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NEW YORK STATE
- HUMAN HEALTH FACT SHEET -

Ambient Water Quality Value for
Protection of Sources of Potable Water

SUBSTANCE: 1,4-Dibromobenzene **CAS REGISTRY NUMBER:** 106-37-6

AMBIENT WATER QUALITY VALUE: 5 ug/L

BASIS: Surface Water: Principal Organic Contaminant Classes

Groundwater: Former Reference to 10 NYCRR Subpart 5-1 Principal Organic Contaminant (POC) General Maximum Contaminant Level (MCL)

I INTRODUCTION

This value applies to the water column and is designed to protect humans from the effects of contaminants in souces of drinking water; it is referred to as a Health (Water Source) or H(WS) value.

Regulations (6 NYCRR 702.2) require that the water quality value be based on the procedures in sections 702.3 through 702.7. Available information on 1,4-dibromobenzene was examined as described in "Scope of Review," below. Potential water quality values are derived below, and the value of 5 ug/L selected as described under "Selection of Value."

II PRINCIPAL ORGANIC CONTAMINANT CLASSES AND SPECIFIC MCL (702.3)

A. Discussion

1,4-Dibromobenzene does not have a Specific MCL as defined in 700.1. However, this substance is in principal organic contaminant class iii as defined in 700.1.

The U.S. Environmental Protection Agency has not established a maximum contaminant level goal (MCLG) or MCL for drinking water for 1,4-dibromobenzene.

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 1,4-dibromobenzene in drinking water.

B. Derivation of Water Quality Value

Because 1,4-dibromobenzene is in a principal organic contaminant class and has no Specific MCL, regulations require that the water quality value not exceed 5 ug/L.

III ONCOGENIC EFFECTS (702.4)

A. Data

CSWG (1977) noted that "the aryl bromide structure represents a gap in knowledge of potential carcinogenicity" and selected 1,4-dibromobenzene for testing by the National Cancer Institute (NCI) Bioassay Program. However, such testing apparently was never conducted.

U.S. EPA (1984) found no information regarding the carcinogenicity or mutagenicity of 1,4-dibromobenzene.

Covalent binding and genotoxicity can indicate oncogenic potential. Colacci et al. (1990) showed that 1,4-dibromobenzene is genotoxic in terms of causing DNA damage in vivo and in vitro. They found it to covalently bind to DNA from mouse but not rat organs. The covalent binding value (CBI) classifies this substance as a weak initiator for the mouse.

Fishbein (1979) reports that two major metabolites, 2,4- and 2,5-dibromophenol have been identified in rabbits given intraperitoneal injections of 1,4-dibromobenzene. One of these metabolites, 2,4-dibromophenol, has been identified as a tumor promoter in mouse skin (Boutwell and Bosch, 1959).

B. Derivation of Value

No information was found upon which to derive a water quality value for 1,4-dibromobenzene based on oncogenic effects.

IV NON-ONCOGENIC EFFECTS (702.5)

A. Data

U. S. EPA (1994) derived an oral reference dose (RfD) for 1,4-dibromobenzene of 0.01 mg/kg/day from a rat subchronic study by Carlson and Tardiff (1977). In this study, adult Sprague-Dawley rats were administered the substance orally in corn oil at 0, 5, 10 or 20 mg/kg for 45 or 90 days. At the high dose, liver-to-body weight ratio and liver enzyme activity were both significantly increased after 45 and 90 days. At 10 mg/kg/day, a statistically significant increase in the activity of 1 of 6 microsomal enzymes was found, but there was no accompanying increase in liver-to-body weight ratio. U.S. EPA considers this to be a no-observed-adverse-effects level (NOAEL), with 20 mg/kg/day a lowest-observed-adverse-effects level (LOAEL).

U.S. EPA (1984) did not report any information on teratogenicity or other reproductive effects.

Carlson (1979) studied the porphyrinogenic effect of 1,4-dibromobenzene in rats. Animals were given 0, 50, 100, or 200 mg/kg in corn oil orally for 30, 60, 90 or 120 days. Statistically significant effects at various doses and exposure periods include increased liver weight, increased liver porphyrins, and an isolated finding of decreased urine porphyrin. Effects at the low dose were increased liver porphyrins in the 90- and 120-day groups, with increased liver weight in the 90-day group. Thus, 50 mg/kg/day represents a LOAEL.

B. Derivation of Water Quality Value

1. Selection of Data

The study by Carlson and Tardiff (1977) was judged the most appropriate for deriving a water quality value based on non-oncogenic effects. It was selected over that of Carlson (1979) because it yields both a NOAEL and a LOAEL.

2. Calculation of Acceptable Daily Intake (ADI)

An ADI is calculated from the study of Carlson and Tardiff (1977) by dividing the NOAEL of 10 mg/kg/day by a total uncertainty factor of 1000 as follows:

$$ADI = \left(\frac{10 \text{ mg/kg/day}}{1000} \right) = 0.01 \text{ mg/kg/day}$$

This uncertainty factor was selected to account for intra- and interspecies differences and the short duration of the study.

3. Calculation of Water Quality Value

A potential water quality value is calculated from the ADI, above, based on a 70 kg adult consuming 2 liters of water per day and allocating 20% of the ADI to come from drinking water, as follows:

$$\text{Water Quality Value} = \frac{(0.01 \text{ mg/kg/day})(1000 \text{ ug/mg})(70 \text{ kg})(0.2)}{2 \text{ L/day}} = 70 \text{ ug/L}$$

V CHEMICAL CORRELATION (702.7)

Although available data were not sufficient to evaluate 1,4-dibromobenzene based on 702.4, a value based on chemical correlation was not derived. An oncogen-based value of 3 ug/L has been derived for 1,4-dichlorobenzene (NYS, 1997). However, the mechanism of oncogenic action for 1,4-dichlorobenzene is unknown. If 1,4-dibromobenzene is also oncogenic, it is unknown what its potency is relative to the chlorinated compound. It was concluded that there is not a strong enough case to warrant deriving a value for 1,4-dibromobenzene based on chemical correlation.

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 for 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 principal organic contaminant class value of 5 ug/L (702.3(b)) is the most stringent value derived by these procedures and is the ambient water quality value for 1,4-dibromobenzene.

It should be noted that the principal organic contaminant (POC) value of 5 ug/L became a standard for groundwater (6 NYCRR 703.5) effective on January 9, 1989 by inclusion by reference to 10 NYCRR Subpart 5-1 standards. The basis and derivation of this POC standard are described in a separate fact sheet.

VII REFERENCES

Boutwell, R.K. and D.K. Bosch. 1959. The tumor-promoting action of phenol and related compounds for mouse skin. Cancer Res. 19:413-424. (As cited by Fishbein, 1979).

Carlson, G.P. and R. G. Tardiff. 1977. Effect of 1,4-dibromobenzene and 1,2,4-tribromobenzene on xenobiotic metabolism. Toxicol. Appl. Pharmacol. 42:189-196. (As cited by U.S. EPA, 1994).

Carlson, G.P. 1979. Brominated benzene induction of hepatic porphyria. Experientia 35(4):513-514.

Colacci, A., S. Bartoli, B. Bonora, M. Mazzulo, A. Niero, P. Perocco, P. Silingardi and S. Grilli. 1990. The covalent interaction of 1,4-dibromobenzene with rat and mouse nucleic acids: in vivo and in vitro studies. Toxicol. Lett. 54:121-127.

CSWG (Chemical Selection Working Group). 1977. Organic bromides, iodides, and fluorides. Class study. November 17, 1977. Submitted by SRI International, 1981. NTIS/OTS #0523797.

Fishbein, L. 1979. Potential halogenated industrial carcinogenic and mutagenic chemcals. IV. Halogenated aryl derivatives. Sci. Total Environ. 11:259-278.

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 Public Water Supply Protection.

NYS (New York State). 1997. Human Health Fact Sheet. Ambient Water Quality Value for Protection of Sources of Potable Water. 1,4-Dichlorobenzene. Albany, NY: Department of Health.

U.S. EPA (Environmental Protection Agency). 1984. Health and Environmental Effects Profile for Bromobenzenes. Cincinnati, OH: Environmental Criteria and Assessment Office, EPA/600/X-84/128. PB88-137757.

U.S. EPA (Environmental Protection Agency). 1994. 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 1,4-dibromo-benzene; 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.
- CCRIS (Chemical Carcinogenesis Research Information System). On-line database. (not on CCRIS).
- ATSDR (Agency for Toxic Substances and Disease Registry) toxicological profile (not found).
- U.S. EPA ambient water quality criteria document (not found).
- U.S. EPA health advisory (not found).
- U.S. EPA drinking water criteria document (not found).
- U.S. EPA Drinking Water Regulations and Health Advisories, Office of Water, May 1994.

- IARC (International Agency for Research on Cancer) Monographs Supplement 7.

The sources above are deemed adequate to assess the literature through 1977. Coverage of recent literature (to 1994) was provided by a New York State Library on-line search of the databases listed below.

- NTIS (National Technical Information Service)
- TOXLINE
- BIOSIS

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