1,4-Dioxane and Water

1,4-Dioxane is used as a stabilizer for chlorinated solvents such as trichloroethane and trichloroethylene (TCE).[1] It can also be an unintended contaminant of chemical ingredients used in consumer products including: bubble bath, shampoo, laundry detergent, soap, skin cleanser, adhesives, and antifreeze. Foods may also contain small amounts of 1,4-dioxane from some additives and packaging materials.

The Minnesota Department of Health (MDH) Risk Assessment Unit evaluates health risks for contaminants in drinking water and develops health-based guidance values for groundwater. The toxicological summary for 1,4-dioxane can be found at the MDH Human Health-Based Water Guidance Table website.[2] MDH works in collaboration with the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Agriculture (MDA) to understand the occurrence and environmental effects of these contaminants.

1,4-Dioxane in Minnesota waters

1,4-Dioxane has been detected in several public water supplies in Minnesota at levels ranging from 0.05 µg/L to 5.5 µg/L. 1,4-Dioxane has also been detected in several groundwater monitoring wells in areas with known chemical contamination. One microgram per liter (µg/L) is the same as one part per billion (ppb).

MDH Guidance value

In 2013, MDH developed a guidance value of 1 µg/L (or ppb) for 1,4-dioxane in drinking water based on its potential to cause cancer. The scientific literature for dioxane was reviewed again in 2022, and MDH determined the cancer guidance value was still applicable.

MDH does not use health-based guidance values to regulate water quality, but they may be useful for situations where federal regulations do not exist. MDH develops guidance values to protect people who are most highly exposed and people who are most sensitive to the potentially harmful effects of a contaminant, including pregnant people, fetuses, infants, and children. A person drinking water at or below the guidance value would be at little or no risk for harmful health effects.

Potential health effects

The U.S. EPA has classified 1,4-dioxane as a likely human carcinogen.[1] Low level exposure to 1,4-dioxane over a person's lifetime may increase the risk of cancer. Higher exposures over a shorter amount of time can damage cells in the liver, kidney, and respiratory system. This damage limits the ability of those organs to work properly. People with questions about their personal risk of health impacts from dioxane exposure should consult with their physician.

Potential exposure to 1,4-dioxane

1,4-Dioxane can get into your body mainly from consuming contaminated water, breathing contaminated air or vapors, and using contaminated cosmetic and/or cleaning products.

You can reduce your exposure to 1,4-dioxane by reducing your use of products containing 1,4-dioxane. 1,4-Dioxane is not intentionally added to products, so it will not be listed on product labels. Chemicals that can contain 1,4-dioxane are listed on product labels as PEG, polyethylene, polyethylene glycol, polyoxyethyelene, polyoxynolethylene, and chemicals ending in –eth and -oxynol.

1,4-Dioxane in the environment

1,4-Dioxane gets into the environment from accidental spills of solvents that contain it as a stabilizer. Once it is in water, 1,4-dioxane is likely to stay there and does not break down. This is why it can reach groundwater, surface water, and potentially drinking water. If 1,4-dioxane is released to air, it is likely to remain in air as a vapor.

References

1. Agency for Toxic Substances and Disease Registry (ATSDR). (June 2015). ToxFAQs for 1,4-Dioxane. https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=954&toxid=199.
2. Minnesota Department of Health (MDH). (September 2013). Human Health-Based Water Guidance Table. “Toxicological Summary for: 1,4-dioxane.” https://www.health.state.mn.us/communities/environment/risk/docs/guidance/gw/14dioxane.pdf.

Minnesota Department of Health
Health Risk Assessment Unit
PO Box 64975, St. Paul MN 55164
651-201-4899
health.risk@state.mn.us
www.health.state.mn.us

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