Section 1. Identification of the Substance and Company

1.1 Product Identification:
Product Name: Nickel Oxide

Synonyms:
- Nickel oxide sinter 75
- FMW
- Mononickel oxide
- Nickel (II) oxide
- TNOS
- NOS75
- Green nickel oxide
- Nickel monoxide
- Nickel (2+) oxide
- Japanese Nickel Oxide
- Nickel oxide (NiO)
- Black nickel oxide
- Nickelous oxide
- Bunsenite

CAS No: 1313-99-1 / 11099-02-8
REACH Registration number: see Section 3

1.2 Uses
Identified Uses:
- Industrial use of powdered and shaped nickel oxide containing catalysts (A)
- Industrial use of nickel oxide-containing catalysts for the production of catalysts containing other nickel compounds (B)
- Production of nickel based powders from nickel oxide
- Production of nickel-containing electronics and thermally functioning ceramics
- Production of nickel-containing enamel frits
- Production of nickel-containing pigments
- Production of nickel-containing glass
- Stainless, special steels and special alloys manufacturing

Uses Advised Against:
- None Identified.

Exposure Scenarios: See Annex 1

1.3 Company Identification
Vale Europe Limited
Clydach,
Swansea
SA6 5QR

msds@vale.com
REACH@vale.com

Telephone Number: +44 (0) 1792 842501
For Fire, Spill, or chemical emergency call CHEMTREC: +(44)-870-8200418
Section 2. Hazards Identification

2.1 Classification of the Substance:
2.1.1 Classification according Regulation (EC) No. 1272/2008
   Skin Sensitization – Category 1
   Carcinogenicity – Category 1A
   Specific Target Organ Toxicity, Repeated exposure – Category 1
   Aquatic Chronic – Category 4

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

Signal Word: Danger

Hazard Statements: H317 - May cause an allergic skin reaction.
                   H350 - May cause cancer by inhalation
                   H372 - Causes damage to lungs through prolonged or repeated inhalation exposure
                   H413 - May cause long lasting harmful effects to aquatic life.

Precautionary Statements: P201, P202, P260, P261, P264, P270, P272, P273, P280, P302+P352, P308+P313,
                          P333+P313, P314, P321, P362+P364, P405, P501

2.2: Label elements
Labelling according to Regulation (EC) No 1272/2008

Product identifier: Nickel Oxide
CAS #: 1313-99-1/11099-02-8

Symbols: GHS07 - Exclamation mark, GHS08 - Health Hazard

Signal Word: Danger

Hazard Statements: H317, H350, H372, H413

Precautionary Statements: P201, P261, P273, P302+P352, P501

For full text of Precautionary statements see section 15.

Section 3. Composition

☒ Substance ☐ Mixture

Typical Analysis:
### Hazardous Ingredients

<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>Nickel Oxide (NiO)</td>
<td>98</td>
<td>1313-99-1</td>
<td>215-215-7</td>
</tr>
<tr>
<td>Cobaltous Oxide (CoO)</td>
<td>0 - 1.5</td>
<td>1307-96-6</td>
<td>215-154-6</td>
</tr>
<tr>
<td>Nickel hydroxide</td>
<td>0 – 0.5</td>
<td>12054-48-7</td>
<td>235-008-05</td>
</tr>
</tbody>
</table>

**REACH Registration #’s:**
01-2119467172-41-XXXX – Vale Europe Limited
01-2119467172-41-XXXX – Vale Japan Limited (Vale Europe Limited acting as Only Representative)

### Section 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 soap and 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 and affects, both acute and delayed**
- Skin contact: Rash
- Eye contact: Redness

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

### Section 5. Fire Fighting Measures

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

**Special risks:** Non-flammable. Extinguish surrounding fires with appropriate methods.

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

### Section 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:
Spillages and uncontrolled discharges must be prevented from entering waterways.

Procedures for cleaning/absorption:
Pick up and replace in original container. Nickel-containing material is normally collected to recover nickel values.

Section 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.

Section 8. Exposure Controls / Personal Protection

8.1.1 Exposure Limits:

<table>
<thead>
<tr>
<th>Nickel Oxide (NiO) – CAS 1313-99-1</th>
<th>Exposure Limit (mg/m³)</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGIH TLV-TWA ¹</td>
<td>0.2 * ‡ as Ni</td>
<td>2008</td>
</tr>
<tr>
<td>UK WEL ²</td>
<td>0.5 as Ni</td>
<td>2011</td>
</tr>
<tr>
<td>Japan</td>
<td>1 as Ni</td>
<td>2012</td>
</tr>
<tr>
<td>Korea</td>
<td>0.1 as Ni</td>
<td>2006</td>
</tr>
<tr>
<td>China</td>
<td>1 as Ni</td>
<td>2007</td>
</tr>
</tbody>
</table>

* Inhalable fraction
‡ Insoluble inorganic fraction

8.1.2 Environmental Limits:

<table>
<thead>
<tr>
<th>PNEC's</th>
<th>Compartment</th>
<th>Unit</th>
<th>PNEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater</td>
<td>µg Ni/L (bioavailable)</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>Marine</td>
<td>µg Ni/L</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>Terrestrial</td>
<td>mg Ni/kg</td>
<td>29.9</td>
<td></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>Long-term local</td>
<td>mgNi/cm²/day</td>
<td>0.035</td>
</tr>
<tr>
<td>Inhalation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute local</td>
<td>mgNi/m³</td>
<td>4.0</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>

### 8.2.1 Occupational exposure controls:
Do not inhale dust. 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.

### Section 9. Physical And Chemical Properties

Solid, granular dark grey material.

<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>&gt;1900°C</td>
</tr>
<tr>
<td>Boiling point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Relative density</td>
<td>6.75 g/cm³ at 20°C</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>3.52X10⁻⁶ g/l at 20°C (green nickel oxide)</td>
</tr>
<tr>
<td></td>
<td>2.26X10⁻³ g/l at 20°C (black nickel oxide)</td>
</tr>
<tr>
<td>Partition coefficient n-octanol/water</td>
<td>Not applicable</td>
</tr>
<tr>
<td>(log value)</td>
<td></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>Not applicable</td>
</tr>
<tr>
<td>Property</td>
<td>Value</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>Self-ignition temperature</td>
<td>&gt;400°C</td>
</tr>
<tr>
<td>Oxidising properties</td>
<td>Non-oxidising</td>
</tr>
<tr>
<td>Granulometry</td>
<td>&lt;0.1% of particles with a diameter &lt;100 μm</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>

**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
None.

10.5 Incompatible materials
None.

10.6 Hazardous Decomposition Product(s)
No information available

**Section 11. Toxicological Information**

As a mixture the toxicological properties of this product are unknown. The toxicology of the reported ingredients are summarized below.

**Nickel Oxide**

_Acute Toxicity:_

_a) Oral:_
Non toxic - LD₅₀ ORAL RAT >11,000 mg/kg (green); 9,990 (black)

_b) Inhalation:_
Non toxic - LD₅₀ INHAL RAT >5.08 mg/m³ (green); >5.15 mg/m³ (black)

_c) Dermal:_
No information available.

_Corrosivity/Irritation:_

_a) Respiratory Tract:_
No classification

_b) Skin:_
Not corrosive/irritating.

_c) Eyes:_
Mildly irritating.

_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 oxide is currently classified as a dermal sensitizer according to the 1st ATP to the CLP Regulation. Recent studies evaluating the bioaccessibility of a series of nickel compounds in synthetic sweat indicated very low nickel ion release from nickel oxide suggesting very low or no sensitization potency. Early Guinea pig maximization and Beuhler test results show low potential for nickel oxide to act as a dermal sensitizer.

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: Exposure related toxicities were noted following 13 weeks and two years of exposure to nickel oxide in both rats and mice in the US NTP chronic rat inhalation study. Adverse effects in rodents were primarily limited to the lung (e.g., increased tissue weight, inflammation, macrophage hyperplasia). The LOAEC from the chronic study in rats was 0.6 mg NiO/m³ or 0.5 mg Ni/m³.

c) Dermal: No information available.

Mutagenicity /
Reproductive toxicity: Not classified for reproductive/developmental toxicity. Not classified for mutagenicity.

Carcinogenicity:

a) Ingestion: No information available. Not classified

b) Inhalation: Cat. 1A; Human epidemiological and animal data suggest that at least some forms of nickel oxide can be carcinogenic to the respiratory tract of humans after inhalation.

Cobaltous Oxide (CoO)

LD₅₀ ORAL RAT: 202 mg/kg

Inhalation: Causes irritation to the respiratory tract, symptoms may include coughing, shortness of breath, and nausea. Respiratory hypersensitivity, asthma may appear. Inhalation of cobalt dust and fumes is associated with an increased incidence of lung disease.

Ingestion: Causes abdominal pain, nausea, vomiting, flushing of the face and ears, mild hypotension, rash, and ringing in the ears. May have cumulative toxic action where elimination cannot keep pace with absorption. Large amounts depress erythrocyte production.
Skin Contact: May cause dermatitis. Cause irritation to skin. Symptoms include redness, itching, and pain.

Eye Contact: Causes irritation, redness, and pain.

Chronic Exposure: Repeated oral administration may produce goitre and reduced thyroid activity. Prolonged or repeated skin exposure may cause dermatitis. Chronic exposure associated with kidney, heart and lung damage.

Pre-existing Conditions: Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance. Persons with allergies or sensitivity to cobalt may also be more susceptible to the effects of the substance.

Nickel Hydroxide
No information currently available.

Section 12. Ecological Information

12.1 Toxicity
Aquatic Chronic 3. May cause long lasting harmful effects to aquatic life.

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

12.3 Bio accumulative 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

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Dept. of Transportation Regulations</td>
<td>Not regulated.</td>
</tr>
<tr>
<td>Canadian Transportation of Dangerous Goods Act</td>
<td>Not regulated.</td>
</tr>
<tr>
<td>European Agreement Concerning the International Carriage of Dangerous Goods by Road</td>
<td>Not regulated.</td>
</tr>
</tbody>
</table>

### Section 15. Regulatory Information

**Europe:**
- **Classification according to Part 3 of Annex VI of EU Regulation No. 1272/2008**
- **Skin Sensitization** – Category 1
- **Carcinogenicity** – Category 1A
- **Specific Target Organ Toxicity, Repeated exposure** – Category 1
- **Aquatic Chronic** – Category 4

**Symbols:**
- GHS07 - Exclamation mark
- GHS08 - Health Hazard

**Signal Word:** Danger

**Hazard Statements:**
- H317 - May cause an allergic skin reaction.
- H350 - May cause cancer by inhalation
- H372 - Causes damage to lungs through prolonged or repeated inhalation 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 or fume
P261 - Avoid breathing dust or fume; Wear respiratory protective equipment if fine dusts are generated.
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.
P273 - Avoid release to the environment.
P280 - Wear protective gloves and protective clothing

Response:  
P302+P352 - If on skin: Wash with plenty of soap and water.
P308+P313 - If exposed or concerned: Get medical advice/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
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/international regulations

Canada:
WHMIS Classification: D2A
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)

P.R. Korea:
All components are listed in the Korean Toxic Substances Control Act inventory; KE-25818

Philippines:
All components are listed in the Philippine Inventory of Chemicals and Chemical Substances (PICCS)

Japan:
All components are listed in the Japanese Handbook of Existing and New Chemical Substances.

P.R. China:
All components are listed in the Inventory of Existing Substances in China (IECSC).
Section 16. Other Information

Indications of Change

1.0 – Original Document
2.2 – Formatting Changes
3.0 – Added new GES title to Annex I, Update P-Statements
4.0 – Removal of classification according to Directive 67/538/EEC, update of DNELs
4.1 – Corrections in DNEL table

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:
Vale Canada Limited
200 Bay St., Royal Bank Plaza
Suite 1600, South Tower, PO Box 70
Toronto, ON
Canada, M5J 2K2
Product Stewardship (416) 361-7801
msds@vale.com
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. 2008.
ANNEX 1 – Exposure Scenarios

Exposure Scenarios can be obtained by clicking on the following link: Vale Nickel Oxide Exposure Scenarios. Exposure Scenarios are listed on the page according to GES # and by language.

If you are unable to retrieve the document or have difficulties, please contact one of the following email addresses for assistance: REACH@vale.com or msds@vale.com

GES 2 - Industrial use of powdered and shaped nickel oxide containing catalysts (A)
GES 3 - Industrial use of nickel oxide-containing catalysts for the production of catalysts containing other nickel compounds (B)
GES 4 - Production of nickel based powders from nickel oxide
GES 5 - Production of nickel-containing electronics and thermally functioning ceramics
GES 6 - Production of nickel-containing enamel frits
GES 7 - Production of nickel-containing pigments
GES 8 - Production of nickel-containing glass
GES 9 - Stainless, special steels and special alloys manufacturing
GES 10 - Production of NiZn cores and solids from NiO powder