SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Trade Name: Direct Reduced Iron (DRI) Pellets
CAS Number: 7439-89-6
Synonyms: DRI Pellets
Use/Description: To be used as feedstock for steel making / pellets. Please consult with Nucor Safety Data Sheet (SDS) for DRI fines as appropriate.

NU-IRON UNLIMITED
Carribean Drive,
Point Lisas Industrial Estate
Trinidad, West Indies
Phone: 1 (868) 636-1944
Fax: 1 (868) 679-0561

NUCOR STEEL LOUISIANA LLC
9101 HWY 3125
Convent, LA 70723
United States
Phone: 1 (225) 331-4000

CHEMTREC 24-HOUR CONTACT NUMBER
1 (800) 424-9300

For general product information, contact facility as listed above. For emergencies, use the 24 Hour Contact.

2. HAZARDS IDENTIFICATION

OSHA Hazards: Self-heating Mixture
Combustible Dust

GHS Classification: Self-heat (Category 2)
Comb. Dust

Pictogram(s):

Signal Word: **Warning**

Hazard Statement(s)
H252: Self-heating in large quantities; may catch fire
H232: May form combustible dust concentrations in air

Precautionary Statement(s)
P210: Keep away from heat, open flames, hot surfaces, sparks. – No smoking
P232: Protect from moisture
P240: Ground/bond container and receiving equipment
P241: Evaluate the need for explosion-proof electrical, lighting, ventilating equipment as required with OSHA and NFPA standards
P281: Use personal protective equipment as required
P407: Maintain air gap between stacks and pallets
P370: In case of fire: some common fire extinguishing agents such as CO2 and ABC may react violently, intensify or be ineffective when applied to DRI fires. In case of a fire, use a Class D fire extinguisher (yellow) or other appropriate extinguishing methods described in Section 5.
P402: Store in a dry place. Under certain conditions, DRI pellets or fines may react with water, causing self-heating and producing flammable or toxic gases. Storage of large quantities may lead to self-heating conditions.

Potential Health Effects

Eye Contact

Dusts or particulates may cause mechanical irritation including pain, tearing, and redness. Scratching of the cornea can occur if eye is rubbed. Fumes may be irritating. Contact with heated material may cause thermal burns.

Skin Contact

Dusts or particulates may cause mechanical irritation due to abrasion. Contact with heated material may cause thermal burns.

Inhalation

Dusts may cause irritation of the nose, throat, and lungs. The inhalation of large amounts of iron dust results in iron pneumoconiosis (arc welder's lung).

Ingestion

Ingestion overexposures to iron may affect the gastrointestinal, nervous, and hematopoietic system and the liver. Swallowing of excessive amounts of the dust may cause irritation, nausea, and diarrhea.

Chronic or Special Toxic Effects

Repeated exposure to fine dusts may inflame the nasal mucosa and cause changes to the lung. In addition, a red-brown pigmentation of the eye and/or skin may occur. Chronic exposure to excess iron can result in pathological deposition in the body tissues, the symptoms of which are fibrosis of the pancreas, diabetes melitus and liver cirrhosis. DRI pellets and dusts may react with water. Under certain conditions, it may react with water to form hydrogen and carbon monoxide.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components, %	Average % Weight	CAS No.	ACGIH TLV TWA (mg/m3)	OSHA PEL TWA (mg/m3)
Total Iron	74 - 93.3	7439-89-6	5 (respirable iron oxide)	10 (Iron oxide fume) 15 (total Iron oxide dust) 5 (respirable Iron oxide) 5 (Iron oxide fume)
Metallic iron	83 - 90	7439-89-6		
Carbon	2.5 - 4	7440-44-0	3 (respirable Carbon black)	3.5 (carbon black)
Silicon dioxide (SiO2)	1.3 - 1.9	7631-86-9	0.025 (respirable quartz)	(30)/(%SiO2 + 2) total quartz (10)/(%SiO2 + 2) respirable quartz
Graphitic Carbon	0.3 - 0.5	7440-44-0	Not established	15 Total dust 5 Respirable fraction
Calcium Oxide (CaO)	0.6 - 1.4	1305-78-8	2	5
Aluminium Oxide(Al2O3)	0.5 - 0.7	1344-28-1	Not established	15 (total dust 5 (respirable fraction)
Magnesium Oxide (MgO)	0.2 - 0.8	1309-48-4	10 (respirable fraction)	15 (fume and particulate)
Manganese (Mn)	.005- 0.12	7439-96-5	0.02 (respirable fraction) 0.1 (inhalable fraction)	5 (fume, ceiling)
Phosphorous (P)	0.02 - 0.04	7723-14-0	0.1	0.1 (Yellow Phosphorus)
Sulfur (S)	0.002 - 0.003	7704-34-9	Not established	Not established
Vanadium (V)	0.0049 - 0.0469	7440-62-2	0.05 (Oxide dust/fume)	0.5 Oxide Dust (Ceiling) 0.1 Oxide Fume (Celiing)

NOTE: No permissible exposure limits (PEL) or threshold limit values (TLV) exist for DRI overall. The above listing is a summary of elements found in DRI.

4. FIRST AID MEASURES

Eye Contact - Immediately flush eyes with plenty of water for at least 15 minutes occasionally lifting the eye lids. Get medical attention if irritation persists.
Skin Contact - In case of overexposure to dusts or particulates, wash with soap and plenty of water. Get medical attention if irritation develops or persists.
Inhalation - In case of overexposure to dusts or fumes, remove affected person to fresh air and keep at rest in a comfortable position.
Ingestion - Not considered an ingestion hazard. However, if ingested, seek medical attention.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media - For small incipient fires, class D fire extinguishers can be used; however typical portable fire extinguishers will not contain enough material to cool larger amounts of overheating DRI. If possible, divide into small piles and allow material to cool to ambient. Cover with dry sand if the temperature of the material continues to rise. If necessary, flood completely with water. Do not spray water on large piles of DRI due to the possible generation of hydrogen gas.
Unsuitable Extinguishing Media - Do not use CO_2 as an extinguishing media as carbon monoxide can be formed. Some common firefighting agents such as CO2 and ABC may violently react, intensify, or be ineffective when applied to DRI pellets and fines. Do not use ordinary dry chemical extinguishers. Do not use firefighting methods that may disperse dust accumulations and create dust clouds.
Fire hazard – Product is porous iron, which rusts in the presence of water and air. Rusting (re-oxidation) causes heat, which may cause large piles to heat up and ignite. DRI dust generated during handling will ignite more easily than pellets. Accumulations of DRI dust may self heat in the presence of humid air. DRI is dense and overheating stockpiles can store a large amount of heat, requiring very large amounts of water to cool the material.
Explosion hazard – Dusts at sufficient concentrations may form explosive mixtures with air. Results indicate a potential for moderate explosion severity (ST1 class explosive). Dust accumulations should be avoided to prevent potential for secondary dust explosions.
Reactivity - Introduction of water onto very hot DRI can release steam and hydrogen. Burning piles of DRI and/or DRI dust may release carbon monoxide (CO), and could accumulate to the explosive limit in poorly or unventilated buildings, storage bins or other closed vessels. Hydrogen gas may be released from wet DRI and could accumulate to the lower explosive limit in unventilated buildings, storage bins, silos or other closed vessels.
Firefighting instructions – – Some vessels containing DRI may be oxygen deficient or use inert gas such as nitrogen. Remove overheating product from all fuel sources including other DRI product, DRI dust, conveyor belts, etc. Divide overheating product into small piles in a well-ventilated area and allow to cool to ambient temperature. Flood with water if necessary and/or possible. Overheating DRI can compromise electrical insulation inside conduit and around electrically driven material handling equipment. In order to prevent electrocution, ensure that all electrical power sources to the area of DRI fire have been de-energized before fighting a DRI fire with water.
Protection during firefighting – Do not enter fire area without propr protective equipment, including respiratory protection.

6. ACCIDENTAL RELEASE MEASURES

General measures – DRI pellets roll. Care must be taken when walking on and around them. Spilled DRI pellets can present a tripping hazard. All accidental spills should be cleaned up in accordance with good housekeeping practice. Dust deposits should not be allowed to accumulate on surfaces, as they may form an explosive mixture if they are disturbed and released into the atmosphere in sufficient concentration.
Environmental precautions – Do not allow water (or moist air) contact with this material. Avoid release to the environment.
Methods for containment – Spilled material that may have become wet should not be mixed with other DRI product, as it may initiate an overheating reaction. Any closed container used for cleaning a DRI spill should

be emptied immediately to a well-ventilated area. Spilled material that may have become wet could generate hydrogen and should not be stored or retained in a closed container.
Methods for clean-up – Use only non-sparking conductive tools for cleaning dust. Fugitive dust accumulations should be removed with a soft-bristled broom or an approved explosion-proof vacuum cleaner. When removing larger accumulations of dust with a vacuum cleaner or vacuum truck, all equipment must be designed for combustible metal dust use and include safety features, including but not limited to, bonding and grounding explosion protection, and control of ignition sources. Only use an explosion-proof vacuum to remove accumulations. Do not use ordinary shop vacuums. Consult NFPA 484, Standard for Combustible Metals (2012 Edition) for guidance on cleaning combustible metal dust accumulations.

7. HANDLING AND STORAGE

Precautions for safe handling – Conveyors should be covered or enclosed to avoid contact with rain. Special attention should be paid to ensure product is not impacted by rain during transfers, loading. Offloading or any other handling. Protect material from all ignition souces such as spark, heat or flame. Minimize dust generation and accumulation in all product handling, storage and use areas. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces.
Storage conditions – Store material in cool, dry areas protected from moisture. Hydrogen and/or carbon monoxide could be emitted slowly by material reacting with water or heat. Closed storage silos/bins should be either be ventilated, monitored for combustible gasses and/or inerted to prevent the risk of explosion. Prevent contact with water, carbon dioxide, aluminum, acid, open flames, sparks, or hot surfaces. If nitrogen is being used as an inerting gas, use precautions and monitoring as appropriate for oxygen. If DRI pellets or files are in confined location, oxygen deficient conditions may be present without inerting gas as a condition of the material itself. Equipment containing DRI should have appropriate explosion protection for gas and dust fires and explosion hazasrds. See NFPA 484, Standard for Combustible Metals (2012 Edition), NFPA 68, Standard on Explosion Deflagration Venting (2013 Edition) and NFPA 69, Standard on Explosion Prevention Systems (2008 Edition) for additional guidance on acceptable engineering controls and safe handling practices.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters – No Occupation Exposure Limit (OEL) values exist for DRI. See section 3 for component OELs.
Ventilation and Dust Control Equipment - Operations with potential for generating high concentrations of airborne particulates should be evaluated and controlled as necessary. Permanent dust control equipment is recommended for material handling systems to reduce dust accumulations and worker exposure to air born dust. It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product, contain explosion relief vents or an explosion suppression system or an oxygen- deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area. Use only appropriately classified electrical equipment and powered industrial trucks.
Eye Protection - Use safety glasses. Dust-resistant safety goggles are recommended under circumstances where particles could cause mechanical injury such as grinding or cutting. Face shield should be used when welding or cutting. Pre-existing conditions or skin disorders may require additional personal protective equipment.
Skin - Protective gloves, long sleeves and long pants are recommended to minimize contact with skin. Flame-resistant garments are needed with personnel exposed to flash fire or explosion hazards due to the presence of DRI dust accumulations. These garments shall be clean and static dissapative, and designed to precent accumulations of DRI dust on them.
Respiratory Protection - Work areas should be adequately ventilated. Supplied air line respirators may be required in confined spaces where IDLH atmospheres may be present. Appropriately selected respirators with HEPA filters or NIOSH/MSHA approved dust mask should be used in dusty environments.

Up to 50 mg/m3:

Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100.
(APF = 10) Any supplied-air respirator

Up to 125 mg/m3:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.

Up to 250 mg/m3:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 2500 mg/m3:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Any appropriate escape-type, self-contained breathing apparatus

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance – DRI pellets are grey spheres of approximately 1/4“ to1/2” diameter. Dust is a fine gray particulate.
Odor - none
Boiling Point - Not applicable
Melting Point – No data available
pH – No data available
Specific Gravity – 7.5
Apparent Density - 3,500 kg/m^3 for pellets. Density of dust can vary.
Bulk Density – 1,800 kg/m^3
Porosity – > 35%
Water pick-up – 12%
Moisture content – < 0.3%
Evaporation rate – Not applicable
Dimensions – 6-30 mm
Fines (< 5mm) – 3%
Solubility in water – insoluble
Partition Coefficient (n-octanol: water) – Not applicable.
Auto-Ignition Temperature – Not available for pellets. 824°F (440°C) for dispersed dust clouds. 374°F(190°C) for dust layers of one-half inch in thickness.
Viscosity – Not applicable.

DRI Dust is classified as a Category 2 Flammable Solid and a Combustible Dust according to OSHA Hazard Communication Standard 29 CFR 1910.1200.

Dust Explosion Classification	ST-1 (Weak to Moderate Explosion)
Deflagration Index (Kst):	0 - -126 bar.m/s
Maximum Explosion Pressure (Pmax):	0 - -5.4 bar
Minimum Ignition Energy (MIE):	82 to > 4686 mJ
Minimum Ignition Temp.	400 – 570°C
Hot Surface Ignition Temperature (HSIT)	190 – 340° C for 12.7 mm (1/2") thick layer
Minimum Explosion Concentration (MEC):	120 – 600 g/m3
Limiting Oxygen Concentration (LOC):	8.5 to 12.5% O2 in N2
Volume Resistivity Ambient R.H.	No data available
Volume Resistivity Low R.H.	No data available
Charge Decay Time Ambient R.H.	No data available
Charge Decay Time Low R.H.	No data available
Lower Flammability Limit	Not applicable for pellets. 120 grams per cubic meter for dust.
Upper Flammability Limit	Not applicable for pellets. Unknown for dust.

10. STABILITY AND REACTIVITY

Chemical stability - Material is stable under normal conditions in the absence of moisture. However, as with all metals, it becomes more reactive when finely divided.
Possibility of hazardous reactions – Ultrafine powder is potentially explosive.
Conditions to Avoid – Avoid open flame.
Incompatible materials – Avoid contact with water, acids. Explosive and violent reaction with ammonium nitrate and heat, ammonium peroxodisulphate, chloric acid, chlorine trifluoride, chloroformamidinium nitrate, bromine pentafluoride and heat (with iron powder), air and oil (with iron dust), sodium acetylide. Ignites on contact with chlorine, dinitrogen tetraoxide, liquid fluorine, hydrogen peroxide (with DRI dust), nitryl fluoride and heat, peroxyformic acid, potassium perchlorate, potassium dichromate, sodium peroxide (at 240oC), polystyrene and friction or spark (DRI dust).
Hazardous Decomposition Products - Hydrogen is emitted slowly from bulk material, dust or fines when in contact with water. Overheating DRI can release carbon monoxide. It catalyzes the exothermic polymerization of acetaldehyde.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity –

LD/LC50 values that are relevant for classification:
Oral LD50 – 20,000mg/kg (guinea pig)
Oral LD50 – 30,000 mg/kg (rat)
Oral LDLo – 20 mg/kg (rabbit)

Irritation - Potentially irritating to skin and mucous membranes. Direct eye contact likely irritating.

Sensitization – No sensitizing effects known

The primary component of this product is iron. Long-term exposure to iron dusts or fumes can result in a condition called siderosis which is considered to be a benign pneumoconiosis. Symptoms may include chronic bronchitis, emphysema, and shortness of breath upon exertion.

Penetration of iron particles in the skin or eye may cause an exogenous or ocular siderosis which may be characterized by a red-brown pigmentation of the affected area. It can also cause conjunctivitis, choroiditis, retinitis and siderosis of tissues if iron contacts and remains in these tissues.

Iron is potentially toxic in all forms and by all routes of exposure. The inhalation of large amounts of iron dust results in iron pneumoconiosis (arc welder's lung).

Chronic exposure to excess levels in the body tissues (>50 – 100 mg Fe/day) can result in pathological deposition of iron in the body tissues, the symptoms of which are fibrosis of the pancreas, diabetes mellitus and liver cirrhosis.

Ingestion overexposures to iron may affect the gastrointestinal, nervous, and hematopoietic system and the liver.

The Registry of Toxic Effect of Chemical Substances (RTECS) contains tumorigenic and/or carcinogenic and/or neoplastic data for components in this product.

No classification data on carcinogenic properties of this material is available from the EPA, IARC, NTP, OSHA, or ACGIH.

12. ECOLOGICAL INFORMATION

Ecotoxicity – no data available
Persistence and degradability – no data available
Bioaccumulative potential – no data available
Mobility in environmental media – no data available
Additional information - Metallic iron can scavenge dissolved oxygen from uncirculated and aerated bodies of water.

13. DISPOSAL CONSIDERATIONS

Waste disposal recommendations – Recovery and reuse, rather than disposal, should be the ultimate goal. . Dispose in accordance with federal, state, and local health and environmental regulations. Prevent materials from entering drains, sewers, or waterways.

14. TRANSPORT INFORMATION

DOT Proper Shipping Information – DRI pellets must be transported in accordance with applicable U.S. Department of Transportation hazardous material transportation regulations, if any.

Transport by sea (IMO/IMDG) - The International Maritime Solid Bulk Cargoes Code (IMSBC Code) classifies DRI Pellets as 'DRI B' and DRI Fines as 'DRI C'. This code contains regulations for the maritime transport of solid bulk cargoes. Both DRI A and DRI C are classified as Group B cargo types, which consists of cargoes which possess a chemical hazard which could give rise to a dangerous situation on a ship.

15. REGULATORY INFORMATION

Toxic Substances Control Act (TSCA)
All components of this product are listed on the TSCA Inventory.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

Chemical Name	Reportable Quantity (in lb)
Aluminum Oxide	Na
Manganese	Na
Phosphorus	1
Vanadium	na

Superfund Amendments and Reauthorization Act of 1986 (SARA), Title III
SECTION 311/312 HAZARD CATEGORIES: Fire hazard

This product contains no chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372).

SARA Section 302 Threshold Planning Quantity (TPQ):

Chemical Name	TPQ (in lb)
Phosphorus	100

SECTION 313 REPORTABLE INGREDIENTS:

Chemical Name	CAS Number	Concentration (% by weight)
Aluminum Oxide	1344-28-1	<.7
Lead	7439-92-1	<0.1
Manganese	7439-96-5	<.12
Phosphorus	7723-14-0	<.1
Vanadium	7440-62-2	<.5

California Proposition 65:

⚠ **WARNING:** This product can expose you to chemicals including carbon black which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Massachusetts Substance List: Aluminum oxide, Magnesium oxide, Manganese, Phosphorus, Silicon dioxide, Sulfur

Pennsylvania Hazardous Substance List: Aluminum oxide, Magnesium oxide, Manganese, Phosphorus, Silicon dioxide, Sulfur **.**

New Jersey Hazardous Substance List: Aluminum oxide, Magnesium oxide, Manganese, Phosphorus, Silicon dioxide, Sulfur

16. OTHER INFORMATION

This SDS covers Nucor product as delivered from the Nucor facility, but does not include chemicals that may be applied by subsequent handlers and/or distributors of this product. This could include a variety of materials including lime, oils, paints, galvanization, etc. that are not included in this SDS. Additionally, specialty orders may require application of coating material not listed in this SDS. SDSs for any Nucor-applied specialty coating will be provided separately. During welding, precautions should be taken for airborne contaminants that may originate from components of the welding rod. Arc or spark generated when welding or burning could be a source of ignition for combustible and/or flammable materials. The information in this SDS was obtained from sources which we believe are reliable; however, the information is provided without any representation or warranty, expressed or implied, regarding the accuracy or correctness. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with the handling, storage, use, or disposal of this product.

Refer to these standards for additional guidance on fire protection.

Related NFPA Codes:

NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, for safe handling.
NFPA 484, Standard for Combustible Metals
NFPA 68, Standard on Explosion Protection by Deflagration Venting
NFPA 69, Standard for Explosion Prevention systems
NFPA70, National Electric Code
NFPA 505, Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations