RITCHEY METALS

GHS SAFETY DATA SHEET

Zinc

Revised/Reapproved: Jan 2017

Supersedes: June 2013

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: **Zinc**

FORM: Ball Anode, Bar Anode, Marine Anode, SHG Slab, Custom Shape

PRODUCT USE: Electroplating, Electrogalvanizing, Galvanizing, Sacrificial Anode

MANUFACTURER: Ritchey Metals Company, Inc.
30 Georgetown Road
Canonsburg, PA, USA, 15137

TELEPHONE: 724-745-7700 **WEBSITE:** www.ritcheymetals.com

SECTION 2 – HAZARD IDENTIFICATION

General Hazard Statement: Zinc in solid metallic form is a non-hazardous material as per the OSHA Hazard Communication Standard. The coating produced by this material in electroplating and galvanizing operations is generally classified as non-hazardous. However, some hazardous elements contained in this product can be emitted under certain processing conditions such as but not limited to: burning, melting, cutting, sawing, brazing, grinding, machining, milling, and welding. Products in the solid state generally present no fire or explosion hazard, but fine chips, powders and dust may ignite readily. This material may present an explosion hazard if placed directly into molten metal without adequate pre-heating to assure all entrained moisture is eliminated.

Potential Health and Safety Effects: Zinc in solid metallic form present little hazard to the health of those who come into contact with it. Zinc oxide fume is formed when zinc alloy is heated to, or near, the boiling point of zinc, or burned. Zinc oxide may cause mild local irritation to nose, throat and upper airways. Acute over-exposure to zinc oxide may cause metal fume fever, characterized by flu-like symptoms such as chills, fever, nausea and vomiting. The onset of these symptoms may be delayed from exposure by 3 to 10 hours. Contact of zinc with acids and alkalis generate flammable hydrogen gas which can accumulate in poorly ventilated areas, Contact with acidic solutions of arsenic and antimony compounds may evolve highly toxic gasses. Contact of powered material with strong oxidizers may produce violent reactions. In most cases, dermal exposure to zinc or compounds of zinc does not result in any notable toxic effects. There are no known carcinogenetic or mutagenic effects from exposure to zinc and zinc compounds.

Potential Environmental Effects: Zinc has relatively low bioavailability and produces no short term ecological risks. However, long term exposure to weathering, especially in aquatic environments, can produce an accumulated toxicity to marine life. Zinc does have a potential to bio-accumulate in plants and animals, in both aquatic and terrestrial environments.

GHS Classification: Not a hazardous substance according to GHS

GHS LABEL Elements (These hazards primarily exist only during processing operations)

Symbol(s)

Signal Word

Danger

Hazard Statements

Explosive condition if placed into molten metal with entrained moisture

Flammable solid in powder or dust form

Fine powder and dust may cause eye irritation

May cause allergy or asthma symptoms or breathing difficulties if inhaled (dust or fume)

May cause damage to respiratory system through prolonged or repeated exposure

Toxic to aquatic life

NFPA Ratings

Health	1
Flammability	1
Reactivity	1
Specific Hazard	Not Available

HMIS Ratings

Health	1
Fire	1
Reactivity	1
Personal	C

SECTION 3 – COMPOSITION / INFORMATION ON INGREDIENTS

Component	Symbol	CAS#	Percent
Zinc	Zn	7440-66-6	99.9 - 100

Notes: See Section 8 for OEL (Occupational Exposure Limits)

SECTION 4 – FIRST-AID MEASURES

Inhalation: If symptoms are experienced remove source of contamination or move victim from exposure area to fresh air immediately and obtain medical advice. If breathing is difficult, give oxygen. NOTE: Metal fume fever may develop 3-10 hours after exposure to zinc oxide fumes. If symptoms of metal fume fever (flu-like symptoms) develop, obtain medical attention.

Eye Contact: Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. If particle/dust does not dislodge, flush with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, obtain medical attention. **DO NOT** attempt to manually remove anything stuck to the eye.

Skin Contact: No health effects expected. If irritation does occur, flush with lukewarm, gently flowing water for 5 minutes. If irritation persists, obtain medical advice. **Molten Metal:** Flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Ingestion: If swallowed, no specific intervention is normally needed as ingestion of this material is not hazardous from a toxicological standpoint and not likely to produce symptoms. However, if ingested material contained sharp edges, may be large enough to obstruct digestive tract, or if any irritation or discomfort occurs, obtain medical advice. **Do not Induce Vomiting!**

SECTION 5 – FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Zinc in bulk sold form is difficult to ignite and is not considered a serious fire hazard. However, zinc heated to near its boiling point can ignite readily. Finely divided metallic dust may form flammable or explosive dust clouds when dispersed in the air at high concentrations and exposed to heat, flame, or other ignition sources. Bulk dust in a damp state may heat spontaneously and ignite on exposure to air. Contact with acids and alkali hydroxides results in evolution of hydrogen gas which is potentially explosive. Mixtures with potassium chlorate or fused ammonium nitrate may explode on impact.

Extinguishing Media: Apply only dry chemical, dry sand, or special powder extinguishing (Class D) media. **Do NOT** use water, carbon dioxide or foam on a metal fire. Water is ineffective for extinguishing a zinc fire and can act as an accelerant. However, water may be used to keep fire-exposed billets, ingots and castings cool. Do not use water to cool molten zinc as entrapped water will rapidly turn to steam which can generate an explosion.

Fire Fighting: If possible, move material not yet involved in the fire from the fire area. If this is not possible, cool fire-exposed zinc by applying hose streams or fogs. Apply only dry chemical, sand, or special powder extinguishing media to any molten or burning zinc. Take extreme caution to prevent contact of water with molten or burning zinc. Zinc oxide fumes may evolve in fires. Fire fighters should be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

Flashpoint and Method: Not Applicable.

Upper and Lower Flammable Limit: Lower Flammable Limit (Zinc Dust): 500 g/m3; Upper Flammable Limit: Not Applicable.

Autoignition Temperature: Approximately 680ºC (dust cloud in air), 460ºC (dust layer).

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Materials and Methods for Clean-Up: If product is molten, contain the flow using dry sand or salt flux as a dam if possible to do so safely. All tools and containers which come in contact with molten metal must be preheated or specially coated and rust free. Observe precautions in Section 8, Personal Protection. Molten zinc should be allowed to cool and harden before cleanup. Powder or dust should be cleaned up by sweeping/shoveling, etc. Solid metal is recyclable. Return uncontaminated spilled material to the process if possible. Place contaminated material in clean, dry, suitably labeled containers for later recovery or disposal. Treat or dispose of waste material in accordance with all local, state/provincial, and national requirements.

Environmental Precautions: Releases of the product to water and soil should be prevented. Prevent spillage from entering drains. Any release to the environment may be subject to federal/national or local reporting requirements.

SECTION 7 – HANDLING & STORAGE

Handling Procedures: Avoid contact with skin, eyes and clothing. Wear personal protective equipment. Avoid dust formation. Keep material dry. Avoid contact with sharp edges or heated material. Hot and cold zinc is not visually different. Solid zinc hot enough to cause serious burns does not glow red.

Storage Procedures: Store zinc alloy in a DRY covered area, separate from incompatible materials. Zinc ingots suspected of containing moisture must be **THOROUGHLY DRIED** before being added to a molten

bath. Ingots may contain cavities that collect moisture. Entrained moisture will expand explosively when immersed in a molten bath. Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate designated areas. No special packaging materials are required

Incompatibilities: Acids. Alkalis. Water. Halogenated compounds. Strong Oxidizers

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

Component Exposure Limits

Zinc (7440-66-6) as zinc oxide fume

ACGIH: 2 mg/m3 TWA (respirable fraction)

OSHA: 5 mg/m3 TWA (respirable fraction)

NIOSH: 5 mg/m3 10 hr TWA (dust or fume)

Protective Clothing: Gloves and coveralls, shop coat or other work clothing are recommended to prevent prolonged or repeated direct skin contact when zinc is processed. Eye protection should be worn where fume or dust is generated. Respiratory protection may be required where zinc oxide fume is generated. Where hot or molten metal is handled, heat-resistant gloves, face shield, and clothing to protect from hot metal splash must be worn. Follow protective clothing requirements of plating bath solution SDS when product is used in electroplating applications. Safety type boots with metatarsal guards are recommended in all uses when handling product.

Ventilation: Use adequate local or general ventilation to maintain the concentration of zinc oxide fumes and other metallic dust and fumes in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system. Where metallic particles of zinc alloy are being collected and transported by a ventilation system, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Locate dust collectors and fans outdoors if possible and provide dust collectors with explosion vents or blow out panels. Refer to appropriate NFPA Standards 484, 654, and/or 68 for specific guidance. Follow ventilation requirements of plating bath solution SDS when product is used in electroplating applications.

Respirators: Where zinc oxide dust or fumes are generated and cannot be controlled to within acceptable levels, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-95 particulate filter cartridge).

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance (physical state, color, etc.)	Bluish-grey lustrous solid.
Odor	None
Odor threshold	None
pH	Not Applicable
Melting point/freezing point	420°C (788°F)
Initial boiling point and boiling range	910°C (1670°F)
Flash point	Not Flammable
Evaporation rate	Not Applicable
Flammability (solid, gas)	Not Flammable
Upper/lower flammability or explosive limit	Not Explosive
Vapor pressure	1 mm at 487ºC, Negligible at 20ºC
Vapor density	Not Applicable
Density	7.14 g/cm^3 at 25°C (77°F) (Water = 1)
Solubility (ies)	Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.
Partition coefficient: n-octanol/water	Not Applicable
Auto-ignition temperature	Not Applicable
Decomposition temperature	Not Applicable

SECTION 10 – STABILITY AND REACTIVITY

Stability & Reactivity: Solid zinc is stable and not considered reactive under normal temperatures and pressures. Zinc slowly becomes covered with a white coating of a hydrated basic zinc carbonate on exposure to moist air. Fine, condensed zinc dust or powder may heat spontaneously and ignite on exposure to air when damp. Zinc will react with acids and strong alkalis to generate hydrogen gas. A violent, explosive reaction may occur when powdered zinc is heated with sulfur. Powdered zinc will become incandescent or ignite in the presence of fluorine, chlorine, or bromine. Powdered zinc can also react explosively with halogenated hydrocarbons if heated. Mixtures with potassium chlorate or fused ammonium nitrate may explode on impact.

Incompatibilities: Contact with acids and alkalis will generate highly flammable hydrogen gas. Contact with acidic solutions of arsenic and antimony compounds may evolve highly toxic ARSINE or STIBINE gas. Incompatible with strong oxidizing agents such as chlorine, fluorine, bromine, sodium, potassium or barium peroxide, sodium or potassium chlorate, chromium trioxide and fused ammonium nitrate. Also incompatible with elemental sulfur dust, halogenated hydrocarbons or chlorinated solvents, chlorinated rubber, and ammonium sulfide or calcium disulphide.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting, electric arc welding or overheating a molten bath will generate zinc oxide fume which, on inhalation in sufficient quantity, can produce metal fume fever, a transient influenza-like illness.

SECTION 11 – TOXILOGICAL INFORMATION

General: Zinc, especially in the solid metal form, is relatively non-toxic. However, it can react with other materials, such as oxygen or acids, to form compounds that can be potentially toxic. The primary route of exposure would be through the generation and inhalation of zinc oxide fume.

Acute:

Skin/Eye: In most cases, dermal exposure to zinc or zinc compounds does not result in any noticeable toxic effects. Zinc metal is not chemically irritating to the eyes.

Inhalation: Inhalation of dust may cause respiratory tract and mucous membrane irritation with cough and chest pain. Inhalation of fumes can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headache, fever, malaise, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis. The symptoms of metal fume fever will occur within 3 to 10 hours of exposure. The symptoms are temporary and generally disappear, without medical intervention within 24 to 48 hours of onset.

Ingestion: Zinc normally is not harmful if ingested and usually does not produce symptoms if ingested. When ingested in excessive quantities, zinc can irritate the stomach resulting in digestive tract irritation with tightness in throat, nausea, vomiting, abdominal pain, diarrhea loss of appetite, malaise, fever, and chills. Ingestion is not a typical route of occupational exposure.

Chronic: There is no chronic form of metal fume fever but in rare instances an acute incident may be followed by complaints such as bronchitis or pneumonia. There is no known chronic illness attributable to physical exposure of solid zinc, even in finely-divided metallic form. However, prolonged or repeated skin contact with zinc dust or powder may cause dryness, irritation and cracking (dermatitis) since this material is astringent and may tend to draw moisture from the skin.

Carcinogenicity: Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the American Conference of Governmental Industrial Hygienists (ACGIH) or the European Union (EU) - This product is not listed by any of these agencies as probable, possible or confirmed human carcinogen.

SECTION 12 – ECOLOGICAL INFORMATION

General: Zinc is relatively insoluble; however, processing of the product or extended exposure in aquatic and terrestrial environments may lead to the release of zinc, other alloying elements, and compounds in bio-available forms. Water hardness, pH and dissolved organic carbon content are major regulating factors in its toxicity. Dissolved zinc and zinc compounds also have the potential to bio-accumulate in plants and animals in both aquatic and terrestrial environments.

SECTION 13 – DISPOSAL CONSIDERATIONS

General: Zinc and most of the byproducts of its processing are recyclable. Material should be returned to appropriate facilities for reclamation. When not possible to return the waste material for reclamation, then users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product or residues.

SECTION 14 – TRANSPORT INFORMATION

US DOT	Not Dangerous Goods
TDG	Not Dangerous Goods
IMDG	Not Dangerous Goods
Marine Pollutant	No
IATA/ICAO	Not Dangerous Goods

SECTION 15 – REGULATORY INFORMATION

Note: The information in this section pertains to zinc in its solid form as provided, and for the normal processing operations involved for its intended usage of coating other metals or as sacrificial anode. The data in this section considers controlled melting, plating, and those machining operations which only produce metallic chips as part of normal usage. It does not include processing or usage operations that may produce air-borne dust or fumes, or for zinc dissolved in plating solutions. Other uses, emergency situations, or out of the ordinary processing is not within the scope of this safety data sheet section.

TSCA Inventory Status	All ingredients are listed on the TSCA inventory.
DSCL (EEC)	All ingredients are listed on the DSCL inventory.
California Proposition 65	Not Listed
SARA 302	Not Listed
SARA 304	Not Listed
SARA 311	No SARA Hazards
SARA 312	No SARA Hazards
SARA 313	Not Listed
WHMIS Canada	Not Listed

SECTION 16 – OTHER INFORMATION

Disclaimer: Ritchey Metals Company, Inc. has taken reasonable measures to assure the information contained in this safety data sheet is accurate. However, Ritchey Metals Company, Inc. extends no warranty and assumes no responsibility for the accuracy of the content of this safety data sheet and expressly disclaims all liability for reliance thereon. This document it is not intended to be all inclusive and offered solely for your information, consideration and investigation. The information relates to a group of similar products rather than to a specific material. Although a few strong interactions are listed, this safety data sheet does not, and cannot, fully describe all possible interactions with other materials. This safety data sheet provides generic guidelines for the safe handling and processing of this product. It does not, and cannot, advise on all possible situations or any specific process. Therefore, your specific use of this product should be evaluated to determine if additional precautions are required. Because safety standards and regulations are subject to change, and because Ritchey Metals has no continuing control over the material, those handling, storing or using the material should satisfy themselves that they have current information regarding the particular way the material is handled, stored or used and that the same is done in accordance with federal, state and local law. Individuals exposed to this product should read and understand this information and be provided pertinent training prior to working with this product.

Specific Alloys: The following table lists a designation with ASTM specifications this SDS applies to:

UNS	ASTM	Common	Traditional
Z13001		Special High Grade Zinc	SHG

SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Trade Name: Merchant, rebar, structural, and select sheet steel grades
CAS Number: Not applicable
Synonyms: Carbon Steels
Use/Description: Bar and structural steel products, billets (sheet steel for Castrip®), grinding balls

Nucor Mill Locations **24 Hour Contact – CHEMTREC 1-800-424-9300**

Nucor Steel – South Carolina
300 Steel Mill Road
Darlington, S.C. 29540
(843) 393-5841

Nucor Steel – Auburn, Inc.
25 Quarry Road
Auburn, N.Y. 13021
(315) 253-4561

Nucor Steel – Texas
U.S. Highway 79 South
Jewett, Texas 75846
(903) 626-4461

Nucor Steel Connecticut, Inc.
35 Toelles Road
Wallingford, CT 06492
(203) 265-0615

Nucor Steel Kankakee, Inc.
One Nucor Way
Bourbonnais, IL 60914
(815) 939-5541

Nucor Steel – Utah
West Cemetery Road
Plymouth, Utah 84330
(435) 458-2300

Nucor Steel Marion, Inc.
912 Cheney Avenue
Marion, Ohio 43302
(740) 383-4011

Nucor Steel Kingman, LLC
3000 West Old Highway 66
Kingman, AZ 86413
(928) 718-7035

Nucor Steel Jackson, Inc.
3630 Fourth Street
Flowood, MS 39232
(601) 939-1623

Nucor Steel Birmingham, Inc.
2301 F.L. Shuttlesworth Drive
Birmingham, Alabama 35234
(205) 250-7400

Nucor Steel – Berkeley
1455 Hagan Avenue
Huger, SC 29450
(843) 336-6000

Nucor Steel – Nebraska
2911 East Nucor Road
Norfolk, Nebraska 68701
(402) 644-0200

Nucor Steel Seattle, Inc.
2424 SW Andover
Seattle, WA 98106
(206) 933-2222

Nucor Yamato Steel/ Nucor Castrip Arkansas, LLC
5929 E. State Hwy 18
Armorel, AR 72310
(870) 762-5500

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

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
STEEL PRODUCTS AS SOLD BY NUCOR ARE NOT HAZARDOUS PER OSHA GHS 29 CFR 1910, 1915, 1926. However, individual customer processes, (such as welding, sawing, brazing, grinding, abrasive blasting, and machining) may result in the formation of fumes, dust (combustible or otherwise), and/or particulate that may present the following hazards:

OSHA Hazards:
Carcinogen
Skin Sensitizer
Target Organ Effect – Lungs

GHS Classification:
Carcinogenicity (Category 2)
Skin Sensitization (Category 1)
Specific Target Organ Toxicity-Repeated Exposure (Category 1)

Pictogram(s):

Signal Word: Danger

Hazard Statement(s)
H317: Dust/fumes may cause an allergic skin reaction.
H351: Dust/fumes suspected of causing cancer via inhalation.
H372: Inhalation of dust/fumes causes damage to respiratory tract through prolonged or repeated exposure.

Precautionary Statement(s)
P202: Do not handle until all safety precautions have been read and understood.
P261: Avoid breathing dust/fumes.
P281: Use personal protective equipment as required.
P308+P313: If exposed or concerned: Get medical advice/attention.

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 the heated material may cause thermal burns.

Skin Contact
Dusts or particulates may cause mechanical irritation due to abrasion. Coated steel may cause skin irritation in sensitive individuals (see Section 16 for additional information.) Some components in this product are capable of causing an allergic reaction, possibly resulting in burning, itching and skin eruptions. Contact with heated material may cause thermal burns.

Inhalation
Dusts may cause irritation of the nose, throat, and lungs. Excessive inhalation of metallic fumes and dusts may result in metal fume fever, an influenza-like illness. It is characterized by a sweet or metallic taste in the mouth, accompanied by dryness and irritation of the throat, cough, shortness of breath, pulmonary edema, general malaise, weakness, fatigue, muscle and joint pains, blurred vision, fever and chills. Typical symptoms last from 12 to 48 hours.

Ingestion
Not expected to be acutely toxic via ingestion based on the physical and chemical properties of the product. Swallowing of excessive amounts of the dust may cause irritation, nausea, and diarrhea.

Potential Fire and Explosion Hazards
Under normal conditions, steel products do not present fire or explosion hazards, and dust generated by handling steel products is oxidized and not combustible. Processing of steel product by some individual customers may produce potentially combustible dust that may represent a fire or explosion hazard.

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. Welding fumes have been associated with adverse health effects. Contains components that may cause cancer or reproductive effects. The following components are listed by NTP, OSHA, or IARC as carcinogens: Nickel, chromium (hexavalent), cobalt, lead, cadmium, antimony (trioxide), arsenic, beryllium. See Section 11, for additional, specific information on effects noted above.

Target Organs
Overexposure to specific components of this product that are generated in dusts or fumes may cause adverse effects to the following organs or systems: eyes, skin, liver, kidney, central nervous system, cardiovascular system, respiratory system.

Medical Conditions Aggravated by Exposure
Diseases of the skin such as eczema may be aggravated by exposure. Also, disorders of the respiratory system including asthma, bronchitis, and emphysema. Long-term inhalation exposure to agents that cause pneumoconiosis (e.g. dust) may act synergistically with inhalation of oxide fumes or dusts of this product.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components		CAS No.	% Weight	Exposure Limits			
				ACGIH TLV (mg/m^3)		OSHA PEL (mg/m^3)	
Base Metal:							
Iron	(Fe)	7439-89-6	Balance	5	Oxide Dust/Fume	10	Oxide Dust/Fume
Alloying Elements							
Aluminum	(Al)	7429-90-5	<0.05	10 5	Dust Fume	15 5	Dust Respirable fraction
Antimony	(Sb)	7440-36-0	<0.9	0.5	As Antimony	0.5	As Antimony
Arsenic	(As)	7440-38-2	<0.09	0.01	As Arsenic (A1 Carcinogen)	0.01	As Arsenic
Beryllium	(Be)	7440-41-7	<0.09	0.00 2 0.01	As Beryllium (A1 Carcinogen) As Beryllium (STEL)	0.002 0.005	As Beryllium As Beryllium (Ceiling)
Boron	(B)	7440-42-8	<0.9	10	Oxide Dust	15	Oxide Dust
Cadmium	(Cd)	7440-43-9	<0.01	0.01 0.00 2	As Cadmium (A2 Carcinogen) Respirable fraction	0.005 0.0025	As Cadmium As Cadmium (Action Level)
Calcium	(Ca)	1305-78-8	<0.9	2	Oxide Dust	5	Oxide Dust
Carbon	(C)	7440-44-0	<1.2		Not Established		Not Established
Chromium	(Cr)	7440-47-3	0.01-1.2	0.5	Metal	1	Metal
Cobalt	(Co)	7440-48-4	<0.09	0.02	As Cobalt (A3 Carcinogen)	0.1	Metal/Dust/Fume
Copper	(Cu)	7440-50-8	<0.9	1 0.2	Dust Fume	1 0.1	Dust Fume
Lead	(Pb)	7439-92-1	<0.07	0.05	Dust / Fume (A3 Carcinogen)	0.05	Dust / Fume
Magnesium	(Mg)	7439-95-4	<0.9		Not Established		Not Established
Manganese	(Mn)	7439-96-5	0.2-2	0.2	Elemental Mn and Inorg Compounds	5	Fume (Ceiling)
Molybdenum	(Mo)	7439-98-7	<0.9	10	Insoluble Compounds	15	Insoluble Compounds
Niobium	(Nb)	7440-03-1	<0.9		Not Established		
Nickel	(Ni)	7440-02-0	<1.0	1.5	Metal	1	Metal and Insoluble Compounds
Nitrogen	(N)	7727-37-9	<0.9		Simple Asphyxiant		Simple Asphyxiant
Phosphorus	(P)	7723-14-0	<0.9	0.1	Phosphorus	0.1	Phosphorus
Selenium	(Se)	7782-49-2	<0.9	0.2	Selenium	0.2	Selenium
Silicon	(Si)	7440-21-3	<0.9	10	Dust	15	Dust
Sulfur	(S)	7446-09-05	<0.9	5.2 13	Sulfur Dioxide Sulfur Dioxide (STEL)	13	Sulfur Dioxide
Tin	(Sn)	7440-31-5	<0.9	2	Metal,Oxide and Inorganic Compounds	2	Inorganic Compounds
Titanium	(Ti)	7440-32-6	<0.9		Not Established		Not Established
Tungsten	(W)	7440-33-7	<0.9	5 10	Insoluble Compounds as W Insoluble Compounds as W (STEL)		Not Established
Vanadium	(V)	7440-62-2	<0.9	0.05	Oxide Dust/Fume	0.5 0.1	Oxide Dust (Ceiling) Oxide Fume (Ceiling)
Zinc	(Zn)	7440-66-6	0.0-0.10	10 5 10	Oxide Dust OxideFume Oxide Fume (STEL)	5 10	Oxide Fume Oxide Dust

NOTE: No permissible exposure limits (PEL) or threshold limit values (TLV) exist for steel over all. The above listing is a summary of elements used in alloying Nucor Steel Products. Various grades of steel will contain different combinations of these elements and/or trace materials. Exact specifications may be found by calling the division and asking for a specifications sheet.

4. FIRST AID MEASURES

Eye Contact - In case of overexposure to dusts or fumes, immediately flush eyes with plenty of water for at least 15 minutes occasionally lifting the eye lids. Get medical attention if irritation persists. Thermal burns should be treated as medical emergencies.
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. If thermal burn occurs, flush area with cold water and get immediate medical attention.
Inhalation - In case of overexposure to dusts or fumes, remove to fresh air. Get immediate medical attention if symptoms described in this SDS develop.
Ingestion - Not considered an ingestion hazard. However, if excessive amounts of dust or particulates are swallowed, treat symptomatically and supportively. Get medical attention.
Notes to Physician - Inhalation of metal fume or metal oxides may produce an acute febrile state, with cough, chills, weakness, and general malaise, nausea, vomiting, muscle cramps, and remarkable leukocytosis. Treatment is symptomatic, and condition is self limited in 24-48 hours. Chronic exposure to dusts may result in pneumoconiosis of mixed type.

5. FIRE FIGHTING MEASURES

Flash Point (Method) - Not applicable
Flammable Limits (% volume in air) - Not applicable
Auto ignition Temperature - Not applicable
Extinguishing Media - For molten metal, use dry powder or sand. For steel dust use or dry sand, water, foam, argon or nitrogen.
Special Fire Fighting Procedures - Do not use water on molten metal. Do not use Carbon Dioxide (CO_2). Firefighters should not enter confined spaces without wearing NIOSH/MSHA approved positive pressure breathing apparatus (SCBA) with full face mask and full protective equipment.
Unusual Fire or Explosion Hazards - Steel products do not present fire or explosion hazards under normal conditions. Any non-oxidized fine metal particles/ dust generated by grinding, sawing, abrasive blasting, or individual customer processes may produce materials that the customer should test for combustibility and other hazards in accordance with applicable regulations. High concentrations of combustible metallic fines in the air may present an explosion hazard.

6. ACCIDENTAL RELEASE MEASURES

Precautions if Material is Spilled or Released - Emergency response is unlikely unless in the form of combustible dust. Avoid inhalation, eye, or skin contact of dusts by using appropriate precautions outlined in this SDS (see section 8). Fine turnings and small chips should be swept or vacuumed and placed into appropriate disposable containers. Keep fine dust or powder away from sources of ignition. Scrap should be reclaimed for recycling. Prevent materials from entering drains, sewers, or waterways. Specific standards and regulations may be applicable to materials generated by individual customer processes. As appropriate, these standards and regulations should be consulted for applicability.
Fire and Explosion Hazards - Some customer processes may generate combustible dust that may require specific precautions when cleaning spills or releases of dust.
Environmental Precautions - Some grades of steel may contain reportable quantities of alloying elements. See Section 15 for additional information.
Waste Disposal Methods - Dispose of used or unused product in accordance with applicable Federal, State, and Local regulations. Please recycle.

7. HANDLING AND STORAGE

Storage Temperatures - Stable under normal temperatures and pressures.
Precautions to be Taken in Handling and Storing - Store away from strong oxidizers. Dusts and/or powders, alone, or combined with process specific fluids, may form explosive mixtures with air. Applicable Federal, state and local laws and regulations may require testing dust generated from processing of steel

products to determine if it represents a fire or explosion hazard and to determine appropriate protection methods. Avoid breathing dusts or fumes.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Operations with potential for generating high concentrations of airborne particulates or fumes should be evaluated and controlled as necessary.
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.
Skin - Appropriate protective gloves should be worn as necessary. Good personal hygiene practices should be followed including cleansing exposed skin several times daily with soap and water, and laundering or dry cleaning soiled work clothing.
Respiratory Protection - NIOSH/MSHA approved dust/fume/mist respirator should be used to avoid excessive exposure. See Section 3 for component material information exposure limits. If such concentrations are sufficiently high that this respirator is inadequate, or high enough to cause oxygen deficiency, use a positive pressure self-contained breathing apparatus (SCBA). Follow all applicable respirator use, fitting, and training standards and regulations.
Ventilation - Provide general and/or local exhaust ventilation to control airborne levels of dust or fumes below exposure limits.
Exposure Guidelines - No permissible exposure limits (PEL) or threshold limit values (TLV) exist for steel. See Section 3 for component materials. Various grades of steel will contain different combinations of these elements. Trace elements may also be present in minute amounts

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor – Silver grey to grey black with metallic luster.
Boiling Point - Not applicable
Melting Point - Approximately 2800 ^{o}F
pH - Not applicable
Specific Gravity (at 15.6^{o}C) - Not applicable
Density (at 15.6 ^{o}C) - Not applicable
Vapor Pressure - Not applicable
Vapor Density (air = 1) - Not applicable
% Volatile, by Volume - Not applicable
Solubility in Water - Insoluble.
Evaporation Rate (Butyl Acetate = 1) - Not applicable
Other Physical and Chemical Data - None

10. STABILITY AND REACTIVITY

Stability - Stable
Conditions to Avoid - Steel at temperatures above the melting point may liberate fumes containing oxides of iron and alloying elements. Avoid generation of airborne fume.
Hazardous Polymerization - Will not occur.
Incompatibility (Materials to Avoid) - Reacts with strong acids to form hydrogen gas. Do not store near strong oxidizers.
Hazardous Decomposition Products - Metallic fumes may be produced during welding, burning, grinding, and possibly machining or any situation with the potential for thermal decomposition. Refer to ANSI Z49.1

11. TOXICOLOGICAL INFORMATION

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. Ingestion overexposures to iron may affect the gastrointestinal, nervous, and hematopoietic system and the liver. Iron and steel founding, but not iron or iron oxide, has been listed as carcinogenic (Group 1) by IARC.

When this product is welded, fumes are generated. Welding fumes may be different in composition from the original welding product, with the chief component being ordinary oxides of the metal being welded. Chronic health effects (including cancer) have been associated with the fumes and dusts of individual component metals (see above), and welding fumes as a general category have been listed by IARC as a carcinogen (Group 2B). There is also limited evidence that welding fumes may cause adverse reproductive and fetal effects. Evidence is stronger where welding materials contain known reproductive toxins, e.g., lead, which may be present in the coating material of this product.

Breathing fumes or dusts of this product may result in metal fume fever, which is an illness produced by inhaling metal oxides. These oxides are produced by heating various metals including cadmium, zinc, magnesium, copper, antimony, nickel, cobalt, manganese, tin, lead, beryllium, silver, chromium, aluminum, selenium, iron, and arsenic. The most common agents involved are zinc and copper.

This product may contain small amounts of manganese. Prolonged exposure to manganese dusts or fumes is associated with "manganism", a Parkinson-like syndrome characterized by a variety of neurological symptoms including muscle spasms, gait disturbances, tremors, and psychoses.

This product may contain small amounts of cadmium. Primary target organs for cadmium overexposure are the lung and the kidney. Because of its cumulative nature, chronic cadmium poisoning can cause serious disease which takes many years to develop and may continue to progress despite cessation of exposure. Progression of the disease may not reflect current exposure conditions. It is also capable of causing a painful osteomalacia called “Itai-Itai” in postmenopausal women, and has caused developmental effects and/or reproductive effects in male and female animals. Cadmium is a listed carcinogen by NTP, OSHA, and IARC (Group 1).

This product may contain small amounts of chromium. Prolonged and repeated overexposure to chromium dusts or fumes may cause skin ulcers, nasal irritation and ulceration, kidney damage and cancer of the respiratory system. Chromium is skin sensitizer. Cancer is generally attributed to the hexavalent (+6) form of chromium which is listed as a carcinogen by NTP and IARC (Group 1).

This product may contain small amounts of nickel. Prolonged and repeated contact with nickel may cause sensitization dermatitis. Inhalation of nickel compounds has caused lung damage as well as sinus, nasal and lung cancer in laboratory animals. Nickel is a listed carcinogen by NTP and IARC (Group 1).

This product may contain small amounts of vanadium. Adverse effects from dermal, inhalation or parenteral exposure to various vanadium compounds have been reported. The major target for vanadium pentoxide toxicity is the respiratory tract. Fumes or dust can cause severe eye and respiratory irritation, and systemic effects. Chronic bronchitis, green tongue, conjunctivitis, pharyngitis, rhinitis, rales, chronic productive cough, and tightness of the chest have been reported following overexposure. Allergic reactions resulting from skin and inhalation exposures have also been reported. A statistical association between vanadium air levels and lung cancer has been suggested, but vanadium currently is not regarded as a human carcinogen.

This product may contain small amounts of lead. Lead can accumulate in the body. Consequently, exposure to fumes or dust may produce signs of polyneuritis, diminished vision and peripheral neuropathy, such as tingling and loss of feeling in fingers, arms and legs. Lead is a known reproductive and developmental toxin. It is also associated with central nervous system disorders, anemia, kidney dysfunction and neurobehavioral abnormalities. The brain is a major target organ for lead exposure. Elemental lead is listed as an IARC 2B carcinogen.

The product may contain small amounts of copper. Copper dust and fumes can irritate the eyes, nose and throat causing coughing, wheezing, nosebleeds, ulcers and metal fume fever. Other effects from repeated inhalation of copper fumes include a metallic or sweet taste, and discoloration of skin, teeth or hair. Copper also may cause an allergic skin reaction. Overexposure to copper can affect the liver.

12. ECOLOGICAL INFORMATION

Aquatic Ecotoxicological Data - No specific information available on this product.
Environmental Fate Data - No specific information available on this product.

13. DISPOSAL CONSIDERATIONS

Recovery and reuse, rather than disposal, should be the ultimate goal of handling efforts. 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 Name - Not regulated
DOT Hazard Classification - Not regulated
UN/NA Number - Not applicable
DOT Packing Group - Not applicable
Labeling Requirements - Not applicable
Placards - Not applicable
DOT Hazardous Substance - Not applicable
DOT Marine Pollutant - Not applicable

15. REGULATORY INFORMATION

This product is not hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1910.1200. However, dusts and fumes from this product may be combustible or hazardous and require protection to comply with applicable Federal, state and local laws and regulations.

California Proposition 65: This product contains chemicals (antimony [oxide], arsenic, beryllium, chromium [hexavalent], cobalt, cadmium, lead, nickel) known to the State of California to cause cancer and chemicals (cadmium, lead) known to the State of California to cause birth defects or other reproductive harm.

Massachusetts Substance List: Aluminum, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Lead, Magnesium, Manganese, Molybdenum, Nickel, Nitrogen, Phosphorus, Selenium, Silicon, Sulfur, Tin, Titanium, Tungsten, Vanadium, Zinc

Pennsylvania Hazardous Substance List: Aluminum, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Lead, Magnesium, Manganese, Molybdenum, Nickel, Nitrogen, Phosphorus, Selenium, Silicon, Sulfur, Tin, Titanium, Tungsten, Vanadium, Zinc

New Jersey Hazardous Substance List: Aluminum, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Lead, Magnesium, Manganese, Molybdenum, Nickel, Nitrogen, Phosphorus, Selenium, Silicon, Sulfur, Tin, Titanium, Tungsten, Vanadium, Zinc

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

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
Steel is not reportable, however, it contains hazardous substances that may be reportable if released in pieces with diameters less than or equal to 0.004 inches (RQ marked with a "*").

Chemical Name	Reportable Quantity (in lb)
Antimony	5000*
Arsenic	1*
Beryllium	10*
Cadmium	10*
Chromium	5000*
Copper	5000*

Chemical Name	Reportable Quantity (in lb)
Lead	10*
Nickel	100*
Phosphorus	1
Selenium	100*
Zinc	1000*

Superfund Amendments and Reauthorization Act of 1986 (SARA), Title III
SECTION 311/312 HAZARD CATEGORIES: Immediate Health Effect, Delayed Health Effect

This product contains the following EPCRA Section 313 chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right – To – Know Act of 1986 (40 CFR 372):

SECTION 313 REPORTABLE INGREDIENTS:

Chemical Name	CAS Number	Concentration (% by weight)	Reportable
Aluminum	7429-90-5	<0.05	No – Less than 1%
Antimony	7440-36-0	<0.9	No – Less than 1%
Arsenic	7440-38-2	<0.09	No – Less than 0.1%
Beryllium	7440-41-7	<0.09	No – Less than 0.1%
Cadmium	7440-43-9	<0.01	No – Less than 0.1%
Chromium	7440-47-3	0.01-1.2	Yes – Greater than 0.1%
Cobalt	7440-48-4	<0.09	No – Less than 0.1%
Copper	7440-50-8	<0.9	No – Less than 1%
Lead	7439-92-1	<0.07	Yes
Manganese	7439-96-5	0.2-2	Yes – Greater than 1%
Nickel	7440-02-0	<1.0	Yes – Greater than 0.1%
Phosphorus	7723-14-0	<0.9	No – Less than 1%
Selenium	7782-49-2	<0.9	No – Less than 1%
Vanadium	7440-62-2	<0.9	No – Less than 1%
Zinc	7440-66-6	0-0.10	No – Less than 1%

Concentrations based on analytical data and process knowledge of typical products distributed by the facility.

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 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 Safety Data Sheet (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.