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: Asbestos (intermediate range, fibers longer than 10 micrometers (um))

CAS REGISTRY NUMBER: Not applicable

AMBIENT WATER QUALITY VALUE: 7×10^6 fibers (longer than 10 um)/liter

BASIS: Specific MCL

INTRODUCTION

The physical, chemical and toxicological properties of asbestos have been reviewed (ATSDR, 1993; Marsh, 1983; NAS, 1983; US EPA 1985a,b, 1991). Asbestos is the name applied to a group of six different minerals that occur naturally in the environment. Chrysotile is the most common form and the form mainly used in industry; most of the asbestos in water is chrysotile (ATSDR, 1993). 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)

Asbestos has a Specific MCL of 7×10^6 fibers (longer than 10 um)/L as defined in 6 NYCRR 700.1. This is a maximum contaminant level for drinking water established by the New York State Department of Health nder the State Sanitary Code (10 NYCRR Part 5, Public Water Systems). Therefore, a water quality value of 7×10^6 fibers (longer than 10 um)/L) (the Specific MCL) can be derived based on 6 NYCRR 702.3(a). Asbestos is not in a principal organic contaminant class as defined in 6 NYCRR 700.1.

ONCOGENIC EFFECTS (702.4)

Asbestos causes cancer in humans and animals when inhaled (ATSDR, 1993). Some epidemiological studies have found a positive association between chronic exposure to asbestos, including exposure via drinking water, and higher incidences of gastrointestinal tract cancer (ATSDR, 1993; Marsh, 1983; NAS, 1983; US EPA, 1995). Other studies have not found a relationship and the available human data are inadequate to evaluate the oncogenic potential of ingested asbestos (US EPA, 1995). Only one of several studies on the oncogenicity of ingested asbestos in animals was positive (ATSDR, 1993).

Chrysotile asbestos induced adenomatous polyps (benign tumors) in the colon of male rats exposed to a diet containing 1% intermediate-range chrysotile asbestos (fibers longer than 10 um) for two years (NTP, 1985). Although these lesions are not cancerous and did not progress to carcinoma during the study, they have the potential to progress to carcinoma and can be considered oncogenic effects. Nine of 250 rats (mean body weight of 0.38 kg) developed benign tumors of the colon, which was substantially higher than the incidence of epithelial neoplasms (benign and malignant combined) of the colon in the pooled control groups (male) of all the NTP oral asbestos lifetime studies (3/524 as reported by US EPA, 1985a). The estimated dose was 6.45×10^{10} fibers (longer than 10 um) per kilogram per day and was based on transmission electron microscope analyses (US EPA, 1985a).

Given the above, the U.S. EPA (1985b, 1989, 1991) promulgated drinking-water standards to reduce the potential risk of cancer and other effects from asbestos in drinking water. The U.S. EPA (1985a, 1991) evaluated the dose-response data for ingested asbestos and calculated a cancer potency factor of 1.4×10^{-13} per fibers (longer than 10 um) per liter (1.4×10^{-13} (fibers (longer than 10 um)/L) $^{-1}$) using a one-hit model (extra risk) and procedures consistent with those outlined in paragraphs (b) to (e) of 6 NYCRR 702.4. The one-hit model and the linearized multistage model are functionally equivalent when there is only one non-zero dose level. The cancer potency factor was 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 1×10^{7} fibers (longer than 10 um)/L. This value was derived using the adjusted cancer potency factor (0.91×10^{-13} (fibers (longer than 10 um)/L)$^{-1}$) 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 1.4×10^{-13} (fibers (longer than 10 um)/L)$^{-1}$ by 0.65 (the adjustment factor for a rat body weight of 0.38 kg). This value does not take into consideration the possibility that high concentrations of asbestos in water can increase airborne asbestos concentrations and increase the cancer risks from inhaled asbestos.

Further investigation is needed to address this issue.

NON-ONCOGENIC EFFECTS (702.5)

Non-oncogenic effects caused by ingested chrysotile asbestos (intermediate range, fibers longer than 10 um) are limited to the gastrointestinal tract (ATSDR, 1993; NTP, 1985, 1990). The low-observed-effect level for adenomatous polyps (benign tumors) in the colon of male rats exposed to a diet containing 1% intermediate-range chrysotile fibers for two years was 6.45×10^{10} fibers (longer than 10 um) per kilogram per day (NTP, 1985). The dose was calculated by the U.S. EPA (1985a) and was based on transmission electron microscope analyses. If an uncertainty factor of 1,000 is applied to this dose, an oral reference dose (equivalent to an acceptable daily intake) of 6.45×10^{7} fibers (longer than 10 um) per kilogram per day can be derived for asbestos 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, and the use of a lowest-observed-effect level. A value of 4.5×10^{8} fibers (longer than 10 um)/L is derived using the procedure outlined in paragraph (e) of 6 NYCRR and allowing 20% of the acceptable daily intake to come from drinking water (6 NYCRR 702.5 (c)). This value is substantially higher than the value based on oncogenic risk and does not take into consideration the possibility that high concentrations of asbestos in water can increase airborne asbestos concentrations and increase the cancer risks from inhaled asbestos.

CHEMICAL CORRELATION (702.7)

A value based on chemical correlation was not derived because data were sufficient to derive values based on oncogenic (6 NYCRR 702.4) and non-oncogenic (6 NYCRR 702.5) effects.

OTHER STANDARDS AND GUIDELINES

Under the Safe Drinking Water Act, the federal maximum contaminant level goal (MCLG) and the maximum contaminant level (MCL) for asbestos are both 7×10^{6} fibers (longer than 10 um)/L. Under New York State Department of Health regulations for drinking-water standards (10 NYCRR Part 5), the specific MCL for asbestos is also 7×10^{6} fibers (longer than 10 um)/L.

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 7×10^6 fibers (longer than 10 um)/L (based on a Specific MCL) and is the value selected as the water quality value for asbestos.

REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1993. Toxicological Profile for Asbestos. Update. Atlanta, GA: U.S. Department of Health and Human Services, U.S. Public Health Service.

Marsh, G.M. 1983. Critical review of epidemiologic studies related to ingested asbestos. Environ. Health Perspect. 53:49-56.

NAS (National Academy of Sciences). 1983. Drinking Water and Health, Vol. 5. Washington, DC: National Academy Press.

NTP (National Toxicology Program). 1985. Toxicology and Carcinogenesis Studies of Chrysotile Asbestos (CAS NO. 12001-29-5) in F344/N Rats (Feed Studies). Technical Report Series No. 295. Research Triangle Park, NC: U.S. Department of Health and Human Services, U.S. Public Health Service.

NTP (National Toxicology Program). 1990. Lifetime Carcinogenesis Studies of Chrysotile Asbestos (CAS NO. 12001-29-5) in Syrian Golden Hamsters (Feed Studies). Technical Report Series No. 246. 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.

US EPA (U.S. Environmental Protection Agency). 1985a. Drinking Water Criteria Document for Asbestos (Final Draft). PB192074/AS. Cincinnati, OH: Environmental Criteria and Assessment Office.

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

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

US EPA (U.S. Environmental Protection Agency). 1991. National Primary Drinking Water Regulations; Final Rule. Fed. Register. 56:3526-3597.

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

SEARCH STRATEGY: TOXICOLOGIC DATABASE

ToxLine (1981 to May, 1995) was searched linking asbestos with the keywords "ingested" and "toxicity."

Bureau of Toxic Substance Assessment/kgb02
New York State Department of Health
May, 1995
Revised 1997

93263PRO0015