Letter Health Consultation

Arsenic in Private Wells

ARMENTROUT EXCAVATING LANDFILL SITE

XENIA, GREENE COUNTY, OHIO

EPA FACILITY ID: OHD980510010

Prepared by
Ohio Department of Health

JUNE 23, 2010

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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

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LETTER HEALTH CONSULTATION

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Ohio Department of Health
Health Assessment Section
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May 19, 2010

Steve Renninger, On-Scene Coordinator
U.S. EPA Region V
Emergency Response Branch
26 West Martin Luther King Drive (G41)
Cincinnati, OH 45268

Dear Steve:

At your request, the Ohio Department of Health's Health Assessment Section (HAS) evaluated the U.S. EPA sampling results for arsenic in drinking water wells at the Armentrout Excavating Landfill site in Xenia, Ohio. Arsenic, the contaminant of concern, was found at levels above federal drinking water standards in seven out of ten of the area wells tested.

Background and Statement of Issues

The Armentrout Excavation Landfill (AEL) site is located at 766 Hawkins Road in a rural portion of Xenia Township in Greene County, immediately northwest of the city limits of Xenia, Ohio. The former landfill makes up most of the 8-acre property, which also includes several aluminum buildings. Access is through a 2-acre property with two buildings that were originally part of AEL. The landfill, which closed in 1980, is covered with soil and overgrown with vegetation. It is mostly fenced but the fencing has not been maintained. The excavation that was the source of soil that was used to cover the landfill in 1981 is now a 2-acre pond located 150 feet to the north on an adjacent property (Ohio EPA 2010b). The site is bordered on the west and northwest by residential properties along Hawkins Road and the Little Miami River, to the north by agricultural land (including the pond) and a nearby residence, on the east by thickly-wooded properties that back up to residences along the west end of Hawkins-Schoolhouse Road, and on the south by Shawnee Creek, partially-wooded residential properties, and a gravel pit.

The AEL site is on top of a steep hill and is underlain by unconsolidated glacial sand, gravel, and clay to depths of at least 100 feet below ground surface (bgs). Boring logs for monitoring wells drilled along the perimeter of the landfill area indicate that the area is underlain by an upper sand, gravel, and clay unit (at least 40 feet thick), followed by a nearly impermeable, tight clay confining unit (30-40 feet thick, thinning to the west), and a water-bearing deep sand and gravel unit of variable thickness occurring at depths from 90 to 100 feet bgs. Twenty-eight residences, including five residences within 500 feet of the site, are within ½ miles of the AEL site. The people living in these homes use private wells as the source of their drinking water. Down-gradient residences in the immediate vicinity of the site obtain their drinking water from private wells drilled to depths of 90 to 150 feet into the deep sand and gravel aquifer unit (HAS 1999, Ohio Department of Natural Resources Well Logs).

History

The Armentrout Excavating Landfill site originally operated as a sand and gravel pit with sand and gravel quarried from the upper 60 feet of strata. Mining ceased when the underlying clay layer was encountered. Paint-related wastes, which included organic compounds, inorganic chemicals, solvents, and metals, were reportedly dumped at the site as early as 1957. Two thousand 55-gallon drums containing miscellaneous paint materials and wastes containing PCB resins were also reportedly disposed of at the site.

The site operated as a licensed sanitary landfill from 1971 to 1980 and was approved for dry, solid industrial wastes and construction and demolition wastes. AEL received a significant amount of debris from clean-up of the Xenia tornado in 1974 and 1975. The landfill reportedly was closed when Ohio EPA and Greene County Health Department staff discovered that the landfill had accepted unapproved domestic and commercial wastes for disposal. The landfill was completely filled and capped with two feet of clean soil excavated from what is now a 2-acre pond. The property is partially fenced but is accessible by trespassers (HAS 1999).

Environmental Sampling Results

Ohio EPA collected groundwater samples from residential wells surrounding the former Armentrout Excavating Landfill site in October of 2009. Six residential wells had arsenic concentrations above the U.S. EPA maximum contaminant level (MCL) of 10 parts per billion (ppb). The highest concentration detected in a sampled well was 50.9 ppb. Two additional wells had concentrations approaching the MCL. On March 1, 2010, the Ohio EPA requested U.S. EPA assistance at this site (Ohio EPA 2010a).

In April, 2010, U.S. EPA conducted sampling of residential wells in the same area and confirmed levels of arsenic in the drinking water above federal drinking water standards (U.S. EPA 2006). The table below summarizes the U.S. EPA sample results.

Chemical	*Range of Detections (ppb)*	*Average (ppb)*	*Frequency of Detections*	*Location of Maximum Detection*	*Frequency Above Comparison Value*	*Comparison Value (ppb)*	*Type*
Arsenic	ND - 49.4	19.7	9/10	RW-19	7	10	MCL

ppb – parts per billion
MCL – Maximum Contaminant Level
ND – Not detected

Seven out of ten residential wells had arsenic concentrations above the U.S. EPA MCL. Nine out of ten are above ATSDRs environmental media evaluation guide (EMEG) of 3 ppb, based on chronic (long-term) exposure to arsenic in drinking water for a child.

Arsenic Toxicity

Children and adults who are exposed to elevated levels of inorganic arsenic may develop similar health effects, including irritation of the stomach and intestines, blood vessel damage, skin changes, and reduced nerve function. There is some evidence that long-term exposure to arsenic in children may result in lower IQ (intelligence quotient) scores and that exposure to high levels of arsenic in early life (including in the womb) may increase mortality in young adults. An association has been demonstrated between exposure to arsenic in drinking water and an increased incidence of diabetes mellitus (ATSDR 2007).

Inorganic arsenic has long been recognized as a human poison and very large oral doses (above 60,000 ppb in water) can result in death. Exposures to lower levels of inorganic arsenic (ranging from about 300 to 30,000 ppb in water) are associated with irritation of the stomach and intestines, resulting in symptoms such as stomach ache, nausea, vomiting, and diarrhea. Long-term exposure to lower levels of arsenic can lead to the development of peripheral neuropathy characterized by numbness in the hands and feet that may progress to a painful "pins and needles" sensation. Perhaps the single-most characteristic effect of long-term oral exposure to inorganic arsenic is a pattern of skin changes. These include the development of patches of darkened skin and the appearance of small corns or warts on the palms, soles, and torso, and are often associated with changes in the blood vessels of the skin. Skin cancer may also develop. Several studies have shown that ingestion of inorganic arsenic via the drinking water pathway can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. The International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), and the U.S. EPA have all determined that inorganic arsenic is a human carcinogen (ATSDR 2007).

Health Risk Assessment

For this site, HAS evaluated acute (short-term) and chronic (long-term) exposure to the highest detected concentration (49.4 ppb) in the most contaminated well. Based on an adult drinking 2 liters of water a day, the estimated dose would be 0.0014 mg/kg/day, falling below ATSDR's acute minimal risk level (MRL) of 0.005 mg/kg/day, but exceeding ATSDR's chronic MRL of 0.0003 mg/kg/day. An MRL is an estimate of daily human exposure to a substance that is unlikely to pose noncancerous health effects. MRLs are set well below levels that are known or anticipated to result in adverse health effects. However, the calculated exposure is below the lowest observed adverse effect level (LOAEL) of 0.05 mg/kg/day, the dose where harmful effects have been observed. Therefore, for those drinking water with the highest level of arsenic for a short or a long period of time would not be at risk for harmful non-cancer health effects.

The lifetime excess cancer risk (LECR) was calculated to be 9×10^{-4} or 9 in 10,000, based on a 30-year exposure at the highest detected arsenic concentration of 49.4 ppb. This theoretical cancer estimate is above a lifetime cancer risk of 1×10^{-4} generally considered acceptable. However, cancer effects are not generally observed at arsenic concentrations at or near the concentrations detected in the private wells at the Armentrout Excavating Landfill site. Studies in U.S. populations exposed to arsenic in drinking water have not yielded the cancer incidences and health effects noted in Taiwan, Mexico, and Chile. For example, early studies performed in the U.S. did not show an increased frequency of skin cancer in small populations consuming water

containing arsenic at levels of around 100 to 200 ppb. Later studies suggested that arsenic-exposed individuals within the U.S. may have increased risk of skin cancer, but either the exposure was insufficient for dose-response analysis or the association did not achieve statistical significance. While the risk of arsenic-induced skin cancers in U.S. may appear to be less than those observed in some other countries, this may be the reflection that, in most studies, exposures were lower (ATSDR 2007).

Conclusions

HAS concludes that drinking elevated levels of arsenic in water for a year or longer from private wells around the Armentrout Excavating Landfill site could harm people's health. People drinking the water for many years could have increased risks of harmful effects, including increased risks of developing certain types of cancer, although the risk is considered to be low. This is a public health hazard. While the current risk is low based on the levels of arsenic recently detected in these wells, these levels are above the federal drinking water standard for public water supplies and arsenic is considered to be a known human carcinogen. As such, HAS considers it prudent to advise the use an alternative safe drinking water supply or in-house water treatment systems to reduce or eliminate arsenic exposures through the drinking water route at the Amentrout Excavating site.

Recommendations

To prevent future exposures, residences exceeding the MCL for arsenic in their well water should be connected to a safe drinking water source or home water treatment systems should be installed on the impacted wells to reduce or eliminate the arsenic at the tap.

Public Health Action Plan

Ohio EPA and U.S. EPA are currently conducting an investigation to determine whether the arsenic in area wells is site-related or naturally-occurring. Plans to provide alternate water or water treatment systems will be made based on these findings.

Sincerely,

Robert C. Frey, Ph.D.
Chief, Health Assessment Section
Ohio Department of Health

RF/jk

References

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HAS (Health Assessment Section). 1999. Health Consultation, Armentrout Excavating, Xenia, Greene County, Ohio. Ohio Department of Health (ODH) /ATSDR. 10 August.

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Certification

The Armentrout Excavating Landfill Site Letter Health Consultation was prepared by the Ohio Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun. Editorial review was completed by the Cooperative Agreement Partner.

Technical Project Officer
Cooperative Agreement Team, CAPEB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Team Lead
Cooperative Agreement Team, CAPEB, DHAC, ATSDR