



FREQUENTLY ASKED QUESTIONS 1,4-Dioxane in Drinking Water

Table of Contents

General Information about 1,4-Dioxane in Drinking Water

[What is 1,4-dioxane and where does it come from?](#)

[How can I be exposed to 1,4-dioxane?](#)

[Does 1,4 dioxane degrade in the environment?](#)

[How does 1,4-dioxane get in my drinking water?](#)

[Why is there no federal regulation for 1,4-dioxane?](#)

[What action is NJDEP taking?](#)

[Why are the state MCLs for 1,4-dioxane so different from the federal health advisory level?](#)

[What do we know about the occurrence of 1,4- dioxane in drinking water? Is 1,4-Dioxane only a concern in NJ?](#)

[What are the health risks of 1,4-dioxane?](#)

[What levels of 1,4-Dioxane in drinking water are safe?](#)

[Where can I get information about the health effects of 1,4-dioxane?](#)

[How do I know if my water contains 1,4-dioxane?](#)

[Will boiling my water or a water treatment system remove 1,4-dioxane from my drinking water?](#)

[Do current drinking water treatment facilities reduce or remove these contaminants?](#)

[Can I bathe or shower with water containing 1,4-dioxane?](#)

[Can I breastfeed my child if I drank water containing 1,4-dioxane?](#)

Information for Public Water Systems

[Are systems required to sample for 1,4-dioxane?](#)

[What should a system do if 1,4-dioxane has been detected in its supply?](#)

[What labs will analyze for 1,4-dioxane?](#)

[How should I let my customers know if 1,4-Dioxane has been detected in the water system?](#)

[What treatment can be used to remove 1,4-Dioxane?](#)

[How can I protect the customers of my water system from 1,4-Dioxane?](#)

[Who should I contact if I am concerned about possible 1,4-dioxane levels in my water?](#)

Information for Private Well Owners

[How do I find out if 1,4-dioxane is in my well water?](#)

[What are the types of home drinking water treatment devices available, and which are generally effective for 1,4-Dioxane contaminants?](#)

General Information on 1,4-Dioxane

What is 1,4-dioxane and where does it come from?

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?

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.

Does 1,4 dioxane degrade in the environment?

The physical and chemical properties and behavior of 1,4-dioxane create challenges for its characterization and treatment. It is highly mobile and does not readily biodegrade in the environment. However, it can be treated. The NJ Drinking Water Quality Institute's Treatment Subcommittee report on 1,4-dioxane (<https://www.state.nj.us/dep/watersupply/pdf/14-dioxane-pub-rev-treatsub.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 DWQI MCL recommendation of 0.33 µg/L.

How does 1,4-dioxane get in my drinking water?

New Jersey relies on ground water and surface waters for our drinking water supply. 1,4-Dioxane can be released into the air, water, and soil from industrial facilities where it is manufactured or used. Once deposited on soil, 1,4-dioxane leaches readily into the groundwater, where it can persist for many years. 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.

Why is there no federal regulation for 1,4-dioxane?

No federal drinking water standard (or maximum contaminant level, MCL) has been established for 1,4-dioxane. The Safe Drinking Water Act (SDWA), as amended in 1996, requires the Environmental Protection Agency (EPA) to make regulatory determinations every five years on at least five unregulated contaminants. EPA uses the Unregulated Contaminant Monitoring Rule (UCMR) to collect data to be used by EPA to identify occurrence of various unregulated contaminants and can be used to prioritize contaminants for potential rulemaking. Under the third iteration of that rule (UCMR 3), EPA

included 1,4-dioxane in that list. While occurrence for 1,4-dioxane was noted nationwide, some states, such as NJ, did have relatively higher occurrence than others (24% of samples had 1,4-dioxane detections vs 11.4% nationwide.) Since EPA has not yet determined whether it will regulate 1,4-dioxane, states with higher occurrence of unregulated contaminants may leverage that data to implement their own MCLs. After the completion of a UCMR cycle, EPA evaluates the data to determine whether the monitored contaminants occur in public water systems with a frequency and at levels of public health concern. Establishing such occurrence is one of the three criteria that EPA is required to meet under the SDWA when making a determination to regulate a contaminant in drinking water (the other two criteria are having adverse health effects and whether regulation would result in a meaningful opportunity for public health risk reductions for persons served by public water systems). EPA has not yet determined whether the third criteria (meaningful opportunity for risk reduction) can be met for 1,4-dioxane.

Other actions have been taken by USEPA on 1,4-dioxane, including the development of a Health Reference Level of 0.35 µg/L (micrograms per liter; parts per billion or ppb). This Health Reference Level is based on a one in one million increase in cancer risk from lifetime exposure. Additionally, 1,4-dioxane was included in the third iteration of the Unregulated Contaminant Monitoring Rule (UCMR). Under the UCMR, EPA is required to issue a list of no more than 30 unregulated contaminants that must be monitored by public water systems. The data collected under this rule is used by EPA to identify occurrence of various unregulated contaminants and can be used to prioritize contaminants for potential rulemaking. Under the third iteration of this rule (UCMR3), 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 in 2013 to 2015. In addition, 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 action is NJDEP taking?

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.

There are no current federal or New Jersey drinking water standards for 1,4-dioxane. The DEP and the New Jersey's Drinking Water Quality Institute (DWQI), New Jersey's drinking water advisory body, are in the process of developing a 1,4-dioxane drinking water standard. This process would establish a regulatory limit for 1,4-dioxane in drinking water that is based on potential health effects from long-term consumption of affected water. In August 2021, the DWQI met to finalize their recommendation of a health based Maximum Contaminant Level (MCL) for 1,4 Dioxane of 0.33 ug/L. The DWQI forwarded a formal recommendation to the NJDEP Commissioner, which was accepted on December 16, 2021. Following this, the Department is initiating the stakeholder and rulemaking process

Once formally regulated, water systems would be required to monitor for the presence of 1,4-dioxane and would be obligated to take remediation measures where the levels detected above the MCL, including the potential installation of additional treatment technology. Presently, no home-treatment systems or filters have been certified to remove 1,4-dioxane.

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.

Why are the state MCLs for 1,4-dioxane so different from the federal health advisory level?

The USEPA (2018b) Table of Drinking Water Health Advisories and Standards states that a concentration 35 µg/L of 1,4-dioxane in drinking water corresponds to an excess estimated lifetime cancer risk of 1 in 10,000 (10⁻⁴), based on the USEPA IRIS classification of 1,4-dioxane as "likely to be carcinogenic to humans" and the IRIS cancer slope factor of 0.10 (mg/kg/day)⁻¹. This slope factor is also the basis for the range of Reference Concentrations of 0.35 to 35 µg/L, based on risk levels of 1 in 10,000 (10⁻⁴) to 1 in 1 million (10⁻⁶), for evaluation of detections of 1,4-dioxane in a nationwide public water system monitoring program, the Third Unregulated Contaminant Monitoring Rule (UCMR3) (USEPA, 2017). A recent assessment by USEPA Office of Chemical Safety and Pollution Prevention (OCSPP, 2020) that considers newer information that became available subsequent to USEPA IRIS (2013) confirms the USEPA IRIS (2013) cancer classification and slope factor.

What do we know about the occurrence of 1,4- dioxane in drinking water? Is 1,4-dioxane only a concern for New Jersey residents?

Under the third iteration of the Unregulated Contaminants Monitoring Rule (UCMR), 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 in 2013 to 2015. 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 µg/L. This Health Reference Level is based on a one in one million increase in cancer risk from lifetime exposure.

1,4-Dioxane was detected in UCMR3 across the country, however NJ observed a higher rate of occurrence than the national rate. Nationwide, 1,4-dioxane was detected over USEPA's risk assessment level of 0.35 µg/L in 6.6% of the public water systems who sampled. In NJ, 1,4-dioxane was detected above USEPA's risk assessment level of 0.35 µg/L in 24% of samples vs 11.4 % of the samples nationwide. The observed detections were in 30 public water systems, or 17.2% of systems who sampled, with levels over USEPA's risk assessment level of 0.35 µg/L.

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 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. Detections of unregulated contaminants (outside of UCMR requirements) are encouraged to be included in the CCR but not required.

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.

Additional information regarding occurrence may be available at: <https://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3>

What are the health risks of 1,4-dioxane?

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. These studies show that exposure to low levels of 1,4-dioxane, over a long time (i.e. 70 years), may result in adverse health impacts. Based on the available scientific data, 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.

What levels of 1,4-Dioxane in drinking water are safe?

The USEPA has developed a Health Reference Level of Reference Level of 0.35 µg/L. This Health Reference Level is the estimated the 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.

The New Jersey’s Drinking Water Quality Institute (DWQI) is currently taking comment (until December 21, 2020) on a draft MCL recommendation of 0.33 µg/L. The draft MCL recommendation is based on the same toxicology information and one in one million cancer risk level as the USEPA 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 potential rulemaking to establish a NJ MCL.

Where can I get information about the health effects of 1,4-dioxane?

- **NJDEP’s website:**
www.nj.gov/dep/14-dioxane
- **DWQI Draft Recommendation Reports:**
https://www.state.nj.us/dep/watersupply/g_boards_dwqi.html
- **ITRC Factsheets:**
<https://14dx-1.itrcweb.org/>
- **Agency for Toxic Substances and Disease Registry (ATSDR) Tox FAQs:**
<https://www.atsdr.cdc.gov/toxfaqs/tfacts187.pdf>
- **USEPA Technical Fact Sheet 1,4-Dioxane:**
https://www.epa.gov/sites/production/files/2014-03/documents/ffrro_factsheet_contaminant_14-dioxane_january2014_final.pdf
- **USEPA Integrated Risk Information System (IRIS):**
https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0326_summary.pdf

- **USEPA TSCA Work Plan Chemical Problem Formulation and Initial Assessment:**
https://www.epa.gov/sites/production/files/2017-06/documents/14_dioxane_problem_formulation_and_intial_assessment.pdf
- **National Institute for Occupational Safety and Health (NIOSH). “Dioxane – NIOSH Pocket Guide to Chemical Hazards:”**
<https://www.cdc.gov/niosh/npg/npgd0237.html>

How do I know if my water contains 1,4-dioxane?

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 USEPA Unregulated Contaminant Monitoring program. The results from the sampling are publicly available on USEPA’s website located: <https://www.epa.gov/dwucmr>. All of the water systems which tested for 1,4-dioxane have reported their detected results in their Consumer Confidence Report (CCR), which is provided annually to all customers and may be available online at your water provider’s website. Contact your water provider for more information on 1,4-dioxane in your drinking 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://njems.nj.gov/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. If tap or well water is found to contain 1,4-dioxane, people may choose to use bottled water for drinking and cooking to reduce exposure. 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.

Do current drinking water treatment facilities reduce or remove these contaminants?

Some water systems may have elected to install treatment to address 1,4 dioxane, but without regulation, treatment is not required.

Can I bathe or shower with water containing 1,4-dioxane?

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.

Can I breastfeed my child if I drank water containing 1,4-dioxane?

Yes. 1,4-dioxane breaks down readily and is rapidly eliminated from the body. Furthermore, 1,4-dioxane has not been detected in breastmilk. Infant formula and other beverages for infants, such as juice, should be prepared with bottled water when levels of 1,4-dioxane are elevated in drinking water.

Information for Public Water Systems

Are systems required to sample for 1,4-dioxane?

Some systems were required to monitor for 1,4-dioxane under the third cycle of EPA's Unregulated Contaminant Monitoring Rule (2013 – 2015). This monitoring applied to all public water systems serving at least 10,000 people and a representative group of public water systems serving 10,000 people or fewer. The results from the sampling are publicly available on EPA's website located: <https://www.epa.gov/dwucmr>.

What should a system do if 1,4-dioxane has been detected in its supply?

It is strongly recommended that water systems with detections of 1,4-dioxane take the following steps:

- Conduct quarterly monitoring of the finished water at the treatment plant points of entry (POE);
- Conduct quarterly monitoring of raw water from the wells and surface water intakes serving the treatment plant to determine which sources may be contributing to the 1,4-dioxane levels;
- Analyze samples for 1,4-dioxane using a laboratory that is certified by NJDEP's Office of Quality Assurance to analyze for 1,4-dioxane using EPA Method 522, with a Minimum Reporting Level (MRL) of 0.1 µg/L.
- Submit sample results electronically to NJDEP through the E2 system.
- Evaluate whether it would be prudent to conduct quarterly monitoring for 1,4-dioxane at any other treatment plant(s) and wells that had lower concentrations.

What labs will analyze for 1,4-dioxane?

A list of laboratories that are NJ-certified for EPA Method 522 can be found here: <https://njems.nj.gov/DataMiner> then clicking on "Laboratories Certified by Analytical Method," and using the drop-down menu to find "EPA 522."

Note: On this webpage you will note that the "Matrix Description" is listed as "Non-Potable Water." A laboratory certified under a Non-Potable Water Matrix description may be used in addition to a laboratory certified under a Drinking Water Matrix Description, provided the laboratory uses EPA Method 522 and is capable of reporting 1,4-dioxane to 0.1 µg/L or lower.

How should I let my customers know if 1,4-dioxane has been detected in the water system?

Water systems may notify customers of detections through the Consumer Confidence Report or through a special notification. Links to NJDEP's 1,4-dioxane factsheet can be included to provide consumers with important health risk information. Systems that submit 1,4-dioxane results to NJDEP can refer customers to the Drinking Water Watch web page:

https://www9.state.nj.us/DEP_WaterWatch_public/index.jsp for the latest test results.

What treatment can be used to remove 1,4-Dioxane?

Advanced Oxidation Processes (AOPs) and/or an equally efficient technology should be considered for treatment of 1,4-dioxane, according to the Drinking Water Quality Institute (DWQI) draft Treatment Subcommittee Report. AOPs have been shown to be effective at reducing 1,4-Dioxane to below the draft DWQI MCL recommendation of 0.33 µg/L.

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 or surface 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.

Who should I contact if I am concerned about possible 1,4-dioxane levels in my water?

You may contact NJDEP's Bureau of Water System Engineering at watersupply@dep.nj.gov with "1,4 – Dioxane" in the Subject line.

Information for Private Well Owners

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://njems.nj.gov/DataMiner> then clicking on "Laboratories Certified by Analytical Method," and using the drop-down menu to find "EPA 522."

What are the types of home drinking water treatment devices available, and which are generally effective for 1,4-Dioxane contaminants?

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.