

Fact Sheet Date: March 12, 1998

**NEW YORK STATE
- HUMAN HEALTH FACT SHEET -**

**Ambient Water Quality Value for
Protection of Sources of Potable Water**

SUBSTANCE: epsilon-Hexachlorocyclohexane **CAS REGISTRY NUMBER:** 6108-10-7

AMBIENT WATER QUALITY VALUE: 0.04 ug/L

BASIS: Chemical Correlation to Oncogenic

I INTRODUCTION

The Ambient Water Quality Value applies to the water column and is designed to protect humans from the effects of contaminants in sources of drinking water; it is referred to as a Health (Water Source) or H(W S) value. Regulations (6 NYCRR 702.2) require that the water quality value be based on the procedures in sections 702.3 through 702.7. A previous fact sheet supported a value of 0.02 ug/L for surface water for hexachlorocyclohexane (HCH) and the sum of isomers alpha-HCH, beta-HCH, gamma-HCH, delta-HCH and epsilon-HCH (NYS, 1985). Available information on epsilon-HCH published after 1985 was examined as described in "Scope of Review," below. Potential water quality values are derived below, and the value of 0.04 ug/L selected as described under "Selection of Value."

II PRINCIPAL ORGANIC CONTAMINANT CLASSES AND SPECIFIC MCL (702.3)

A. Discussion

epsilon-Hexachlorocyclohexane does not have a New York State Specific MCL as defined in 700.1. However, epsilon-hexachlorocyclohexane is in a principal organic contaminant class (vi) as defined in 700.1.

The U.S. Environmental Protection Agency has not established a maximum contaminant level goal (MCLG) or a MCL for drinking water for epsilon-hexachlorocyclohexane.

Under the State Sanitary Code (10 NYCRR Part 5, Public Water Supplies), the New York State Department of Health has established a general maximum contaminant level of 5 ug/L for principal organic contaminants such as epsilon-hexachlorocyclohexane in drinking water.

B. Derivation of Water Quality Value

Because epsilon-hexachlorocyclohexane is in a principal organic contaminant class and has no Specific MCL, a water quality value of 5 ug/L can be derived based on 702.3(b).

III ONCOGENIC EFFECTS (702.4)

U.S. EPA (1997) classifies epsilon-hexachlorocyclohexane in class D, not classifiable as to human carcinogenicity. IARC (1987) classifies hexachloro-cyclohexanes in Group 2B (possibly carcinogenic to humans) but lists no separate entry for epsilon-hexachlorocyclohexane.

There are no oncogenic data on which to base a quantitative risk assessment. However, Goto et al. (1972) reported benign and malignant liver tumors in ICR-JCI mice after 26 weeks of exposure to a diet containing 600 ppm of a mixture of delta-hexachlorocyclohexane and epsilon-hexachlorocyclohexane. The study was inadequately reported and the exact number of animals with tumors was unclear.

IV NON-ONCOGENIC EFFECTS (702.5)

There are no non-oncogenic data on which to base a quantitative risk assessment.

V CHEMICAL CORRELATION (702.7)

A. Data

The toxicologic database for epsilon-hexachlorocyclohexane has been reviewed (ATSDR, 1997; Goto et al., 1972; IARC, 1979). Although there are limited data on its non-oncogenic and oncogenic effects, the data are not sufficient for establishing a specific water quality value on the basis of sections 702.4 or 702.5.

The chemical structure, metabolic pathways, and target organs of five hexachlorocyclohexane isomers (alpha, beta, gamma, delta and epsilon) are similar (ATSDR, 1997); moreover, all have oncogenic potential in mice (see reviews in ATSDR, 1997; IARC, 1979). The collective evidence from studies on the oncogenic potential of individual isomers (alpha, beta, gamma, and delta) and mixtures of isomers (including mixtures of delta and epsilon) indicate that the potency of alpha-hexachlorocyclohexane to induce oncogenic effects in the liver of mice is greater than that of the other isomers (Hanada et al., 1973; Ito et al., 1973a,b). However, the evidence is not sufficient to rank the relative potencies of beta-, gamma-, delta-, and epsilon-hexachlorocyclohexane (Hanada et al., 1973; Ito et al., 1973a,b).

B. Derivation of Water Quality Value

Three hexachlorocyclohexane isomers (alpha-hexachlorocyclohexane, beta-hexachlorocyclohexane, and gamma-hexachlorocyclohexane) are classified as animal oncogens under 6 NYCRR 700.1; their ambient water quality values based on oncogenic effects are 0.01 ug/L, 0.04 ug/L, and 0.05 ug/L, respectively (NYS, 1997a,b,c). Given the similarities of the hexachlorocyclohexane isomers and the available data that indicates that the potency of alpha-hexachlorocyclohexane to induce oncogenic effects in mice is greater than that of the other isomers, an ambient water quality value of 0.04 ug/L is derived for epsilon-hexachlorocyclohexane based on its chemical correlation to other hexachlorocyclohexanes, specifically beta-hexachlorocyclohexane and gamma-hexachlorocyclohexane. The value was based on the geometric mean of the values for beta- and gamma-hexachlorocyclohexane (as shown below) because of the uncertainties regarding the relative oncogenic potency of epsilon-hexachlorocyclohexane compared to beta- and gamma-hexachlorocyclohexane.

$$\text{Water Quality Value} = [(0.04 \text{ ug/L})(0.05 \text{ ug/L})]^{0.5} = 0.045, \text{ rounded to } 0.04 \text{ ug/L}$$

VI SELECTION OF VALUE

The H(WS) value is designed to protect humans from oncogenic and non-oncogenic effects from contaminants in sources of drinking water. To protect from these effects, regulations (6 NYCRR 702.2(b)) require that the value be the most stringent of the values derived using the procedures found in sections 702.3 through 702.7. The chemical correlation value of 0.04 ug/L (6 NYCRR 702.7) is the most stringent value derived by these procedures and is the ambient water quality value for epsilon-hexachlorocyclohexane.

VII REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1997. Toxicological Profile on Alpha-, Beta-, Gamma, and Delta-Hexachlorocyclohexane. Draft update. Washington, DC Public Health Service.

Goto, M., M. Hattori, T. Miyagawa, and M. Enomoto. 1972. Contribution to ecological chemistry. II. Hepatoma formation in mice after administration of hexachlorocyclohexane isomers in high doses. *Chemosphere* 6:279-282.

Hanada, M., C. Yutani, and T. Miyaji. 1973. Induction of hepatoma in mice by benzene hexachloride. *Gann*. 64:511-513. (As cited in IARC, 1979).

IARC (International Agency for Research on Cancer). 1979. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Hexachlorocyclohexane. 20:195-239.

IARC (International Agency for Research on Cancer). 1987. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Supplement 7. Lyon, France. pp. 45, 220-222.

Ito, N., H. Nagasaki, M. Arai, et al. 1973a. Histopathologic studies on liver tumorigenesis induced in mice by technical polychlorinated biphenyls and its promoting effect on liver tumors induced by benzene hexachloride. *J. Natl. Cancer Inst.* 51:1637-1646.

Ito, N., H. Nagasaki, M. Arai, et al. 1973b. Histologic and ultrastructural studies on the hepatocarcinogenicity of benzene hexachloride in mice. *J. Natl. Cancer Inst.* 51:817-826.

6 NYCRR (New York State Codes, Rules and Regulations). Water Quality Regulations, Surface Water and Groundwater Classifications and Standards: Title 6 NYCRR, Chapter X, Parts 700-705. Albany, NY: New York State Department of Environmental Conservation.

10 NYCRR (New York State Codes, Rules and Regulations). Public Water Systems: Title 10 NYCRR, Chapter 1, State Sanitary Code, Subpart 5-1. Albany, NY: New York State Department of Health, Bureau of Water Supply Protection.

NYS (New York State). 1985. Ambient Surface Water Quality Standards Documentation. Hexachlorocyclohexanes and the isomers alpha-, beta-, gamma-, delta- and epsilon-HCH. Albany, NY: Department of Health.

NYS (New York State). 1997a. Human Health Fact Sheet. Ambient Water Quality Value for Protection of Sources of Potable Water. alpha-Hexachlorocyclohexane. Albany, NY: Department of Environmental Conservation.

NYS (New York State). 1997b. Human Health Fact Sheet. Ambient Water Quality Value for Protection of Sources of Potable Water. beta-Hexachlorocyclohexane. Albany, NY: Department of Environmental Conservation.

NYS (New York State). 1997c. Human Health Fact Sheet. Ambient Water Quality Value for Protection of Sources of Potable Water. gamma-Hexachlorocyclohexane. Albany, NY: Department of Environmental Conservation.

U.S. EPA (Environmental Protection Agency). 1997. epsilon-Hexachlorocyclohexane. On-line. Integrated Risk Information System (IRIS). Cincinnati, OH: Office of Research and Development, Environmental Criteria and Assessment Office.

VIII SCOPE OF REVIEW

Several of the widely-recognized sources listed below can provide a comprehensive review and often a quantitative assessment of the toxicity of a substance. These sources were searched for information on epsilon-HCH; where none was found it is so noted.

- ! IRIS (U.S. EPA's Integrated Risk Information System). On-line database.
- ! RTECS (Registry of Toxic Effects of Chemical Substances). On-line database (substance not on RTECS).
- ! CCRIS (Chemical Carcinogenesis Research Information System). On-line database (substance not on CCRIS).
- ! ATSDR (Agency for Toxic Substances and Disease Registry) toxicological profile (document not found).
- ! IARC (International Agency for Research on Cancer) Monographs Supplement 7 (substance not listed).
- ! U.S. EPA ambient water quality criteria document (document not found).
- ! U.S. EPA health advisory (document not found).
- ! U.S. EPA drinking water criteria document (document not found).

The sources below were reviewed by NYSDOH (1985).

- ! Howe, R.B. and K.S. Crump. GLOBAL82 Computer Program. Science Research Systems, Inc., Ruson, LA.
- ! International Agency for Research on Cancer. 1974. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. 5: 47-74.
- ! International Agency for Research on Cancer. 1979. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. 20: 195-223.
- ! National Academy of Sciences. 1977. Drinking Water and Health, Vol. 1. National Academy of Sciences. Washington, D.C.
- ! National Academy of Sciences. 1980. Drinking Water and Health, Vol. 3. National Academy Press. Washington, D.C.
- ! Thorpe, E. and A.I.T. Walker. 1973. The toxicology of dieldrin (HEOD). II. Comparative long-term oral toxicity studies in mice with dieldrin, DDT, phenobarbitone, beta-BHC and gamma-BHC. *Fd. Cosmet. Toxicol.* 11: 433-442.
- ! U.S. Environmental Protection Agency. 1980. Ambient water quality criteria for hexachlorocyclohexane. NTIS No. PB81-117659.

The sources above are deemed adequate to assess the literature through 1994.

New York State Department of Environmental Conservation
Division of Water
AS
November, 1995
Revised-SJS, November, 1996
Revised-DOH, December, 1997