Rolling Revision of the
WHO Guidelines for Drinking-Water Quality

Draft for review and comments
(Not for citation)

1,4 Dioxane in drinking-water
Summary statement

World Health Organization
July 2004
**1,4-Dioxane**

1,4-Dioxane is used as a stabilizer in chlorinated solvents, as a solvent, for agricultural and biochemical intermediates and for adhesives, sealants, cosmetics, pharmaceuticals, rubber chemicals and surface coatings.

<table>
<thead>
<tr>
<th><strong>Guideline value</strong></th>
<th>50 µg/litre (derived using TDI approach as well as linear multistage modelling)</th>
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</thead>
<tbody>
<tr>
<td><strong>Occurrence</strong></td>
<td>Has been measured in surface water at concentrations up to 40 µg/litre and in groundwater at concentrations up to 80 µg/litre</td>
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<tr>
<td><strong>TDI</strong></td>
<td>16 µg/kg of body weight, based on a NOAEL of 16 mg/kg of body weight per day for hepatocellular tumours observed in a long-term drinking-water study in rats, using an uncertainty factor of 1000 (100 for inter- and intraspecies variation and 10 for non-genotoxic carcinogenicity)</td>
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| **Guideline derivation** | 10% of TDI  
- allocation to water  
- weight  
- consumption  
60-kg adult  
2 litres/day |
| **Basis of guideline derivation based on carcinogenicity** | Linear multistage model applied to data for hepatic tumours from drinking-water studies in rats, without body surface correction |
| **Limit of detection** | 0.1 and 50 µg/litre by GC/MS |
| **Treatment achievability** | Not removed using conventional water treatment processes; effectively removed by biological activated carbon treatment |
| **Additional comments** | Similar guideline values were derived using the TDI approach (assuming 1,4-dioxane is not genotoxic in humans at low doses) and linear multistage modelling (because the compound clearly induces multiple tumours in various organs). |

**Toxicological Review**

1,4-Dioxane caused hepatic and nasal cavity tumours in rodents in most long-term oral studies conducted. Tumours in peritoneum, skin and mammary gland were also observed in rats given a high dose. Lung tumours were specifically detected after intraperitoneal injection. Although cohort studies of workers did not reveal any elevation in the incidence of death by cancer, a significant increase in the incidence of liver cancer was found in a comparative mortality study. However, the evidence is inadequate for human carcinogenicity assessment because of small samples or lack of exposure data. A possibly weak genotoxic potential of 1,4-dioxane has been suggested. IARC has classified 1,4-dioxane as Group 2B (possibly carcinogenic to humans).

**History of Guideline Development**

1,4-Dioxane was not referred to in the 1958, 1963 and 1971 WHO International Standards for Drinking-water, the first edition of the Guidelines for Drinking-water...

Principal Reference