SAFETY DATA SHEET

Revision date: 12-Feb-2024

Revision Number 5

Section 1: Identification

Product identifier

Product Name STEEL GRINDING BALLS

Product Code(s) 000000017804

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Ore grinding.

Uses advised against No information available.

Details of manufacturer or importer

Supplier
Ixom Operations Pty Ltd
ABN: 51 600 546 512
Level 8, 1 Nicholson Street
Melbourne 3000
Australia

Telephone Number: +61 3 9906 3000

Emergency telephone number

Emergency telephone number **1 800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

Section 2: Hazard identification

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG).
Not classified as a hazardous substance in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

GHS Classification

Label elements

Other hazards which do not result in classification

Section 3: Composition and information on ingredients

Chemical name	CAS No.	Weight-%
Iron	7439-89-6	95-97
Silicon	7440-21-3	0.15-2
Manganese	7439-96-5	0.3-1.2
Carbon	7440-44-0	0.5-1.1
Other component(s)	-	1-2

Section 4: First aid measures

Description of first aid measures

General advice For advice, contact a Poisons Information Centre (e.g. phone Australia 13 11 26; New Zealand 0800 764 766) or a doctor.

Inhalation IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. If symptoms persist, call a physician.

Eye contact In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician if irritation persists.

Skin contact Wash skin with soap and water. Get medical attention if irritation develops and persists.

Ingestion Clean mouth with water. Drink 1 or 2 glasses of water. Get medical attention if symptoms occur.

Most important symptoms and effects, both acute and delayed

Symptoms May cause physical irritation to the eyes.

Effects of Exposure No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media Use extinguishing agent suitable for type of surrounding fire.

Unsuitable extinguishing media None known.

Specific hazards arising from the chemical

Specific hazards arising from the chemical Non-combustible.

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions Avoid contact with skin, eyes or clothing. Avoid breathing dust or spray mist. Avoid generation of dust. Ensure adequate ventilation. Evacuate personnel to safe areas. Do not touch or walk through spilled material. Use personal protective equipment as required. Wash thoroughly after handling.

For emergency responders Clear area of all unprotected personnel. Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions Prevent further leakage or spillage if safe to do so. Refer to protective measures listed in Sections 7 and 8.

Methods and material for containment and cleaning up

Methods for containment Stop leak if you can do it without risk. Do not touch or walk through spilled material.

Methods for cleaning up Use appropriate personal protective equipment (PPE). Carefully shovel or sweep up spilled material and place in suitable container. Avoid generating dust.

Section 7: Handling and storage

Precautions for safe handling

Advice on safe handling Avoid contact with skin, eyes or clothing. Avoid breathing dust or spray mist. Ensure adequate ventilation. Use personal protection equipment. Wash thoroughly after handling.

POTENTIAL HAZARDS FROM USE

During grinding in a ball mill the mill load (ore and balls) is lifted by the centrifugal action of the mill and the action ofthe mill liners. Rotational speeds are selected to drop the lifted portion of the charge onto the remaining toe of the charge. The impacts generated by this action crush the ore.

In semi-autogenous grinding in large diameter mills these forces become quite large since the charge falls from considerable height and the balls are typically much larger in diameter and much heavier (up to nearly 15 KG each).

When a cascading ball falls onto a piece of ore, the energy of impact is absorbed in crushing the ore. This cushions the impact so that the ball absorbs only a small proportion of that energy. However if a cascading ball falls onto the mill liners or onto another ball the energy is not dissipated by the work required for crushing, but is mostly absorbed within the metal - mostly in elastic and plastic deformation with some loss to heat and noise. Plastic deformation of grinding balls causes the steel structures to work harden.

Typically, in a well-managed milling operation where the frequency and severity of ball-on-ball impacts is low, work hardening advances at a rate slower than the ball wear speed. Where the severity and frequency of ball-on-ball impacts is high, work hardening by plastic deformation can become severe with a great deal of energy absorbed as elastic compressive stressing at and near the ball surface. This can develop to an extent where the ball will split into halves with explosive force. A highly stressed grinding ball removed from a mill might remain intact for days or weeks before splitting. This phenomenon is a safety hazard.

The severity of impact to which balls are exposed is dependent on specific mill operating

parameters. Operating conditions that lead to ball - liner and ball - ball contact are: Increasing the rotational speed of the mill causes the charge to be thrown higher and further. Excessive speed causes the cascading portion of the charge to impact against the "hard and immovable" mill liners rather than the "soft and impact absorbent" toe of the charge.
Increasing the percentage of balls in the charge increases the frequency of ball - liner and ball - ball impacts.

General hygiene considerations Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Wash hands and face before breaks and immediately after handling the product. Regular cleaning of equipment, work area and clothing is recommended.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Keep container closed when not in use.

Incompatible materials Acids. Alkalis.

Section 8: Exposure controls and personal protection

Control parameters

Exposure Limits No value assigned for this specific material by Safe Work Australia. However, Workplace Exposure Standard(s) for constituent(s):.

Chemical name	Australia	New Zealand	ACGIH TLV
Silicon 7440-21-3	TWA: 10 mg/m³	TWA: 10 mg/m³	-
Manganese 7439-96-5	TWA: 1 mg/m³ STEL: 3 mg/m³	TWA: 0.2 mg/m³ TWA: 0.02 mg/m³	TWA: 0.02 mg/m³ respirable particulate matter TWA: 0.1 mg/m³ inhalable particulate matter

Chemical name	European Union	United Kingdom	Germany DFG
Silicon 7440-21-3	-	TWA: 10 mg/m³ TWA: 4 mg/m³ STEL: 30 ppm STEL: 12 mg/m³	-
Manganese 7439-96-5	-	TWA: 0.2 mg/m³ TWA: 0.05 mg/m³ STEL: 0.6 mg/m³ STEL: 0.15 mg/m³	TWA: 0.2 mg/m³ TWA: 0.02 mg/m³ Peak: 1.6 mg/m³ Peak: 0.16 mg/m³

Dusts not otherwise classified: 8hr TWA = 10 mg/m³

As published by Safe Work Australia Workplace Exposure Standards for Airborne Contaminants.

TWA - The time-weighted average airborne concentration of a particular substance when calculated over an eight-hour working day, for a five-day working week.

STEL (Short Term Exposure Limit) - the airborne concentration of a particular substance calculated as a time-weighted average over 15 minutes, which should not be exceeded at any time during a normal eight hour work day. According to current knowledge this concentration should neither impair the health of, nor cause undue discomfort to, nearly all workers.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Appropriate engineering controls

Engineering controls

Ensure adequate ventilation, especially in confined areas. Apply technical measures to comply with the occupational exposure limits.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

Individual protection measures, such as personal protective equipment

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, SAFETY GLASSES, GLOVES, DUST MASK.

Eye/face protection Glasses.

Skin and body protection Wear suitable protective clothing. Boots. Overalls.

Hand protection Impervious gloves.

Respiratory protection If determined by a risk assessment an inhalation risk exists, wear a dust mask/respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.

Environmental exposure controls No information available.

Thermal hazards No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Solid
Appearance	Steel balls
Color	No information available
Odor	Odourless
Odor threshold	No information available

Property	**Values**	**Remarks • Method**
pH	Not applicable	None known
Melting point / freezing point	>1400°C	None known
Boiling point / boiling range	No data available	None known
Flash point	Not applicable	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	

Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	7.5-8.0	None known
Water solubility	Insoluble in water	None known
Solubility(ies)	No data available	None known
Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known

Other information

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable.

Explosion data
Sensitivity to mechanical impact None.
Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid

Conditions to avoid Dust formation. Damp conditions.

Incompatible materials

Incompatible materials Acids. Alkalis.

Hazardous decomposition products

Hazardous decomposition products None known based on information supplied.

Section 11: Toxicological information

Information on likely routes of exposure

Product Information No adverse health effects expected if the chemical is handled in accordance with this Safety Data Sheet and the chemical label. Symptoms or effects that may arise if the chemical is mishandled and overexposure occurs are:

Inhalation May cause irritation.

Eye contact May cause irritation. May cause physical irritation to the eyes.

Skin contact May cause irritation.

Ingestion May cause gastrointestinal discomfort if consumed in large amounts.

Symptoms May cause physical irritation to the eyes.

Acute toxicity .

Numerical measures of toxicity - Product Information

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Iron	= 30 g/kg (Rat)	-	-
Silicon	= 3160 mg/kg (Rat)	-	-
Manganese	= 9 g/kg (Rat)	-	> 5.14 mg/L (Rat) 4 h
Carbon	> 10000 mg/kg (Rat)	-	-

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation No information available.

Serious eye damage/eye irritation No information available.

Respiratory or skin sensitization No information available.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Aspiration hazard No information available.

Section 12: Ecological information

Ecotoxicity

Aquatic ecotoxicity Avoid contaminating waterways.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Manganese	-	LC50: >3.6mg/L (96h, Oncorhynchus mykiss)	-	-

Terrestrial ecotoxicity There is no data for this product.

Persistence and degradability

Persistence and degradability No information available.

Bioaccumulative potential

Bioaccumulation There is no data for this product.

Mobility

Mobility No information available.

Other adverse effects

Other adverse effects No information available.

Section 13: Disposal considerations

Waste treatment methods

Waste from residues/unused products Refer to Waste Management Authority. Dispose of material through a licensed waste contractor.

Contaminated packaging Empty containers should be taken to an approved waste handling site for recycling or disposal.

See section 8 for more information

Section 14: Transport information

ADG Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS.

IATA Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; NON-DANGEROUS GOODS.

IMDG Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; NON-DANGEROUS GOODS.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG).
Not classified as a hazardous substance in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).
See section 8 for national exposure control parameters

Standard for Uniform Scheduling of Medicines and Poisons (SUSMP)
No poisons schedule number allocated

Poison Schedule Number Not applicable

Australian Industrial Chemicals Introduction Scheme (AICIS)
Contact supplier for inventory compliance status

Chemical name	Australian Industrial Chemicals Introduction Scheme (AICIS)	Additional information
Iron - 7439-89-6	Present	-
Silicon - 7440-21-3	Present	-
Manganese - 7439-96-5	Present	-
Carbon - 7440-44-0	Present	-

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

National pollutant inventory
Subject to reporting requirement

Chemical name	National pollutant inventory
Manganese - 7439-96-5	10 tonne/yr Threshold category 1

International Inventories

AIIC	All the constituents of this material are listed on the Australian Inventory of Industrial Chemicals or are exempt.
NZIoC	All the constituents of this material are listed on the New Zealand Inventory of Chemicals or are exempt.
TSCA	Contact supplier for inventory compliance status.
DSL/NDSL	Contact supplier for inventory compliance status.
EINECS/ELINCS	Contact supplier for inventory compliance status.
ENCS	Contact supplier for inventory compliance status.
IECSC	Contact supplier for inventory compliance status.
KECL	Contact supplier for inventory compliance status.
PICCS	Contact supplier for inventory compliance status.

Legend:
AIIC- Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Section 16: Other information

Supplier Material Safety Data Sheet , not dated.

Reason(s) For Issue: Reissue of an obsolete SDS

Prepared By This Safety Data Sheet has been prepared by Ixom Operations Pty Ltd (Toxicology and SDS Services).

Revision date: 12-Feb-2024

Revision Note:

The symbol (*) in the margin of this SDS indicates that this line has been revised.

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend
SVHC: Substances of Very High Concern for Authorization:
PBT: Persistent, Bioaccumulative, and Toxic (PBT) Substances
vPvB: Very Persistent and very Bioaccumulative (vPvB) Substances
STOT: Specific Target Organ Toxicity
ATE: Acute Toxicity Estimate
LC50: 50% Lethal Concentration
LD50: 50% Lethal Dose

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation
C	Carcinogen		

Key literature references and sources for data used to compile the SDS
Agency for Toxic Substances and Disease Registry (ATSDR)
U.S. Environmental Protection Agency ChemView Database
European Food Safety Authority (EFSA)
EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
National Institute of Technology and Evaluation (NITE)
Australia National Industrial Chemicals Notification and Assessment Scheme (NICNAS)

Australian Industrial Chemicals Introduction Scheme (AICIS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
World Health Organization

Disclaimer

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since Ixom Operations Pty Ltd cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Ixom representative or Ixom Operations Pty Ltd at the contact details on page 1.

Ixom Operations Pty Ltd's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

End of Safety Data Sheet