GERMANIUM DIOXIDE
SAFETY DATA SHEET

SECTION 1. IDENTIFICATION

Product Identity: Germanium Dioxide

Trade Names and Synonyms: Fast Dissolving Germanium Dioxide; Germanic acid; Germanium Oxide; Germania; G-15; ACC10380.

Manufacturer:
Teck Metals Ltd.
Trail Operations
25 Aldridge Avenue
Trail, British Columbia
V1R 4L8
Emergency Telephone: 250-364-4214

Supplier:
In U.S.:
Teck American Metal Sales Incorporated
501 North Riverpoint Blvd, Suite 300
Spokane, WA
USA 99202
Other than U.S.:
Teck Metals Ltd.
#600 - 100 Wellington St. W.
Toronto, Ontario
M5K 1H1

Preparer:
Teck Metals Ltd.
Trail Operations
25 Aldridge Avenue
Trail, British Columbia
V1R 4L8

Date of Last Review: February 23, 2021. **Date of Last Edit:** August 9, 2022

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.
Restrictions on Use: Not for use in contact with human food or animal feed materials.

This product has been classified in accordance with the hazard criteria of the Canadian Hazardous Products Regulation SOR/2015-17 and this SDS contains all the information required by both the HPR and the OSHA Hazard Communication Standard of 2012 (29 CFR 1910.1200(g) and Appendix D).

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

Health		Physical	Environmental
Acute Toxicity (Oral, Inhalation)	– Does not meet criteria	Does not meet criteria for any Physical Hazard	Aquatic Toxicity –
Skin Corrosion/Irritation	– Does not meet criteria		**Short Term/Acute Category 1**
Eye Damage/Eye Irritation	– Does not meet criteria		**Long Term/Chronic Category 3**
Respiratory or Skin Sensitization	– Does not meet criteria		
Mutagenicity	– Does not meet criteria		
Carcinogenicity	– Does not meet criteria		
Reproductive Toxicity	**– Category 2**		
Specific Target Organ Toxicity			
Acute Exposure	– Does not meet criteria		
Chronic Exposure	– Does not meet criteria		

LABEL:

Symbols:

Signal Word:

WARNING

Hazard Statements	**Precautionary Statements:**
Suspected of damaging fertility or the unborn child. Very toxic to aquatic life. Harmful to aquatic life with long lasting effects.	Obtain special instructions before use. Do not use until all safety precautions have been read and understood. Wear protective clothing when using this product. Store locked up or in a secure location.

	Dispose of contents/containers in accordance with local regulations. Avoid release to the environment. Collect all spillage. If exposed or concerned: get medical advice/attention.

Emergency Overview: An odourless white powder which is non-combustible. Germanium dioxide 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. Animal experiments with germanium dioxide have resulted in reproductive effects. 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 has been shown to be highly toxic to freshwater and marine diatoms (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	CAS Registry No.	CONCENTRATION (% wt./wt.)
Germanium Dioxide	1310-53-8	100%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Mild irritation. If irritation occurs, cautiously rinse eye(s) with lukewarm, gently flowing water for 5 minutes, while holding the eyelids open. If eye irritation persists, get medical advice/attention.

Skin Contact: *Symptoms:* No health effects expected. If irritation does occur, flush with lukewarm, gently flowing water for 5 minutes. If irritation occurs, obtain medical advice.

Inhalation: *Symptoms:* Possible respiratory irritation. If symptoms are experienced remove source of contamination or move victim from exposure area to fresh air immediately. Get medical advice/attention if you feel unwell or are concerned.

Ingestion: *Symptoms:* If swallowed, no specific intervention is indicated as this material is not likely to be hazardous by ingestion. However, if you feel unwell or are concerned, get medical advice/attention.

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.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Prevent material from reaching floor drains or open water courses. 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: Releases of this product to soil and particularly to water should be avoided as germanium has been shown to replace silica in the skeletal structure of diatoms and to cause significant toxicity.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling: Minimize the release of dust into the workplace or the environment. Avoid breathing dust. Clean up any significant spills immediately and do not flush down drains. Good housekeeping is important to prevent accumulations of dust.

Conditions for Safe Storage: Store germanium dioxide in a tightly closed container in a cool, dry, covered area away from incompatible materials. No special packaging materials are required.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines: *(Time-Weighted Average (TWA) concentration over 8 hrs unless otherwise indicated.)*

Component	ACGIH TLV	OSHA PEL	NIOSH REL
Germanium Dioxide	None established	None established	None established

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

NOTE: The selection of the necessary level of engineering controls and personal protective equipment will vary depending upon the conditions of use and the potential for exposure. The following are therefore only general guidelines that may not fit all circumstances. Control measures to consider include:

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.

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.

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).

General Hygiene Considerations: 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.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Colourless crystals or white powder	**Odour:** None	**Odour Threshold:** Not Applicable	**pH:** Not Applicable
Vapour Pressure: <9.25 Pa @ 25°C	**Vapour Density:** Not Applicable	**Melting Point/Range:** 1115°C	**Boiling Point/Range:** Not Applicable
Relative Density: (Water = 1) 4.23 **Bulk Density:** 1614 Kg/m^3	**Evaporation Rate:** Not Applicable	**Coefficient of Water/Oil Distribution:** log Pow = 2.21	**Solubility:** 4.14 g/L @ 20 ºC, 4.5 g/L @ 25ºC, 10.7 g/L @ 100ºC
Flammability: Non-combustible solid.	**Flammable Limits (LEL/UEL):** Not Applicable	**Auto-ignition Temperature:** None	**Decomposition Temperature:** None

NOTE: Flash point and viscosity are not relevant physical chemical properties of this product and therefore have not been included above.

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Germanium dioxide is stable and not considered reactive 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 both 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 acute toxicity by all routes of administration including inhalation.

Acute:
Skin/Eye: 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. However, animal experiments have demonstrated that the irritation is mild and does not meet criteria to classify it as a skin or eye irritant.

Inhalation: Inhalation of germanium dioxide under very dusty conditions 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. However, ingestion is not an expected route of exposure in occupational settings.

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 mutagenic in bacterial testing (OECD 471) and 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). Recent tests have demonstrated a reduced number of implantations and reduced pup body weight gain in rats fed large doses of germanium dioxide.

Animal Toxicity:

Hazardous Ingredient:	Acute Oral Toxicity:	Acute Dermal Toxicity:	Acute Inhalation Toxicity:
Germanium Dioxide	>2,000 mg/kg †	No data	>1.42 mg/L‡

† LD_{50}, Rat, Oral, determined on a sample of Trail's production ‡ LC_{50}, Rat, Inhalation, 4 hour – RTECS report

SECTION 12. ECOLOGICAL INFORMATION

Germanium ions have been shown to replace silica in the skeletal structure of diatoms and to cause significant toxicity as a consequence. Releases of germanium dioxide to both fresh water and marine environments should therefore be prevented.

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. It material cannot be returned to process, dispose of only in accordance with applicable regulations. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated in order to determine the proper waste classification and disposal method.

SECTION 14. TRANSPORT INFORMATION

Transport Canada and U.S. DOT Shipping Name ..... Environmentally Hazardous Substance, Solid, n.o.s. (Germanium Dioxide)
Transport Canada and U.S. DOT Classification..... Class 9, Packing Group III
Transport Canada and U.S. DOT Product Identification Number..... UN3077
Marine Pollutant ..... Yes
IMO Classification ..... Class 9, Packing Group III, UN3077

SECTION 15. REGULATORY INFORMATION

U.S.
Ingredients Listed on TSCA Inventory..... Yes

Hazardous Under Hazard Communication Standard ..... Yes

CERCLA Section 103 Hazardous Substances..... No

EPCRA Section 302 Extremely Hazardous Substance..... No

EPCRA Section 311/312 Hazard Categories ..... Delayed (chronic) health hazard – Reproductive Toxin

EPCRA Section 313 Toxic Release Inventory: ..... This product does not contain any toxic chemicals subject to the Toxic Release reporting requirements.

SECTION 16. OTHER INFORMATION

Date of Original Issue: December 3, 1998 **Version:** 01 *(First edition)*

Date of Latest Revision: April 5, 2021 **Version:** 16

The information in this 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, 2021, Guide to Occupation Exposure Values.
- American Conference of Governmental Industrial Hygienists, 2021, 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, European Regulation (EC) No 1272/2008 (Classification, Labelling and packaging of substances and mixtures).
- Handbook on the Toxicology of Metals, 3rd Ed., Gunnar F. Nordberg, Bruce A. Fowler, Monica Nordberg and Lars Friberg, Editors, Academic Press, New York, NY (2007).
- Health Canada, SOR/2015-17, Hazardous Products Regulations, 11 February 2015.
- 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. Dept. 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.

Acronyms not spelled out elsewhere in the SDS:

CAS: Chemical Abstract Service
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
DOT: Department of Transportation
EPCRA: Emergency Planning and Community Right-to-Know Act
IMO: International Maritime Organization
LD50, LC50: Lethal Dose 50%, Lethal Concentration 50%
MSHA: Mine Safety and Health Administration, U.S. Department of Labour
TSCA: Toxic Substances Control Act
Wt.: Weight

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