SGI

QUALITY ENDORSED COMPANY
ISO9002

SAFETY DATA SHEET (SDS)

Executive Summary

- Safety should always be the number one priority when handling grinding media.
- Grinding media can be very dangerous, both before and after deployment into the mill(s).
- It is important to take action and prevent any unnecessary injury if at all possible.
- This SDS sheet has been split up into two (2) sections: **Primary Safety Issues** and **Secondary Safety Issues**.
- While there are potentially hazardous elements within a single Forged Steel Ball, the primary danger lies after the grinding media has been removed from the mill(s).
- It is highly important that you are aware of these potentially fatal reactions, and what you can do to prevent or minimalize risk when handling grinding media.
- It is recommended that a full review of both sections of this SDS sheet are understood before any further handling of new and used grinding media.
- The issues of cast grinding media are similar to the same elements that occur with forged grinding media.

ALL OF THE ABOVE COMMENTS HAVE BEEN CAREFULLY CONSIDERED. THE DANGER OF INJURY EXISTS. THIS IS AN ONGOING SDS, AND SGI INVITES ANY FURTHER SUGGESTIONS OF HOW THIS DOCUMENT CAN BE IMPROVED. ANY ADJUSTMENTS MADE WILL SUPERCEDE THE ISSUE DATE OF JULY 2015.

SITE-SPECIFIC SDS DOCUMENTS ARE AVAILABLE ON REQUEST AND SITE INSPECTION

ALLOY STEEL GRINDING MEDIA

PRIMARY SAFETY ISSUES

STORAGE AND CARE

1. **Introduction:** This MSDS is issued in regards to new grinding media and used mill media (rejects) storage and handling. It is to clearly state the dangers of steel shattering of used media due to stress buildup in the steel. This shattering in some cases can release large amounts of energy resulting in "fly shards".

2. **New (unused) media:** Storage of unused media has only two issues to consider: The clear safety of materials handling and ensuring that the balls are kept at an ambient temperature prior to loading into mills. Using various scoop or magnet loading of kibbles with care is vital to keeping employees safe; keeping them at a safe distance reduces the possibility of an individual being struck by grinding media. Temperatures above 50c (122°F) or below -40c (-40°F) may affect the heat treatment memory instilled in the product which could reduce product efficiency and increase stress when introduced into the mill. Inside and undercover storage is highly encourages.

3. **Used (reject) media for disposal or reuse:** Care is taken by the manufacturers to remove residual stress through the heat treatment process of a grinding ball. It is not always the case that media is delivered in this fully stress relieved condition. In such cases, high ball on ball incidents and excessive grindout operational procedures will cause breakage. High temperature variation will increase this risk substantially in used media.

4. **Handling and storage of used media:** Used media is always potentially volatile, and should be handled as if they are volatile at every instance (these reject pieces can remain dangerous for many months after they have been removed from the mill). Storage of this material should be covered to prevent the exposure of fly shards to employees in the workplace. When dealing with this material, PPE consisting of hand and eye protection must be worn at all times. When first opening a mill, especially after any grindout procedure, wait for any evidence of "popping ball charge". If this is experienced: Helmet, full face protection, and long sleeves and pants should be worn. The application of blasting mats placed over the charge for containment of fly steel is highly recommended.

5. **DO NOT:**
    a. Hold samples without secure containment.
    b. Allow samples out of your containment area.
    c. Handle without the necessary PPE.
6. **DO:**
    a. Assume that all samples are volatile.
    b. Advise your scrap metal collector of this MSDS.
    c. Avoid high risk activities such as extended grind outs, placing warm rejects in cold locations, and ensure all personnel are aware of the required PPE.

SUITABLE SIGNAGE FOR STORAGE OF REJECT STEEL (USED) GRINDING MEDIA

Sino Grinding (Americas) Inc. Safety Data Sheet

Secondary Safety Issues

1. Identification

a. **Product identifier used on table:** Forged steel balls.*

b. **Other means of identification:** Grinding media, grinding balls, mill balls.

c. **Recommended use of the chemical and restriction on use:** These products are supplies to all steel-consuming industries including Semi-autogenous (SAG) mills and Ball mills. The main market for these products is processing plants for mineral/metal extraction.

d. **Name, address, and telephone number:**

Sino Grinding (Americas) Inc.
PO Box 754
Gilbert, AZ 85299

Phone Number: (480) 886-1557
Email: chan@sinogrinding.com

e. **Emergency phone number: (480) 886-1557 (24/7)**

*This SDS is also available to alloy cast media, both high & low chrome.

2. Hazard(s) Identification

a. **Classification of the chemical**: Forged Steel Balls is considered an article under Reach regulation (REACH REGULATION (EC) No 1907/2006) and is not subject to classification under CLP regulation (REGULATION (EC) No 1272/2008). However, forged steel balls are not exempt as an article under OSHA's Hazard Communication Standard (29 CFR 1910.1200) due to its downstream use, thus this product is considered a mixture and a hazardous material. Therefore, the categories of Health Hazards as defined in "GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS (GHS), Third revised edition ST/SG/AC.10/30/Rev. 3" United Nations, New York and Geneva, 2009 have been evaluated. Refer to Section 3, 8 and 11 for additional information.

b. **Signal word, hazard statement(s), symbol(s) and precautionary statement(s)**:

Hazard Symbol	Hazard Classification	Signal Word	Hazard Statement(s)
	Carcinogenicity – 2 Reproductive Toxicity – 2 Single Target Organ Toxicity (STOT) Repeat Exposure – 1	**Danger**	Suspected of causing cancer. Suspected of damaging fertility or the unborn child. Causes damage to lungs and central nervous system through prolonged or repeated inhalation exposure.
	Skin Sensitization – 1 STOT Single Exposure – 3		May cause and allergic skin reaction. Causes eye irritation.
NA	Eye Irritation – 2B		

Precautionary Statements:

Prevention	Response	Storage/Disposal
Do not breathe dusts / fume / gas / mist / vapor / spray. Wear protective gloves / protective clothing / eye protection /face protection. Contaminated work clothing must not be allowed out of the workplace. Use only outdoors or in well ventilated areas. Wash thoroughly after handling. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not eat, drink or smoke when using this product.	If inhaled: Remove person to fresh air and keep comfortable for breathing. If exposed, concerned or feel unwell: Get medical advice/attention. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue Rinsing. If on skin: Wash with plenty of water. If irritation or rash occurs: Get medical advice/attention. Take off and wash contaminated clothing before reuse. Call a poison center/doctor if you feel unwell.	Dispose of contents in accordance with federal, state and local regulations.

c. **Describe any hazards not otherwise classified:** None known.

d. **Unknown acute toxicity statement (mixture):** None known.

3. Composition/Information on Ingredients

a-c. **Chemical Name, common name, CAS number and other identifiers, and concentration:**

Chemical Name	CAS Number	EC Number	Composition (subject to grade)
Carbon	7440-44-0	231-153-3	0.70-0.90
Manganese	7439-96-5	211-334-3	0.30-1.00
Nickel	7440-02-0	231-743-0	0.10-0.30
Chromium	7440-47-3	231-157-5	0.50-1.00
Molybdenum	7439-98-7	215-204-7	0.05-0.15
Silicon	7440-21-3	238-878-4	≤0.35
Vanadium	7440-62-2	215-239-8	≤0.35

EC - European Community
CAS - Chemical Abstract Service

Commercial steel products contain small amounts of various elements in addition to those listed. These small quantities are frequently referred to as “trace” or “residual” elements that generally originate in the raw materials used. Steel products may contain the following trace or residual elements including typical percentages for the elements identified: Chromium (1.0*), silicon (≤0.35max), molybdenum (≤ 0.15max), vanadium (0.35 max), carbon (0.9max), manganese (1.0max), and nickel (0.3max).
Percentages are expressed as typical ranges or maximum concentrations of trace elements for the purpose of communicating the potential hazards of the finished product.

*Chromium in forged media has the typical levels of about 1.0%. Cast media may vary greatly at times exceeding 30%.

4. First-aid Measures

a. **Description of necessary measure:**

- **Inhalation:** forged steel balls as sold/shipped are not a likely form of exposure. However, during further processing (welding, grinding, burning, etc.), if inhaled: Remove person to fresh air and keep comfortable for breathing. If exposed, concerned or feel unwell: Get medical advice/attention.
- **Eye contact:** Forged steel balls as sold/shipped are not a likely form of exposure. However, during further processing (welding, grinding, burning, etc.), if in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue Rinsing. If eye irritation persists: Get medical advice attention. If exposed, concerned or feel unwell: Get medical advice/attention (REFER TO PRIMARY HAZARDS PAGE).

- **Skin Contact:** If on skin: Wash thoroughly after handling. Wash with plenty of water. If irritation or rash occurs: Get medical advice/attention. Take off and wash contaminated clothing before reuse. If exposed, concerned or feel unwell: Get medical advice/attention (REFER TO PRIMARY HAZARDS PAGE).
- **Ingestion:** Forged steel balls as sold/shipped are not a likely form of exposure. However, during further processing (welding, grinding, burning, etc.), if exposed, concerned or feel unwell: Get medical advice/attention.

b. **Most important symptoms/effects, acute and delayed (chronic):**
   - **Inhalation:** Forged steel balls as sold/shipped are not likely to present an acute or chronic health effect.
   - **Eye:** Forged steel balls as sold/shipped are not likely to present an acute or chronic health effect.
   - **Skin:** Forged steel balls as sold/shipped are not likely to present an acute or chronic health effect.
   - **Ingestion:** Forged steel balls as sold/shipped are not likely to present an acute or chronic health effect. However, during further processing (welding, grinding, burning, etc.) individual components may illicit an acute or chronic health effect. Refer to Section 11-Toxicological Information.

c. **Immediate Medical Attention and Special Treatment:** None known.

5. Fire-fighting measures

a. **Suitable (and unsuitable) Extinguishing Media:** Not Applicable for Forged Steel Balls as sold/shipped. Use extinguishers appropriate for surrounding materials.

b. **Specific Hazards arising from the chemical:** Not Applicable for Forged Steel Balls as sold/shipped. When burned, toxic smoke, fume and vapor may be emitted.

c. **Special protective equipment and precautions for fire-fighters:** Self-contained NIOSH approved respiratory protection and full protective clothing should be worn when fumes and/or smoke from fire are present. Heat and flames cause emittance of acrid smoke and fumes. Do not release runoff from fire control methods to sewers or waterways. Firefighters should wear full face-piece self-contained breathing apparatus and chemical protective clothing with thermal protection. Direct water stream will scatter and spread flames and, therefore, should not be used.

6. Accidental Release Measures

a. **Personal Precautions, Protective Equipment and Emergency Procedures:** Not Applicable for Forged Steel Balls as sold/shipped. 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.

b. **Methods and materials for containment and clean up:** Not Applicable for Forged Steel Balls as sold/shipped. Collect material in appropriate, labeled containers for recovery or disposal in accordance with federal, state, and local regulations. Follow applicable OSHA regulations (29 CFR 1910.120) and all other pertinent state and federal requirements.

7. Handling and Storage (REFER TO PRIMARY HAZARDS PAGE)

a. **Precautions for safe handling:** Not Applicable for Forged Steel Balls as sold/shipped, however further processing (welding, burning, grinding, etc.) with the potential for generating high concentrations of airborne particulates should be evaluated and controlled as necessary. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use only outdoors or in well ventilated areas. Practice good housekeeping. Avoid breathing metal fumes and/or dust. Do not eat, drink

or smoke when using this product. Cut resistant gloves and sleeves should be worn when working with steel products.

b. **Conditions for safe storage, including any incompatibilities:** Store away from acids and incompatible materials.

8. Exposure Controls / Personal Protection

a. **Occupational Exposure Limits (OELs):** Forged Steel Balls as sold/shipped in its physical form does not present an inhalation, ingestion or contact hazard, nor would any of the following exposure data apply. However, operations such as burning, welding (high temperature), sawing, brazing, machining, grinding, etc. may produce fumes and/or particulates. The following exposure limits are offered as reference for an experienced industrial hygienist to review.

Ingredients	OSHA PEL	ACGIH TLV	NIOSH REL	IDLH
Carbon	15 mg/m³	10 mg/m³	NE	NE
Manganese	5 mg/m³	0.2 mg/m³	5 mg/m³	500 mg Mn/m³
Nickel	1 mg/m³	1.5 mg/m³	0.015 mg/m³	10 mg/m³
Chromium	2.5 µg/m³	0.05 mg/m³	0.0002 mg/m³	NE
Molybdenum	15 mg/m³	10 mg/m³	NE	5000 mg/m³
Silicon	15 mg/m³	10 mg/m³	NE	7 mg/m³
Vanadium	0.1 mg/m³	0.05 mg/m³	0.05 mg/m³	35 mg/m³

NE - None Established

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 Peak is defined as the acceptable maximum peak for a maximum duration above the ceiling concentration for an eight-hour shift. A skin notation refers to the potential significant contribution to the overall exposure by the cutaneous route, either by contact with vapors or, of probable greater significance, by direct skin contact with the substance. A Short Term Exposure Limit (STEL) is defined as a 15-minute exposure, which should not be exceeded at any time during a workday. An Action level (AL) is used by OSHA and NIOSH to express a health or physical hazard. They indicate the level of a harmful or toxic substance/activity, which requires medical surveillance, increased industrial hygiene monitoring, or biological monitoring. Action Levels are generally set at one half of the PEL but the actual level may vary from standard to standard. The intent is to identify a level at which the vast majority of randomly sampled exposures will be below the PEL.
2. Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted. A Short Term Exposure Limit (STEL) is defined as the maximum concentration to which workers can be exposed for a short period of time (15 minutes) for only four times throughout the day with at least one hour between exposures. A “skin” notation refers to the potential significant contribution to the overall exposure by the cutaneous route, either by contact with vapors or, of probable greater significance, by direct skin contact with the substance. ACGIH-TLVs are only recommended guidelines based upon consensus agreement of the membership of the ACGIH. As such, the ACGIH TLVs are for guideline use purposes and are not legal regulatory standards for compliance purposes. The TLVs are designed for use by individuals trained in the discipline of industrial hygiene relative to the evaluation of exposure to various chemical or biological substances and physical agents that may be found in the workplace.
3. The National Institute for Occupational Safety and Health Recommended Exposure Limits (NIOSH-REL)- Compendium of Policy and Statements. NIOSH, Cincinnati, OH (1992). NIOSH is the federal agency designated to conduct research relative to occupational safety and health. As is the case with ACGIH TLVs, NIOSH RELs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
4. The "immediately dangerous to life or health air concentration values (IDLHs)" are used by NIOSH as part of the respirator selection criteria and were first developed in the mid-1970's by NIOSH. The Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs) is a compilation of the rationale and sources of information used by NIOSH during the original determination of 387 IDLHs and their subsequent review and revision in 1994.

5. PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by a 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.
6. 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 2014 TLVs ® and BEIs ® (Biological Exposure Indices) Appendix D, paragraph A.
7. PNOS (Particulates Not Otherwise Specified). Particulates identified under the PNOS heading are "nuisance dusts" containing no asbestos and <1% crystalline silica.
8. 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 ACGIH 2014 TLVs ® and BEIs ® Appendix D, paragraph C.

b. Appropriate Engineering Controls: Use controls as appropriate to minimize exposure to metal fumes and dusts during handling operations. Provide general or local exhaust ventilation systems to minimize airborne concentrations. Local exhaust is necessary for use in enclosed or confined spaces. Provide sufficient general/local exhaust ventilation in pattern/volume to control inhalation exposures below current exposure limits.

c. Individual Protection Measures (REFER TO PRIMARY HAZRADS PAGE):

- **Respiratory Protection:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, use only 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. Concentration in air of the various contaminants determines the extent of respiratory protection needed. Half-face, negative-pressure, air-purifying respirator equipped with P100 filter is acceptable for concentrations up to 10 times the exposure limit. Full-face, negative-pressure, air-purifying respirator equipped with P100 filter is acceptable for concentrations up to 50 times the exposure limit. Protection by air-purifying negative pressure and powered air respirators is limited. Use a positive-pressure-demand, full-face, supplied air respirator or self-contained breathing apparatus (SCBA) for concentrations above 50 times the exposure limit. If exposure is above the IDLH (Immediately dangerous to life or health) for any of the constituents, or there is a possibility of an uncontrolled release or exposure levels are unknown, then use positive demand, full-face, supplied air respirator with escape bottle or SCBA. **WARNING**: Air-purifying respirators both negative-pressure, and powered-air do not protect workers in oxygen-deficient atmospheres.
- **Eyes:** Wear appropriate eye protection to prevent eye contact. 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 safety glasses to prevent 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.
- **Skin:** Wear appropriate personal protective clothing to prevent skin contact. Cut resistant gloves and sleeves should be worn when working with steel products. 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, and gloves to prevent skin contact. Protective gloves should be worn as required for welding, burning or handling operations. Contaminated work clothing must not be allowed out of the workplace.
- **Other protective equipment:** An eyewash fountain and deluge shower should be readily available in the work area.

9. Physical and Chemical Properties

a. **Appearance:** Solid, Metallic Gray
b. **Odor:** Odorless
c. **Odor Threshold:** N/A
d. **pH:** N/A
e. **Melting Point/Freezing Point:** ~2750 °F (~1510 C)
f. **Initial Boiling Point and Boiling Range:** N/D
g. **Flash Point:** N/A
h. **Evaporation Rate:** N/A
i. **Flammability:** Non-flammable, non-combustible.
j. **Upper/lower Flammability or Explosive Limits:** N/A
k. **Vapor Pressure:** N/A
l. **Vapor Density:** N/A
m. **Relative Density:** 7.85 metric tonne per m^3
n. **Solubility(ies):** Water Insoluble
o. **Partition Coefficient n-octanol/water:** N/D
p. **Auto-ignition Temperature:** N/A
q. **Decomposition Temperature:** N/D
r. **Viscosity:** N/A

NA= Not applicable
ND= Not determined

10. Stability and Reactivity

a. **Reactivity:** Not Determined (ND) for product in a solid form. Do not use water on molten metal.
b. **Chemical Stability:** Steel products are stable under normal storage and handling conditions.
c. **Possibility of hazardous reaction:** None known.
d. **Conditions to avoid:** Storage with strong acids or calcium hypochlorite.
e. **Incompatible Materials:** Will react with strong acids to form hydrogen. Iron oxide dusts in contact with calcium hypochlorite evolve oxygen and may cause an explosion.
f. **Hazardous Decomposition Products:** Thermal oxidative decomposition of steel products can produce fumes containing oxides of iron and manganese as well as other alloying elements.
g. **Stress (Internal) Buildup:** Refer to primary hazards page.

11. Toxicological Information

Information on toxicological effects: The following toxicity data has been determined for Forged Steel Balls when further processed using the information available for its components applied to the guidance on the preparation of an SDS under the GHS requirements of OSHA
and the EU CPL:

Hazard Classification	Hazard Catagory		Hazard Symbols	Signal Word	Hazard Statement
	EU	OSHA			
Eye damage/irritation (covers categories 1, 2A,and 2B)	NA*	2B[c]	No pictogram	Warning	Causes eye irritation – rating due to iron particulate generated from further processing (welding, grinding, burning, etc.).
Skin/dermal sensitization (cover category 1)	NA*	1d		Warning	May cause an allergic skin reaction – Nickel is a skin sensitizer.
Carciogenicity (covers categories 1A, 1B and 2)	NA*	2g		Warning	Suspected of causing cancer.- Rating due to nickel particulate or fume that can enter the body generated when further processed (welding, grinding, burning, etc.)
Toxic reproduction (covers categories 1A, 1B and 2)	NA*	2h		Warning	Suspected of damaging fertility of the unborn child.- Rating due to nickel particulate or fume that can enter the body generated when further processed (welding, grinding, burning, etc.)
Specific target organ toxicity (STOT) following single exposure (covers categories 1-3)	NA*	3i		Warning	May cause respiratory irritation.- Rating due to iron particulate or fume that can enter the body generated when further processed (welding, grinding, burning, etc.)
STOT following repeated exposure (covers categories 1 and 2)	NA*	1j		Danger	Causes damage to lungs and central nervous system through prolonged or repeated inhalation exposure.- Rating due to nickel or manganese particulate or fume that can enter the body generated when further processed (welding, grinding, burning, etc.)
Stress buildup following mill application	NA*	*		Warning	High ball on ball incidents and excessive grindout operational procedures will cause breakage. High temperature variation will increase this risk substantially in used media. Ball on ball impact creates stress that can release in used media many months after removal from mill (See primary hazards page).

* Not applicable – semi-formed steel products are considered articles under Reach regulation (REACH REGULATION (EC) No 1907/2006) and are not subject to classification under CLP regulation (REGULATION (EC) No 1272/2008).

Toxicological data listed below are presented regardless to classification criteria. Individual hazard classification categories where toxicological information has met or exceeded a classification criteria threshold are listed above.

a. No LC_{50} or LD_{50} has been established for Forged Steel Balls.
b. No Skin (Dermal) Irritation data available for Forged Steel Balls a mixture or its components.
c. No Eye Irritation data available for Forged Steel Balls as a mixture. The following Eye Irritation information was found for the components:
    - **Nickel:** Slight eye irritation from particulate abrasion only.
d. No Skin (Dermal) Sensitization data available for Forged Steel Balls as a mixture. The following Skin (Dermal) Sensitization information was found for the components:
    - **Nickel:** May cause allergic skin sensitization.

e. No Respiratory Sensitization data available for Forged Steel Balls as a mixture or its components.
f. No Germ Cell Mutagenicity data available for Forged Steel Balls as a mixture. The following Mutagenicity and Genotoxicity information was found for the components:
    - **Nickel:** EU RAR has found positive results in vitro and in vivo but insufficient data for classification.
g. Carcinogenicity: IARC, NTP, and OSHA do not list Forged Steel Balls as carcinogens. The following Carcinogenicity information was found for the components:
    - **Welding Fumes** - IARC Group 2B carcinogen, a mixture that is possibly carcinogenic to humans.
    - **Nickel and certain nickel compounds** – Group 2B - metallic nickel Group 1 - nickel compounds ACGIH confirmed human carcinogen. Nickel – EURAR Insufficient evidence to conclude carcinogenic potential in animals or humans; suspect carcinogen classification Category 2 Suspected of causing cancer.
h. No Toxic Reproduction data available for Forged Steel Balls as a mixture. The following Toxic Reproductive information was found for the components:
    - **Nickel:** Effects on fertility.
i. No Specific Target Organ Toxicity (STOT) following a Single Exposure data available for Forged Steel Balls as a mixture.
j. No Specific Target Organ Toxicity (STOT) following Repeated Exposure data was available for Forged Steel Balls as a whole. The following STOT following Repeated Exposure data was found for the components:
    - **Nickel:** Rat 4 wk inhalation LOEL 4 mg/m3 Lung and Lymph node histopathology. Rat 2 yr inhalation LOEL 0.1 mg/ m3 Pigment in kidney, effects on hematopoiesis spleen and bone marrow and adrenal tumor. Rat 13 Week Inhalation LOAEC 1.0 mg/m3 Lung weights, and Alveolar histopathology.
    - **Manganese:** Inhalation of metal fumes - Degenerative changes in human Brain; Behavioral: Changes in motor activity and muscle weakness (Whitlock et al., 1966).

The above toxicity information was determined from available scientific sources to illustrate the prevailing posture of the scientific community. The scientific resources includes: The American Conference of Governmental Industrial Hygienist (ACGIH) Documentation of the Threshold Limit Values (TLVs) and Biological Exposure indices (BEIs) with Other Worldwide Occupational Exposure Values 2009, The International Agency for Research on Cancer (IARC), The National Toxicology Program (NTP) updated documentation, the World Health Organization (WHO) and other available resources, the International Uniform Chemical Information Database (IUCLID), European Union Risk Assessment Report (EU-RAR), Concise International Chemical Assessment Documents (CICAD), European Union Scientific Committee for Occupational Exposure Limits (EU-SCOEL), Agency for Toxic Substances and Disease Registry (ATSDR), Hazardous Substance Data Bank (HSDB), and International Programme on Chemical Safety (IPCS), European Union Classification, Labeling and Packaging. (EU CPL), Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), International Uniform Chemical Information Database (IUCLID), TOXicology Data NETwork (TOXNET), European Risk Assessment Reports (EU RAR).

The following health hazard information is provided regardless to classification criteria and is based on the individual component(s) and potential resultant components from further processing:

Acute Effects:

- **Inhalation:** Excessive exposure to high concentrations of metal 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 micrometer and usually between 0.02-0.05 micrometers 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 have been associated with causing metal fume fever.
- **Eye:** Excessive exposure to high concentrations of metal dust may cause irritation to the eyes.
- **Skin:** Skin contact with metal dusts may cause irritation or sensitization, possibly leading to dermatitis. Skin contact with metallic fumes and dusts may cause physical abrasion.
- **Ingestion:** Ingestion of harmful amounts of this product as distributed is unlikely due to its solid insoluble form. Ingestion of metal dust may cause nausea or vomiting.

Acute Effects by component:

- **Carbon:** Not Reported/ Not Classified
- **Manganese and manganese oxides:** Manganese and Manganese oxide are harmful if swallowed.
- **Nickel and nickel oxides:** Nickel may cause allergic skin sensitization. Nickel oxide may cause an allergic skin.

Delayed (chronic) Effects by component:

- **Carbon:** Chronic inhalation may lead to decreased pulmonary function.

- **Manganese and manganese oxides:** Chronic exposure to high concentrations of manganese fumes and dusts may adversely affect the central nervous system 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. Occupational overexposure (Manganese) is a progressive, disabling neurological syndrome that typically begins with relatively mild symptoms and evolves to include altered gait, fine tremor, and sometimes, psychiatric disturbances. May cause damage to lungs with repeated or prolonged exposure. Neurobehavioral alterations in worker populations exposed to manganese oxides include: speed and coordination of motor function are especially impaired.
- **Nickel and nickel oxides:** Exposure to nickel dusts and fumes can cause sensitization dermatitis, respiratory irritation, asthma, pulmonary fibrosis, edema, and may cause nasal or lung cancer in humans. Nickel causes damage to lungs through prolonged or repeated inhalation exposure. IARC lists nickel and certain nickel compounds as Group 2B carcinogens (sufficient animal data). ACGIH 2014 TLVs® and BEIs® lists insoluble nickel compounds as confirmed human carcinogens. Nickel is suspected of damaging the unborn child.

12. Ecological Information

a. **Ecotoxicity (aquatic & terrestrial):** No Data Available for Forged Steel Balls as sold/shipped. However, individual components of the product when processed have been found to be toxic to the environment. Metal dusts may migrate into soil and groundwater and be ingested by wildlife as follows:
   - **Iron Oxide:** LC50: >1000 mg/L; Fish 48 h-EC50 > 100 mg/L (Currenta, 2008k); 96 h-LC0 ≥ 50,000 mg/L Test substance: Bayferrox 130 red (95 – 97% Fe_2O_3; < 4% SiO_2 and Al_2O_3) (Bayer, 1989a).
   - **Nickel Oxide**: IUCLID found LC50 in fish, invertebrates and algae > 100 mg/l.

b. **Persistence & Degradability:** No Data Available for Forged Steel Balls as sold/shipped or individual components.

c. **Bioaccumulative Potential:** No Data Available for Forged Steel Balls as sold/shipped or individual components.

d. **Mobility (in soil):** No data available for Forged Steel Balls as sold/shipped. However, individual components of the product have been found to be absorbed by plants from soil.

e. **Other adverse effects:** None Known

13. Disposal Considerations

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. Copy of this SDS sheet must accompany pick up.

14. Transport Information (Refer to primary hazards page)

a. **US Department of Transportation (DOT)** under 49 CFR 172.101 does not regulate Forged Steel Balls as a hazardous material. All federal, state, and local laws and regulations that apply to the transport of this type of material must be adhered to.

Shipping Name: Not Applicable (NA) **Shipping Symbols:** NA **Hazard Class:** NA **UN No.:** NA **Packing Group:** NA **DOT/ IMO Label:** NA **Special Provisions (172.102):** NA	**Packaging Authorizations** **a) Exceptions:** NA **b) Group:** NA **c) Authorization:** NA	**Quantity Limitations** **a) Passenger, Aircraft, or Railcar:** NA **b) Cargo Aircraft Only:** NA **Vessel Stowage Requirements** **a) Vessel Stowage:** NA **b) Other:** NA **DOT Reportable Quantities:** NA

International Maritime Dangerous Goods (IMDG) and the Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID) classification, packaging and shipping requirements follow the US DOT Hazardous Materials Regulation.

Regulations Concerning the International Carriage of Dangerous Goods by Road (ADR) does not regulate Forged Steel Balls as a hazardous material.

Shipping Name: Not Applicable (NA) **Classification Code:** NA **UN No.:** NA **Packing Group:** NA **ADR Label:** NA **Special Provisions:** NA **Limited Quantities:** NA	**Packaging** **a) Packing Instructions:** NA **b) Special Packing Provisions:** NA **c) Mixed Packing Provisions:** NA	**Portable Tanks & Bulk Containers** **a) Instructions:** NA **b) Special Provisions:** NA

International Air Transport Association (IATA) does not regulate Forged Steel Balls as a hazardous material.

Shipping Name: Not Applicable (NA) **Class/Division:** NA **Hazard Label (s):** NA **UN No.:** NA **Packing Group:** NA **Excepted Quantities (EQ):** NA	**Passenger & Cargo Aircraft Limited Quantity (EQ)**		**Cargo Aircraft Only** **Pkg Inst:** NA **Max Net Qty/Pkg:** NA	**Special Provisions:** NA **ERG Code:** NA
	Pkg Inst: NA **Max Net Qty/Pkg:** NA	**Pkg Inst:** NA **Max Net Qty/Pkg:** NA		

Pkg Inst – Packing Instructions Max Net Qty/Pkg — Maximum Net Quantity per Package ERG — Emergency Response Drill Code

Transport Dangerous Goods (TDG) Classification: Forged Steel Balls does not have a TDG classification.

15. Regulatory Information

Regulatory Information: *The following listing of regulations relating to an ArcelorMittal 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:
OSHA Regulations: Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-2, Z-3): The product Forged Steel Balls as a whole is not listed. However, individual components of the product are listed: Refer to Section 8, Exposure Controls and Personal Protection.
EPA Regulations: The product, Forged Steel Balls is not listed as a whole. However, individual components of the product are listed:

Components	**Regulations**
Manganese	CAA, SARA 313, SDWA
Nickel	CAA, CERCLA, CWA, SARA 313

SARA 311/312 Potential Hazard Categories: Immediate Acute Health Hazard; Delayed Chronic Health Hazard.
Section 313 Supplier Notification: The product, Forged Steel Balls contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-to-Know Act and 40 CFR part 372:

CAS #	Chemical Name	Percent by Weight
7439-96-5	Manganese	1.10 Max
7440-02-0	Nickel	0.3 Max

Regulations Key:

CAA	Clean Air Act (42 USC Sec. 7412; 40 CFR Part 61 [As of: 8/18/06])
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act (42 USC Secs. 9601(14), 9603(a); 40 CFR Sec. 302.4, Table 302.4, Table 302.4 and App. A)
CWA	Clean Water Act (33 USC Secs. 1311; 1314(b), (c), (e), (g); 136(b), (c); 137(b), (c) [as of 8/2/06])
RCRA	Resource Conservation Recovery Act (42 USC Sec. 6921; 40 CFR Part 261 App VIII)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III Section 302 Extremely Hazardous Substances (42 USC Secs. 11023, 13106; 40 CFR sec. 372.65) and Section 313 Toxic Chemicals (42 USC Secs. 11023, 13106; 40 CFR Sec. 372.65 [as of 6/30/05])
TSCA	Toxic Substance Control Act (15 U.S.C. s/s 2601 et seq. [1976])

SDWA Safe Drinking Water Act (42 U.S.C. s/s 300f et seq. [1974])

State Regulations: The product, High Carbon Ball Steel 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: Manganese and Nickel
- Environmental Hazards: Manganese and Nickel
- Special Hazardous Substance: Nickel

California Prop. 65: Contains elements known to the State of California to cause cancer or reproductive toxicity. This includes Nickel.
New Jersey: Contains regulated material in the following categories:

- Hazardous Substance: Manganese, and Nickel
- Environmental Hazards: Manganese and Nickel
- Special Hazardous Substance: Manganese

Minnesota: Manganese and Nickel
Massachusetts: Manganese and Nickel

Other Regulations:

WHMIS Classification (Canadian): The product, Forged Steel Balls is not listed as a whole. However individual components are listed.

Ingredients	**WHMIS Classification**
Manganese	D2A
Nickel	D2A, D2B

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.

16. Other Information

Prepared By: Sino Grinding (Americas) Inc.
Issue Date: 6/12/15

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