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1,4-dioxane and our Health

Government policies continued

The USEPA conducted a review of the



Photo Credit: Monica D. Ramirez.

information regarding 1,4-dioxane and approved a toxicity reassessment suggesting it is more probable to cause cancer than previously thought.

The new health advisory level for 1,4-dioxane in drinking water is 0.35 ppb. The previous range was 3 ppb to 300 ppb. The USEPA uses 0.35 ppb to determine the degree of clean-up when there are no current drinking water standards.

One part per billion is equal to one pinch of salt in a 10 ton bag of potato chips



Superfund Research Program
The University of Arizona

Available Online at:
<https://superfund.arizona.edu>

Want to learn more about 1,4-Dioxane?

• **Agency for Toxic Substances and Disease Registry:**

<https://wwwn.cdc.gov/TSP/PHS/PHS.aspx?phsid=953&toxid=199>

• **US Environmental Protection Agency:**

- https://www.epa.gov/sites/default/files/2014-03/documents/ffrro_factsheet_contaminant_14-dioxane_january2014_final.pdf

- <https://clu-in.org/contaminantfocus/default.focus/sec/1,4-Dioxane/cat/Overview/>

- https://clu-in.org/contaminantfocus/default.focus/sec/1,4-dioxane/cat/treatment_technologies/

• **National Institute of Environmental Health Sciences:**

- <https://ntp.niehs.nih.gov/ntp/roc/content/profiles/dioxane.pdf>

For further information:

UA Superfund Research Center

E-Mail: UASRP@email.arizona.edu

What is 1,4-dioxane?

Often, it is referred to as just "dioxane." 1,4-dioxane is a human-made organic (contains carbon) chemical. It is a colorless, flammable liquid with a mild sweet odor. 1,4-dioxane dissolves in water at all concentrations.

1,4-dioxane is a:

Solvent - a liquid that can dissolve oily and greasy substances. 1,4-dioxane is employed in surface finishing processes.

Stabilizer for other solvents - prevents other solvents from breaking down. 1,4-dioxane was utilized primarily as a stabilizer for chlorinated solvents like 1,1,1-trichloroethane or TCA. About 90% of the 1,4-dioxane produced is used to stabilize chlorinated solvents.

By-product - produced during the manufacturing process.

Ingredient - can be present in food packaging material, food additives, varnishes, waxes, plastics, antifreeze, cosmetics, detergents, shampoos, and pesticides.

How Does 1,4-dioxane Enter Our Environment?



Photo Credit: Denise Moreno.

1,4-dioxane can be released into the air, water, and soil. It can evaporate like water; it can be present as a liquid or as a vapor in the air. 1,4-dioxane can readily move through soil to contaminate groundwater. When mixed with water, 1,4-dioxane does not readily break down or degrade.

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How does 1,4-dioxane affect our health?



Whether 1,4-dioxane can make someone ill depends on:

- **Dose** - How much you are exposed
- **Duration** - How long are you exposed
- **Exposure Route** - Drinking/eating (ingestion), breathing (inhalation), or skin contact (dermal contact)
- **Genetics** - Family traits
- **Individual characteristics** - Age, general health, and lifestyle

1,4-dioxane exposure occurs by absorption through the skin, the lungs, and the intestines. The following are possible effects based on exposure duration:

- **Acute (short-term)** - dizziness, drowsiness, headache, and irritation of the eyes, nose, throat, skin, and lungs.
- **Chronic (long-term)** - damage to the liver and kidneys, development of tumors, and liver and nasal cancer.

Studies in animals have shown that 1,4-dioxane exposure mainly affects the liver and kidneys. However, the levels of 1,4-dioxane used in studies with experimental animals

are much higher than the levels the general public might be exposed to commonly (includes exposure via consumer products, food, or environmental sources). Few studies are available that provide information about the



effects of 1,4-dioxane in humans. Deaths have been reported due to severe accidental exposure to high concentrations of 1,4-dioxane vapors in occupational settings.

How can I reduce 1,4-dioxane exposure in my home?

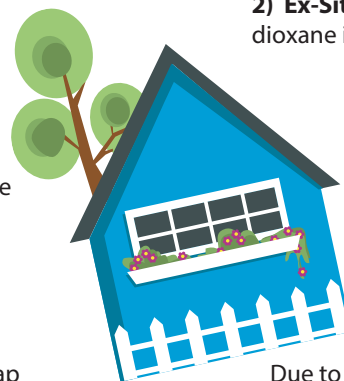
Reducing skin exposure

To avoid skin contact with 1,4-dioxane, choose cosmetic, detergent, and shampoo products that do not contain: **PEG, polyethylene, polyethylene glycol, or polyoxyethylene**. Contact with contaminated water via bathing or showering is another potential route of exposure.

Reducing ingestion and inhalation exposure

Food may contain 1,4-dioxane due to pesticides or packaging. When tap water is contaminated with this chemical, drinking water or inhaling vapors during bathing or showering, are also routes of exposure. The only way to know if your drinking water contains 1,4-dioxane is to contact your local water provider and/or have your water tested. If you own a private water well, you can take a sample to a state certified laboratory. In Arizona call 602-364-0728 for a list of state certified laboratories.

There are technologies available that can treat 1,4-dioxane in water. They can be used to treat contaminated groundwater, surface water, and industrial and municipal waste waters.



The two primary methods are:

- 1) **Advanced Oxidation Processes** - this treatment system uses hydrogen peroxide with ultraviolet light or ozone to destroy 1,4-dioxane.
- 2) **Ex-Situ Bioremediation** - uses bacteria that degrade 1,4-dioxane into less toxic components.

What are the government policies concerning 1,4-dioxane?

Due to the occurrence of cancer in animals studies, the International Agency for Research on Cancer, US Environmental Protection Agency, and US Department of Health and Human Services have determined that 1,4-dioxane may cause cancer in humans. 1,4-dioxane is considered an "emerging contaminant" or in other words, it is potentially a threat to humans and environmental health. Currently, there is no federal drinking water standard for 1,4-dioxane. However, some states such as Maine and Michigan have established their own enforceable drinking water standards. The US Occupational Safety and Health Administration has established a workplace airborne exposure limit for 1,4-dioxane of 100 parts per million (ppm) for an 8-hour workday, 40 hours per week.



The US Environmental Protection Agency (USEPA)

has created a health advisory level regarding 1,4-dioxane. This advisory is a recommendation, but cannot be enforced by the law. It is available at: www.epa.gov/waterscience/criteria/drinking/dwstandards.html

