

1,4-Dioxane in Drinking Water

What is 1,4-dioxane?

1,4-dioxane is a synthetic chemical used as a solvent in products such as adhesives, resins, oils, and waxes; and wood pulping. It is also used in the manufacturing of pharmaceuticals, certain plastics and rubber, and other products and is an unintended byproduct of surfactants used in personal care products, detergents, and cosmetics.

In the past, the primary use of 1,4-dioxane was as a stabilizer for chlorinated solvents, particularly 1,1,1-trichloroethane. It has been released at sites where these chlorinated solvents were produced or used. Once released, it is stable in the environment and moves through soil to groundwater. This can result in contamination of drinking water sources. It can also enter into surface water drinking water supplies from unintended leaks and spills, landfill leachate, wastewater discharges (due to its use in consumer products), and disposal sites.

How can I be exposed to 1,4-dioxane in drinking water?

When drinking water is contaminated with 1,4-dioxane, exposure can occur by drinking the water, or using it to make beverages and foods such as tea, coffee, or formula, or to prepare foods that contain water (e.g., oatmeal, soup). Significant exposure to 1,4-dioxane is not known to occur during showering or bathing, as the chemical is not absorbed through the skin and does not vaporize significantly into the air from drinking water.

Is 1,4-dioxane harmful to my health?

Exposure to 1,4-dioxane over a lifetime (70 years) can cause adverse health effects. Studies of exposure to humans from drinking water remain limited. Information on health effects of 1,4-dioxane comes primarily from studies of laboratory animals. Based on this information, 1,4-dioxane is classified as “likely to be carcinogenic to humans” by USEPA, and NJDEP reviewed and agrees with the USEPA evaluation. Additionally, the National Toxicology Program concludes that 1,4-dioxane is “reasonably anticipated to be a human carcinogen based on sufficient evidence of carcinogenicity from studies of experimental animals.” Non-cancer effects were also shown in animal studies with 1,4-dioxane causing toxicity to the liver, kidney, and respiratory system.

The USEPA has developed a Health Reference Level of 0.35 ug/L. This Health Reference Level is the estimated concentration of 1,4-dioxane in water corresponding to an increased lifetime cancer risk of one in one million, assuming consumption of 2 liters of water per day every day for a 150 pound person during a lifetime of 70 years.

What do we know about the occurrence of 1,4-dioxane in drinking water?

All large public water systems (serving over 10,000 customers) in the U.S. and a representative subset of smaller water systems were required to test for 1,4-dioxane as part of the third iteration of USEPA’s Unregulated Contaminant Monitoring Rule (UCMR3). Through UCMR3 sampling, there were detections in 30 public water systems in New Jersey with levels over USEPA’s risk assessment level of 0.35 ug/L. This Health Reference Level is based on a one in one million increase in cancer risk from lifetime exposure.

The results from the sampling are publicly available on USEPA’s website located: <https://www.epa.gov/dwucmr>. All of the water systems which experienced detections for 1,4-dioxane through UCMR3 have reported their

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results in their Consumer Confidence Report (CCR) the year in which it was detected. CCRs are provided annually to all customers and may be available online at your water provider's website.

After receiving the results of the UCMR3 testing, the NJDEP sent out written correspondence to 27 systems above USEPA's risk assessment level highly recommending quarterly monitoring. The remaining three systems that did not receive letters had detections at interconnections. Therefore, the water quality was not representative of the sampled systems sources. Through voluntary monitoring, NJDEP is also aware of one other public water system with levels over USEPA's Health Reference Level of 0.35 µg/L. Of the 31 systems with levels over USEPA's Health Reference Level of 0.35 µg/L, at least 25 systems have submitted this data to NJDEP. As a result of elevated levels detected through voluntary monitoring, there are 8 water systems that are currently installing or planning to install treatment to remove 1,4-dioxane, and one system that has taken their facility offline to reduce the levels of 1,4-dioxane.

Additional information regarding occurrence is available at:

<https://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3>

Is 1,4-dioxane regulated in drinking water?

No federal or New Jersey-specific drinking water standard (or maximum contaminant level, MCL) has been established for 1,4-dioxane. The USEPA has developed a Health Reference Level of 0.35 µg/L (micrograms per liter; parts per billion or ppb). However, in February 2020, USEPA decided not to make a preliminary regulatory determination for 1,4-dioxane pending further evaluation. In addition to the USEPA Health Reference Level, state health-based drinking water guidance values and federal occupational exposure limits have been established. Fifteen states including New Jersey have drinking water and/or ground water guidance values or standards for 1,4-dioxane ranging from 0.3 µg/L to 35 µg/L. The Federal Consumer Product Safety Commission (FCPSC) monitors for 1,4-dioxane in consumer products. Many personal care product companies are beginning to voluntarily remove 1,4-dioxane from their products.

What is being done in New Jersey?

The NJDEP has adopted a Ground Water Quality Standard (GWQS) of 0.4 µg/L. Of an estimated State population of 8.9 million, about 3 million people rely on ground water from public water supply wells and private domestic potable wells. The ground water quality standard for 1,4-dioxane ensures that a current and scientifically-based standard to protect, maintain, and restore ground water quality is in place. The ground water quality standards also establish minimum standards for the remediation of contaminated ground water.

Further, the New Jersey's Drinking Water Quality Institute (DWQI), New Jersey's drinking water advisory body, is currently accepting comments (until December 21) on a draft MCL recommendation of 0.33 µg/L. The Ground Water Quality Standard and the draft MCL are both based on the same toxicology information and one in one million cancer risk level from lifetime exposure as the EPA Health Reference Level of 0.35 µg/L. The DWQI anticipates finalizing the draft recommendation in 2021 and forwarding it to the NJDEP Commissioner for a determination of rulemaking to establish a NJ MCL. If the Commissioner accepts a recommendation from DWQI, the NJDEP rule process includes stakeholder sessions followed by a formal proposal of a rule. The NJDEP then has one year from proposal to adopt or the rule will expire.

NJDEP contacted systems with levels of 1,4-dioxane at their treatment plant above USEPA's Health Reference Level of 0.35 µg/L and recommended that they conduct quarterly monitoring of their finished water and take samples of their raw water to identify which well(s) may be contributing to 1,4-dioxane levels.

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As a water system, how can I protect customers from 1,4-dioxane?

There are several ways to reduce 1,4-Dioxane concentrations in the drinking water supply. Some water systems may choose to stop using the contaminated source (well water), and instead rely on their other sources to provide water to customers or purchase water from a neighboring water system that does not have 1,4-dioxane. Some systems, however, will need to install treatment for the removal of 1,4-dioxane. The DWQI's draft Treatment Subcommittee report on 1,4-dioxane (<https://www.state.nj.us/dep/watersupply/pdf/14-dioxane-pub-rev-treat-sub.pdf>) advises that Advanced Oxidation Processes (AOPs) and/or an equally efficient technology should be considered for treatment of 1,4-dioxane. AOPs have successfully been used to reduce 1,4-dioxane below the draft DWQI MCL recommendation of 0.33 µg/L.

As a private well owner, how do I find out if 1,4-dioxane is in my well water?

The only way to know whether your private well has 1,4-dioxane is to have it tested. To find a laboratory certified to test, you can contact NJDEP Office of Quality Assurance at 609-292- 3950. Additionally, a list of laboratories that are NJ-certified for EPA Method 522 can be found here:

<https://www13.state.nj.us/DataMiner> then clicking on "Laboratories Certified by Analytical Method," and using the drop-down menu to find "EPA 522."

Will boiling my water or a water treatment system remove 1,4-dioxane from my drinking water?

1,4-dioxane is not removed from water by boiling. At present there are no home water treatment devices that have been certified for the removal of 1,4-dioxane by NSF or UL, the organizations that provide certification for such devices. Further research is needed to better understand treatment for 1,4-dioxane at the residential level.