

## GERMANIUM POWDER MATERIAL SAFETY DATA SHEET

### SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Identity:** Germanium Powder

*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.  
Trail Operations  
Trail, British Columbia  
V1R 4L8

**MSDS Preparer:**

Teck Cominco Metals Ltd.  
600-200 Burrard Street  
Vancouver, British Columbia  
V6C 3L9

**Date of Last Review/Edit:** November 15, 2005.

**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	CAS Number	Occupational Exposure Limits (OELs)	LD <sub>50</sub> /LC <sub>50</sub> Species and Route
Germanium	100	7440-56-4	OSHA PEL None Established ACGIH TLV None Established NIOSH REL None Established	Rat-inhl LC <sub>50</sub> >5,340 mg/m <sup>3</sup> /4Hr

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 grayish-white, lustrous metal powder that does not burn except when dispersed into the air as a fine powder and exposed to flames or other sources of ignition. 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:** Germanium has low toxicity and limited bioavailability in the environment. It poses no immediate ecological risk. However, contamination of soil and water should be prevented. (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:** Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. If particle/dust does not dislodge, flush with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, obtain medical attention. DO NOT attempt to manually remove anything stuck to the eye.

**Skin Contact:** No health effects expected. If irritation does occur, flush with lukewarm, gently flowing water for 5 minutes or until chemical is removed.

**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 swallowed, no specific intervention is indicated as elemental germanium is not likely to be hazardous by ingestion. However, consult a physician if irritation or discomfort occurs.

## SECTION 5. FIRE FIGHTING MEASURES

**Fire and Explosion Hazards:** Germanium powder may be flammable or explosive when dispersed in the air at high concentrations. When finely divided, germanium also 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 facepiece 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 is considered to have low toxicity. However, there is limited information on the effects and fate of germanium in the environment. Good management practices should be applied in the storage and use of germanium and its compounds.

## SECTION 7. HANDLING AND STORAGE

Store germanium powder in a dry, covered area away from incompatible materials and protect from physical damage. Avoid handling procedures that generate dust, particularly where open flames or other sources of ignition exist. 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 with germanium powder. Eye protection should be worn where dust is generated. Safety type boots are recommended.

**Ventilation:** Use adequate local or general ventilation to maintain the concentration of germanium powder 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 dust is 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

<b>Appearance:</b> Grey-white powder	<b>Odour:</b> None	<b>Physical State:</b> Solid	<b>pH:</b> Not Applicable
<b>Vapour Pressure:</b> Negligible	<b>Vapour Density:</b> Not Applicable	<b>Boiling Point/Range:</b> 2830°C	<b>Freezing/Melting Point/Range:</b> 937°C
<b>Specific Gravity:</b> 5.32 (Solid Metal)	<b>Evaporation Rate:</b> Not Applicable	<b>Coefficient of Water/Oil Distribution:</b> Not Applicable	<b>Odour Threshold:</b> None
<b>Solubility:</b> Insoluble in water	<b>Bulk Density:</b> 3.2 grams/cm <sup>3</sup>		

## SECTION 10. STABILITY AND REACTIVITY

**Stability & Reactivity:** Germanium powder is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur.

**Incompatibilities:** Powdered germanium 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. Germanium powder 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 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, anemia, 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

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, 2004, Documentation of the Threshold Limit Values and Biological Indices, Seventh Edition.
- American Conference of Governmental Industrial Hygienists, Guide to Occupational Exposure Values - 2003.
- American Conference of Governmental Industrial Hygienists, 2005, 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, last accessed 2005-09-26.
- 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, Hazardous Substance Data Bank. On-line Version, last accessed Nov 25, 2003.
- Patty's Toxicology, 5th Edition, (E Bingham, B Cohnsen & C H Powell, ed.) 2001:
- Sax, N. Irving, 1989, Dangerous Properties of Industrial Materials, Seventh Edition.
- Urban, P. G., 1995, Bretherick's Handbook of Reactive Chemical Hazards, Fifth 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.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

### Notice to Reader

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