

Ground Water Quality Standard

1,4-Dioxane

CASRN# 123-91-1

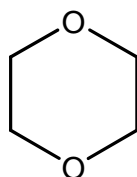
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NJDEP

Summary of Decision: In accordance with the New Jersey Ground Water Quality Standards rules at N.J.A.C. 7:9C-1.7, the Department of Environmental Protection (Department) has developed an interim specific ground water quality criterion of 0.4 µg/L and PQL of 0.1 µg/L for 1,4-dioxane. The basis for this criterion and PQL are discussed below. Pursuant to N.J.A.C. 7:9C-1.9(c), **the applicable constituent standard is 0.4 µg/L.**

1,4-Dioxane
1, 4-Diethylene dioxide
Molecular Formula: C₄H₈O₂

Molecular Structure:



Background: 1,4-Dioxane is used as a solvent and a laboratory reagent. It is also found as a trace contaminant in the manufacture of cosmetics.

Derivation of Ground Water Quality Criterion: 1,4-Dioxane had been previously evaluated by the U.S. Environmental Protection Agency (USEPA) in 1988 and was classified as a Group B2 Probable Human Carcinogen. The IRIS assessment for 1,4-dioxane was updated on August 11, 2010 and again in September 2013 (see chronology in USEPA, 2013a), and is supported by a Toxicological Review document (USEPA, 2013b). The updated IRIS assessment classifies 1,4-dioxane as likely to be carcinogenic to humans and provides an updated slope factor of 0.10 (mg/kg/day)⁻¹. The current slope factor, is based on liver tumors in female mice in a more recent study (Kano et al., 2009) which provides a more sensitive endpoint for carcinogenicity than the previously used studies.

For chemicals classified as likely to be carcinogenic to humans, the cancer slope factor is used to develop a ground water quality criterion at the 10⁻⁶ risk level. The ground water quality criterion was derived pursuant to the formula established in the New Jersey Ground Water Quality Standards rules at N.J.A.C. 7:9C-1.7(c)4, using 0.10 (mg/kg/day)⁻¹ as the cancer slope factor (as explained above) and standard default assumptions:

$$\frac{(10^{-6} / 0.10 \text{ (mg/kg/day)}^{-1}) \times 70 \text{ kg}}{2 \text{ L/day}} = 0.00035 \text{ mg/L or } 0.35 \mu\text{g/L or } 0.4 \mu\text{g/L}$$

rounded to one significant figure

Where:

10^{-6} = Risk Level

$0.10 \text{ (mg/kg/day)}^{-1}$ = Cancer Slope Factor

70 kg = assumed body weight of average person

2 L/day = assumed daily drinking water intake

Derivation of PQL: The method detection limit (MDL) and the practical quantitation level (PQL) are performance measures used to estimate the limits of performance of analytical chemistry methods for measuring contaminants. The MDL is defined as "the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analytic concentration is greater than zero" (40 CFR Part 136 Appendix B). 1,4-dioxane appears as a listed parameter in a published USEPA Method 522 entitled; "*DETERMINATION OF 1,4-DIOXANE IN DRINKINGWATER BY SOLID PHASE EXTRACTION (SPE) AND GAS CHROMATOGRAPHY/ MASS SPECTROMETRY (GC/MS) WITH SELECTED ION MONITORING (SIM).*" The published detection level (DL) range for water is 0.020 $\mu\text{g/L}$ to 0.026 $\mu\text{g/L}$ depending on the absorbent cartridge used to isolate this compound. Using the Department's standard practice for calculating a Practical Quantification Level this DL is multiplied by a factor of five (5) which results in a PQL value of 0.1 ppb.

Conclusion: Based on the information provided above (and cited below), the Department has established an interim specific ground water quality criterion of 0.4 $\mu\text{g/L}$ and a PQL of 0.1 $\mu\text{g/L}$ (ppb) for 1,4-dioxane. Pursuant to N.J.A.C. 7:9C-1.9(c), since the criterion is higher than the PQL, **the applicable constituent standard for 1,4-dioxane is 0.4 $\mu\text{g/L}$.**

Technical Support Documents: *Interim Specific Ground Water Quality Criterion Recommendation Report for 1,4-Dioxane*, Gloria Post, Ph.D., NJDEP, October 29, 2010; *Procedure for Describing Process for Development of Analytical Practical Quantitation Levels (PQLs) for 1,4-Dioxane*, R. Lee Lippincott, Ph.D., NJDEP, October 8, 2014.

References:

Kano H; Umeda Y; Kasai T; Sasaki T; Matsumoto M; Yamazaki K; Nagano K; Arito H; Fukushima S (2009). *Carcinogenicity studies of 1,4-dioxane administered in drinking-water to rats and mice for 2 years*. Food Chem Toxicol, 47: 2776-2784.

NCI (1978). *Bioassay of 1,4-dioxane for possible carcinogenicity*. National Cancer Institute. Bethesda, MD. 78-1330 NCICGTR-80. http://ntp.niehs.nih.gov/ntp/htdocs/LT_rpts/tr080.pdf

USEPA (2013a). *Integrated Risk Information System. 1,4-Dioxane* (CASRN 123-91-1). Last updated on 9/21/2013. http://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0326_summary.pdf

USEPA (2010b). *Toxicological Review of 1,4-Dioxane* (CAS No. 123-91-1). EPA/635/R-09/005-F. September 2013. http://cfpub.epa.gov/ncea/iris/iris_documents/documents/toxreviews/0326tr.pdf



New Jersey Department of Environmental Protection
Water Monitoring and Standards
Bureau of Environmental Assessment, Restoration and Standards
www.state.nj.us/dep/wms/bears/
(609) 633-1441

