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Cyanogen chloride in Drinking-water

Background document for development of
WHO *Guidelines for Drinking-water Quality*

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Preface

One of the primary goals of WHO and its member states is that "all people, whatever their stage of development and their social and economic conditions, have the right to have access to an adequate supply of safe drinking water." A major WHO function to achieve such goals is the responsibility "to propose regulations, and to make recommendations with respect to international health matters ...."

The first WHO document dealing specifically with public drinking-water quality was published in 1958 as International Standards for Drinking-Water. It was subsequently revised in 1963 and in 1971 under the same title. In 1984–1985, the first edition of the WHO Guidelines for drinking-water quality (GDWQ) was published in three volumes: Volume 1, Recommendations; Volume 2, Health criteria and other supporting information; and Volume 3, Surveillance and control of community supplies. Second editions of these volumes were published in 1993, 1996 and 1997, respectively. Addenda to Volumes 1 and 2 of the second edition were published in 1998, addressing selected chemicals. An addendum on microbiological aspects reviewing selected microorganisms was published in 2002.

The GDWQ are subject to a rolling revision process. Through this process, microbial, chemical and radiological aspects of drinking-water are subject to periodic review, and documentation related to aspects of protection and control of public drinking-water quality is accordingly prepared/updated.

Since the first edition of the GDWQ, WHO has published information on health criteria and other supporting information to the GDWQ, describing the approaches used in deriving guideline values and presenting critical reviews and evaluations of the effects on human health of the substances or contaminants examined in drinking-water.

For each chemical contaminant or substance considered, a lead institution prepared a health criteria document evaluating the risks for human health from exposure to the particular chemical in drinking-water. Institutions from Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Poland, Sweden, United Kingdom and United States of America prepared the requested health criteria documents.

Under the responsibility of the coordinators for a group of chemicals considered in the guidelines, the draft health criteria documents were submitted to a number of scientific institutions and selected experts for peer review. Comments were taken into consideration by the coordinators and authors before the documents were submitted for final evaluation by the experts meetings. A "final task force" meeting reviewed the health risk assessments and public and peer review comments and, where appropriate, decided upon guideline values. During preparation of the third edition of the GDWQ, it was decided to include a public review via the world wide web in the process of development of the health criteria documents.

During the preparation of health criteria documents and at experts meetings, careful consideration was given to information available in previous risk assessments carried out by the International Programme on Chemical Safety, in its Environmental Health

Criteria monographs and Concise International Chemical Assessment Documents, the International Agency for Research on Cancer, the joint FAO/WHO Meetings on Pesticide Residues, and the joint FAO/WHO Expert Committee on Food Additives (which evaluates contaminants such as lead, cadmium, nitrate and nitrite in addition to food additives).

Further up-to-date information on the GDWQ and the process of their development is available on the WHO internet site and in the current edition of the GDWQ.

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GENERAL DESCRIPTION

Identity

CAS no.: 506-77-4
Molecular formula: CNCl

Physicochemical properties *(1–3)* [Conversion factor in air: 1 ppm = 2.5 mg/m^3]

Property	*Value*
Boiling point	12.7 °C
Melting point	-6 °C
Density	1.186 g/cm^3 at 20 °C
Water solubility	Very soluble

Major uses

Cyanogen chloride is used in tear gas, in fumigant gases, and as a reagent in the synthesis of other compounds (*4*).

ANALYTICAL METHODS

EPA Method 524.2, in which purge-and-trap gas chromatography is combined with mass spectroscopy, can be used for the determination of cyanogen chloride. This method has a practical quantification limit of 0.3 µg/litre.

ENVIRONMENTAL LEVELS AND HUMAN EXPOSURE

Water

Cyanogen chloride may be formed as a by-product of chloramination or chlorination of water. It has been found in finished water supplies at concentrations below 10 µg/litre. The concentration in water when chlorination was used for disinfection was reported to be 0.4 µg/litre. The level was higher (1.6 µg/litre) in chloraminated water (*6*).

KINETICS AND METABOLISM IN LABORATORY ANIMALS AND HUMANS

In an *in vitro* study with rat blood, cyanogen chloride was metabolized to cyanide ion by haemoglobin and glutathione (*7*).

EFFECTS ON LABORATORY ANIMALS AND *IN VITRO* TEST SYSTEMS

Acute exposure

Estimates of inhalation LC_{50}s range from 100 mg/m^3 in cats to 7536 mg/m^3 in rabbits (*8*). In other lethality tests, a concentration of 100 mg/m^3 was fatal to cats within 18 min, 120 mg/m^3 for 6 h was fatal to dogs, 5 mg/m^3 for 2 min was fatal to goats, and a subcutaneous dose of 20 mg/kg of body weight was fatal to rabbits (*9*). An LD_{50} of 6 mg/kg of body weight was reported in rats following oral administration (*10*). Toxic signs included irritation of the respiratory tract, haemorrhagic exudate of the bronchi and trachea, and pulmonary oedema.

EFFECTS ON HUMANS

On inhalation, a concentration of 2.5 mg/m^3 causes irritation. Cyanogen chloride was used as a war gas in the First World War. A concentration of 120 mg/m^3 was lethal (*5*).

GUIDELINE VALUE

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

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