



United States Steel Corporation

Galvanized (Electrolytic) Sheet
Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS)

USS IHS Number: 7644

(Replaces USS Code Number: 3C013)

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Section 1 – Chemical Product and Company Identification

GHS Product Identifier: Galvanized (Electrolytic) Sheet

Other means of identification: Galvannealed (Electrolytic) Sheet

CAS Number: Mixture

Supplier's Details: United States Steel Corporation, 600 Grant Street, Room 1662, Pittsburgh, PA 15219-2800

Phone Number (s): (412) 433-6840 (8:00 am to 5:00 pm); FAX: (412) 433-5019

Off-Hour Emergency Phone Number: 1-800-262-8200 (CHEMTREC)

Section 2 - Hazards Identification

As sold, this product, **Galvanized (Electrolytic) Sheet** (semi-finished steel products) is not hazardous according to the criteria specified in European Directives 67/548/EEC and 1999/45/EC. Under 29 CFR 1910.1200 Hazard Communication Standard, steel products are considered mixtures due to further processing which may produce dusts and or fumes. Refer to Section 3 and 8 for additional information. Refer to Section 11 for Toxicological Information.

Precautionary Statement/Emergency Overview: This formed solid metal product poses little or no immediate health or fire hazard. When product is subjected to welding, burning, melting, sawing, brazing, grinding or other similar processes, potentially hazardous airborne particulate and fumes may be generated. In Dust state: Contact with water liberates extremely flammable gasses, Irritating to skin, spontaneously flammable in air. These operations should be performed in well-ventilated areas. Avoid inhalation of metal dusts and fumes. Iron or steel foreign bodies imbedded in the cornea of the eye will produce rust stains unless removed fairly promptly. If appropriate, respiratory protection and other personal protective equipment should be used.

Section 3 – Composition/Information on Ingredients

Chemical identity of the substance:

Ingredient Name	EC Number	CAS Number	% weight
Iron	231-096-4	7439-89-6	>95
Copper	231-159-6	7440-50-8	0.2 max
Chromium	231-157-5	7440-47-3	0.2 max
Manganese	231-105-1	7439-96-5	2.0 max
Nickel	231-111-4	7440-02-0	0.2 max

Metallic Coating

Zinc	231-175-3	7440-66-6	0.14 – 4.2
Iron	231-096-4	7439-89-6	0.75 max

EC - European Community

CAS - Chemical Abstract Service

All 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: aluminum, boron, carbon, molybdenum, phosphorous, sulfur and silicon.

Section 4 - First Aid Measures

Description of necessary first aid measures:

- **Inhalation:** If large amounts of dusts, fumes, or particulates are generated, move person to fresh air. If symptoms develop, seek medical attention.
- **Eye Contact:** For contact with dusts or particulates, flush eyes with water for 15 minutes. Eye injuries from solid particles should be treated by a physician immediately.
- **Skin Contact:** For skin contact with dusts or powders, wash immediately with soap and water. Cuts or abrasions should be treated promptly with thorough cleansing of the affected area.
- **Ingestion:** No need for first aid is anticipated if material is swallowed, however if symptoms develop, seek medical attention. For Ingestion of Dusts: IF SWALLOWED: Call a poison center or Doctor/physician if you feel unwell. Rinse mouth.

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Section 4 - First Aid Measures (continued)

Most important acute and chronic symptoms/effects:

Primary Entry Routes: Galvanized (Electrolytic) Sheet (semi-finished steel products) in its usual physical form does not present an inhalation, ingestion or contact hazard. However, operations such as burning, welding, sawing, brazing, machining and grinding may result in the following effects if exposures exceed recommended limits as listed in Section 8.

Target Organs: Respiratory system

Acute Effects:

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

Acute Effects by component:

- **IRON (and Iron Oxide):** Iron is harmful if swallowed, causes skin irritation, and causes eye irritation. Contact with iron oxide has been reported to cause skin irritation and serious eye damage.
- **COPPER (and Copper Oxide):** Copper may cause allergic skin reaction. Copper oxide is harmful if swallowed, causes skin and eye irritation, and may cause an allergic skin reaction.
- **CHROMIUM (as Hexavalent Chrome):** Hexavalent chrome causes damage to gastrointestinal tract, lung, severe skin burns and eye damage, serious eye damage, skin contact may cause an allergic skin reaction, inhalation may cause allergic or asthmatic symptoms or breathing difficulties.
- **MANGANESE (and Manganese Oxide):** Manganese and Manganese oxide are harmful if swallowed.
- **NICKEL (and Nickel Oxide):** Nickel may cause allergic skin sensitization. Nickel oxide may cause an allergic skin sensitization.
- **Zinc:** Not Reported/ Not Classified

Chronic Effects by component:

- **IRON (as Iron Oxide):** Chronic inhalation of excessive concentrations of iron oxide fumes or dusts may result in the development of a benign pneumoconiosis, called siderosis, which is observable as an X-ray change. No physical impairment of lung function has been associated with siderosis. Inhalation of excessive concentrations of ferric oxide may enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens. Iron oxide is listed as a Group 3 (not classifiable) carcinogen by the International Agency for Research on Cancer (IARC).
- **CHROMIUM:** The health hazards associated with exposure to chromium are dependent upon its oxidation state. The metal form (chromium as it exists in this product) is of very low toxicity. The hexavalent form is very toxic. Repeated or prolonged exposure to hexavalent chromium compounds may cause respiratory irritation, nosebleed, ulceration and perforation of the nasal septum. Industrial exposure to certain forms of hexavalent chromium has been related to an increased incidence of cancer. NTP (The National Toxicology Program) Fourth Annual report on Carcinogens cites "certain Chromium compounds" as human carcinogens. ACGIH has reviewed the toxicity data and concluded that chromium metal is not classifiable as a human carcinogen. Hexavalent chromium may cause genetic defects and is suspected of damaging the unborn child. Developmental toxicity in the mouse, suspected of damaging fertility or the unborn child.
- **NICKEL:** 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. 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 2009 TLVs® and BEIs® lists insoluble nickel compounds as confirmed human carcinogens. Suspected of damaging the unborn child.
- **MANGANESE:** 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 MnO including: speed and coordination of motor function are especially impaired.
- **Zinc:** Zinc dusts are a low health risk by inhalation and should be treated as a nuisance dust. Inhalation of zinc oxide fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count.

Long-term inhalation exposure to high concentrations (over-exposure) to pneumoconiotic agents may act synergistically with inhalation of oxides, fumes or dusts of this product to cause toxic effects.

Carcinogenicity: IARC, NTP, and OSHA do not list steel products as carcinogens. IARC identifies welding fumes as a Group 2B carcinogen, a mixture that is possibly carcinogenic to humans. IARC identifies nickel and certain nickel compounds and welding fumes as Group 2B carcinogens that are possibly carcinogenic to humans. ACGIH lists insoluble nickel compounds as confirmed human carcinogens. IARC lists chromium metal and trivalent chromium compounds as Group 3 carcinogens, not classifiable as to their human carcinogenicity. Hexavalent chromium compounds are listed by IARC as Group 1 carcinogens that are carcinogenic to humans. NTP Fourth Annual report on Carcinogens cites "certain Chromium compounds" as human carcinogens. ACGIH has reviewed the toxicity data and concluded that chromium metal is not classifiable as a human carcinogen.

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

SARA Potential Hazard Categories: Immediate Acute Health Hazard; Delayed Chronic Health Hazard

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Section 5 – Fire and Explosion Hazard Information

Suitable Extinguishing Media: Not applicable for solid product. Use extinguishers appropriate for surrounding materials.

Specific Hazards arising from the chemical: Not applicable for solid product. Do not use water on molten metal.

Explosion hazard: Accumulated metal dust can be combustible. Avoid creating dust. Do not use water on molten metal.

Special protective equipment and precautions for fire fighters: Self-contained MSHA/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.

Section 6 - Accidental Release Measures

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

Environmental precautions: Not applicable to steel in solid state. Follow applicable Federal, state, and local regulations

Methods and materials for containment and clean up: 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.

Section 7 - Handling and Storage

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

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

Section 8 - Exposure Controls / Personal Protection

Occupational Exposure Limits (OELs): This product, **Galvanized (Electrolytic) Sheet** (semi-finished steel products) in its physical form as sold does not present an inhalation, ingestion or contact hazard, nor would any of the following exposure data apply. However, operations such as high temperature (burning, welding), sawing, brazing, machining and grinding may produce fumes and/or particulates. The following exposure limits are offered as reference, for an experience industrial hygienist to review.

Ingredients	OSHA PEL ¹	ACGIH TLV ²	NIOSH REL ³	IDLH ⁴
Iron	10 mg/m ³ (as iron oxide fume)	5.0 mg/m ³ (as iron oxide dust and fume)	5.0 mg/m ³ (as iron oxide dust and fume)	2,500 mg Fe/m ³
Copper	0.1 mg/m ³ (as fume, Cu) 1.0 mg/m ³ (as dusts & mists, Cu)	0.1 mg/m ³ (as fume) 1.0 mg/m ³ (as dusts & mists, Cu)	1.0 mg/m ³ (as dusts & mists)	100 mg Cu/m ³
Manganese	“C” 5.0 mg/m ³ (as Fume & Mn compounds)	0.2 mg/m ³	“C” 5.0 mg/m ³ 1.0 mg/m ³ (as fume) “STEL” 3.0 mg/m ³	500 mg Mn/m ³
Nickel	1.0 mg/m ³ (as Ni metal & insoluble compounds)	1.5 mg/m ³ (as inhalable fraction ⁵ Ni metal) 0.2 mg/m ³ (as inhalable fraction Ni inorganic only insoluble and soluble compounds)	0.015 mg/m ³ (as Ni metal & insoluble and soluble compounds)	10 mg/m ³ (as Ni)
Chromium	0.5 mg/m ³ (as Cr II & III, inorganic compounds) 1.0 mg/m ³ (as Cr, metal) 0.005 mg/m ³ (as Cr VI, inorganic compounds & certain water insoluble) “AL” 0.0025 mg/m ³ (as Cr VI, inorganic compounds & certain water insoluble)	0.5 mg/m ³ (as Cr III, inorganic compounds) 0.5 mg/m ³ (as Cr, metal) 0.05 mg/m ³ (as Cr VI, inorganic compounds) 0.01 mg/m ³ (as Cr VI, inorganic compounds & certain water insoluble)	0.5 mg/m ³ (as Cr II & III, inorganic compounds) 0.5 mg/m ³ (as Cr, metal) 0.001 mg/m ³ (as Cr VI, inorganic compounds & certain water insoluble)	250 mg/m ³ (as Cr II & metal) 25 mg/m ³ (as Cr III) 15 mg/m ³ (as Cr VI)
Zinc	5.0 mg/m ³ (as zinc oxide fume) 15 mg/m ³ (as total dust) 5.0 mg/m ³ (as respirable fraction)	2.0 mg/m ³ (as zinc oxide)	10 mg/m ³ (as total dust) 5.0 mg/m ³ (as respirable dust)	NE

NE - None Established

Notes:

All commercial steel products contain small amounts of various elements in addition to those specified. 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: antimony, arsenic, cadmium, cobalt, lead, tin and zirconium.

1. OSHA PELs (Permissible Exposure Limits) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted. A (“C”) designation denotes a ceiling limit, which should not be exceeded during any part of the working exposure unless otherwise noted. A Short Term Exposure Limit (STEL) is defined as a 15-minute exposure, which should not be exceeded at any time during a workday.
2. Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted. ACGIH TLVs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
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.

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Section 8 - Exposure Controls / Personal Protection (continued)

- 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.
- 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 2009 TLVs[®] and BEIs[®] (Biological Exposure Indices) Appendix D, paragraph A.

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.

Personal Protective Equipment (PPE)

- 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 a 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.

Protective Clothing/Equipment:

- 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.
- Other protective equipment:** An eyewash fountain and deluge shower should be readily available in the work area.

Section 9 - Physical and Chemical Properties

Appearance and Odor: Metallic Gray, Odorless

Odor Threshold: NA

Vapor Pressure: NA

Vapor Density (Air = 1): NA

Formula Weight: ND

Density: 7.85 g/cc **Coating:** 7.14 g/cc

Specific Gravity (H₂O = 1, 60°F): NA

pH: NA

Flash Point (closed cup): NA

Auto-ignition Temperature: NA

Decomposition Temperature: ND

Partition Coefficient n-octanol/water: ND

Flammability (solid, gas): Non-flammable, non-combustible

Explosive Properties: ND

NA - Not Applicable

ND - Not Determined for product as a whole

Water Solubility: Insoluble

Fat Solubility: NA

Other Solubilities: NA

Boiling Point: ND **Coating:** ~1700 °F (~927 C)

Viscosity: NA

Refractive Index: NA

Surface Tension: NA

% Volatile by volume: NA

Evaporation Rate: NA

Freezing Point: NA

Melting Point: ~2750 °F (~1510 C), **Coating:** ~787 °F (~419 C),

UEL: NA

LEL: NA

Oxidizing Properties: ND

Section 10 - Stability and Reactivity

Reactivity: Not Determined (ND) for product as a whole.

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

Polymerization: Hazardous polymerization cannot occur.

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

Conditions to Avoid: Storage with strong acids or calcium hypochlorite

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











Sensitivity to Mechanical Impact: ND

Sensitivity to Static Discharge: ND

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Section 11 - Toxicological Information

Toxicological information has not been established for this product as sold. However, processing of this product in operations such as high temperature (burning, welding), sawing, brazing, machining and grinding may produce fumes and/or particulates, which would result in the material being classified as hazardous under OSHA 29 CFR 1910.1200. 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 and are listed below:

Potential Hazard	Hazard Category	Hazard Symbol	Signal Word	Hazard Statement
Acute Toxicity Hazard	4 ^a		Warning	Harmful if swallowed
Skin Irritation	1 ^b		Danger	Causes severe skin burns
Eye Damage/ Irritation	1 ^c		Danger	Causes severe eye damage
Skin Sensitization	1 ^d		Warning	May cause an allergic skin reaction
Respiratory Sensitization	1 ^e		Warning	May cause allergy or asthma symptoms or breathing difficulties if inhaled
Germ Cell Mutagenicity	1B ^f		Danger	May cause genetic defects
Carcinogenicity	1A ^g		Danger	May cause cancer
Toxic Reproduction	2 ^h		Warning	Suspected of damaging fertility or the unborn child
Specific Target Organ Systemic Toxicity (STOST) following Single Exposure	3 ⁱ		Warning	May cause respiratory irritation
STOST following Repeated Exposure	1 ^j		Danger	Causes damage to lungs and central nervous system through prolonged or repeated inhalation exposure. Causes damage to skin, mucosal membranes and lungs through all exposures

Notes:

a. No LC₅₀ or LD₅₀ has been established for **Galvanized (Electrolytic) Sheet** (semi-finished steel products). The following data has been determined for the components:

- **Chromium (as Cr^{+VI}):** LD₅₀ = 80 mg/kg (Oral/Rat)
- **Copper Oxide:** LD₅₀ = 470 mg/kg (Oral/Rat)
- **Manganese:** Mn single oral exposures, LD₅₀ ranged from 275 to 804 mg/kg body weight per day for manganese chloride in different rat strains
- **Iron Oxide:** LD₅₀ = 10,000 mg/kg (Oral/ Rat); and as **Iron:** LD₅₀ = 1060 mg/kg (Oral/ Rat)
- **Nickel:** LD₅₀ > 9000 mg/kg (Oral/Rat); LC₅₀ > 10.2 mg/l (Inhalation/Rat); and as **Nickel Oxide:** LD₅₀ > 5000 mg/kg (Oral/Rat)
- **Zinc:** LD₅₀ = >2000 mg/kg (Oral/Rat); and **Zinc Oxide:** LC₅₀ = >5700 mg/m³ (Inhalation/Rat)

b. No Skin (Dermal) Irritation data available for **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a mixture. The following Skin (Dermal) Irritation information was found for the components:

- **Chromium (as Cr^{+VI}):** Corrosive. Human skin sensitizer. Causes severe skin burns
- **Copper Oxide:** Irritating
- **Copper:** May cause allergic skin reaction. It is reported that copper may induce allergic contact dermatitis in susceptible individuals.
- **Iron, Iron Oxide, Copper Oxide:** Causes skin irritation
- **Iron Oxide:** Moderately irritating
- **Nickel Oxide:** Human skin sensitizer
- **Nickel:** Slight irritation only in rabbits

c. No Eye Irritation data available for **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a mixture. The following Eye Irritation information was found for the components:

- **Iron, Copper Oxide:** Irritating
- **Iron Oxide:** Severely irritating; may cause burns.
- **Chromium (as Cr^{+VI}):** Causes serious eye damage, Corrosive
- **Nickel:** Slight eye irritation from particulate abrasion only

d. No Skin (Dermal) Sensitization data available for **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a mixture. The following Skin (Dermal) Sensitization information was found for the components:

- **Nickel and Nickel Oxide:** Human skin sensitizer
- **Copper:** It is reported that copper may induce allergic contact dermatitis in susceptible individuals.
- **Chromium (as Cr^{+VI}):** May cause allergic skin reaction

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Section 11 - Toxicological Information (continued)

- e. No Respiratory Sensitization data available for **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a mixture. The following Respiratory Sensitization information was found for the components:
- **Chromium (as Cr^{+VI}):** Occupational asthma reported in workers
- f. No Germ Cell Mutagenicity data available for **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a mixture. The following Mutagenicity and Genotoxicity information was found for the components:
- **Iron:** IUCLID has found some positive and negative findings in vitro
 - **Iron Oxide:** IUCLID has found some positive and negative findings
 - **Chromium (as Cr^{+VI}):** SCOEL has found positive in vitro and in vivo assays including cell transformation in vitro and dominant lethal in vivo
 - **Nickel:** EU RAR has found positive results *in vitro and in vivo* but insufficient data for classification
 - **Nickel (as Nickel Oxide):** ATSDR has found positive and negative results *in vitro and in vivo*
- g. Carcinogenicity: IARC, NTP, and OSHA do not list **Galvanized (Electrolytic) Sheet** (semi-finished steel products) 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.
 - **Chromium metal and trivalent chromium compounds** – IARC Group 3 carcinogens, not classifiable as to their human carcinogenicity. Hexavalent chromium compounds – IARC as Group 1 carcinogens, carcinogenic to humans. Chromium metal – ACGIH not classifiable as a human carcinogen. NTP Fourth Annual report on Carcinogens cites “certain Chromium compounds” as human carcinogens.
 - **Nickel and certain nickel compounds** – IARC Group 2B carcinogens that are possibly carcinogenic to humans. Insoluble 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. Nickel Oxide – HSDB listed as Category 1a, may cause cancer. Human data in which exposure to nickel refinery dust caused lung and nasal tumors.
- h. No Toxic Reproduction data available for **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a mixture. The following Toxic Reproductive information was found for the components:
- **Hexavalent Chromium:** EU RAR listed as Category 2, has found developmental toxicity in the mouse.
 - **Nickel and Nickel Oxide:** EURAR listed as Category 2, has found oral administration to experimental animals caused fetotoxicity.
- i. No Specific Target Organ Systemic Toxicity (STOST) following a Single Exposure data available for **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a mixture. The following STOST following a Single Exposure data was found for the components:
- **Iron, Copper Oxide:** Listed as Category 3, Irritating to respiratory tract.
 - **Manganese Oxide:** CICAD reported Lung inflammation following single inhalation exposures to at 2.8-43 mg/m³ for manganese dioxide or manganese tetroxide particulates in rodent species
- j. No Specific Target Organ Systemic Toxicity (STOST) following Repeated Exposure data was available for **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a whole. The following STOST following Repeated Exposure data was found for the components:
- **Manganese Oxide:** CICAD listed as Category 2, has found signs of lung inflammation in rhesus monkeys exposed via inhalation to 0.7mg/m³ manganese, as manganese dioxide for 22 hours per day over 10 months.
 - **Nickel and Nickel Oxide:** EU-RAR listed as Category 1, has found rats exposed to Nickel by inhalation at 1 mg/m³ for 90 days developed lung inflammation, hyperplasia and fibrosis.
 - **Hexavalent Chrome:** EU-SCOEL listed as Category 1, has found inflammation of lung, skin irritation and ulceration with repeat exposures in workers.
 - **Manganese and Manganese Oxide:** CICAD listed as Category 1a, has found neurobehavioral alterations in worker populations with Mn and MnO including: speed and coordination of motor function are especially impaired.
 - **Zinc and Zinc Oxide:** EU RAR has found rats repeatedly exposed by oral route to Zn salts developed reduced copper levels and changes in the pancreas (focal acinar degeneration and necrosis) and the spleen (decreased number of pigmented macrophages)

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).

Section 12 - Ecological Information

Hazard Category: 3

Hazard Symbol: No Symbol

Signal Word: No Signal Word

Hazard Statement: Harmful to aquatic life

Ecotoxicity: No data available for the product, **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a whole. However, individual components of the product have been found to be toxic to the environment. Metal dusts may migrate into soil and groundwater and be ingested by wildlife as follows:

- **Iron Oxide:** LC₅₀: >1000 mg/L; Fish
- **Hexavalent Chrome:** EU RAR listed as category 1, found acute EC₅₀ and LD₅₀ to algae and invertebrates < 1 mg.
- **Nickel Oxide:** IUCLID found LC₅₀ in fish, invertebrates and algae > 100 mg/l.
- **Zinc and Zinc Oxide:** EU RAR lists as Category 1 Very toxic to aquatic life with long lasting effects

Mobility: No data available for the product, **Galvanized (Electrolytic) Sheet** (semi-finished steel products) as a whole. However, individual components of the product have been found to be absorbed by plants from soil.

Persistence & Degradability: No Data Available

Bioaccumulative Potential: No Data Available

Note: The listing of regulations relating to a USS product may not be complete and should not be solely relied upon for all regulatory compliance responsibilities.

Galvanized (Electrolytic) Sheet

Section 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.

Container Cleaning and Disposal: Follow applicable Federal, state and local regulations. Observe safe handling precautions. European Waste Catalogue (EWC): 16-01-17 (ferrous metals), 12-01-99 (wastes not otherwise specified), 16 03 (off specification batches and unused products), or 15 01 04 (metallic packaging).

Please note this information is for Tin Free Steel in its original form. Any alterations can void this information.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

US Department of Transportation (DOT) under 49 CFR 172 **does not regulate Galvanized (Electrolytic) Sheet** (semi-finished steel products) 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.: Not applicable 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
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The 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.

ADR – Regulations Concerning the International Carriage of Dangerous Goods by Road does not regulate Galvanized (Electrolytic) Sheet (semi-finished steel products) as a hazardous material.

Shipping Name: Not Applicable (NA) Classification Code: NA UN No.: Not applicable 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
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IATA – International Air Transport Association (IATA) does not regulate Galvanized (Electrolytic) Sheet (semi-finished steel products) 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) <table border="1"> <tr> <td data-bbox="678 1150 880 1260"> Pkg Inst: NA Max Net Qty/Pkg: NA </td> <td data-bbox="880 1150 1084 1260"> Pkg Inst: NA Max Net Qty/Pkg: NA </td> </tr> </table>	Pkg Inst: NA Max Net Qty/Pkg: NA	Pkg Inst: NA Max Net Qty/Pkg: NA	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: Galvanized (Electrolytic) Sheet (semi-finished steel products) does not have a TDG classification..

Section 15 - Regulatory Information

Regulatory Information: *The following listing of regulations relating to a U. S. Steel 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, **Galvanized (Electrolytic) Sheet** (semi-finished steel products) 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: Galvanized (Electrolytic) Sheet (semi-finished carbon steel) is not listed as a whole. However, individual components of the product are listed:

Components	Regulations
Copper	CWA, SDWA
Chromium	CAA, CWA, SARA 313, SDWA
Manganese	SARA 313, CAA
Nickel	CAA, , CWA, SARA 313
Zinc	CWA, SARA 313

SARA Potential Hazard Categories: Immediate Acute Health Hazard; Delayed Chronic Health Hazard

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 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])

Galvanized (Electrolytic) Sheet

Section 15 - Regulatory Information (continued)

Section 313 Supplier Notification: This product contains the following toxic chemicals subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372:

CAS #	Chemical Name	Percent by Weight
7440-47-3	Chromium	0.2 max
7439-96-5	Manganese	2.0 max
7440-02-0	Nickel	0.2 max
7440-66-6	Zinc	4.2 max

This information should be included in all MSDSs that are copied and distributed for this material.

State Regulations: The product, **Galvanized (Electrolytic) Sheet** (semi-finished steel products) 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:

- Environmental Hazards: Copper, Chromium, Manganese, Nickel, and Zinc
- Special Hazardous Substance: Chromium and Nickel

California Prop. 65: The product may possibly contain trace quantities (generally much less than 0.1%) of metallic elements known to the State of California to cause cancer or reproductive toxicity. These include chromium and nickel.

New Jersey: Contains regulated material in the following categories:

- Hazardous Substance: Copper, Chromium, Manganese, Nickel, and Zinc

Minnesota: Copper, Chromium, Manganese, and Nickel

Massachusetts: Copper, Chromium, Manganese, Nickel, and Zinc

Other regulations:

WHMIS Classification (Canadian): Galvanized (Electrolytic) Sheet (semi-finished steel products) is not listed as a whole. However individual components are listed.

Ingredients	WHMIS Classification
Iron	B4, D2B
Copper	D2B, B4
Manganese	B4, D2A
Nickel	D2B
Zinc	B4, D2B

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

Section 16 - Other Information

Prepared By: United States Steel Corporation

Revision History:

03/21/11 – Update of content and format to comply with GHS. Replaces USS Code 3C013

Hazardous Material Identification System (HMIS) Classification

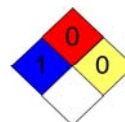
Health Hazard	1
Fire Hazard	0
Physical Hazard	0

HEALTH= 1, * Denotes possible chronic hazard if airborne dusts or fumes are generated Irritation or minor reversible injury possible.

FIRE= 0, Materials that will not burn

PHYSICAL HAZARD= 0, Materials that are normally stable, even under fire conditions, and will not react with water, polymerize, decompose, condense, or self-react. Non-explosives

National Fire Protection Association (NFPA)



HEALTH = 1, Exposure could cause irritation but only minor residual injury even if no treatment is given.

FIRE = 0, Materials that will not burn

INSTABILITY = 0, Normally stable, even under fire exposure conditions, and are not reactive with water.

Disclaimer: This information is taken from sources or based upon data believed to be reliable. However, United States Steel Corporation makes no warranty as to the absolute correctness or sufficiency of any of the foregoing or that additional or other measures may not be required under particular conditions.