Evaluation of Drinking Water from Residential Wells Contaminated by a Gasoline Leak

Roanoke & Franklin Counties, VIRGINIA

Letter Health Consultation

February 29, 2024

Virginia Department of Health
Office of Environmental Health Services
109 Governor Street
Richmond, Virginia 23219

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Thank you for contacting the Virginia Department of Health and sharing the methyl *tert*-butyl ether (MTBE) findings in well water to be evaluated for health impact. Through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) we have finished reviewing the well water samples with concentrations of MTBE less than 100 micrograms per liter (µg/L). In addition, in the appendix we have included answers to questions that the community presented to you during a meeting on December 10, 2023.

BACKGROUND AND STATEMENT OF THE ISSUE

In November 2023, a homeowner in the Cooper's Cove community reported petroleum in their private drinking water supply. The Department of Environmental Quality (DEQ), through one of its contractors, subsequently sampled the water supply and confirmed the presence of petroleum constituents. After confirming the presence of petroleum constituents in this water supply, DEQ and one of its State Lead contractors expanded testing of other private water supplies in the area and initiated an investigation of possible sources of petroleum contamination in the area.

As of late December 2023, DEQ sampled 36 private water supplies in the Cooper's Cove community and discovered petroleum constituents (mostly low-level MTBE) in 18 of them. As of January 24, 2024, carbon filtration units had been installed at all 18 of the residences having petroleum contaminated water supplies. Follow-up testing confirmed that the carbon filtration units can and are removing MTBE from the water entering the homes.

Possible petroleum sources in the area
Three gasoline underground storage tanks (USTs) were found on a property located on Cooper's Cove Road. The tanks were used for a plumbing business and have reportedly been out of service since 1998. DEQ's State Lead Contractor collected soil samples from around these tanks in late December. Elevated concentrations of petroleum hydrocarbons were found in some of these samples indicating that a release had occurred from these tanks. DEQ's state lead contractor excavated and removed the three USTs from the property along with approximately 150 tons of petroleum contaminated soil.

The DEQ State Lead Contractor also took samples around an out of service home heating oil tank on Cooper's Cove Road. Soil samples collected from the vicinity of this tank had elevated concentrations of petroleum hydrocarbons indicating a discharge of oil from this tank.

Ongoing environmental work
DEQ is presently trying to determine the extent of the contaminated area and search for any additional drinking water wells that may have been impacted by petroleum. DEQ is also trying to find all the possible sources of petroleum within the impacted area.

DISCUSSION

Exposure pathway analysis
Prior to evaluating a health hazard, the VDH determines if there is an exposure pathway. A complete pathway requires the following five elements which are identified as:

1. **A source of exposure**: underground storage tank
2. **An environmental transport medium**: groundwater
3. **A route of exposure**: ingestion of well water or breathing of air containing volatilized chemicals
4. **A point of exposure**: private well
5. **A receptor population**: residents living near leaking underground storage tank

There is a completed *past* exposure pathway at this site for all residences sampled with MTBE identified in their potable well water. Installation of water filtration at home eliminates any *future* exposure pathway.

Evaluation of MTBE concentrations in well water
To determine if an exposure could result in harm to people's health, the VDH compares concentrations of MTBE in well water to health-based comparison values (CV). VDH first uses CVs developed by ATSDR, and if one is not available then VDH will use CVs developed by other federal or state agencies.

ATSDR's CVs are media-specific concentrations used to identify contaminants that require additional evaluation. They are derived using standard default exposure assumptions and are not site-specific. For contaminants detected below their respective CVs, exposure is not anticipated to result in adverse health effects. Concentrations above CVs do not mean that adverse health

effects occurred or will occur, but that further evaluation is needed. The environmental media evaluation guide (EMEG) CV for children exposed to MTBE for 15-365 days is 2,800 µg/L.

The United States Environmental Protection Agency has an advisory level of 20-40 µg/L for MTBE based on taste and odor.[1,2] Because MTBE has a disagreeable taste and odor, it is unlikely that water contaminated above 20 µg/L would be consumed by people due to taste and odor. EPA Regional Screening Level (RSL) for MTBE is 14 µg/L.[3] This is consistent with other states that have evaluated the adverse health effects from long-term exposure to MTBE in drinking water.[4,5] Long-term exposures means that an individual is exposed to levels greater than 14 µg/L for their entire life (more than 70 years). VDH will use 14 µg/L as the CV to screen MTBE in drinking water for potential chronic adverse health effects.

VDH is not able to determine how long anyone was exposed to MTBE contaminated well water. However, unless an offensive taste or odor was detected, most individuals would probably not have been exposed to concentrations greater than 20-40 µg/L. Five wells had concentrations greater than 20 µg/L and two wells had concentrations greater than 40 µg/L. Seven wells had concentrations of MTBE greater than the long-term CV, 14 µg/L. Water filtration systems added to homes would stop exposure and reduce the risk of any potential adverse health effects from long-term consumption.

Concentrations of MTBE in most wells sampled were far below the comparison value of 2800 µg/L for exposures lasting from 15-365 days. Although the duration of exposure to MTBE in water from these wells is not certain, health effects are unlikely since consuming water containing MTBE below 2800 µg/L for less than a year is not expected to harm people's health, and the RSL of 14 µg/L assumes a person drinks that water across their lifetime. Exposures are now considered eliminated since homes where MTBE has been found in well water have had filters installed. Drinking water from these wells treated with properly maintained filters going forward will eliminate exposure to MTBE.

LIMITATIONS

It is unknown how long MTBE may have been in people's well water. It is easier to estimate duration of exposure to concentrations above 20-40 µg/L, since most people can smell MTBE in water at this level.

The health effects in humans of long-term low dose exposure to MTBE are not well understood, and determinations of safe exposure levels are primarily based upon animal studies.

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[1] https://archive.epa.gov/mtbe/web/html/water.html
[2] https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals
[3] https://semspub.epa.gov/work/HQ/404394.pdf
[4] https://oehha.ca.gov/water/public-health-goal/public-health-goal-methyl-tertiary-butyl-ether-drinking-water
[5] https://www.health.ny.gov/environmental/water/drinking/oxygenates_in_drinking_water.htm

CONCLUSIONS

VDH concludes that an acute health impact is unlikely because the concentration of MTBE in wells reviewed by VDH were less than the intermediate exposure (less than a year) comparison value, 2,800 µg/L.

VDH concludes that several of the wells sampled had concentration of MTBE that exceeded the long-term comparison value, 14 µg/L. However, health effects are unlikely because exposure to water containing 14 µg/L MTBE is only anticipated to be hazardous if a person drinks the water over their entire lifespan, and exposures at higher concentrations are unlikely because MTBE has an unpleasant odor and taste at 20-40 µg/L.

RECOMMENDATIONS

VDH recommends that those concerned about their health talk to their health care provider.

VDH recommends that water filtration be properly maintained according to the manufacturer's instructions.

Public Health Action

Share this letter health consultation with the community. A copy will be available on the Virginia Department of Health website at https://www.vdh.virginia.gov/environmental-health/

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APPENDIX

Chemical specific information (MTBE)
Methyl *tert*-butyl ether (MTBE) is a volatile organic compound (VOC) that was added to gasoline in the 1980s. While still in use in other countries, MTBE is no longer used as an additive in gasoline in the U.S. Contamination of groundwater was a major concern in eliminating MTBE as a gasoline additive. The most likely route of exposure to the general population is through inhalation of air and ingestion of contaminated water.

Information on the noncancer toxicity of MTBE comes primarily from studies in laboratory animals; however, some data on MTBE and human health comes from a few controlled exposure studies, epidemiological studies of humans exposed to gasoline containing MTBE, and side effects reported in patients where MTBE is used to treat dissolve gallstones. Animals that were orally administered high levels of MTBE showed decreased activity and incoordination (similar to effects seen with inhalation exposure), liver effects, abnormal growth of the lymph nodes, and damage to the developing and mature male reproductive system. Stomach irritation was also observed at high oral doses but is not expected in humans at low environmental levels. Most studies have been done using high concentrations of MTBE and it is not known what relevance these results have for evaluating human health risks at low concentrations. There is no consensus among federal environmental and health agencies as to whether MTBE cause cancer or not. However, some states used MTBE animal cancer studies when developing their drinking water contaminant level. These levels are consistent with the RSL used for a long-term CV in this consult.

Community health & exposure questions answered
How long have residents been exposed to MTBE?

Samples only represent a snapshot of what the concentration of MTBE was in well water at that time. Your well water MTBE concentration may have been higher or lower prior to sampling. What we do know is that future exposure is eliminated with filtration.

What happens when people are exposed to MTBE?

Animals that were orally administered high levels of MTBE showed decreased activity and incoordination (similar to inhalation exposure), liver effects, abnormal growth of the lymph nodes, and damage to the developing and mature male reproductive system. Stomach irritation was also observed at high oral doses but is not expected in humans at low environmental levels.

Most human studies are from inhalation. Breathing gasoline with MTBE may cause headaches, nausea or vomiting, dizziness, a feeling of spaciness, and coughing in humans. These effects may be partially due to other chemicals in gasoline, as exposure to low levels of MTBE for short periods did not cause these effects.

How do residents find out if their personal health has been impacted?

Residents concerned about their personal health should reach out to their family physician.

How do residents find out if the health of their animals (livestock, pets, etc.) has been impacted?

If the concern is whether livestock that are potentially affected with toxins can be slaughtered and enter the food chain (ex. lead in cattle), then VDACS/State Veterinarian should be contacted 804-692-0601; vastatevet@vdacs.virginia.gov.

If the concern is how an animal owner can determine if their pets/livestock have been affected by a toxin or are requesting toxin testing for their animals, the owner should contact their veterinarian who can consult with a veterinary toxicologist through a veterinary school.

If residents have an unfounded health issue, how can it be determined whether or not exposure to MTBE is responsible for the health issue?

Residents should discuss health issues with their family physician. It is always challenging to link an environmental exposure to any particular health issue.

Is there are a test to determine whether or not a person has been exposed to MTBE / has MTBE present in their system? If so, who will pay for this test?

There are tests available to measure MTBE and its breakdown product in your breath, blood, and urine. MTBE does not stay in your body long, so these tests need to be done soon after exposure (up to 1–2 days). These tests cannot predict whether you will have health problems from the exposure to MTBE. Doctor's offices do not routinely offer these tests. If you are concerned about being exposed to MTBE or any other chemical, talk to your doctor or call poison control 1 (800) 222-1222. Exposure to contaminants may be covered by the individual's insurance.

What is VDH's threshold for launching an epidemiology study in situations like this?

VDH does not have a defined threshold for launching an epidemiology study. An epidemiological study requires a population that has been exposed to a source of contamination at a known level of concern and for sufficient duration. It also requires including enough people to be able to determine through statistical analysis that health problems in the group are due to the exposure and not due to chance. A major hinderance to a study in this situation is knowing what concentration individuals were exposed to and for how long. Without continuous groundwater monitoring it would not be possible to know this.

Additional information

For questions regarding this environmental health consultation contact the authors of this report using the information provided above.

Poison Control Center at (800) 222-1222
Pediatric Environmental Health Specialty Unit at https://www.pehsu.net