Beryllium (glucinium) or compounds thereof

Definition of causal agent

Beryllium is the lightest metal.; it is a grey hard metal, with chemical properties between those of aluminium and magnesium.
Its commonest ores are beryl (double silicate of aluminium and beryllium) and bertrandite. Very pure gem-quality beryls are known as blue-green aquamarine and green emerald. It is the inhalation of insoluble beryllium compounds which seems to cause the most serious health problems; these include beryllium oxide and various alloys, the most important being copper-beryllium alloy.

Main occupational uses and sources of exposure:
Beryllium extraction and metallurgy; manufacture and processing (melting, grinding, welding, drilling) of beryllium alloys (for springs, switches, relays, connectors in automobiles, computers, radar and telecommunications equipment; high strength non-sparking tools; moulds for metal, glass, and plastic items; sports equipment such as golf clubs and bicycle frames; and dental bridges and related applications); beryllium soluble salts, such as beryllium fluoride, chloride, and sulfate, are used in nuclear reactors, in glass manufacture, and as catalysts for certain chemical reactions. Beryllium oxide is used to make ceramics for electronics and electrical equipment. Pure beryllium metal is used in nuclear weapons and reactors, aircraft and space vehicle structures, and other instruments. Because of its unique properties, beryllium is used in many high-technology consumer and commercial products.
It is no longer used in fluorescent lamps.

Toxic effects

☐ Skin

Irritant contact dermatitis; allergic contact dermatitis; ulcerating granulomas; and allergic dermal granulomas.

Exposure criteria:
Minimum intensity of exposure: Occupational exposure confirmed, if possible assessed, by history and study of working conditions providing evidence of exposure to beryllium compounds.

Minimum duration of exposure: May be very short (ulceration and subcutaneous granulomas develop if small beryllium crystals penetrate the skin).

Maximum latent period: granulomas: one month.

Skin irritation and sensitisation: See section on ***Occupationally caused irritation of the skin and mucous membranes*** in Annex I entry nr. 202.

☐ Acute beryllium disease

In acute disease, beryllium (mainly soluble salts) acts as a direct chemical irritant, causing a nonspecific inflammatory reaction of the upper or lower respiratory tract or both. Tracheo-bronchitis may occur, but the most serious complication is chemical pneumonitis the severity of which depends on the intensity of exposure. Chemical pneumonitis occurred in almost all workers exposed to 1000 µg beryllium/m^3 and above and in none exposed to less than 100 µg/m^3 and appears to be reversible at concentrations of less than 1000 µg beryllium/m^3 (condition of historical interest).

☐ Chronic beryllium disease (CBD)

Workers exposed to beryllium may develop a specific hypersensitivity detectable by a beryllium lymphocyte transformation (proliferation) test on blood or broncho-alveolar lavage samples. The risk of hypersensitivity seems to be related to genotype; in susceptible workers it may develop at very low levels of exposure.

Chronic beryllium disease is a granulomatous lung disease caused by inhalation of insoluble beryllium dusts and characterized by the accumulation of CD4+ T cells and macrophages in the lower respiratory tract and in the presence of beryllium hypersensitivity.

Diagnostic criteria include:
- history of beryllium exposure
- restrictive or mixed obstructive/restrictive changes in lung function; loss of diffusing capacity
- changes on chest X-ray similar to those of sarcoidosis
- histological evidence of non-caseating granulomas in bronchial tissue
- a positive beryllium lymphocyte transformation test.

Exposure criteria :

Minimum intensity of exposure: Occupational exposure confirmed, if possible assessed, by history and study of working conditions providing evidence of repeated or prolonged exposure to beryllium. The probability of developing sensitisation or CBD appears to be very low when the exposure level is kept < 0.02 µg/m^3. Skin exposure to fine beryllium particles might provide an alternative route for sensitization.

Minimum duration of exposure: unknown

Maximum latent period: none

☐ Bronchial cancer

Since the causal relationship between prolonged or repeated exposure to beryllium and the occurrence of a bronchial cancer has not been firmly established, and due to the multicausality of the occurrence of this type of cancer, the recognition of the occupational origin must lie on a thorough assessment based on rigorous scientific criteria taking into account all other possible aetiologies.

Each case must therefore be considered separately.

See also section on ***Occupational cancers*** in the **Preface.**