

Anthracene and Groundwater

Anthracene

Anthracene belongs to a class of compounds known as polycyclic aromatic hydrocarbons (PAHs). Anthracene naturally occurs as a component of fossil fuels (i.e. coal tar, oil, and gas) and is formed during incomplete combustion and processing of coal, oil, gas, and plant materials such as wood. Many old industrial sites in Minnesota where fossil fuels were refined, stored, or used have had soil or groundwater contaminated with PAHs.

Anthracene is also used in several production processes, including for certain dyes, synthetic fibers, and the chemotherapeutic drug Amsacrine. It is also used in wood preservatives, in smoke screens, to detect and measure ionizing radiation, and in research.

Workers may be exposed if they inhale air contaminated by products of incomplete combustion or touch soot, oil, or coal tar. The general population may be exposed to anthracene by smoking cigarettes or eating and drinking contaminated food and water.

Anthracene in Minnesota Waters

Most of the environmental monitoring data on the occurrence of PAHs in groundwater and drinking water, including for anthracene, comes from investigation and cleanup activities at contaminated sites. Anthracene has been observed in groundwater, moving away from known contamination sites and affecting nearby drinking water wells. The Minnesota Pollution Control Agency (MPCA) has detected anthracene in groundwater at 16 percent of contaminated sites they have investigated.¹

Anthracene has been detected in monitoring wells and drinking water wells near known contamination sites. It is not commonly tested for outside of these sites. The maximum level detected in drinking water in Minnesota was 3,900 µg/L.

*One microgram per liter (µg/L) is the same as one part per billion (ppb).

MDH Guidance Value and Potential Health Effects

Based on available information, MDH developed risk assessment advice of 600 ppb for anthracene in groundwater. MDH does not use guidance values to regulate water quality, but they may be useful for situations in which no regulations exist. MDH develops guidance values to protect people who are most vulnerable to the potentially harmful effects of a contaminant. A person drinking water at or below the guidance value would be at little or no risk for harmful health effects.

There is only one high quality health study for anthracene. While health effects were observed in limited, lower quality animal studies, no effects were observed in the higher quality animal study.² In the absence of data from high quality studies, MDH selected the highest dose tested in the high quality study to derive risk assessment advice (RAA). RAA may help to provide context when anthracene is found in water samples.

Potential Exposure to Anthracene

Most people are exposed to anthracene when they breathe in contaminated air (from combustion of fossil fuels) or tobacco smoke. People may also be exposed when they eat smoked foods, charbroiled meats, or seafood from contaminated waters, or drink contaminated water.³

Anthracene in the Environment

Anthracene is naturally occurring in fossil fuels, including coal tar. It can also be found in the air as both a vapor and particulate matter when it is released during industrial and other combustion processes. Anthracene in vapor form breaks down rapidly, but anthracene in particulate form will fall to the ground. Anthracene in the soil is more persistent than anthracene in the air and has been found in groundwater by MPCA.^{1,3}

Potential Environment Impacts of Anthracene

Anthracene is toxic to aquatic organisms though surface water concentrations are most often lower than the water quality standard. Anthracene can persist in aquatic sediments, which may pose a risk to those organisms living in the bottom of lakes and rivers. Sediment concentrations of concern are most often associated with past waste disposal practices.

Health Risk Assessment Unit

The MDH Health Risk Assessment Unit evaluates the health risks from contaminants in drinking water sources and develops health-based guidance values for groundwater. MDH works in collaboration with the Minnesota Pollution Control Agency and the Minnesota Department of Agriculture to understand the occurrence and environmental effects of contaminants in water.

References

1. Minnesota Pollution Control Agency. (2018). 2018 Health Risk Limits Nominations.
2. U.S. Environmental Protection Agency (2009). *Provisional Peer-Reviewed Toxicity Values for Anthracene*. Washington, D.C. Retrieved from: <https://cfpub.epa.gov/ncea/pprtv/recordisplay.cfm?deid=338824>
3. NLM, National Library of Medicine. (2018). Hazardous Substances Data Bank. Retrieved from: <https://toxnet.nlm.nih.gov/>.

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