AMBIENT SURFACE WATER QUALITY
STANDARDS DOCUMENTATION

VALUE(S) ADDED 7-24-85

FACT SHEET REVISED _____

VALUE(S) REMOVED _____

CHEMICAL: Beryllium

CAS NO.(s): 7440-41-7

BASIS (Human/Aquatic): Human

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

STANDARD: 3 ug/l **Note** B

REMARKS:

SUMMARY INFORMATION:

The available toxicity data on beryllium has been reviewed [1-3]. The inhalation of beryllium particles is a major hazard to humans, causing acute and chronic lung disease. While laboratory experiments have shown that this compound can produce lung cancer (via inhalation or intratracheal instillation) and bone cancer (via intravenous injection or direct implantation) in animals, the limited epidemiological evidence that occupational exposure to beryllium dust or fumes may lead to an increased lung cancer risk is only suggestive.

Lifetime exposure of rats and mice to 5 ppm beryllium in drinking water (providing a daily dose of 400 ug/kg of body weight), caused a slight depression of growth (male rats), glycosuria (female rats) and a small excess of lymphoma leukemia (female mice) [4,5,8]. No significant effect on the incidence of tumors was observed in these studies.

In another study,[6,7] rats were given beryllium via the diet (5, 50 and 500 ppm) for two years; a significant accumulation of beryllium in bone was observed at all dose levels, growth depression was observed at the two higher dose levels, and an increased incidence of lung tumors (males) was observed at the low and mid-dose levels. The investigators considered the increase in lung tumors as being less than the known variation in different groups of control animals and, in the absence of a dose-response relationship (the highest incidence occurred in the low dose males), concluded that beryllium had no effect on the incidence of tumorigenesis in rats employed in this study. However, inadequacies in the experimental protocol and reporting of results limit the usefulness of this study; additional studies are needed to assess the oncogenic potential of ingested beryllium.

Beryllium is a relatively rare element and is not likely to be found in natural waters in greater than trace (less than 1 ug/l) amounts.

STANDARD DERIVATION:

While the available data from animal studies are sufficient to conclude that inhalation of beryllium dust or fumes may reasonably be anticipated to pose a carcinogenic risk (lung cancer) to humans, they do not support an assumption of carcinogenicity via the oral route of exposure. In view of these results and until additional data become available, it is recommended that the ambient water quality standard for beryllium be based on the limited results of long term ingestion studies in animals. Based on the lowest observed effect level of 400 ug/kg/day from the rat drinking water study[5] and an uncertainty factor of 1000, an acceptable daily intake (ADI) of 0.4 ug/kg be estimated for humans. A concentration of 3 ug beryllium/l in water would provide 20% of the ADI, assuming an average body weight of 70 kg and consumption of two liters of water per day. The level of 3 ug/l is recommended as the ambient surface water quality standard for beryllium.

REFERENCES:

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

(2) U.S. Environmental Protection Agency. 1980. Ambient Water Quality Criteria for Beryllium. NTIS No. PB117350.

(3) International Agency for Research on Cancer. 1980. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. World Health Organization, Rome.

(4) Schroeder, H.A. and M. Mitchener. 1975. Life-Term effects of mercury, and nine other trace metals in mice. Jour. Nutr. 105:452-458.

(5) Schroeder, H.A. and M. Mitchener. 1975. Life-Term studies in rats: effects of aluminum, barium, beryllium, and tungsten. Jour. Nutr. 105:421-427.

(6) Morgareidge, K. et al. 1975. Chronic feeding studies with beryllium sulfate in rats, evaluation of carcinogenic potential. Submitted to the Aluminum Company of America by Food and Drug Research Laboratories, Inc. (unpublished).

(7) Morgareidge, K. et al. 1977. Chronic oral toxicity of beryllium in the rat. Toxicol. Appl. Pharmacol. 41: 204-205. (abstract)

(8) Kanisawa, M. and H. Schroeder. 1969. Life-term studies on the effects of trace elements on spontaneous tumors in mice and rats. Cancer Research, 29: 892-895.

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