Materials Science International, Inc.
1660 Georgesville Road
Columbus, OH 43228-3620

Phn# (614)870-0400
Fax# (614)878-6000
http://www.msitarget.com

Chemtrec: (800)424-9300
Poison Center: (800)562-823

Material Safety Data Sheet

1. GENERAL INFORMATION

Product Name: Chromium
Chemical Family and Formula: Metallic Element / Cr

2. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW

IMMEDIATE CONCERNS:
Chromium:

HMIS/NFPA classification for solid product as shipped:
Health = 0; Flammability = 0; Reactivity = 0; PPE = See Section 8
HMIS classification for possible resultant powder:
Health = 1; Flammability = 3; Reactivity = 0; PPE = See Section 8

Chromium is essentially non-toxic in its elemental form. However, some Chromium compounds (such as Cr+6) are considered human poisons with gastrointestinal effects. The information in this MSDS pertains to elemental Chromium only and does not necessarily apply to Chromium compounds.

POTENTIAL HEALTH EFFECTS

EYES: Chromium dust can irritate the surface of the eye. Blinking and tearing may occur. Chromium dust exposure could cause conjunctivitis. Severity of injury depends on size and location of foreign body.

SKIN: Chromium and Chromium dust are generally not irritating to the skin. It could cause dermatitis in sensitive individuals. Cross sensitization could occur when Cobalt and Chromium are combined.

INGESTION: Metallic Chromium is mostly non-toxic and is not absorbed by the body. However, Chromium compounds such as Cr+6 can cause gastrointestinal difficulties (see Immediate Concerns).

INHALATION: Inhalation hazards of powder are dependent on particle size. Exposure to Chromium metal dust may be involved with the development of lung disease (pulmonary fibrosis or pneumoconiosis) but has not been confirmed. If in dust form, Chromium may cause temporary irritation of the respiratory tract, including coughing and mild temporary irritation. There is little information about inhalation of Chromium.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

EYES: Redness in eyes, irritation and mild, temporary pain may occur.

SKIN: Urticaria (vascular reaction involving the upper dermis), contact dermatitis, irritation, itchiness, burning sensation or inflammation.

INGESTION: Ingestion is unlikely to occur in the workplace. Symptoms could include a metallic taste in the mouth, salivation, nausea, vomiting, stomachache, diarrhea, rapid heartbeat and convulsions.

INHALATION: Coughing, sneezing and irritation of throat or nasal passages.

ACUTE EFFECTS: Short-term exposures of Chromium dust may cause headaches, coughing, wheezing, dyspnea, shortness of breath, pneumoconiosis, fever, weight loss, nasal irritation, pain or discomfort, inflammation of the conjunctiva, and dermatitis. Tracheobronchial irritation and edema persist after other symptoms subside.

CHRONIC: Repeated or prolonged breathing of particles of respiratory size may cause histologic fibrosis of the lungs. Excessive exposure to Chromium may cause asthmatic bronchitis.

MEDICAL CONDITIONS AGGRAVATED: There seems to be an increased incidence of brochogenic carcinoma in workers exposed to Chromate dust.

ROUTES OF ENTRY: Inhalation of dusts, powders or fumes, ingestion, skin and eye contact.

TARGET ORGANS: Respiratory system

CANCER STATEMENT: This substance is present on the International Agency for Research on Cancer (IARC) as Group 3 (not classifiable).

IRRITANCY: As listed above.

SENSITIZATION: Some Chromium compounds (hexavalent Chromium) could cause sensitization (Chrome allergy). Cobalt and Chromium together could cause cross sensitization.

COMMENTS HEALTH: Chromium compounds in the +3 state are of a low order of toxicity. In the +6 state, Chromium compounds are irritants and corrosive, and can enter the body by ingestion, inhalation and through the skin. +6 Chromium poisoning in humans can lead to nephritis, anuria and extensive lesions in the kidneys. Exposure to Chrome can also cause sensitization in some individuals (Chrome allergy).

3. COMPOSITION/INFORMATION ON INGREDIENTS

	wt%	CAS Registry #
Chromium	~99.9	7440-47-3

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200):

CHEMICAL COMPOSITION/HAZARDOUS INGREDIENTS/OCCUPATIONAL EXPOSURE LIMITS
Exposure limits are time weighted averages (twa), short-term exposure limits (stel) and ceiling (c) are included if established.

Ingredient	ACGIH-TLV	OSHA-PEL	IDLH	OSHA-STEL	NIOSH REL
Chromium	0.5 mg/m3	1 mg/m3	250 mg/m3	Not established	0.5 mg/m3

4. FIRST AID MEASURES

EYES: Hold eyelid(s) apart and flush eyes with large amounts of water for at least 15 minutes or until particles have been removed. If irritation persists, seek medical attention.

SKIN: After contact with skin, immediately flush skin with plenty of water. Remove clothing. Obtain medical attention immediately. Wash clothing separately before reuse.

INGESTION: Rinse mouth thoroughly with water. **DO NOT** induce vomiting. Drink 240 to 300 ml (about 8 to 10 oz.) of water. If vomiting occurs, keep victim's head low than hips to avoid aspiration. Rinse out mouth and repeat procedure. Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Obtain immediate medical attention.

INHALATION: If symptoms are present, remove sources of contamination or move person to fresh air. Administer oxygen if necessary. If symptoms persist or keep developing, obtain medical attention.

NOTES TO PHYSICIAN: Acute toxicity of Chromium +6 appears in 2 phases:
-Multi-system shock from gastrointestinal corrosivity, and
-Hepatic, renal hematopoieticity.

Treatment can include using ascorbic acid as a neutralizer with gastric lavage. If a large amount of Chromium +6 occurred, exchange transfusions and/or consider hemodialysis. Treat allergic dermatitis with local cortisone or 10% ascorbic acid to reduce Chromium +6 to Chromium +3. To help heal skin ulcers, apply 10% EDTA in lanolin base every 24 hours.

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use substance appropriate for surrounding fire. A dry chemical or sand can be used. **DO NOT USE** carbon dioxide, which may form an explosive mixture with powdered Chromium.

EXPLOSION HAZARDS: Chromium is noncombustible in solid, bulk form. Particle size and dispersion in air determine reactivity. Chromium powder could explode spontaneously in air, while Chromium dust suspended in carbon dioxide could be ignitable and explosive when heated. Finely divided dust burns rapidly if heated in a flame.

FIRE FIGHTING PROCEDURES: Firefighters should wear proper protective equipment and self-contained breathing apparatus (SCBA) with full face-piece operated in positive pressure mode.

FIRE FIGHTING EQUIPMENT: Use fire-fighting equipment appropriate for surrounding fire.

AUTOIGNITION TEMPERATURE: Chromium cloud, 1076° F (580° C); Chromium dust layer, 752° F (400°C).

FLAMMABLE LIMIT: For Chromium dust cloud explosion, 0.230 (oz / ft 3)(g/L.

SENSITIVITY TO IMPACT: Not sensitive.

6. ACCIDENTAL RELEASE MEASURES

WATER SPILL:
-The permissible concentration in water that the EPA has suggested to protect human health for trivalent Chromium is 170 ug/l and hexavalent Chromium 50 ug/l.
-For determination in water, total Chromium may be determined by digestion followed by atomic absorption or by colorimeter (diphenylcarbazide) or by Inductively Coupled Plasma (ICP) optical emission spectrometry. Chromium (VI) may be determined by extraction and atomic absorption or colorimeter (using diphenylhydrazide).

-Dissolved total Chromium or Chromium (VI) may be determined by 0.45 microgram filtration followed by the above-cited methods.

AIR SPILL:
-For determination of Chromium metal and both insoluble and soluble salts in the air, collect on a filter work-up with acid and analyze by atomic absorption. See NIOSH Methods, Set O.

GENERAL PROCEDURES:
-Try to restrict access to area until material is cleaned up. Always shut off ignition sources. Take immediate steps to stop and contain spill. For dry spills, shovel or sweep into containers and cover. Vacuuming with HEPA filters is preferred for dust. Exercise caution regarding personnel safety and exposure to the spilled area. Flush spill area with water.

RELEASE NOTES:
-For both small and large leaks / spills, carefully transfer material into a container and arrange for removal and / or reclamation. Always wash down site of accident with water and detergent.

SPECIAL PROTECTIVE EQUIPMENT:
-Use the appropriate respiratory protection if there is a possibility of dust, powders or fumes exposure.

7. HANDLING AND STORAGE

GENERAL PROCEDURES:
-Always store in tightly closed containers. Store in a clean, dry area, away from any corrosive gases or vapors. Empty containers may contain toxic, flammable/combustive or explosive residue. Do not alter, reuse or dispose of containers unless proper precautions are taken against these hazards.

SPECIAL HANDLING AND STORAGE:
-Label containers indicating contents. Store in a cool, well-ventilated place away from incompatible materials. (See Section 10. STABILITY AND REACTIVITY).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:

When handling Chromium dust, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Methods to control hazardous conditions are recommended. Methods include process or personnel enclosure, mechanical ventilation (dilution and local exhaust), control of process condition, and process modification. Administrative controls and personal protective equipment may be required. Local exhaust ventilation and process enclosure can control airborne dust or fume, if necessary. If work area generates dust, install dust collectors outside or where permitted by regulation (see OSHA 29 CFR 1910.94, ventilation and CFR 1910.1000, air contaminants). Supply sufficient fresh air to make up for air removed by exhaust system.

PERSONAL PROTECTION

EYES AND FACE: For dust, wear chemical safety goggles or dust resistant safety goggles. Depending on circumstances, a face shield may be necessary. Eye protection shall be worn in accordance with 29 CFR 1910.133 for operations, such as grinding, etc. Contact lenses should not be worn.

SKIN: For dust, wear impervious gloves, coveralls, apron, boots, etc., as required. It is good practice to avoid skin contact.

RESPIRATORY:
-If in sold state, respiratory protection is not required where adequate ventilation conditions exist.
-For up to 2.5 mg/m3 Chromium metal concentrations in air use, NIOSH recommends a dust and mist respirator.
-For up to 5 mg/m3, use a dust and mist respirator except single-use and quarter-mask; or SAR (Supplied Air Respirator).
-Up to 12.5 mg/m3, NIOSH recommends a powered air-purifying respirator with dust and mist filters or a SAR operated in a continuous flow mode. Use a high efficiency particulate filter, powered air purifying respirator, full face-piece SCBA, or a full face-piece SAR.
-If concentrations are up to 500 mg/m3, use a full face-piece SAR in positive pressure.

PROTECTIVE CLOTHING: There are no specific guidelines available. Most materials used for protective clothing are probably sufficient under general work conditions. Full protective clothing is recommended for exposures that exceed permissible air concentrations. All contaminated clothing should be removed before leaving premises.

WORK HYGIENIC PRACTICES: Do not eat, drink, or smoke in work areas. Always wash hands after handling this material. Maintain good housekeeping.

OTHER USE PRECAUTIONS: An eyewash station and safety deluge shower should be located in the work area. Work clothing should be changed if clothing becomes wet or contaminated.

9. PHYSICAL AND CHEMICAL PROPERTIES

Chromium-

Physical State:	Solid
Color:	Steel gray, lustrous metal
Odor:	Odorless
Vapor Pressure:	Not listed
Boiling Point:	4840° F (2671° C)
Melting Point:	3465° F (1907° C)
Solubility in Water:	Insoluble
Evaporation Rate:	Not Applicable
Specific Gravity:	7.2 (water = 1)
Molecular Weight:	51.996

10. STABILITY AND REACTIVITY

STABLE: Yes

HAZARDOUS POLYMER: No

CONDITIONS TO AVOID

POLYMERIZATION: Does not occur.

NOTES:
Sputtering of material in high oxygen at low temperature may produce hexavalent Chromium species in deposits on shields and substrate. (See Comments Health in Section 3 in this MSDS for more information regarding the hazards associated with hexavalent Chromium.) If reactively sputtering in oxygen, the system must be heated to convert hexavalent species to a lower valence.

HAZARDOUS DECOMPOSITION: Thermal oxidative decomposition of Chromium can produce toxic Chromium oxide fumes.

INCOMPATIBLE MATERIALS: Chromium reacts quickly with dilute (not nitric) acids to form chromous salts. It is also soluble in acids (not nitric) and strong alkalis. Chromium powder is incompatible with strong oxidizing agents. Evaporation of mercury (Hg) from Chromium amalgam leaves pyrophoric Chromium. Finely divided Chromium attains incandescence with oxidizing agents. Molten lithium at 18° C severely attacks Chromium. Additional incompatible materials include, ammonium nitrate, hydrogen peroxide, nitric oxide, potassium chlorate, sulfur dioxide, hydrochloric acid and nitrogen oxide.

11. TOXICOLOGICAL INFORMATION

EYES: Animal studies showed Chromium imbedded in rabbit's eyes for one year was tolerated well. In tests conducted on laboratory animals, all chromium compounds were found to show irritating effects: some effects were corrosive, but not toxic.

TARGET ORGAN: Respiratory system.

CHRONIC / CARCINOGENICITY: Elemental Chromium is not listed as a carcinogen, but toxicity varies with the compound. One study conducted on rats indicated that Chromium administered intravenously caused gastrointestinal tumors, and lymphomas in blood, including Hodgkin's disease. In another series of studies, test rats that were injected with powdered Chromium did not significantly develop more tumors than that of the control animals. Mice studies indicated similar results. One in three rabbits involved in similar experiments developed a tumor.

GENERAL COMMENTS:

NOTE: Chromium compounds in the +3 state (trivalent) are of a low order of toxicity. In the +6 state (hexavalent), Chromium compounds are more toxic. In a rabbit, TDLo for Chromium +6 = 75 mg/kg. The route of administration was implant.

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION: The EPA has suggested the following criteria for permissible concentrations in water to protect freshwater aquatic life: trivalent Chromium, not to exceed e[1.08 ln (hardness) + 3.48] ug/l; hexavalent Chromium, 0.29 ug/l as a 24-hour average, never to exceed 21.0 ug/l. To protect saltwater aquatic life, trivalent Chromium is 10,300 ug/l as an acute toxicity basis. For hexvalent Chromium, 18 ug/l as a 24-hour average, not to exceed 1,260 ug/l.

GENERAL COMMENTS: Further information under this section is being developed.

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: Disposal must be in accordance with applicable federal, state and local governmental regulations.

PRODUCT DISPOSAL: This substance, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulation (40 CFR 261).

EMPTY CONTAINER: Empty containers may contain toxic, flammable, combustible or explosive residue or vapors. Use precaution when handling.

RCRA / USPA WASTE INFORMATION: If discarded in unaltered form, material should be tested to determine if it must be classified as a hazardous waste for disposal purposes. Under specific circumstances, application can be made to the EPA Administrator to have a particular waste designated non-hazardous.

GENERAL COMMENTS: Recovery and recycling of material is the preferred technique for both health and economic reasons.

14. TRANSPORT INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION):
NA / UN Number: 3089

AIR (I.C.A.O.)
Proper Shipping Name: Flammable Solid, N.O.S.

SPECIAL SHIPPING NOTES:
DOT Shipping Requirements are not applicable to this product when shipped as a solid.

15. REGULATORY INFORMATION

CERCLA (COMPREHENSIVE RESPONSE, COMPENSATION, AND LIABILITY ACT)
-CERCLA Regulatory: No reporting of releases of this substance required if diameter of solid is equal to or exceeds 0.004 inches.
-CERCLA RQ: Final RQ = 5,000 pounds (2,270 kg) (no reporting of releases of this hazardous substance is required if the diameter of the solid metal released is equal to or exceeds 0.004 inches).

TSCA (TOXIC SUBSTANCE CONTROL ACT)
-TSCA Regulatory: The ingredients of this product are listed on the EPA TSCA Chemical Inventory List.

RCRA STATUS
-D Series – Maximum Concentration of Contaminants = 5.0 mg/L (D007).
-Appendix VIII - Hazardous Wastes: no waste number.
-Appendix VII - Basis for Listing: Included in waste streams: F039, K090, and K091.
-Substance Banned From Land Disposal: present.
-TSD Facilities Ground Water Monitoring: TM 6010 = 70 ug/L PQL: TM 7190 = 500 ug/L PQL; TM 7190 = 10 ug/L PQL (all species in the ground water that contain this element are included).

CLEAN WATER ACT
-Present on list of Priority Pollutants as listed in Section 307.
-Present on list of Toxic Pollutants.

REGULATIONS:
International Regulations:
-This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and this MSDS contains all of the information required by the CPR.
-This product as shipped is excluded from WHMIS as it meets the definition of a manufactured article. However, possible resultant powders from the use of this product would be WHMIS classified as Class B, Division 6 and Class D, Division 2, Subdivision B {0.1% item 399 (561)].
-Present on the Canadian National Pollutant Release Inventory (NPRI).
-Canadian Maximum Acceptable Concentration (MAC) = 0.05 mg/L.

EUROPEAN INVENTORY OF EXISTING CHEMICALS (EINECS):
-Chromium is included on EINECS.

State Regulation:
-Florida Hazardous Substances List: Present.
-Massachusetts Right-to-Know List: Present, listed as carcinogen; extraordinarily hazardous.
-Minnesota Hazardous Substances List: Present.
-New Jersey Right-to-Know List: sn 0432.
-Pennsylvania Right-to-Know List: Present, listed as environmental hazard; special hazardous substance (any compound of this substance is also an environmental hazard).
-Pennsylvania Right-to-Know – Special Hazardous Substance: Present.
-California Director's List of Hazardous Substances: Present, California Permissible Exposure Limit (PEL): 0.5 mg/m3.

16. OTHER INFORMATION

REVISION INFORMATION:

R00 (09/12/1994) Original issue MSDS developed in accordance with standards developed by the American National Standards Institute (ANSI) Z400.1-1993.

R01 (12/20/1996) Section 15: WHMIS classification and clarification of toxicological information added.

R02 (02/07/1997) Section 3: Added HMIS / NFPA classification data; Section 8: Revised PPE information to reflect dust hazard; Section 14: Revised DOT shipping requirements; Section 15: Removed CERCLA Ratings and SARA Title III Information, Revised WHMIS classification; Section 16: Updated references.

R03 (03/31/1998) Section 1 and 16: Changed emergency contact and approval name; Section 10: Added information related to sputtering hazards.

R04 (05/29/2003) Section 2: Chemical Composition / Hazardous Ingredients / Occupational; Section 5: Fire Fighting Measures; Section 9: Physical Properties; Section 10 Stability and Reactivity; References: #3; Section 16: Other Information.

R05 (09/15/2006) Section 16: Other Information.

R06 (02/06/2009) Sections 2 and 3 updated to comply with GHS format; Section 15: EINECS information added; Section 16: Other Information.

Approved by: Vice President – Global Operations
Approval date: 02/06/2009

REFERENCES:

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2. National Institute of Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards.
3. 2001 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, ACGIH-2001.
4. Hawley's Condensed Chemical Dictionary
5. NFPA, Fire Protection Guide on Hazardous Materials.
6. Handbook of Toxic and Hazardous Chemicals and Carcinogens.
7. Toxline Database (CD-ROM) – 1996.
8. Registry of Toxic Effects Chemical Substances (RTECS) Database (CD-ROM) – 1996.
9. Toxic Substance Control Act Chemical Inventory List.

10. Code of Federal Regulations (CFR) 29, 40 and 49.
11. NIOSH Recommendations for Occupational Safety and Health.
12. EPA Title III List of Lists – 1996.
13. Sax's Dangerous Properties of Industrial Materials.
14. Agency for Toxic Substances and Disease Registry – 09/01/95.
15. Handbook of Chemistry and Physics, 68th ed. Boca Raton, FL.
16. Patty's Industrial Hygiene and Toxicology – 1981 – 1982.
17. Department of Transportation Emergency Response Guidebook – 2008.

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