12.33 Cyanide

Cyanides can be found in some foods, particularly in some developing countries, and they are occasionally found in drinking-water, primarily as a consequence of industrial contamination.

<table>
<thead>
<tr>
<th>Guideline value</th>
<th>0.07 mg/litre</th>
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<tr>
<td>Occurrence</td>
<td>Occasionally found in drinking-water</td>
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**TDI**

12 μg/kg of body weight, based on a LOAEL of 1.2 mg/kg of body weight per day for effects on behavioural patterns and serum biochemistry in a 6-month study in pigs, using an uncertainty factor of 100 for inter- and intraspecies variation (no additional factor for use of a LOAEL instead of a NOAEL was considered necessary because of doubts over the biological significance of the observed changes).

**Limit of detection**

2 μg/litre by titrimetric and photometric techniques.

**Treatment achievability**

Cyanide is removed from water by high doses of chlorine.

**Guideline derivation**

- allocation to water: 20% of TDI (because exposure to cyanide from other sources is normally small and because exposure from water is only intermittent)
- weight: 60-kg adult
- consumption: 2 litres/day

**Additional considerations**

The guideline value is considered to be protective for acute and long-term exposure.

**Toxicological review**

The acute toxicity of cyanides is high. Effects on the thyroid and particularly the nervous system were observed in some populations as a consequence of the long-term consumption of inadequately processed cassava containing high levels of cyanide.

**History of guideline development**

The 1958 WHO *International Standards for Drinking-water* recommended a maximum allowable concentration of 0.01 mg/litre for cyanide, based on health concerns. This value was raised to 0.2 mg/litre in the 1963 International Standards. The tentative upper concentration limit was lowered to 0.05 mg/litre in the 1971 International Standards upon consideration of the ADI of hydrogen cyanide residues in some fumigated foods of 0.05 mg/kg of body weight and to ensure that the water source is not too highly contaminated by industrial effluents and that water treatment has been adequate. In the first edition of the *Guidelines for Drinking-water Quality*, published in 1984, it was determined that a guideline value of 0.1 mg/litre would be a reasonable level for the protection of public health. A health-based guideline value of 0.07 mg/litre, which was considered to be protective for both acute and long-term exposure, was derived in the 1993 Guidelines.
Assessment date
The risk assessment was originally conducted in 1993. The Final Task Force Meeting in 2003 agreed that this risk assessment be brought forward to this edition of the Guidelines for Drinking-water Quality.

Principal reference

12.34 Cyanogen chloride
Cyanogen chloride is a by-product of chloramination. It is a reaction product of organic precursors with hypochlorous acid in the presence of ammonium ion. Concentrations detected in drinking-water treated with chlorine and chloramine were 0.4 and 1.6 μg/litre, respectively.

Cyanogen chloride is rapidly metabolized to cyanide in the body. There are few data on the oral toxicity of cyanogen chloride, and the guideline value is based, therefore, on cyanide. The guideline value is 70 μg/litre for cyanide as total cyanogenic compounds (see Cyanide in section 12.33).

History of guideline development
The 1958, 1963 and 1971 WHO International Standards for Drinking-water and the first edition of the Guidelines for Drinking-water Quality, published in 1984, did not refer to cyanogen chloride. The 1993 Guidelines derived a health-based guideline value for cyanogen chloride based on cyanide, as cyanogen chloride is rapidly metabolized to cyanide in the body and as there are few data on the oral toxicity of cyanogen chloride. The guideline value is 0.07 mg/litre for cyanide as total cyanogenic compounds (see Cyanide in section 12.33).

Assessment date
The risk assessment was originally conducted in 1993. The Final Task Force Meeting in 2003 agreed that this risk assessment be brought forward to this edition of the Guidelines for Drinking-water Quality.

Principal reference

12.35 2,4-D (2,4-dichlorophenoxyacetic acid)
The term 2,4-D is used here to refer to the free acid, 2,4-dichlorophenoxyacetic acid (CAS No. 94-75-7). Commercial 2,4-D products are marketed as the free acid, alkali