

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: Bis(2-ethylhexyl)phthalate

CAS REGISTRY NUMBER: 117-81-7

AMBIENT WATER QUALITY VALUE: 5 micrograms/liter (5 ug/L)

BASIS: Oncogenic Effects

INTRODUCTION

The physical, chemical, and toxicological properties of bis(2-ethylhexyl)phthalate [di(2-ethylhexyl)phthalate] have been reviewed (ATSDR, 1993; CHAP, 1985; US EPA, 1990, 1992, 1995). 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.

SPECIFIC MCL AND PRINCIPAL ORGANIC CONTAMINANT CLASS (702.3)

Di(2-ethylhexyl)phthalate does not have a Specific MCL (maximum contaminant level) as defined in 6 NYCRR 700.1 and is not in a principal organic contaminant class as defined in 6 NYCRR 700.1. Therefore, a water quality value cannot be derived under 6 NYCRR 702.3.

ONCOGENIC EFFECTS (702.4)

Di(2-ethylhexyl)phthalate induces hepatocellular carcinomas and adenomas in mice and rats (Cattley et al., 1987; NTP, 1982; US EPA, 1995) and is an oncogen under 6 NYCRR 700.1. In 1987, the U.S. EPA evaluated the dose-response data for di(2-ethylhexyl)phthalate and calculated cancer potency factors that range from

0.014 per milligram per kilogram per day ($0.014 \text{ (mg/kg/day)}^{-1}$) to $0.0032 \text{ (mg/kg/day)}^{-1}$ (Exhibit 1, taken from US EPA, 1995), using procedures consistent with those outlined in paragraphs (a) through (e) of 6 NYCRR 702.4, including the linearized multistage model (extra risk). These cancer potency factors were calculated by the U.S. EPA using a cross-species scaling factor for carcinogen risk assessment based on the assumption that lifetime cancer risks are equal when daily administered doses are in proportion to body weights raised to the $2/3$ power (the surface area scaling factor). Proposed New York State regulations state that the scaling factor should be 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. This change requires application of an adjustment factor to cancer potency factors calculated using a cross-species scaling factor based on surface area.

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 5 ug/L. This value was derived using the adjusted cancer potency factor ($0.00742 \text{ (mg/kg/day)}^{-1}$) based on the most sensitive response in the most sensitive sex and species (the incidence of liver tumors in male mice exposed, via food, for two years (NTP, 1982)), and the procedure in paragraph (f) of 6 NYCRR 702.4. The adjusted cancer potency factor was calculated by multiplying the U.S. EPA cancer potency factor of $0.014 \text{ (mg/kg/day)}^{-1}$ by 0.53 (the adjustment factor for a mouse body weight of 0.035 kg).

NON-ONCOGENIC EFFECTS (702.5)

Di(2-ethylhexyl)phthalate damages the liver, testes and kidney and is fetotoxic in laboratory animals (ATSDR, 1993; CHAP, 1985). In 1986, the U.S. EPA established an oral reference dose (equivalent to an acceptable daily intake) for di(2-ethylhexyl)phthalate of 20 micrograms per kilogram per day (20 ug/kg/day , rounded from the calculated value of 19 ug/kg/day) (Exhibit 2, taken from US EPA, 1995), 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 lowest-observed-effect level of 19 mg/kg/day for increased relative liver weights in guinea pigs exposed, via food, for one year (Carpenter et al., 1953). A value of 140 ug/L is derived using the procedure outlined in paragraph (e) of 6 NYCRR 702.5 and allowing 20% of the acceptable daily intake (i.e., 20 ug/kg/day) to come from drinking water (6 NYCRR 702.5(c)).

A recent study with rats provides alternative data for use in deriving a reference dose for di(2-ethylhexyl)phthalate. Crocker et al. (1988) reported a lowest-observed-effect level of 0.9 mg/kg/day for an increased incidence of renal focal cysts and a decrease in creatinine clearance rates in rats dosed orally for one year. If an uncertainty factor of 1,000 is applied to this dose, an oral reference dose of 0.9 ug/kg/day can be derived for di(2-ethylhexyl)phthalate using procedures consistent with those outlined in paragraphs (a) and (b) of 6 NYCRR 702.5. An uncertainty factor of 1,000 was used to account for variability among humans, differences between animals and humans, the use of a one-year study, the use of a lowest-observed-effect level and the nature and severity of the observed effects. A value of 6.3 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 was not derived because there were sufficient data to derive values based on oncogenic effects (6 NYCRR 702.4) and non-oncogenic effects (6 NYCRR 702.5).

OTHER STANDARDS AND GUIDELINES

Under the New York State Department of Health regulations for drinking-water standards (10 NYCRR Part 5), di(2-ethylhexyl)phthalate is an unspecified organic contaminant (UOC) and has a MCL of 50 ug/L. Under the Safe Drinking Water Act, the federal maximum contaminant level goal (MCLG) for di(2-ethylhexyl)phthalate is zero and the MCL is 6 ug/L, based on analytical considerations (US EPA, 1992). The World Health Organization (WHO) derived a guideline value of 8 ug/L for di(2-ethylhexyl)phthalate in drinking water (rounded from 7.5 ug/L), assuming a 60-kg adult drinks 2 L/day and allocating 1% of the WHO reference dose (25 ug/kg/day) to drinking water (WHO, 1993).

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 5 ug/L (based on oncogenic effects) and is the value selected as the water quality value for di(2-ethylhexyl)phthalate.

REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1993. Toxicological Profile for Di(2-ethylhexyl)phthalate. Atlanta, GA: U.S. Department of Health and Human Services, U.S. Public Health Service.

Carpenter, C.P., C.S. Weil and H.F. Smyth. 1953. Chronic oral toxicity of di(2-ethylhexyl)phthalate for rats and guinea pigs. Arch. Ind. Hyg. Occup. Med. 8:219-226.

Cattley, R.C., J.G. Conway and J.A. Popp. 1987. Association of persistent peroxisome proliferation and oxidative injury with hepatocarcinogenicity in female F-344 rats fed di(2-ethylhexyl)phthalate. *Cancer Letters*. 38:15-22.

CHAP (Chronic Hazard Advisory Panel on Di(2-ethylhexyl)phthalate). 1985. Report. Washington, DC: U.S. Consumer Product Safety Commission.

Crocker, J.F.S., S.H. Safe and P. Acott. 1988. Effects of chronic phthalate exposure on the kidney. *J. Toxicol. Environ. Health*. 23:433-444.

NTP (National Toxicology Program). 1982. Carcinogenesis Bioassay of Di(2-ethylhexyl)phthalate (CAS No. 117-81-7) in F-344 Rats and B6C3F¹ Mice (Feed Study). Technical Report Series No. 217. Bethesda, MD: U.S. Department of Health and Human Services.

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.

US EPA (U.S. Environmental Protection Agency). 1990. National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals; Proposed Rule. *Fed. Register*. 55:30370-30448.

US EPA (U.S. Environmental Protection Agency). 1992. National Primary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals; Final Rule. *Fed. Register*. 57:31776-31849.

US EPA (U.S. Environmental Protection Agency). 1995. Di(2-ethylhexyl)phthalate. On-Line as of March 1. Integrated Risk Information System (IRIS). Cincinnati, OH: Office of Research and Development, Environmental Criteria and Assessment Office.

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, 1995) was searched linking the CAS Registry Number for di(2-ethylhexyl)-phthalate with the keyword "toxicity."

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