



## Department of Environmental Protection

One Winter Street Boston, MA 02108 • 617-292-5500

DEVAL L. PATRICK  
Governor

TIMOTHY P. MURRAY  
Lieutenant Governor

RICHARD K. SULLIVAN JR.  
Secretary

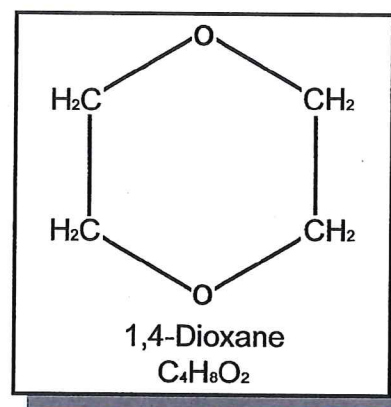
KENNETH L. KIMMELL  
Commissioner

### 1,4-Dioxane

#### What is 1,4-Dioxane?

1,4-Dioxane ( $C_4H_8O_2$ ) is a clear liquid that easily dissolves and moves quickly in water. Once dissolved into water, it does not easily leave the water and enter into air. It is used primarily as a solvent in the manufacture of chemicals; as a laboratory reagent; and as a stabilizer and an adhesive. 1,4-dioxane may also be present in trace amounts in cosmetics, detergents, and shampoos.

[Note: 1,4-dioxane is not the same as “dioxin,” which is a much different type of chemical.]



#### How Might I be Exposed to 1,4-Dioxane?

Any chemical that enters your body can be harmful if you take in too much. Whether your health will be affected by a chemical that gets into your body depends on several factors:

- How much of the chemical you take in.
- How long you are exposed to it.
- How it enters the body (for example, eating, drinking, breathing, or touching).
- Your age, general health and other individual traits.
- Other exposures you have to the same or similar chemicals.
- How toxic the chemical is.

Human exposure to 1,4-dioxane can occur if contaminated water is consumed directly or used to make beverages such as tea, coffee or formula. Because 1,4-dioxane is highly soluble in water, dermal absorption of 1,4-dioxane as a result of skin contact during showering and bathing is less of a concern, although children may be incidentally exposed by ingesting water during bathing. Showering is not an exposure pathway of concern, because the possible inhalation of aerosolized particles in the air is less likely and 1,4-dioxane does not readily evaporate from water.

## **What Are The Health Effects Of 1,4-Dioxane?**

Government agencies believe that 1,4-dioxane is likely to be carcinogenic to humans, based upon evidence from laboratory studies. High doses of 1,4-dioxane over long periods of time have caused liver and nasal cancer in several animal studies.

There are also non-cancer health effects that may be associated with exposure to 1,4-dioxane. Very high levels 1,4-dioxane can affect the nervous system causing loss of coordination, tiredness, dizziness and headache. These high levels can also cause liver and kidney damage. Such obvious effects are very unlikely if you are exposed to low levels of 1,4-dioxane in drinking water. 1,4-dioxane is unlikely to cause birth defects or effects on fertility, although there are only a few studies in this area.

## **What Is The Drinking Water Standard For 1,4-Dioxane?**

MassDEP has not set a drinking water standard for 1,4-dioxane. State drinking water standards apply to public water supply systems and are called Massachusetts Maximum Contaminant Levels (MMCLs). However, MassDEP has established a state drinking water guideline of 0.3 µg/L (micrograms per liter, which can also be described as parts-per-billion, or 'ppb') based on potential cancer risk.

The Massachusetts Waste Site Cleanup Program has set cleanup standards for groundwater contaminated with 1,4-dioxane, including a standard for groundwater that is or may be a source of drinking water (category GW-1). The GW-1 standard for 1,4-dioxane is currently 3 µg/L, although the standard is being revised to be consistent with the drinking water guideline of 0.3 µg/L. Depending upon site-specific conditions, target cleanup levels for 1,4-dioxane in GW-1 groundwater may be as high as 5 µg/L, where No Significant Risk can exist, even if the existing risk standard is exceeded. Again, this is dependent upon site specific conditions and may not apply to every site with 1,4-dioxane contamination.

## **What Is The Basis For The 1,4-Dioxane Drinking Water Guideline And the Proposed GW-1 Standard?**

The drinking water guideline is calculated using the US EPA's toxicity information for 1,4-dioxane and assumes that an adult ingests 2 liters per day of contaminated water throughout a 70-year lifetime. In order to limit exposure to concentrations of carcinogenic chemicals as much as possible, the Massachusetts drinking water guidelines for these chemicals are set at an excess lifetime cancer risk of one-in-one million, or at the lowest practical quantitation limit.

For target cleanup levels under the Massachusetts Contingency Plan, the drinking water guideline is simply adopted as the groundwater category GW-1 standard, although alternative cleanup levels that meet a cumulative excess lifetime cancer risk limit of one-in-one hundred thousand may also be proposed on a case-by-case basis.