Ferro Nickel

(In accordance to Regulation (EC) No. 1907/2006, Annex II, as amended by Regulation (EU) 2015/830)

Section 1. Identification of the Substance and Company

1.1 Product Identification:
Product Name: Ferro Nickel
Synonyms: FeNi

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

Nickel:	*Cobalt:*	*Iron:*
CAS No: 7440-02-0	*CAS No.:* 7440-48-4	*CAS No:* 7439-89-6
EC #: 231-111-4	*EC #:* 231-158-0	EC *#:* 231-096-4

***REACH Registration numbers:* see Section 15**

1.2 Relevant identified uses of the substance uses advised against
Identified Uses:
Formulation or re-packing; Use of nickel metal in the production of stainless, special steels and special alloys
Formulation or re-packing; Use of nickel metal in the production of integrated steel and iron
Formulation or re-packing; Use of nickel metal in electric arc furnace carbon steel manufacturing
Formulation or re-packing; Use of nickel metal in the production of brazing alloys
Formulation or re-packing; Use of nickel metal and nickel containing alloys for the production of steel and other alloy powders by atomisation
Use at industrial sites; Use of nickel-containing stainless, special steels and special alloys
Use at industrial sites; Use of nickel-containing integrated steel and iron
Use at industrial sites; Use of nickel-containing carbon steel

Uses Advised Against:
Use of nickel-containing High Sulphur stainless steel for surgical implants (AISI grade 303 or ISO 7153-1reference grade N)
Use of nickel and nickel compounds in tattoo inks or permanent makeup products.
Use of nickel containing food contact materials for which release into foodstuff would exceed more than 0.14mg/kg food of nickel

1.3 Company Identification and supplier of the safety data sheet

Manufactured by:
Vale Onca Puma
Nickel Operations Department (DION)
Avenida Getúlio Vargas
1300/20° andar-Funcionários
Belo Horizonte - MG
CEP: 30.112.021, Brazil

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Amsterdam, The Netherlands
Tel No 31 20 308 5644 214

1.4 Emergency Telephone Number
For Fire, Spill, or chemical emergency call CHEMTREC: +1 703 527-3887
for Europe call CHEMTREC: +(44) 870 8200418

Section 2. Hazards Identification

2.1 Classification of the Substance:

Skin Sensitization – Category 1
Respiratory Sensitization – Category 1
Carcinogenicity – Category 1B
Specific Target Organ Toxicity, Repeated exposure – Category 1
Reproductive Toxicity – Category 1B

Hazard Pictograms:	GHS07 - Exclamation mark, GHS08 - Health Hazard
Signal Word:	Danger
Hazard Statements:	H317 – May cause an allergic skin reaction H334 – May cause allergy or asthma symptoms or breathing difficulties if inhaled H350 – May cause cancer H360f – May damage fertility or the unborn child H372i – Causes damage to lungs through prolonged or repeated inhalation exposure
Precautionary Statements:	P201, P202, P260, P261, P264, P270, P272, P280, P284, P302+P352, P304+P340, P308+P313, P314, P321, P333+P313, P342+P311, P362+P364, P405, P501

2.2: Label elements

Product identifier: Ferro Nickel
CAS #: 11110-39-7
Contains: Iron [7439-89-6] 65-75%, Nickel [7440-02-0] 25-45%, Cobalt [7440-48-4] 0.6-1.1%
Symbols:

GHS07 - Exclamation mark

GHS08 - Health Hazard

Signal Word:	Danger
Hazard Statements:	H317 – May cause an allergic skin reaction H334 – May cause allergy or asthma symptoms or breathing difficulties if inhaled H350 – May cause cancer H360f – May damage fertility or the unborn child H372i - Causes damage to lungs through prolonged or repeated inhalation exposure
Precautionary Statements:	P202- Do not handle until all safety precautions have been read and understood P261 – Avoid breathing dust or fume P280 – Wear protective gloves and protective clothing P284 – In case of inadequate ventilation wear respiratory protection P302+P352 – If on skin: Wash with plenty of soap and water

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

(NOTE: P-statements have been reduced).
For full text of Precautionary Statements see section 15.

2.3: Other Hazards
The PBT and vPnB criteria of Annex XIII of the REACH regulation does not apply to inorganic substances, such as nickel metal

2.4: Additional Information
For full text of Precautionary Statements see section 15.

Section 3. Composition

☐ **3.1 Substance** ☒ **3.2 Mixture (alloy)**

Hazardous Ingredients	Typical Composition	C.A.S. Number	EINECS/EC Label No.
Ferronickel ($Fe_{1.87}Ni$)	>98.5 %	11110-39-7	N/A
INDIVIDUAL INGREDIENTS			
Nickel (Ni)	25 - 45	7440-02-0	231-111-4
Cobalt (Co)	0.6-1.1	7440-48-4	231-158-0
Silicon (Si)	≤ 0.06	7440-21-3	231-130-8
Copper (Cu)	≤ 0.20	7440-50-8	231-159-6
Chromium (Cr)	≤ 0.05	7440-47-3	231-157-5
Phosphorus (P)	≤ 0.03	7723-14-0	231-768-7
Sulphur (S)	≤ 0.06	7704-34-9	231-722-6
Carbon (C)	≤ 0.06	7440-44-0	231-153-3
Iron (Fe)	Balance	7439-89-6	231-096-4

Section 4. First Aid Measures

4.1 Description of first aid measures

Ingestion: No specific first aid required.

Inhalation: IF INHALED: Remove person to fresh air and keep comfortable for breathing. If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.

Skin: IF ON SKIN: Wash with plenty of water. 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.
4.2 Most important symptoms and affects, both acute and delayed	Inhalation: Cough, sore throat, wheezing, increased difficulty in breathing. Skin contact: Rash Eye contact: Redness
4.3 Indication of immediate medical attention and special treatment needed	No special requirements

Section 5. Fire Fighting Measures

5.1 Suitable Extinguishing media:	Any, type to be selected according to materials stored in the immediate neighbourhood.
Unsuitable extinguishing media	None
5.2 Special hazards and risks:	Non-flammable. May oxidize to Nickel Oxide if exposed to high temperatures within a fire. Keep containers cool with water spray.
5.3 Special protective equipment for firefighting:	None needed. Wear protective equipment if required for other materials within the immediate vicinity.

Section 6. Accidental Release Measures

6.1 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.
6.2 Environmental Protection measures:	No specific measures needed.
6.3 Procedures for cleaning/absorption:	Pick up and replace in original container. Nickel-containing material is normally collected to recover nickel values.
6.4 Reference to other sections:	See also sections 7 and 8.

Section 7. Handling and Storage

7.1 Precautions for Safe Handling:	Provide adequate ventilation. Do not inhale dust. Wear appropriate nationally approved respirators if handling is likely to cause the concentration limits of airborne particulates to exceed the locally prescribed exposure limits. Wear suitable protective clothing and gloves. Contaminated work clothing should not be allowed out of the workplace. Do not eat, drink or smoke when using this product.
7.2 Conditions for Safe Storage:	Store locked up. Keep in the container supplied, and keep container closed when not in use. Local regulations should be followed regarding the storage of this product.
7.3 Specific End Uses:	See also section 1.2

Section 8. Exposure Controls / Personal Protection

8.1 Control Parameters

8.1.1 Exposure Limits:

	Nickel [7440-02-0] (mg/m³)	Cobalt [7440-48-4] (mg/m³)
ACGIH TLV-TWA	1.5 *	0.02
UK WEL TWA [2]	0.5	0.1
Japan	1	0.05
Korea	1	0.02
China	1	0.05

* - as Ni in inhalable fraction

DNEL's

	Unit	DNEL
Inhalation		
Acute local	mg Ni/m³	11.9
Long-term local	mg Ni/m³	0.05

	Unit	DNEL
Inhalation		
Long-term local	mg Co/m³	0.05

8.1.2 Environmental Limits:

PNEC's

Compartment	Unit	PNEC

Freshwater	µg Ni/L (bioavailable)	7.1
Marine	µg Ni/L	8.6
Terrestrial	mg Ni/kg	29.9

Compartment	Unit	PNEC
Freshwater	µg Co/L	0.62
Marine	µg Co/L	2.36
Terrestrial	mg Co/kg	10.9

8.2 Exposure Controls

8.2.1 Occupational engineering 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.

8.2.2 Individual protective measures such as 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.

Section 9. Physical and Chemical Properties

9.1 Information on basic physical and chemical properties

Grey odourless metal.

Physical state at 20°C and 101.3 kPa	Solid
Melting / freezing point	Not available
Boiling point	Not available
Decomposition temperature	Not applicable
Relative density	3.8 g/cm^3
Vapour pressure	Not applicable
Vapour density	Not applicable
Surface tension	Not applicable
Water solubility	Not available
pH	Not applicable

Evaporation rate	Not applicable
Partition coefficient n-octanol/water (log value)	Not applicable
Flash point	Not applicable
Flammability	Non-flammable
Explosive properties	Non-explosive
Self-ignition temperature	Auto flammability is not applicable to massive ferronickel
Oxidising properties	Non-oxidising
Granulometry	3 - 50 mm
Stability in organic solvents and identity of relevant degradation products	Not applicable
Dissociation constant	Not applicable
Viscosity	Not applicable
Packaged density	See relative density

9.2 Other Information None

Section 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 This product can react vigorously with acids to liberate hydrogen, which can form explosive mixtures with air. 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

Section 11. Toxicological Information[3]

11.1 Information on toxicological effects

The toxicological properties of this product are unknown. The toxicology of the reported ingredients is summarized below.

Nickel

Acute Toxicity:

a) Oral: Non toxic - LD_{50} 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 those people already sensitized to nickel, so called nickel allergic contact dermatitis.

c) Pre-existing 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.

Cobalt

Acute Toxicity

a) Oral: LD_{50} ORAL RAT 550 mg/kg. Acute Tox. 4; Harmful if swallowed.

b) Inhalation: Low acute toxicity. Main Symptoms: cough, sore throat, wheezing, increased difficulty in breathing.

c) Dermal: LD50(Dermal) >2000mg/kg. Low acute toxicity.

Corrosivity/Irritation

a) Respiratory Tract: None

b) Skin: No data. Not classified. See sensitization section.

c) Eyes: Low acute toxicity. Main Symptoms: Redness.

Sensitization

a) Respiratory tract: Resp. Sens. 1; May cause allergy or asthma symptoms or breathing difficulties if inhaled.

b) Skin: Skin Sens. 1; May cause an allergic skin reaction. Repeated contact with metallic cobalt can cause cobalt sensitivity and allergic skin rashes.

c) Pre-existing conditions: Sensitized individuals may experience an allergic skin rash or asthma.

Chronic Toxicity

a) Oral: No information available.

b) Inhalation: No information available.

c) Dermal: No information available.

Mutagenicity / Reproductive Toxicity:	There is no evidence of mutagenic potential. Reproductive toxicity category 2; Suspected of damaging fertility. Specific effect: fertility impairment in males.
Carcinogenicity	
a) Ingestion:	Not classified.
b) Inhalation:	Carcinogenicity category 1B; May cause cancer by inhalation.
Specific Target Organ Toxicity:	
a) Single Exposure:	None anticipated.
b) Repeated Exposure:	None anticipated.
Aspiration Hazard:	None.

Section 12. Ecological Information

12.1 Toxicity	Not classified as toxic to the aquatic 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 nickel metal. The methods for determining the biological degradability are not applicable to inorganic substances
12.3 Bioaccumulative potential	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.

Section 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.

Section 14. Transport Information

International Maritime Dangerous Goods Code	Not regulated.
International Civil Aviation Organization Technical Instructions for the Carriage of Dangerous Goods by Air	Not regulated.
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.

MARPOL Annex V

Under the 7 Criteria contained within the MARPOL Annex V, This material is classified as:

	Harmful to the Marine Environment (HME)
X	**Not Harmful to the Marine Environment (non-HME)**

Section 15. Regulatory Information

15.1 and 15.2: Safety, health and environmental regulations/legislation specific for the substance or mixture, and chemical safety assessment.

Europe:

REACH Registration #'s:

ECHA: Nickel: 01-2119438727-29-xxxx– Mineracao Onca Puma (H2 Compliance acting as Only Representative)
ECHA: Iron: 01-2119462838-24-xxxx – Mineracao Onca Puma (H2 Compliance acting as Only Representative)
UK: Nickel: UK-01-2823397175-4-0006 - Mineracao Onca Puma (Vale Europe Ltd acting as Only Representative)
UK: Iron: UK-01-7119464644-5-0003- Mineracao Onca Puma (Vale Europe Ltd acting as Only Representative)

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

Skin Sensitization – Category 1
Respiratory Sensitization – Category 1
Carcinogenicity – Category 1B
Specific Target Organ Toxicity, Repeated exposure – Category 1
Reproductive Toxicity – Category 1B

Symbols:
GHS07 - Exclamation mark GHS08 - Health Hazard

Signal Word: Danger

Hazard Statements:

H317 – May cause an allergic skin reaction
H334 – May cause allergy or asthma symptoms or breathing difficulties if inhaled
H350 – May cause cancer
H360f – May damage fertility or the unborn child
H372i – Causes damage to lungs through prolonged or repeated inhalation exposure

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
P264 - Wash hands and face 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.
P280 - Wear protective gloves and protective clothing
P284 -In case of inadequate ventilation wear respiratory protection.

Response:
P302+P352 - If on skin: Wash with plenty of soap and water
P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P308+P313 - If exposed or concerned: Get medical advice/attention.
P314 - Get medical advice/attention if you feel unwell.
P321 - See Safety Data Sheet for specific treatment.
P333+P313 - If skin irritation or rash occurs: Get medical advice/attention.
P342+P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
P362+P364 - Take off contaminated clothing and wash it before reuse.

Storage:
P405 - store locked up

Disposal:

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

Canada:
WHMIS 2015 Classification:
Skin Sensitization – Category 1
Respiratory Sensitization – Category 1
Carcinogenicity – Category 1B
Specific Target Organ Toxicity, Repeated exposure – Category 1

All components are listed on the Canadian Domestic Substances List (DSL)

United States of America:
Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200) 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)

Section 16. Other Information

Indications of change

1.0 – Original document
2.0 – Updated Ingredient information
3.0 – Updated classification as a result of Cobalt metal classification changes
4.0 – Removal of classification in regards to Directive 67/548/EEC, update of DNELs and PNECs
5.0 - Updated uses and uses advised against, updated exposure scenarios and update for WHMIS 2015
5.1 – Updated exposure scenarios
5.2 – Update Only Representative and exposure scenarios.
5.3 – Update of uses and exposure scenarios, and update of Freshwater PNEC for cobalt.
5.4 – Update to the UK REACH registration numbers.
5.5 – Update to EU contact information and classification

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	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)

Safety Data Sheet prepared by:

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SDS available online at: http://www.vale.com/canada/en/business/mining/nickel/pages/default.aspx

Note:
Vale Canada believes that the information in this 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. 2016
2. Maximum Exposure Limit of the Health and Safety Executive in the U.K. in EH40/2005.
3. Describes possible health hazards of the product supplied. If user operations change it to other chemical forms, whether as end products, intermediates or fugitive emissions, the possible health hazards of such forms must be determined by the user.

ANNEX 1 – Exposure Scenarios

Exposure Scenarios can be obtained by clicking on the following link:

http://www.vale.com/canada/EN/business/mining/product-safety-information/reach-scenarios-metals-powder/Pages/default.aspx

If you are unable to retrieve the document or have difficulties, please use the following email address for assistance: msds@vale.com

ES1 - Formulation or re-packing; Use of nickel metal in the production of stainless, special steels and special alloys
ES2 - Formulation or re-packing; Use of nickel metal in the production of integrated steel and iron
ES3 - Formulation or re-packing; Use of nickel metal in electric arc furnace carbon steel manufacturing
ES4 - Formulation or re-packing; Use of nickel metal in the production of brazing alloys
ES6 - Formulation or re-packing; Use of nickel metal and nickel containing alloys for the production of steel and other alloy powders by atomisation
ES8 - Use at industrial sites; Use of nickel-containing stainless, special steels and special alloys
ES9 - Use at industrial sites; Use of nickel-containing integrated steel and iron
ES10 - Use at industrial sites; Use of nickel-containing carbon steel