

**Section 1: Identification of the Substance/Mixture and of the Company/Undertaking**

**1.1 Product identifier**

**Product Name** • **Cobalt Alloy and Cobalt Alloy Casting**

**1.2 Relevant identified uses of the substance or mixture and uses advised against**

**Relevant identified use(s)** • Aircraft Engine Blades and Vanes Industrial Gas Turbine Components for power generation

**1.3 Details of the supplier of the safety data sheet**

**Manufacturer** • **PCC Airfoils, LLC, Deer Creek**  
13350 SE Johnson Road,  
Milwaukie, Oregon 97222  
United States

Telephone (General) • (503) 353-1007

**1.4 Emergency telephone number**

**Manufacturer** • **800-424-9300 - CHEMTREC**

**Section 2: Hazards Identification**

**EU/EEC**

According to: Regulation (EC) No 1272/2008 (CLP)/REACH 1907/2006 [amended by 453/2010]

According to: EU Directive 67/548/EEC (DSD) or 1999/45/EC (DPD)

**2.1 Classification of the substance or mixture**

**CLP** • Products do not present an inhalation, ingestion or skin contact health hazard under normal handling and use as it is in a metallic form. However, processes such as welding, grinding, burning, melting, or otherwise generating dust, fumes and gases may present a health hazard.

Skin Sensitization 1 - H317

Respiratory Sensitization 1 - H334

Carcinogenicity 2 - H351

Reproductive Toxicity 2 - H361d

Specific Target Organ Toxicity Repeated Exposure 1 - H372

Specific Target Organ Toxicity Repeated Exposure 2 - H373

Hazardous to the aquatic environment Chronic 4 - H413

**DSD/DPD**

- Irritant (Xi)
- Toxic (T)
- Harmful (Xn)
- Carcinogenic Substances - Category 3
- Substances Toxic To Reproduction - Category 3
- R40, R42/43, R48/23, R53, R63

## 2.2 Label Elements

### CLP

#### DANGER



- Hazard statements**
- H317 - May cause an allergic skin reaction
  - H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
  - H351 - Suspected of causing cancer.
  - H361d - Suspected of damaging the unborn child.
  - H372 - Causes damage to organs through prolonged or repeated exposure.
  - H373 - May cause damage to organs through prolonged or repeated exposure.
  - H413 - May cause long lasting harmful effects to aquatic life

#### Precautionary statements

- Prevention**
- P201 - Obtain special instructions before use.
  - P202 - Do not handle until all safety precautions have been read and understood.
  - P260 - Do not breathe dust.
  - P264 - Wash thoroughly after handling.
  - P270 - Do not eat, drink or smoke when using this product.
  - P272 - Contaminated work clothing should not be allowed out of the workplace.
  - P273 - Avoid release to the environment.
  - P281 - Use personal protective equipment as required.
  - P285 - In case of inadequate ventilation wear respiratory protection.
- Response**
- P304+P341 - IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
  - P342+P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
  - P302+P352 - IF ON SKIN: Wash with plenty of soap and water.
  - P363 - Wash contaminated clothing before reuse.
  - P321 - Specific treatment, see supplemental first aid information.
  - P333+P313 - If skin irritation or rash occurs: Get medical advice/attention.
  - P314 - Get medical advice/attention if you feel unwell.
- Storage/Disposal**
- P501 - Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

### DSD/DPD



- Risk phrases**
- R40 - Limited evidence of a carcinogenic effect.
  - R42/43 - May cause sensitisation by inhalation and skin contact.
  - R48/23 - Toxic: danger of serious damage to health by prolonged exposure through inhalation.
  - R53 - May cause long-term adverse effects in the aquatic environment.
  - R63 - Possible risk of harm to the unborn child.

- Safety phrases**
- S36 - Wear suitable protective clothing.
  - S37 - Wear suitable gloves.
  - S45 - In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
  - S53 - Avoid exposure - obtain special instructions before use.

## 2.3 Other Hazards

### CLP

- According to Regulation (EC) No. 1272/2008 (CLP) this material is considered hazardous.

### DSD/DPD

- According to European Directive 1999/45/EC this material is considered dangerous.

## United States (US)

According to: OSHA 29 CFR 1910.1200 HCS

### 2.1 Classification of the substance or mixture

- OSHA HCS 2012**
- Products do not present an inhalation, ingestion or skin contact health hazard under normal handling and use as it is in a metallic form. However, processes such as welding, grinding, burning, melting, or otherwise generating dust, fumes and gases may present a health hazard.
- Skin Sensitization 1  
Specific Target Organ Toxicity Single Exposure 3: Respiratory Tract Irritation  
Eye Irritation 2  
Respiratory Sensitization 1  
Carcinogenicity 2  
Reproductive Toxicity 2  
Specific Target Organ Toxicity Repeated Exposure 1

### 2.2 Label elements

OSHA HCS 2012

#### DANGER



- Hazard statements**
- May cause an allergic skin reaction
  - Causes serious eye irritation
  - May cause allergy or asthma symptoms or breathing difficulties if inhaled
  - May cause respiratory irritation
  - Suspected of causing cancer.
  - Suspected of damaging fertility or the unborn child.
  - Causes damage to organs through prolonged or repeated exposure.

#### Precautionary statements

- Prevention**
- Obtain special instructions before use.
  - Do not handle until all safety precautions have been read and understood.
  - Do not breathe dust.
  - Wash thoroughly after handling.
  - Do not eat, drink or smoke when using this product.
  - Use only outdoors or in a well-ventilated area.
  - Contaminated work clothing should not be allowed out of the workplace.
  - Wear protective gloves, clothing, and eye/face protection, .
  - In case of inadequate ventilation wear respiratory protection.
- Response**
- If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
  - IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
  - If on skin: Wash with plenty of water .
  - Wash contaminated clothing before reuse.
  - Specific treatment, see supplemental first aid information.
  - If skin irritation or rash occurs: Get medical advice/attention.
  - 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.
  - Call a POISON CENTER or doctor/physician if you feel unwell.
  - Get medical advice/attention if you feel unwell.

- Storage/Disposal**
- Store in a well-ventilated place. Keep container tightly closed.
  - Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

## 2.3 Other hazards

**OSHA HCS 2012** • Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

## Section 3 - Composition/Information on Ingredients

### 3.1 Substances

- Material does not meet the criteria of a substance.

### 3.2 Mixtures

Composition					
Chemical Name	Identifiers	%	LD50/LC50	Classifications According to Regulation/Directive	Comments
Cobalt	CAS:7440-48-4 EC Number:231-158-0 EU Index:027-001-00-9	42.38% TO 74.2%	Ingestion/Oral-Rat LD50 • 6171 mg/kg	<b>EU DSD/DPD:</b> Annex VI, Table 3.2: R42/43; R53 <b>EU CLP:</b> Annex VI, Table 3.1: Resp. Sens. 1, H334; Skin Sens. 1, H317; Aquatic Chronic 4, H413 <b>OSHA HCS 2012:</b> Resp Sens. 1; Skin Sens. 1; Carc. 2	NDA
Chromium	CAS:7440-47-3 EC Number:231-157-5	19% TO 27%	NDA	<b>EU DSD/DPD:</b> Xi, R37 <b>EU CLP:</b> STOT SE 3: Resp. Irrit., H335 <b>OSHA HCS 2012:</b> STOT SE 3: Resp. Irrit.	NDA
Nickel	CAS:7440-02-0 EC Number:231-111-4	0% TO 12%	NDA	<b>EU DSD/DPD:</b> Annex VI, Table 3.2: T; R48/23; Xi; R43; Carc. Cat. 3, Xn, R40; R52/53 <b>EU CLP:</b> Annex VI, Table 3.1: Skin Sens. 1, H317; Carc. 2, H351 (Inhl); STOT RE 1, H372 (Lungs, Orl, Dermal, Inhl); Aquatic Chronic 3, H412 <b>OSHA HCS 2012:</b> Flam. Sol. 1; Comb. Dust; Resp. Sens. 1B; Skin Sens. 1A; Carc. 2 (Inhl); STOT RE 2 (Lungs, Orl, Inhl)	NDA
Tungsten	CAS:7440-33-7 EC Number:231-143-9	6% TO 8%	NDA	<b>EU DSD/DPD:</b> Repr. Cat. 3, R63 <b>EU CLP:</b> Repr. 2, H361d <b>OSHA HCS 2012:</b> Eye Irrit. 2; Repr. 2	NDA
Tantalum	CAS:7440-25-7 EC Number:231-135-5	0% TO 3%	NDA	<b>EU DSD/DPD:</b> Xn, R22 <b>EU CLP:</b> Acute Tox. 4, H302 <b>OSHA HCS 2012:</b> Acute Tox. 4 (orl)	NDA
Iron oxide	CAS:1309-37-1 EC Number:215-168-2	< 3%	NDA	<b>EU DSD/DPD:</b> Not Classified <b>EU CLP:</b> Not Classified <b>OSHA HCS 2012:</b> Not Classified	NDA
Manganese	CAS:7439-96-5 EC Number:231-105-1	0% TO 2%	Ingestion/Oral-Rat LD50 • 9 g/kg	<b>EU DSD/DPD:</b> T, R48/23; Repr. Cat. 3, R63 <b>EU CLP:</b> STOT RE 1 (CNS), H372; Repr. 2, H361 <b>OSHA HCS 2012:</b> Eye Irrit. 2; Repr. 2; STOT RE 1 (CNS)	NDA
Silicon	CAS:7440-21-3 EC Number:231-130-8	0.4% TO 1%	Ingestion/Oral-Rat LD50 • 3160 mg/kg	<b>EU DSD/DPD:</b> F; R11 <b>EU CLP:</b> Flam. Sol. 2, H228 <b>OSHA HCS 2012:</b> Flam. Sol. 2	NDA
Carbon	CAS:7440-44-0 EC Number:231-153-3	0.4% TO 0.7%	NDA	<b>EU DSD/DPD:</b> Not Classified <b>EU CLP:</b> Not Classified <b>OSHA HCS 2012:</b> Comb. Dust	NDA
Zirconium	CAS:7440-67-7 EC Number:231-176-9 EU Index:040-001-00-3	0% TO 0.4%	NDA	<b>EU DSD/DPD:</b> Annex VI, Table 3.2: F, R15, R17 <b>EU CLP:</b> Annex VI, Table 3.1: Water-react. 1, H260; Pyr. Sol. 1, H250 <b>OSHA HCS 2012:</b> Not Classified	NDA
Titanium	CAS:7440-32-6 EINECS:231-	< 0.25%	NDA	<b>EU DSD/DPD:</b> Repr. Cat. 3, R63 <b>EU CLP:</b> Repr. 2, H361	NDA

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Aluminum	<b>CAS:</b> 7429-90-5 <b>EC Number:</b> 231-072-3	< 0.25%	NDA	<b>EU DSD/DPD:</b> Annex VI, Table 3.2: F, R11; R15 <b>EU CLP:</b> Annex VI, Table 3.1: Flam. Sol. 1, H228; Water-react. 2, H261 <b>OSHA HCS 2012:</b> Flam. Sol. 1; Water-react. 2; Comb. Dust; STOT RE 1 (Lungs, Inhl)	NDA

See Section 16 for full text of H-statements and R-phrases.

## Section 4 - First Aid Measures

### 4.1 Description of first aid measures

- Inhalation** • Move victim to fresh air. Give artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult. If signs/symptoms continue, get medical attention.
- Skin** • In case of contact with substance, immediately flush skin with running water for at least 20 minutes. If skin irritation occurs: Get medical advice/attention.
- Eye** • In case of contact with substance, immediately flush eyes with running water for at least 20 minutes. If eye irritation persists: Get medical advice/attention.
- Ingestion** • Rinse mouth. Do not give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

### 4.2 Most important symptoms and effects, both acute and delayed

- Refer to Section 11 - Toxicological Information.

### 4.3 Indication of any immediate medical attention and special treatment needed

- Notes to Physician** • All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

## Section 5 - Firefighting Measures

### 5.1 Extinguishing media

**Suitable Extinguishing Media** • Use special mixtures of dry chemical, or sand.

**Unsuitable Extinguishing Media** • Do not use water.

### 5.2 Special hazards arising from the substance or mixture

**Unusual Fire and Explosion Hazards** • Solid, massive form of material is not combustible. Fire and explosion hazards are moderate when material is in the form of dust and exposed to heat or flames, or by chemical reaction.

**Hazardous Combustion Products** • No data available

### 5.3 Advice for firefighters

- Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection.

## Section 6 - Accidental Release Measures

### 6.1 Personal precautions, protective equipment and emergency procedures

- Personal Precautions** • Special precautions are not necessary for solid castings. If large quantities of dust are spilled: Ventilate enclosed areas. Wear appropriate personal protective equipment, avoid direct contact. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Emergency** • Use normal clean up procedures.

**Procedures**

**6.2 Environmental precautions**

- Prevent entry into waterways, sewers, basements or confined areas.

**6.3 Methods and material for containment and cleaning up**

- Containment/Clean-up** • Carefully shovel or sweep up spilled material and place in suitable container.  
**Measures** Residues should be evaluated for metal leachability and consignable waste standards.  
 Do not use compressed air for cleanup.

**6.4 Reference to other sections**

- Refer to Section 8 - Exposure Controls/Personal Protection and Section 13 - Disposal Considerations.

**Section 7 - Handling and Storage**

**7.1 Precautions for safe handling**

**Handling** • Use only with adequate ventilation. Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Wear appropriate personal protective equipment, avoid direct contact. Do not breathe dust or fumes. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, or using tobacco.

**7.2 Conditions for safe storage, including any incompatibilities**

**Storage** • Store in a cool, dry place. Keep away from incompatible materials.

**7.3 Specific end use(s)**

- Refer to Section 1.2 - Relevant identified uses.

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

**8.1 Control parameters**

Exposure Limits/Guidelines						
	Result	ACGIH	Europe	France	Germany DFG	Germany TRGS
Manganese (7439-96-5)	TWAs	0.02 mg/m3 TWA (respirable fraction); 0.1 mg/m3 TWA (inhalable fraction)	Not established	1 mg/m3 TWA [VME] (fume, as Mn)	Not established	0.5 mg/m3 TWA AGW (The risk of damage to the embryo or fetus can be excluded when AGW and BGW values are observed, inhalable fraction)
	Ceilings	Not established	Not established	Not established	1.6 mg/m3 Peak (Ceiling factor 1 for Permanganates, inhalable fraction); 0.16 mg/m3 Peak (Ceiling factor 1 for Permanganates, respirable fraction)	Not established
	MAKs	Not established	Not established	Not established	0.2 mg/m3 TWA MAK (inhalable fraction); 0.02 mg/m3 TWA MAK (respirable fraction)	Not established
Tantalum (7440-25-7)	TWAs	Not established	Not established	5 mg/m3 TWA [VME]	Not established	Not established
	MAKs	Not established	Not established	Not established	4 mg/m3 TWA MAK (inhalable fraction); 1.5 mg/m3 TWA MAK (respirable fraction)	Not established
Nickel (7440-02-0)	TWAs	1.5 mg/m3 TWA (inhalable fraction)	Not established	1 mg/m3 TWA [VME]; 1 mg/m3 TWA [VME] (metal)	Not established	Not established

				gratings)		
Zirconium (7440-67-7)	STELs	10 mg/m3 STEL	Not established	Not established	Not established	Not established
	TWAs	5 mg/m3 TWA	Not established	Not established	Not established	1 mg/m3 TWA AGW (including Zirconium compounds, insoluble in water, inhalable fraction, exposure factor 1)
	Ceilings	Not established	Not established	Not established	1 mg/m3 Peak (inhalable fraction)	Not established
	MAKs	Not established	Not established	Not established	1 mg/m3 TWA MAK (inhalable fraction)	Not established
Aluminum (7429-90-5)	TWAs	1 mg/m3 TWA (respirable fraction)	Not established	10 mg/m3 TWA [VME] (metal); 5 mg/m3 TWA [VME] (dust)	Not established	Not established
	MAKs	Not established	Not established	Not established	4 mg/m3 TWA MAK (dust, inhalable fraction); 1.5 mg/m3 TWA MAK (dust, respirable fraction)	Not established
Silicon (7440-21-3)	TWAs	Not established	Not established	10 mg/m3 TWA [VME]	Not established	Not established
Iron oxide (1309-37-1)	TWAs	5 mg/m3 TWA (respirable fraction)	Not established	5 mg/m3 TWA [VME] (fume, as Fe)	Not established	Not established
Tungsten (7440-33-7)	STELs	10 mg/m3 STEL	Not established	Not established	Not established	Not established
	TWAs	5 mg/m3 TWA	Not established	Not established	Not established	Not established
Chromium (7440-47-3)	TWAs	0.5 mg/m3 TWA	2 mg/m3 TWA	2 mg/m3 TWA [VME] (indicative limit)	Not established	2 mg/m3 TWA AGW (inhalable fraction, exposure factor 1)
Cobalt (7440-48-4)	TWAs	0.02 mg/m3 TWA	Not established	Not established	Not established	Not established

**Exposure Limits/Guidelines (Con't.)**

	Result	Italy	Mexico	NIOSH	OSHA	United Kingdom
Manganese (7439-96-5)	STELs	Not established	3 mg/m3 STEL [LMPE-CT] (fume, as Mn)	3 mg/m3 STEL	Not established	1.5 mg/m3 STEL (calculated)
	TWAs	Not established	0.2 mg/m3 TWA LMPE-PPT; 1 mg/m3 TWA LMPE-PPT (fume, as Mn)	1 mg/m3 TWA (fume)	Not established	0.5 mg/m3 TWA (as Mn)
	Ceilings	Not established	Not established	Not established	5 mg/m3 Ceiling (fume)	Not established
Tantalum (7440-25-7)	STELs	Not established	10 mg/m3 STEL [LMPE-CT]	10 mg/m3 STEL (dust)	Not established	10 mg/m3 STEL
	TWAs	Not established	5 mg/m3 TWA LMPE-PPT	5 mg/m3 TWA (dust)	5 mg/m3 TWA	5 mg/m3 TWA
Nickel (7440-02-0)	TWAs	Not established	1 mg/m3 TWA LMPE-PPT	0.015 mg/m3 TWA	1 mg/m3 TWA	0.5 mg/m3 TWA
	STELs	Not established	Not established	Not established	Not established	1.5 mg/m3 STEL (calculated)
Zirconium (7440-67-7)	STELs	Not established	Not established	10 mg/m3 STEL	Not established	Not established
	TWAs	Not established	Not established	5 mg/m3 TWA	Not established	Not established
Aluminum (7429-90-5)	TWAs	Not established	10 mg/m3 TWA LMPE-PPT (dust)	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)	10 mg/m3 TWA (inhalable dust); 4 mg/m3 TWA (respirable dust)
	STELs	Not established	Not established	Not established	Not established	30 mg/m3 STEL (calculated, inhalable dust); 12 mg/m3 STEL (calculated, respirable dust)

Silicon (7440-21-3)	STELs	Not established	20 mg/m3 STEL [LMPE-CT]	Not established	Not established	30 ppm STEL (calculated, inhalable dust); 12 mg/m3 STEL (calculated, respirable dust)
	TWAs	Not established	10 mg/m3 TWA LMPE-PPT (inhalable fraction)	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)	10 mg/m3 TWA (inhalable dust); 4 mg/m3 TWA (respirable dust)
Carbon (7440-44-0)	TWAs	Not established	2 mg/m3 TWA LMPE-PPT (dust)	Not established	Not established	Not established
Iron oxide (1309-37-1)	STELs	Not established	10 mg/m3 STEL [LMPE-CT] (as Fe)	Not established	Not established	10 mg/m3 STEL (fume, as Fe); 30 mg/m3 STEL (calculated, total inhalable, as Rouge); 12 mg/m3 STEL (calculated, respirable, as Rouge)
	TWAs	Not established	5 mg/m3 TWA LMPE-PPT	5 mg/m3 TWA (dust and fume, as Fe)	10 mg/m3 TWA (fume); 15 mg/m3 TWA (total dust, listed under Rouge); 5 mg/m3 TWA (respirable fraction, listed under Rouge)	5 mg/m3 TWA (fume, as Fe); 10 mg/m3 TWA (total inhalable, as Rouge); 4 mg/m3 TWA (respirable, as Rouge)
Tungsten (7440-33-7)	STELs	Not established	Not established	10 mg/m3 STEL	Not established	10 mg/m3 STEL
	TWAs	Not established	Not established	5 mg/m3 TWA	Not established	5 mg/m3 TWA
Chromium (7440-47-3)	TWAs	0.5 mg/m3 TWA	0.5 mg/m3 TWA LMPE-PPT	0.5 mg/m3 TWA	1 mg/m3 TWA	0.5 mg/m3 TWA
	STELs	Not established	Not established	Not established	Not established	1.5 mg/m3 STEL (calculated)
Cobalt (7440-48-4)	TWAs	Not established	0.1 mg/m3 TWA LMPE-PPT (dust and fume, as Co)	0.05 mg/m3 TWA (dust and fume)	0.1 mg/m3 TWA (dust and fume)	0.1 mg/m3 TWA
	STELs	Not established	Not established	Not established	Not established	0.3 mg/m3 STEL (calculated)

## Exposure Control Notations

### United Kingdom

- Nickel (7440-02-0): **Skin:** (Potential for cutaneous absorption)
- Cobalt (7440-48-4): **Carcinogens:** (Capable of causing cancer and/or heritable genetic damage) | **Sensitizers:** (Capable of causing occupational asthma)

### France

- Nickel (7440-02-0): **Carcinogens:** (Carcinogen category 2)

### ACGIH

- Nickel (7440-02-0): **Carcinogens:** (A5 - Not Suspected as a Human Carcinogen)
- Cobalt (7440-48-4): **Carcinogens:** (A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans)
- Aluminum (7429-90-5): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)
- Chromium (7440-47-3): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)
- Manganese (7439-96-5): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)
- Iron oxide (1309-37-1): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)
- Zirconium (7440-67-7): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)

### Germany TRGS

- Cobalt (7440-48-4): **Carcinogens:** (Category 2 (bioavailable, as inhalable dust/aerosol, except hard metals, cobalt containing spinels and organic cobalt desiccants)) | **Developmental Toxins:** (Based on current data, this substance cannot be classified in categories 1-3 (bioavailable, as inhalable dust/aerosol, except hard metals, cobalt containing spinels and organic cobalt desiccants)) | **Reproductive Toxins:** (Based on current data, this substance cannot be classified in categories 1-3 (bioavailable, as inhalable dust/aerosol, except hard metals, cobalt containing spinels and organic cobalt desiccants)) | **Germ Cell Mutagens:** (Based on current data, this substance cannot be classified in categories 1-3 (bioavailable, as inhalable dust/aerosol, except hard metals, cobalt containing spinels and organic cobalt desiccants))

### Germany DFG

- Nickel (7440-02-0): **Carcinogens:** (Category 1 (causes cancer in man)) | **Sensitizers:** (respiratory and skin sensitizer (inhalable fraction, respiratory sensitization confirmed for water soluble Nickel compounds only))
- Cobalt (7440-48-4): **Carcinogens:** (Category 2 (considered to be carcinogenic for man)) | **Sensitizers:** (respiratory and skin sensitizer) | **Skin:** (skin notation)
- Aluminum (7429-90-5): **Pregnancy:** (classification not yet possible (respirable, inhalable, dust))



- Manganese (7439-96-5): **Pregnancy:** (no risk to embryo/fetus if exposure limits adhered to (inhalable fraction, respirable fraction))
- Iron oxide (1309-37-1): **Carcinogens:** (Category 3B (could be carcinogenic for man, with the exception of non-bioavailable ferrous oxides))
- Zirconium (7440-67-7): **Pregnancy:** (classification not yet possible) | **Sensitizers:** (respiratory and skin sensitizer)
- Tantalum (7440-25-7): **Pregnancy:** (no risk to embryo/fetus if exposure limits adhered to (inhalable fraction)); no risk to embryo/fetus if exposure limits adhered to (respirable fraction))

**Exposure Limits Supplemental  
ACGIH**

- Nickel (7440-02-0): **TLV Basis - Critical Effects:** (dermatitis; pneumoconiosis)
- Cobalt (7440-48-4): **BEIs:** (15 µg/L Medium: urine Time: end of shift at end of workweek Parameter: Cobalt (background); 1 µg/L Medium: blood Time: end of shift at end of workweek Parameter: Cobalt (background, semi-quantitative)) | **TLV Basis - Critical Effects:** (asthma; myocardial effects; pulmonary function) | **Notice of Intended Changes (BEIs):** (15 ug/L Medium: urine Time: end of shift at end of workweek Parameter: Cobalt (nonspecific))
- Aluminum (7429-90-5): **TLV Basis - Critical Effects:** (pneumoconiosis; lower respiratory tract irritation; neurotoxicity)
- Chromium (7440-47-3): **TLV Basis - Critical Effects:** (skin and upper respiratory tract irritation)
- Manganese (7439-96-5): **TLV Basis - Critical Effects:** (CNS impairment)
- Iron oxide (1309-37-1): **TLV Basis - Critical Effects:** (pneumoconiosis)
- Tungsten (7440-33-7): **TLV Basis - Critical Effects:** (lower respiratory tract irritation)

**8.2 Exposure controls**

**Engineering Measures/Controls**

- Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is not leakage from the equipment).

**Personal Protective Equipment**

**Respiratory**

- For limited exposure use an N95 dust mask. For prolonged exposure use an air-purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

**Eye/Face**

- Wear safety goggles.

**Hands**

- Wear appropriate gloves.

**Skin/Body**

- Wear long sleeves and/or protective coveralls.

**Environmental**

- Follow best practice for site management and disposal of waste.

**Exposure Controls**

**Key to abbreviations**

ACGIH = American Conference of Governmental Industrial Hygiene

BEI = Biological Exposure Indices

MAK = Maximale Arbeitsplatz Konzentration is the maximum permissible concentration

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

STEL = Short Term Exposure Limits are based on 15-minute exposures

TLV = Threshold Limit Value determined by the American Conference of Governmental Industrial Hygienists (ACGIH)

TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

**Section 9 - Physical and Chemical Properties**

**9.1 Information on Physical and Chemical Properties**

<b>Material Description</b>			
Physical Form	Solid	Appearance/Description	Solid metal alloy.
Color	Data lacking	Odor	Data lacking
Odor Threshold	Data lacking		
<b>General Properties</b>			
Boiling Point	3100 C(5612 F)	Melting Point/Freezing Point	1493 C(2719.4 F)
Decomposition Temperature	Data lacking	pH	Data lacking
Specific Gravity/Relative Density	7.7 to 9.2 Water=1	Water Solubility	Negligible < 0.1 %

Viscosity	Data lacking	Explosive Properties	Data lacking
Oxidizing Properties:	Data lacking		
<b>Volatility</b>			
Vapor Pressure	Data lacking	Vapor Density	Data lacking
Evaporation Rate	Data lacking		
<b>Flammability</b>			
Flash Point	Data lacking	UEL	Data lacking
LEL	Data lacking	Autoignition	Data lacking
Flammability (solid, gas)	Data lacking		
<b>Environmental</b>			
Octanol/Water Partition coefficient	Data lacking		

## 9.2 Other Information

- No additional physical and chemical parameters noted.

## Section 10: Stability and Reactivity

### 10.1 Reactivity

- Molten metal reacts violently with water. Store away from oxidizers, can react violently.

### 10.2 Chemical stability

- Stable under normal temperatures and pressures.

### 10.3 Possibility of hazardous reactions

- Hazardous polymerization will not occur.

### 10.4 Conditions to avoid

- Avoid generating dust.

### 10.5 Incompatible materials

- Material may be incompatible with acids, bases, and oxidizers.

### 10.6 Hazardous decomposition products

- No data available

## Section 11 - Toxicological Information

### 11.1 Information on toxicological effects

		Components
Nickel (0% TO 12%)	7440-02-0	<b>Acute Toxicity:</b> Ingestion/Oral-Rat TDLo • 200 mg/kg; <i>Nutritional and Gross Metabolic:</i> Gross Metabolite Changes: <b>Weight loss or decreased weight gain</b> ; <i>Behavioral:</i> <b>Somnolence (general depressed activity)</b> ; <b>Multi-dose Toxicity:</b> Ingestion/Oral-Rat TDLo • 500 mg/kg 5 Day(s)-Intermittent; <i>Lungs, Thorax, or Respiration:</i> <b>Fibrosis, focal (pneumoconiosis)</b> ; <i>Related to Chronic Data:</i> <b>Death in the Other Multiple Dose data type field</b> ; Inhalation-Rabbit TCLo • 1 mg/m <sup>3</sup> 6 Hour(s) 13 Week(s)-Intermittent; <i>Lungs, Thorax, or Respiration:</i> <b>Other changes</b> ; <i>Lungs, Thorax, or Respiration:</i> <b>Changes in lung weight</b> ; <i>Blood:</i> <b>Hemorrhage</b> ; Inhalation-Rat TCLo • 0.4 mg/m <sup>3</sup> 40 Week(s)-Intermittent; <i>Vascular:</i> <b>Thrombosis distant from injection site</b> ; <i>Lungs, Thorax, or Respiration:</i> <b>Other changes</b> ; <i>Related to Chronic Data:</i> <b>Death in the Other Multiple Dose data type field</b> ; <b>Reproductive:</b> Ingestion/Oral-Rat TDLo • 158 mg/kg (multigenerations); <i>Reproductive Effects:</i> Effects on Embryo or Fetus: <b>Fetotoxicity (except death, e.g., stunted fetus)</b> ; <i>Reproductive Effects:</i> Effects on Embryo or Fetus: <b>Fetal death</b> ; <b>Tumorigen / Carcinogen:</b> Inhalation-Guinea Pig TCLo • 15 mg/m <sup>3</sup> 91 Week(s)-Intermittent; <i>Tumorigenic:</i> <b>Equivocal tumorigenic agent by RTECS criteria</b> ; <i>Lungs, Thorax, or Respiration:</i> <b>Tumors</b> ; <i>Lungs, Thorax, or Respiration:</i> <b>Bronchiogenic carcinoma</b>
Cobalt (42.38% TO 74.2%)	7440-48-4	<b>Acute Toxicity:</b> Ingestion/Oral-Rat LD50 • 6171 mg/kg; <i>Behavioral:</i> <b>Somnolence (general depressed activity)</b> ; <i>Behavioral:</i> <b>Ataxia</b> ; <i>Gastrointestinal:</i> <b>Hypermotility, diarrhea</b> ; <b>Multi-dose Toxicity:</b> Inhalation-Rat TCLo • 2 mg/m <sup>3</sup> 4 Day(s)-Intermittent; <i>Lungs, Thorax, or Respiration:</i> <b>Fibrosing alveolitis</b>
Aluminum (< 0.25%)	7429-90-5	<b>Multi-dose Toxicity:</b> Inhalation-Man TCLo • 4 mg/m <sup>3</sup> 1 Year(s)-Intermittent; <i>Lungs, Thorax, or Respiration:</i> <b>Cough</b> ; <i>Lungs, Thorax, or Respiration:</i> <b>Dyspnea</b> ; <i>Nutritional and Gross Metabolic:</i> Gross Metabolite Changes: <b>Weight loss or</b>

		<b>decreased weight gain</b> ; Inhalation-Rat TCl <sub>0</sub> • 206 mg/m <sup>3</sup> 5 Hour(s) 30 Day(s)-Intermittent; <i>Lungs, Thorax, or Respiration</i> : <b>Fibrosis (interstitial)</b> ; <i>Endocrine</i> : <b>Hypoglycemia</b> ; <i>Blood</i> : <b>Changes in serum composition (e.g., TP, bilirubin cholesterol)</b>
Silicon (0.4% TO 1%)	7440-21-3	<b>Acute Toxicity</b> : Ingestion/Oral-Rat LD <sub>50</sub> • 3160 mg/kg; <b>Irritation</b> : Eye-Rabbit • 3 mg • Mild irritation
Manganese (0% TO 2%)	7439-96-5	<b>Acute Toxicity</b> : Ingestion/Oral-Rat LD <sub>50</sub> • 9 g/kg; <b>Irritation</b> : Eye-Rabbit • 500 mg 24 Hour(s) • Mild irritation; Skin-Rabbit • 500 mg 24 Hour(s) • Mild irritation; <b>Reproductive</b> : Ingestion/Oral-Rat TDLo • 90 mg/kg (18D post); <i>Reproductive Effects</i> : <b>Effects on Newborn:Growth statistics (e.g., reduced weight gain)</b> ; <i>Reproductive Effects</i> : <b>Effects on Newborn:Biochemical and metabolic</b> ; <i>Reproductive Effects</i> : <b>Effects on Newborn:Other postnatal measures or effects</b>
Iron oxide (< 3%)	1309-37-1	<b>Acute Toxicity</b> : Inhalation-Rat TCl <sub>0</sub> • 50 mg/m <sup>3</sup> 60 Hour(s); <i>Behavioral</i> : <b>Excitement</b> ; <i>Behavioral</i> : <b>Fluid intake</b> ; <i>Gastrointestinal</i> : <b>Hypermotility, diarrhea</b> ; Inhalation-Rat TCl <sub>0</sub> • 0.8 mg/kg; <i>Lungs, Thorax, or Respiration</i> : <b>Emphysema</b> ; <i>Biochemical</i> : <b>Enzyme inhibition, induction, or change in blood or tissue levels:Multiple enzyme effects</b> ; <i>Biochemical</i> : <b>Metabolism (intermediary):Effect on inflammation or mediation of inflammation</b> ; <b>Multi-dose Toxicity</b> : Inhalation-Rat TCl <sub>0</sub> • 500 µg/m <sup>3</sup> 24 Hour(s) 61 Day(s)-Continuous; <i>Brain and Coverings</i> : <b>Other degenerative changes</b> ; <i>Blood</i> : <b>Changes in serum composition (e.g., TP, bilirubin cholesterol)</b> ; <i>Biochemical</i> : <b>Enzyme inhibition, induction, or change in blood or tissue levels:True cholinesterase</b>
Titanium (< 0.25%)	7440-32-6	<b>Reproductive</b> : Ingestion/Oral-Rat TDLo • 158 mg/kg (multigeneration); <i>Reproductive Effects</i> : <b>Effects on Embryo or Fetus:Fetotoxicity (except death, e.g., stunted fetus)</b> ; <i>Reproductive Effects</i> : <b>Effects on Embryo or Fetus:Fetal death</b>
Tungsten (6% TO 8%)	7440-33-7	<b>Irritation</b> : Eye-Rabbit • 500 mg 24 Hour(s) • Mild irritation; Skin-Rabbit • 500 mg 24 Hour(s) • Mild irritation; <b>Reproductive</b> : Ingestion/Oral-Rat TDLo • 1210 µg/kg (35W pre); <i>Reproductive Effects</i> : <b>Effects on Fertility:Post-implantation mortality</b> ; <i>Reproductive Effects</i> : <b>Specific Developmental Abnormalities:Musculoskeletal system</b>
Tantalum (0% TO 3%)	7440-25-7	<b>Acute Toxicity</b> : Ingestion/Oral-Mouse LD <sub>50</sub> • 595 mg/kg

GHS Properties	Classification
Respiratory sensitization	<b>EU/CLP</b> •Respiratory Sensitizer 1 <b>OSHA HCS 2012</b> •Respiratory Sensitizer 1
Serious eye damage/Irritation	<b>EU/CLP</b> •Data lacking <b>OSHA HCS 2012</b> •Eye Irritation 2
Acute toxicity	<b>EU/CLP</b> •Data lacking <b>OSHA HCS 2012</b> •Data lacking
Aspiration Hazard	<b>EU/CLP</b> •Data lacking <b>OSHA HCS 2012</b> •Data lacking
Carcinogenicity	<b>EU/CLP</b> •Carcinogenicity 2 <b>OSHA HCS 2012</b> •Carcinogenicity 2
Skin corrosion/Irritation	<b>EU/CLP</b> •Data lacking <b>OSHA HCS 2012</b> •Data lacking
Skin sensitization	<b>EU/CLP</b> •Skin Sensitizer 1 <b>OSHA HCS 2012</b> •Skin Sensitizer 1
STOT-RE	<b>EU/CLP</b> •Specific Target Organ Toxicity Repeated Exposure 1; Specific Target Organ Toxicity Repeated Exposure 2 <b>OSHA HCS 2012</b> •Specific Target Organ Toxicity Repeated Exposure 1
STOT-SE	<b>EU/CLP</b> •Data lacking <b>OSHA HCS 2012</b> •Specific Target Organ Toxicity Single Exposure 3: Respiratory Tract Irritation
Toxicity for Reproduction	<b>EU/CLP</b> •Toxic to Reproduction 2 <b>OSHA HCS 2012</b> •Toxic to Reproduction 2
Germ Cell Mutagenicity	<b>EU/CLP</b> •Data lacking <b>OSHA HCS 2012</b> •Data lacking

## Potential Health Effects

### Inhalation

#### Acute (Immediate)

- May cause respiratory irritation. Processes such as cutting, grinding, crushing, or impact may result in generation of excessive amounts of airborne dusts in the workplace. Nuisance dust may affect

the lungs but reactions are typically reversible.

**Chronic (Delayed)**

- May cause allergy or asthma symptoms or breathing difficulties if inhaled. Extended exposure to excessive concentrations of metal fumes and dusts can be associated with permanent changes in the lung function and pulmonary diseases.

**Skin**

**Acute (Immediate)**

- Exposure to dust may cause mechanical irritation. May cause skin sensitization. Symptoms include redness, and skin rash.

**Chronic (Delayed)**

- No data available.

**Eye**

**Acute (Immediate)**

- Causes serious eye irritation. Exposure to dust may cause mechanical irritation. Excessive concentrations of nuisance dust in the workplace may reduce visibility and may cause unpleasant deposits in eyes.

**Chronic (Delayed)**

- No data available.

**Ingestion**

**Acute (Immediate)**

- Excessive concentrations of nuisance dust in the workplace may cause mechanical irritation to mucous membranes.

**Chronic (Delayed)**

- No data available

**Other**

**Chronic (Delayed)**

- Prolonged or repeated exposure to manganese can cause Manganism (Parkinson like disease).

**Carcinogenic Effects**

- Repeated and prolonged exposure may cause cancer.

<b>Carcinogenic Effects</b>			
	<b>CAS</b>	<b>IARC</b>	<b>NTP</b>
Nickel	7440-02-0	Group 2B-Possible Carcinogen	Reasonably Anticipated to be Human Carcinogen
Cobalt	7440-48-4	Group 2B-Possible Carcinogen	Not Listed

**Reproductive Effects** • Repeated and prolonged exposure may cause reproductive effects.

**Key to abbreviations**

LD = Lethal Dose

TC = Toxic Concentration

TD = Toxic Dose

**Section 12 - Ecological Information**

**12.1 Toxicity**

<b>Cobalt Alloy and Cobalt Alloy Casting</b>					
<b>Dosage</b>	<b>Species</b>	<b>Duration</b>	<b>Results</b>	<b>Exposure Conditions</b>	<b>Comments</b>
0.06 mg/L	<b>Fish:</b> Oncorhynchus mykiss (Rainbow Trout)	96 Hour(s)	LC50	NDA	Nickel (7440-02-0)
0.233 mg/L	<b>Aquatic Plant(s):</b> Pseudokirchneriella subcapitata (Green Algae)	96 Hour(s)	EC50	NDA	Nickel (7440-02-0)
0.0035 µg/L	<b>Fish:</b> Cyprinus carpio (Common Carp)	28 Day(s)	NOEC	NDA	Nickel (7440-02-0)
0.213 mg/L	<b>Crustacea:</b> Americamysis bahia (Opossum Shrimp)	7 Day(s)	NOEC	NDA	Nickel (7440-02-0)

- May cause long lasting harmful effects to aquatic life.

**12.2 Persistence and degradability**

- Material Data Lacking.

### 12.3 Bioaccumulative potential

- Material Data Lacking.

### 12.4 Mobility in Soil

- Material Data Lacking.

### 12.5 Results of PBT and vPvB assessment

- No PBT and vPvB assessment has been conducted.

### 12.6 Other adverse effects

- No studies have been found.

## Section 13 - Disposal Considerations

### 13.1 Waste treatment methods

**Product waste** • Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

**Packaging waste** • Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

## Section 14 - Transport Information

	14.1 UN number	14.2 UN proper shipping name	14.3 Transport hazard class(es)	14.4 Packing group	14.5 Environmental hazards
DOT	NDA	Not Regulated	NDA	NDA	NDA
IMO/IMDG	NDA	Not Regulated	NDA	NDA	NDA
IATA/ICAO	NDA	Not Regulated	NDA	NDA	NDA

**14.6 Special precautions for user** • None specified.

**14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code** • Data lacking.

## Section 15 - Regulatory Information

### 15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

#### SARA Hazard Classifications

- Acute, Chronic

Component	CAS	State Right To Know		
		MA	NJ	PA
Aluminum	7429-90-5	Yes	Yes	Yes
Boron	7440-42-8	No	Yes	No
Carbon	7440-44-0	No	No	No
Chromium	7440-47-3	Yes	Yes	Yes
Cobalt	7440-48-4	Yes	Yes	Yes
Iron oxide	1309-37-1	Yes	Yes	Yes
Manganese	7439-96-5	Yes	Yes	Yes
Nickel	7440-02-0	Yes	Yes	Yes
Silicon	7440-21-3	Yes	Yes	Yes
Tantalum	7440-25-7	Yes	Yes	Yes
Titanium	7440-32-6	No	Yes	No
Tungsten	7440-33-7	Yes	Yes	Yes

Zirconium	7440-67-7	Yes	Yes	Yes
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Inventory				
Component	CAS	EU EINECS	EU ELNICS	TSCA
Aluminum	7429-90-5	Yes	No	Yes
Boron	7440-42-8	Yes	No	Yes
Carbon	7440-44-0	Yes	No	Yes
Chromium	7440-47-3	Yes	No	Yes
Cobalt	7440-48-4	Yes	No	Yes
Iron oxide	1309-37-1	Yes	No	Yes
Manganese	7439-96-5	Yes	No	Yes
Nickel	7440-02-0	Yes	No	Yes
Silicon	7440-21-3	Yes	No	Yes
Tantalum	7440-25-7	Yes	No	Yes
Titanium	7440-32-6	Yes	No	Yes
Tungsten	7440-33-7	Yes	No	Yes
Zirconium	7440-67-7	Yes	No	Yes

## Europe

### Other

#### EU - CLP (1272/2008) - Annex VI - Table 3.2 - Classification

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	F; R15-17
•Cobalt	7440-48-4	R42/43 R53
•Aluminum	7429-90-5	F; R11-15
•Nickel	7440-02-0	Carc.Cat.3; R40 R43 T; R48/23
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

#### EU - CLP (1272/2008) - Annex VI - Table 3.2 - Concentration Limits

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

#### EU - CLP (1272/2008) - Annex VI - Table 3.2 - Labelling

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	F R:15-17 S:(2)-7/8-43
•Cobalt	7440-48-4	Xn R:42/43-53 S:(2)-22-24-37-61
•Aluminum	7429-90-5	F R:11-15 S:(2)-7/8-43

•Nickel	7440-02-0	T R:40-43-48/23 S:(2)-36/37/39-45
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>EU - CLP (1272/2008) - Annex VI - Table 3.2 - Notes - Substances and Preparations</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	T
•Nickel	7440-02-0	S, 7
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>EU - CLP (1272/2008) - Annex VI - Table 3.2 - Safety Phrases</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	S:(2)-7/8-43
•Cobalt	7440-48-4	S:(2)-22-24-37-61
•Aluminum	7429-90-5	S:(2)-7/8-43
•Nickel	7440-02-0	S:(2)-36/37/39-45
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

## United States

### Labor

#### U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

#### U.S. - OSHA - Specifically Regulated Chemicals

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed

•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

## Environment

### U.S. - CAA (Clean Air Act) - 1990 Hazardous Air Pollutants

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

### U.S. - CERCLA/SARA - Hazardous Substances and their Reportable Quantities

•Carbon	7440-44-0	Not Listed
		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 >100 µm); 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 >100 µm)
•Chromium	7440-47-3	
		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 >100 µm); 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 >100 µm)
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
		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 >100 µm); 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 >100 µm)
•Nickel	7440-02-0	
		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 >100 µm); 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 >100 µm)
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

### U.S. - CERCLA/SARA - Radionuclides and Their Reportable Quantities

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed



•Boron	7440-42-8	Not Listed
<b>U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances EPCRA RQs</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances TPQs</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - CERCLA/SARA - Section 313 - Emission Reporting</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	1.0 % de minimis concentration
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	1.0 % de minimis concentration
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	0.1 % de minimis concentration
•Aluminum	7429-90-5	1.0 % de minimis concentration (dust or fume only)
•Nickel	7440-02-0	0.1 % de minimis concentration
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - CERCLA/SARA - Section 313 - PBT Chemical Listing</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - RCRA (Resource Conservation &amp; Recovery Act) - Basis for Listing - Appendix VII</b>		

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Included in waste streams: F032, F034, F035, F037, F038, F039
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Included in waste streams: F006, F039
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - RCRA (Resource Conservation &amp; Recovery Act) - Constituents for Detection Monitoring</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	(total)
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	(total)
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	(total)
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - RCRA (Resource Conservation &amp; Recovery Act) - D Series Wastes - Max Conc of Contaminants for the Toxic Characteristic</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	5.0 mg/L regulatory level
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - RCRA (Resource Conservation &amp; Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	hazardous constituent - no waste number
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	hazardous constituent - no waste number
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - RCRA (Resource Conservation &amp; Recovery Act) - List for Hazardous Constituents</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	(total)

•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	(total)
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	(total)
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - RCRA (Resource Conservation &amp; Recovery Act) - Phase 4 LDR Rule - Universal Treatment Standards</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	2.77 mg/L (total, wastewater); 0.60 mg/L TCLP (total, nonwastewater)
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	3.98 mg/L (wastewater); 11.0 mg/L TCLP (nonwastewater)
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - RCRA (Resource Conservation &amp; Recovery Act) - TSD Facilities Ground Water Monitoring</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	(total)
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	(total)
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	(total)
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

## United States - California

### Environment

#### U.S. - California - Proposition 65 - Carcinogens List

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	carcinogen, initial date 7/1/92 (powder)
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	carcinogen, initial date 10/1/89 (metallic)
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

#### U.S. - California - Proposition 65 - Developmental Toxicity

•Carbon	7440-44-0	Not Listed
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•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - California - Proposition 65 - Maximum Allowable Dose Levels (MADL)</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - California - Proposition 65 - No Significant Risk Levels (NSRL)</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - California - Proposition 65 - Reproductive Toxicity - Female</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed
<b>U.S. - California - Proposition 65 - Reproductive Toxicity - Male</b>		
•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	Not Listed
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed

•Nickel	7440-02-0	Not Listed
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

## United States - Pennsylvania

### Labor

#### U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	
•Aluminum	7429-90-5	
•Nickel	7440-02-0	
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

#### U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances

•Carbon	7440-44-0	Not Listed
•Chromium	7440-47-3	
•Iron oxide	1309-37-1	Not Listed
•Manganese	7439-96-5	Not Listed
•Tantalum	7440-25-7	Not Listed
•Zirconium	7440-67-7	Not Listed
•Cobalt	7440-48-4	Not Listed
•Aluminum	7429-90-5	Not Listed
•Nickel	7440-02-0	
•Silicon	7440-21-3	Not Listed
•Tungsten	7440-33-7	Not Listed
•Titanium	7440-32-6	Not Listed
•Boron	7440-42-8	Not Listed

## 15.2 Chemical Safety Assessment

- No Chemical Safety Assessment has been carried out.

## 15.3 Other Information

- WARNING: This product contains a chemical known to the State of California to cause cancer.

## Section 16 - Other Information

### Relevant Phrases (code & full text)

- H228 - Flammable solid
- H250 - Catches fire spontaneously if exposed to air
- H260 - In contact with water releases flammable gases which may ignite spontaneously
- H261 - In contact with water releases flammable gas
- H302 - Harmful if swallowed
- H335 - May cause respiratory irritation
- H361 - Suspected of damaging fertility or the unborn child.
- H412 - Harmful to aquatic life with long lasting effects
- R11 - Highly flammable.
- R15 - Contact with water liberates extremely flammable gases.
- R17 - Spontaneously flammable in air.
- R22 - Harmful if swallowed.
- R43 - May cause sensitisation by skin contact.
- R52/53 - Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic

environment.

**Revision Date**

- 13/August/2015

**Preparation Date**

- 01/January/1993

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of Liability**

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**Key to abbreviations**

NDA = No Data Available

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