

Beryllium



Safety Data Sheet

Section 1: Identification

1.1 Product Identifier

Product Name: Beryllium
 Product Form: Solid
 Chemical Family: Metal
 CAS Number: 7440-41-7
 Molecular Formula: Be
 Molecular Weight: 9.01

1.2 Other Means of Identification

Synonyms: Beryllium-9, Glucinium, Beryllium Element, Glucinum, UN 1567, RCRA P015, Be, DLA02910, RTECS DS1750000

1.3 Recommended Uses

Recommended Use: Variety of radiological, mechanical, and industrial applications.

1.4 Manufacturer, Importer, or Responsible Party

Responsible Party: Defense Logistics Agency Strategic Materials
 8725 John J. Kingman Road
 Fort Belvoir, Virginia 22060-6223
 (703) 767-5525

1.5 Emergency Phone Number

Emergency Phone Number: (800) 424-9300 (CHEMTREC)
 (703) 527-3887 (CHEMTREC INTERNATIONAL)

Section 2: Hazard(s) Identification

2.1 Classification of Chemical per OSHA CFR 1910.1200

Acute Toxicity (Oral): Category 4
 Acute Toxicity (Inhalation): Category 2
 Skin Irritation: Category 2
 Eye Irritation: Category 2A
 Carcinogen: Category 1A
 Reproductive Toxicity: Category 2
 Target Organ – Single: Category 3 (Respiratory System)
 Target Organ – Prolonged: Category 1 (Respiratory System)

2.2 Label Elements

Signal Word: DANGER



Symbol(s):

Hazard Statements:

May cause lung cancer via inhalation. Causes damage to lungs through prolonged or repeated exposure via inhalation. Harmful if swallowed. Fatal if inhaled. Causes skin irritation and serious eye irritation. Suspected of damaging fertility or the unborn child, may cross the placenta.

Precautionary Statements:

Prevention: Obtain special instruction before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves, clothing, and eye and/or face protection. Do not eat, drink, or smoke when using this product. Do not breathe dust. Use only outdoors or in a well-ventilated area. In case of inadequate ventilation, wear respiratory protection. Contaminated work clothing must not be allowed out of the workplace. Wash hands and exposed skin thoroughly after handling.

Response: If swallowed or inhaled, immediately call a poison control center and/or doctor. Rinse mouth. If inhaled, remove person to fresh air and keep comfortable for breathing. If on skin, wash with plenty of water. If skin and eye irritation occurs and/or persists or exposed, concerned or skin rash occurs, get medical attention and/or advice. Wash contaminated clothing before reuse. If in eyes, rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Storage: Store in a well-ventilated place. Keep container tightly closed. Store locked up.

Disposal: Dispose of contents in accordance with federal, state, and local regulations.

2.3 Other Hazards

Negligible fire and explosion hazard in bulk form. Dust/air mixtures may ignite or explode. May react on contact with water. Contaminated clothing should not be taken home at the end of shift, but should remain at employee's place of work for cleaning.

2.4 Unknown Acute Toxicity

Does not apply to this product.

Section 3: Composition / Information on Ingredients

3.1 Chemical Name

Chemical Name: Beryllium
Composition: 99.0%-99.7% Be

The health and physical hazards information provided in this SDS are for its major component. Beryllium metal contains other elements in addition to Be. For concentrations of other components, see the Certificates of Analysis for each lot.

3.2 Common Names/Synonyms

Synonyms: See **Section 1.2** for common names and synonyms.

3.3 CAS Number/Unique Identifiers

CAS Number: 7440-41-7
EC Number (EINECS): 231-150-7
EC Index Number: 004-001-00-7

3.4 Impurities/Stabilizing Additives

No data available.

Section 4: First-Aid Measures

4.1 Description of First-Aid Measures

Ensure that adequate decontamination has been carried out.

Inhalation:	If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.
Skin Contact:	Remove contaminated clothing and shoes. Wash skin with soap and water for at least 15 minutes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.
Eye Contact:	Flush eyes with plenty of water for at least 15 minutes. Get immediate medical attention.
Ingestion:	If swallowed, get medical attention. Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Get medical attention.

4.2 Most Important Symptoms/Effects, Acute and Delayed

Inhalation (Short-Term):	May cause irritation, fever, difficulty breathing, irregular heartbeat, lung congestion.
Inhalation (Chronic):	Long term exposure may cause skin disorders, changes in blood pressure, weight loss, chest pain, difficulty breathing fatigue, blood disorders, bone disorders, kidney damage, liver damage, cancer. Storage of absorbed beryllium takes place in bones. There is some retention of a transient nature by liver, kidney, and lung.
Skin Contact (Acute):	May cause irritation.
Skin Contact (Chronic):	May cause irritation.
Eye Contact (Acute):	May cause irritation.
Eye Contact (Chronic):	May cause irritation.
Ingestion (Acute):	May cause irritation, difficulty breathing.
Ingestion (Chronic):	No information on significant adverse effects.

4.3 Indication of Immediate Medical Attention/Special Treatment

Get immediate medical attention if inhaled, exposed to eyes, and/or ingested. Identified antidotes include calcium disodium edetate/dextrose, intravenous, and calcium disodium edetate/procaine, intramuscular.

Section 5: Fire-Fighting Measures

5.1 Suitable Extinguishing Media

Extinguishing media includes dolomite, dry powder for metal fires, dry sand, graphite, soda ash, and sodium chloride or approved Class D extinguishers. DO NOT use carbon dioxide or halogenated extinguishing agents. For fires involving beryllium, extinguish with water spray, fog, or standard foam. DO NOT use straight water streams.

5.2 Specific Hazards

Negligible fire and explosion hazard in bulk form. Dust/air mixtures may ignite or explode.

5.3 Special Protective Equipment and Precautions

Wear a self-contained breathing apparatus and protective clothing when fighting fires. Move container from fire area if it can be done without risk. Cool containers with flooding amounts of water until well after the fire is out; however, do not get water inside containers. Stay away from the ends of tanks. For fires in cargo or storages areas, cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is not possible, take the following precautions: Keep all unauthorized personnel away, isolate hazard area, and deny entry. Let the

fire burn. Use extinguishing agents appropriate for the surrounding fire. Avoid inhalation of material or combustion by-products. Keep run-off water out of sewers and water sources.

Section 6: Accidental Release Measures

6.1 Personal Precautions, Protective Equipment, and Emergency Procedures

Wear nitrile rubber gloves, eye protection, self-contained respirator, and protective clothing. Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ of 10 lb or 4.54 kg (US SARA Section 304). If release occurs in the US and is reportable under CERCLA Section 103, notify the National Response Center at (800) 424-8802 or (202) 426-2675. No reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers (0.004 inches). Keep out of water supplies and sewers. Keep all unauthorized people away, isolate hazard area, and deny entry. Personal protective equipment is discussed **Section 8.3**.

6.2 Methods and Materials for Containment and Cleaning Up

For small dry spills, collect beryllium and place in a clean, dry container for later disposal. Scoop up and place in a large stoppered wide mouth bottle. Save spilled material for recovery. Wash site with soap solution. Wastewater from contaminant suppression, cleaning of protective clothing/equipment, or contaminated sites should be contained and evaluated for subject chemical or decomposition product concentrations. For large spills, first dike the area, then wet down material with water for later disposal.

For a land spill, dig a pit, pond, lagoon, holding area to contain liquid or solid material. If time permits, pits, ponds, lagoons, soak holes, or holding areas should be sealed with an impermeable flexible membrane liner. Cover solids with a plastic sheet to prevent dissolving in rain or fire-fighting water. Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete. If spilled to water, use natural barriers or oil spill control booms to limit spill travel. Remove trapped material with suction hoses.

Section 7: Handling and Storage

7.1 Precautions for Safe Handling

Keep storage container tightly sealed. Transfer material in closed systems or within a completely hooded containment with local exhaust ventilation. Prevent spillage. Prevent contact with clothing. Flush container clean before discarding. Particulate may enter the body through cuts, abrasions or other wounds on the surface of the skin. Wear gloves when handling this product. Personal protective equipment is discussed in **Section 8.3**.

7.2 Conditions for Safe Storage

Store in accordance with all current regulations and standards. Beryllium should be stored in dry areas, away from incompatible substances and sources of ignition, including any sparking or arcing electrical apparatus. Incompatible materials are identified in **Section 10.5**.

Section 8: Exposure Controls / Personal Protection

8.1 Exposure Limits

OSHA PEL TWA:	0.002 mg/m ³
OSHA Ceiling:	0.005 mg/m ³ (30 minutes) with a maximum peak of 0.025 mg/m ³
ACGIH TWA:	0.002 mg/m ³
ACGIH STEL:	0.01 mg/m ³
IDLH:	4 mg/m ³ , Ca
NIOSH REL TWA (10 Hr NTE):	0.0005 mg/m ³ Ceiling, Ca
AGS TRK (Metal):	0.005 mg/m ³
AGS TRK (Other):	0.002 mg/m ³
UK WEL TWA:	0.002 mg/m ³

8.2 Appropriate Engineering Controls

Ventilation:

Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

8.3 Individual Protection Measures

Eye Protection:

Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate area.

Clothing:

Wear appropriate chemical resistant clothing (preferably disposable, one-piece and close fitting at ankles and wrists), gloves, hair covering, and over shoes. Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Gloves:

Wear appropriate chemical resistant gloves.

Respirator:

Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use.

1. Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, or P100.

2. Any air-purifying full-facepiece respirator equipped with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, or P100.

3. Any powered, air-purifying respirator with a high-efficiency particulate filter.

4. Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter.

5. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.

Unknown Concentrations/IDLH:

1. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

2. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Section 9: Physical and Chemical Properties

9.1 Appearance

Physical State:

Solid

Physical Description:

Grayish-white brittle metal.

9.2 Odor

Odor:

Odorless.

9.3 Odor Threshold

Not applicable.

9.4 pH

Not applicable.

9.5 Melting / Freezing Points

Melting Point: 2,323°F - 2,341°F (1,273°C - 1,283°C)
Freezing Point: Not applicable.

9.6 Initial Boiling Point and Boiling Range

Boiling Point: 5,378°F (2,970°C) @ 5 mmHg

9.7 Flash Point

No data available.

9.8 Evaporation Rate

Not applicable.

9.9 Flammability

No data available.

9.10 Upper/Lower Explosive Limits

No data available.

9.11 Vapor Pressure

Vapor Pressure: 7.6 mmHg @ 3,470°F (1,910°C)

9.12 Vapor Density

Not applicable.

9.13 Relative Density

Water = 1: 1.848

9.14 Solubility(ies)

Insoluble: Cold Water, Mercury
Soluble: Acids, Alkalis, Dilute Nitric Acid, Slightly Soluble in Hot Water

9.15 Partition Coefficient

No available.

9.16 Auto-Ignition Temperature

No data available.

9.17 Decomposition Temperature

No data available.

9.18 Viscosity

No data available.

Section 10: Stability and Reactivity

10.1 Reactivity

Avoid contact with water or moisture. May react with evolution of heat on contact with water.

10.2 Chemical Stability

Stable at normal temperatures and pressures.

10.3 Possibility of Hazardous Reactions

Acids (Strong): Reacts to produce flammable hydrogen gas.
Bases (Strong): Attacked and evolves flammable hydrogen gas.
Carbon Dioxide: Violent reaction.
Carbon Dioxide + Nitrogen: May ignite on heating.
Carbon Tetrachloride: Forms shock-sensitive mixture.

Chlorine:	Incandescent reaction when heated.
Fluorine:	Incandescent reaction when heated.
Halides:	Reacts.
Halocarbon Solvents:	May form shock-sensitive mixtures.
Hydrochloric Acid:	Reacts with finely divided or amalgamated beryllium.
Lithium:	Severely attacks beryllium metal.
Metals (Alkali):	Reacts to forms salts.
Nitric Acid (Dilute):	Reacts with finely divided or amalgamated beryllium.
Oxidizers:	Reacts vigorously.
Phosphorus:	Incandescent reaction on heating.
Sulfuric Acid:	Reacts with finely divided or amalgamated beryllium.
Trichloroethylene:	Forms shock-sensitive mixture.

10.4 Conditions to Avoid

None reported.

10.5 Incompatible Materials

Incompatibilities: Acids, bases, halocarbons, oxidizing materials, halogens, metals, and combustible materials.

Safe storage of the material is discussed in **Section 7.2**.

10.6 Hazardous Decomposition Products

Thermal Decomposition Products: Oxides of beryllium.

Section 11: Toxicological Information

11.1 Likely Routes of Exposure

Routes of entry include inhalation, skin contact, eye contact, and ingestion.

11.2 Symptoms

See **Section 4.2** for symptoms related to the chemical and toxicological characteristics.

11.3 Short and Long Term Effects

Inhalation (Acute):

Brief, intense exposure to pulmonary irritants may cause severe chemical pneumonitis. Symptoms may include bronchial spasm, nasopharyngitis, tracheobronchitis, cough, blood tinged sputum, dyspnea, cyanosis, nasal discharge, fever, anorexia, fatigue, tachycardia, and possibly cor pulmonale. Fatal pulmonary edema or spontaneous pneumothorax has been reported. Studies in rats indicate a severe, chemical pneumonitis followed by a quiescent period of minimal inflammation and mild fibrosis occurs. Later, progressive fibrosing pneumonitis was observed in these rats. With sufficient exposure, effects as detailed in chronic exposure may occur.

Inhalation (Chronic):

In addition to the effects described in acute exposure, prolonged or repeated exposure may cause "berylliosis", a disorder that generally affects the upper and lower respiratory tract, but the onset may be marked by weakness, fatigue, and weight loss with or without dyspnea. Symptoms may be delayed from 1-25 years from exposure and may be precipitated by additional physical stress. Signs of pulmonary insufficiency and systemic effects may occur including dyspnea on exertion or at rest, burning chest pain, constant non-productive hacking cough, wheezing, clubbing of fingers, low blood pressure, enlarged liver, spleen, and parotid gland, osteoarthropathy, increase in hematocrit, elevated serum uric acid, nephrolithiasis, hypercalciuria with or without stones, hypercalcemia, spontaneous skin lesions, and cor pulmonale due to increasing pulmonary fibrosis and pulmonary resistance. Less common effects may include hemoptysis, seizure disorders and palpitations. Severely disabled persons may show cachexia and signs of right heart impairment with severe non-productive

cough, spontaneous pneumothorax, and bouts of chills and fever. Death may be due to cardiac or respiratory failure, or in rare cases, renal failure. Pathological findings include extrapulmonary changes of focal granulomatous lesions in the abdominal lymph nodes, spleen, liver, and bone marrow, as well as renal involvement. Human studies indicate that berylliosis may be a disease resulting from pulmonary sensitization and responding with inflammatory changes which tend to be granulomatous. Cumulative exposure to beryllium has produced decreased lung function that is distinct from berylliosis. Epidemiological studies show an excess of lung cancer in white males occupationally exposed to beryllium or beryllium compounds.

Skin Contact (Acute):

May cause irritation. Sensitization is reported to not occur from contact of intact skin with beryllium metal. However, accidental implantation of particles beneath the skin may cause necrosis of adjacent tissue, formation of ulcer, and granulomatous hypersensitivity reaction.

Skin Contact (Chronic):

Repeated exposure to irritants may cause dermatitis.

Eye Contact (Acute):

Contact with dust may cause conjunctival inflammation. Introduction into corneas of rabbits produced slight clouding of the surrounding cornea.

Eye Contact (Chronic):

May cause conjunctivitis and possibly severe periorbital edema.

Ingestion (Acute):

May cause coughing and shortness of breath. Experimental evidence suggests that little beryllium is absorbed from the gastrointestinal tract.

Ingestion (Chronic):

In animal studies, beryllium metal eaten in the diet at a level of 5% is so poorly absorbed that no effect on growth occurred over long periods of feeding. However, beryllium tends to displace magnesium in the body after a prolonged period of time.

11.4 Numerical Measures of Toxicity

Target organs include the immune system (sensitizer). May cross the placenta. Contact with beryllium compounds may exacerbate a pre-existing berylliosis condition.

Toxicity Data:

496 µg/kg intravenous-rat LD₅₀
 51 mg/kg intratracheal-rat LD₅₀
 20 ng/m³/8 hour (s)-26 week(s) intermittent inhalation-rat TCL₀
 20 ng/m³/1 hour(s)-17 week(s) intermittent inhalation- mammal TCL₀
 2 µg/m³/8 hour(s)-26 week(s) intermittent inhalation-human TCL₀

Tumorigenic Data:

13 mg/kg intratracheal-rat TDL₀; 20 mg/kg intravenous-rabbit TDL₀

Mutagenic Data:

DNA adduct - Escherichia coli 30 µmol/L
 DNA inhibition - non-mammalian species intravenous 30 µmol/kg
 DNA adduct - human HeLa cell 30 µmol/L
 DNA adduct - mouse Ascites tumor 30 µmol/L

11.5 Carcinogen Status

OSHA:

No data available.

NTP:

Known Human Carcinogen

IARC:

Human Sufficient Evidence, Animal Sufficient Evidence, Group 1 (Beryllium and Beryllium Compounds)

ACGIH:

A1 – Confirmed Human Carcinogen (Beryllium and Beryllium Compounds)

EC:

Category 2 (Beryllium and Beryllium Compounds)

TRGS:

K2

Section 12: Ecological Information

12.1 Ecotoxicity

LC50

Daphnia magna (Water Flea) age < or =24 hr
 Conditions: freshwater, static, 22 deg C, pH 7.4-9.4, dissolved oxygen 6.5-9.1 mg/L; Concentration: 1900 µg/L for 24 hr (95% confidence interval: 1100-3300 µg/L) /> or =80% purity

LC50	<i>Daphnia magna</i> (Water Flea) age < or =24 hr Conditions: freshwater, static, 22 deg C, pH 7.4-9.4, dissolved oxygen 6.5-9.1 mg/L; Concentration: 1900 ug/L for 48 hr (95% confidence interval: 800-1600 ug/L) /> or =80% purity
LC50	<i>Hyalella azteca</i> (Scud) age 1-11 day young organism Conditions: freshwater, static, 24-25 deg C, pH 7.39 (6.44-8.52); Concentration: 67 ug/L for 7 days (95% confidence interval: 53-85 ug/L)
LC50	<i>Hyalella azteca</i> (Scud) age 1-11 day young organism Conditions: freshwater, static, 24-25 deg C, pH 8.21 (7.23-8.83); Concentration: 240 ug/L for 7 days (95% confidence interval: 181-316 ug/L)

12.2 Persistence and Degradability

No data available.

12.3 Bioaccumulative Potential

No data available.

12.4 Mobility in Soil

No data available.

12.5 Other Adverse Effects

No data available.

Section 13: Disposal Considerations

Dispose in accordance with all applicable regulations. Subject to disposal regulations: USEPA 40 CFR 262. Hazardous Waste Number(s): P015. Consider recovering and recycling of beryllium as an alternative to its disposal.

Beryllium solid waste should be placed into impermeable, sealed bags or containers (e.g., drums) that are labeled in accordance with the requirements of USEPA or applicable regulations.

Waste waters containing beryllium may require treatment to reduce the concentration of beryllium. A typical treatment method for beryllium involves steps such as chemical precipitation, settling clarification, neutralization, filtration, and sludge dewatering.

Section 14: Transport Information

14.1 UN Number

UN Number: 3077 (solid)

14.2 UN Proper Shipping Name

UN Proper Shipping Name: RQ Environmentally Hazardous Substances, Solid, N.O.S., (Beryllium).

14.3 Transport Hazard Class(es)

Hazard Class:	9 (solid)
CA Transportation/Dangerous Goods:	No classification assigned.
Land Transport ADR:	No classification assigned.
Land Transport RID:	No classification assigned.
Air Transport IATA:	No classification assigned.
Air Transport ICAO:	No classification assigned.
Maritime Transport IMDG:	No classification assigned.

14.4 Packing Group

Packing Group: III (solid)

14.5 Environmental Hazards

No data available.

14.6 Transport in Bulk

No data available.

14.7 Special Precautions

No data available.

Section 15: Regulatory Information

US Regulations

CERCLA 102A/103 (40 CFR 302.4): Beryllium: 10 lbs. RQ
(solid metal particles <100 micrometer diameter).

SARA Title III

Section 302 (40 CFR 355.30): Not regulated.
 Section 304 (40 CFR 355.40): Not regulated.
 Sections 311/312 (40 CFR 370.21): Yes (Acute, Chronic, Reactive)
 Section 313 (40 CFR 372.65): Yes (Beryllium and compounds)

OSHA Process Safety: Not regulated.

State Regulations

California Proposition 65: Beryllium and compounds are known to cause cancer.

National Inventory Status

US Inventory (TSCA): Listed on inventory.
 TSCA 12(b) Export Notification: Not listed.

Section 16: Other Information

The information in this Safety Data Sheet meets the requirements of the United States Department of Labor OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION and regulations promulgated thereunder (29 CFR 1910.1200 et. seq.). This document is intended only as a guide to the appropriate precautionary material handling by a person trained in, or supervised by a person trained in, chemical handling. Exposure to this chemical may have serious adverse health effects. This chemical may interact with other substances. Since the potential uses are so varied, all of the potential hazards of use or interaction with other chemicals or materials cannot be identified on this Safety Data Sheet. The user should recognize that this chemical can cause injury, especially if improperly handled, precautionary measures are not followed, and personal protective equipment not worn. Read and understand all precautionary information prior to use. The Defense Logistics Agency (DLA) shall not be held liable for any damage resulting from handling or from contact with the above chemical.

References:

ChemADVISOR. *Material Safety Data Sheet, Beryllium*. March 13, 2008. (as provided by the Defense Logistics Agency)

American Conference of Governmental Industrial Hygienists. *2013 TLVs® and BEIs®, ACGIH® Publication #0113*. 2013.

US Department of Transportation. *Emergency Response Guidebook*. 2012

Centers for Disease Control and Prevention. *NIOSH Pocket Guide to Chemical Hazards*, <http://www.cdc.gov/niosh/npg/>.

National Institute of Health, Toxicology Data Network. <http://toxnet.nlm.nih.gov/>

NOTE: No data available: no data for this topic found using references listed.

Date of Preparation of Updated SDS: April 10, 2015