



## Guidelines for drinking water quality

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# Arsenic

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### Summary information extracted from:

*Guidelines for drinking-water quality, 2nd ed.  
Vol. 1. Recommendations.  
Geneva, World Health Organization, 1993. pp. 41-42.*

Arsenic is widely distributed throughout the earth's crust and is used commercially, primarily in alloying agents. It is introduced into water through the dissolution of minerals and ores, from industrial effluents, and from atmospheric deposition; concentrations in ground water in some areas are sometimes elevated as a result of erosion from natural sources. The average daily intake of inorganic arsenic in water is estimated to be similar to that from food; intake from air is negligible.

Inorganic arsenic is a documented human carcinogen and has been classified by IARC in Group 1. A relatively high incidence of skin and possibly other cancers that increase with dose and age has been observed in populations ingesting water containing high concentrations of arsenic.

Arsenic has not been shown to be carcinogenic in the limited bioassays in animal species that are available, but it has given positive results in studies designed to assess the potential for tumour promotion. Arsenic has not been shown to be mutagenic in bacterial and mammalian assays, although it has been shown to induce chromosomal aberrations in a variety of cultured cell types, including human cells; such effects have not been observed in vivo.

Data on the association between internal cancers and ingestion of arsenic in drinking-water were insufficient for quantitative assessment of risk. Instead, owing to the documented carcinogenicity of arsenic in drinking-water in human populations, the lifetime risk of skin cancer was estimated using a multistage model. On the basis of observations in a population ingesting arsenic-contaminated drinking-water, the concentration associated with an excess lifetime skin cancer risk of  $10^{-5}$  was calculated to be 0.17 µg/ litre. This value may, however, overestimate the actual risk of skin cancer owing to the possible contribution of other factors to disease incidence in the population and to possible dose-dependent variations in metabolism that could not be taken into consideration. In addition, this value is below the practical quantification limit of 10 µg/litre.

With a view to reducing the concentration of this carcinogenic contaminant in drinking-water, a provisional guideline value for arsenic in drinking-water of 0.01 mg/litre is established. The estimated excess lifetime skin cancer risk associated with exposure to this concentration is  $6 \times 10^{-4}$  was calculated to be 0.17 µg/litre. This value may, however, overestimate the actual risk of skin cancer owing to the possible contribution of other factors to disease incidence in the population and to possible dose-dependent variations in metabolism that could not be taken into consideration. In addition, this value is below the practical quantification limit of 10 µg/litre.

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A similar value may be derived (assuming a 20% allocation to drinking-water) on the basis of the provisional maximum tolerable daily intake (PMTDI) for inorganic arsenic of 2 µg/kg of body weight established by JECFA in 1983 and confirmed as a PTWI of 15 ¼ /kg of body weight for inorganic arsenic in 1988. JECFA noted, however, that the margin between the PTWI and intakes reported to have toxic effects in epidemiological studies was narrow.

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