

**GERMANIUM TETRACHLORIDE
SAFETY DATA SHEET**

SECTION 1. IDENTIFICATION

Product Identity: Germanium Tetrachloride

Trade Names and Synonyms: Germanium Chloride, Tetrachloro Germanium, GeCl₄

Manufacturer:
Teck Metals Ltd.
Trail Operations
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

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

Other than U.S.:
Teck Metals Ltd.
#1700 – 11 King Street West
Toronto, Ontario
M5H 4C7

Date of Last Review: July 7, 2015.

Date of Last Edit: July 7, 2015.

Product Use: Optical fibre production.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

	Health	Physical	Environmental
Acute Toxicity (Oral, Inhalation)	- Does not meet criteria	Corrosive to Metals - Category 1	Aquatic Toxicity – Short Term/Long Term (Insufficient information to classify)
Skin Corrosion/Irritation	- Category 1A		
Eye Damage/Eye Irritation	- Category 1		
Respiratory or Skin Sensitization	- Does not meet criteria		
Mutagenicity	- Does not meet criteria		
Carcinogenicity	- Does not meet criteria		
Reproductive Toxicity	- Does not meet criteria		
Specific Target Organ Toxicity			
Acute Exposure	- Category 3		
Chronic Exposure	- Does not meet criteria		

LABEL:

Symbols: 		Signal Word: DANGER
Hazard Statements DANGER! Causes severe skin burns and eye damage. May cause respiratory irritation. May be corrosive to metals.	Precautionary Statements: Absorb spillage immediately. Store locked up in well ventilated place. Keep in original container and tightly closed. Wear protective gloves/protective clothing/eye protection/face protection. Contact with water or moist air liberates white fumes and corrosive/irritating gas. Do not breathe these fumes. IF INHALED: Remove person to fresh air and keep at rest in a position comfortable for breathing. IF ON SKIN: Immediately remove all contaminated clothing. Rinse skin with water or shower as quickly as possible. Get immediate medical attention. IF IN EYES: Rinse cautiously with water for several minutes. If a contact lens is present, DO NOT delay irrigation in order to attempt to remove the lens. Get immediate medical attention.	

Emergency Overview: A non-combustible, colourless, fuming liquid with a pungent, acidic odour. Reacts violently with water or moist air to produce visible white fumes containing hydrochloric acid vapour, which can be a severe respiratory irritant and a severe eye irritant. Firefighters responding to an accidental release must always wear a self-contained breathing apparatus and full protective clothing, including chemical safety goggles. 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).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS
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HAZARDOUS COMPONENTS	CAS Registry No.	CONCENTRATION (% wgt/wgt)
Germanium Tetrachloride	10038-98-9	98 – 100%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Pain, tears, redness. Avoid direct contact. Wear chemical protective gloves if necessary. Gently blot away excess liquid off the face, if present. 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 in order to 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: *Symptoms:* Blistering, pain or irritation. Avoid direct contact. Wear chemical protective clothing, if necessary. As quickly as possible, remove contaminated clothing, shoes and leather goods (e.g., watchbands, belts). Gently blot away excess liquid, if present. Flush with lukewarm, gently flowing water for 15 – 20 minutes. Immediately obtain medical attention. Thoroughly wash contaminated clothing, shoes and leather goods before reuse or else discard.

Inhalation: *Symptoms:* Coughing, choking, respiratory tract irritation. Take proper precautions to ensure your own safety before attempting rescue (e.g., wear appropriate protective equipment, use the buddy system). Remove source of exposure or move

person from exposure area to fresh air immediately and keep comfortable for breathing. Call for medical advice/attention if person feels unwell or continues to have breathing difficulties.

Ingestion: *Symptoms:* Burns to mouth, throat, stomach. Have person rinse mouth thoroughly with water. **DO NOT INDUCE VOMITING.** (The irritant action of swallowed germanium tetrachloride may lead to spontaneous vomiting). If vomiting occurs naturally, have victim rinse mouth with water again and lie person on their side in the recovery position. Immediately obtain medical attention and bring a copy of this SDS.

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 eye and 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 chemical safety goggles and an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask. Move container(s) from fire area if it can be done without risk. Runoff water from fire control methods will contain hydrochloric acid. Do not release to sewers or waterways.

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 such as absorbent mat/ pillow/ boom.

Large Spills: Restrict access to the area until completion of cleanup. Immediately evaluate the need for evacuation/isolation of any adjoining areas, especially those potentially downwind. 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, footwear and gloves, as well as 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 containers retain product residue and can be hazardous. Clean containers of all residues before adding more product to container, to avoid potentially dangerous reactions. Personnel should be thoroughly trained regarding the proper use and handling procedures for the material and its containers.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines:

Component	ACGIH TLV	OSHA PEL	NIOSH REL
Germanium Tetrachloride	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: 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 for HCl.

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: 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.

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.

Respirators: Where germanium tetrachloride fumes are generated and cannot be controlled to within acceptable levels, use a full face-piece chemical cartridge respirator or full face, powered air-purifying respirator (PAPR) with a combined 42 CFR 84 Class N, R or P-100 particulate filter and acid gas cartridge or a 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 face-piece mask.

General Hygiene Considerations: 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.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Colourless, fuming liquid	Odour: Peculiar, acidic odour	Odour Threshold: 0.77 ppm for HCl	pH: Not Applicable (non-aqueous liquid)
Vapour Pressure: 76 mm Hg @ 20°C	Vapour Density: No Data	Freezing Point/Range: - 50°C (-58°F)	Boiling Point/Range: 82-84°C (182-183°F)
Relative Density (Water = 1): 1.879 @ 20°C	Evaporation Rate: No Data	Coefficient of Water/Oil Distribution: No Data	Solubility: Hydrolyzes to produce HCl
Flash Point: None	Flammable Limits (LEL/UEL): Not Flammable	Auto-ignition Temperature: None	Decomposition Temperature: None

SECTION 10. STABILITY AND REACTIVITY

Stability & 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 and duration of exposure. 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.

Animal Toxicity:

<u>Hazardous Ingredient:</u>	<u>Acute Oral Toxicity:</u> †	<u>Acute Dermal Toxicity:</u>	<u>Acute Inhalation Toxicity:</u> ‡
Germanium Tetrachloride	No Data	No Data	1622 ppm HCl (gas) 1 mg/L HCl (Vapour)

† LD₅₀, Rat, Oral, ‡ LC₅₀, Rat, Inhalation, 4 hour

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

Do not wash down drain or allow to reach natural water courses. In view of the economic value of germanium, every effort should be made to recover and reuse any spilled material. If material cannot be returned to process or salvage, dispose of in accordance with applicable federal, state/provincial and local regulations. Empty and thoroughly clean all residues from containers before reuse or disposal.

SECTION 14. TRANSPORT INFORMATION

TRANSPORT CANADA

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

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

SECTION 16. OTHER INFORMATION

Date of Original Issue:	June 14, 2002	Version:	01 (<i>First edition</i>)
Date of Latest Revision:	July 7, 2015	Version:	08

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 Exposure Indices, 7th Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 2015, Guide to Occupational Exposure Values.
- American Conference of Governmental Industrial Hygienists, 2015, 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 Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH).
- 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, Hazardous Products Regulations SOR/2015-17, 30 January 2015.
- International Agency for Research on Cancer (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, 1972 – present, (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 version).
- Patty's Toxicology, 5th Edition, (E. Bingham, B. Cohnsen & C H Powell, Ed.) 2001.
- Toxicology of the Eye, 2nd Ed. W. Morton Grant, MD, Charles C. Thomas, Publishers; Springfield, IL (1974).
- 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), (on-Line version).
- U.S. Department of Health and Human Services, National Institute of Environmental Health Sciences, National Toxicology Program (NTP), 13th Report on Carcinogens, October 2014.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

Notice to Reader

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