GERMANIUM DIOXIDE
MATERIAL SAFETY DATA SHEET

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product Identity: Germanium Dioxide

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

Supplier:
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M5H 4C7

MSDS Preparer:
Teck Metals Ltd.
Suite 3300 – 550 Burrard Street
Vancouver, British Columbia
V6C 0B3

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Product Use: Germanium dioxide is used in the production of phosphors, transistors and diodes, infrared-transmitting glass, and as a catalyst in the manufacture of PET resin. It is often converted to other germanium compounds for use in applications such as fibre optics and chemotherapy.

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Ingredient	Approximate Percent by Weight	CAS Number	Occupational Exposure Limits (OELs)		LD_{50} / LC_{50} Species and Route	
Germanium Dioxide	100%	1310-53-8	OSHA PEL	None Established	LD_{50}, oral, mouse	1250 mg/kg
			ACGIH TLV	None Established	LD_{50}, oral, rat	1250 mg/kg
			NIOSH PEL	None Established	LC_{50}, inhal, rat	>1420 mg/m^3/4hr

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: Germanic acid; germanium oxide; germania; G-15; ACC10380

SECTION 3. HAZARDS IDENTIFICATION

Emergency Overview: An odourless white powder which is non-combustible. Germanium dioxide is relatively non-toxic and poses little immediate hazard to personnel or the environment in an emergency situation. However, acrid and irritating smoke can form at very high temperatures. Contact with hydrochloric acid will emit volatile germanium tetrachloride, which is corrosive and irritating.

Potential Health Effects: Inhalation or ingestion of germanium dioxide dust may cause localized irritation. Direct contact of germanium dioxide with eyes or skin may cause local irritation. It is not considered a human carcinogen by OSHA, NTP, ACGIH, IARC or the EU. (See Toxicological Information, Section 11).

Potential Environmental Effects: Germanium dioxide is considered to have low bioavailability and toxicity when released into the environment; therefore, it poses no immediate ecological risk. (See Ecological Information, Section 12.)

European Union (EU) Risk Phrase(s): 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, immediately 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. If irritation persists, obtain medical advice.

Inhalation: If symptoms are experienced remove source of contamination or move victim from exposure area to fresh air immediately. Obtain medical advice.

Ingestion: If swallowed, no specific intervention is indicated as this material is not likely to be hazardous by ingestion. However, if irritation or discomfort occurs, obtain medical advice.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Germanium dioxide is non-combustible and is a negligible fire or explosion hazard when exposed to heat or flame. However, acrid and irritating smoke can form at very high temperatures.

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 labelled containers for later recovery in view of the economic value of germanium dioxide. 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 responding to an accidental release (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with the dust.

Environmental Precautions: Germanium dioxide is considered to have low bioavailability and toxicity when released into the environment; therefore, it poses no immediate ecological risk. Releases of the product to water and soil should be prevented.

SECTION 7. HANDLING AND STORAGE

Store germanium dioxide in a tightly closed container in a cool, dry, covered area away from incompatible materials. 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 dioxide 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 dioxide is processed. Eye protection should be worn where dust is generated.

Ventilation: Use adequate local or general ventilation to maintain the concentration of germanium dioxide dust 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 dioxide dust or 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: Colourless crystals or white powder	**Odour:** None	**Physical State:** Solid	**pH:** Not Applicable
Vapour Pressure: Negligible @ 20°C	**Vapour Density:** Not Applicable	**Boiling Point/Range:** No Data	**Melting Point/Range:** 1115°C
Specific Gravity: 4.23	**Evaporation Rate:** Not Applicable	**Coefficient of Water/Oil Distribution:** No Data	**Odour Threshold:** None

Solubility:
4.5 g/L @ 25ºC, 10.7 g/L @ 100ºC

SECTION 10. STABILITY AND REACTIVITY

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

Incompatibilities: Germanium dioxide is incompatible with strong oxidizing agents and concentrated hydrochloric acid.

Hazardous Decomposition Products: Acrid and irritating smoke will form at very high temperatures. 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 local irritation due to the reaction between germanium dioxide and moisture on the skin or eye to form germanic acid, which is an irritant.

Inhalation: Inhalation of germanium dioxide 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 dioxide 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 dioxide has low bioavailability in water and is believed to present no immediate ecological risk. Little is known about the toxicity of germanium compounds; therefore, care should be taken to prevent any releases to the environment.

SECTION 13. DISPOSAL CONSIDERATIONS

In view of the economic value of germanium dioxide, every effort should be made to recover and reuse any spilled materials. 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 Metals Ltd. is in compliance with the New Substances Notification Regulations under the Canadian Environmental Protection Act., 1999.

WHMIS CLASSIFICATION..... Not applicable. Germanium Dioxide 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 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 plus updates.
- American Conference of Governmental Industrial Hygienists, 2009, Guide to Occupation Exposure Values.
- American Conference of Governmental Industrial Hygienists, 2009, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition. (P. G. Urben Ed.) 1995.
- 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).
- Patty's Toxicology, Fifth Edition, 2001: E. Bingham, B. Cohrssen & C.H. Powell, Ed.
- 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 September 2005.

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 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.