundwater, and tap water laboratory analytical data were evaluated using ATSDR data evaluation protocols. Table 1 lists chemicals of concern (COCs) by medium and summarizes detected concentrations, detection frequencies, applicable environmental screening values, and site sampling locations of the maximum detected concentrations. Chemicals of concern were selected on the basis of occurrence, distribution, frequency of detection, and comparison to background.

As a preliminary step in assessing the potential health risks associated with contaminants at this site, we compared contaminant concentrations to media-specific concentrations used to screen contaminants for further evaluation. Where these values were not available, representative human health risk-based screening levels were derived from U.S. EPA risk assessment guidelines. The findings of these evaluations assume that chemical concentrations exceeding either type of screening value do not necessarily constitute a public health threat, but those contaminants do warrant further consideration.

Fate and Transport of Chemicals of Concern (COCs)

Arsenic, iron, lead, thallium, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene were identified as COCs in on-site surface soil. Arsenic and thallium were identified as chemicals of concern in surface water sediment. Arsenic was the only COC identified in tap water. It is possible that metal-containing chemicals formerly used at the site were released into the environment. Component heavy metals may have

subsequently bound tightly to surface soil. Through runoff to surface water, those chemicals could have settled to the bottom of a nearby stream, adsorbing to the underlying sediment layers. It is also possible that metals could have leached through the soil to an underlying groundwater aquifer. Other chemicals, the polycyclic aromatic hydrocarbons (benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene), are characteristically semivolatile and slightly less mobile in the environment.

Exposure Pathway Analysis

ATSDR's general approach to evaluating a site is to evaluate environmental data concerning release of chemicals into the environment and the further evaluation of pathways by which the public might be exposed to the chemicals. ATSDR typically looks for five elements of a completed or potentially completed exposure pathway:

1. a *source* of contamination or the release of a chemical,
2. a *medium* such as air or soil through which the contaminant is transported,
3. a *point of exposure* where people come into direct contact with the contaminant,
4. a *route of exposure* by which the contaminant enters or contacts the body, and
5. a *receptor population*.

These elements may be evaluated under past, present, and future exposure scenarios. If all five elements are present and connected then the pathway is considered *complete*. *Potential* pathways exist where exposure might have occurred, may be occurring, or could occur. These pathways lack one or more of the five elements, but may become complete as more data become available or site conditions change. *Eliminated* pathways are eliminated from further analysis because one or more of the five elements is missing and will never be present, or where conditions make exposure highly unlikely. Consequently, no exposure can occur.

Exposure to soil and sediment on-site – Eliminated Exposure Pathways

On-site media were evaluated to determine whether complete or potential pathways of exposure exist for hypothetical child and adult trespassers to the site. Gravel, grass, and thick plant overgrowth block direct access to the on-site surface soil. Therefore, the surface soil pathway was considered *eliminated*.

Surface water sediment from the unnamed tributary at the site is intermittently covered by water throughout the year. (The unnamed tributary was covered by 4–5 inches of water during the site visit.) Visits to the site by trespassers are expected to be limited because the site is being used for business purposes and few people live near the site. The likelihood of significant exposure to the occasional trespasser via surface water sediment is minimal to nonexistent. Therefore, sediment pathway was considered to be *eliminated*.

Exposure to Groundwater Tap Water – Completed Exposure Pathway

Residential exposure to arsenic in off-site groundwater (tap water) was considered a complete pathway because private well water is the only source of water for potable and other domestic use for the residents of the trailer near the site and visitors to the church. A completed pathway means that people have been exposed to chemicals. That said, however, the existence of a

completed pathway *does not necessarily mean that a public health hazard existed* in the past, exists currently, or is likely to exist in the future. Additional evaluation is needed to see if there are any health implications from the chemicals found in the completed pathway.

Arsenic was the only chemical identified as a chemical of concern in the groundwater. Because only one sample of groundwater was used for this analysis, the conclusions that follow are uncertain.

Health Implications of Exposure to Groundwater (Tap Water)

Estimated exposure doses were calculated for exposure by drinking the water only, as this is the primary route through which arsenic enters the body. Ingestion results in the most sensitive substance-induced endpoint considered relevant to humans. Standard assumptions used to estimate ingestion exposures are shown below.

Estimated exposure doses (milligrams per kilogram per day or mg/kg/day) were calculated by multiplying

- the amount of water ingested in a day,
- the amount of chemical found in the water (17.6 parts per billion or ppb), and
- the exposure factor (the amount of time over which the exposures occurred), followed by
- dividing the product of all these factors by the body weight of the person exposed.

The calculations used these assumptions:

	Resident			Churchgoer	
	Child	Adolescent	Adult	Child	Adult
Body weight (kilograms)	10	45	70	10	70
Daily water ingestion (liters per day)	1	2	2	1	2
Exposure Frequency (days per year)	350	350	350	52	52
Exposure Duration (years)	6	14	24	6	24

Arsenic, Noncarcinogenic Effects

The potential for the detected concentration of arsenic in tap water (17.6 ppb) to cause an adverse, noncarcinogenic (non-cancer) health effect was evaluated by comparing the estimated dose to ATSDR’s chronic oral minimal risk level (MRL) for arsenic (0.0003 mg/kg). ATSDR chronic oral MRLs are estimates of human exposure to ingested chemicals that are not likely to cause noncarcinogenic health effects when exposures last 365 days or more. Although residential exposures are not currently occurring to children under six years of age, these exposures are evaluated in this document because exposures to children could have occurred in the past or may occur in the future.

The estimated noncarcinogenic exposure doses to arsenic from drinking the tap water were calculated as follows:

- 0.00169 mg/kg/day for a child resident
- 0.00075 mg/kg/day for an adolescent resident
- 0.00048 mg/kg/day for an adult resident
- 0.00025 mg/kg/day for a child churchgoer
- 0.00007 mg/kg/day for an adult churchgoer

Estimated exposure doses for the adult churchgoers, because they are less than the MRL, would not be expected to have any adverse noncarcinogenic health effects. Because the estimated exposure doses to arsenic for the residents of the trailer and the child churchgoer were higher than the MRL, these exposures were evaluated further.

The lowest amount of arsenic found to cause harmful (adverse) health effects in humans or animals is called a lowest-observed-adverse-effect level, or LOAEL. For this health consultation WVDHHR selected a LOAEL of 0.005 milligrams of arsenic per kilogram per day as an appropriate LOAEL based on a study of long term exposure to arsenic in drinking water by Lianfang and Jianzhong in 1994 [8].

Applying a safety factor of three to the LOAEL, to account for estimated human variability to the effects of arsenic, results in a value of 0.0017 mg of arsenic /kg/day. A child resident that is sensitive to the effects of arsenic and who was regularly drinking this water for more than a year could possibly experience some harmful (adverse) noncarcinogenic health effects. These effects could be numbness of the hands and feet, fatigue, headache, and dizziness. However, based on the limited test data reviewed, the arsenic found in the well water at this site is not expected to cause adverse noncarcinogenic health effects to the current residents of the trailer, none of whom are children. If the people drinking this water are exposed to other sources of arsenic, such as in food or from ingesting soil containing arsenic, then these exposures could be enough to result in adverse health effects to people regularly drinking this tap water. Finally, if the amount of arsenic in the water is greater than that found in the one sample taken, then these conclusions could change.

Arsenic, Carcinogenic Effects

The estimated risk of developing cancer from exposure to arsenic was calculated by averaging the non-carcinogenic estimated exposures doses over a 70 year lifetime and multiplying this number by the U.S. EPA's cancer slope factor for arsenic, $1.5 \text{ (mg/kg/day)}^{-1}$. The results estimate the theoretical excess cancer risk over a lifetime from exposure to this chemical during the specified number of years.

The theoretical excess cancer risks from exposure to arsenic in the drinking water are given in numbers of people that might develop cancer out of one million people.

A person	who drinks the water for	has a possible excess cancer risk of
Child resident	6 years	2 in 10,000
Adolescent resident	14 years	2 in 10,000
Adult resident	24 years	2 in 10,000
Resident	44 years	7 in 10,000
Child churchgoer	6 years	less than 1 in 10,000
Adult churchgoer	24 years	less than 1 in 10,000

Based on the limited data available, the theoretical excess cancer risk from drinking this water over a lifetime is low. Under regulations developed by U.S. EPA to implement the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as “Superfund”), U.S. EPA established an acceptable human health risk range of one additional cancer in a population of 10,000 to 1 million (10^{-4} to 10^{-6}). Taking this into account, the theoretical cancer risks below 99 in a million were considered a very low risk. The estimated excess cancer risks calculated from this limited data were only slightly above the 1 in 10,000 risk level.

Child Health Considerations

Infants and children are often assumed to be more susceptible to potentially toxic effects of chemicals in the environment because of their physical vulnerability and small body size. Their developing body systems can sustain permanent damage if toxic exposures occur during critical stages of growth and development. Scientific studies support the notion that susceptibility clearly depends on the chemical and on the exposure situation. Although the differences in responses are chemical-dependent, infants and children are a unique population. ATSDR evaluated the likelihood that adolescent children living in the vicinity of the DWR chemical site and any child attending the Pennsboro Apostolic Church could be exposed to waterborne chemical releases at levels of public health concern.

Conclusions

ATSDR requires that one of five conclusion categories be used to summarize findings of a health consultation:

- Urgent public health hazard
- Public health hazard
- Indeterminate public health hazard
- No apparent public health hazard
- No public health hazard.

A category is selected from site-specific conditions such as the degree of public health hazard based on the presence and duration of human exposure, contaminant concentration, the nature of toxic effects associated with site-related contaminants, presence of physical hazards, and community health concerns.

Using ATSDR's criteria, the offsite private well poses an **indeterminate public health hazard** to the residents of the trailer near to the site who drink this well water and the parishioners of the Pennsboro Apostolic Church (if churchgoers drink the water). This category was selected because the amount of data available was extremely limited. Only one sample was used to determine potential health effects. The conclusions reached are highly uncertain and may change as more data become available.

The DWR chemical site poses **no public health hazard** for onsite surface soil and surface water sediment. The WVDHHR determined that the potential for exposure to the chemicals found on site in these media in sufficient quantities to cause adverse health effects was highly unlikely.

Recommendations

The potential for adverse health effects from exposure to arsenic should be further evaluated. The WVDHHR recommends that additional tests for arsenic be performed on the well water. The actual amount of arsenic that the residents of the trailer are exposed to may be different from the amount reflected in the one sample used for this health consultation. In lieu of additional sampling information, the most protective action that could be taken by the church goers and residents of the trailer adjacent to the site would be to discontinue the use of the well water for drinking purposes by using bottled water or by connecting to a water source that is not contaminated.

Public Health Action Plan

- 1.) The WVDHHR will assist the property owner to obtain additional tests for arsenic in the well water should he decide to do so.
- 2.) If additional test results become available, the WVDHHR will evaluate the potential for adverse health effects from exposure to the arsenic in the well water.
- 3.) The WVDHHR will remain available to answer any questions that the community may have pertaining to the site.

References

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CERTIFICATION

The West Virginia Department of Health and Human Resources (WVDHHR) prepared this DWR Chemical Site Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures in existence at the time the health consultation was initiated.



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The Division of Health Assessment and Consultation of ATSDR has reviewed this Health Consultation, and concurred with its findings.



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