HAEMATITE AND FERRIC OXIDE:
FERRIC OXIDE (Group 3)
HAEMATITE (Group 3)
UNDERGROUND HAEMATITE MINING WITH EXPOSURE TO RADON (Group 1)

A. Evidence for carcinogenicity to humans (*inadequate* for haematite and ferric oxide; *sufficient* for underground haematite mining with exposure to radon)

Underground haematite miners have a higher incidence of lung cancer in the presence of exposure to radon daughters (although other agents might also contribute to the risk) than

surface haematite miners[1-11]. Haematite mining with low-grade exposure to radon daughters and silica dust was not associated with excess lung cancer in a relatively large cohort[12]. The importance of exposure to radon daughters in the occurrence of lung cancer in haematite miners is also suggested by the time trend of lung cancer rates in a mining population[4]. One mining population with an increased lung cancer risk but with current low exposure to radon daughters might have had higher exposures in the past due to poorer ventilation[13,14].

Some studies of metal workers exposed to ferric oxide dusts have shown an increased incidence of lung cancer[1,15], but the influence of factors in the workplace other than ferric oxide, i.e., soots (see p. 343), silica (see p. 341) and asbestos (see p. 106) in foundry work, cannot be discounted. In other studies of metal and chemical workers exposed to ferric oxide, the incidence of lung cancer has generally not been increased[1,16].

B. Evidence for carcinogenicity to animals (*inadequate* for haematite; *evidence suggesting lack of carcinogenicity* for ferric oxide)

No conclusive carcinogenic effect was observed in mice, hamsters or guinea-pigs given ferric oxide intratracheally or by inhalation[1]. Repeated intratracheal instillation to hamsters of benzo[*a*]pyrene bound to fine ferric oxide dust particles induced squamous-cell and anaplastic carcinomas[17]. There was no increase in tumour yield in hamsters administered a constant dose of benzo[*a*]pyrene and increasing amounts of ferric oxide intratracheally, indicating that, beyond a certain ratio of benzo[*a*]pyrene to ferric oxide, the latter does not affect tumour yield[18]. Administration of ferric oxide particles alone occasionally induced interstitial fibrosis, indicating that ferrous oxide particles act as cofactors in this system, mainly as carriers[19]. In one study, intrapleural inoculation of the respirable fraction of iron ore mine dust to female BALB/c mice resulted in an increased incidence of lung adenomas; in a second study, an increased incidence of lymphoma/leukaemia was observed in female C57BL/6J mice exposed chronically to the same dust. In neither study was the number of animals specified, nor whether the mice were killed serially or died; in the second study, the type of exposure was not specified[20]. In several studies in hamsters, ferric oxide was not carcinogenic when given alone but enhanced lung and nasal-cavity carcinogenesis induced by *N*-nitrosodiethylamine and *N*-nitrosodimethylamine, respectively[21-23].

C. Other relevant data

No data were available on the genetic and related effects of ferric oxide in humans. It did not induce transformation of Syrian hamster embryo cells[24].

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