

**INDIUM METAL
SAFETY DATA SHEET**

SECTION 1. IDENTIFICATION

Product Identity: Indium Metal

Trade Names and Synonyms: None.

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: June 12, 2015.

Date of Last Edit: June 12, 2015.

Product Use: Indium metal is used in the production of indium tin oxide (ITO) as the coating in flat panel display devices: liquid crystal displays, plasma display devices and field emission devices. It is also used in making coatings in architectural glass, low pressure sodium lamps, solar collectors, and windshield glass. Indium is used in plating for bearings, alloys for solders, fusible alloys, nuclear control rods and dental alloys. Indium is used in compounds for phosphors and semiconductors. Other uses include batteries and radioisotopes.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

NOTE: In the form in which it is sold, this product is not regulated as a Hazardous Product in the U.S. or Canada. This Safety Data Sheet is provided for information purposes only.

Health	Physical	Environmental
Acute Toxicity (Oral, Inhalation) – Does not meet criteria	Does not meet criteria for any Physical Hazard	Aquatic Toxicity – Short Term/Long Term does not meet criteria
Skin Corrosion/Irritation – Does not meet criteria		
Eye Damage/Eye Irritation – Does not meet criteria		
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 – Does not meet criteria		
Chronic Exposure – Does not meet criteria		

LABEL:

Symbols: None required	Signal Word: None required
Hazard Statements None required	Precautionary Statements: None required

Emergency Overview: A soft, silvery-white metal that does not burn in bulk but may form explosive mixtures if dispersed in air as a fine powder. Indium is relatively non-toxic and poses little immediate hazard to the health of emergency response personnel or the environment in an emergency situation.

Potential Health Effects: Relatively non-toxic to humans by inhalation or ingestion. Chronic exposure may cause irritation to the lungs and gastrointestinal disorders. It is not considered a human carcinogen by the OSHA, NTP, ACGIH, IARC or the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: In the form in which this product is sold, it has low bioavailability, and does not pose any significant environmental risks. Releases of the product to water and soil should, nevertheless, be prevented (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	CAS Registry No.	CONCENTRATION (% wgt/wgt)
Indium	7440-74-6	99.9%

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. If splashed by molten metal, flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

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: Massive metal is not considered a fire or explosion hazard. Finely-divided indium metal dust or powder may be flammable or explosive when dispersed in the air at high concentrations and exposed to heat, flame, or other ignition sources. Explosions may also occur upon contact with certain incompatible materials (see Stability and Reactivity, Section 10).

Extinguishing Media: Use any means of extinction appropriate for surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam. Do not use direct water streams on fires where molten metal is present.

Fire Fighting: Indium metal has a low melting point (156°C). Therefore, if possible move this material from the fire area and/or cool material exposed to flame in order to prevent molten pools of indium. Do not use direct water streams on fires where molten metal is present, due to the risk of a steam explosion that could potentially eject molten metal uncontrollably. Use a fine water mist on the front-running edge of the spill and on the top of the molten metal to cool and solidify it. 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. Clean up spilled material immediately, observing precautions outlined below. Molten metal should be allowed to cool and harden before cleanup. Once solidified, wear gloves, pick up and return to process. Powder or dust should be cleaned up using methods which will minimize dust generation (e.g., vacuum solids or dampen material and shovel / 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 indium. 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 indium metal dust or fume.

Environmental Precautions: Indium metal has low bioavailability and poses no immediate ecological risks. However, good management practices should always be applied in the storage and use of indium and its compounds; any releases of the product to water and soil should be prevented.

SECTION 7. HANDLING AND STORAGE

Store in a cool, dry, covered area away from incompatible materials. Solid metal suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath. Otherwise, entrained moisture could expand explosively and spatter molten metal out of the bath. No special packaging materials are required.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines:

<u>Component</u>	<u>ACGIH TLV</u>	<u>OSHA PEL</u>	<u>NIOSH REL</u>
Indium	0.1 mg/m ³	None established	0.1 mg/m ³

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 indium fumes in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system. Where indium metal dust or filings are being collected and transported by a ventilation system, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Locate dust collectors and fans outdoors if possible and provide dust collectors with explosion vents or blow out panels. Refer to appropriate NFPA Standards 484, 654, and/or 68 for specific guidance.

Protective Clothing: Work clothes and gloves are recommended to prevent prolonged or repeated direct skin contact. Eye protection should be worn where fume or dust is generated. Where molten metal is handled, heat resistant gloves, goggles or face-shield, and clothing to protect from hot metal splash and radiant heat should be worn. Safety type boots are recommended.

Respirators: Where indium dust or fumes are generated and cannot be controlled in the working environment 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 or better).

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: Soft, silvery-white metal	Odour: None	Odour Threshold: Not Applicable	pH: Not Applicable
Vapour Pressure: Negligible @ 20°C	Vapour Density: Not Applicable	Melting Point/Range: 156.6°C	Boiling Point/Range: 2072°C
Relative Density (Water = 1): 7.31	Evaporation Rate: Not Applicable	Coefficient of Water/Oil Distribution: Not Applicable	Solubility: Insoluble in water
Flash Point: None	Flammable Limits (LEL/UEL): Non-Flammable	Auto-ignition Temperature: None	Decomposition Temperature: None

SECTION 10. STABILITY AND REACTIVITY

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

Incompatibilities: An explosive reaction may occur on contact with dinitrogen tetraoxide dissolved in acetonitrile. Indium reacts vigorously with mercury (II) bromide at high temperatures (350° C). Mixtures with sulphur ignite when heated. Reacts with halogens, selenium, tellurium, arsenic or phosphorus on heating. Avoid oxidizing agents and acids.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting, electric arc welding or arc-air gouging will generate indium oxide fumes. The particle size of metal fumes is largely within the respirable size range, which increases the likelihood of inhalation and deposition of the fume within the body.

SECTION 11. TOXICOLOGICAL INFORMATION

General: The information available on the toxic properties of indium in humans is limited. It is known that soluble indium salts are extremely toxic when injected into laboratory animals with a direct effect on the heart, liver, kidneys and blood. However, indium salts are far less toxic when administered orally or by inhalation. Teratogenic effects have been reported in laboratory animals injected with indium but it is considered that the risk of developmental toxicity in humans is low. The inhalation route is by far the most significant route in the occupational setting.

Acute:

Skin/Eye: Indium metal is not irritating to the eyes or skin other than by direct abrasive action of metal particles on eye or skin tissue. Soluble indium salts are very irritating to the eyes.

Inhalation/Ingestion: Inhalation of indium fume or dust may cause irritation and damage to the respiratory tract. It may also irritate the gastrointestinal tract if ingested.

Chronic: Prolonged exposure to indium fume or dust may cause irritation and damage to the lung. Russian workers exposed to indium compounds during the production of indium complained of tooth decay, pain in joints and bones, nervous and gastrointestinal disorders, heart pains, and general debility. However, an EPA review of indium metal suggests that "... possibly too much weight is given to a Russian report ... This (*these health effects*) has not been reported in comparable US activities." Indium and indium oxide are not listed as human carcinogens 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).

Animal Toxicity:

<u>Hazardous Ingredient:</u>	<u>Acute Oral Toxicity:</u>	<u>Acute Dermal Toxicity:</u>	<u>Acute Inhalation Toxicity:</u>
Indium	4,200 mg/kg [†]	No data	No data

[†] LD₅₀, Rat, Oral,

[‡] LC₅₀, Rat, Inhalation, 4 hour

SECTION 12. ECOLOGICAL INFORMATION

Indium metal is highly insoluble, and therefore presents minimal ecological risk. However, its processing or extended exposure in the environment may lead to the release of indium in more bioavailable compound forms. As there is limited information on the fate and effects of indium compounds, care should be taken to prevent releases to the environment.

SECTION 13. DISPOSAL CONSIDERATIONS

In view of the economic value of indium metal, every effort should be made to recover and reuse any spilled material. 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.

INGREDIENTS LISTED ON TSCA INVENTORY Yes
HAZARDOUS UNDER HAZARD COMMUNICATION STANDARD No (According to OSHA HSC - CFR 1910.1200 Rev 2012)
CERCLA SECTION 103 HAZARDOUS SUBSTANCES 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.

SECTION 16. OTHER INFORMATION

Date of Original Issue:	December 3, 1998	Version: 01 (<i>First edition</i>)
Date of Latest Revision:	June 12, 2015	Version: 13

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, Guide to Occupation Exposure Values - 2015.
- 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.
- Canadian Centre for Occupational Health and Safety (CCOHS) CHEMINFO Record 3500 (accessed 3 June 2015).
- Commission de la santé et la sécurité du travail, Service du Répertoire toxicologique – Indium. (accessed 3 June 2015).
- Developmental toxicity of indium: embryotoxicity and teratogenicity in experimental animals. M. Nakajima, m. Usami, K. Nakazawa *et al*, *Conjenit. Anom.* (Kyoto) 2008, Dec. 48(4), 145 – 150 (Nat'l Library of Medicine PubMed ID 18983530).
- European Economic Community, Commission Directives 91/155/EEC and 67/548/EEC.
- Health Canada, SOR/2015-17, Hazardous Products Regulations, 31 January 2015.
- International Labour Office (WHO/ILO) Encyclopaedia of Occupational Health & Safety 4th Ed.
- 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 (accessed 3 June 2015).
- Patty's Toxicology, Fifth Edition, 2001. E. Bingham, B. Cohnsen & C.H. Powell, Ed.
- Preliminary Investigation of Effects on the Environment of Boron, Indium, Nickel, Selenium, Tin, Vanadium, and Their Compounds – Volume II, Indium (August 1975) EPA Document EPA 560/2-75-005B.
- U.S. Dept. 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. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

Notice to Reader

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