# Nickel-Chromium Alloys

# Safety Data Sheet



# **Section 1: Identification**

# 1.1 Product Identifier

Product Name:
Product Form:
Chemical Family:
CAS Number:
Molecular Formula:
Molecular Weight:

# **1.2 Other Means of Identification** Synonyms:

Nickel-Chromium Alloys Solid Metal Alloy No CAS number assigned. See **Section 3.1** for component CAS numbers. See **Section 3.1**. Varies, See **Section 3.1**.

226V, Alloy Y, AlResis 319, AM1, AM3, B1900, B1900 + Hf, B1910, B1914, C101, C103, C103SC, C130, C242, C262, C263, C1023, CH22 LZR, DS 1000, G39, GTD111,GTD222, GTD241, GTD444, GTD741, HA 236, Hastelloy C, Hastelloy X, How C, How W, How X, IN™ 100, IN™ 600, IN™ 625, IN<sup>™</sup> 706, IN<sup>™</sup> 713, IN<sup>™</sup> 713C, IN<sup>™</sup> 713LC, IN<sup>™</sup> 718, IN<sup>™</sup> 718 VPSD, IN<sup>™</sup> 722, IN<sup>™</sup> 738, IN<sup>™</sup> 750X, IN<sup>™</sup> 792, IN<sup>™</sup> 792 Hf 0.5, IN<sup>™</sup> 792 Hf 1, IN™ 792 Mod 5A, IN™ 901, IN™ 939, IN™ 939HAL, IN™ 6203, IN™ W, IN™ X, Inconel™ 706, Inconel™ 718, KH85, MA 6000E, MA 754, Mar-M™ 002. Mar-M<sup>™</sup> 004. Mar-M<sup>™</sup> 200. Mar-M<sup>™</sup> 200 + 2% Hf. Mar-M<sup>™</sup> 246. Mar-M<sup>™</sup> 247, Mar-M<sup>™</sup>247LC, Mar-M<sup>™</sup> 421, Merl 76, MGA1400, MGA2400, MK4®, MK4HC®, Monoloy 454, NiCr, Nim90, Nimonic<sup>™</sup> 75, Nimonic<sup>™</sup> 80, Nimonic<sup>™</sup> 90, NX 188, PD21, PE10, PT999, PWA 1475, Rene<sup>™</sup> 41, Rene<sup>™</sup> 77, Rene<sup>™</sup> 80, Rene<sup>™</sup> 80H, Rene<sup>™</sup> 88, Rene<sup>™</sup> 120, Rene<sup>™</sup> 125, Rene<sup>™</sup> 142, Rene<sup>™</sup> 150, Rene<sup>™</sup> 220, Rene<sup>™</sup> N-4, Rene<sup>™</sup> N-4+, Rene<sup>™</sup> N-5, Rene<sup>™</sup> N-6, Rinsealoy, SC180, SC 1000, SC 2000, SCRY3, SCRY4, Sel 1, Sel 15, Siemet®, Turbo 25, U-500, U-700, Waspaloy and other nickelchromium alloys.

IN<sup>™</sup>, Inconel<sup>™</sup> and Nimonic<sup>™</sup> are registered trademarks of Inco. Mar-M<sup>™</sup> is a registered trademark of Martin Marietta. Rene<sup>™</sup> is a registered trademark of GE Corporation.

#### 1.3 Recommended Uses Recommended Use:

Cast aerospace parts and forgings.

#### 1.4 Manufacturer, Importer, or Responsible Party Responsible Party: Defense

Defense Logistics Agency Strategic Materials 8725 John J. Kingman Road Fort Belvoir, Virginia 22060-6223 (703) 767-5525

# 1.5 Emergency Phone Number

Emergency Phone Number:

(800) 424-9300 (CHEMTREC) (703) 527-3887 (CHEMTREC INTERNATIONAL)

# Section 2: Hazard(s) Identification

# 2.1 Classification of Chemical per OSHA CFR 1910.1200

Skin Irritation:	Category 2
Eye Irritation:	Category 2A
Respiratory Sensitization:	Category 1A
Skin Sensitization:	Category 1A
Carcinogen (from Processing):	Category 1A

# 2.2 Label Elements

Signal Word:

DANGER



Symbol(s):

Hazard Statements:

**Precautionary Statements:** 

Causes skin irritation and serious eye irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction. May cause lung cancer. May damage fertility or the unborn child. <u>Prevention:</u> Obtain special instructions before use. Do not handle until all

safety precautions have been read and understood. Wear protective gloves, protective clothing, eye protection, and face protection. Wash hands and exposed skin thoroughly after handling. Avoid breathing dust or fumes. In case of inadequate ventilation, wear respiratory protection. Contaminated clothing must not be allowed out of the workplace.

<u>Response:</u> If on skin, wash with plenty of water. If skin irritation or rash occurs, get medical advice and/or attention. Take off contaminated clothing and wash before reuse. If in eyes, rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, get medical advice/attention. If inhaled and breathing is difficult, remove person to fresh air and keep comfortable for breathing. If experiencing respiratory symptoms: Call a poison center and/or doctor. Storage: Store locked up.

<u>Disposal</u>: Dispose of contents/container in accordance with federal, state, and local regulations.

# 2.3 Other Hazards

Product as shipped does not present any cancer, reproductive hazard, fire or explosion hazard. Dust and fines may be ignitable. Dust or fume from processing can aggravate asthma, chronic lung disease, skin rashes, and secondary Parkinson's disease. Explosion/fire hazards may be present when molten metal is in contact with water, moisture, or when heavily concentrated dust clouds are dispersed in the air.

# 2.4 Unknown Acute Toxicity

Does not apply to this product.

# Section 3: Composition / Information on Ingredients

# 3.1 Chemical Name

Chemical Name:

Nickel-Chromium Alloys

Ingredients	CAS No.	% Weight
Nickel	7440-02-0	40-82
Iron	7439-89-6	0-37
Chromium	7440-47-3	4-25
Cobalt	7440-48-4	0-24
Molybdenum	7439-98-7	0-24

Ingredients	CAS No.	% Weight
Tungsten	7440-33-7	0-15
Tantalum	7440-25-7	0-12
Aluminum	7429-90-5	0-11
Niobium	7440-03-1	0-7
Rhenium	7440-15-5	0-6
Titanium	7440-32-6	0-6
Hafnium	7440-58-6	0-2
Vanadium	7440-62-2	0-2
Manganese	7439-96-5	0-1

#### 3.2 Common Names/Synonyms Synonyms:

See Section 1.2 for common names and synonyms.

#### 3.3 CAS Number/Unique Identifiers Nickel: Chromium:

# **3.4 Impurities/Stabilizing Additives** No data available.

# **Section 4: First-Aid Measures**

7440-02-0

7440-47-3

# 4.1 Description of First-Aid Measures

Inhalation:	Breathing difficulty, caused by inhalation of dust or fume requires removal to
	fresh air. If unconscious or severely injured, check for clear airway, breathing
	and presence of pulse. Perform CPR if there is no pulse or respiration. Get
	medical assistance at once.
Skin Contact:	Wash skin with soap and water for at least 15 minutes. Get medical attention
	if irritation persists.
Eye Contact:	Flush eyes with plenty of water or saline for at least 15 minutes. Get medical attention.

# 4.2 Most Important Symptoms/Effects, Acute and Delayed

The following statements summarize the health effects generally expected in cases of overexposures. User specific situations should be assessed by a qualified individual. Additional health information can be found in **Section 11.3**.

The health effects listed below are not likely to occur unless mechanical processing (e.g., cutting, grinding) or recycling/combustion generate dusts or fumes:

Eyes:	Can cause irritation.	
Skin:	Can cause irritation, sensitization and allergic contact dermatitis.	
Inhalation:	Can cause irritation of upper respiratory tract.	
Chronic overexposures:	Can cause respiratory sensitization, asthma, scarring of the lungs (pulmonary fibrosis) and deformities of the joints.	
Additional health effects from elevated	temperature processing (e.g., welding, melting):	

Acute overexposures: Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever).

Chronic overexposures: Can cause the accumulation of fluid in the lungs (pulmonary edema) and lung cancer.

# **4.3 Indication of Immediate Medical Attention/Special Treatment** No data available.

# Section 5: Fire Fighting Measures

# 5.1 Suitable Extinguishing Media

Use a Class D agent, fluxing salts, graphite or dry sand on dust or fine fires. Otherwise, use firefighting methods and materials that are appropriate for surrounding fire.

#### 5.2 Specific Hazards

This product does not present fire or explosion hazards as shipped. Dust and fines may be ignitable. Product may be a potential hazard if molten metal comes in contact with water or moisture. Moisture entrapped by molten metal can be explosive. Dust or fines dispersed in the air can be explosive. Heavily concentrated dusts in air can be explosive if subjected to a strong ignition source.

# 5.3 Special Protective Equipment and Precautions

Fire fighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate. Do not use water around molten metal. These agents will react with the burning metal.

# Section 6: Accidental Release Measures

# 6.1 Personal Precautions, Protective Equipment, and Emergency Procedures

Avoid generating dust. Recover using mechanical means. Collect scrap for recycling. Personal protective equipment is discussed in **Section 8.3**.

#### 6.2 Methods and Materials for Containment and Cleaning Up

Remove all ignition sources, and ventilate the area of spill. Collect spilled material in the most convenient and safe manner, and deposit in sealed containers for reclamation or for disposal in a secured sanitary landfill. Where possible, wet methods of cleaning should be used (see exception for molten metal in **Section 5.2**). Liquid containing nickel should be absorbed in vermiculite, dry sand, earth, or a similar material.

# Section 7: Handling and Storage

# 7.1 Precautions for Safe Handling

Do not eat, drink, apply cosmetics, or smoke when handling or using. Avoid generating dust. Avoid contact with sharp edges or heated metal.

Molten metal and water can be an explosive combination. The risk is greatest when there is sufficient molten metal to entrap or seal off the water. Water and other forms of contamination on or contained in scrap or remelt ingot are known to have caused explosions in melting operations. While the products may have minimal surface roughness and internal voids, there remains the possibility of moisture contamination or entrapment. If confined, even a few drops of water can lead to violent explosions.

During melting operations, the following minimum guidelines should be observed:

- 1. Inspect all materials prior to furnace charging and completely remove surface contamination such as water, ice, snow, deposits of grease and oil or other surface contamination resulting from weather exposure, shipment, or storage.
- 2. Store materials in dry, heated areas with any cracks or cavities pointed downwards.
- 3. Preheat and dry large or heavy items such as ingot adequately before charging into a furnace containing molten metal. This is typically done by use of a drying oven or homogenizing furnace. The drying cycle should bring the internal metal temperature of the coldest item of the batch to 400°F and then hold at that temperature for 6 hours.

# 7.2 Conditions for Safe Storage

Product should be kept dry. Incompatible materials are identified in **Section 10.5**.

# **Section 8: Exposure Controls / Personal Protection**

# 8.1 Exposure Limits

Component Exposure Limits: Nickel (7440-02-0) ACGIH TLV TWA: 1.5 mg/m<sup>3</sup> (inhalable fraction) OSHA PEL TWA:  $1 \text{ mg/m}^3$ 10 mg/m<sup>3</sup> as Nickel IDLH: NIOSH REL TWA: 0.015 mg/m<sup>3</sup> Ca Chromium (7440-47-3) ACGIH TLV TWA: 0.5 mg/m<sup>3</sup> OSHA PEL TWA:  $1 \text{ mg/m}^3$ 0.5 mg/m<sup>3</sup> NIOSH REL TWA: Cobalt (7440-48-4) 0.02 mg/m<sup>3</sup> ACGIH TWA TLV: OSHA PEL TWA: 0.1 mg/m<sup>3</sup> (dust and fume) NIOSH REL TWA: 0.05 mg/m<sup>3</sup> Molybdenum (7439-98-7) ACGIH TLV TWA: 10 mg/m<sup>3</sup> (inhalable fraction, as Mo) 3 mg/m<sup>3</sup> (respirable fraction, as Mo) OSHA PEL TWA: 15 mg/m<sup>3</sup> (total dust) Tungsten (7440-33-7) ACGIH TLV TWA: 5 mg/m<sup>3</sup> 10 mg/m<sup>3</sup> STEL OSHA PEL TWA: Not applicable NIOSH REL TWA:  $5 \text{ mg/m}^3$ 10 mg/m<sup>3</sup> STEL Tantalum (7440-25-7) OSHA PEL TWA:  $5 \text{ mg/m}^3$ NIOSH REL TWA:  $5 \text{ mg/m}^3$ 10 mg/m<sup>3</sup> STEL Aluminum (7429-90-5) ACGIH TLV TWA: 1 mg/m<sup>3</sup> (respirable fraction) OSHA PEL TWA: 15 mg/m<sup>3</sup> (total dust) 5 mg/m<sup>3</sup> (respirable fraction) NIOSH REL TWA: 10 mg/m<sup>3</sup> (total dust) 5 mg/m<sup>3</sup> (respirable fraction) Hafnium (7440-58-6) ACGIH TLV TWA: 0.5 mg/m<sup>3</sup> OSHA PEL TWA: 0.5 mg/m<sup>3</sup> NIOSH REL TWA: 0.5 mg/m<sup>3</sup> Manganese (7439-96-5) ACGIHV TLV TWA: 0.02 mg/m<sup>3</sup> TWA (respirable fraction) 0.1 mg/m<sup>3</sup> (inhalable fraction) OSHA PEL TLV: 5 mg/m<sup>3</sup> Ceiling (fume) NIOSH REL TWA:  $1 \text{ mg/m}^3$ 

3 mg/m<sup>3</sup> STEL

Exposure Limits for Compounds Which May Be Formed During Processing: Nickel, Insoluble Compounds (CAS Not Available) ACGIH TLV TWA: 0.2 mg/m<sup>3</sup> (inhalable fraction, as Ni) (related to Nickel insoluble inorganic compounds (NOS)) OSHA PEL TWA: 1 mg/m<sup>3</sup> (as Ni) NIOSH REL TWA: 0.015 mg/m<sup>3</sup> Ca (as Ni) Iron Oxide (1309-37-1) ACGIH TLV TWA: 5 mg/m<sup>3</sup> (respirable fraction) OSHA PEL TWA:  $10 \text{ mg/m}^{3}$ NIOSH REL TWA:  $5 \text{ mg/m}^3$ Chromium (II) Compounds (CAS Not Available) OSHA PEL TWA: 0.5 mg/m<sup>3</sup> (as Cr) 0.5 mg/m<sup>3</sup> NIOSH REL TWA: Chromium (III) Compounds (as Cr) (CAS Not Available) ACGIH TLV TWA: 0.5 mg/m<sup>3</sup> (Metal and Cr III Compounds) OSHA PEL TWA: 0.5 mg/m<sup>3</sup> (as Cr) 0.5 mg/m<sup>3</sup> NIOSH REL TWA: Chromium (VI) Compounds - Water Soluble (CAS Not Available) ACGIH TLV TWA:  $0.05 \text{ mg/m}^3$  (as Cr) NIOSH REL TWA: 0.0002 mg/m<sup>3</sup> (CrVI) Chromium (VI) Compounds (Certain Water Insoluble Forms) (CAS Not Available) ACGIH TLV TWA:  $0.01 \text{ mg/m}^3$  (as Cr) OSHA PEL TWA:  $5 \mu g/m^3$ 2.5 µg/m<sup>3</sup> Action Level (as Cr.); 5 µg/m<sup>3</sup> (as Cr, Cancer Hazard - See 29 CFR 1910.1026) NIOSH REL TWA: 0.0002 mg/m<sup>3</sup> (Cr(VI)) Chromium (VI) (18540-29-9) OSHA PEL TWA: 2.5 µg/m<sup>3</sup> Action Level 5 µg/m<sup>3</sup> (Cancer Hazard - See 29 CFR 1910.1026) Molybdenum, Insoluble Compounds (CAS Not Available) ACGIH TLV TWA: 10 mg/m<sup>3</sup> (inhalable fraction, as Mo) 3 mg/m<sup>3</sup> (respirable fraction, as Mo) 15 mg/m<sup>3</sup> (total dust) OSHA PEL TWA: Tungsten, Insoluble Compounds (CAS Not Available) ACGIH TLV TWA: 5 mg/m<sup>3</sup> (as W) 10 mg/m<sup>3</sup> STEL (as W)  $5 \text{ mg/m}^3$ NIOSH REL TWA: 10 ma/m<sup>3</sup> STEL Tantalum Oxide (1314-61-0) OSHA PEL TWA:  $5 \text{ mg/m}^3$ NIOSH REL TWA:  $5 \text{ mg/m}^3$ 10 mg/m<sup>3</sup> STEL Aluminum Oxide (1344-28-1) ACGIH TLV TWA: 1 mg/m<sup>3</sup> (respirable fraction) OSHA PEL TWA: 15 mg/m<sup>3</sup> (total dust) 5 mg/m<sup>3</sup> (respirable fraction) Titanium Dioxide (13463-67-7) ACGIH TLV TWA: 10 mg/m<sup>3</sup> OSHA PEL TWA: 15 mg/m<sup>3</sup> (total dust)

8.2

8.3

Vanadium Pentoxide (1314-62-1) ACGIH TLV TWA: OSHA PEL TWA: NIOSH REL TWA:	0.05 mg/m <sup>3</sup> (dust or fume, respirable fraction) 0.5 mg/m <sup>3</sup> Ceiling (respirable dust, as V205) 0.05 mg/m <sup>3</sup> (15 minute, as V)
Hafnium Compounds (7440-58-6) ACGIH TLV TWA: OSHA PEL TWA: NIOSH REL TWA:	0.5 mg/m <sup>3</sup> (as Hf) 0.5 mg/m <sup>3</sup> (related to Hafnium) 0.5 mg/m <sup>3</sup> (related to Hafnium)
Manganese Compounds, Inorganic (CA ACGIH TLV TWA: OSHA PEL TWA: NIOSH REL TWA:	S Not Available) 0.02 mg/m <sup>3</sup> (respirable fraction) (as Mn) 0.1 mg/m <sup>3</sup> (inhalable fraction) (as Mn) 5 mg/m <sup>3</sup> Ceiling (as Mn) (related to Manganese compounds) 1 mg/m <sup>3</sup> (as Mn) 3 mg/m <sup>3</sup> STEL (as Mn)
Appropriate Engineering Controls Ventilation:	If dust or fumes are generated through processing, use with adequate ventilation to meet the limits listed in <b>Section 8.1</b> .
Individual Protection Measures Eye Protection:	Wear safety glasses/goggles to avoid eye injury.
Clothing:	Personnel who handle and work with <b>molten metal</b> should utilize primary protective clothing like polycarbonate face shields, fire resistant tapper's jackets, neck shades (snoods), leggings, spats and similar equipment to prevent burn injuries. In addition to primary protection, secondary or day-to- day work clothing that is fire resistant and sheds metal splash is recommended for use with molten metal. Synthetic materials should never be worn even as secondary clothing (undergarments).
Gloves:	Wear appropriate gloves to avoid any skin injury.
Respirator:	If dust or fumes are generated through processing, use NIOSH-approved respiratory protection as specified by an Industrial Hygienist or other qualified professional if concentrations exceed the limits listed in <b>Section 8.1</b> . Suggested respiratory protection is an N95 equipped respirator.

The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA for Nickel metal and other compounds (as Nickel):

#### At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Any appropriate escape-type, self-contained breathing apparatus.

# **Section 9: Physical and Chemical Properties**

#### 9.1 Appearance Physical State: Physical Description:

Format: GHS Language: English (US) Lustrous, silvery solid Metallic appearance

9.2	<b>Odor</b> Odor:	Odorless.
9.3	<b>Odor Threshold</b> Not applicable.	
9.4	<b>pH</b> Not applicable.	
9.5	<b>Melting/Freezing Points</b> Melting Point: Freezing Point:	2,653°F (1,456°C) Nickel No data available.
9.6	Boiling Point Not determined.	
9.7	Flash Point No data available.	
9.8	<b>Evaporation Rate</b> No data available.	
9.9	<b>Flammability</b> No data available.	
9.10	<b>Upper/Lower Explosive Limits</b> No data available.	
9.11	Vapor Pressure Not applicable.	
9.12	Vapor Density Not applicable.	
9.13	<b>Relative Density</b> Density:	550 lb/ft <sup>3</sup> (8.8 g/cm <sup>3</sup> )
9.14	Solubility(ies) Insoluble:	Water
9.15	Partition Coefficient No data available.	
9.16	Auto-Ignition Temperature Not determined.	
9.17	<b>Decomposition Temperature</b> No data available.	
9.18	<b>Viscosity</b> No data available.	

Section 10: Stability and Reactivity

**10.1 Reactivity** No data available.

# 10.2 Chemical Stability

Stable under normal conditions of use, storage, and transportation.

#### 10.3 Possibility of Hazardous Reactions

Nickel compounds react vigorously or explosively with aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium).

#### 10.4 Conditions to Avoid

In powder form, can react with strong oxidizers such as concentrated nitric acid. Molten metal can react violently/explosively with water or moisture, particularly when the water is entrapped.

#### **10.5** Incompatible Materials

Strong acids, Sulfur, Selenium, Wood & other Combustibles, Nickel Nitrate

Safe storage of the material is discussed in Section 7.2.

#### **10.6 Hazardous Decomposition Products**

Toxic gases and vapors (such as nickel carbonyl) may be released in the decomposition of nickel compounds.

# Section 11: Toxicological Information

#### 11.1 Likely Routes of Exposure

Routes of entry include inhalation, skin contact, eye contact, and ingestion.

#### 11.2 Symptoms

See Section 4.2 for symptoms related to the physical, chemical, and toxicological characteristics.

#### 11.3 Short and Long Term Effects

# Carcinogenicity and Reproductive Hazard:

Product as shipped does not present any cancer or reproductive hazards. Dust and fumes from mechanical processing can present a cancer hazard (nickel, cobalt), and can present a reproductive hazard for males (manganese). Dust and fumes from welding or elevated temperature processing can present a cancer hazard (nickel compounds, cobalt compounds, hexavalent chromium compounds, welding fumes), and can present a reproductive hazard for males (manganese).

Health Effects Associated with Individual Ingredients:

Nickel dust and fumes: Eye Contact: Skin Contact: Chronic Overexposures:	Can cause irritation of eyes, skin, and respiratory tract. Can cause inflammation of the eyes and eyelids (conjunctivitis). Can cause sensitization and allergic contact dermatitis. Can cause perforation of the nasal septum, inflammation of the nasal passages (sinusitis), respiratory sensitization, asthma, and scarring of the lungs (pulmonary fibrosis).
Chromium Dust and Mist:	Can cause irritation of eyes, skin, and respiratory tract.
Cobalt: Skin Contact: Acute and Chronic Overexposures:	Can cause irritation of eyes, skin, and respiratory tract. Can cause allergic reactions. Can cause respiratory sensitization, asthma, scarring of the lungs (pulmonary fibrosis), and damage to the heart muscle (cardiomyopathy).
Molybdenum Dust and Fumes: Acute Overexposures: Chronic Overexposures:	Can cause irritation of mucous membranes, skin, and respiratory tract. Can cause headache, backache, and sore joints. Can cause deformities of the joints, blood disorders, kidney damage, lung damage, and liver damage.
Tungsten Dust:	Can cause irritation of eyes, skin, and upper respiratory tract.
Tantalum and Tantalum Oxide:	Can cause mechanical irritation of eyes, skin, and upper respiratory tract. Generally of low toxicity.

	Aluminum Dust, Fines, and Fumes:	Low health risk by inhalation. Generally considered to be biologically inert (milling, cutting, grinding).
	Niobium Dust and Fumes: Acute Overexposures: Chronic Overexposures:	Generally of low toxicity. Can cause lung damage.
	Manganese Dust or Fumes: Chronic Overexposures:	Can cause inflammation of the lung tissue, scarring of the lungs (pulmonary fibrosis), central nervous system damage, secondary Parkinson's disease, and reproductive harm in males.
Health Effects Associated with Individual Compounds Formed During Processing: (The following could be expected if welded, remelted, or otherwise processed at elevated temperation)		al Compounds Formed During Processing: led, remelted, or otherwise processed at elevated temperatures.)
	Nickel Compounds:	Associated with lung cancer, cancer of the vocal cords, and nasal cancer.
	Iron Oxide: Chronic Overexposures: Ingestion:	Can cause benign lung disease (siderosis). Can cause irritation of gastrointestinal tract, bleeding, changes in the pH of the body fluids (metabolic acidosis), and liver damage.
	Hexavalent Chromium (Chrome VI):	Can cause irritation of eyes, skin, and respiratory tract. Skin contact: Can cause irritant skin dermatitis, allergic skin reactions, and skin ulcers.
	Chronic Overexposures.	the accumulation of fluid in the lungs (pulmonary edema), lung damage, kidney damage, lung cancer, nasal cancer, and cancer of the gastrointestinal tract.
	Molybdenum Trioxide:	Can cause irritation of eyes, mucous membranes, and upper respiratory
	Chronic Overexposures:	Can cause reduction in the number of red blood cells (anemia), predisposition to gout, thyroid function changes, liver damage, and lung damage.
	Additional Information:	Studies with experimental animals by inhalation have found lung cancer.
	Alumina (Aluminum Oxide):	Low health risk by inhalation. Generally considered to be biologically inert.
	Titanium Dioxide: Chronic Overexposures:	Can cause irritation of eyes and respiratory tract. Can cause chronic bronchitis.
	Vanadium Pentoxide: Skin Contact (Prolonged or Repeated): Acute Overexposures:	Can cause irritation of eyes, skin, and respiratory tract. Can cause sensitization and dermatitis. Can cause inflammation of the eyes and eyelids (conjunctivitis), bronchitis, and the accumulation of fluid in the lungs (pulmonary edema). Effects can be delayed for several days
	Chronic Overexposures:	Can cause kidney damage, blindness, asthma, and emphysema.
	Manganese Oxide Fumes: Acute Overexposures:	Can cause irritation of eyes, skin, and respiratory tract. Can cause nausea, fever, chills, shortness of breath, and malaise (metal fume fever).
11.4	Numerical Measures of Toxicity General Product Information:	No information available for product.
	<u>Component Analysis - LD<sub>50</sub>/LC<sub>50</sub>:</u> Nickel (7440-02-0): Iron (7439-89-6):	Oral LD₅₀ Rat: >9,000 mg/kg Oral LD₅₀ Rat: 984 mg/kg

	Cobalt (7440-48-4): Manganese (7439-96-5):	Inhalation LC <sub>50</sub> Rat: >10 mg/L/1H Oral LD <sub>50</sub> Rat: 6,170 mg/kg Oral LD <sub>50</sub> Rat: 9,000 mg/kg
	5	
	Formed Compound Toxicity - LD50s/LC2 Iron Oxide (1309-37-1): Tantalum Oxide (1314-61-0): Aluminum Oxide (1344-28-1): Titanium Dioxide (13463-67-7): Vanadium Pentoxide (1314-62-1):	
11.5	Carcinogen Status <u>Component Ingredients:</u> Nickel Alloys (No CAS RN) NTP: IARC:	Reviewed but not recommended for listing. Group 2B, Possibly Carcinogenic to Humans.
	ACGIH:	A5 - Not Suspected as a Human Carcinogen.
	Nickel (7440-02-0) NTP: IARC: ACGIH:	Reasonably anticipated to be a Human Carcinogen. Group 2B, Possibly Carcinogenic to Humans. A5 - Not Suspected as a Human Carcinogen.
	Chromium (7440-47-3) NTP: IARC: ACGIH:	Not identified. Group 3, Not Classifiable as a Human Carcinogen. A4 - Not Classifiable as a Human Carcinogen.
	Cobalt (7440-48-4) NTP: IARC: ACGIH:	Not identified. Group 2B, Possibly Carcinogenic to Humans. A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans.
	Aluminum (7429-90-5) NTP: IARC: ACGIH:	Not identified. Not identified. A4 - Not Classifiable as a Human Carcinogen.
	Formed Compounds during Processing: Nickel, Insoluble Compounds (CAS Not NTP: IARC: ACGIH:	Available) Group K Group 1, Carcinogenic to Humans. A1 - Confirmed Human Carcinogen {related to Nickel, inorganic compounds, insoluble (NOS)}.
	Iron Oxide (1309-37-1) NTP: IARC: ACGIH:	Not identified. Group 3, Not Classifiable as a Human Carcinogen. A4 - Not Classifiable as a Human Carcinogen.
	Chromium (III) Compounds (as Cr) (CAS NTP: IARC: ACGIH:	S Not Available) Not identified Group 3, Not Classifiable as a Human Carcinogen. A4 - Not Classifiable as a Human Carcinogen.

Chromium (VI) Compounds, Water Solu	uble (CAS Not Available)
NTP:	Not identified.
IARC:	Group 1, Carcinogenic to Humans.
ACGIH:	A1 - Confirmed Human Carcinogen.
Chromium (VI) Compounds, Certain Wa	ater Insoluble Forms (CAS Not Available)
NTP:	Group K
IARC:	Group 1, Carcinogenic to Humans.
ACGIH:	A1 - Confirmed Human Carcinogen.
Titanium Dioxide (13463-67-7) NTP: IARC: ACGIH:	Not identified. Group 2B, Possibly Carcinogenic to Humans. A4 - Not Classifiable as a Human Carcinogen.
Vanadium Pentoxide (1314-62-1) NTP: IARC: ACGIH:	Not identified. Group 2B, Possibly Carcinogenic to Humans. A4 - Not Classifiable as a Human Carcinogen.

# Section 12: Ecological Information

96 Hr EC<sub>50</sub> water flea: 510 µg/L

96 Hr LC50 Oncorhynchus mykiss: 31.7 mg/L (adult)

72 Hr EC<sub>50</sub> freshwater algae (4 species): 0.1 mg/L 72 Hr EC<sub>50</sub> Selenastrum capricornutum: 0.18 mg/L

96 Hr LC<sub>50</sub> Marone saxatilis: 13.6 mg/L [static]

96 Hr LC<sub>50</sub> Brachydanio rerio:>100 mg/L [static]

96 Hr LC<sub>50</sub> *Pimephales promelas*: 3.1 mg/L 96 Hr LC<sub>50</sub> *Brachydanio rerio*:>100 mg/L

#### 12.1 Ecotoxicity

Nickel (7440-02-0):

Iron (7439-89-6): Cobalt (7440-48-4):

# 12.2 Persistence and Degradability

No data available.

# 12.3 Bioaccumulative Potential

The potential for bioconcentration in aquatic organisms is low to moderate. Due to their low vapor pressure and ionic form, volatilization from water surfaces is not expected to be an important fate process for most nickel compounds. An exception is nickel carbonyl which is expected to volatilize from water surfaces. The mobility of nickel in the aquatic environment is controlled largely by the capability of various sorbents to scavenge it from solution. Although data are limited, it appears that in pristine environments, hydrous oxides of iron and manganese control nickel's mobility via coprecipitation and sorption. In polluted environments, the more prevalent organic material will keep nickel soluble. In reducing environments, insoluble nickel sulfide may be formed. Although nickel is bioaccumulated, the concentration factors are such as to suggest that partitioning into the biota is not a dominant fate process. Nickel is one of the most mobile of the heavy metals in the aquatic environment.

In general, the mobility of nickel compounds that are soluble in water, such as nickel chlorides and nickel nitrate, will tend to be greater than the mobility of insoluble compounds such as nickel oxides and nickel sulfides. At pH values less than 6.5 the soluble nickel compounds predominate, increasing the mobility of nickel. Organic substances and sulphate ion can increase the mobility of nickel through the formation of complexes. In polluted environments, the presence of EDTA, a common substitute for polyphosphates, will tend to increase the mobility of nickel and nickel compounds through the formation of complexes.

Fish can accumulate nickel from food and water. Levels up to 13 mg/kg were measured in pike and pickerel. Six strains of algae and one Euglena species were tested for their ability to bioaccumulate nickel. The cyanobacteria tested were more sensitive to nickel toxicity than the green algae or the Euglena sp. The concentration factor for nickel was determined under a variety of conditions and in the range 0-3.0x10+3. The effect of environmental variables on nickel uptake was examined, and a striking pH effect for bioaccumulation was observed, with most of the algae strains accumulating nickel optimally at approximate pH=8.0.

#### 12.4 Mobility in Soil

If released to soil, soluble nickel compounds such as nickel chlorides and nickel nitrate will tend to migrate more than the insoluble compounds such as nickel oxides and nickel sulfides. Volatilization from moist and dry soil surfaces is not expected to be an important fate process based upon the low vapor pressures for most nickel compounds. An exception is nickel carbonyl which is expected to volatilize from moist and dry soil surfaces. If released into water, nickel compounds are expected to adsorb to suspended solids and sediment in water.

#### 12.5 Other Adverse Effects

No data available.

# **Section 13: Disposal Considerations**

Reuse or recycle material whenever possible. If reuse or recycle is not possible, then characterize in accordance with applicable regulations (40 CFR 261 or state equivalent in the U.S.) prior to disposal. TCLP testing is recommended for chromium.

RCRA waste codes other than described under Section A may apply depending on use of product. Refer to 40 CFR 261 or state equivalent in the U.S.

# **Section 14: Transport Information**

#### 14.1 UN Number

UN Number:

Not applicable.

# 14.2 UN Proper Shipping Name

UN Proper Shipping Name: Not regulated.

NOTE: When "Not regulated," enter the proper freight classification, "MSDS Number," and "Product Name" on the shipping paperwork.

# 14.3 Transport Hazard Class(es)

U.S. Department Of Transportation:<br/>CA Transportation/Dangerous Goods:No classification assigned.<br/>Not regulated.Land Transport ADR:<br/>Land Transport RID:<br/>Air Transport IATA:<br/>Maritime Transport IMDG:No classification assigned.<br/>No classification assigned.<br/>No classification assigned.<br/>No classification assigned.<br/>No classification assigned.<br/>No classification assigned.

# 14.4 Packing Group

No classification assigned.

**14.5 Environmental Hazards** No data available.

# 14.6 Transport in Bulk

No data available.

# 14.7 Special Precautions

No data available.

# Section 15: Regulatory Information

# US Federal Regulations:

In reference to Title VI of the Clean Air Act of 1990, this material does not contain nor was it manufactured using ozone-depleting chemicals. This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR

0.1% de minimis concentration 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)
1.0% de minimis concentration CERCLA: 5,000 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); 2,270 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)
0.1% de minimis concentration
1.0% de minimis concentration (dust or fume only)
zard Categories: Yes, if particulates/fumes generated during processing Yes, if particulates/fumes generated during processing No No No
"Special Hazardous Substance": Chromium, Nickel Chemical(s) known to cause cancer: Chromium compounds (hexavalent), Cobalt metal powder, and Nickel (metallic) and nickel compounds.
California, Massachusetts, Minnesota, New Jersey, Pennsylvania California California California, Massachusetts, Minnesota, New Jersey, Pennsylvania California, New Jersey California, Massachusetts, Ninnesota, New Jersey, Pennsylvania California, Massachusetts, New Jersey, Pennsylvania California, Massachusetts, New Jersey, Pennsylvania

The following statement(s) are provided under the CA Safe Drinking Water and Toxic Enforcement Act of 1986: This product contains a chemical known to the state of California to cause cancer.

Component Analysis – Inventory Nickel (7440-02-0): Iron (7439-89-6): Chromium (7440-47-3): Cobalt (7440-48-4): Molybdenum (7439-98-7): Tungsten (7440-33-7)

Tantalum (7440-25-7):	TSCA, DSL, EINECS, AUST.
Aluminum (7429-90-5):	TSCA, DSL, EINECS, AUST.
Niobium (7440-03-1):	TSCA, DSL, EINECS, AUST.
Rhenium (7440-15-5):	TSCA, DSL, EINECS, AUST.
Titanium (7440-32-6):	TSCA, DSL, EINECS, AUST.
Hafnium (7440-58-6):	TSCA, DSL, EINECS
Vanadium (7440-62-2):	TSCA, DSL, EINECS, AUST.
Manganese (7439-96-5):	TSCA, DSL, EINECS, AUST.

# **Section 16: Other Information**

The information in this Safety Data Sheet meets the requirements of the United States Department of Labor OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION and regulations promulgated thereunder (29 CFR 1910.1200 et. seq.). This document is intended only as a guide to the appropriate precautionary material handling by a person trained in, or supervised by a person trained in, chemical handling. Exposure to this chemical may have serious adverse health effects. This chemical may interact with other substances. Since the potential uses are so varied, all of the potential hazards of use or interaction with other chemicals or materials cannot be identified on this Safety Data Sheet. The user should recognize that this chemical can cause injury, especially if improperly handled, precautionary measures are not followed, and personal protective equipment not worn. Read and understand all precautionary information prior to use. The Defense Logistics Agency (DLA) shall not be held liable for any damage resulting from handling or from contact with the above chemical.

# References:

ALCOA, Inc. Material Safety Data Sheet Product Name: Nickel-Chromium Alloys, ID: 1154. June 4, 2008.

American Conference of Governmental Industrial Hygienists. 2013 TLVs® and BEIs®, ACGIH® Publication #0113. 2013.

Centers for Disease Control and Prevention. NIOSH Pocket Guide to Chemical Hazards, http://www.cdc.gov/niosh/npg/.

National Institute of Health, Toxicology Data Network. http://toxnet.nlm.nih.gov/

US Department of Transportation. Emergency Response Guidebook. 2012

NOTE: No data available: no data for this topic found using references listed.

Date of Preparation of Updated SDS: April 23, 2015