BERYLLIUM AND BERYLLIUM COMPOUNDS (Group 2A)

A. Evidence for carcinogenicity to humans (*limited*)

Observations, reviewed elsewhere[1,2], on beryllium-exposed subjects cover two industrial populations and a registry of berylliosis cases. Workers at beryllium extraction, production and fabrication facilities in the USA were followed up and their causes of mortality compared with those of both the general population and a cohort of viscose-rayon workers. Ratios of observed to expected deaths for lung cancer in the two industrial populations (65 observed) were found to be elevated in both comparisons (1.4 in respect of both the general population [95% confidence interval (CI), 1.1-1.8] and the viscose-rayon workers [1.0-2.0]) and tended to be concentrated in workers who had been employed for less than five years. Data from the US Beryllium Case Registry, in which cases of beryllium-related lung diseases were collected from a wide variety of sources (including the two facilities previously mentioned), indicate an approximately three-fold (six deaths observed, 2.1 expected; ratio of observed:expected, 2.9 [95% CI, 1.0-6.2]) increase in mortality from lung cancer among subjects who had suffered from acute berylliosis, which usually follows heavy exposure to beryllium, but not among those who had had chronic berylliosis (one death observed, 1.4 expected; ratio of observed:expected, 0.7; 95% CI, 0.1-3.7).

B. Evidence for carcinogenicity to animals (*sufficient*)

Beryllium metal, beryllium-aluminium alloy, beryl ore, beryllium chloride, beryllium fluoride, beryllium hydroxide, beryllium sulphate (and its tetrahydrate) and beryllium oxide[1,3,4] all produced lung tumours in rats exposed by inhalation or intratracheally. Single intratracheal instillations or one-hour inhalation exposures were effective[3]. Beryllium oxide and beryllium sulphate produced lung tumours in monkeys after intrabronchial implantation or inhalation[1]. Beryllium metal, beryllium carbonate, beryllium oxide, beryllium phosphate, beryllium silicate and zinc beryllium silicate all produced osteosarcomas in rabbits following their intravenous and/or intramedullary administration[1].

C. Other relevant data

No data were available on the genetic and related effects of beryllium and beryllium compounds in humans.

All of the available experimental studies considered by the Working Group were carried out with water-soluble beryllium salts. In one study, beryllium sulphate increased the frequency of chromosomal aberrations and sister chromatid exchanges in human lymphocytes and in Syrian hamster cells *in vitro*; in another study, chromosomal aberrations were not seen in human lymphocytes. It caused transformation of cultured rodent cells in several test systems. In one study, beryllium chloride induced mutation in cultured Chinese hamster cells. Beryllium sulphate did not induce unscheduled DNA synthesis in rat hepatocytes *in vitro*, mitotic recombination in yeast or mutation in bacteria. Beryllium chloride was mutagenic to bacteria[5].

References

[1]*IARC Monographs, 23*, 143-204, 1980

[2]Saracci, R. (1985) *Beryllium: epidemiological evidence.* In: Wald, N.J. & Doll, R., eds, *Interpretation for Negative Epidemiological Evidence for Carcinogenicity* (*IARC Scientific Publications No. 65*), Lyon, International Agency for Research on Cancer, pp. 203-219

[3]Litvinov, N.N., Kazenashev, V.K. & Bugryshev, P.F. (1983) Blastomogenic activities of various beryllium compounds (Russ.). *Eksp. Oncol., 5*, 23-26

[4]Ishinishi, N., Mizunoe, M., Inamasu, T. & Hisanaga, A. (1980) Experimental study on carcinogenicity of beryllium oxide and arsenic trioxide to the lung of rats by an intratracheal instillation (Jpn.). *Fukuoka Acta med., 71*, 19-26

[5]*IARC Monographs, Suppl. 6*, 110-112, 1987