Dear Educator,

This file contains the Safety Data Sheets (SDS) for FOSS MAGNETISM & ELECTRICITY, 2nd EDITION as of July 24, 2017.

Because kit contents can sometimes be replaced, we recommend searching our online portal of SDS for current sheets as you need them. To make that searching easier, we have provided a listing below of the items with SDS in this kit.

Portal: http://www.schoolspecialty.com/sds

<table>
<thead>
<tr>
<th>Part Number to Search</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>020-9152</td>
<td>Batteries-D cell</td>
</tr>
<tr>
<td>060-0313</td>
<td>Iron filings</td>
</tr>
<tr>
<td>190-9709</td>
<td>Steel strips</td>
</tr>
</tbody>
</table>

Note: The part numbers to search for in the portal are often not the same part numbers used to order replacements. To order replacements, please visit www.deltaeducation.com/refillcenter

If you have any questions, please contact Customer Care at 800-258-1302 for assistance.
Energizer has prepared copyrighted Product Safety Datasheets to provide information on the different Eveready/Energizer battery systems. Batteries are articles as defined under the GHS and exempt from GHS classification criteria (Section 1.3.2.1.1 of the GHS). The information and recommendations set forth herein are made in good faith, for information only, and are believed to be accurate as of the date of preparation. However, ENERGIZER BATTERY MANUFACTURING, INC. MAKES NO WARRANTY, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THIS INFORMATION AND DISCLAIMS ALL LIABILITY FROM REFERENCE ON IT.

### SECTION 1 - MANUFACTURER INFORMATION

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Address</th>
<th>Telephone Number</th>
<th>Date Prepared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energizer Battery Manufacturing, Inc.</td>
<td>25225 Detroit Rd. Westlake, OH 44145</td>
<td>800-383-7323 (USA / CANADA)</td>
<td>March 2015</td>
</tr>
</tbody>
</table>

### SECTION 2 – HAZARDS IDENTIFICATION

**GHS classification:** N/A

**Signal Word:** N/A

**Hazard Classification:** N/A

Under normal conditions of use, the battery is hermetically sealed.

**Ingestion:** Swallowing a battery can be harmful. Contents of an open battery can cause serious chemical burns of mouth, esophagus, and gastrointestinal tract.

**Inhalation:** Contents of an open battery can cause respiratory irritation.

**Skin Contact:** Contents of an open battery can cause skin irritation and/or chemical burns.

**Eye Contact:** Contents of an open battery can cause severe irritation and chemical burns.

### SECTION 3 - INGREDIENTS

**IMPORTANT NOTE:** The battery should not be opened or burned. Exposure to the ingredients contained within or their combustion products could be harmful.

<table>
<thead>
<tr>
<th>MATERIAL OR INGREDIENT</th>
<th>PEL (OSHA)</th>
<th>TLV (ACGIH)</th>
<th>%/wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphite (CAS# 7782-42-5)</td>
<td>15 mg/m³ TWA (total dust) 5 mg/m³ TWA (respirable fraction)</td>
<td>2 mg/m³ TWA (respirable fraction)</td>
<td>2-6</td>
</tr>
<tr>
<td>Manganese Dioxide (CAS# 1313-13-9)</td>
<td>5 mg/m³ Ceiling (as Mn)</td>
<td>0.2 mg/m³ TWA (as Mn)</td>
<td>30-45</td>
</tr>
<tr>
<td>Potassium Hydroxide (CAS# 1310-58-3)</td>
<td>None established</td>
<td>2 mg/m³ Ceiling</td>
<td>4-8</td>
</tr>
<tr>
<td>Zinc (CAS# 7440-66-6)</td>
<td>15 mg/m³ TWA PNOR* (total dust) 5 mg/m³ TWA PNOR* (respirable fraction)</td>
<td>10 mg/m³ TWA PNOC** (inhalable particulate) 3 mg/m³ TWA PNOC** (respirable particulate)</td>
<td>12-25</td>
</tr>
</tbody>
</table>
Non-Hazardous Components

Steel  (iron CAS# 65997-19-5)  None established  None established  18-22
Water, Paper, Plastic and Other  None established  None established  Balance

* PNOR: Particulates not otherwise regulated
**PNOC: Particulates not otherwise classified

SECTION 4 – FIRST AID MEASURES

Ingestion: Do not induce vomiting or give food or drink. Seek medical attention immediately. CALL NATIONAL BATTERY INGESTION HOTLINE for advice and follow-up (202-625-3333) collect day or night.
Inhalation: Provide fresh air and seek medical attention.
Skin Contact: Remove contaminated clothing and wash skin with soap and water. If a chemical burn occurs or if irritation persists, seek medical attention.
Eye Contact: Immediately flush eyes thoroughly with water for at least 15 minutes, lifting upper and lower lids, until no evidence of the chemical remains. Seek medical attention.

SECTION 5 - FIRE FIGHTING MEASURES

In case of fire, it is permissible to use any class of extinguishing medium on these batteries or their packing material. Cool exterior of batteries if exposed to fire to prevent rupture. Fire fighters should wear self-contained breathing apparatus.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

To cleanup leaking batteries:
Ventilation Requirements: Room ventilation may be required in areas where there are open or leaking batteries.
Eye Protection: Wear safety glasses with side shields if handling an open or leaking battery.
Gloves: Use neoprene or natural rubber gloves if handling an open or leaking battery.
Battery materials should be collected in a leak-proof container.

SECTION 7 - HANDLING  AND STORAGE

Storage: Store in a cool, well ventilated area. Elevated temperatures can result in shortened battery life.
Mechanical Containment: If potting or sealing the battery in an airtight or watertight container is required, consult your Energizer Battery Manufacturing, Inc. representative for precautionary suggestions. Batteries normally evolve hydrogen which, when combined with oxygen from the air, can produce a combustible or explosive mixture unless vented. If such a mixture is present, short circuits, high temperature, or static sparks can cause an ignition.
Do not obstruct safety release vents on batteries. Encapsulation (potting) of batteries will not allow cell venting and can cause high pressure rupture.
Handling: Accidental short circuit for a few seconds will not seriously affect the battery. Prolonged short circuit will cause the battery to lose energy, and can cause the safety release vent to open. Sources of short circuits include jumbled batteries in bulk containers, metal jewelry, metal covered tables or metal belts used for assembly of batteries into devices.
If soldering or welding to the battery is required, consult your Energizer Battery Manufacturing, Inc. representative for proper precautions to prevent seal damage or short circuit.
Charging: This battery is manufactured in a charged state. It is not designed for recharging. Recharging can cause battery leakage or, in some cases, high pressure rupture. Inadvertent charging can occur if a battery is installed backwards.
Labeling: If the Eveready / Energizer Battery label or package warnings are not visible, it is important to provide a package and/or device label stating:

WARNING: do not install backwards, charge, put in fire, or mix with other battery types. May explode or leak causing injury.
Replace all batteries at the same time.

Where accidental ingestion of small batteries is possible, the label should include:
Keep away from small children. If swallowed, promptly see doctor; have doctor phone (202) 625-3333 collect.

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SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

Ventilation Requirements: Not necessary under normal conditions.

Respiratory Protection: Not necessary under normal conditions.

Eye Protection: Not necessary under normal conditions.

Gloves: Not necessary under normal conditions.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance (physical state, color, etc.)</td>
<td>Solid object</td>
</tr>
<tr>
<td>Upper Explosive Limits</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Lower Explosive Limits</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Odor</td>
<td>No odor</td>
</tr>
<tr>
<td>Vapor Pressure (mm Hg @ 25°C)</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No odor</td>
</tr>
<tr>
<td>Vapor Density (Air = 1)</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>pH</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Density (g/cm³)</td>
<td>2.0 – 3.0</td>
</tr>
<tr>
<td>Melting point/Freezing Point</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Solubility in Water (% by weight)</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Boiling Point @ 760 mm Hg (°C)</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Flash Point</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Evaporation Rate (Butyl Acetate = 1)</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Flammability</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Partition Coefficient</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Auto-ignition Temperature</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>Not applicable for an Article</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not applicable for an Article</td>
</tr>
</tbody>
</table>

SECTION 10 – STABILITY AND REACTIVITY

Alkaline batteries do not meet any of the criteria established in 40 CFR 261.2 for reactivity.
SECTION 11 – TOXICOLOGICAL INFORMATION

Under normal conditions of use, alkaline batteries are non-toxic.

SECTION 12 – ECOLOGICAL INFORMATION

Issues such as ecotoxicity, persistence and bioaccumulation are not applicable for articles.

SECTION 13 – DISPOSAL CONSIDERATIONS

Dispose of in accordance with all applicable federal, state and local regulations. Appropriate disposal technologies include incineration and land filling.

SECTION 14 – TRANSPORT INFORMATION

In general, all batteries in all forms of transportation (ground, air, or ocean) must be packaged in a safe and responsible manner. Regulatory concerns from all agencies for safe packaging require that batteries be packaged in a manner that prevents short circuits and be contained in "strong outer packaging" that prevents spillage of contents. All original packaging for Energizer alkaline batteries has been designed to be compliant with these regulatory concerns.

Alkaline batteries (sometimes referred to as "Dry cell" batteries) are not listed as dangerous goods under the ADR European Agreement Concerning the International Carriage of Dangerous Goods by Road, the IMDG International Maritime Dangerous Goods Code, UN Dangerous Good Regulations, IATA Dangerous Goods Regulations, ICAO Technical Instructions and the U.S. hazardous materials regulations (49 CFR). These batteries are not subject to the dangerous goods regulations provided they meet the requirements contained in the following special provisions.

<table>
<thead>
<tr>
<th>Regulatory Body</th>
<th>Special Provisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADR</td>
<td>Not regulated</td>
</tr>
<tr>
<td>IMDG</td>
<td>Not regulated</td>
</tr>
<tr>
<td>UN</td>
<td>Not regulated</td>
</tr>
<tr>
<td>US DOT</td>
<td>49 CFR 172.102 Provision 130</td>
</tr>
<tr>
<td>IATA</td>
<td>A123</td>
</tr>
<tr>
<td>ICAO</td>
<td>Not regulated</td>
</tr>
</tbody>
</table>

All Energizer alkaline batteries are packed in such a way to prevent short circuits or the generation dangerous quantities of heat and meet the special provisions listed above. In addition, the IATA Dangerous Goods Regulations and ICAO Technical Instructions require the words "not restricted" and the Special Provision number A123 be provided on the air waybill, when an air waybill is issued.

SECTION 15 - REGULATORY INFORMATION

Batteries marketed by Energizer Battery Manufacturing, Inc. are not classified as dangerous goods by the US Department of Transportation or the major international regulatory bodies and are therefore not regulated.

SARA/TITLE III - As an article, this battery and its contents are not subject to the requirements of the Emergency Planning and Community Right-To-Know Act.

SECTION 16 - OTHER INFORMATION

None.
1 Identification

- **Product identifier**
- **Trade name:** Iron Filings, Coarse
- **Article number:** 060-0313
- **CAS Number:** 7439-85-6
- **EC number:** 231-696-4

- **Details of the supplier of the safety data sheet**
  - **Manufacturer/Supplier:**
    - Aqua Solutions, Inc.
    - 6913 Highway 225
    - DEER PARK, TX 77536
    - USA
    - 800-256-2586
  - **Information department:**
    - Product safety department
    - Technical Coordinator
    - Shannon Welson sherman@aquasolutions.org
  - **Emergency telephone number:**
    - Chemtrec: 800-424-8590
    - Contact: 913-956-4665

2 Hazard(s) identification

- **Classification of the substance or mixture**
  - The substance is not classified according to the Globally Harmonized System (GHS).

- **Label elements**
  - GHS label elements: Not Applicable
  - Hazard pictograms: Not Applicable
  - Signal word: Not Applicable
  - Hazard statements: Not Applicable

- **Precautionary statements**
  - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.
  - Continue rinsing.
  - If swallowed: Call a poison center/doctor if you feel unwell.
  - If on skin: Wash with plenty of water.
  - Dispose of contents/container in accordance with local/regional/national/international regulations.

- **Classification system:**
  - **NFPA ratings (scale 0 - 4)**
    - Health = 0
    - Fire = 0
    - Reactivity = 0
  - **HMIS-ratings (scale 0 - 4)**
    - **Health:** 0
    - **Fire:** 0
    - **Reactivity:** 0

- **Other hazards**
  - **Results of PBT and vPvB assessment**
  - **PBT:** Not applicable.
  - **vPvB:** Not applicable.
3 Composition/Information on ingredients

- Chemical characterization: Substances
- CAS No. Description
  7439-89-9 Iron Metal
- Identification number(s)
- EC number: 231-095-4

4 First-aid measures

- Description of first aid measures
  - General information: No special measures required.
  - After inhalation: Supply fresh air. Consult doctor in case of complaints.
  - After skin contact: Generally the product does not irritate the skin.
  - After eye contact: Rinse opened eye for several minutes under running water.
  - After swallowing: If symptoms persist consult doctor.
- Most important symptoms and effects, both acute and delayed: No further relevant information available.
- Indication of any immediate medical attention and special treatment needed: No further relevant information available.

5 Fire-fighting measures

- Extinguishing media
  - Suitable extinguishing agents: CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
- Special hazards arising from the substance or mixture: No further relevant information available.
- Advice for firefighters
- Protective equipment: No special measures required.

6 Accidental release measures

- Personal precautions, protective equipment and emergency procedures: Not required.
- Environmental precautions: No special measures required.
- Methods and material for containment and cleaning up: Pick up mechanically.
- Reference to other sections: See Section 7 for information on safe handling.
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.

7 Handling and storage

- Precautions for safe handling: No special measures required.
- Information about protection against explosions and fires: No special measures required.
- Conditions for safe storage, including any incompatibilities
- Storage:
  - Requirements to be met by storerooms and receptacles: No special requirements.
- Information about storage in one common storage facility: Not required.
- Further information about storage conditions: None.
- Specific end use(s): No further relevant information available.

8 Exposure controls/personal protection

- Additional information about design of technical systems: No further data; see item 7.
Trade name: Iron Filings, Course

Control parameters
Components with limit values that require monitoring at the workplace: Not required.
Additional information: The lists that were valid during the creation were used as basis.

Exposure controls
Personal protective equipment:
General protective and hygienic measures:
The usual precautionary measures for handling chemicals should be followed.
Breathing equipment: Not required
Protection of hands:
The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
Material of gloves
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
Penetration time of glove material
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
Eye protection: Not required.

9 Physical and chemical properties

Information on basic physical and chemical properties
General Information
Appearance:
Form: Powder, ribbon, chips or granules
Color: Silver or grey
Odor: Odor-less
Odour threshold: Not determined.

pH-value: Not applicable.

Change in condition
Melting point/Melting range: 1335 °C (2447 °F)
Boiling point/Boiling range: 2750 °C (4982 °F)

Flash point: Not applicable.

Flammability (solid, gaseous): Product is not flammable.

Ignition temperature:

Decomposition temperature: Not determined.

Auto igniting: Not determined.

Danger of explosion: Product does not present an explosion hazard.

Explosion limits:
Lower: Not determined.
Upper: Not determined.

Vapor pressure: Not applicable

Density at 20 °C (68 °F): 7.81 g/cm³ (165.675 lb/gal)

Bulk density at 20 °C (68 °F): 2900 kg/m³

Relative density
Vapor density
Not determined.
Not applicable.

(Contd. on page 4)
10 Stability and reactivity

- Reactivity:
- Chemical stability:
- Thermal decomposition / conditions to be avoided: No decomposition if used according to specifications.
- Possibility of hazardous reactions: No dangerous reactions known.
- Conditions to avoid: No further relevant information available.
- Incompatible materials: No further relevant information available.
- Hazardous decomposition products: No dangerous decomposition products known.

11 Toxicological information

- Information on toxicological effects:
- Acute toxicity:
  - LD/LC50 values that are relevant for classification:
    - Oral (LD50) 7500 mg/kg (rat): No data available.
- Primary irritant effect:
  - on the skin: No irritant effect.
  - on the eyes: No irritating effect.
- Sensitization: No sensitizing effects known.
- Additional toxicological information:
  When used and handled according to specifications, the product does not have any harmful effects according to our experience and the information provided to us. The substance is not subject to classification.

- Carcinogenic categories:
- IARC (International Agency for Research on Cancer): Substance is not listed.
- NTP (National Toxicology Program): Substance is not listed.
- OSHA-Ca (Occupational Safety & Health Administration): Substance is not listed.

12 Ecological information

- Toxicity:
- Aquatic toxicity: No further relevant information available.
- Persistence and degradability: No further relevant information available.
- Bioaccumulative potential: No further relevant information available.
- Mobility in soil: No further relevant information available.
- Additional ecological information:
  - General notes: Generally not hazardous for water.
  - Results of PBT and vPvB assessment:
    - PBT: Not applicable.
    - vPvB: Not applicable.

(Cond. on page 5)
Trade name: Iron Filings, Coarse

- Other adverse effects: No further relevant information available.

13 Disposal considerations

- Waste treatment methods
  - Recommendation: Smaller quantities can be disposed of with household waste.
- Uncleaned packagings:
  - Recommendation: Disposal must be made according to official regulations.

14 Transport information

- UN-Number
  - DOT, ADN, IMDG, IATA: Not regulated
- UN proper shipping name
  - DOT, ADN, IATA: Not regulated
  - IMDG: Not Regulated
- Transport hazard class(es)
  - DOT: Not applicable
  - Class: Not regulated
  - ADN/R Class: Not regulated
- Packing group
  - DOT, IMDG, IATA: Not regulated
- Environmental hazards:
  - Marine pollutant: No
- Special precautions for user: Not applicable.
- Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable.

15 Regulatory information

- Safety, health and environmental regulations/legislation specific for the substance or mixture
  - Saro
  - Section 355 (extremely hazardous substances): Substance is not listed.
  - Section 313 (Specific toxic chemical listings): Substance is not listed.
  - TSCA (Toxic Substances Control Act): Substance is listed.
  - Proposition 65
    - Chemicals known to cause cancer: Substance is not listed.
    - Chemicals known to cause reproductive toxicity for females: Substance is not listed.
    - Chemicals known to cause reproductive toxicity for males: Substance is not listed.
Safety Data Sheet
ace. to OSHA HCS

Printing date 11/13/2014
Reviewed on 03/1/2014

Trade name: Iron Filings, Coarse

- Chemicals known to cause developmental toxicity: Substance is not listed.
- Carcinogenic categories: EPA (Environmental Protection Agency) Substance is not listed
- TLV (Threshold Limit Value established by ACGIH) Substance is not listed.
- NIOSH-Ca (National Institute for Occupational Safety and Health) Substance is not listed.
- GHS label elements Not Applicable
- Hazard pictograms Not Applicable
- Signal word Not Applicable
- Hazard statements Not Applicable
- Preventive statements
  If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
  If swallowed: Call a poison control center if you feel unwell.
  If on skin: Wash with plenty of water.
  Dispose of contents/container in accordance with local/regional/national/international regulations.
- Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

- Department issuing SDS: Environment protection department.
- Contact: Mr. Nelson
- Date of preparation/last revision
  Creation date for SDS 08-25-2014, STN 11/13/2014
- Abbreviations and acronyms:
  ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
  IMDG: International Maritime Code for Dangerous Goods
  DOT: US Department of Transportation
  IATA: International Air Transport Association
  ACGIH: American Conference of Governmental Industrial Hygienists
  EINECS: European Inventory of Existing Commercial Chemical Substances
  CAS: Chemical Abstracts Service (division of the American Chemical Society)
  NFPA: National Fire Protection Association (USA)
  HMIS: Hazardous Materials Identification System (USA)
  LC50: Lethal concentration, 50 percent
  LD50: Lethal dose, 50 percent
Safety Data Sheet

Original Issue Date: 10/01/03

Section 1 - Chemical Product Identification

Product/Chemical Name: 1095 series High Carbon Steel
Common Name: Carbon Steel

Section 2 - Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>CAS Number</th>
<th>Percentage by wt.</th>
<th>OSHA PEL ¹</th>
<th>ACGIH TLV ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe (Iron)</td>
<td>7439-89-6</td>
<td>Balance</td>
<td>10 mg/m³ - Iron oxide fume</td>
<td>5 mg/m³ - Iron oxide dust and fume</td>
</tr>
<tr>
<td>C (Carbon)</td>
<td>7440-44-0</td>
<td>0.90 to 1.04%</td>
<td>15 mg/m³ - Total dust (PNOR) ³</td>
<td>10 mg/m³ - Inhalable fraction ⁶ (PNOS) ⁷</td>
</tr>
<tr>
<td></td>
<td>7440-21-3</td>
<td>0.3 ~ 0.5%</td>
<td>15 mg/m³ - Total dust (PNOR) ³</td>
<td>3 mg/m³ - Respirable fraction ⁶ (PNOS)</td>
</tr>
<tr>
<td>Mn (Manganese)</td>
<td>7439-96-5</td>
<td>0.3 ~ 0.5%</td>
<td>5 mg/m³ (C) - Fume &amp; Mn compounds</td>
<td>0.2 mg/m³</td>
</tr>
<tr>
<td>P (Phosphorus)</td>
<td>7723-14-0</td>
<td>0 ~ 0.040% max</td>
<td>0.1 mg/ m³</td>
<td>0.01 mg/ m³</td>
</tr>
<tr>
<td>S (Sulfur)</td>
<td>7704-34-9</td>
<td>0 ~ 0.05% max</td>
<td>15 mg/m³ - Total dust (PNOR) ³</td>
<td>10 mg/m³ - Inhalable fraction (PNOS)</td>
</tr>
</tbody>
</table>

* All commercial steel products may contain small amounts of various elements in addition to those specified. These small quantities (less than 0.1%) may exist as intentional additions, or as “trace” or “residual” elements that generally originate in the raw materials used. These elements may include: aluminum, antimony, arsenic, boron, cadmium, calcium, cobalt, columbium, lead, molybdenum, tin, vanadium, and zirconium.

¹ OSHA Permissible Exposure Limits (PELs) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted. A (“C”) designation denotes a ceiling limit, which should not be exceeded during any part of the working exposure unless otherwise noted. A Short Term Exposure Limit (STEL) is defined as a 15-minute exposure, which should not be exceeded at any time during a workday.
² Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted.
³ PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the PNOR limit which is the same as the inert or nuisance dust limit of 15 mg/m³ for total dust and 5 mg/m³ for the respirable fraction.
⁴ Inhalable fraction. The concentration of inhalable particulate for the application of this TLV is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH TLVs and BEIs Appendix D, paragraph A.
⁵ PNOS (Particulates Not Otherwise Specified). Particulates identified under the PNOS heading are “nuisance dusts” containing no asbestos and <1% crystalline silica. A TWA-TLV of 10 mg/m³ for inhalable particulate and 3 mg/m³ for respirable particulate has been recommended.
⁶ Respirable fraction. The concentration of respirable dust for the application of this limit is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH TLVs and BEIs Appendix D, paragraph C.
⁷ NOS. Not otherwise specified.

Section 3 - Hazards Identification

Emergency Overview
This formed solid metal product poses little or no immediate health or fire hazard. When product is subjected to welding, burning, grinding, melting, sawing, brazing, or other similar machining activities, potentially hazardous airborne particulate and fumes may be generated and should be evaluated by an industrial hygienist. Avoid inhalation of metal dusts and fumes. Operations having the potential to generate airborne particulates should be performed in well ventilated areas and, if it is impossible, respiratory protection and other personal protective equipment should be used. The presence of nonmetallic coatings (for example, oils, paints, epoxies, laminates, etc.) on steel products should be considered when evaluating potential employee health hazards during handling, welding, grinding, sanding or other fume/dust generating activities.

Potential Health Effects

Primary Entry Routes: Inhalation. Steel products in the natural state do not present an inhalation, ingestion or contact hazard. However, operations such as burning, welding, sawing, brazing, machining and grinding may result in the following effects if exposures exceed recommended limits as listed in Section 2.

Target Organs: Respiratory system

Acute Effects:

. **Inhalation:** Excessive exposure to high concentrations of dust may cause irritation to the eyes, skin and mucous membranes of the upper respiratory tract. Excessive inhalation of fumes of freshly formed metal oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns from many metals can produce an acute reaction known as “metal fume fever”. Symptoms consist of chills and fever (very similar to and easily confused with flu symptoms), metallic taste in the mouth, dryness and irritation of the throat followed by weakness and muscle pain. The symptoms come on in a few hours after excessive exposures and usually last from 12 to 48 hours. Long-term effects from metal fume fever have not been noted. Freshly formed oxide fumes of manganese and copper have been associated with causing metal fume fever.

. **Eye:** Excessive exposure to high concentrations of dust may cause irritation to the eyes. Particles of iron or iron compounds, which become imbedded in the eye, may cause rust stains unless removed fairly promptly. Torching or burning operations on steel products with oil coatings may produce emissions that can be irritating to the eyes.

. **Skin:** Skin contact with dusts may cause irritation or sensitization, possibly leading to dermatitis. Repeated or prolonged contact with oil residue may cause skin irritation, dermatitis or allergic reactions in sensitized individuals.

. **Ingestion:** Ingestion of harmful amounts of this product as distributed is unlikely due to its solid insoluble form. Ingestion of dust may cause nausea or vomiting.

Chronic Effects:

Presented below are the potential health effects that have been identified for the ingredients listed that are of industrial hygiene significance.

. **IRON OXIDE:** Chronic inhalation of excessive concentrations of iron oxide fumes or dusts may result in the development of a benign lung conditions known as pneumoconiosis, called siderosis, which is observable as an X-ray change. But, no physical impairment of lung function has been associated with siderosis.

. **CARBON:** Chronic inhalation of high concentrations to carbon may cause pulmonary disorders.

. **CHROMIUM:** The health hazards associated with exposure to chromium are dependent upon its oxidation state. The metal form (chromium as it exists in this product) is of relatively low toxicity. Long term excessive inhalation of ferrochromium dusts and fumes may cause lung changes in exposed workers. Exposure to chromium metal does not give rise to pulmonary fibrosis or pneumoconiosis. The hexavalent form (Cr\(^{+6}\)), unlike chromium metal is very toxic. Repeated or prolonged exposure to hexavalent chromium compounds may cause respiratory irritation, nosebleed, ulceration and perforation of the nasal septum. Industrial exposure to certain forms of hexavalent chromium has been related to an increased incidence of respiratory cancer.

. **COPPER:** Chronic exposure to copper dusts may result in runny nose, irritation of mucous membranes, and atrophic changes with resultant dementia. Chronic inhalation of copper dust has caused, in animals, hemolysis of the red blood cells, deposition of hemofuscin in the liver and pancreas, injury to lung cells and
gastrointestinal symptoms.

- **MANGANESE**: Manganese dust and fume can act as minor irritants to the eyes and respiratory tract. Excessive inhalation exposure to manganese fume may result in a flu-like illness termed metal fume fever. Chronic exposure to high concentrations of manganese fumes and dusts may adversely affect the central nervous system (CNS) with symptoms including languor, sleepiness, weakness, emotional disturbances, spastic gait, mask-like facial expression and paralysis. Animal studies indicate that manganese exposure may increase susceptibility to bacterial and viral infections.

- **NICKEL**: Exposure to nickel dusts and fumes can cause allergic dermatitis, respiratory irritation, asthma, pulmonary fibrosis, eye irritant, edema and may cause nasal or lung cancer in humans. Respiratory cancer risks primarily relate to chronic exposure to soluble nicks at concentrations in excess of 1 mg Ni/m³ and exposure to the less soluble forms at concentrations greater than 10 mg Ni/m³. Metallic nickel does not appear to pose such a threat.

- **PHOSPHOROUS**: Inhalation of dusts and fumes of ferrophosphorus and phosphorous oxides may cause respiratory irritation.

- **SILICON**: Silicon dusts are a low health risk by inhalation and should be treated as a nuisance dust.

- **SULFUR**: Sulfur compounds, present in the fumes, may irritate the skin, eyes, lungs and gastrointestinal tract. Long-term inhalation exposure to high concentrations (over-exposure) to pneumoconiotic agents may act synergistically with inhalation of oxides, fumes or dusts of this product to cause toxic effects.

- **TITANIUM**: There is no evidence of a health hazard from inhalation of titanium dioxide at airborne concentrations below 10 mg/m³. The toxicity of titanium dioxide has been found to be relatively inert.

**Carcinogenicity**: The International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), and OSHA do not list steel products as carcinogens. IARC identifies nickel compounds as Group 1 (sufficient evidence for carcinogenicity in humans) and metallic nickel as Group 2B (possibly carcinogenic for humans). NTP lists nickel as Group 2 (reasonably anticipated to be a human carcinogen). The American Conference of Governmental Industrial Hygienists (ACGIH) lists insoluble nickel compounds as A1 (confirmed human carcinogen) and elemental/metallic nickel as A5 (not suspected as a human carcinogen). IARC lists chromium metal and trivalent chromium compounds as Group 3 (not classifiable as to their human carcinogenicity). ACGIH lists chromium metal and trivalent compounds as A4 (not classifiable as a human carcinogen). IARC identifies welding fumes as a Group 2B carcinogen, a mixture that is possibly carcinogenic to humans.

**Medical Conditions Aggravated by Long-Term Exposure**: Individuals with chronic respiratory disorders (i.e., asthma, chronic bronchitis, emphysema, etc.) may be adversely affected by any fume or airborne particulate matter exposure.

**Section 4 - First Aid Measures**

**Inhalation**: For over-exposure to airborne fumes and particulate, remove exposed person to fresh air. If breathing is difficult or has stopped, administer artificial respiration or oxygen as indicated. Seek medical attention promptly. Metal fume fever may be treated by bed rest, and administering a pain and fever reducing medication.

**Eye Contact**: Treat for foreign body in the eye. Flush with large amounts of clean water to remove particles. Seek medical attention if irritation persists.

**Skin Contact**: Not anticipated to pose a significant skin hazard. However, should dermatitis develop, wash affected area thoroughly with mild soap and water. If irritation or other symptoms develop, seek medical attention. Remove contaminated clothing. If thermal burn has occurred, flush area with cold water and seek medical attention. If mechanical abrasion has occurred, seek medical attention.

**Ingestion**: Not considered an ingestion hazard.

**Section 5 - Fire-Fighting Measures**

Steel products do not present fire or explosion hazards under normal conditions. But, molten metal may react violently with water. High concentrations of metallic fines in the air may present an explosion hazard. Fire
fighters are to wear full protective equipment, including full bunker gear and SCBA respiratory protection.

<table>
<thead>
<tr>
<th>Flash Point</th>
<th>Not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEL</td>
<td>Not applicable</td>
</tr>
<tr>
<td>UEL</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flash Point Method</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability Classification</td>
<td>Non-flammable, non-combustible</td>
</tr>
<tr>
<td>Unusual Fire or Explosion Hazards</td>
<td>Not applicable for solid product. Do not use water on molten metal.</td>
</tr>
<tr>
<td>Hazardous Combustion Products</td>
<td>At temperatures above the melting point, fumes containing metal oxides and other alloying elements may be liberated.</td>
</tr>
</tbody>
</table>

Section 6 - Accidental Release Measures

Any excess product can be recycled for further use, disposed in an appropriately permitted waste landfill, or disposed by other methods in accordance with local, state, and federal regulations. Finely divided, dry particles should be removed by vacuuming or wet sweeping to prevent spreading dusts. Avoid using compressed air.

Spill/Leak Procedures: Not applicable to steel in solid state. For spills involving finely divided particles, clean-up personnel should be protected against contact with eyes and skin. If material is in a dry state, avoid inhalation of dust. Fine, dry material should be removed by vacuuming or wet sweeping methods to prevent spreading of dust. Avoid using compressed air. Do not release into sewers or waterways. Collect material in appropriate, labeled containers for recovery or disposal in accordance with federal, state, and local regulations.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120) and all other pertinent state and federal requirements.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 7 - Handling and Storage

Handling Precautions: Operations with the potential for generating high concentrations of airborne particulates should be evaluated and controlled as necessary. Practice good housekeeping. Avoid breathing metal fumes and/or dust.

Storage Requirements: Store away from acids and incompatible materials.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use controls as appropriate to minimize exposure to metal fumes and dusts during handling operations. Use lifting and work devices, e.g., crane, hoist, etc., within rated capacities and in accordance with manufacturer’s instructions when handling these products.

1. avoid breathing dust and fume
2. evaluate potential employee exposure
3. minimize generation of airborne emissions
4. maintain surfaces free as practical of accumulated material
5. use protective clothing as specified by an industrial hygienist or safety professional where exposure levels may be excessive
6. do not smoke in work area
7. wash hands before eating, drinking or smoking and after handling,
8. change contaminated clothing before leaving work premises.

Ventilation: Provide general or local exhaust ventilation systems to minimize airborne concentrations. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling
Administrative Controls: Do not use compressed air to clean-up spills.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen.

Skin and eye protection: For operations which result in elevating the temperature of the product to or above its melting point or result in the generation of airborne particulates, use protective clothing, gloves and safety glasses to prevent skin and eye contact. Contact lenses should not be worn where industrial exposures to this material are likely. Use safety glasses or goggles as required for welding, burning, sawing, brazing, grinding or machining operations. Protective gloves should be worn as required for welding, burning or handling operations.

Section 9 - Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Physical State</th>
<th>Solid</th>
<th>Water Solubility</th>
<th>Insoluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance and Odor</td>
<td>Metallic Bright, grey Blue Odorless</td>
<td>Boiling Point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>Not applicable</td>
<td>Evaporation Rate</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vapor Density (Air=1)</td>
<td>Not applicable</td>
<td>Freezing/Melting Point</td>
<td>~2750 °F</td>
</tr>
<tr>
<td>Specific Gravity (H₂O=1, at 4 °C)</td>
<td>7.85</td>
<td>pH</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Section 10 - Stability and Reactivity

Stability: Steel products are stable under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Will react with strong acids to form hydrogen. Iron oxide dusts in contact with calcium hypochlorite evolve oxygen and may cause an explosion.

Conditions to Avoid: Storage with strong acids or calcium hypochlorite.

Hazardous Decomposition Products: Thermal oxidative decomposition of steel products can produce fumes containing oxides of iron and manganese as well as other alloying elements.

Section 11 - Toxicological Information

No information is available for the product as a mixture.

Eye Effects: Eye contact with the individual components may cause particulate irritation. Implantation of iron particles in guinea pig corneas has resulted in rust rings with corneal softening about rust ring.

Skin Effects: Skin contact with the individual dust components may cause physical abrasion, irritation, dermatitis, and sensitization.

Acute Inhalation Effects: Inhalation of the individual alloy components has been shown to cause various respiratory effects.

Acute Oral Effects: No data available

Other: No LC50 or LD50 has been established for the mixture as a whole.


Chronic Effects, Carcinogenicity: See Section 3. Mutagenicity, Teratogenicity: No data available
Section 12 - Ecological Information

Steel products in their usual form do not pose an ecological hazard.

**Ecotoxicity:** No data available for the product as a whole. However, individual components of the product have been found to be toxic to the environment. Metal dusts may migrate into soil and groundwater and be ingested by wildlife.

**Environmental Fate:** No data available.

**Environmental Degradation:** No data available.

**Soil Absorption/Mobility:** No data available for the product as a whole. However, individual components of the product have been found to be absorbed by plants from soil.

Section 13 - Disposal Considerations

Any excess product can be recycled for further use, disposed in an appropriately permitted waste landfill, or disposed by other methods in accordance with local, state, and federal regulations.

**Disposal:** Steel scrap should be recycled whenever possible. Product dusts and fumes from processing operations should also be recycled, or classified by a competent environmental professional and disposed of in accordance with applicable federal, state or local regulations.

**Container Cleaning and Disposal:** Follow applicable Federal, state and local regulations. Observe safe handling precautions.

Section 14 - Transport Information

Not a hazardous material for DOT shipping.

Section 15 - Regulatory Information

**Regulatory Information:** The following listing of regulations relating to a product may not be complete and should not be solely relied upon for all regulatory compliance responsibilities. This product and/or its constituents are subject to the following regulations. And those followings are described (listed) by counting of first importance to USA.

**OSHA Regulations:**
Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A): The product as a whole is not listed. However, individual components of the product are listed.

**EPA Regulations:**
- **RCRA** (40 CFR 261): Steel scrap is not regulated as a solid waste or a hazardous waste under this act. If product dusts and/or fumes from processing operations are not recycled, they are considered to be a solid waste and may be classified as a hazardous waste depending on the toxicity characteristics of the dust as defined within 40 CFR 261.24.
- **CERCLA** Hazardous Substance (40 CFR 302.4): The product as a whole is not listed. However, individual components of the product are listed: Copper (Reportable Quantity (RQ)-5000#). Manganese compounds are also listed although no reportable quantity is assigned to this generic or broad class.
- **SARA** 311/312 Codes (40 CFR 372.65): Manganese is subject to SARA 313 reporting requirements. Please note that if you prepackage or redistribute this product to industrial customers, SARA 313 requires that a notice be sent to those customers.

**State Regulations in USA:** The product as a whole is not listed in any state regulations. However, individual components of the product are listed in various state regulations.

- **Pennsylvania Right to Know:** Contains regulated material in the following categories:
  - Hazardous Substances: Calcium, Silicon and Sulfur.
  - Environmental Hazards: Aluminum, Copper and Manganese.

- **New Jersey Right to Know:** Contains regulated material in the following categories:
  - Hazardous Substance: Aluminum (dust and fume), Copper, Manganese and Sulfur.
. Special Health Hazard Substances: Calcium.
California Prop. 65: The product may possibly contain trace quantities (generally much less than 0.1%) of metallic elements known to the State of California to cause cancer or reproductive toxicity. These include arsenic (inorganic), cadmium, lead and nickel.

Other Regulations: The product as a whole is not listed in any state regulations. However, individual components of the product are listed in various state regulations.

Section 16 - Other Information

Prepared By:

Disclaimer: All information, recommendations, and suggestions appearing herein concerning this product are taken from sources or based upon data believed to be reliable. Although reasonable care has been taken in the preparation of this information, EXTENDS NO WARRANTIES OR GUARANTEES, EXPRESS OR IMPLIED, MAKES NO REPRESENTATIONS, AND ASSUMES NO RESPONSIBILITY AS TO THE ACCURACY, RELIABILITY OR COMPLETENESS OF THE INFORMATION PRESENTED. Since the actual use of the product described herein is beyond our control, assumes no liability arising out of the use of the product by others. It is the user’s responsibility to determine the suitability of the information presented herein, to assess the safety and toxicity of the product under their own conditions of use, and to comply with all applicable laws and regulations. Appropriate warnings and safe handling procedures should be provided to handlers and users.