

**CADMIUM METAL
SAFETY DATA SHEET**

SECTION 1. IDENTIFICATION

Product Identity: Cadmium Metal

Trade Names and Synonyms: Tadanac Cadmium; Cadmium Balls; Cadmium Sticks; Cd; ASTM B440.

Manufacturer:
Teck Metals Ltd.
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Product Use: Cadmium metal is used as a constituent in easily fusible alloys, in soft solder and solder for aluminum, in electroplating, as a deoxidizer in nickel plating, in process engraving, in electrodes for cadmium vapour lamps, in photoelectric cells, in nickel-cadmium storage batteries, and in pigment manufacture.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

Health		Physical	Environmental
Acute Toxicity (Oral)	- Category 3	Does not meet criteria for any Physical Hazard	Aquatic Toxicity Long Term – Category 4
Acute Toxicity (Inhalation)	- Category 1		
Skin Irritation	- Does not meet criteria		
Eye Irritation	- Does not meet criteria		
Sensitization	- Does not meet criteria		
Mutagenicity	- Does not meet criteria		
Carcinogenicity	- Category 1A		
Reproductive Toxicity	- Category 2		
Specific Target Organ Toxicity (Acute Exposure)	- Category 1		
(Chronic Exposure)	- Category 1		

LABEL:

Symbols:  		Signal Word: DANGER
Hazard Statements DANGER! Toxic if swallowed. Fatal if inhaled as freshly generated cadmium oxide fume. May cause cancer through inhalation of dust/fume. Suspected of damaging fertility or the unborn child. Causes damage to organs through single exposure or prolonged / repeated inhalation of dust or particularly fume. May cause long lasting harmful effects to aquatic life.		Precautionary Statements: Do not handle until all safety precautions have been read and understood. Use only outdoors or in a well-ventilated area. Do not breathe cadmium fumes or dust. Wear respiratory protection where cadmium fumes may be generated. Use other personal protective equipment as required. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling this product. Avoid release to the environment. IF INHALED: Remove person to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTRE or doctor/physician. Specific treatment for possible pulmonary edema is urgent following cadmium fume exposure. IF SWALLOWED: Rinse mouth. Immediately call a POISON CENTRE or doctor/physician. If concerned about exposure, get medical advice.

Emergency Overview: A bluish-silver lustrous metal that does not burn in bulk. Clouds of finely-divided dust are a fire and explosion hazard, however. When heated strongly in air cadmium oxide fumes will be generated. Freshly formed cadmium fume is an intense pulmonary irritant and may result in development of pulmonary edema several hours after exposure. Inhalation or ingestion of dust or fumes may produce both acute and chronic health effects. Probable cancer hazard. A self-contained breathing apparatus (SCBA) and full protective clothing are required for all emergency response personnel when cadmium is involved in a fire situation. Do NOT use water or foam. Apply dry chemical, dry sand, or special powder extinguishing media.

Potential Health Effects: Cadmium dust and fume have both acute and chronic health effects. Cadmium dust is a pulmonary irritant. Freshly formed cadmium fume is an intense pulmonary irritant, resulting in respiratory distress and possible pulmonary edema that may develop as much as 48 hours after exposure. In severe cases death may result. Long term exposures may cause kidney dysfunction and lung injury (emphysema) as well as other symptoms. Cadmium is classified as a carcinogen or probable carcinogen by IARC, ACGIH, NTP, OSHA and the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: While cadmium metal has relatively low bioavailability, compounds which it forms with other elements can be potentially toxic to biota at low concentrations. Bioaccumulation of cadmium occurs readily in aquatic and terrestrial food chains, specifically in plants and aquatic organisms (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	CAS Registry No.	CONCENTRATION (% wgt/wgt)
Cadmium	7440-43-9	99.97+%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Eye irritation, redness. Gently brush product off face. Do not rub eye(s). Let the eye(s) water naturally for a few minutes. Look right and left, then up and down. If particle/dust does not come out, cautiously rinse eye(s) with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If eye irritation persists, get medical advice/attention. DO NOT attempt to manually remove anything stuck to the eye.

Skin Contact: *Symptoms:* Skin soiling, irritation. *Dust:* Gently brush away excess product. Take off contaminated clothing, shoes and leather goods (e.g., watchbands, belts). Wash with plenty of lukewarm, gently flowing water and a non-abrasive soap for 5 minutes. If skin irritation occurs, get medical advice/attention. Wash contaminated clothing before re-use. *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:* Wheezing, coughing, throat/chest irritation. Take proper precautions to ensure your own safety before attempting rescue (e.g., wear appropriate protective equipment). Remove source of exposure or move person from exposure area to fresh air immediately and keep comfortable for breathing. Immediately call a Poison Control Centre/Doctor. If breathing is difficult, trained personnel should administer emergency oxygen if advised to do so by the Poison Control Centre/Doctor. DO NOT allow victim to move around unnecessarily. Treat pulmonary edema as a priority, even if no symptoms (i.e. wheezing, coughing, shortness of breath, etc.) are apparent. Symptoms of pulmonary edema can be delayed up to 48 hours after exposure. Quickly transport victim to an emergency care facility.

Ingestion: *Symptoms:* Stomach pain. Immediately call an emergency care facility/poison control centre. Have patient rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. However, the irritant and emetic action of swallowed cadmium usually leads to spontaneous vomiting. If vomiting occurs naturally, have victim rinse mouth with water again, then lie the affected person on their side in the recovery position. If breathing has stopped, trained personnel should begin rescue breathing or, if the heart has stopped, immediately start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED).

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not flammable or combustible. Finely-divided metallic dust or powder is a moderate fire hazard and moderate explosion hazard when dispersed in air at high concentrations and exposed to heat, flame or other ignition sources. Freshly formed cadmium powder, in contact with limited amounts of water, may heat spontaneously and may ignite combustible materials in contact with the powder. Fires and explosions may also occur upon contact with certain incompatible materials (see Stability and Reactivity, Section 10).

Extinguishing Media: Apply dry chemical, dry sand, or special powder extinguishing media (i.e. a Class D Extinguisher) to any burning pieces of metal and allow to cool. Do NOT use water, carbon dioxide, foam or Halon fire extinguishing agents on any burning or molten metal. Water may be ineffective for extinguishing fire but should be used to keep fire-exposed containers cool.

Fire Fighting: If possible, move material from fire area and cool material exposed to flame. Apply dry chemical, dry sand or special powder extinguishing media to burning cadmium. Highly toxic cadmium oxide fumes will evolve in fires. 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 face-piece mask.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Restrict access to the area until completion of clean-up. Clean up spilled material immediately, observing precautions outlined below. Molten metal should be allowed to solidify prior to clean-up. If solid metal, wear gloves, pick up and return to process. If dust, wear recommended personal protective equipment (see below) and use methods that will minimize dust generation (e.g., vacuum solids). Return uncontaminated spilled material to the process if possible. Place contaminated and non-recyclable material into suitable labelled containers for later disposal. Treat or dispose of waste material in accordance with all local, regional and national requirements, as applicable.

Personal Precautions: Persons responding to an accidental release should wear protective clothing, gloves and a respirator (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with dust and fume. Where molten metal is involved, wear heat-resistant gloves and suitable clothing for protection from radiant heat and hot-metal splash as well as a respirator to protect against inhalation of cadmium fume. Workers should wash and change clothing following cleanup of a cadmium spill to prevent personal contamination with cadmium / cadmium oxide dust.

Environmental Precautions: Cadmium metal has relatively low bioavailability; however, compounds which it forms with other elements can be toxic to aquatic and terrestrial biota. Releases of the product to water and soil should be prevented.

SECTION 7. HANDLING AND STORAGE

Store cadmium in a DRY, covered area, away from incompatible materials and food or feedstuffs. Cadmium ingots 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.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines:

<u>Component</u>	<u>ACGIH TLV</u>	<u>OSHA PEL</u>	<u>NIOSH REL</u>
Cadmium	0.01 mg Cd/m ³ (total dust) 0.002 mg Cd/m ³ (respirable)	0.005 mg Cd/m ³ OSHA SECAL* 0.015 or 0.05 mg/m ³	Lowest feasible level

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. SECAL – Separate Engineering Control Airborne Limit.

*Separate Engineering Control Airborne Limits: To be achieved in specified processes and work places where it is not possible to achieve the PEL through engineering and work practices alone. The OSHA SECAL for cadmium is 0.015 or 0.050 mg/m³, depending on the processes involved. See Table 1 of 29 CFR § 1910.1027.

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 cadmium 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. Local exhaust is strongly recommended for melting, casting, grinding and welding or flame cutting of cadmium.

Protective Clothing: Gloves and coveralls or other work clothing are recommended to prevent prolonged or repeated direct skin contact when cadmium is processed. Appropriate eye protection should be worn where fume or dust is generated. Where hot or molten metal is handled, heat resistant gloves, goggles or face shield, respirator and clothing to protect from radiant heat and hot metal splash should be worn. Safety type boots are recommended.

Respirators: Where cadmium 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-100 particulate filter cartridge). When exposure levels are obviously high but the actual concentration is unknown, a self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask should be worn.

General Hygiene Considerations: Do not eat, drink or smoke in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate, designated areas only. Work clothing should be removed immediately and laundered before reuse if it becomes heavily contaminated. Work clothing should be removed before leaving the plant site and should be changed daily if there is a reasonable probability that the clothing may be contaminated. If using a commercial or industrial laundry service, inform laundry personnel of contaminants' hazards. Workers should shower at the end of each work shift. A double locker-shower system with separate clean and dirty sides is required for cadmium handling operations to avoid cross-contamination of street clothes. Workers should not take dirty work clothes home and launder them with other personal clothing.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Bluish-silver lustrous metal	Odour: None	Odour Threshold: Not Applicable	pH: Not Applicable
Vapour Pressure: 1 mm of Hg @ 394°C negligible @ 20°C	Vapour Density: Not Applicable	Boiling Point/Range: 765°C	Melting Point/Range: 321°C
Relative Density (Water = 1): 8.65	Evaporation Rate: Not Applicable	Coefficient of Water/Oil Distribution: Not Applicable	Solubility: Insoluble in water
Flash Point: Not Applicable	Flammable Limits (LEL/UEL): Not Applicable	Auto-ignition Temperature: Not Applicable	

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Massive metal is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur. Metal surfaces tarnish on exposure to moist air. Finely powdered metal or dust can be ignited from a dust cloud in air. Freshly formed cadmium powder, in contact with limited amounts of water, may heat spontaneously and may ignite combustible materials in contact with the powder.

Incompatibilities: Cadmium reacts vigorously with oxidizing agents such as peroxides, chlorates, nitrates, and halogens or interhalogen compounds such as chlorine trifluoride as well as with elemental sulphur, zinc, selenium, or tellurium. Mixtures with nitric acid liberate toxic fumes of nitrogen oxides. Violent explosions can occur when the metal is in contact with fused ammonium nitrate or immersed in hydrazoic acid. Burning metal reacts violently with fire extinguishing agents such as water, foam, carbon dioxide or Halons. Cadmium metal reacts with strong acids giving off flammable hydrogen gas.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting or burning, electric arc welding or overheating a molten bath will generate highly toxic cadmium oxide fumes. These brownish fumes are highly soluble in body fluids and the particle size of the 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: Cadmium dust and fume are both pulmonary irritants, but freshly generated cadmium fume is an intense irritant and its small particle size allows it to reach into the lung more readily. The onset of symptoms is frequently delayed by 4 to 10 hours after exposure and is aggravated by physical effort. Pulmonary edema may then develop rapidly. The mortality rate from acute pulmonary disease is about 20% according to the ACGIH. Those surviving an episode of acute poisoning generally recover slowly but without apparent residual effects.

Chronic exposure to cadmium has been associated with a wide variety of gastrointestinal symptoms, pulmonary edema, and kidney malfunction with increased excretion of a specific low molecular weight protein (beta-2-microglobulin). The body to a large extent retains absorbed cadmium, and excretion is very slow. Cadmium has been linked to both prostate cancer and lung cancer, though several researchers have questioned the association with prostate cancer recently.

Individuals with pre-existing lung, liver, kidney, and blood ailments should be precluded from exposure until approved by a physician. Initial and periodic medical examinations are recommended for persons exposed to levels above the exposure limits of cadmium.

Acute:

Skin/Eye: Contact with dust or fume may cause local irritation but would not cause tissue damage.

Inhalation: Fumes of cadmium (i.e. cadmium oxide) are highly toxic by inhalation. They may cause serious systemic poisoning and possible permanent damage to the lungs. Early symptoms of excessive exposure include dryness of the throat; irritation of the nose, throat, and respiratory tract; headache; coughing, and a metallic taste. After a delay of several hours (up to 10), a person may develop constriction of the chest, persistent cough, and progressive shortness of breath. There may be headache, chills, diarrhea, muscle aches, nausea, vomiting, irritability, and restlessness. Pulmonary congestion may progress rapidly causing wheezing and symptoms of oxygen deficiency. Death may follow. Recovery from an acute exposure episode is slow but generally without ongoing or lingering effects. Milder cases of acute exposure have produced symptoms resembling metal fume fever with some symptoms and signs of acute gastroenteritis as well.

Ingestion: Ingestion of excessive quantities of cadmium dust may cause salivation, choking, nausea, vomiting, diarrhea, abdominal pain, tenseness, blurred vision, dizziness, vertigo, and headache. Convulsions, exhaustion, collapse, shock, and unconsciousness may occur. Death has followed within 24 hours from shock or after 7 to 14 days from acute kidney failure or cardiopulmonary depression.

Chronic: Prolonged exposure to cadmium dust and/or fume may cause loss of sense of smell, occasional ulcerations of the nasal passages, rhino laryngitis, cough, shortness of breath, mild anemia, sleeplessness, irritability, loss of appetite, and cadmium-yellow fringe on teeth. The primary target organ for chronic cadmium effects is the kidney with increased excretion of a specific low molecular weight protein (beta-2-microglobulin). Damage to the lungs (of the emphysematous type) has been reported in some studies of cadmium-exposed workers but not found in other studies. Cigarette tobacco contains cadmium and smoking adds to the daily intake of cadmium which may increase the risk of cumulative toxic effects. Clinical evidence of the cumulative effects of cadmium may appear after exposure has ceased. Disease may then be progressive.

The International Agency for Research on Cancer (IARC) has classified cadmium and certain cadmium compounds as Group 1 Carcinogens (carcinogenic to humans). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies cadmium as a Suspected Human Carcinogen (A2). The National Toxicology Program (NTP) classifies cadmium as a Known Human Carcinogen and OSHA lists cadmium as a Carcinogen. The European Union (EU) classifies cadmium as a Category 2 (Probable) Carcinogen.

Animal Toxicity:

Hazardous Ingredient:

Acute Oral Toxicity:

Acute Dermal Toxicity:

Acute Inhalation Toxicity:

Cadmium	LD ₅₀ † = 225 mg/kg	No Data	LC ₅₀ ‡ = 11 mg/m ³ /4 hr (CdO fume)
† LD ₅₀ , Rat, Oral, ‡ LC ₅₀ , Rat, Inhalation, 4 hour			

SECTION 12. ECOLOGICAL INFORMATION

While cadmium metal is relatively insoluble, its processing or extended exposure in aquatic and terrestrial environments may lead to the release of cadmium in bioavailable forms. Compared to most other metals, cadmium is relatively mobile and toxic in the aquatic environment. Water hardness, pH and dissolved organic carbon are three major factors which regulate the degree of cadmium toxicity. In soils, higher acidity (lower pH) results in the release of cadmium ions, which may, in turn, yield higher toxicity to soil organisms and uptake of cadmium by plants.

Cadmium is strongly accumulated by all organisms through the food chain. Bioaccumulation in aquatic organisms is greatest in invertebrates, followed by fish and aquatic plants. Bioaccumulation of cadmium into terrestrial plants can result in higher cadmium concentrations in terrestrial animals that feed on the plants.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

PROPER SHIPPING NAME	Not a regulated product in ingot form
TRANSPORT CANADA AND U.S. DOT HAZARD CLASSIFICATION	Not Applicable
TRANSPORT CANADA AND U.S. DOT PIN	Not Applicable
MARINE POLLUTANT	No
IMO CLASSIFICATION	Not Regulated

SECTION 15. REGULATORY INFORMATION

U.S.	
INGREDIENTS LISTED ON TSCA INVENTORY.....	Yes
HAZARDOUS UNDER HAZARD COMMUNICATION STANDARD.....	Yes
CERCLA SECTION 103 HAZARDOUS SUBSTANCES	Cadmium Yes.....RQ: 10lbs. (4.54 kg.)*
*reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).	
EPCRA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCE	No
EPCRA SECTION 311/312 HAZARD CATEGORIES	Immediate (Acute) Health Hazard – Toxic Delayed (Chronic) Health Hazard – Target Organ Effects (Kidney) Delayed (Chronic) Health Hazard - Carcinogen
EPCRA SECTION 313 TOXIC RELEASE INVENTORY:.....	Cadmium CAS NO. 7440-43-9 Percent by Weight: 99.97+

SECTION 16. OTHER INFORMATION

Date of Original Issue:	July 23, 1997	Version:	01 (first edition)
Date of Latest Revision:	April 15, 2015	Version:	11

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, Seventh Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 2014, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Governmental Industrial Hygienists, 2014, Guide to Occupational Exposure Values.

- Australian National Industrial Chemicals Notification & Assessment Scheme (NICNAS) - Human Health Tier II Assessment for Cadmium.
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- Canadian Centre for Occupational Health and Safety, Hamilton, ON, CHEMINFO Record No. 3454 Cadmium.
- Chemical Hazards of the Workplace, Nick H. Proctor and James P. Hughes, J. B. Lippincott Company, Philadelphia, 1978.
- European Chemical Agency (ECHA) - Registered Substances Database - Cadmium (last accessed 3 February 2015).
- European Economic Community, Commission Directives 91/155/EEC and 67/548/EEC.
- Health Council of the Netherlands, Cadmium and its compounds - evaluation of the effects on reproduction Report No. 2000-04OSH (3 mei 2000).
- Industry Canada, SOR/2015-17, Hazardous Products Regulations.
- 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.
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- International Labour Office (WHO/ILO) Encyclopedia of Occupational Health & Safety 4th Ed. CD-ROM Version (1998).
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- National Library of Medicine, National Toxicology Information Program, Hazardous Substance Data Bank. (On line version).
- Oak Ridge National Laboratory, Health Sciences Research Division, Toxicity Summary for Cadmium. - November 1991.
- Patty's Toxicology, 5th Edition, (E Bingham, B Cohrssen & C H Powell, Ed.) 2001.
- Scientific Basis for Swedish Occupational Standards XXIV - Cadmium (February 5, 2003).
- U.S. Dept. 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. Dept. of Health and Human Services, National Institute of Environmental Health Sciences, National Toxicology Program (NTP), 12th Report on Carcinogens, June 2011.
- U.S. Dept. of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Toxicological Profile for Cadmium (September 2012).
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.127.

Notice to Reader

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