

Inhalation of beryllium dust or fumes can cause serious lung disease and cancer

Inhalation of even low levels of beryllium-containing dust or fumes can cause chronic beryllium disease, a serious lung disease. Exposure to beryllium or beryllium-containing compounds can also lead to lung cancer and skin disease.

The main workplace sources of exposure to beryllium dust and fumes are during the refining and machining of the metal and during the production of beryllium-containing products. Beryllium in solid form or in manufactured products poses no special health risk.

What is beryllium?

Beryllium is a naturally occurring metal. The second-lightest metal, beryllium is hard and non-magnetic. It is a good conductor of electricity

and has a high melting point. Metals such as copper, nickel, or aluminum are often mixed with beryllium to form alloys with high strength and hardness. Beryllium ceramics are made from beryllium oxide.

Do I work with beryllium?

Workplaces need to identify sources of beryllium. WHMIS regulations require the identification of beryllium if it is present in more than 0.1 percent in a product other than a manufactured article or hazardous waste. Check the Material Safety Data Sheets (MSDS) for the materials you use.

The properties of beryllium make it suitable for use in a large variety of industrial applications. The chart below lists many of these:

Industrial applications and processes involving beryllium

Industry/Trade	Uses
Aerospace	Landing gear bearings, jet brake pads, weather satellites, windshield frames in high-speed aircraft, solid-propellant in rocket fuels
Atomic energy production	Nuclear reactors, heat shields, neutron moderators or reflectors
Automotive	Airbag sensors, electronics, ignition control systems to increase gas mileage
Beryllium smelting/fabrication/extraction/metallizing	
Ceramics	Laser and electronic applications, high-speed integrated circuits
Computers	Microelectronics
Dental	Research and development; dental supplies; alloys in crowns, bridges, and dental plates
Electronics	Cell phones, transistors, heat sinks
Fire extinguisher	Sprinkler heads
Foundries (nonferrous)	
Hazardous waste processing	
Laboratory work	Research and development, metallurgy, chemistry
Medical	X-ray windows, medical laser bores, pacemakers
Nuclear weapons production, research and development	Nuclear devices for defence, electro-optical targeting, missile systems, advanced surveillance satellites, radar systems



Industry/Trade	Uses
Oil exploration	Equipment for oil exploration
Plating	
Refractories	
Smelters (nonferrous)	
Sporting goods	Golf clubs, bicycle frames
Telecommunications	Connectors and switches
Tool and die manufacturing	Plastic injection molding dies, non-sparking tools and springs
Welding	

What processes can expose me to beryllium?

Processes that can generate beryllium dust and fume include:

- Extraction, smelting, and refining of beryllium
- Cutting, machining, grinding, polishing, and finishing
- Maintenance and housekeeping
- Melting/casting/welding
- Production of beryllium metal, alloys, and compounds
- Heat-treating
- Research and development using powder
- Decommissioning and demolition of nuclear facilities, power generation plants, and aerospace facilities

What are the health effects of beryllium exposure?

There are several health effects resulting from exposure to beryllium: chronic beryllium disease, acute beryllium disease, cancer, and skin disease.

Chronic beryllium disease

Workers who inhale beryllium-containing dust or fumes, metal oxides, alloys, ceramics, or salts may become sensitized to beryllium and develop chronic beryllium disease (CBD). CBD is a serious lung disease that can be disabling and even fatal.

Recent information suggests that even low levels of exposure over a period of only weeks or months can lead to CBD in some workers.

Symptoms of CBD include unexplained cough, shortness of breath, fatigue, loss of appetite, weight loss, fever, and night sweats. CBD usually develops very slowly. Workers may not experience symptoms of the disease until several years after their exposure.

Acute beryllium disease

Acute beryllium disease is thought to result from exposures well above the exposure limit. It has a rapid onset and has symptoms similar to pneumonia or bronchitis. The frequency of acute beryllium disease is now very low.

Cancer

Inhalation of beryllium dust or fumes can cause lung cancer. The International Agency for Research on Cancer (IARC) classifies beryllium and beryllium compounds as carcinogenic to humans.

Skin disease

Exposure of the skin to beryllium can cause contact dermatitis with symptoms such as itching, redness, rashes, swelling, and blisters of the skin. Lesions, ulcerations, or wart-like bumps may also develop if beryllium penetrates into cuts or scratches.

How can I protect myself from beryllium exposure?

In workplaces where beryllium is present, a risk assessment must be conducted by the employer to identify whether there is the potential for workers to be exposed to beryllium in their workplace. Where the risk assessment determines there is potential for exposure, stringent protective measures must be implemented. Several suitable protective measures to control exposure to beryllium include:

- Engineering controls
- Substitution
- Worker hygiene and administrative controls
- Personal protective equipment
- Worker education and training
- Exposure monitoring

1. Engineering controls

- Enclose processes.
- Use local exhaust ventilation.
- Use vacuum systems in machining operations.
- Use high-efficiency particulate air (HEPA) vacuums to clean equipment and floors.

2. Substitution

Examples of substitution for beryllium-containing products

Form of beryllium	Examples of substitutes
Beryllium metal	Steel, titanium, graphite composites
Beryllium-copper alloys	Phosphor bronze
Beryllium oxide	Aluminum nitride
Beryllium-containing powders	Beryllium-containing pellets

3. Worker hygiene and administrative controls

Employers should:

- Designate personnel access control zones.
- Provide a change room where workers can shower and change work clothing.
- Provide workers with protective work uniforms such as overalls, lab coats, and booties.
- Provide a laundry area for contaminated clothing and respirators.

Workers should:

- NOT wear work uniforms and shoes outside the work areas.
- Leave contaminated clothing and shoes at the work premises. (CBD cases have occurred among family members of workers exposed to beryllium.)
- NOT eat, drink, or smoke in areas where beryllium is used.
- Wash thoroughly face, hands, and forearms prior to eating, smoking, or applying cosmetics.

4. Personal protective equipment

- Respiratory protection: Recent evidence indicates that levels below the exposure limit to beryllium may cause CBD. If workers are exposed to beryllium, employers should consider providing them with air-purifying respirators equipped with NIOSH 100 series filters (HEPA filters).
- Skin protection: Wear gloves recommended by the manufacturer for the particular process/operation involved. Wear protective clothing with arm sleeves.
- Eye protection: Wear dust-proof goggles and a face shield.

5. Worker education and training

Workers should understand:

- The hazards of beryllium
- The proper use of personal protective equipment
- Monitoring procedures
- Methods for decontamination and waste management

Workers should follow safe work procedures for proper handling and control of materials containing beryllium (refer to the MSDS).

For example:

- Do not use compressed air to clean parts or working surfaces.
- Use work practices that generate less dust such as hand filing rather than power grinding.
- After cleaning with a damp mop, do not leave a dust film after the water dries.
- Read labels.

6. Exposure monitoring

Evaluation of worker exposure to beryllium by:

- Personal air monitoring
- Area air monitoring
- Surface monitoring

What is the current exposure limit for beryllium in B.C.?

In B.C. the 8-hour exposure limit for beryllium and its compounds is 0.002 mg/m³.

Note: Due to new evidence indicating that levels below the current exposure limit may cause CBD, the American Conference of Governmental Industrial Hygienists (ACGIH) intends to change its exposure limit for beryllium from 0.002 mg/m³ to 0.0002 mg/m³ averaged over an 8-hour work shift.

Exposure limit, designations, and WHMIS classification for beryllium

	8-hour exposure limit for B.C.	Designation	WHMIS classification
Beryllium and compounds	0.002 mg/m ³	K1 (confirmed human carcinogen) Z (sensitizer) A (ALARA)	B6 (combustible solid) D2A (carcinogen, lung sensitizer) D2B (skin sensitizer)

The Z designation does not apply to elemental beryllium.

ALARA substances: If a substance is designated ALARA, measures must be taken to keep a worker's exposure to a level **as low as reasonably achievable**.

Where can I find additional information?

Additional information about beryllium is available on the internet:

- Canadian Centre for Occupational Health and Safety (CCOHS)
Beryllium Disease
<http://www.ccohs.ca/oshanswers/diseases/beryllium.html>
- International Agency for Research on Cancer (IARC)
Beryllium and Beryllium Compounds
<http://monographs.iarc.fr/htdocs/monographs/vol58/mono58-1.htm>
- OSHA Hazard Information Bulletin
Preventing Adverse Health Effects from Exposure to Beryllium on the Job
http://www.osha-slc.gov/dts/hib/hib_data/hib19990902.html
- Ontario Ministry of Labour Alert
Workplace Beryllium Exposure
<http://www.gov.on.ca/lab/ohs/a21e.htm>
- Worker's Compensation Board of British Columbia
Occupational Health and Safety Regulation
<http://regulation.healthandsafetycentre.org/s/Home.asp>

