

# Appendix A: Summary of State Regulations, Policies, and Guidance for 1,4-Dioxane

## Alabama

Alabama has not developed any state-specific information for 1,4-dioxane. However, the Alabama Department of Environmental Management document [Alabama Risk-Based Corrective Action Manual Revision 3.0](#), dated February 2017, references the U.S. Environmental Protection Agency (USEPA) [Regional Screening Levels](#) for soil and groundwater.

Air emission regulations ([ADEM Admin. Code r. 335-3](#)) include 1,4-dioxane by referencing the List of Hazardous Pollutants included in the Clean Air Act Amendments of 1990. The rule references the [National Emission Standards for Hazardous Air Pollutants](#).

## Alaska

The Alaska Department of Conservation has regulations ([18 AAC Chapter 75](#)), summarized below for 1,4-dioxane in soil and groundwater, under its Spill Prevention and Response Program.

The groundwater cleanup level is 4.6 micrograms per liter (µg/L). The following standards have been adopted for soil in Alaska.

Soil Cleanup Levels			
Arctic zone	Under 40-inch zone	Over 40-inch zone	Migration to groundwater (mg/kg)
Human health (mg/kg)	Human health (mg/kg)	Human health (mg/kg)	
100	73	58	0.012

## Other

Alaska has published a document titled [Procedures for Calculating Cumulative Risk](#), dated February 1, 2018. This document contains additional human health risk-based concentrations associated with the exposure of 1,4-dioxane in soil and water.

## Arizona

Arizona does not have any regulations pertaining to 1,4-dioxane. The USEPA Regional Screening Levels (RSLs) have been referenced when assessing drinking water sources that have been contaminated with 1,4-dioxane.

## Arkansas

Arkansas has no specific regulations for 1,4-dioxane.

## California

The [California State Water Resources Control Board](#) has requested that the [Office of Environmental Health Hazard Assessment \(OEHHA\)](#) develop a [Public Health Goal](#), which is the first step in setting a maximum contaminant level (MCL).

The drinking water [notification level](#) for 1,4-dioxane is currently 1 µg/L. Certain [requirements and recommendations](#) apply to a water system if it serves its customers drinking water containing a contaminant greater than its notification level. [The public protective concentration is 3 µg/L](#). A [public health protective concentration](#) is a health-based advisory level that OEHHA develops for a chemical in drinking water for which there is no public health goal or formal regulatory standard. Like a public health goal, a public health protective concentration is based on a risk assessment, using the most current principles, practices, and methods in the fields of toxicology, epidemiology, and risk assessment. The susceptibility and exposure of infants and children are explicitly incorporated into the assessment. Regulatory entities can use a public health protective concentration as guidance in their management of potential drinking water sources where the chemical may be present. Like a public health goal, a public health protective concentration is not a boundary line between a “safe” and “dangerous” level of a contaminant. Drinking water can still be considered acceptable for public consumption if it contains a chemical at a level exceeding the public health protective concentration. The response level—that is, the level at which water systems must remove a source of water from service—is 35 µg/L. More information can be found at [https://www.waterboards.ca.gov/drinking\\_water/certlic/drinkingwater/14-Dioxane.html](https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/14-Dioxane.html).

California State Water Resources Board has developed numerous [environmental screening levels](#) for 1,4-dioxane in soil, groundwater, surface water, and indoor air for various environmental settings. Environmental screening levels are intended

to help expedite the identification and evaluation of potential environmental concerns at contaminated sites. [Environmental screening levels are not intended to establish policy or regulation.](#)

1,4-Dioxane is listed as a chemical known to cause cancer under California's [Safe Drinking Water and Toxic Enforcement Act of 1986](#) (commonly referred to as Prop 65). Prop 65 requires manufacturers, distributors, and retailers to provide warning labels on products containing 1,4-dioxane at concentrations expected to result in human exposures above the [Safe Harbor Level of 30 µg per day](#). Prop 65 also prohibits companies from discharging 1,4-dioxane to sources of drinking water. [California's Cleaning Products Right to Know Act](#) requires manufacturers to disclose all ingredients in cleaning products beginning in 2020 (online disclosure) and 2021 (on-label disclosure), including 1,4-dioxane if present in the final product at or above a concentration of 0.001% or 10,000 µg/L.

### **Colorado**

The Colorado Water Quality Control Commission has promulgated a groundwater standard of 0.35 µg/L in [Regulation 41, Basic Standards for Groundwater](#). The Water Quality Control Commission has promulgated a surface water standard of 0.35 µg/L in [Regulation 31, Basic Standards and Methodologies for Surface Water](#).

A guidance document published by the Colorado Department of Public Health and Environment provides soil cleanup concentration of 0.0016 mg/kg to protect groundwater quality.

### **Connecticut**

The Connecticut Department of Public Health has stabled a [drinking water action level for 1,4-dioxane of 3 µg/L](#).

If well contamination exceeds the action level, the Connecticut Department of Energy and Environmental Protection (CTDEEP) is authorized to take further action in addressing groundwater contamination at the site.

[The remediation standard regulations in Connecticut do not contain a numeric cleanup standard for 1,4-dioxane. However, 1,4-dioxane does require remediation using the procedures for Additional Polluting Substances.](#) CTDEEP has developed a document titled [Technical Support Document: Recommended Criteria Values for Common Additional Polluting Substances and Alternative Criteria Requests](#), dated September 2018, that provides the following recommended criteria for 1,4-dioxane in various types of environmental media.

Direct Exposure Criteria		Groundwater protection criteria	Surface water protection criteria	Indoor air	
Residential	Industrial/ commercial			Residential	Industrial/ commercial
(mg/kg)		(µg/L)		(mg/m <sup>3</sup> )	
6.1	57	3.0	960	0.24	1.635

CTDEEP requires site to collect environmental samples for 1,4-dioxane at sites where it has been detected or is a contaminant of concern.

### **Delaware**

The Delaware Department of Natural Resources and Environmental Control, in a February 2018 document titled [Screening Level Table](#), establishes screening levels for 1,4-dioxane. The document notes that the screening levels should be used for screening purposes only for the protection of human health and the environment and that the screening levels are not to be construed as site-specific cleanup levels. The following screening levels are listed for 1,4-dioxane:

- Soil: 5.3 mg/kg (references USEPA's RSLs)
- Groundwater (ingestion): 0.46 µg/L
- Sub Slab and Soil Gas (µg/m<sup>3</sup>): 18 µg/m<sup>3</sup>

### **District of Columbia**

The District of Columbia has no regulations pertaining to 1,4-dioxane.

### **Florida**

The Florida Department of Health has established a [health advisory level](#) for 1,4-dioxane of 0.35 µg/L.

The Florida Department of Environmental Protection established the following Water Cleanup Target Levels for 1,4-dioxane in [water](#) and [soil](#).

Groundwater Criteria (µg/L)	Freshwater surface water criteria (µg/L)	Marine surface water criteria (µg/L)	Groundwater of low-yield/poor quality criteria (µg/L)	Direct exposure—residential (µg/L)	Direct exposure—industrial (µg/L)
3.2	120	120	32	23	38

### Georgia

Georgia Environmental Protection Division has established a [groundwater standard](#) for 1,4-dioxane of 4.6 µg/L under its [Hazardous Site Response Regulations](#). It has also adopted [a regulation that requires notification](#) to the agency if 1,4-dioxane is detected in soil. The soil notification level for 1,4-dioxane is 0.13 mg/kg, or any concentration that is detected if the detection limit is lower than 0.13 mg/kg.

### Hawaii

In a fall 2017 document titled [Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater](#), Hawaii has established numerous action levels for 1,4-dioxane in soil, groundwater, surface water, and indoor air. These are summarized as follows:

Groundwater is current or potential source of drinking water				
	>150 m to surface water body		≤150 m to surface water body	
	Soil (mg/kg)	Groundwater (µg/L)	Soil (mg/kg)	Groundwater (µg/L)
1,4-dioxane	2.1E-04	4.6E-01	2.1E-04	4.6E-01

Groundwater is not current or potential source of drinking water				
	>150 m to surface water body		≤150 m to surface water body	
	Soil (mg/kg)	Groundwater (µg/L)	Soil (mg/kg)	Groundwater (µg/L)
1,4-dioxane	5.3E+00	5.0E+04	5.3E+00	5.0E+04

Indoor air and soil vapor				
	Indoor air action levels		Shallow soil vapor action levels	
	Residential (µg/m <sup>3</sup> )	Commercial/industrial (µg/m <sup>3</sup> )	Residential (µg/m <sup>3</sup> )	Commercial/industrial (µg/m <sup>3</sup> )
1,4-dioxane	5.6E-01	2.5E+00	1.1E+03	9.8E+03

Surface water action levels
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	Freshwater (µg/L)	Marine (µg/L)	Estuarine (µg/L)
1,4-dioxane	4.6E-01	5.0E+04	5.0E+04

### **Idaho**

Idaho has not established any specific regulations for 1,4-dioxane.

### **Illinois**

The Illinois Pollution Control Board has adopted a rule titled [Section 620.410 Groundwater Quality Standards for Class I: Potable Resource Groundwater Illinois](#) which specifies a groundwater standard for 1,4-dioxane of 7.7 µg/L.

### **Indiana**

The Indiana Department of Environmental Management annually publishes screening levels in [Table A-6 Screening Levels](#). The following screening levels for 1,4-dioxane in various media were included in the table published in 2020:

Soil exposure			Groundwater		Vapor exposure	
Direct contact			Soil MTG	Tap	Indoor air	
Residential	Commercial/ industrial	Excavation	Residential	Residential	Residential	Commercial/ industrial
(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(µg/L)	(µg/m <sup>3</sup> )	(µg/m <sup>3</sup> )
74	240	13,000	0.019	4.6	5.6	25

\*MTG: Migration to groundwater.

### **Iowa**

Chapter 137 of the Iowa Department of Natural Resources' voluntary cleanup rules prescribes statewide standards (SWSs) for groundwater. Iowa has established the following [Statewide Standards](#) for 1,4-dioxane in soil and groundwater.

- Protected groundwater source: 200 µg/L
- Nonprotected groundwater source: 1,000 µg/L
- Statewide standards for soil: 31 mg/kg

### **Kansas**

The Kansas Department of Health and Environment—Bureau of Environmental Remediation has established [Risk-Based Standards \(RSK\) for Kansas](#). The fifth version of the document was published in 2015 and contains the following standards for 1,4-dioxane:

Residential scenario			Nonresidential scenario			Soil saturation
Soil pathway	Groundwater	Soil-to- groundwater	Soil pathway	Groundwater	Soil-to-groundwater	
(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)
79.6	0.00849	0.0384	247	0.0285	0.129	126,000

### **Kentucky**

Kentucky Revised Statutes Title XVIII, Public Health [§224.1-530](#)—Screening Levels Relating to Remediation; Tiered Remediation Management; Administrative Regulations incorporates by reference USEPA RSLs as screening levels for use in

Kentucky.

### **Louisiana**

The Louisiana Department of Environmental Quality (DEQ) has not developed any regulatory values for 1,4-dioxane in soil or groundwater.

The Louisiana DEQ has adopted regulatory code [Title 33, Part III—Air](#), which stipulates emission and ambient air quality standards for 1,4-dioxane. The code requires that if emissions for 1,4-dioxane exceed 1,040 pounds per year, the owner must control emissions to a degree that constitutes Maximum Achievable Control Technology. The code also stipulates an ambient air standard of 2,140 µg/m<sup>3</sup> averaged over an 8-hour period.

### **Maine**

The Maine Center for Disease Control published [Maximum Exposure Guidelines for Drinking Water](#) in December 2016. The document specifies a Maximum Exposure Guideline of 4 µg/L for 1,4-dioxane in drinking water.

Maine published *Maine Remedial Action Guidelines (RAGs) for Sites Contaminated with Hazardous Substances* on October 19, 2018. The guidelines contain criteria for groundwater, soil air, and fish tissue.

Water RAG (µg/L)	
Residential	Construction worker
4.6	8,600

Soil RAG (mg/kg)					
Leaching to groundwater	Residential	Commercial worker	Park user	Recreator sediment	Construction worker
0.052	74	340	260	310	1,700

Air RAG (µg/m <sup>3</sup> )	
Residential	Commercial
5.6	25

The fish tissue RAG is 0.69 mg/kg.

### **Maryland**

The State of Maryland Department of the Environment published [Cleanup Standards for Soil and Groundwater—Interim Guidance](#) in October 2018. This document does not provide any specific regulatory values for 1,4-dioxane. However, it does incorporate by reference the May 2018 USEPA *Regional Screening Level User's Guide*[\[MG10\]](#) [\[LGA11\]](#) and associated USEPA risk assessment guidance to conduct a property-specific risk assessment.

### **Massachusetts**

The Massachusetts Department of Environmental Protection's Office of Research and Standards (Bell et al.) set a [drinking water guideline for 1,4-dioxane](#) of 0.3 µg/L.

The [Massachusetts Contingency Plan](#) (MCP) provides numerical standards to determine whether remediation is necessary at a site and when no further remedial response action is necessary. The MCP provides numerous promulgated [categories of standards](#) for 1,4-dioxane (Method 1 Standards) that can be used to determine if remediation is required at a site. The MCP also provides additional parameters for 1,4-dioxane that allow a site-specific risk assessment to be completed. The criteria that determine the applicability of the groundwater standards are described in regulation at 310 CMR 40.0932:

- Category GW-1: Concentrations based on the use of groundwater as drinking water, either currently or in the foreseeable future.
- Category GW-2: Concentrations based on the potential for volatile material to migrate into indoor air.
- Category GW-3: Concentrations based on the potential environmental effects resulting from contaminated groundwater discharging to surface water.

The criteria that determine the applicability of the soil standards are described in regulation at 310 CMR 40.0932.

MCP Method 1: Groundwater Standards Applicable in areas where the groundwater is considered to be one or more of the following categories per 310 CMR 40.0932		
GW-1	GW-2	GW-3
(µg/L)	(µg/L)	(µg/L)
0.3	6,000	50,000

MCP Method 1: Soil Category S-1 Standards Applicable to soil where the combination of soil and groundwater categories are:		
S-1 Soil & GW-1	S-1 Soil & GW-2	S-1 Soil & GW-3
(µg/g)	(µg/g)	(µg/g)
0.2	6	20

MCP Method 1: Soil Category S-2 Standards Applicable to soil where the combination of soil and groundwater categories are:		
S-2 Soil & GW-1	S-2 Soil & GW-2	S-2 Soil & GW-3
(µg/g)	(µg/g)	(µg/g)
0.2	6	90

MCP Method 1: Soil Category S-3 Standards Applicable to soil where the combination of soil and groundwater categories are:		
S-3 Soil & GW-1	S-3 Soil & GW-2	S-3 Soil & GW-3
(µg/g)	(µg/g)	(µg/g)
0.2	6	500

Direct Contact Exposure Based Soil Concentrations Applicable to the Specified Soil Category
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Soil Category S-1	Soil Category S-2	Soil Category S-3
(µg/g)	(µg/g)	(µg/g)
20	90	500

Remediation activities at contamination sites that require a discharge to surface water must comply with the [NPDES Remediation General Permit for New Hampshire and Massachusetts](#), which stipulates an effluent limitation of 200 µg/L for 1,4-dioxane.

### Michigan

The Department of Environmental Quality Remediation and Redevelopment Division adopted [R 299.44 Generic groundwater cleanup criteria](#), which contains the following groundwater, residential, and residential Part 201 generic cleanup criteria and screening levels for drinking water, surface water, groundwater, and indoor air.

Residential Drinking Water Criteria	Nonresidential drinking water criteria	Groundwater-surface water criteria	Flammability and explosivity screening level
(µg/L)	(µg/L)	(µg/L)	(µg/L)
7.2	350	2,800	1.4E+8

The Michigan Department of Environment, Great Lakes, and Energy has [adopted Rule 57 Surface Water Quality Values](#). Values associated with 1,4-dioxane are summarized below.

Human Health Values					
Human noncancer value (HNV) (µg/L)			Human cancer value (HCV) (µg/L)		
Drink value	Non-drink value	Tier	Drink value	Non-drink value	Tier
890	72,000	1	3.5	280	1

Aquatic Life Values					
Chronic (µg/L)		Acute (µg/L)			
Final chronic value (FCV)	Tier	Aquatic maximum value (AMV)		Final acute value (Horst et al.)	Tier
22,000	2	200,000		390,000	22

In an [interoffice communication dated January 29, 2014](#), the Michigan Department of Environmental Quality established updated screening levels for 1,4-dioxane. The screening levels include two new initial threshold screening levels (ITSLs) based on two different averaging times, and a revised initial risk screening level (IRSL) and secondary risk screening level (SRSL). The screening levels are as follows:

ITSL (1-hour averaging time): 7,200 µg/m<sup>3</sup>

ITSL (annual averaging time): 100 µg/m<sup>3</sup>

IRSL (annual averaging time): 0.2 µg/m<sup>3</sup>

SRSL (annual averaging time): 2 µg/m<sup>3</sup>

### Minnesota

Minnesota has established a [Drinking Water Guidance value for 1,4-dioxane](#) of 1 µg/L.

Minnesota included 1,4-dioxane in its [Remediation Division Soil Leaching Pathway Spreadsheet](#) in which site-specific parameters can be entered in the spreadsheet to calculate soil leaching values for a given site.

Minnesota has established [Tier 1](#) and [Tier 2 Soil Reference Values](#) for 1,4-dioxane. The Tier 1 Soil Reference Value for 1,4-dioxane is 150 mg/kg and is based on the assumption that human exposure to the contaminants is long term (chronic) and occurs in a residential site setting through a defined set of common exposure pathways. The Tier 2 Soil Reference Value for 1,4-dioxane is 250 mg/kg and is for human exposure scenarios based on industrial property use categories to enable the risk assessor to select the human exposure scenario that best fits the actual site use.

### Mississippi

The Mississippi Department of Environmental Quality has established [Tier 1 target remediation goal values](#) for 1,4-dioxane. A Tier 1 evaluation is the comparison of site-specific data to a look-up table of chemical-specific target remediation goals (TRGs)[[MG12](#)] [[BH13](#)]. Specific TRG concentrations have been determined to be protective of human health and the environment for restricted use and unrestricted use of a site.

	Groundwater (µg/L)	Soil—restricted (mg/kg)	Soil—unrestricted (mg/kg)
1,4-dioxane	6.09	5,200	58.1

### Missouri

The Missouri Department of Natural Resources has established the following [Lowest Default Target Levels](#) for 1,4-dioxane in soil and groundwater:

All Soil Types and Pathways		
	Soil—protection of domestic groundwater use pathway (mg/kg)	Groundwater—domestic water use of groundwater (µg/L)
1,4-dioxane	0.235	61

Additionally, the [Missouri Risk-Based Corrective Action Guidance Document](#) contains numerous additional risk-based target values for various media, soil types, and exposure scenarios.

### Montana

Montana has a [groundwater human health standard](#) for 1,4-dioxane of 3 µg/L. As part of its August 2012 study, [Typical Indoor Air Concentrations of Volatile Organic Compounds in Non-Smoking Montana Residences Not Impacted by Vapor Intrusion—A Montana Indoor Air Quality Investigation](#), the Montana Department of Environmental Quality established a Risk Screening Level of 0.32 g/m<sup>3</sup> for 1,4-dioxane in indoor air.

### Nebraska

In the September 2018 document [Nebraska Voluntary Cleanup Program Guidance Document](#), the Nebraska Department of Environmental Quality established numerous remediation goals for 1,4-dioxane in various media:

Groundwater and Remediation Goals			
	Direct contact exposure pathways		Protection of groundwater
	Groundwater (µg/L)	Soil (mg/kg)	Soil (dilution attenuation factor = 20)

	Residential	Residential	Industrial	Residential
1,4-dioxane	0.46	5.3	2,400	0.0019

Indoor Air, Soil Gas, and Groundwater Vapor Intrusion Remediation Goals						
	Indoor air (µg/m <sup>3</sup> )		Groundwater (µg/L)		Subslab and exterior soil gas (µg/m <sup>3</sup> )	
	Residential	Industrial	Residential	Industrial	Residential	Industrial
1,4-dioxane	0.56	25	6,500	280,000	19	8,200

### **Nevada**

The Nevada Division of Environmental Protection published [Basic Comparison Levels](#) for industrial sites in Henderson, Nevada. The Basic Comparison Levels included levels for 1,4-dioxane in soil, air, and water. The table and the supporting document, [User's Guide and Background Technical Document for the Nevada Division of Environmental Protection Basic Comparison Levels for Human Health for the BMI Complex and Common Areas](#), were updated in 2017. The Basic Comparison Levels table was not generated to represent action levels or final cleanup levels but rather as a technical screening tool to assist users in risk assessment components, such as the evaluation of data usability, determination of extent of contamination, identifying chemicals of potential concern, and identifying preliminary remediation goals.

Nevada Division of Environmental Protection—Basic Comparison Levels					
	Residential soil (mg/kg)	Indoor industrial/commercial worker w/o dermal soil (mg/kg)	Outdoor industrial/commercial worker soil (mg/kg)	Ambient air (µg/m <sup>3</sup> )	Residential water (µg/L)
1,4-dioxane	6.4	65.4	36.3	0.562	0.672

### **New Hampshire**

The New Hampshire Department of Environmental Services (NHDES) has adopted administrative rule [Env-Or 600—Contaminated Site Management](#), which specifies an Ambient Groundwater Quality Standard for 1,4-dioxane of 0.32 µg/L. This standard applies to all groundwater in New Hampshire and, in accordance with administrative rule [Env-Dw 707.02\(b\)](#), is also an enforceable drinking water standard for public water systems.

NHDES had adopted administrative rule Env-Wq 402—[Groundwater Discharge Permits and Registrations](#). Entities discharging nondomestic wastewater to the groundwater or domestic wastewater in excess of 10,000 gallons per day must obtain a groundwater discharge permit from NHDES. The permittee must demonstrate through routine monitoring that groundwater at the compliance monitoring locations that are downgradient of the designated discharge zone meets Ambient Groundwater Quality Standards. The Groundwater Discharge Permits and Registrations provide special provisions for 1,4-dioxane that allow 1,4-dioxane to exceed the Ambient Groundwater Quality Standard at the compliance monitoring locations because typical domestic wastewater contains 1,4-dioxane and it is not financially feasible to remove 1,4-dioxane from wastewater below a concentration of 0.32 µg/L. The rules do require the permittee to monitor nearby private and public drinking water supply wells and to mitigate impacts if water derived from these wells exceeds Ambient Groundwater Quality Standards. New Hampshire has not established a surface water quality standard for 1,4-dioxane. However, remediation activities at contamination sites that require a discharge to surface water must comply with the [NPDES Remediation General Permit for New Hampshire and Massachusetts](#), which stipulates an effluent limitation of 200 µg/L for 1,4-dioxane.

Administrative rule [Env-Or 606.19\[MG16\] \[LGA17\]](#) —Soil Remediation Criteria has established a 1,4-dioxane soil remediation standard of 5 mg/kg.

NHDES adopted administrative rule [Env-A 1400—Regulated Toxic Air Pollutants](#), which establishes the following limits for 1,4-dioxane emissions into air:

	24-hour ambient air limit (µg/m <sup>3</sup> )	Annual ambient air limit (µg/m <sup>3</sup> )	24-hour de minimis (lb/day)	Annual de minimis (lb/year)
1,4-dioxane	258	30	3.1	488

### **New Jersey**

The New Jersey Department of Environmental Protection has adopted Administrative Code N.J.A.C 7:9C — Ground Water Quality Standards, which establishes a 1,4-dioxane Ground Water Quality Criterion of 0.4 µg/L.

The New Jersey Department of Environmental Protection has adopted New Jersey Administrative Code 7:27-17, which establishes a reporting threshold of 9 pounds (Johnson)/year and state-of-the-art treatment thresholds of 10,000 lbs/year for air emissions associated with 1,4-dioxane.

### **New Mexico**

The New Mexico Environment Department published [Risk Assessment Guidance for Site Investigations and Remediation Volume I Soil Screening Guidance for Human Health Risk Assessments](#) in March 2017. The document includes soil and tap water screening levels for 1,4-dioxane.

Residential Soil, Cancer (mg/kg)	Residential soil, noncancer (mg/kg)	Industrial/ occupational soil, cancer (mg/kg)	Industrial/ occupational soil, noncancer (mg/kg)	Construction worker soil, cancer (mg/kg)	Construction worker soil, noncancer (mg/kg)
53.3E	1,850	257	27,500	1,880	7,850

Tap Water, Cancer (µg/L)	Tap water, noncancer (µg/L)	Risk-based soil screening level—Dilution Attenuation Factor 1 (mg/kg)	Risk-based soil screening level—Dilution Attenuation Factor 20 (mg/kg)
4.59	56.7	0.000814	0.0163

Residential Indoor Air (µg/m <sup>3</sup> )	Residential vapor intrusion screening level—soil gas (µg/m <sup>3</sup> )	Residential vapor intrusion screening level—groundwater (µg/L)	Industrial indoor air (µg/m <sup>3</sup> )	Industrial vapor intrusion screening level—soil gas (µg/m <sup>3</sup> )	Industrial vapor intrusion screening level—groundwater (µg/L)
5.62	187	28,500	27.5	918	140,000

### **New York**

The New York State Department of Health is currently [in the process of adopting a drinking water MCL](#) of 1 µg/L for 1,4-dioxane. Public water systems must routinely sample and report results for MCLs to demonstrate compliance. No other state has adopted an MCL for 1,4-dioxane.

The New York Department of Environmental Conservation (NYDEC) has adopted [6 CRR-NY 375-6.8](#), which establishes a Unrestricted Use Soil Cleanup Objective of 0.1 mg/kg for 1,4-dioxane. For restricted-use soil cleanup objectives, New York has established the following values:

Restricted Use Soil Cleanup Objectives (SCOs)
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Residential (mg/kg)	Restricted-residential (mg/kg)	Commercial (mg/kg)	Industrial (mg/kg)	Protection of ecological resources (mg/kg)	Protection of groundwater (mg/kg)
9.8	13	130	250	0.1*	0.1

\*For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the SCO value.

In May 2010, NYDEC published [DER-10—Technical Guidance For Site Investigation and Remediation](#). This document established an Allowable Constituent Level for Imported Fill or Soil Subdivision of 0.1 mg/kg for all land uses.

[Environmental Conservation Law \(ECL\) Article 35](#) and [Part 659 of Title 6 of the New York Code of Rules and Regulations \(NYCRR\)](#) require that manufacturers of household cleansing products sold in New York State disclose information about the cleaning products if the concentration of 1,4-dioxane exceeds 0.35 µg/L.

#### **North Carolina**

The North Carolina Department of Environmental Quality (NCDEQ) has adopted [15A NCAC 02L.0202](#) Groundwater Standards, which include a groundwater standard for 1,4-dioxane of 3 µg/L.

The February 2018 document titled [North Carolina Department of Environmental Quality Preliminary Soil Remediation Goals](#) gives preliminary soil remediation goals for 1,4-dioxane based on the November 2017 USEPA Regional Screening Tables:

Preliminary Soil Remediation Goals		
Residential (mg/kg)	Industrial/commercial health based (mg/kg)	Protection of groundwater (mg/kg)
5.4	25	0.012

The NCDEQ has published the [North Carolina Division of Water Resources Surface Water Quality Standards, Criteria, and In-Stream Target Values](#), which establish a target value for 1,4-dioxane of 0.35 µg/L for surface water that is used as a water supply and 80 µg/L for fresh and salt surface water where fish may be consumed.

#### **North Dakota**

North Dakota has no regulations pertaining to 1,4-dioxane.

#### **Ohio**

Ohio has adopted [Generic Numerical Standards—3745-300-08](#) for hazardous substances and petroleum. These standards include the following provisions for 1,4-dioxane in groundwater and soil:

Generic Direct-Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern— Residential Land Use Category			
Standard for single chemical noncarcinogen (mg/kg)	Standard for single chemical carcinogen (mg/kg)	Soil saturation (mg/kg)	Generic direct-contact soil standard for a single chemical (mg/kg)
7,400	260	270,000	260

Generic Direct-Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern—Commercial and Industrial Land Use Categories			
Standard for single chemical noncarcinogen (mg/kg)	Standard for single chemical carcinogen (mg/kg)	Soil saturation (mg/kg)	Generic direct-contact soil standard for a single chemical (mg/kg)

160,000	600	270,000	600
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Generic Direct-Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern— Construction and Excavation Category			
Standard for single chemical noncarcinogen (mg/kg)	Standard for single chemical carcinogen (mg/kg)	Soil saturation (mg/kg)	Generic direct-contact soil standard for a single chemical (mg/kg)
87,000	2,300	270,000	2,300

Risk-Derived Generic Unrestricted Potable Use Standards		
Standard for single chemical noncarcinogen (µg/L)	Standard for single chemical carcinogen (µg/L)	Generic unrestricted potable use standard for a single chemical (µg/L)
1,600	140	140

## Oregon

In October 2017, the Oregon Department of Environmental Quality published a document titled [Risk-Based Decision Making for the Remediation of Contaminated Sites](#), with risk-based concentrations for 1,4-dioxane in groundwater, soil, and air.

Groundwater (µg/L)			Groundwater (µg/L)		
Ingestion and inhalation from tap water			Volatilization to outdoor air		
Residential	Urban residential	Occupational	Residential	Urban residential	Occupational
5.2	8.9	37	1,600,000	3,400,000	9,100,000

Soil (mg/kg)					Soil (mg/kg)		
Surface soil ingestion, dermal contact, and inhalation					Volatilization to outdoor air		
Residential	Urban residential	Occupational	Construction worker	Excavation worker	Residential	Urban residential	Occupational
53	140	240	1,800	50,000	83	180	470

Soil (mg/kg)	Soil (mg/kg)
Soil vapor intrusion into buildings	Soil leaching to groundwater

Residential	Urban residential	Occupational	Residential	Urban residential	Occupational
100	220	1,700	0.048	0.083	0.35

Groundwater (µg/L)			Groundwater (µg/L)	Air (µg/m <sup>3</sup> )		
Vapor intrusion into buildings			GW in excavation	Inhalation		
Residential	Urban residential	Occupational	Excavation worker	Residential	Urban residential	Occupational
660,000	1,400,000	11,000,000	1,800,000	0.65	1.4	3.7

The Oregon Department of Environmental Quality and the Oregon Health Authority are developing the [Cleaner Air Oregon program](#). The agencies use toxicity reference values to evaluate potential toxic air contaminant risks to people near commercial facilities and reduce those risks below action levels adopted into law or rules. The toxicity reference value is the concentration of a toxic air contaminant below which health effects are not expected to occur, even in sensitive people, based on the best available science. The toxicity reference values are published by the Oregon Department of Environmental Quality in [OAR 340-245-8010 Table 1-Risk Action Levels and De Minimis Levels](#). The toxicity reference values for 1,4-dioxane in the rules are shown below:

Chronic Cancer (µg/m <sup>3</sup> )	Chronic noncancer (µg/m <sup>3</sup> )	Acute noncancer (µg/m <sup>3</sup> )
0.20	30	7,200

Additional risk-based concentrations for 1,4-dioxane in air are provided in [OAR 340-245-8050 Table 5 Risk-Based Concentrations](#).

Residential Chronic		Nonresidential Chronic				Acute
Cancer (µg/m <sup>3</sup> )	Noncancer (µg/m <sup>3</sup> )	Child cancer (µg/m <sup>3</sup> )	Child noncancer (µg/m <sup>3</sup> )	Worker cancer (µg/m <sup>3</sup> )	Worker noncancer (µg/m <sup>3</sup> )	Noncancer (µg/m <sup>3</sup> )
0.20	30	5.0	130	2.4	130	7,200

The Oregon Health Authority (Karges, Becker, and Püttmann) has adopted rule [333-016-2020—Chemicals of High Concern to Children](#), which includes 1,4-dioxane as a high-priority chemical of concern for children's health when used in children's products. The [rules](#) stipulate the notification requirements for manufacturers regarding chemicals of high concern to children. The rules require manufacturers to notify the OHA if 1,4-dioxane is present in children's products in amounts exceeding 1 mg/kg or 1 mg/L. OHA is currently developing rules to address removing chemicals of high concern to children from products.

The Oregon Health Authority has identified 1,4-dioxane as a solvent that may be used to extract or concentrate the active ingredients from cannabis. In an August 2015 [technical report](#), it set an action level of 380 µg/g for 1,4-dioxane contamination in cannabis products.

### Pennsylvania

The Pennsylvania Department of Environmental Protection Land Recycling Program has established Medium Specific Concentrations for 1,4-dioxane in groundwater in [Appendix A, Table 1](#), of regulation [25 Pa. Code Chapter 250, Administration](#)

[of the Land Recycling Program \(Act 2 cleanup standards\).](#)

Concentrations of 1,4-Dioxane in Groundwater					
Used aquifers				Nonuse aquifers	
Total dissolved solids ≤2,500 mg/L		Total dissolved solids >2,500 mg/L			
Residential (µg/L)	Nonresidential (µg/L)	Residential (µg/L)	Nonresidential (µg/L)	Residential (µg/L)	Nonresidential (µg/L)
6.4	32	640	3200	64	320

### **Puerto Rico**

Puerto Rico has no regulations pertaining to 1,4-dioxane. USEPA's RSLs have been used at one site to address 1,4-dioxane contamination.

### **Rhode Island**

Rhode Island has no regulations pertaining to 1,4-dioxane in soil or water at this time.

In a September 2008 document, [Rhode Island Air Toxics Guidelines](#), the Rhode Island Department of Environmental Management provides guidelines for acceptable ambient levels of 1,4-dioxane in air as summarized below:

Proposed Acceptable Ambient Levels (AALs) in $\text{m(g/m}^3\text{)}$		
1-hour AAL	Annual AAL	
Level	For all other processes	For processes that achieved the lowest achievable emissions rate
3,000	0.1	1

The guideline also provides a minimum quantity for 1,4-dioxane in air. The minimum quantity is designed to correspond to a quantity of a substance that, if emitted under poor dispersion conditions, would result in an ambient groundwater level impact no higher than the AAL for that substance. The minimum quantity for the emission of 1,4-dioxane to air is 10.95 pounds per year.

### **South Dakota**

South Dakota requires new potential public drinking water systems to test for an initial suite of compounds during installation and certification of the system

(<https://danr.sd.gov/OfficeOfWater/DrinkingWater/DrinkingWaterRequirementsForNewSystems.aspx>). The list of analytes required for initial certification of new public drinking water systems includes 1,4-dioxane by reference to the USEPA 2006 Edition of Drinking Water Standards and Health Advisories.

### **South Carolina**

South Carolina has no regulations pertaining to 1,4-dioxane.

### **Tennessee**

The Tennessee Department of Environment and Conservation's Voluntary Cleanup program [references](#) USEPA's RSLs as cleanup values for 1,4-dioxane.

### **Texas**

The Texas Commission on Environmental Quality (TCEQ) has established [remediation health-based protective concentration levels \(PCLs\)](#) for groundwater, soil, and air. These levels are applied under the Texas Risk Reduction Program (TRRP) at remediation sites. The PCL for groundwater in a residential setting is  $9.1 \mu\text{g/L}$ . Texas has numerous additional health-based levels for 1,4-dioxane in various settings and media, summarized in [10 tables that accompany](#) the TRRP Rule.

### **Utah**

Utah has no regulations pertaining to 1,4-dioxane.

### **Vermont**

The State of Vermont Agency of Natural Resources Department of Environmental Conservation has adopted [Chapter 12 of the Environmental Protection Rules: Groundwater Protection Rule and Strategy](#). This rule includes a groundwater enforcement standard and preventative action level of 0.3 µg/L for 1,4-dioxane in groundwater.

The agency has also adopted Chapter 35 of the Environmental Protection Rules: Investigation and Remediation of Contaminated Properties Rule. These rules contain the standards below for 1,4-dioxane in soil:

Vermont Soil Standards	
Resident soil (mg/kg)	Nonresident soil (mg/kg)
2.8	17

### **Virginia**

Virginia has no regulation pertaining to 1,4-dioxane.

### **Washington**

The State of Washington Department of Ecology has adopted [WAC 173-200-040](#), which establishes water quality criteria for groundwater. The rule includes a criterion of 7.0 µg/L for 1,4-dioxane. The department has also published [Cleanup Levels and Risk Calculation \(CLARC\) tables](#). The tables provide generic assumptions and values for 1,4-dioxane and other hazardous substances for varying exposure scenarios that can be used to calculate the total risk associated with a single or multiple hazardous substances in soil or groundwater at a site.

### **West Virginia**

The West Virginia Department of Environmental Protection has adopted [60CSR3—Voluntary Remediation and Redevelopment Rule](#), which includes the de minimis values for 1,4-dioxane shown below:

Residential Soil (mg/kg)	Industrial soil (mg/kg)	Groundwater (µg/L)	Migration to water (mg/kg)
5.4	400	0.46	0.000094

### **Wisconsin**

The Wisconsin Department of Natural Resources has adopted administrative code [NR 140—Groundwater Quality](#). This rule includes an enforcement standard for 1,4-dioxane of 3 µg/L. Enforcement standards establish the level of contaminants that may be in drinking water or groundwater. Wisconsin also has preventive action limits to inform the department of potential groundwater contamination problems, establish the level of groundwater contamination at which the department is required to commence efforts to control the contamination and provide a basis for design and management practice criteria in administrative rules. Wisconsin's preventive action limit for 1,4-dioxane is 0.3 µg/L. Wisconsin relies upon [USEPA's Regional Screening Level web calculator](#) to calculate soil residual contaminant levels (soil cleanup standards).

### **Wyoming**

The Wyoming Department of Environmental Quality Solid and Hazardous Waste Division has established the cleanup levels for 1,4-dioxane in soil and water shown below:

Residential Soil (mg/kg)	Migration to groundwater (mg/kg)	Water cleanup levels (µg/L)
5.30	0.000180	0.897