1. Identification of the Substance and Company

Product Identification:
Product Name: Ferro Nickel
Synonyms: FeNi

Chemical Family: Alloy

CAS No: 11110-39-7
EC No: Not Available

Company Identification
Distributed by:
Vale International SA;
Route de Pallatex 29;
1162 St. Prex, Switzerland

msds@vale.com

Telephone Number: +011 41 21 806 0555
For Fire, Spill, or chemical emergency call CHEMTREC: +44 (0) 2033 180470

2. Hazards Identification

Classification of the material is based on the classification of Nickel metal.

2.1 Classification of the Substance:
2.1.1 Classification according Regulation (EC) No. 1272/2008
Skin Sensitization – Category 1;
Carcinogenicity – Category 2;
Specific Target Organ Toxicity, Repeated exposure – Category 1

Hazard Pictograms: GHS07 - Exclamation mark, GHS08 - Health Hazard

Signal Word: Danger

Hazard Statements: H317 - May cause an allergic skin reaction.
H351 - Suspected of causing cancer
H372 - Causes damage to lungs through prolonged or repeated inhalation exposure

Precautionary Statements: P201, P202, P260, P261, P272, P280, P281, P264, P270, P302+P352,
P308+P313, P333+P313, P314, P321, P363, P405, P501

2.1.2. Classification according to Directive 67/548/EEC
2.2: Label elements
Labeling according to Regulation (EC) No 1272/2008

Product identifier: Ferro Nickel
CAS #: 11110-39-7


Symbols: GHS07 - Exclamation mark, GHS08 - Health Hazard

Signal Word: Danger

Hazard Statements: H317, H351, H372

Precautionary Statements: P202, P261, P281, P302+352, P501
(NOTE: P-statements have been reduced as per CLP regulation, the full list can be found in Section 15).

For full text of R-Statements and Precautionary, statements see section 15.

3. Composition

<table>
<thead>
<tr>
<th>Substance/Mixture (alloy)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Hazardous Ingredients</th>
<th>Typical Composition</th>
<th>C.A.S. Number</th>
<th>EINECS/EC Label No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferronickel (Fe1.87Ni)</td>
<td>&gt;99 %</td>
<td>11110-39-7</td>
<td>N/A</td>
</tr>
<tr>
<td>INDIVIDUAL INGREDIENTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel (Ni)</td>
<td>25 - 45</td>
<td>7440-02-0</td>
<td>231-111-4</td>
</tr>
<tr>
<td>Cobalt (Co)</td>
<td>0.6-1.8</td>
<td>7440-48-4</td>
<td>231-158-0</td>
</tr>
<tr>
<td>Silicon (Si)</td>
<td>≤ 1</td>
<td>7440-21-3</td>
<td>231-130-8</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>≤ 0.20</td>
<td>7440-50-8</td>
<td>231-159-6</td>
</tr>
<tr>
<td>Chromium (Cr)</td>
<td>≤ 0.10</td>
<td>7440-47-3</td>
<td>231-157-5</td>
</tr>
<tr>
<td>Phosphorus (P)</td>
<td>≤ 0.03</td>
<td>7723-14-0</td>
<td>231-768-7</td>
</tr>
<tr>
<td>Sulfur (S)</td>
<td>≤ 0.03</td>
<td>7704-34-9</td>
<td>231-722-6</td>
</tr>
<tr>
<td>Carbon (C)</td>
<td>≤ 0.03</td>
<td>7440-44-0</td>
<td>231-153-3</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>Balance</td>
<td>7439-89-6</td>
<td>231-096-4</td>
</tr>
</tbody>
</table>

4. First Aid Measures

**Ingestion:** No specific first aid required.

**Inhalation:** No specific first aid required.

**Skin:** Remove contaminated clothing, and wash affected areas thoroughly with water. If
skin irritation or rash occurs: Get medical advice/attention. Show label if possible.

**Eyes:**
Irrigate eyeball thoroughly with water for at least 10 minutes. If discomfort persists, seek medical attention.

**Most important symptoms & affects, both acute/ delayed**
Skin contact: Rash  
Eye contact: Redness

**Indication of immediate medical attention and special treatment needed**
No special requirements

### 5. Fire Fighting Measures

**Suitable extinguishing media:**
Any, type to be selected according to materials stored in the immediate neighborhood.

**Special risks:**
Non-flammable. May oxidize to Nickel Oxide if exposed to high temperatures within a fire. Keep containers cool with water spray.

**Special protective equipment for fire fighting:**
None needed. Wear protective equipment if required for other materials within the immediate vicinity.

### 6. Accidental Release Measures

**Person related precautionary measures:**
Avoid generation of dusty atmospheres. Do not inhale dusts. Contaminated work clothing should not be allowed out of the workplace. Use personal protective equipment as required. Wash hands, and face thoroughly after handling.

**Environmental Protection measures:**
No specific measures needed.

**Procedures for cleaning/absorption:**
Pick up and replace in original container. Material is normally collected for recovery.

### 7. Handling and Storage

**7.1 Precautions for Safe Handling:**
Prevent the generation of inhalable dusts e.g. by the use of suitable ventilation. Do not inhale dust. Wear appropriate nationally approved respirators if handling is likely to cause the concentration limits of airborne nickel to exceed the locally prescribed exposure limits. Wear suitable protective clothing and gloves. Contaminated work clothing should not be allowed out of the workplace.

**7.2 Conditions for Safe Storage:**
Keep in the container supplied, and keep container closed when not in use. Local regulations should be followed regarding the storage of this product.

### 8. Exposure Controls / Personal Protection

Exposure limits and Environmental limits based on Nickel metal
8.1.1 Exposure Limits:

<table>
<thead>
<tr>
<th>Nickel Metal (Ni) – CAS 7440-02-0</th>
<th>Exposure Limit (mg/m³)</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGIH TLV-TWA ¹</td>
<td>1.5 *</td>
<td>2008</td>
</tr>
<tr>
<td>UK WEL ²</td>
<td>0.5</td>
<td>2006</td>
</tr>
<tr>
<td>Japan</td>
<td>1</td>
<td>1968</td>
</tr>
<tr>
<td>Korea</td>
<td>1</td>
<td>2006</td>
</tr>
<tr>
<td>China</td>
<td>1</td>
<td>2007</td>
</tr>
</tbody>
</table>

* as Ni in inhalable fraction

8.1.2 Environmental Limits:

**PNEC’s**

<table>
<thead>
<tr>
<th>Compartment</th>
<th>Unit</th>
<th>PNEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater</td>
<td>μg Ni/L (bioavailable)</td>
<td>3.55</td>
</tr>
<tr>
<td>Marine</td>
<td>μg Ni/L</td>
<td>8.6</td>
</tr>
<tr>
<td>Terrestrial</td>
<td>mg Ni/kg</td>
<td>29.9</td>
</tr>
</tbody>
</table>

**DNEL’s**

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>DNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute systemic</td>
<td>mgNi/kg/day</td>
<td>-</td>
</tr>
<tr>
<td>Acute local</td>
<td>mgNi/cm²/day</td>
<td>-</td>
</tr>
<tr>
<td>Long-term systemic</td>
<td>mgNi/kg/day</td>
<td>-</td>
</tr>
<tr>
<td>Long-term local</td>
<td>mgNi/cm²/day</td>
<td>0.07</td>
</tr>
<tr>
<td>Inhalation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute systemic</td>
<td>mgNi/m³</td>
<td>680</td>
</tr>
<tr>
<td>Acute local</td>
<td>mgNi/m³</td>
<td>4</td>
</tr>
<tr>
<td>Long-term systemic</td>
<td>mgNi/m³</td>
<td>0.05</td>
</tr>
<tr>
<td>Long-term local</td>
<td>mgNi/m³</td>
<td>0.05</td>
</tr>
</tbody>
</table>

¹ Based on MMAD of 1.5 μm, increases with increasing MMAD (estimated as ≥6.4 mg Ni/m³ for exposures to particles with a MMAD of ≥30 μm.

² When exposure are solely to metallic and oxidic nickel dusts (without exposure to soluble nickel or sulfidic nickel) and the mean particle size of the aerosol is greater than 10 μm aerodynamic diameter (<10% of aerosol mass in respirable fraction), inhalable exposure levels up to 0.2 mg Ni/m³ could be reasonably assumed to be safe.

8.2.1 Occupational exposure controls:

As supplied, this product does not pose a health hazard by inhalation. Mechanical extraction ventilation may be required if user operations change it to other physical or chemical forms, whether as end products, intermediates or fugitive emissions, which are inhalable. Maintain airborne nickel levels as low as possible. Avoid repeated skin contact.

**PPE**
**Respiratory protection:** If required, use an approved respirator with particulate filters.

**Eye protection:** None

**Hand & Skin Protection:** Wear suitable protective clothing and gloves, which should be selected specifically for the working place, depending on concentration and quantity of the hazardous material (overalls and leather/rubber gloves). Wash skin thoroughly after handling and before eating, drinking or smoking. Change contaminated clothing frequently. Launder clothing and gloves as needed. Use of skin-protective barrier cream advised.

### 9. Physical and Chemical Properties

Silver-grey odourless metal.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state at 20°C and 101.3 kPa</td>
<td>Solid</td>
</tr>
<tr>
<td>Melting / freezing point</td>
<td>1440°C</td>
</tr>
<tr>
<td>Boiling point</td>
<td>2900°C</td>
</tr>
<tr>
<td>Relative density</td>
<td>3.8 g/cm³</td>
</tr>
<tr>
<td>Vapour pressure</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Surface tension</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Water solubility</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Partition coefficient n-octanol/water (log value)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flash point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability</td>
<td>Non-flammable</td>
</tr>
<tr>
<td>Explosive properties</td>
<td>Non-explosive</td>
</tr>
<tr>
<td>Self-ignition temperature</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Oxidising properties</td>
<td>Non-oxidizing</td>
</tr>
<tr>
<td>Granulometry</td>
<td>3 - 50 mm</td>
</tr>
<tr>
<td>Stability in organic solvents and identity of relevant degradation products</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Dissociation constant</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### 10. Stability and Reactivity

10.1 Reactivity

Stable under normal conditions.

10.2 Chemical stability

Stable under normal conditions.

10.3 Possibility of hazardous reactions

Stable under normal conditions.

10.4 Conditions to avoid

Under special conditions nickel can react with carbon monoxide in reducing atmospheres to form nickel carbonyl, Ni(CO)₄, a toxic gas.

10.5 Incompatible materials

Acids, Strong oxidising agents.

10.6 Hazardous Decomposition Product(s)

Nickel carbonyl gas
11. Toxicological Information

The toxicology of the material is unknown. The information provided is based on the toxicity of nickel.

**Nickel**

*Acute Toxicity:*

a) **Oral:** Non toxic - LD<sub>50</sub> ORAL RAT >9000 mg/kg

b) **Inhalation:** No information available

c) **Dermal:** No information available.

**Corrosivity/Irritation:**

a) **Respiratory Tract:** None

b) **Skin:** See sensitization section.

c) **Eyes:** Mechanical irritation may be expected.

**Sensitization:**

a) **Respiratory tract:** Nickel metal induced asthma is very rare. 3 case reports are available; the data is not sufficient to conclude that nickel metal is classified as a respiratory sensitizer.

b) **Skin:** Nickel metal is a well-known skin sensitizer. Direct and prolonged skin contact with metallic nickel may induce nickel allergy and elicit nickel allergic skin reactions in people already sensitized to nickel, so called nickel allergic contact dermatitis.

c) **Preexisting conditions:** Individuals known to be allergic to nickel should avoid contact with nickel whenever possible to reduce the likelihood of nickel allergic contact dermatitis reactions (skin rashes). Repeated contact may result in persistent chronic palmar/hand dermatitis in a smaller number of individuals, despite efforts to reduce or avoid nickel exposure.

**Chronic toxicity:**

a) **Oral:** No information available

b) **Inhalation:** Animal studies (rats) show that repeated dose inhalation of nickel damages the lung. Chronic inflammation, lung fibrosis and accumulation of nickel particles were observed.

c) **Dermal:** Direct and prolonged skin contact with nickel metal may cause nickel sensitization resulting in nickel allergic contact dermatitis /skin rash.

**Mutagenicity / Reproductive toxicity:** No data.

**Carcinogenicity:**

a) **Ingestion:** The U.S. National Institute for Occupational Safety and Health (NIOSH) concluded that there is no evidence that nickel metal is carcinogenic when ingested.

b) **Inhalation:** To date, there is no evidence that nickel metal causes cancer in humans based on epidemiology data from workers in the nickel producing and nickel consuming industries. A recent animal (rat) inhalation study showed no increased respiratory cancer risk for nickel metal powder indicating that no carcinogen classification is
warranted for nickel metal. The U.S. National Toxicology Program has listed metallic nickel as reasonably anticipated to be a human carcinogen.

The International Agency for Research on Cancer (IARC)(Vol 49) found there was inadequate evidence that metallic nickel is carcinogenic to humans but since there was sufficient evidence that it is carcinogenic to animals, IARC concluded that metallic nickel is possibly carcinogenic to humans (Group 2B). In 1997, the ACGIH categorized elemental nickel as: A5 "Not Suspected as a Human Carcinogen". Epidemiological studies of workers exposed to nickel powder and to dust and fume generated in the production of nickel alloys and of stainless steel have not indicated the presence of a significant respiratory cancer hazard.

12. Ecological Information

12.1 Toxicity
Not classified as aquatic to the environment

12.2 Persistence and degradability
The PBT and vPvB criteria of Annex XIII to the Regulation does not apply to inorganic substances, such as Ferro nickel. The methods for determining the biological degradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential
Ferro Nickel does not tend to bioaccumulate or biomagnify in aquatic or terrestrial systems.

12.4 Mobility in soil
The substance is essentially insoluble in water.

12.5 Results of PBT and vPvB assessment
Not classified as PBT or vPvB.

12.6 Other adverse effects
None anticipated.

13. Disposal Considerations

13.1 Waste treatment methods
Recover or recycle if possible. Dispose of contents in accordance with local, state or national legislation.

13.2 Additional Information
No information available.

14. Transport Information

| U.S. Dept. of Transportation Regulations | Not regulated. |
| Canadian Transportation of Dangerous Goods Act | Not regulated. |
| European Agreement Concerning the International Carriage of Dangerous Goods by Road | Not regulated. |
15. Regulatory Information

Europe:

**Classification according to Dangerous Substance Directive 67/548/EEC**

- T - Toxic: Category 3 carcinogen
- R48/23 - Toxic: danger of serious damage to health by prolonged exposure through inhalation.
- R40 – Limited evidence of a carcinogenic effect
- R43 - May cause sensitization by skin contact.

**S36/27/39** - Wear suitable protective clothing, gloves and eye/face protection
**S45** - In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

All components are listed on EINECS. (European Inventory of Existing Chemical Substances)

**Classification according to Part 3 of Annex VI of EU Regulation No. 1272/2008**

- Skin Sensitization – Category 1
- Carcinogenicity – Category 2
- Specific Target Organ Toxicity, Repeated exposure – Category 1

Symbols: GHS07 - Exclamation mark, GHS08 - Health Hazard

**Signal Word: Danger**

**Hazard Statements:**

- H317 - May cause an allergic skin reaction.
- H372 - Causes damage to lungs through prolonged or repeated inhalation exposure
- H351 - Suspected of causing cancer

**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 or fume
- P261 - Avoid breathing dust or fume
- P272 - Contaminated work clothing should not be allowed out of the workplace.
- P280 - Wear protective gloves and protective clothing
- P281 - Use personal protective equipment as required
- P264 - Wash hands, and face thoroughly after handling.
- P270 - Do not eat, drink or smoke when using this product.

**Response:**

- P302+P352 - If on skin: Wash with plenty of soap and water.
- P308+P313 - If exposed or concerned: Get medical advise/attention
- P333+P313 - If skin irritation or rash occurs: Get medical advice/attention.
- P314 - Get medical advice/attention if you feel unwell.
P321 - See Safety Data Sheet for specific treatment  
P363 - Wash contaminated clothes before reuse

Storage:  
P405 - store locked up

Disposal:  
P501 - Dispose of contents/container in accordance to local; regional; national and international regulations

Canada:  
WHMIS Classification: D2B  
All components are listed on the Canadian Domestic Substances List (DSL)

United States of America:  
This product contains NICKEL which 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. Refer to the Hazardous Ingredients section of this MSDS for the appropriate CAS numbers and percent by weight.  
All components are listed on the US Toxic Substances Control Act (TSCA) inventory

Australia:  
Classified as Hazardous according to ASCC criteria  
All components are listed on the Australian Inventory of Chemical Substances (AICS)

16. Other Information

The following acronyms may be found in this document:

- ACGIH: American Conference of Governmental Industrial Hygienists
- DNEL: Derived No Effect Level
- LTEL: Long Term Exposure Limit
- LR: Lead Registrant
- MMAD: Mass Median Aerodynamic Diameter
- NIOSH: National Institute of Occupational Safety and Health
- OEL: Occupational Exposure Limits
- OR: Only Representative
- OSHA: Occupational Safety and Health Administration
- PBT: Persistent, Bioaccumulative and Toxic
- PNEC: Predicted No Effect Concentration
- STEL: Short Term Exposure Limit
- STOT: Specific Target Organ Toxicity
- TLV-TWA: Threshold Limit Value – Time Weighted Average
- vPvB: very Persistent and very Bioaccumulative
- WEL: Workplace Exposure Limit (UK HSE EH40)

Document Control:  
V1 – original Safety Data Sheet  
V2 – update Nickel, carbon, and silicon composition information.

Safety Data Sheet prepared by:  
Vale Canada Limited  
200 Bay St., Royal Bank Plaza
Note:
Vale Canada believes that the information in this Material Safety Data Sheet is accurate. However, Vale Canada makes no express or implied warranty as to the accuracy of such information and expressly disclaims any liability resulting from reliance on such information.

1. Threshold Limit Values of the American Conference of Governmental Industrial Hygienists. 2008.