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Email: info@aquilogic.com
Telephone: +1.714.770.8040

1,4-Dioxane
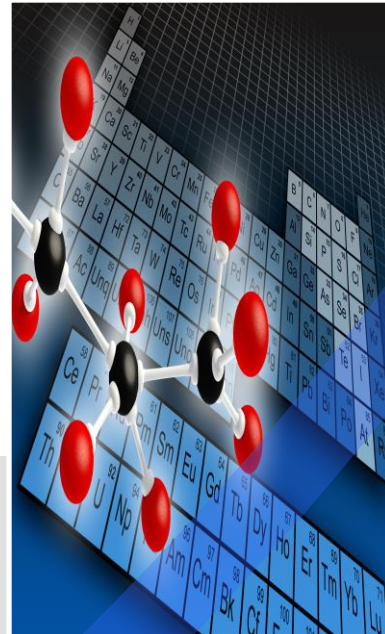
The 1,4-Dioxane Experts

Responsible Party Identification

GIS and Geomatics

Contaminant Hydrogeology

Fate and Transport Modeling

Risk Assessment

Remediation Feasibility Studies

Soil and Groundwater Remediation

Natural Resource Damage Assessment

Water Resources Assessment

Source Water Assessment and Protection

Drinking Water Treatment

Environmental Risk Management

Litigation Support/Expert Witness

Forensic Engineering

Stakeholder/Public Participation

Regulatory Strategy

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1,4-Dioxane Properties

Molecular Weight	Density	Solubility	Henry's Law Constant K_h	Octanol-Water Partition Coefficient (log K_{ow})	log K_{oc}
g	g/cm³ at 20°C	mg/l at 25°C	kPa m³/mol at 25°C	unitless	unitless
88.10	1.034[1]	Miscible[1]	4.94 x 10⁻⁴[2]	-0.27[2]	1.23[3]

Composition of 1,1,1-TCA From Various Manufacturers[4]

Compound	Fischer	Vulcan	J.T. Baker	PPG	Unocal Chemical	Occidental Chemical	GW Chemical
1,1,1-TCA	95%	> 95%	96 - 100%	95%	96 - 98%	96 - 97.5%	95%
1,4-dioxane	~5%		< 3%		0 - 4%	2 - 2.7%	0%
Nitromethane						0.2 - 0.5%	
1,2-butylene oxide		< 0.5%	< 0.5%				
sec-butanol				< 2%			1 - 2%
1,3-dioxolane		< 3%		< 2%			2%

Affected California Drinking Water Sources and Systems[5]

County	Number of Sources	Number of Systems	Maximum Detected Concentration (µg/L)
Los Angeles	52	20	28
Monterey	1	1	3.9
Orange	24	13	27
Sacramento	2	1	1.1
TOTAL	79	35	-

Notes to Tables:
1. Riddick JA, Bunger WB, Sakano TK. 1986. 1,4-Dioxane. In: Organic solvents. Physical properties and methods of purification. New York, NY: John Wiley & Sons, 312, 938.
2. Howard JA, Ingold KU. 1969. Absolute rate constants for hydrocarbon autoxidation XVII. The oxidation of some cyclic ethers. Can J Chem.
3. Lyman WJ, Reehl WF, Rosenblatt DH. 1982. Handbook of chemical property estimation methods:
4. Environmental behavior of organic compounds. New York: McGraw-Hill Book Company, 9-64.
5. Santa Clara Valley Water District. 2001. 1,4-Dioxane and other Solvent Stabilizers. June 14.
6. California Department of Public Health as of November 2011.
7. USGS. (2006). Description, Properties, and Degradation of Selected Volatile Organic Compounds Detected in Groundwater – A Review of Selected Literature. Open-File Report 2006-1338.
8. CDPH. (2011). MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants. July 27.

Regulatory Levels

Criteria	Concentration
Risk based Soil Screening Level for Protection of Groundwater (ug/kg)[6]	0.14 ug/kg
Response Level (CA)	35 ug/l
Notification Level (CA)	1 ug/l

Understanding 1,4-Dioxane
1,4-Dioxane is a semi-volatile, colorless liquid with a mild ethereal odor, also known as diethylene dioxide, dioxane, or p-dioxane. It is miscible with water, oils and most chlorinated solvents. It is also flammable and, during storage, may form explosive peroxides.

Sources
1,4-Dioxane is primarily used as a stabilizer in chlorinated solvents. At one time, approximately 90% of the 1,4-Dioxane produced went into the production of 1,1,1-trichloroethane (TCA). This application has now been phased out due to TCA's destructive effects on atmospheric ozone. Industries or processes in which 1,4-Dioxane is used, or is associated, include:
- Chlorinated solvents manufacturing (as a stabilizer)
- Organic chemical manufacturing
- Textile processing
- Paper manufacturing
- Varnish stripper and paint production
- Pesticide production

Releases to the Environment
In the U.S., approximately 10 million pounds (lbs) of 1,4-Dioxane are produced per year. When released into the air, 1,4-Dioxane degrades relatively quickly through reactions with photochemically-produced hydroxyl radicals. However, degradation in water and soil is slow. For this reason, 1,4-Dioxane is persistent in the environment, and will remain present in areas of groundwater contamination.

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