

## GERMANIUM TETRACHLORIDE MATERIAL SAFETY DATA SHEET

### SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Identity:** Germanium Tetrachloride

**Manufacturer:**

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

**Supplier:**

Teck Metals Ltd.  
#1700 – 11 King Street West  
Toronto, Ontario  
M5H 4C7

**MSDS Preparer:**

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

**Date of Last MSDS Review/Edit:** August 18, 2010.

**Product Use:** Optical fibre production.

### SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredient	Approximate Percent by Weight	CAS Number	Occupational Exposure Limits (OELs)	LD <sub>50</sub> /LC <sub>50</sub> Species and Route
Germanium Tetrachloride	98 – 100%	10038-98-9	OSHA PEL None established ACGIH TLV None established NIOSH REL None established (see NOTE below)	Mouse, Inhl LC <sub>50</sub> 44 gm/m <sup>3</sup> /2hr (3535 ppm/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.

NOTE: While there are no established OELs for germanium tetrachloride as such, there are OELs for hydrogen chloride gas which may be formed when germanium tetrachloride comes into contact with water, water vapour or atmospheric moisture. The OSHA and NIOSH OEL is a ceiling limit of 5 ppm and the ACGIH TLV is a ceiling limit of 2 ppm.

**Trade Names and Synonyms:** Germanium Chloride, Tetrachloro Germanium, GeCl<sub>4</sub>

### SECTION 3. HAZARDS IDENTIFICATION

**Emergency Overview:** A non-combustible, colourless, fuming liquid with a pungent, acidic odour. Reacts violently with water to produce visible white fumes containing hydrochloric acid vapour, which can be a severe respiratory irritant on inhalation. Firefighters responding to an accidental release must always wear a self-contained breathing apparatus and full protective clothing. Use water spray or fog nozzles to knock down vapours or fumes and avoid directing water streams into spilled product pools whenever possible.

**Potential Health Effects:** A severe skin, eye and mucous membrane irritant. Inhalation of fumes may cause mild to severe irritation of the upper airways, depending on the concentration. Ingestion will result in irritation and may result in serious chemical burns to the mouth, throat (esophagus) and stomach. This material is not listed as a human carcinogen by OSHA, NTP, ACGIH, IARC or the EU (see Toxicological Information, Section 11).

**Potential Environmental Effects:** Although the ecological hazards of this chemical have not been fully investigated, it should be assumed to be a significant toxicant to aquatic and terrestrial organisms. Contact with water or moisture in soil and organisms has the potential to result in the generation of hydrochloric acid. (see Ecological Information, Section 12)

**EU Risk Phrase(s):** R14 – Reacts violently with water; R34 – Causes burns.

## SECTION 4. FIRST AID MEASURES

**Eye Contact:** Avoid direct contact. Wear chemical protective gloves if necessary. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water, for 15-20 minutes, while holding the eyelid(s) open. If a contact lens is present, DO NOT delay irrigation or attempt to remove the lens. Take care not to rinse contaminated water into the unaffected eye or onto the face. Immediately obtain medical attention.

**Skin Contact:** As quickly as possible, remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Immediately flush with lukewarm, gently flowing water for 15 – 20 minutes. Immediately obtain medical attention. Completely decontaminate clothing, shoes and leather goods before reuse or else discard.

**Inhalation:** Take proper precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment, use the buddy system). Remove source of contamination or move victim from exposure area to fresh air immediately. If breathing has stopped, trained personnel should begin artificial respiration. Avoid mouth-to-mouth contact by using mouth guard or shields. If the heart has stopped, immediately start cardiopulmonary resuscitation (CPR), or automated external defibrillation (AED). Quickly transport victim to an emergency care facility.

**Ingestion:** NEVER give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 2 – 8 oz. (60 – 240 ml) of water. (The irritant action of swallowed germanium tetrachloride may lead to spontaneous vomiting). If vomiting occurs naturally, have victim rinse mouth with water again. Immediately obtain medical attention and bring a copy of this MSDS.

## SECTION 5. FIRE FIGHTING MEASURES

**Fire and Explosion Hazards:** Product is not considered a fire or explosion hazard. However, germanium tetrachloride reacts violently with water to produce visible white fumes containing hydrochloric acid vapour, which can be a severe respiratory irritant to firefighters.

**Extinguishing Media:** Use any means of extinction appropriate for surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam. Use water spray or fog nozzle to knock down vapours in area. Do not pour directed water streams onto liquid pools of germanium tetrachloride as this will only disperse them and increase evaporation/fuming.

**Fire Fighting:** Fire fighters must 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. Move container(s) from fire area if it can be done without risk.

**Flashpoint and Method:** Not Applicable.

**Upper and Lower Flammable Limit:** Not Applicable.

**Autoignition Temperature:** Not Applicable.

## SECTION 6. ACCIDENTAL RELEASE MEASURES

**Procedures for Cleanup:** Avoid all unprotected contact with spilled material.

**Small Spills:** Small spills may be flushed with water to a process sewer/process water collection sump or absorbed with sand, vermiculite, clay absorbents or other non-combustible material.

**Large Spills:** Restrict access to the area until completion of cleanup. Clean up spilled material immediately, observing precautions in Section 8, Personal Protection. Stop leak if possible to do so without personal risk. Reduce vapours with water spray if available. Dike area around spill and pump uncontaminated material back to process if possible. Collect non-recyclable material in appropriately labelled corrosion-resistant barrels and keep tightly closed until final disposal. Provide ventilation to remove fumes.

**Personal Precautions:** Persons responding to an accidental release should wear acid resistant protective clothing, gloves and a respirator or SCBA (see also Section 8). Sleeves and pant legs should be worn outside, not tucked into gloves and rubber boots. Use close-fitting safety goggles or a combination of safety goggles and a face shield where splashing is a possibility. Workers should wash and change clothing following cleanup of a spill to prevent prolonged contact.

**Environmental Precautions:** Releases of this product can be a threat to the environment. Spills should be contained and contamination of watercourses and land should be prevented.

## SECTION 7. HANDLING AND STORAGE

Store under vacuum or an inert atmosphere. Store in a dry, cool, well-ventilated area away from potentially incompatible materials. Keep container tightly closed and dry. Protect from physical damage. Empty and clean containers of all residues before adding more product to container, to avoid potentially dangerous reactions. Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands after handling and before eating, drinking, or smoking in appropriate designated areas.

**EU Safety Phrase(s):** S25 – Avoid contact with eyes; S36/37/39 – Wear suitable protective clothing, gloves and eye/face protection; S45 – In case of accident, or if you feel unwell, seek medical advice immediately (show label where possible); S8 – Keep container dry.

## SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

**Protective Clothing:** The level of protective clothing required will depend greatly on how the material is used and the potential for skin and eye contact. In general, chemical resistant gloves, safety glasses and coveralls, lab coat or other work clothing with long sleeves are recommended to prevent prolonged or repeated direct skin contact. An eyewash and quick drench shower should be provided near the work area. Workers should wash immediately when skin becomes contaminated and at the end of each work shift. Work clothing should be removed immediately if it becomes soaked or heavily contaminated and laundered before reuse. A higher level of protective clothing may be required if there is a significant risk of direct skin contact. A full face shield and/or close-fitting safety goggles may also be necessary in some circumstances to prevent direct eye contact.

**Ventilation:** Local exhaust ventilation should be applied wherever there is an incidence of point source emissions or dispersion of germanium tetrachloride vapours in the work area. Ventilation control of the contaminant as close to its point of generation as possible is both the most economical and the safest way to minimize personnel exposure to airborne contaminants.

**Respiratory Protection:** Where germanium tetrachloride fumes are generated and cannot be controlled to within acceptable levels, use a full facepiece chemical cartridge respirator (combined 42 CFR 84 Class N, R or P-100 particulate filter and acid gas cartridge) or full face, powered air-purifying respirator (PAPR) or supplied air respirator (SAR). For emergency or planned entry into a high concentration condition, workers must be fully trained and wear full protective clothing including a NIOSH-approved, self-contained breathing apparatus which supplies a positive air pressure within a full facepiece mask.

## SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

<b>Appearance:</b> Colourless, fuming liquid	<b>Odour:</b> Peculiar, acidic odour	<b>Physical State:</b> Liquid	<b>pH:</b> Not Applicable (non-aqueous liquid)
<b>Vapour Pressure:</b> 76 mm Hg @ 20°C	<b>Vapour Density:</b> No Data	<b>Boiling Point/Range:</b> 82-84°C (182-183°F)	<b>Freezing Point/Range:</b> – 50°C (–58°F)
<b>Specific Gravity:</b> 1.879	<b>Evaporation Rate:</b> No Data	<b>Coefficient of Water/Oil Distribution:</b> No Data	<b>Odour Threshold:</b> No Data
<b>Solubility in Water:</b> Hydrolyzes to produce HCl	<b>Molecular Weight:</b> 214.40		

## SECTION 10. STABILITY AND REACTIVITY

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

**Incompatibilities:** Reacts rapidly with water to produce solid germanium dioxide and hydrochloric acid fumes. Vaporizes readily at room temperature and reacts with moist air or ammonia vapour to produce visible white fumes. Contact with bases (alkalis) will cause a violent reaction. Avoid contact with strong oxidizing materials.

**Hazardous Decomposition Products:** Thermal decomposition may release chlorine and/or hydrogen chloride. Reaction with water or moist air produces irritating hydrogen chloride fumes.

## SECTION 11. TOXICOLOGICAL INFORMATION

**General:** A severe skin, eye and mucous membrane irritant. Hazards are largely those from acute exposure or direct contact rather than chronic or repeated low level exposure. The potential for exposure to hydrochloric acid fumes must always be considered as well, particularly when this product becomes moist or is in contact with water or water solutions.

**Acute:**

**Skin/Eye:** Direct liquid contact with the eyes or skin will cause severe burns with possible tissue damage. Vapours cause eye/skin irritation with possible discomfort, tearing, or blurring of vision, particularly as it hydrolyses rapidly in the moisture of the eye surface to release hydrochloric acid.

**Inhalation:** Inhalation of fumes may cause mild to severe irritation of the upper airways, depending on the concentration. Symptoms may include burning pain in the nose and throat, coughing, wheezing and shortness of breath. Severe cases may lead to pulmonary edema which could be fatal.

**Ingestion:** Ingestion will result in irritation and may result in serious chemical burns to the mouth, throat (esophagus) and stomach. Nausea, vomiting and gastrointestinal pain may result.

**Chronic:** Due to the irritant and corrosive nature of this product, most of the health effects are acute and symptoms from chronic exposure will be similar to those of acute exposure. However, prolonged exposure to hydrochloric acid mist may cause tooth erosion and possible skin dermatitis. Germanium tetrachloride is not considered a human carcinogen by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the American Conference of Governmental Industrial Hygienists (ACGIH), the International Agency for Research on Cancer (IARC), or the EU.

## SECTION 12. ECOLOGICAL INFORMATION

The ecotoxicity of this compound has not been fully investigated. It should be assumed that its germanium content has the potential to be toxic to aquatic and terrestrial organisms. It is known that contact of the product with water or moisture in soil and organisms will generate hydrochloric acid. This therefore has the potential to be toxic in localized areas of aquatic and terrestrial media and directly in the membranes of organisms.

## SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable federal, state/provincial and local regulations.

## SECTION 14. TRANSPORT INFORMATION

TRANSPORT CANADA

PROPER SHIPPING NAME ..... Toxic Liquid, Corrosive, Inorganic, n.o.s. (Germanium Tetrachloride)  
HAZARD CLASSIFICATION ..... Class 6.1, (8), Packing Group I  
PRODUCT IDENTIFICATION NUMBER ..... UN3289

U.S. DEPARTMENT OF TRANSPORTATION

PROPER SHIPPING NAME ..... Toxic by Inhalation Liquid, Corrosive, n.o.s. (Germanium Tetrachloride)  
HAZARD CLASSIFICATION ..... Class 6.1, (8), Packing Group I, Hazard Zone B.  
PRODUCT IDENTIFICATION NUMBER ..... UN3390

U.N. RECOMMENDATIONS (IATA & IMDG)

PROPER SHIPPING NAME ..... Toxic by Inhalation Liquid, Corrosive, n.o.s. (Germanium Tetrachloride)  
HAZARD CLASSIFICATION ..... Class 6.1, (8), Packing Group I  
PRODUCT IDENTIFICATION NUMBER ..... UN3390

MARINE POLLUTANT ..... No  
AIR TRANSPORT ..... Forbidden

## 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.....Immediate (Acute) Health Hazard – Highly Toxic –  
 Toxic by Inhalation  
 Immediate (Acute) Health Hazard - Corrosive  
 Reactive - Water Reactive  
 EPCRA SECTION 313 TOXIC RELEASE INVENTORY.....No

**CANADIAN:**

INGREDIENTS LISTED ON DOMESTIC SUBSTANCES LIST .....Yes  
 WHMIS CLASSIFICATION:.....Controlled Product  
 D2A (Materials Causing other Toxic Effects - Very  
 Toxic Material)  
 E (Corrosive Material)  
 F (Dangerously Reactive Material)

**EUROPEAN UNION (EU):**

Ingredients Listed on the European Inventory  
 of Existing Commercial Chemical Substances (EINECS) .....Yes  
 EU Classification .....Corrosive

**SECTION 16. OTHER INFORMATION**

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

- American Conference of Governmental Industrial Hygienists, 2008, Documentation of the Threshold Limit Values and Biological Exposure Indices, 7<sup>th</sup> Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 2008, Guide to Occupational Exposure Values.
- American Conference of Governmental Industrial Hygienists, 2008, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- Bretherick's Handbook of Reactive Chemical Hazards, 20<sup>th</sup> Anniversary Edition. (P. G. Urben, Ed), 1995.
- European Economic Community, Commission Directives 91/155/EEC, 93/21/EEC, and 67/548/EEC.
- Industry Canada, Controlled Products Regulations SOR/88-66, as amended.
- International Agency for Research on Cancer (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, 1972 – 2008, (multi-volume work), World Health Organization, Geneva.
- 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 (HSDB) on-line.
- Patty's Toxicology, 5<sup>th</sup> Edition, (E Bingham, B Cahrssen & C H Powell, Ed.) 2001.
- 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 September 2005.
- U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, Registry of Toxic Effects of Chemical Substances (RTECS), CCOHS on-line version.
- U.S. Department of Health and Human Services, National Institute of Environmental Health Sciences, National Toxicology Program (NTP), 11<sup>th</sup> Report on Carcinogens, January 2005.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

**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.