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: 1,4-Dichlorobenzene **CAS REGISTRY NUMBER:** 106-46-7

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

BASIS: Oncogenic Effects

INTRODUCTION

1,4-Dichlorobenzene is one of three structurally-similar isomers of dichlorobenzene. The other two isomers are 1,2-dichlorobenzene and 1,3-dichlorobenzene. The physical, chemical, and toxicological properties of 1,4-dichlorobenzene (para-dichlorobenzene) have been reviewed (ATSDR, 1993; NTP, 1987; US EPA, 1980, 1985c, 1987a,c). 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 1,2-dichlorobenzene and 1,3-dichlorobenzene are derived in separate fact sheets (NYS, 1997a,b).

SPECIFIC MCL AND PRINCIPAL ORGANIC CONTAMINANT CLASS (702.3)

1,4-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)

1,4-Dichlorobenzene induces liver tumors in male and female mice and kidney tumors in male rats (NTP, 1987) and is an oncogen under 6 NYCRR 700.1. 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, 1987d) classifies 1,4-dichlorobenzene as a Group C (possible human) carcinogen.

The NTP (1987) gavage study can be used to derive a water quality value based on oncogenic effects. Dose-response data were evaluated and a cancer potency factor of 0.011 per milligram per kilogram per day (0.011 $(mg/kg/day)^{-1}$) was derived using procedures consistent with those outlined in paragraphs (a) through (e) of 6 NYCRR 702.4 including the linearized multistage model (extra risk) (702.4(a)) and a cross-species scaling factor based on the assumption that lifetime cancer risks are equal when daily administered doses are in proportion to body weights raised to the 3/4 power. The cancer potency factor was based on the most sensitive response in the most sensitive sex and species (i.e., the combined incidence of liver adenomas and carcinomas (17/50, 22/49, and 40/50) in male mice given gavage doses of 0, 300, and 600 mg/kg/day, respectively, 5 days/week for 2 years and a body weight of 0.035 kg. The water concentration 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. This value was derived using the above cancer potency factor (0.011 $(mg/kg/day)^{-1}$) and the procedure in paragraph (f) of 6 NYCRR 702.4.

NON-ONCOGENIC EFFECTS (702.5)

1,4-Dichlorobenzene damages the blood, liver, kidneys, parathyroid and adrenal glands, and lungs of laboratory animals (ATSDR, 1993; US EPA, 1985, 1987a,c). The U.S. EPA Office of Drinking Water (US EPA, 1987a,d) derived an oral reference dose (equivalent to an acceptable daily intake) for 1,4-dichlorobenzene of 100 micrograms per kilogram per day (100 ug/kg/day, rounded from the calculated value of 107 ug/kg/day) using procedures consistent with those outlined in paragraphs (a) and (b) of 6 NYCRR 702.5. This reference dose was derived by application of a 1,000-fold uncertainty factor to a no-observed-effect level of 107 mg/kg/day for kidney toxicity in male rats exposed by gavage for 13 weeks (NTP, 1987). The uncertainty factor of 1,000 was used to account for variability among humans, differences between animals and humans and the use of a sub-chronic study. A value of 750 ug/L (rounded from the calculated value of 749 ug/L) is derived using the procedure outlined in paragraph (e) of 6 NYCRR 702.5 and allowing 20% of the calculated acceptable daily intake (i.e., 107 ug/kg/day) to come from drinking water (6 NYCRR702.5(c)).

The results of a NTP (1987) 2-year gavage study of 1,4-dichlorobenzene (a lowest-observed-effect level of 107 mg/kg/day for kidney toxicity in male rats) provide alternative data for use in deriving a reference dose. If an uncertainty factor of 1,000 is applied to this dose, an oral reference dose (equivalent to an acceptable daily intake) of 107 ug/kg/day for 1,4-dichlorobenzene can be derived using procedures consistent with those outlined in paragraphs (a) and (b) of 6 NYCRR 702.5. The uncertainty factor of 1,000 was used to account for variability among humans, differences between animals and humans and the use of a lowest-observed-effect level. A value of 750 ug/L (rounded from the calculated value of 749 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)

A value based on chemical correlation is not applicable because data are sufficient to evaluate 1,4-dichlorobenzene based on both of the sections 6 NYCRR 702.4 and 702.5.

OTHER STANDARDS AND GUIDELINES

Under New York State Department of Health regulations for drinking-water standards (10 NYCRR Part 5), 1,4-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 1,4-dichlorobenzene are both 75 ug/L (rounded from the calculated value of 74.9 ug/L), assuming a 70-kg adult drinks 2 L/day, allocating 20% of the U.S. EPA reference dose (107 ug/kg/day) to drinking water and applying an additional uncertainty factor of 10 (for possible oncogenic effects) (US EPA, 1985a,b, 1987d).

The World Health Organization (WHO) derived a health-based guideline value of 300 ug/L for 1,4-dichlorobenzene in drinking water (rounded from the calculated value of 321 ug/L), assuming a 60-kg adult drinks 2 L/day and allocating 10% of the WHO tolerable daily intake (107 ug/kg/day) to drinking water (WHO, 1993). The tolerable daily intake was derived by applying an uncertainty factor of 1,000 (100 for inter- and intraspecies variation and 10 because a lowest-observed-adverse-effect level was used instead of a no-observed-adverse-effect level and because the toxic end-point was carcinogenicity) to a lowest-observed-adverse-effect level of 150 mg/kg/day (administered 5 days/week) for kidney effects in rats identified in a 2-year gavage study of 1,4-dichlorobenzene (NTP, 1987). The World Health Organization noted that the health-based value far exceeds the lowest reported odor threshold for 1,4-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. This value is 3 ug/L (based on oncogenic effects) and is the value selected as the water quality value for 1,4-dichlorobenzene.

REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1993. Toxicological Profile for 1,4-Dichlorobenzene. Update. TP-92/10. Atlanta, GA: U.S. Department of Health and Human Services, U.S. Public Health Service.

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.

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). 1987. Toxicity and Carcinogenesis Studies of 1,4-Dichlorobenzene (CAS No. 106-46-7) in F344/N Rats and B6C3F1 Mice (Gavage Studies). Technical Report Series No. 319. 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: 1,2-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). 1980. Ambient Water Quality Criteria for Dichlorobenzenes. EPA-440/5-80-039. Washington, DC: Criteria and Standards Division.

US EPA (U.S. Environmental Protection Agency). 1985a. National Primary Drinking Water Regulations; Volatile Synthetic Organic Chemicals; Final Rule. Fed. Reg. 50:46880-46901.

US EPA (U.S. Environmental Protection Agency). 1985b. National Primary Drinking Water Regulations; Volatile Synthetic Organic Chemicals; Proposed Rule. Fed. Reg. 50:46902-46933.

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

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. Water Pollution Control; National Primary Drinking Water Regulations - Volatile Synthetic Organic Chemicals; Para-Dichlorobenzene. Fed. Reg. 52:12876-12883.

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

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

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 1,4-dichlorobenzene with the keyword "toxicity."

Bureau of Toxic Substance Assessment/kgb02&kmm12
New York State Department of Health
March, 1996

94262PRO0706