

# MATERIAL SAFETY DATA SHEET

## Selenium

1.	<b>IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND OF THE COMPANY</b>				
1.1	<b>Identification of the substance or preparation :</b>				
1.1.1	<b>Product Name :</b> Selenium				
1.1.2	<b>Chemical Name :</b> Selenium				
1.2	<b>Manufacturer :</b> Present in Chinese EIMn at a concentration range of typically 0,04-0,16% Se				
1.3	<b>Emergency Telephone No. :</b>				
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2.	<b>COMPOSITION / INFORMATION ON INGREDIENTS :</b>				
2.1	<b>Components :</b>	<b>CAS and EC No.</b>	<b>Weight %</b>	<b>Danger symbol</b>	<b>R and S-phrases</b>
	Selenium	7782-49-2	100		See 15.4
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3.	<b>HAZARDS IDENTIFICATION</b>				
3.1	<p>NFPA Ratings (scale 0-4): Health=2 Fire=0 Reactivity=0</p> <p>EU CLASSIFICATION: T Toxic; R 23/25-33; EC Classification may be inconsistent with independently researched data.</p>				
3.2	<p><b>Emergency Overview:</b></p> <p>COLOR: red, gray or black          PHYSICAL FORM: solid          ODOR: odorless          MAJOR HEALTH HAZARDS: respiratory tract irritation, skin irritation, eye irritation.</p>				
3.3	<p><b>Potential Health Effects:</b></p> <p>INHALATION:  <i>Short term exposure:</i> irritation, lack of sense of smell, metal fume fever, lung congestion.</p> <p><b>Long term exposure: garlic odor, digestive disorders.</b></p> <p>SKIN CONTACT:  <i>Short term exposure:</i> irritation  <i>Long term exposure:</i> same as effects reported in short term exposure.</p> <p>EYE CONTACT:  <i>Short term exposure:</i> irritation (possibly severe)  <i>Long term exposure:</i> same as effects reported in short term exposure.</p> <p>INGESTION:  <i>Short term exposure:</i> same as effects reported in short term inhalation, metallic taste.  <i>Long term exposure:</i> same as effects reported in long term inhalation, sterility, heart damage, liver damage.</p>				
3.4	<p><b>Carcinogen Status:</b></p> <p>OSHA: N</p>				

	NTP: N IARC: N
<b>4. FIRST AID MEASURES</b>	
4.1	<b>Inhalation :</b> When safe to enter area, remove from exposure. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Keep warm and at rest. Get medical attention immediately.
4.2	<b>Skin Contact:</b> Remove contaminated clothing, jewelry, and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). For burns, cover affected area securely with sterile, dry, loose fitting dressing. Get medical attention immediately.
4.3	<b>Eye Contact:</b> Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.
4.4	<b>Ingestion :</b> If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.
4.5	<b>Note to Physician:</b> For inhalation, consider oxygen. For ingestion, consider gastric lavage and catharsis. Consider oxygen.
<b>5. FIRE FIGHTING MEASURES</b>	
5.1	<b>Fire and Explosion Hazard :</b> Negligible fire hazard.
5.2	<b>Extinguishing Media :</b> Regular dry chemical, carbon dioxide, water, and regular foam. Large fires : Use regular foam or flood with fine water spray.
5.3	<b>Fire Prevention :</b> Store in cool dry place. Keep containers closed. Keep away from sources of heat and ignition.
5.4	<b>Fire fighting :</b> Move container from fire area if it can be done without risk. Do not attempt to extinguish fire unless flow of material can be stopped first. Use extinguishing agents appropriate for surrounding fire. Flood with fine water spray. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Consider downwind-evacuation if material is leaking.
<b>6. ACCIDENTAL RELEASE MEASURES</b>	
	<b>Occupational Spill :</b> Do not touch spilled material. Stop leak if possible without personal risk. Small spills : Absorb with sand or other non-combustible material. Collect with absorbent into suitable container. Small dry spills: Collect spilled material in appropriate container for disposal.  Move containers away from spill to a safe area. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard areas and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Resource Center at (800) 424-8802 (USA) or (202) 426-2675 (USA).
<b>7. HANDLING AND STORAGE</b>	
	Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances.

	Dissolve in strong hydrochloric acid solution.	
	Keep in closed container.	
<b>8.</b>	<b>EXPOSURE CONTROLS / PERSONAL PROTECTION</b>	
8.1	<p><b>Exposure Limits :</b> SELENIUM AND COMPOUNDS (as Se): 0.2 mg/m<sup>3</sup> OSHA TWA 0.2 mg/m<sup>3</sup> ACGIH TWA</p> <p>0.2 mg/m<sup>3</sup> NIOSH recommended TWA 10 hour(s)</p> <p>0.1 mg/m<sup>3</sup> DFG MAK 4 times/shift (total dust)</p> <p>0.1 mg(Se)/m<sup>3</sup> UK OES TWA</p> <p>MEASUREMENT METHOD: Particulate filter; Acid; Atomic absorption spectrometry; NIOSH II(7) # S190</p> <p>Immediately dangerous to life or health at 1 mg/m<sup>3</sup> as Se.</p> <p>Occupational exposure limits in other countries are 0,1 mg/m<sup>3</sup> (Austria, Denmark, Finland, Japan, Germany, Hungary, Poland, Sweden, Switzerland, and UK) or 0,2mg/m<sup>3</sup>.</p>	
8.2	<p><b>Ventilation:</b> Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.</p>	
8.3	<p><b>Eye Protection:</b></p> <p>Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.</p>	
8.4	<p><b>Clothing:</b> Wear appropriate chemical resistant clothing.</p>	
8.5	<p><b>Gloves:</b> Wear appropriate chemical resistant gloves.</p>	
8.6	<p><b>Respirator:</b> The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA. Measurement Element: Selenium (Se)</p> <p>1 mg/m<sup>3</sup> Any dust and mist respirator. Any dust, mist, and fume respirator. Any air-purifying respirator with a full facepiece and a high-efficiency particulate filter. Any powered, air-purifying respirator with a dust and mist filter. Any powered, air-purifying respirator with a dust, mist, and fume filter. Any supplied-air respirator. Any self-contained breathing apparatus with a full facepiece.</p> <p>Escape - Any air-purifying respirator with a full facepiece and a high-efficiency particulate filter. Any appropriate escape-type, self-contained breathing apparatus.</p> <p>For Unknown Concentrations or Immediately Dangerous to Life or Health - Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply. Any self-contained breathing apparatus with a full facepiece.</p>	
8.7	<p><b>Biomonitoring:</b> Urinary levels of selenium are a reasonable measure of exposure and dosage. Urinary selenium is normally less than 100 µg/l.</p>	
<b>9.</b>	<b>PHYSICAL AND CHEMICAL PROPERTIES</b>	
9.1	PHYSICAL STATE	Metal-like solid
9.2	ODOUR AND APPEARANCE	Amorphous or crystalline, red to grey/black, odourless.
9.3	ODOUR THRESHOLD	No data
9.4	DENSITY	4,81 g/cm <sup>3</sup> .
9.5	VAPOUR PRESSURE	10 mm Hg @ 429 °C

9.6	FLAMMABILITY	Not applicable
9.7	AUTO-FLAMMABILITY	Not listed
9.8	BOILING POINT	685 °C
9.9	MELTING POINT	200 °C
9.10	SOLUBILITY IN WATER	Insoluble.
9.11	SOLVENT SOLUBILITY	Soluble: sulfuric acid, chloroform, methylene iodide, benzene, quinoline, nitric acid, ether, alkali solutions, and selenium oxychloride. Very slightly soluble: carbon disulfide Insoluble: alcohol
<b>10. STABILITY AND REACTIVITY</b>		
10.1	<b>Reactivity:</b>	Stable at normal temperatures and pressure.
10.2	<b>Conditions To Avoid:</b>	Avoid heat, flames, sparks and other sources of ignition. Avoid generating dust. Keep out of water supplies and sewers.
10.3	<b>Incompatibilities:</b>	Combustible materials, oxidizing materials, halogens, metals, metal carbide, metal salts, metal oxides, bases  SELENIUM: ALKALI METAL AMIDES: Produces explosive products ALKALINE EARTH METAL AMIDES: Produces explosive products BARIUM PEROXIDE: Ignites at 265 C BROMINE PENTAFLUORIDE: Violent reaction and possible ignition CADMIUM: Possible explosion when heated CHLORINE TRIFLUORIDE: Reacts violently, ignition often occurring CHROMIC ANHYDRIDE: Violent reaction FLUORINE: Ignites on contact LITHIUM SILICIDE: Incandescent reaction METAL ACETYLIDES: Incandescent reaction on heating METAL CARBIDES: Incandescent reaction on heating METAL CHLORATES (EXCEPT ALKALI): Incandescent reaction in the presence of water METALS: Contact of many metals with selenium results in incandescence NITROGEN TRICHLORIDE: Explodes on contact ORGANIC MATERIALS + OXYGEN: May result in explosive oxidation OXIDIZERS (STRONG): Fire and explosion hazard PHOSPHORUS: Incandescent reaction when heated POTASSIUM: Incandescence reaction with possible explosion POTASSIUM BROMATE: Violent, explosive reaction SILVER BROMATE: Violent explosive reaction SILVER OXIDE: Ignition on grinding SODIUM PEROXIDE: Forms explosive mixture TIN (POWDERED): Extremely exothermic, incandescent reaction ZINC: Possible explosion on heating
10.4	<b>Hazardous Decomposition:</b>	Thermal decomposition products: selenium
10.5	<b>Polymerization:</b>	Will not polymerize.
<b>11. TOXICITY INFORMATION :</b>		
11.1	<b>Toxicity Data:</b>	6700 mg/kg oral-rat LD50; 33 mg/kg/8 hour(s) inhalation-rat LCLo; 6 mg/kg intravenous-rat LD50; 2500 ug/kg intravenous-rabbit LDLo
11.2	<b>Carcinogen Status:</b>	IARC: Human Inadequate Evidence, Animal Inadequate Evidence, Group 3
11.3	<b>Local Effects:</b>	Irritant: inhalation, skin, eye
11.4	<b>Acute Toxicity Level:</b>	Slightly Toxic: ingestion
11.5	<b>Medical Conditions Aggravated By Exposure:</b>	Gastrointestinal disorders, immune system disorders or allergies, kidney disorders, liver disorders, respiratory disorders, skin disorders and allergies

11.6	<p><b>Tumorigenic Data:</b> 480 mg/kg oral-mouse TDLo/60 day(s) continuous</p>
11.7	<p><b>Reproductive Effects Data:</b> 34 mg/kg oral-mouse TDLo multigenerations</p>
11.8	<p><b>Health Effects</b></p>
11.8.1	<p><u>Inhalation</u>: ACUTE EXPOSURE:</p> <p>SELENIUM: Inhalation may cause irritation of the upper respiratory tract with sneezing and coughing. Dust of metallic selenium may collect in the nostrils and produce catarrh, anosmia, and epistaxis. Exposure to selenium dust at air concentrations of 33 mg/m<sup>3</sup> for 8 hours resulted in death in 10% of the rats tested. The major pathologic finding was interstitial pneumonitis. A brief exposure to high concentrations of fume produced severe irritation of the nose and throat followed by headache in exposed workers. One case of transient dyspnea was reported. Large quantities of fume may produce pulmonary edema within 1 to 4 hours after exposure. Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed metal oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalised feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours.</p> <p>CHRONIC EXPOSURE:</p> <p>SELENIUM: Repeated or prolonged exposure has been reported to cause a metallic taste in the mouth, a garlic odour of the breath and sweat, bronchial and nasopharyngeal irritation, pallor, coated tongue, nervousness, depression, fatigue, vestibulo toxicity and gastrointestinal disturbances. Liver injury has been produced in experimental animals Selenium compounds may affect the kidneys.</p>
11.8.2	<p><u>Skin Contact</u>:</p> <p>ACUTE EXPOSURE:</p> <p>SELENIUM: Contact with dust or fumes may cause irritation.</p> <p>CHRONIC EXPOSURE:</p> <p>SELENIUM: Repeated or prolonged exposure may cause dermatitis.</p>
11.8.3	<p><u>Eye Contact</u>:</p> <p>ACUTE EXPOSURE:</p> <p>SELENIUM: High concentrations of fume may cause severe irritation.</p> <p>CHRONIC EXPOSURE:</p> <p>SELENIUM: Repeated or prolonged exposure to irritants may cause conjunctivitis.</p>
11.8.4	<p><u>Ingestion</u>:</p> <p>ACUTE EXPOSURE:</p> <p>SELENIUM: Elemental selenium is poorly absorbed from the gastrointestinal tract. Ingestion of selenium compounds may cause severe irritation and disturbances of the gastrointestinal tract and a metallic taste in the mouth.</p> <p>CHRONIC EXPOSURE:</p> <p>SELENIUM: Repeated or prolonged ingestion may cause effects similar to those as detailed in chronic inhalation. In addition, symptoms may include partial loss of hair</p>

and nail changes. Additional data reported in animals includes anemia, liver, kidney and heart damage, sterility and congenital defects.

**12. ECOLOGICAL INFORMATION :**

Water

Because there are chemical similarities between selenium and sulphur, selenium can replace sulphur in some biologically important substances and thereby cause toxic effects. The toxic effects are similar in cold- and warm-water adapted fish.

Selenium toxicity effects observed in fish include changes in feeding behaviour and equilibrium, pathological changes, deformities, hematological (blood) changes and death. Fish are generally less sensitive to selenium than are invertebrates. Toxic effects of selenium that have been recorded in invertebrates include immobilisation, reduced survival and reduced reproduction.

Selenium is passed up through the aquatic food chain and accumulates in the liver of mammals and fish; it may therefore pose a threat to predators. Selenium undergoes biological methylation in sediments, a process similar to mercury methylation. Selenomethionine is ten times more toxic than inorganic selenium.

South Africa

Wastewater limit value	£ 0,02 mg/l dissolved selenium
Water quality guideline - livestock watering	£ 0,05 mg/l selenium
Target water quality range - aquatic ecosystems	£ 2 µg/l selenium
Chronic effect value - aquatic ecosystems	5 µg/l selenium
Acute effect value - aquatic ecosystems	30 µg/l selenium

United States

Federal drinking water standard	£ 50 µg/l selenium
Arizona drinking water standard	£ 45 µg/l selenium
Connecticut drinking water standard	£ 10 µg/l selenium
Maine drinking water standard	£ 10 µg/l selenium
Minnesota drinking water standard	£ 30 µg/l selenium
CERCLA reportable quantity	<sup>3</sup> 100 lb/45,4 Kg selenium
EPA Maximum contamination level and goal (CWA)	50 µg/l selenium

Ecotoxicity:

**FISH TOXICITY:**

1000 ug/L 96 hour(s) LC50 (Mortality) Fathead minnow (*Pimephales promelas*)

**INVERTEBRATE TOXICITY:**

115 ug/L 21 hour(s) MATC(Growth) Water flea (*Daphnia magna*)

**ALGAL TOXICITY:**

7930 ug/L 96 hour(s) EC50 (Photosynthesis) Diatom (*Skeletonema costatum*)

**PHYTOTOXICITY:**

2400 ug/L 4 hour(s) EC50 (Growth) Duckweed (*Lemna minor*)

**FATE AND TRANSPORT:**

**BIOCONCENTRATION:**

322 ug/L 21 hour(s) BCF (Residue) Water flea (*Daphnia magna*) 5 ug/L

**13. DISPOSAL CONSIDERATIONS :**

Recycle if possible. Hazardous Waste Number(s): D010. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 1.0 mg/L. Dispose in accordance with all applicable regulations.

14.	<b>TRANSPORT INFORMATION :</b> <b>UN No:</b> 2658 <b>CLASSIFICATION:</b> DOT 6.1 Poison
15.	<b>REGULATORY INFORMATION :</b>
15.1	<b>Airborne Threshold Limit Values</b> See 8.1
15.2	<b>Canadian Ingredients Disclosure List -</b> Listed for Se concentrations of <sup>3</sup> 0,1%.
15.3	<b>Summary of U.S.A. regulatory listings:</b>  ACGIH TLV list "Threshold Limit Values for 1992-1993" ATSDR Toxicology Profile available (NTIS** PB/90/182155/AS) California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals. Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol. 122. Clean Air Act of November 15, 1990. List of pollutants. Clean Water Act Section 307 Priority Pollutants EPA TSCA 8(a) Preliminary Assessment Information Rule - effective 05/16/88 EPA TSCA Chemical Inventory List 1989 EPA TSCA Chemical Inventory List 1990 EPA TSCA Chemical Inventory List 1992 EPA TSCA Test Submission (TSCATS) Database - April 1990 EPA TSCA Test Submission (TSCATS) Database - September 1989 Massachusetts Substance List. New Jersey Right To Know Substance List. (December 1987) OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised. Pennsylvania Hazardous Substance List RCRA Hazardous Waste RCRA Toxicity Characteristics (TC) list dated March 29, 1990 SARA Section 110 Priority List of CERCLA Hazardous Substances SARA Section 313 Toxic Chemicals List SELENIUM [7782-49-2] Wisconsin Air Toxics Control Regulation NR-445 (December 1988)
15.4	<b>International Regulations:</b>   EU Risk and Safety Phrases: R: 23/25-33 Toxic by inhalation and if swallowed. Danger of cumulative effects. S: 1/2-20-21-28b-45 Keep locked up and out of reach of children. When using, do not eat or drink. When using, do not smoke. After contact with skin, wash immediately with plenty of soap and water. In case of accident, or if you feel unwell, seek medical advice immediately (show the label where possible).  The Netherlands: Building Materials Decree Maximum selenium immission 15mg/m <sup>2</sup> 100yr.
16.	<b>OTHER INFORMATION :</b> Prepared by : Manganese Metal Company (Pty) Ltd Telephone : +27 13 759 4600 Preparation date : December 1999.
17.	<b>REFERENCES :</b>
17.1	1998 TLVs and BEIs, Threshold limit Values for Chemical Substances and Physical Agents, ACGIH.
17.2	Hamilton & Hardy. Industrial Toxicology.
17.3	National Library of Medicine, Bethesda MD, USA
17.4	NIOSH Pocket guide to Chemical Hazards, No. 97-140

Last updated:2/9/2005