

GERMANIUM METAL MATERIAL SAFETY DATA SHEET

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product Identity: Germanium Metal

NOTE: In the form in which this product is sold it is not regulated. This Material Safety Data Sheet is provided for information only.

Manufacturer:

Teck Cominco Metals Ltd.
Trail Operations
Trail, British Columbia
V1R 4L8
Emergency Telephone: 250-364-4214

Supplier:

Teck Cominco Metals Ltd.
1500-120 Adelaide Street, W.
Toronto, Ontario
M5H 1T1

MSDS Preparer:

Teck Cominco Metals Ltd.
600-200 Burrard Street
Vancouver, British Columbia
V6C 3L7

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Product Use: Germanium is used to make elements for infrared optical devices, and in solar arrays and panels to generate electricity. It has also been used in the manufacture of rectifying devices and transistors, in red-fluorescing phosphors, and in dental alloys.

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Ingredient	Approximate Percent by Weight	C.A.S. Number	Occupational Exposure Limits (OELs)		LD ₅₀ /LC ₅₀
					Species and Route
Germanium	100	7440-56-4	OSHA PEL	None	Rat-inhl LC ₅₀ >5,340 mg/m ³ /4Hr
				Established	
			ACGIH TLV	None	
				Established	
		NIOSH REL	None		
			Established		

NOTE: OELs for individual jurisdictions may differ from OSHA PELs. Check with local authorities for the applicable OELs in your jurisdiction. OSHA - Occupational Safety and Health Administration; ACGIH - American Conference of Governmental Industrial Hygienists; NIOSH - National Institute for Occupational Safety and Health. OEL – Occupational Exposure Limit, PEL – Permissible Exposure Limit, TLV – Threshold Limit Value, REL – Recommended Exposure Limit.

Trade Names and Synonyms: None.

SECTION 3. HAZARDS IDENTIFICATION

Emergency Overview: A greyish-white, lustrous metal that does not burn except when dispersed into the air as a fine powder. Germanium is relatively non-toxic and poses little immediate hazard to personnel or the environment in an emergency situation.

Potential Health Effects: Elemental germanium is relatively non-toxic to humans by all routes of exposure. No chronic health effects have been reported in humans occupationally exposed to germanium. It is not considered a human carcinogen by the OSHA, NTP, ACGIH, IARC or EU. (see Toxicological Information, Section 11)

Potential Environmental Effects: In the form in which this product is sold, it does not present a significant threat to the environment. (see Ecological Information, Section 12)

European Union (EU) Risk Phrase(s): Not applicable - germanium is not listed as a dangerous substance.

SECTION 4. FIRST AID MEASURES

Eye Contact: Flush with warm, running water including under the eyelids, to remove foreign object. If irritation persists, seek medical attention.

Skin Contact: Remove contaminated clothing and wash affected area with soap and warm water.

Inhalation: Remove victim from exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Medical oxygen may be administered, if available, where breathing is difficult. Seek immediate medical attention.

Ingestion: If victim is conscious, dilute stomach contents with 2-4 cupfuls of water or milk. Do not induce vomiting. Seek medical attention immediately and bring a copy of this MSDS. Never give anything by mouth to an unconscious person.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not considered a fire or explosion hazard. Germanium metal dust or powder may be flammable or explosive when dispersed in the air at high concentrations. When finely divided, germanium burns in chlorine and bromine atmospheres.

Extinguishing Media: Use any means of extinction appropriate for surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam.

Fire Fighting: Fire fighters should be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

Flashpoint and Method: Not Applicable.

Upper and Lower Flammable Limit: Not Applicable.

Autoignition Temperature: Not Applicable.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Clean up spilled material immediately, observing precautions in Section 8, Personal Protection and using methods which will minimize dust generation (e.g., vacuum solids, dampen material and shovel or wet sweep). Return uncontaminated spilled material to the process if possible. Place contaminated material in suitable labeled containers for recovery or disposal. Treat or dispose of waste material in accordance with all local, regional, and national requirements.

Personal Precautions: Protective clothing, gloves, and a respirator are recommended for persons exposed to potentially hazardous levels of germanium dust. Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with the dust.

Environmental Precautions: Germanium metal is considered to have low bioavailability in the environment. However, good management practices should be applied in the storage and use of germanium and its compounds.

SECTION 7. HANDLING AND STORAGE

Store germanium in a dry, covered area away from incompatible materials and protect from physical damage. Solid metal suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath, otherwise entrained moisture could expand explosively and spatter molten metal out of the bath. Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate, designated areas. No special packaging materials are required.

EU Safety Phrase(s): Not applicable - germanium is not listed as a dangerous substance.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Protective Clothing: Gloves and coveralls or other work clothing are recommended to prevent prolonged or repeated direct skin contact when germanium is processed. Eye protection should be worn where fume or dust is generated. Where hot or molten metal is handled, heat resistant gloves, goggles or face-shield, and clothing to protect from hot metal splash should be worn. Safety type boots are recommended.

Ventilation: Use adequate local or general ventilation to maintain the concentration of germanium/germanium dioxide fumes in the working environment as low as practicable. Supply sufficient replacement air to make up for air removed by the exhaust system.

Respirators: Where germanium or germanium dioxide fumes are generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-95 particulate filter cartridge).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Grey-white lustrous brittle metalloid	Odour: None	Physical State: Solid	pH: Not Applicable
Vapour Pressure: Negligible	Vapour Density: Not Applicable	Boiling Point/Range: 2830°C	Freezing/Melting Point/Range: 937°C
Specific Gravity: 5.32	Evaporation Rate: Not Applicable	Coefficient of Water/Oil Distribution: Not Applicable	Odour Threshold: None
Solubility: Insoluble in water			

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Massive metal is stable under normal temperatures and pressures.

Incompatibilities: Powdered germanium metal reacts violently with concentrated nitric acid. Mixtures with potassium chlorate or potassium nitrate explode when heated. It is incompatible with strong oxidizing agents, fused alkalis and halogens. The powdered metal also ignites in atmospheres of bromine, chlorine, fluorine or oxygen. It is soluble in aqua regia and hot concentrated sulphuric acid.

Hazardous Decomposition Products: Irritating and noxious fumes may be generated by thermal decomposition or combustion. Contact between germanium dioxide and hydrochloric acid emits volatile germanium tetrachloride, which is corrosive and irritating.

SECTION 11. TOXICOLOGICAL INFORMATION

General: On the basis of both animal experiments and industrial experience it is believed that elemental germanium and germanium dioxide are of low toxicity both acutely and chronically by all routes of administration including inhalation.

Acute:

Skin/Eyes: Direct contact with skin or eyes may cause mild local mechanical irritation.

Inhalation: Inhalation of germanium dust may be irritating to the respiratory system. Symptoms may include coughing, sneezing and/or shortness of breath.

Ingestion: A few cases of kidney damage, liver damage, peripheral neuropathy and even death have been reported in individuals who have taken large doses of germanium products as food supplements or health promoting elixirs.

Chronic: Prolonged exposure in a few patients ingesting germanium medications has been shown to affect the kidneys (renal dysfunction) and the liver (hepatotoxicity) as well as occasionally affecting the nervous system (peripheral neuropathy). Similar effects have not been reported in workers occupationally exposed to germanium or germanium dioxide. Germanium is not listed as a human carcinogen by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the American Conference of Governmental Industrial Hygienists (ACGIH) or the European Union (EU).

SECTION 12. ECOLOGICAL INFORMATION

As a metal, germanium is insoluble and therefore presents minimal environmental risk. However, little is known about the toxicity of germanium compounds and care should be taken to prevent environmental contamination.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process, dispose of only in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

No special shipping or transportation requirements.

SECTION 15. REGULATORY INFORMATION

U.S.:

LISTED ON TSCA INVENTORY..... Yes
HAZARDOUS UNDER HAZARD COMMUNICATION STANDARD No
CERCLA SECTION 103 HAZARDOUS SUBSTANCE No
EPCRA SECTION 302 EXTREMELY HAZARDOUS
SUBSTANCE..... No
EPCRA SECTION 311/312 HAZARD CATEGORIES No Hazard Categories Apply
EPCRA SECTION 313 Toxic Release Inventory This product does not contain any toxic chemicals subject to the Toxic Release Reporting requirements.

CANADIAN:

LISTED ON DOMESTIC SUBSTANCES LIST No.
However, Teck Cominco Metals Ltd. is in compliance with the New Substances Notification Regulations under the Canadian Environmental Protection Act.

WHMIS CLASSIFICATION Not applicable. Germanium is not a controlled product under WHMIS. This Material Safety Data Sheet is provided for information purposes only.

EUROPEAN UNION:

LISTED ON THE EUROPEAN INVENTORY OF EXISTING
COMMERCIAL CHEMICAL SUBSTANCES (EINECS) Yes
EU CLASSIFICATION Not applicable - germanium is not listed as a dangerous substance.

SECTION 16. OTHER INFORMATION

The information in this Material Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 1991, Documentation of the Threshold Limit Values and Biological Indices, Sixth Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 2002, Guide to Occupation Exposure Values.
- American Conference of Governmental Industrial Hygienists, 2003, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- Commission de la santé et la sécurité du travail, Service du Répertoire toxicologique, Germanium , 1994-05.
- European Economic Community, Commission Directives 91/155/EEC and 67/548/EEC.
- Industry Canada, SOR/88-66, Controlled Products Regulations, as amended.
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Library of Medicine, National Toxicology Information Program, 2003, Hazardous Substance Data Bank.
- Patty's Toxicology, Fifth Edition, 2001: E. Bingham, B. Cohns & C.H. Powell, Ed.
- Sax, N. Irving, 1989, Dangerous Properties of Industrial Materials, Seventh Edition.
- U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health. NIOSH Pocket Guide to Chemical Hazards. CD-ROM Edition DHHS (NIOSH) Publication No. 2001-145, August 2001.
- Urben, P.G., 1995, Bretherick's Handbook of Reactive Chemical Hazards, Fifth Edition.

Notice to Reader

Although reasonable precautions have been taken in the preparation of the data contained herein, it is offered solely for your information, consideration and investigation. Teck Cominco Metals Ltd. extends no warranty and assumes no responsibility for the accuracy of the content and expressly disclaims all liability for reliance thereon. This material safety data sheet provides guidelines for the safe handling and processing of this product; it does not and cannot advise on all possible situations. Therefore, your specific use of this product should be evaluated to determine if additional precautions are required. Individuals exposed to this product should read and understand this information and be provided pertinent training prior to working with this product.