GUIDELINES FOR DRINKING-WATER QUALITY

History of guideline development
The 1958 and 1963 WHO International Standards for Drinking-water did not refer to chlorpyrifos, but the 1971 International Standards suggested that pesticide residues that may occur in community water supplies make only a minimal contribution to the total daily intake of pesticides for the population served. Chlorpyrifos was not evaluated in the first edition of the Guidelines for Drinking-water Quality, published in 1984, in the second edition, published in 1993, or in the addendum to the second edition, published in 1998.

Assessment date
The risk assessment was conducted in 2003.

Principal references

12.30 Chromium
Chromium is widely distributed in the Earth’s crust. It can exist in valences of +2 to +6. In general, food appears to be the major source of intake.

<table>
<thead>
<tr>
<th>Provisional guideline value</th>
<th>0.05 mg/litre for total chromium</th>
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</thead>
<tbody>
<tr>
<td>The guideline value is designated as provisional because of uncertainties in the toxicological database.</td>
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<tr>
<td>Occurrence</td>
<td>Total chromium concentrations in drinking-water are usually less than 2 μg/litre, although concentrations as high as 120 μg/litre have been reported.</td>
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<tr>
<td>Basis of guideline value derivation</td>
<td>There are no adequate toxicity studies available to provide a basis for a NOAEL. The guideline value was first proposed in 1958 for hexavalent chromium, based on health concerns, but was later changed to a guideline for total chromium because of difficulties in analysing for the hexavalent form only.</td>
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<tr>
<td>Limit of detection</td>
<td>0.05–0.2 μg/litre for total chromium by AAS</td>
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<tr>
<td>Treatment achievability</td>
<td>0.015 mg/litre should be achievable using coagulation</td>
</tr>
</tbody>
</table>

Toxicological review
In a long-term carcinogenicity study in rats given chromium(III) by the oral route, no increase in tumour incidence was observed. In rats, chromium(VI) is a carcinogen via the inhalation route, although the limited data available do not show evidence
for carcinogenicity via the oral route. In epidemiological studies, an association has been found between exposure to chromium(VI) by the inhalation route and lung cancer. IARC has classified chromium(VI) in Group 1 (human carcinogen) and chromium(III) in Group 3. Chromium(VI) compounds are active in a wide range of \textit{in vitro} and \textit{in vivo} genotoxicity tests, whereas chromium(III) compounds are not.

**History of guideline development**

The 1958 WHO \textit{International Standards for Drinking-water} recommended a maximum allowable concentration of 0.05 mg/litre for chromium (hexavalent), based on health concerns. This value was retained in the 1963 International Standards. Chromium was not evaluated in the 1971 International Standards. In the first edition of the \textit{Guidelines for Drinking-water Quality}, published in 1984, the guideline value of 0.05 mg/litre for total chromium was retained; total chromium was specified because of difficulties in analysing for the hexavalent form only. The 1993 Guidelines questioned the guideline value of 0.05 mg/litre because of the carcinogenicity of hexavalent chromium by the inhalation route and its genotoxicity, although the available toxicological data did not support the derivation of a new value. As a practical measure, 0.05 mg/litre, which is considered to be unlikely to give rise to significant health risks, was retained as the provisional guideline value until additional information becomes available and chromium can be re-evaluated.

**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 \textit{Guidelines for Drinking-water Quality}.

**Principal reference**


**12.31 Copper**

Copper is both an essential nutrient and a drinking-water contaminant. It has many commercial uses. It is used to make pipes, valves and fittings and is present in alloys and coatings. Copper sulfate pentahydrate is sometimes added to surface water for the control of algae. Copper concentrations in drinking-water vary widely, with the primary source most often being the corrosion of interior copper plumbing. Levels in running or fully flushed water tend to be low, whereas those in standing or partially flushed water samples are more variable and can be substantially higher (frequently > 1 mg/litre). Copper concentrations in treated water often increase during distribution, especially in systems with an acid pH or high-carbonate waters with an alkaline pH. Food and water are the primary sources of copper exposure in developed