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: 1,2-Dichlorobenzene **CAS REGISTRY NUMBER:** 95-50-1

AMBIENT WATER QUALITY VALUE: 3 micrograms/liter (3 ug/L)

BASIS: Chemical Correlation

INTRODUCTION

1,2-Dichlorobenzene is one of three structurally-similar isomers of dichlorobenzene. The other two isomers are 1,3-dichlorobenzene and 1,4-dichlorobenzene. The physical, chemical and toxicological properties of 1,2-dichlorobenzene (ortho-dichlorobenzene) have been reviewed (US EPA, 1985a; 1987a,b; 1996). The following ambient water quality values were derived using these and other references and the procedures outlined in 6 NYCRR 702.2 through 702.7. Water quality values for 1,4-dichlorobenzene and 1,3-dichlorobenzene are derived in separate fact sheets (NYS, 1997a,b).

SPECIFIC MCL AND PRINCIPAL ORGANIC CONTAMINANT CLASS (702.3)

1,2-Dichlorobenzene does not have a Specific MCL (maximum contaminant level) as defined in 6 NYCRR 700.1 and is in principal organic contaminant class iii as defined in 6 NYCRR 700.1. Therefore, a water quality value of 5 ug/L can be derived based on 6 NYCRR 702.3(b).

ONCOGENIC EFFECTS (702.4)

In rats and mice given gavage doses (60 or 120 milligrams per kilogram of body weight (mg/kg)) of 1,2-dichlorobenzene, 5 days/week for 2 years, the NTP (1985) concluded that there was no evidence of carcinogenicity. The U.S. EPA concluded that there were no compound-related effects observed in the bioassays and raised concerns that the maximum tolerated doses were not reached, particularly in the mouse study (US EPA, 1985a, 1996). (The World Health Organization reported kidney effects in male mice

at the highest dose - see discussion in Other Standards and Guidelines.) The U.S. EPA (1996) classifies 1,2-dichlorobenzene as Group D (not classifiable as to human carcinogenicity) compound based on the lack of data in humans and inadequate data in animals. 1,2-Dichlorobenzene is not an oncogen under 6 NYCRR 700.1, however, the doses used in the NTP bioassays may have reduced the sensitivity of the assays to detect oncogenic effects.

1,4-Dichlorobenzene induces liver tumors in mice and kidney tumors in male rats given gavage doses (0, 300, and 600 mg/kg to mice and 0, 150, and 300 to rats, 5 days/week for 2 years) and is an oncogen under 6 NYCRR 700.1 (NYS, 1997a). Both the NTP (1994) and the IARC (1987) consider the evidence on the carcinogenicity of 1,4-dichlorobenzene in animals to be "sufficient" (the strongest ranking). The U.S. EPA Office of Drinking Water (US EPA, 1987c) classifies 1,4-dichlorobenzene as a Group C (possible human) carcinogen. The water concentration of 1,4-dichlorobenzene corresponding to the lower bound estimate on the dose associated with an excess lifetime human cancer risk of one-in-one million is 3 ug/L (NYS, 1997a). Studies on the oncogenic effects of 1,3-dichlorobenzene were not found (NYS, 1997b).

NON-ONCOGENIC EFFECTS (702.5)

1,2-Dichlorobenzene damages the liver and kidneys of laboratory animals (NTP, 1985; US EPA, 1987a). In rats and mice given gavage doses of 0, 30, 60, 125, 250, and 500 mg/kg, 5 days/week for 13 weeks, liver lesions were found in mice and rats starting at 250 mg/kg (NTP, 1985), There were no treatment-related effects in rats and mice given gavage doses of 60 or 120 mg/kg, 5 days/week for 2 years (NTP, 1985).

In 1991, the U.S. EPA established an oral reference dose (equivalent to an acceptable daily intake) of 90 micrograms per kilogram body weight per day (ug/kg/day) for 1,2-dichlorobenzene (Exhibit 1, taken from US EPA, 1996), using procedures consistent with those outlined in paragraphs (a) and (b) of 6 NYCRR 702.5. The reference dose, which was rounded from a value of 85.7 ug/kg/day (US EPA, 1996), was derived by application of a 1,000-fold uncertainty factor to a no-observed-effect level (NOEL) of 85.7 mg/kg/day (the highest dose tested) in rats orally exposed for 2 years (NTP, 1985; US EPA, 1996). The uncertainty factor of 1,000 was used to account for variability among humans, differences between animals and humans, the lack of studies assessing reproductive effects, and limitations of the chronic toxicity studies in a second species. Confidence in this reference dose is low because the chronic study did not assess biochemical and clinical endpoints and because of the lack of reproductive and adequate additional supporting toxicity studies in a nonrodent species (US EPA, 1996). A value of 630 ug/L is derived using the procedure outlined in paragraph (e) of 6 NYCRR 702.5 and allowing 20% of the acceptable daily intake to come from drinking water (6 NYCRR 702.5 (c)).

CHEMICAL CORRELATION (702.7)

The chemical structures, metabolic pathways, and target organs of the three

dichlorobenzenes are similar; thus, the oncogenic potential of the three isomers may be similar. Although an ambient water quality value of 3 ug/L has been established for 1,4-dichlorobenzene based on its oncogenic effects (NYS, 1997a), the data are inadequate to evaluate the oncogenic potential of 1,2-dichlorobenzene (US EPA, 1996) or 1,3-dichlorobenzene (NYS, 1997b). Moreover, the absence of mechanistic data on the carcinogenicity of 1,4-dichlorobenzene precludes dismissing the concerns that 1,2-dichlorobenzene would be oncogenic when tested at higher doses or that 1,3-dichlorobenzene would be oncogenic when tested. Given the similarities of the three isomers and the uncertainties regarding the oncogenic potential of 1,2-dichlorobenzene and 1,3-dichlorobenzene, an ambient water quality value of 3 ug/L is derived for 1,2-dichlorobenzene based on its chemical correlation to 1,4-dichlorobenzene.

OTHER STANDARDS AND GUIDELINES

Under New York State Department of Health regulations for drinking-water standards (10 NYCRR Part 5), 1,2-dichlorobenzene is a principal organic contaminant (POC) and has a MCL of 5 ug/L. Under the Safe Drinking Water Act, the federal maximum contaminant level goal (MCLG) and the MCL for 1,2-dichlorobenzene are both 600 ug/L (rounded from 630 ug/L) (US EPA, 1989, 1991), assuming a 70-kg adult drinks 2 L/day and allocating 20% of the U.S. EPA reference dose (90 ug/kg/day) to drinking water (US EPA, 1996).

The World Health Organization's recommended health-based guideline for 1,2-dichlorobenzene in drinking water is 1,000 ug/L (rounded from 1,287 ug/L), assuming a 60-kg adult drinks 2 L/day and allocating 10% of the tolerable daily intake (TDI) of 429 ug/kg/day to drinking water (WHO, 1993). The TDI was derived by applying an uncertainty factor of 100 (for inter- and intraspecies variation) to a NOEL of 60 mg/kg/day for tubular degeneration of the mouse kidney. This NOEL was taken from a 2-year study in which mice were given gavage doses of 60 or 120 mg/kg/day for 5 days/week (average daily doses of 42.9 and 85.7 mg/kg/day, respectively) (NTP, 1985). This was the same study used by the U.S. EPA (1996) to derive their reference dose, although the U.S. EPA concluded that the kidney lesions (i.e., renal tubular regeneration) observed in mice at the highest dose were of questionable significance and identified this dose as a no-observed-effect level in mice. The conclusion of the U.S. EPA was based on the absence of other treatment-related renal lesions in rats or mice and because the incidence the kidney lesions in male control mice was below those of three similar control groups that were studied during the same period of time at the testing facility. The World Health Organization noted that the health-based value far exceeds the lowest reported odor threshold for 1,2-dichlorobenzene in water.

SELECTION OF VALUE

According to 6 NYCRR 702.2(b), the selected ambient water quality value shall be the most stringent of the values derived using the procedures found in 6 NYCRR 702.3 through 702.7. A value of 3 ug/L based on chemical correlation (6 NYCRR 702.7) to 1,4-dichlorobenzene is the most stringent value for 1,2-dichlorobenzene and is the value selected as the water quality value for 1,2-dichlorobenzene.

REFERENCES

Amoore, J.E. and E. Hautala. 1983. Odor as an aid to chemical safety: Odor thresholds compared with Threshold Limit Values and volatilities for 214 industrial chemicals in air and water dilution. J. Appl. Tox. 3:272-290.

Faust, S.D. and O.M. Aly. 1983. Tastes and Odors in Drinking Water. In: Chemistry of Water Treatment. Boston, MA: Butterworths. Pp. 131-185.

IARC (International Agency for Research on Cancer). 1987. IARC Monographs of the Evaluation of Carcinogenic Risks to Humans. Overall Evaluation of Carcinogenicity: An Updating of IARC Monographs Volumes 1 to 42. Supplement 7. Lyon, France: IARC.

NTP (National Toxicology Program). 1985. Toxicity and Carcinogenesis Studies of 1,2-Dichlorobenzene (CAS No. 95-50-1) in F344/N Rats and B6C3F1 Mice (Gavage Studies). Technical Report Series No. 255. Research Triangle Park, NC: U.S. Department of Health and Human Services, U.S. Public Health Service.

NTP (National Toxicology Program). 1994. Seventh Annual Report on Carcinogens: Summary. Research Triangle Park, NC: U.S. Department of Health and Human Services, U.S. Public Health Service.

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

NYS (New York State). 1997b. Human Health Fact Sheet. Ambient Water Quality Fact Sheet for Protection Of Sources of Potable Water: 1,3-Dichlorobenzene. Albany, NY:

New York State Department of Health.

US EPA (U.S. Environmental Protection Agency). 1985a. Health Assessment Document for Chlorinated Benzenes (Final Report) EPA/600/8-84/015F. Washington, DC: Office of Health and Environmental Assessment.

US EPA (U.S. Environmental Protection Agency). 1985b. National Primary Drinking Water Regulations; Synthetic Organic Chemicals, Inorganic Chemicals and Microorganisms; Proposed Rule. Fed. Reg. 50:46936-47022.

US EPA (U.S. Environmental Protection Agency). 1987a. Final Draft Criteria Document for ortho-Dichlorobenzene, meta-Dichlorobenzene, para-Dichlorobenzene. Washington, DC: Criteria and Standards Division, Office of Drinking Water.

US EPA (U.S. Environmental Protection Agency). 1987b. ortho-, meta- and para-Dichlorobenzene Health Advisory. Washington, DC: Office of Drinking Water.

US EPA (U.S. Environmental Protection Agency). 1987c. National Primary Drinking Water Regulations; Synthetic Organic Chemicals; Monitoring for Unregulated Contaminants; Final Rule. Fed. Reg. 52:25690-25717.

US EPA (U.S. Environmental Protection Agency). 1989. National Primary and Secondary Drinking Water Regulations; Proposed Rule. Fed. Reg. 54:22062-22160.

US EPA (U.S. Environmental Protection Agency). 1991. National Primary Drinking Water Regulations; Final Rule. Fed. Reg. 56:3526-3614.

US EPA (U.S. Environmental Protection Agency). 1996. 1,2-Dichlorobenzene. On-Line as of March 1. Integrated Risk Information System (IRIS). Cincinnati, OH: Office of Research and Development, Environmental Criteria and Assessment Office.

Verschueren, K. 1983. Handbook of Environmental Data on Organic Chemicals, 2nd Edition. New York, NY: Van Nostrand Reinhold.

WHO (World Health Organization). 1993. Guidelines for Drinking-Water Quality, 2nd Edit., Vol. 1: Recommendations. Geneva, Switzerland: World Health Organization.

SEARCH STRATEGY: ON-LINE TOXICOLOGIC DATABASE

Toxline (1981 to March 14, 1996) was searched linking the CAS Registry Number of 1,2-dichlorobenzene with the keyword "toxicity."

Bureau of Toxic Substance Assessment/tbj01&kgb02
New York State Department of Health
March, 1996

96088PRO0176