VALUE(S) ADDED 7-24-85

FACT SHEET REVISED _____

VALUE(S) REMOVED _____

AMBIENT SURFACE WATER QUALITY STANDARDS DOCUMENTATION

CHEMICAL: Benzo(a)pyrene

CAS NO.(s): 50-32-8

BASIS (Human/Aquatic): Human

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

STANDARD: 0.002 ug/l Note A

REMARKS:

SUMMARY INFORMATION:

Polynuclear aromatic hydrocarbons (PAHs) are a diverse group of compounds comprised of substituted and unsubstituted polycyclic and heterocyclic aromatic rings. PAHs are produced largely as a result of the incomplete combustion of organic compounds. Benzo(a)pyrene is the most thoroughly studied PAH. The toxicologic data base for this compound has been reviewed.[1-6] It is embryotoxic and teratogenic in mice and has reduced the fertility of male and female mice exposed *in utero*.[5] It is an animal oncogen as defined in Part 701.1(p). Acute, subchronic or chronic exposure of laboratory animals to doses of this compound via oral (gavage or diet), skin or intratracheal routes has resulted in a significant increase in the incidence of tumors at numerous sites in mice and rats, including tumors of the forestomach, mammary gland, lung, skin and uterus.[4-7] Benzo(a)pyrene is also a transplacental carcinogen in mice and rabbits.[5]

STANDARD DERIVATION:

Dose-response data from the Collins *et al.*[7] carcinogenesis bioassay were used for extrapolation. Other more recent studies, although providing strong qualitative evidence on the carcinogenicity of benzo(a)pyrene, were considered inadequate for use in extrapolation procedures. Using the protocol in Part 701.4 and a linearized multistage extrapolation procedure (GLOBAL82)[7], a benzo(a)pyrene concentration of 0.002 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 benzo(a)pyrene is 0.002 ug/l.

Calculations:

1. Collins et al. Bioassay Data

The incidence of stomach tumors in male mice given doses of 0 and 10 mg/kg of benzo(a)pyrene 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
2.86 mg/kg/day

*Exposure was only for 2 days a week; therefore, doses on treatment days were multiplied by 2/7 to calculate average daily doses during the exposure period. Although the length of average exposure was 306 days, doses were not corrected for less-than-lifetime exposure since all animals died or were sacrificed before exposure was terminated.

3. Data Input for GLOBAL82 Computer Program

Dose (mg/kg/day)	Number of animals with tumors	Number of experimental animals
0	0	12
2.86	23	26

4. GLOBAL82 Result (for animals)

The lower 95% confidence limit value of the benzo(a)pyrene dose corresponding to an increased lifetime cancer risk of 1×10^{-6} for the experimental animals was 8.8×10^{-4} ug/kg/day.

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

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

$$8.8 \times 10^{-4} \text{ ug/kg/day} \times \left(\frac{0.03 \text{ kg}}{70 \text{ kg}}\right)^{0.33} = 6.8 \times 10^{-5} \text{ ug/kg/day}$$

6. Calculation of the benzo(a)pyrene 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.

$$\frac{0.000068 \text{ ug/kg/day} \times 70 \text{ kg}}{2 \text{ l/day}} = 0.0024 \text{ ug/l}$$

REFERENCES:

(1) National Academy of Sciences. 1977. Drinking Water and Health, Vol. 1. National Academy of Sciences. Washington, D.C.

(2) National Academy of Sciences. 1982. Drinking Water and Health, Vol. 4. National Academy Press. Washington, D.C.

(3) National Research Council (U.S.A.) 1983. Polycyclic Aromatic Hydrocarbons: Evaluations of Sources and Effects. National Academy Press. Washington, D.C.

(4) International Agency for Research on Cancer. 1973. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. 3: 91-136.

(5) International Agency for Research on Cancer. 1983. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. 32: 211-224.

(6) U.S. Environmental Protection Agency. 1980. Ambient water quality criteria for polynuclear aromatic hydrocarbons. NTIS No. PB81-117806.

(7) Collins, V.J. et al. 1943. Experimental gastric tumors in mice. Can. Res. 3: 29-35.

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

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