VALUE(S) ADDED 7-24-85

FACT SHEET REVISED _____

VALUE(S) REMOVED _____

AMBIENT SURFACE WATER QUALITY STANDARDS DOCUMENTATION

CHEMICAL: Ethylene oxide

CAS NO.(s): 75-21-8

BASIS (Human/Aquatic): Human

WATER CLASSIFICATION: AA; AA-s; A; A-s

STANDARD: 0.05 ug/l Note A

REMARKS:

SUMMARY INFORMATION:

The toxicologic data base for this compound has been reviewed.[1,2] It is a suspected human oncogen and may adversely affect human reproduction.[2] It is an animal oncogen as defined in Part 701.1(p). Chronic exposure of laboratory animals to this compound has resulted in a significant increase in the incidence of brain tumors and leukemia in male and female rats (air exposure)[3] and stomach tumors in female rats (gavage doses).[4] A carcinogenesis bioassay sponsored by the National Toxicology Program is in progress and the standard may be modified once the results are available for review.

STANDARD DERIVATION:

Dose-response data from the Dunkelberg[4] carcinogenesis bioassay were used for extrapolation. Using the protocol in Part 701.4 and a linearized multistage extrapolation procedure (GLOBAL82)[5], an ethylene oxide concentration of 0.05 ug/l in water was calculated to correspond to an increased human cancer risk of 1×10^{-6} over a lifetime (see calculations below). The recommended ambient water quality standard for ethylene oxide is 0.05 ug/l.

Calculations:

1. Dunkelberg Bioassay Data

The incidence of stomach tumors in female rats given doses of 0, 7.5, and 30 mg/kg of ethylene oxide via gavage on 2 days each week during the exposure period is the dose-response data for the most sensitive tumor type in the most sensitive species and sex, occurring at a statistically significant level.

2. Average Daily Intake (for animals)*

Average Daily Intake During Lifetime
0 mg/kg/day
2.1 mg/kg/day
8.6 mg/kg/day

*Exposure was for 2 days a week; therefore, doses on treatment days were multiplied by 2/7 to calculate average daily doses during exposure.

3. Data Input for GLOBAL82 Computer Program

Dose (mg/kg/day)	Number of animals with tumors	Number of experimental animals
0	0	50
2.1	8	50
8.6	29	50

4. GLOBAL82 Result (for animals)

The lower 95% confidence limit value of the ethylene oxide dose corresponding to an increased lifetime cancer risk of 1×10^{-6} for the experimental animals was 8.1×10^{-3} ug/kg/day.

5. Conversion of the animal dose (ug/kg/day) to a human dose using surface area conversion rule

$$\text{rodent dose (ug/kg/day)} \times \left(\frac{\text{animal body wt. (kg)}}{\text{human body wt. (kg)}}\right)^{0.33} = \text{human dose (ug/kg/day)}$$

$$8.1 \times 10^{-3} \text{ ug/kg/day} \times \left(\frac{0.35 \text{ kg}}{70 \text{ kg}}\right)^{0.33} = 1.4 \times 10^{-3} \text{ ug/kg/day}$$

6. Calculation of the ethylene oxide level in water corresponding to an increased cancer risk of 1×10^{-6} for a 70 kg human ingesting 2 liters of contaminated water per day over a lifetime.

$$\frac{0.0014 \text{ ug/kg/day} \times 70 \text{ kg}}{2 \text{ l/day}} = 0.049 \text{ ug/l}$$

REFERENCES:

(1) International Agency for Research on Cancer. 1976. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. 11: 157-167.

(2) U.S. Occupational Safety and Health Administration. 1983. Occupational Exposure to Ethylene Oxide, Proposed Rule. Fed. Register. 48: 17284-17310.

(3) Snelling, W. N. et al. 1984. A two-year inhalation study of the carcinogenic potential of ethylene oxide in Fischer 344 rats. Toxicol. Appl. Toxicol. 75: 105-117.

(4) Dunkelberg, H. 1982. Carcinogenicity of ethylene oxide and 1,2-propylene oxide upon intragastric administration to rats. Br. J. Cancer. 46: 924-933.

(5) Howe, R.B. and K.S. Crump. 1982. GLOBAL82 Computer Program. Science Research Systems, Inc., Ruston, LA.

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