

Safety Data Sheet

Material Name: All Steel Grades

SDS ID: CIL-001

*** Section 1 - Chemical Product and Company Identification ***

Chemical Name: Mixture

Product Use: High Speed Steel, Tool Steel, 300 Stainless Steel, 400 Stainless Steel, and Valve Steel

Manufacturer Information

Crucible Industries LLC

Phone: (315) 487-4111

575 State Fair Blvd

Solvay, NY 13209

Emergency # 1-800-365-1180

Mfg Contact: Quality Assurance Dept., (315) 487-4111 ext . 5310

General Comments

THIS SDS APPLIES TO ALL ESTABLISHED STEEL GRADES MANUFACTURED AT CRUCIBLE INDUSTRIES. SPECIFIC PERCENT COMPONENTS FOR EACH ELEMENT CAN BE OBTAINED FROM THE CERTIFICATE OF TEST.

*** Section 2 - Hazards Identification ***

Classification of Substance or Mixture



GHS03 Exclamation Mark

Signal Word: Warning

Hazard Statement

Product is a solid iron alloy. As supplied, this product does not present a physical or health hazard. Processing of the product for some final uses can include formation of dusts, particulates or fumes which may present certain health hazards. Dusts from this product may pose a dust explosion hazard. Contact of molten product with water can cause an explosion hazard. Firefighters should wear a positive pressure self-contained breathing apparatus with full face piece.

Precautionary Statements

Potential Health Effects: Eyes

Dust or powder may be irritating to the eyes. Rubbing may cause abrasion of the cornea.

Potential Health Effects: Skin

Dust or powder may irritate the skin. Rubbing may increase mechanical irritation to the skin. Product contains chromium and nickel, which may cause an allergic skin reaction. No components of this product are known to be absorbed through the skin.

Potential Health Effects: Ingestion

Dusts or powders may cause temporary irritation of the throat, stomach and gastrointestinal tract.

Potential Health Effects: Inhalation

Dusts and powders from this product may cause irritation to the nasal passages and respiratory tract. When inhaled in very large amounts, damage to the lung may occur. Dusts, particulates or fumes that may be produced may contain metals that cause metal fume fever, a transitory condition including fever, chills, aches, cough and general malaise. Repeated exposure may lead to respiratory sensitization reactions, producing an asthma-like condition.

HMIS Ratings: Health: 1* Fire: 0 Reactivity: 0 Personal Protection: B, safety glasses, gloves

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

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*** Section 3 - Composition / Information on Ingredients ***

CAS #	Component	Percent
7439-89-6	Iron	60-90
7440-02-0	Nickel*	1-37
7440-47-3	Chromium*	5-26
7440-33-7	Tungsten	0.5-19
7440-62-2	Vanadium*	0.2-18
7440-48-4	Cobalt*	0.5-15
7439-96-5	Manganese*	1-13
7439-98-7	Molybdenum	1-11
7440-21-3	Silicon	1-5
7440-50-8	Copper*	0.5-5
7440-44-0	Carbon	0.5-3.5
7440-32-6	Titanium	0.1-3.2
7440-03-1	Niobium	0.1-3
7429-90-5	Aluminum	0.1-2.2
7782-49-2	Selenium	0.1-0.5

Component Related Regulatory Information

This product may be regulated, have exposure limits or other information identified as the following: Iron compounds, Nickel compounds, Chromium compounds, Tungsten compounds, n.o.s., Vanadium compounds, Cobalt compounds, Manganese compounds, n.o.s., Molybdenum compounds, n.o.s., Copper compounds, n.o.s., Titanium compounds, Aluminum, welding fumes, Selenium compounds.

Component Information/Information on Non-Hazardous Components

This material is considered an "article" under 29 CFR 1910.1200 (Hazard Communication) and the Canadian Controlled Products Regulations. The information in this SDS is provided for situations where this article may be deformed creating dusts or fumes which may be potentially hazardous.

* This component is subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and of 40 CFR 372:

Please note that if you repackage or otherwise redistribute this product to industrial customers, a notice similar to this one must be sent to those customers.

*** Section 4 - First Aid Measures ***

First Aid: Eyes

For contact with dusts or particulates, flush eyes with water for 15 minutes. Eye injuries from solid particles should be treated by a physician immediately.

First Aid: Skin

For skin contact with dusts or powders, wash immediately with soap and water. Cuts or abrasions should be treated promptly with thorough cleansing of the affected area.

First Aid: Ingestion

No need for first aid is anticipated if material is swallowed, however if symptoms develop, seek medical attention.

First Aid: Inhalation

If large amounts of dusts, fumes or particulates are generated, move person to fresh air. If symptoms develop, seek medical attention.

First Aid: Notes to Physician

Respiratory disorders may be aggravated by exposure to metallic dusts or fumes.

*** Section 5 - Fire Fighting Measures ***

General Fire Hazards

See Section 9 for Flammability Properties.

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This material will not burn. Fine dusts of this material mixed with oxygen and a suitable source of ignition may pose an explosion hazard.

Hazardous Combustion Products

Material will begin softening at approximately 2600 °F (1425 °C), will proceed to a liquid and will form irritating and toxic gaseous metallic oxides at extremely high temperatures.

Extinguishing Media

Use methods for the surrounding fire. Use a Class D extinguisher for metal powder fires.

Unsuitable Extinguishing Media

Water may react with metal dust or powder and release flammable hydrogen gas.

Fire Fighting Equipment/Instructions

Firefighters should wear full-face, self contained breathing apparatus and impervious protective clothing.

NFPA Ratings: Health: 1 Fire: 0 Reactivity: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

*** Section 6 - Accidental Release Measures ***

Containment Procedures

Containment of this material should not be necessary. If dusts or particulates are generated, eliminate sources of ignition.

Clean-Up Procedures

Small pieces of this product may be collected with a broom and shovel. Dusts and particulates may be collected by using a vacuum with a HEPA filter. If sweeping of a contaminated area is necessary, use a dust suppressant agent. Place collected material in a closed container.

Evacuation Procedures

Isolate area. Keep unnecessary personnel away.

Special Procedures

None necessary.

*** Section 7 - Handling and Storage ***

Handling Procedures

Avoid generating dusts or particulates. Avoid inhalation of dusts, particulates or fumes. Avoid contact of dusts or particulates with eyes or skin. Wash thoroughly after handling.

Storage Procedures

Store in a dry area.

*** Section 8 - Exposure Controls / Personal Protection ***

Exposure Guidelines

A: General Product Information

Follow all applicable exposure limits.

B: Component Exposure Limits

Nickel (7440-02-0)

ACGIH: 1.5 mg/m³ TWA (inhalable fraction)
OSHA: 1 mg/m³ TWA
NIOSH: 0.015 mg/m³ TWA

Chromium (7440-47-3)

ACGIH: 0.5 mg/m³ TWA
OSHA: 1 mg/m³ TWA
NIOSH: 0.5 mg/m³ TWA

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Tungsten (7440-33-7)

ACGIH: 5 mg/m3 TWA
10 mg/m3 STEL
OSHA: 5 mg/m3 TWA
10 mg/m3 STEL
NIOSH: 5 mg/m3 TWA
10 mg/m3 STEL

Vanadium (7440-62-2)

OSHA: 0.05 mg/m3 TWA (respirable dust, as V₂O₅); 0.05 mg/m3 TWA (fume, as V₂O₅)
NIOSH: 1 mg/m3 TWA (dust, listed under Ferrovandium dust)
3 mg/m3 STEL (dust, listed under Ferrovandium dust)
0.05 mg/m3 Ceiling (15 min, dust and fume, as V, except Vanadium metal and Vanadium carbide (see Ferrovandium dust)) (related to Vanadium compounds)

Cobalt (7440-48-4)

ACGIH: 0.02 mg/m3 TWA
OSHA: 0.05 mg/m3 TWA (dust and fume)
NIOSH: 0.05 mg/m3 TWA (dust and fume)

Manganese (7439-96-5)

ACGIH: 0.2 mg/m3 TWA
OSHA: 1 mg/m3 TWA (fume)
3 mg/m3 STEL (fume)
5 mg/m3 Ceiling
NIOSH: 1 mg/m3 TWA (fume)
3 mg/m3 STEL

Molybdenum (7439-98-7)

ACGIH: 10 mg/m3 TWA (inhalable fraction); 3 mg/m3 TWA (respirable fraction)
OSHA: 10 mg/m3 TWA

Silicon (7440-21-3)

OSHA: 10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
NIOSH: 10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)

Copper (7440-50-8)

ACGIH: 0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist, as Cu)
OSHA: 0.1 mg/m3 TWA (dust, fume, mists, as Cu)
NIOSH: 1 mg/m3 TWA (dust and mist)

Aluminum (7429-90-5)

ACGIH: 1 mg/m3 TWA (respirable fraction)
OSHA: 15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
NIOSH: 10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)

Selenium (7782-49-2)

ACGIH: 0.2 mg/m3 TWA
OSHA: 0.2 mg/m3 TWA
NIOSH: 0.2 mg/m3 TWA

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C: Component Exposure Limits (Canada):

Nickel (7440-02-0)

Alberta:	1.5 mg/m3 TWA
British Columbia:	0.05 mg/m3 TWA
Manitoba:	1.5 mg/m3 TWA (inhalable fraction)
New Brunswick:	1 mg/m3 TWA
Newfoundland:	1.5 mg/m3 TWA (inhalable fraction)
Northwest Territories:	1.5 mg/m3 TWA (inhalable fraction)
Nova Scotia:	1.5 mg/m3 TWA (inhalable fraction)
Nunavut:	2 mg/m3 STEL 1 mg/m3 TWA
Ontario:	1 mg/m3 TWAEV (inhalable)
Prince Edward Island:	1.5 mg/m3 TWA (inhalable fraction)
Quebec:	1 mg/m3 TWAEV
Saskatchewan:	3 mg/m3 STEL (inhalable fraction) 1.5 mg/m3 TWA (inhalable fraction)
Yukon:	3 mg/m3 STEL 1 mg/m3 TWA

Chromium (7440-47-3)

Alberta:	0.5 mg/m3 TWA
British Columbia:	0.5 mg/m3 TWA
Manitoba:	0.5 mg/m3 TWA
New Brunswick:	0.5 mg/m3 TWA
Newfoundland:	0.5 mg/m3 TWA
Northwest Territories:	0.5 mg/m3 TWA
Nova Scotia:	0.5 mg/m3 TWA
Nunavut:	1.5 mg/m3 STEL 0.5 mg/m3 TWA
Ontario:	0.5 mg/m3 TWAEV
Prince Edward Island:	0.5 mg/m3 TWA
Quebec:	0.5 mg/m3 TWAEV
Saskatchewan:	1.5 mg/m3 STEL 0.5 mg/m3 TWA
Yukon:	3.0 mg/m3 STEL 0.1 mg/m3 TWA

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Tungsten (7440-33-7)

Alberta: 10 mg/m3 STEL
5 mg/m3 TWA
British Columbia: 10 mg/m3 STEL
5 mg/m3 TWA
Manitoba: 10 mg/m3 STEL
5 mg/m3 TWA
Newfoundland: 10 mg/m3 STEL
5 mg/m3 TWA
Northwest Territories: 10 mg/m3 STEL
5 mg/m3 TWA
Nova Scotia: 10 mg/m3 STEL
5 mg/m3 TWA
Nunavut: 10 mg/m3 STEL
5 mg/m3 TWA
Prince Edward Island: 10 mg/m3 STEL
5 mg/m3 TWA
Saskatchewan: 10 mg/m3 STEL
5 mg/m3 TWA
Yukon: 10 mg/m3 STEL
5 mg/m3 TWA

Cobalt (7440-48-4)

Alberta: 0.05 mg/m3 TWA
British Columbia: 0.02 mg/m3 TWA
Columbia: 0.02 mg/m3 TWA
Manitoba: 0.02 mg/m3 TWA
New Brunswick: 0.02 mg/m3 TWA
Newfoundland: 0.02 mg/m3 TWA
Northwest Territories: 0.02 mg/m3 TWA
Nova Scotia: 0.02 mg/m3 TWA
Nunavut: 0.3 mg/m3 STEL (dust and fume)
0.1 mg/m3 TWA (metal dust and fume)
Ontario: 0.02 mg/m3 TWAEV (dust and fume)
Prince Edward Island: 0.02 mg/m3 TWA
Quebec: 0.02 mg/m3 TWAEV (dust and fume)
Saskatchewan: 0.06 mg/m3 STEL
0.02 mg/m3 TWA
Yukon: 0.15 mg/m3 STEL (dust and fume)
0.05 mg/m3 TWA (dust and fume)

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Manganese (7439-96-5)

Alberta: 1.0 mg/m3 TWA; 1.0 mg/m3 TWA (fume)
British Columbia: 0.2 mg/m3 TWA
Columbia:
Manitoba: 0.2 mg/m3 TWA
New Brunswick: 0.2 mg/m3 TWA
Brunswick:
Newfoundland: 0.2 mg/m3 TWA
Northwest Territories: 0.2 mg/m3 TWA
Territories:
Nova Scotia: 0.2 mg/m3 TWA
Nunavut: 3 mg/m3 STEL (fume)
1 mg/m3 TWA (fume)
5 mg/m3 Ceiling
Ontario: 0.2 mg/m3 TWAEV
Prince Edward Island: 0.2 mg/m3 TWA
Quebec: 3 mg/m3 STEV (fume)
5 mg/m3 TWAEV (dust); 1 mg/m3 TWAEV (fume)
Saskatchewan: 0.6 mg/m3 STEL
0.2 mg/m3 TWA
Yukon: 5 mg/m3 Ceiling

Molybdenum (7439-98-7)

Alberta: 10 mg/m3 TWA
British Columbia: 3 mg/m3 TWA (respirable); 10 mg/m3 TWA (inhalable)
Columbia:
Manitoba: 10 mg/m3 TWA (inhalable fraction); 3 mg/m3 TWA (respirable fraction)
Newfoundland: 10 mg/m3 TWA (inhalable fraction); 3 mg/m3 TWA (respirable fraction)
Northwest Territories: 10 mg/m3 TWA (inhalable fraction); 3 mg/m3 TWA (respirable fraction)
Territories:
Nova Scotia: 10 mg/m3 TWA (inhalable fraction); 3 mg/m3 TWA (respirable fraction)
Ontario: 10 mg/m3 TWAEV (metal, inhalable); 3 mg/m3 TWAEV (metal, respirable)
Prince Edward Island: 10 mg/m3 TWA (inhalable fraction); 3 mg/m3 TWA (respirable fraction)
Saskatchewan: 20 mg/m3 STEL (inhalable fraction); 6 mg/m3 STEL (respirable fraction)
10 mg/m3 TWA (inhalable fraction); 3 mg/m3 TWA (respirable fraction)

Silicon (7440-21-3)

Alberta: 10 mg/m3 TWA
British Columbia: 10 mg/m3 TWA (total dust); 3 mg/m3 TWA (respirable fraction)
Columbia:
New Brunswick: 10 mg/m3 TWA
Brunswick:
Nunavut: 5 mg/m3 TWA (respirable mass); 10 mg/m3 TWA (total mass)
Ontario: 10 mg/m3 TWAEV (total dust)
Quebec: 10 mg/m3 TWAEV (total dust, containing no asbestos and less than 1% crystalline silica)
Saskatchewan: 20 mg/m3 STEL
10 mg/m3 TWA
Yukon: 20 mg/m3 STEL
30 mppcf TWA; 10 mg/m3 TWA

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Copper (7440-50-8)

Alberta: 0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist)
British Columbia: 1 mg/m3 TWA (dust and mist); 0.2 mg/m3 TWA (fume)
Manitoba: 0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist, as Cu)
New Brunswick: 0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist)
Nova Scotia: 0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist, as Cu)
Newfoundland: 0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist, as Cu)
Northwest Territories: 0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist, as Cu)
Ontario: 0.2 mg/m3 TWAEV (fume); 1 mg/m3 TWAEV (dust and mist)
Prince Edward Island: 0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist, as Cu)
Quebec: 0.2 mg/m3 TWAEV (fume); 1 mg/m3 TWAEV (dust and mist)
Saskatchewan: 0.6 mg/m3 STEL (fume); 3 mg/m3 STEL (dust and mist)
Yukon: 0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist)
0.2 mg/m3 STEL (fume); 2 mg/m3 STEL (dust and mist)
0.2 mg/m3 TWA (fume); 1 mg/m3 TWA (dust and mist)

Aluminum (7429-90-5)

Alberta: 10 mg/m3 TWA (dust)
British Columbia: 10 mg/m3 TWA (total dust); 3 mg/m3 TWA (respirable fraction)
Manitoba: 1 mg/m3 TWA (respirable fraction)
New Brunswick: 10 mg/m3 TWA (metal dust)
Nova Scotia: 1 mg/m3 TWA (respirable fraction)
Newfoundland: 1 mg/m3 TWA (respirable fraction)
Northwest Territories: 1 mg/m3 TWA (respirable fraction)
Ontario: 5 mg/m3 TWAEV (powder); 10 mg/m3 TWAEV (metal and oxide dust)
Prince Edward Island: 1 mg/m3 TWA (respirable fraction)
Quebec: 10 mg/m3 TWAEV
Saskatchewan: 20 mg/m3 STEL
10 mg/m3 TWA
10 mg/m3 TWAEV (dust)
10 mg/m3 TWA (dust)

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Selenium (7782-49-2)

Alberta:	0.2 mg/m3 TWA
British Columbia:	0.1 mg/m3 TWA
Manitoba:	0.2 mg/m3 TWA
New Brunswick:	0.2 mg/m3 TWA
Newfoundland:	0.2 mg/m3 TWA
Northwest Territories:	0.2 mg/m3 TWA
Nova Scotia:	0.2 mg/m3 TWA
Nunavut:	0.6 mg/m3 STEL (as Se) (related to Selenium compounds) 0.2 mg/m3 TWA (as Se) (related to Selenium compounds)
Ontario:	0.2 mg/m3 TWAEV
Prince Edward Island:	0.2 mg/m3 TWA
Quebec:	0.2 mg/m3 TWAEV
Saskatchewan:	0.6 mg/m3 STEL 0.2 mg/m3 TWA
Yukon:	0.2 mg/m3 STEL (as Se) (related to Selenium compounds) 0.2 mg/m3 TWA (as Se) (related to Selenium compounds)

Engineering Controls

Whenever dusts, particulates or fumes are generated, use appropriate local exhaust ventilation to keep exposures below the regulated limits.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Wear safety glasses with side shields.

Personal Protective Equipment: Skin

Wear leather or other appropriate gloves, if necessary for the type of operation.

Personal Protective Equipment: Respiratory

When dusts or thermal processing fumes are generated and ventilation is not sufficient to effectively remove them, appropriate NIOSH approved respiratory protection must be provided.

Personal Protective Equipment: General

Use good industrial hygiene practices in handling this material.

*** Section 9 - Physical & Chemical Properties ***

Appearance:	Metallic color	Odor:	None
Physical State:	Solid	pH:	Not applicable
Vapor Pressure:	Not applicable	Vapor Density:	Not applicable
Boiling Point:	Not available	Melting Point:	2600 - 2800 °F (1425 - 1540 °C)
Solubility (H2O):	Insoluble	Specific Gravity:	7.4 - 8.7 (water=1)
Softening Point:	2600 °F (1425 °C)	Flash Point	Not applicable
Flash Point Method	Not applicable	LFL	Not applicable
UFL	Not applicable		

*** Section 10 - Chemical Stability & Reactivity Information ***

Chemical Stability

Product is stable.

Chemical Stability: Conditions to Avoid

Avoid exposure to generated dust and/or fume.

Incompatibility

Product reacts with strong acids to generate hydrogen gas.

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Hazardous Decomposition

Material will begin softening at approximately 2600 °F (1425 °C), will proceed to a liquid and will form irritating and toxic gaseous metallic oxides at extremely high temperatures.

Possibility of Hazardous Reactions

Will not occur.

* * * Section 11 - Toxicological Information * * *

Acute Dose Effects

A: General Product Information

The product as shipped, does not present a health hazard. Operations which supply sufficient energy to the product (i.e. welding, high speed grinding or melting) can release dust or fumes which may make components of the product biologically available.

Exposure to dusts or fumes from some metals including iron, manganese, chromium, and copper can produce a condition known as metal fume fever, a flu-like illness with nausea, vomiting, chest tightness, muscle aches and weakness. The symptoms come on a few hours after excessive exposures and usually last from 12 to 48 hours. Long-term effects from metal fume fever have not been noted.

ALUMINUM: Excessive exposures to aluminum metal fumes and dust have been associated with scarring of the lung tissue and respiratory irritation, but this effect may be due to simultaneous silica exposure.

CARBON: Elemental carbon, as it exists in this product, is of very low toxicity. Health hazard data presented here is based on exposures to carbon black, not carbon as it is found in this product. Chronic inhalation exposure to carbon black may result in temporary or permanent damage to lungs and heart. Pneumoconiosis has been found in workers engaged in the production of carbon black. Skin conditions such as inflammation of the hair follicles, and oral mucosal lesions have also been reported from skin exposure.

CHROMIUM: The health hazards associated with exposure to chromium are dependent on its oxidation state. The metal form (chromium as it exists in this product) is of very low toxicity. Welding fumes, generated from high chromium stainless steel, may contain hexavalent chromium. This water-soluble hexavalent form is considerably more toxic. Adverse effects of the hexavalent form on the skin may include ulcerations, dermatitis, and allergic skin reactions. Inhalation of hexavalent chromium compounds can result in ulceration and perforation of the mucous membranes of the nasal septum, irritation of the pharynx and larynx, asthmatic bronchitis, bronchospasm and edema. Respiratory symptoms may include coughing and wheezing, shortness of breath, and nasal itch. Eye irritation or inflammation may also result. The NTP lists hexavalent chromium as a known human carcinogen. Chromium metal is listed as not classifiable as to carcinogenic to humans.

COBALT: Inhalation of cobalt metal fumes and dust causes irritation of the nose and throat. Cobalt dust may cause an asthma-like disease with symptoms ranging from cough, chronic bronchitis, shortness of breath and labored breathing, to decreased pulmonary function, nodular scarring of the lung tissue, permanent disability, and death. Exposure to cobalt may cause weight loss, dermatitis (inflammation of the skin) and respiratory hypersensitivity. Although cobalt is not listed by NTP or OSHA as a carcinogen, some data suggests that cobalt is an experimental carcinogen in laboratory animals. The author finds that the current OSHA limit of 0.1 mg/m³ is not protective of worker health.

COLUMBIUM (NIOBIUM): Columbium, when inhaled, is retained mainly in the lungs, and secondarily in bones. It interferes with calcium as an activator of enzyme systems. In laboratory animals, inhalation of niobium nitride and/or pentoxide leads to scarring of the lungs at exposure levels of 40 mg/m³. Columbium is a moderate eye irritant and a powerful skin irritant in laboratory animals.

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COPPER: Industrial exposure to copper fumes, dusts and/or mists results in metal fume fever, nausea, irritation of upper respiratory tract, and irritation of nasal mucous membranes. Chronic poisoning could aggravate individuals who suffer from Wilson's disease, a genetic condition characterized by liver cirrhosis, brain damage, nerve damage, kidney disease, and copper deposition in the cornea (eye).

IRON: Iron oxide can be generated during arc welding of this product. Chronic inhalation of excessive concentrations of iron oxide fumes and dusts may result in development of a benign pneumoconiosis called siderosis, which is observable as an X-ray change. No physical impairment of lung function has been associated with siderosis. Inhalation of excessive concentrations of iron oxide may enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens. Acute exposure to the eyes may result in mild conjunctivitis.

MANGANESE: Chronic exposure to high concentrations of manganese fumes and dusts may increase the incidence of pneumonia and lung damage and may adversely affect the central nervous system with symptoms including sleepiness, weakness, emotional disturbances, spastic walk, mask-like facial expression, and paralysis.

MOLYBDENUM: Dust of metallic molybdenum has caused difficulty breathing, general weakness, dizziness, chest pain, expectoration, fatigue, headache, anorexia, and joint and muscle pain. Molybdenum has caused anemia and poor growth in experimental animals. Molybdenum may also cause pneumoconiosis and irritation to the lungs and eyes. In rats, dusts of metallic molybdenum have caused growth, depression and thickening of intra-alveolar septa, which contained connective tissue fibers.

NICKEL: Nickel fumes are respiratory irritants and have been a known cause of asthma, pneumonia, pulmonary edema and pulmonary fibrosis in welders using nickel alloys. Airborne nickel-contaminated dusts are regarded as capable of producing lung cancer. The risk is higher for workers at primary nickel smelters and refineries than for workers exposed to nickel alloys. Skin contact may cause an allergic rash. Nickel itch is the dermatitis resulting from sensitization to nickel. Itching can occur up to seven days before skin eruption occurs. The primary skin eruption is reddening or infection of the hair follicles, which may be followed by skin ulceration. Nickel sensitivity, once acquired, is apparently not lost.

SELENIUM: Overexposure of selenium fumes may produce accumulation of fluid in the lungs, garlic breath, bronchitis, pneumonitis, bronchial asthma, nausea, chills, fever, headache, sore throat, shortness of breath, conjunctivitis, vomiting, abdominal pain, diarrhea, and enlarged liver. Selenium is an eye and upper respiratory irritant and a sensitizer. Overexposure may result in red staining of the nails, teeth, and hair. Selenium dioxide reacts with moisture to form selenious acid, which is corrosive to the skin and eyes.

SILICON: Elementary silicon is an inert material. Slight pulmonary lesions have been reported in laboratory animals from injections of silicon dust within the trachea. Silicon dust has little adverse effect on lungs and does not appear to produce significant organic disease or toxic effects when exposures are kept under the TLV. Silicon may cause chronic respiratory effects if repeated overexposure occurs.

TITANIUM: Elemental titanium is an inert material. Titanium dioxide may be generated in welding fumes from this product. At extremely high concentrations, titanium dioxide has induced lung cancer in rats. Titanium dioxide dust is a mild pulmonary, eye and skin irritant: Rats exposed to titanium dioxide developed small focal areas of emphysema which were attributable to large deposits of dust. Excessive exposure in humans may result in slight changes in the lungs. The dusts of titanium dioxide can be placed in the nuisance category.

TUNGSTEN: Chronic exposure to tungsten dust has been reported to cause pulmonary fibrosis characterized by cough, labored breathing and wheezing. Dermatitis (inflammation of the skin), primarily on the sides of the neck, inner forearm, and the backs of the hands, was also reported. Dusts of tungsten pose a hazard considered to be somewhat greater than that of nuisance dust.

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VANADIUM: The health hazards associated with exposure to vanadium are dependent on its oxidation state. This product contains elemental vanadium. Elemental vanadium could be oxidized to vanadium pentoxide during welding. The pentoxide form is more toxic than the elemental form. Chronic exposure to vanadium pentoxide dust and fumes may cause severe irritation of the eyes, skin, upper respiratory tract, persistent inflammation of the trachea and bronchi, pulmonary edema, and systemic poisoning. Signs and symptoms of overexposure include: conjunctivitis, nasopharyngitis, cough, labored breathing, rapid heartbeat, lung changes, chronic bronchitis, skin pal, greenish-black tongue, and an allergic skin rash.

B: Component Analysis - LD50/LC50

Iron (7439-89-6)

Oral LD50 Rat: 984 mg/kg

Nickel (7440-02-0)

Oral LD50 Rat: >9000 mg/kg

Cobalt (7440-48-4)

Inhalation LC50 Rat: >10 mg/L/1H; Oral LD50 Rat:6170 mg/kg

Manganese (7439-96-5)

Oral LD50 Rat: 9 g/kg

Silicon (7440-21-3)

Oral LD50 Rat: 3160 mg/kg

Carbon (7440-44-0)

Oral LD50 Rat: >10000 mg/kg

Selenium (7782-49-2)

Oral LD50 Rat: 6700 mg/kg

Epidemiology

No information available for the product.

Carcinogenicity

A: General Product Information

No information available for the product.

Occupational exposure to nickel dusts or fumes increases the risk of respiratory cancers.

Chronic exposure to chromium (VI) has been associated with an increased risk of cancer.

Copper has caused cancer when implanted in experimental animals.

B: Component Carcinogenicity

Nickel (7440-02-0)

ACGIH: A5 - Not Suspected as a Human Carcinogen

NIOSH: potential occupational carcinogen

NTP: Known Human Carcinogen (related to Nickel compounds) (Select Carcinogen)

Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)

IARC: Monograph 49 [1990] (evaluated as a group) (related to Nickel compounds) (Group 1 (carcinogenic to humans))

Chromium (7440-47-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

IARC: Monograph 49 [1990] (listed under Chromium and Chromium compounds), Supplement 7 [1987] (Group 3 (not classifiable))

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Cobalt (7440-48-4)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
IARC: Monograph 86 [2006] (without tungsten carbide), Monograph 52 [1991] (Group 2B (possibly carcinogenic to humans))

Aluminum (7429-90-5)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

Selenium (7782-49-2)

IARC: Supplement 7 [1987], Monograph 9 [1975] (Group 3 (not classifiable))

Mutagenicity

No information available for the product.
Manganese and chromium (VI) have been shown to cause mutations in experimental systems.
Aluminum has been shown to increase the number of sister chromatid exchanges.
Copper can induce DNA structural transformations and chromosomal aberrations.
Nickel inhibited DNA repair and induced transformation in experimental assays.

Teratogenicity

No information available for the product.
Manganese, chromium and aluminum have been shown to have teratogenic effects.
Manganese, chromium, copper and nickel have been reported to have adverse reproductive effects in experimental animals.
Chromium, copper and nickel have been shown to be fetotoxic in experimental animals.

Neurological Effects

No information available for the product.
Chronic exposure to manganese can lead to the neurological condition of parkinsonism and to diminished fine motor coordination.
Occupational exposure to aluminum has been associated with increased adverse effects on the central nervous system.

Other Toxicological Information

None identified.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

No information available for the product.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Iron (7439-89-6)

Test & Species	Conditions
96 Hr LC50 Morone saxatilis	13.6 mg/L [static]

Nickel (7440-02-0)

Test & Species	Conditions
96 Hr LC50 Brachydanio rerio	>100 mg/L
72 Hr EC50 freshwater algae (4 species)	0.1 mg/L
72 Hr EC50 Selenastrum capricornutum	0.18 mg/L
96 Hr EC50 water flea	510 µg/L

Cobalt (7440-48-4)

Test & Species	Conditions
96 Hr LC50 Brachydanio rerio	>100 mg/L [static]

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Copper (7440-50-8)

Test & Species

	Conditions
96 Hr LC50 Pimephales promelas	23 µg/L
96 Hr LC50 Oncorhynchus mykiss	13.8 µg/L
96 Hr LC50 Lepomis macrochirus	236 µg/L
72 Hr EC50 Scenedesmus subspicatus	120 µg/L
96 Hr EC50 water flea	10 µg/L
96 Hr EC50 water flea	200 µg/L

Conditions

Environmental Fate

No information available for the product.

*** Section 13 - Disposal Considerations ***

US EPA Waste Number & Descriptions

A: General Product Information

This product contains a component or components identified as hazardous under 40 CFR 261.24.

B: Component Waste Numbers

Chromium (7440-47-3)

RCRA: 5.0 mg/L regulatory level

Selenium (7782-49-2)

RCRA: 1.0 mg/L regulatory level

Disposal Instructions

This product is not regulated as a hazardous waste by the federal EPA. Collected dusts and other similar wastes generated during processing of the product could contain a constituent identified as hazardous under 40 CFR § 261.24.

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

*** Section 14 - Transportation Information ***

International Transportation Regulations

Not regulated as dangerous goods.

US DOT Information

Shipping Name: Not regulated as dangerous goods.

UN/NA #: None **Hazard Class:** None **Packing Group:** None

Required Label(s): None

Additional Info.: None

TDG Information

Shipping Name: Not regulated as dangerous goods.

UN/NA #: None **Hazard Class:** None **Packing Group:** None

Required Label(s): None

Additional Info.: None

*** Section 15 - Regulatory Information ***

US Federal Regulations

A: General Product Information

No information available for the product.

B: Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A) and/or CERCLA (40 CFR 302.4).

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Nickel (7440-02-0)

SARA 313: 0.1 % de minimis concentration

CERCLA: 100 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers); 45.4 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers)

Chromium (7440-47-3)

SARA 313: 1.0 % de minimis concentration

CERCLA: 5000 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers); 2270 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers)

Vanadium (7440-62-2)

SARA 313: 1.0 % de minimis concentration (except when contained in an alloy)

Cobalt (7440-48-4)

SARA 313: 0.1 % de minimis concentration

Manganese (7439-96-5)

SARA 313: 1.0 % de minimis concentration

Copper (7440-50-8)

SARA 313: 1.0 % de minimis concentration (does not include copper phthalocyanine compounds substituted only with hydrogen and/or bromine and/or chlorine, Chemical Category N100) (related to Copper compounds)

Selenium (7782-49-2)

CERCLA: 100 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers); 45.4 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers)

C: Component Marine Pollutants

This material contains one or more of the following chemicals required by US DOT to be identified as marine pollutants.

Component	CAS #	
Copper	7440-50-8	DOT regulated severe marine pollutant

State Regulations

A: General Product Information

Other state regulations may apply. Check individual state requirements.

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B: Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS #	CA	FL	MA	MN	NJ	PA
Iron	7439-89-6	Yes	No	No	No	No	No
Nickel	7440-02-0	Yes	No	Yes	Yes	Yes	Yes
Chromium	7440-47-3	Yes	No	Yes	Yes	Yes	Yes
Tungsten	7440-33-7	Yes	No	Yes	Yes	Yes	Yes
Vanadium	7440-62-2	Yes	No	Yes	No	Yes	Yes
Cobalt	7440-48-4	Yes	No	Yes	Yes	Yes	Yes
Manganese	7439-96-5	Yes	No	Yes	Yes	Yes	Yes
Molybdenum	7439-98-7	Yes	No	Yes	Yes	Yes	Yes
Silicon	7440-21-3	No	No	Yes	Yes	Yes	Yes
Copper	7440-50-8	Yes	No	Yes	Yes	Yes	Yes
Titanium	7440-32-6	Yes	No	No	No	Yes	No
Aluminum	7429-90-5	Yes	No	Yes	Yes	Yes	Yes
Selenium (¹ related to Selenium compounds)	7782-49-2	Yes	No	Yes	Yes ¹	Yes	Yes

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (as amended August 2016) (Proposition 65):



WARNING! This product can expose you to a chemical known to the state of California to cause cancer.

Canadian WHMIS Information

A: General Product Information

Product as supplied is not a controlled product.

However, if dust or fumes are generated during processing, the following classification applies:

D2A, D2B Materials Causing Other Toxic Effects

B: Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Nickel	7440-02-0	0.1 %
Chromium	7440-47-3	0.1 %
Tungsten	7440-33-7	1 %
Vanadium	7440-62-2	1 %
Cobalt	7440-48-4	0.1 %
Manganese	7439-96-5	1 %
Molybdenum	7439-98-7	1 %
Copper	7440-50-8	1 %
Aluminum	7429-90-5	1 %
Selenium	7782-49-2	0.1 %

Additional Regulatory Information

A: General Product Information

No information available for the product.

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B: Component Analysis - Inventory

Component	CAS #	TSCA	DSL	EINECS
Iron	7439-89-6	Yes	Yes	Yes
Nickel	7440-02-0	Yes	Yes	Yes
Chromium	7440-47-3	Yes	Yes	Yes
Tungsten	7440-33-7	Yes	Yes	Yes
Vanadium	7440-62-2	Yes	Yes	Yes
Cobalt	7440-48-4	Yes	Yes	Yes
Manganese	7439-96-5	Yes	Yes	Yes
Molybdenum	7439-98-7	Yes	Yes	Yes
Silicon	7440-21-3	Yes	Yes	Yes
Copper	7440-50-8	Yes	Yes	Yes
Carbon	7440-44-0	Yes	Yes	Yes
Titanium	7440-32-6	Yes	Yes	Yes
Niobium	7440-03-1	Yes	Yes	Yes
Aluminum	7429-90-5	Yes	Yes	Yes
Selenium	7782-49-2	Yes	Yes	Yes

*** Section 16 - Other Information ***

Other Information

Reasonable care has been taken in the preparation of this information, but the manufacturer makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The manufacturer makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use.

Coatings may be applied to the product for protective purposes. The possible presence of coatings should be recognized and considered when evaluating potential employee hazards and exposures during dust- and fume-generating activities. Applicable coating SDSs are available upon request.

SDS History

Supersedes SDS for this product from February 10, 2016.

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists. CERCLA = Comprehensive Environmental Response, Compensation and Liability Act. CFR = Code of Federal Regulations. DSL = Canadian Domestic Substance List. EINECS = European Inventory of New and Existing Chemical Substances. EPA = Environmental Protection Agency. HEPA = High Efficiency Particulate Air. HMIS = Hazardous Material Information System. IARC = International Agency for Research on Cancer. NFPA = National Fire Protection Association. NIOSH = National Institute of Occupational Safety and Health. NJTSR = New Jersey Trade Secret Registry. NTP = National Toxicology Program. OSHA = Occupational Safety and Health Administration. NA = Not available or Not Applicable. SARA = Superfund Amendments and Reauthorization Act. TLV = Threshold Limit Value. TSCA = Toxic Substance Control Act. WHMIS = Workplace Hazardous Materials Information System.

This is the end of SDS # CIL-001