United States Steel Corporation

Material Safety Data Sheet

USS Code Number: 3C012
Original Issue Date: 09/01/85 **Revised: 06/04**

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: **Galvanized (Hot Dipped) Sheet – Carbon Steel;**
Galvannealed (Hot Dipped) Sheet – Carbon Steel;
ACRYZINC® Sheet – Carbon Steel

Also Includes: Culvert

Manufacturer: United States Steel Corporation, 600 Grant Street, Room 2514H, Pittsburgh, PA 15219-2800
General Information: (412) 433-6840 (8:00 am to 5:00 pm); FAX: (412) 433-5016
Off-Hour Emergency Phone Number: (412) 433-5811

Section 2 - Composition / Information on Ingredients

Ingredient Name	CAS Number	Percentage by wt.	OSHA PEL [1]	ACGIH TLV [2]
Base Metal				
Iron	7439-89-6	>90.0	10 mg/m³ - Iron oxide fume	5 mg/m³ - Iron oxide dust and fume
Alloying Elements				
Calcium	7440-70-2	0.10 max.	5 mg/m³ – Calcium oxide	2 mg/m³ – Calcium oxide
Carbon	7440-44-0	0.60 max.	15 mg/m³ -Total dust (PNOR) [3] 5 mg/m³ - Respirable fraction (PNOR)	10 mg/m³ - Inhalable fraction[4] (PNOS) [5] 3 mg/m³ - Respirable fraction[6] (PNOS)
Copper	7440-50-8	0.50 max.	0.1 mg/m³ - Fume (as Cu) 1 mg/m³ - Dusts & mists (as Cu)	0.2 mg/m³ – Fume 1 mg/m³ – Dusts & mists (as Cu)
Manganese	7439-96-5	1.50 max.	5 mg/m³ (C) - Fume & Mn compounds	0.2 mg/m³
Phosphorus	8049-19-2	0.15 max.	15 mg/m³ - Total dust (PNOR) 5 mg/m³ - Respirable fraction (PNOR)	10 mg/m³ - Inhalable fraction (PNOS) 3 mg/m³ - Respirable fraction (PNOS)
Silicon	7440-21-3	0.60 max.	15 mg/m³ - Total dust 5 mg/m³ - Respirable fraction	10 mg/m³
Sulfur	7704-34-9	0.04 max.	15 mg/m³ - Total dust (PNOR) 5 mg/m³ - Respirable fraction (PNOR)	10 mg/m³ - Inhalable fraction (PNOS) 3 mg/m³ - Respirable fraction (PNOS)
Metallic Coating		*		
Aluminum	7429-90-5	0.055 max.	15 mg/m³ - Total dust 5 mg/m³ - Respirable fraction	10 mg/m³ - Metal Dust 5 mg/m³ - Welding fume
Antimony	7440-36-0	0.011 max.	0.5 mg/m³	0.5 mg/m³
Iron	7439-89-6	0.8 max.	10 mg/m³ - Iron oxide fume	5 mg/m³ - Iron oxide dust and fume
Lead	7439-92-1	0.004 max.	0.05 mg/m³ [7]	0.05 mg/m³
Zinc	7440-66-6	0.15-9.1	5 mg/m³ - Fume 15 mg/m³ - Total dust 5 mg/m³ - Respirable fraction	5 mg/m³ - Fume 10 mg/m³ - Fume (STEL) 10 mg/m³ - Dust

Notes:

- * Percent weight of metallic coating is a percent of the total product.
- Galvanized sheet surfaces may be chemically treated, generally at the customer's specification, with trace amounts of chromate solution (approximately 1 to 2 mg/ft² per side or <0.002% of total product weight) to prevent humid storage stain, and/or phosphate solution (<300 mg/ft² or <0.3%) to enhance paint adherence and formability. Surface may also be treated with small amounts (<0.05%) of corrosion-inhibiting oil.

- ACRYZINC® product has a thin clear resin film (approximately 100 mg/ft² per side) over the galvanized coating. This film consists of a water-insoluble acrylic polymer/chromium matrix in approximately a 100/1 ratio. The composition of the acrylic coating, as a percentage of the total product weight, is <0.1% polymers and <0.001% chromium.

- All commercial steel products may contain small amounts of various elements in addition to those specified. These small quantities (less than 0.1%) may exist as intentional additions, or as "trace" or "residual" elements that generally originate in the raw materials used. These elements may include: aluminum, antimony, arsenic, boron, cadmium, calcium, chromium, cobalt, columbium, copper, lead, molybdenum, nickel, silicon, tin, titanium, vanadium, and zirconium.

[1] OSHA Permissible Exposure Limits (PELs) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted. A ("C") designation denotes a ceiling limit, which should not be exceeded during any part of the working exposure unless otherwise noted. A 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.

[3] PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the PNOR limit which is the same as the inert or nuisance dust limit of 15 mg/m³ for total dust and 5 mg/m³ for the respirable fraction.

[4] 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 TLVs and BEIs Appendix D, paragraph A.

[5] PNOS (Particulates Not Otherwise Specified). Particulates identified under the PNOS heading are "nuisance dusts" containing no asbestos and <1% crystalline silica. A TWA-TLV of 10 mg/m³ for inhalable particulate and 3 mg/m³ for respirable particulate has been recommended.

[6] Respirable fraction. The concentration of respirable dust for the application of this limit is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH TLVs and BEIs Appendix D, paragraph C.

[7] The 8-hour PEL is 50 ug/m³. If an employee is exposed to lead for more than 8 hours in any work day, the PEL, as a TWA for that day, shall be reduced according to the following formula: Maximum permissible limit (in ug/m³) = 400 divided by hours worked in that day. The Action Level is 30 ug/m³ averaged over an 8-hour period.

Section 3 - Hazards Identification

☆☆☆☆☆ 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. Avoid inhalation of metal dusts and fumes. Operations having the potential to generate airborne particulates should be performed in well ventilated areas and, if appropriate, respiratory protection and other personal protective equipment should be used. Iron or steel foreign bodies imbedded in the cornea of the eye may produce rust stains unless removed fairly promptly.

Potential Health Effects

Primary Entry Routes: Inhalation and skin, if coated. Steel products in the natural state do 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 2.

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, copper and zinc have been associated with causing metal fume fever. Although not expected to cause effects based upon the quantity present in the material, inhalation or ingestion of lead particles may result in lead-induced systemic toxicity. Symptoms of lead poisoning include abdominal cramps, anemia, muscle weakness and headache.

- **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. Torching or burning operations on steel products with surface treatments, oil coatings, or acrylic films may produce emissions that can be irritating to the eyes.

- **Skin:** Skin contact with dusts may cause irritation or sensitization, possibly leading to dermatitis. Repeated or prolonged contact with chemical surface treatments or oil residue may cause skin irritation, dermatitis, ulceration or allergic reactions in sensitized individuals.
- **Ingestion:** Ingestion of harmful amounts of this product as distributed is unlikely due to its solid insoluble form. Ingestion of dust may cause nausea and/or vomiting.

Chronic Effects: Chronic inhalation of metallic fumes and dusts are associated with the following conditions:

- 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.
- CALCIUM: Depending on the concentration and duration of exposure, repeated or prolonged inhalation may cause inflammation of the respiratory passages, ulcers of the mucous membranes, and possible perforation of the nasal septum. Repeated or prolonged skin contact may cause dermatitis.
- CARBON: Chronic inhalation of high concentrations to carbon may cause pulmonary disorders.
- COPPER: Skin contact with dusts may cause irritation or sensitization, possibly leading to dermatitis. Repeated or prolonged contact with surface treatments or oil residue may cause skin irritation, dermatitis, ulceration or allergic reactions in sensitized individuals.
- 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.
- PHOSPHOROUS: Inhalation of dusts and fumes of ferrophosphorus and phosphorous oxides may cause respiratory irritation.
- SILICON: Silicon dusts are a low health risk by inhalation and should be treated as a nuisance dust.
- SULFUR: Sulfur compounds, present in the fumes, may irritate the skin, eyes, lungs and gastrointestinal tract.
- ALUMINUM: Aluminum dusts/fines are a low health risk by inhalation and should be treated as a nuisance dust.
- ANTIMONY: Exposure to high concentrations of antimony dust or fumes can cause inflammation of the skin and mucous membranes, headache, dizziness, sleeplessness, bitter taste, nausea, vomiting, diarrhea, abdominal cramps, muscular pains, enlarged liver, pharyngitis, bronchitis, pneumonia.
- LEAD: Lead is classified among the highly toxic heavy metals. It is a cumulative hazard (accumulates in the bone and body tissue) and is a systemic poison that may affect a variety of organ systems, including the central nervous system, kidneys, reproductive system, blood formation, and gastrointestinal tract. Symptoms of chronic over-exposure include loss of appetite, nausea, metallic taste in the mouth, constipation, anxiety, anemia, fatigue, headache, muscle and joint pain, and colic accompanied by severe abdominal pain. Paralysis of the extensor muscles of the arms or legs, with wrist and/or foot drop, may result if the peripheral nervous system is affected. Long-term over-exposure may produce kidney damage. Reproductive damage is characterized by decreased sex drive, impotence, and sterility in men; and decreased fertility, abnormal menstrual cycles, and miscarriages in women. Unborn children may suffer neurological damage or developmental problems due to excessive lead exposure in pregnant women. Prolonged or repeated skin contact to lead dust may result in dermatitis. Systemic toxicity may develop if lead is transferred to the mouth by cigarettes, chewing tobacco, food or make-up. Prolonged eye contact may cause conjunctivitis.
- ZINC: Latent liver dysfunction and gastrointestinal disturbances with pressure in the stomach region, nausea, and weakness have been reported from repeated inhalation zinc oxide. Repeated or prolonged skin contact to zinc oxide, coupled with poor personal hygiene, may result in "oxide pox" due to clogging of sebaceous glands. "Oxide pox", especially localized to moist areas, is characterized by small red, hard projecting papules with a central white plug, which develops into a pustule with intense itching. The lesions usually clear within 7-10 days. Repeated or prolonged eye contact with zinc oxide fume may produce conjunctivitis.

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.

Chemical Surface Treatments/Coatings: The possible presence of chemical surface treatments and oil coatings should be considered when evaluating potential employee health hazards and exposures during handling and welding or other fume generating activities. Removal of surface coatings should be considered prior to such activities. Repeated or prolonged contact with chemical surface treatments or oil residue may cause skin irritation, dermatitis, ulceration or allergic reactions in sensitized individuals. Torching or burning operations on steel products with surface treatments, oil coatings or acrylic films may produce emissions that can be irritating to the eyes and respiratory tract. Inhalation of hexavalent chromium compounds may cause ulceration of the mucous membranes of the nasal septum and has been related to an increased incidence of lung cancer.

Carcinogenicity: The International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), and OSHA do not list steel products as carcinogens. IARC identifies lead and welding fumes as Group 2B carcinogens (possibly carcinogenic to humans). EPA lists lead as Group B2 (probable human carcinogen) based on a combination of sufficient evidence in animals and inadequate evidence in humans. When specified, a hexavalent chromium passivation treatment is applied to the product surface. IARC lists hexavalent chromium compounds as Group 1 (sufficient evidence for carcinogenicity in humans). NTP lists certain hexavalent chromium compounds as Group 1 (known to be carcinogenic). The American Conference of Governmental Industrial Hygienists (ACGIH) lists hexavalent chromium compounds as A1 (confirmed 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.

Section 4 - First Aid Measures

Inhalation: For over-exposure to airborne fumes and particulate, remove exposed person to fresh air. If breathing is difficult or has stopped, administer artificial respiration or oxygen as indicated. Seek medical attention promptly. Metal fume fever may be treated by bed rest, and administering a pain and fever reducing medication.
Eye Contact: Flush with large amounts of clean water to remove particles. Seek medical attention if irritation persists.
Skin Contact: Remove contaminated clothing. Wash affected areas with soap or mild detergent and water. If thermal burn has occurred, flush area with cold water and seek medical attention. If a persistent rash or irritation occurs, seek medical attention.
Ingestion: Not a probable route of industrial exposure. However, if ingested, seek medical attention immediately.

Section 5 - Fire-Fighting Measures

Flash Point: Not applicable
Flash Point Method: Not applicable
Burning Rate: Not applicable
LEL: Not applicable
UEL: Not applicable
Auto-ignition Temperature: Not applicable
Flammability Classification: Non-flammable, non-combustible
Extinguishing Media: Not applicable for solid product. Use extinguishers appropriate for surrounding materials.
Unusual Fire or Explosion Hazards: Not applicable for solid product. Do not use water on molten metal.
Hazardous Combustion Products: At temperatures above the melting point, fumes containing metal oxides and other alloying elements may be liberated. The acrylic resin in the ACRYZINC™ coating may yield particulates which are irritating to the eyes and respiratory tract and noxious gases such as the oxides of carbon.
Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.

Section 6 - Accidental Release Measures

Spill /Leak 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.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120) and all other pertinent state and federal requirements.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 7 - Handling and Storage

Handling Precautions: 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.
Storage Requirements: Store away from acids and incompatible materials.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use controls as appropriate to minimize exposure to metal fumes and dusts during handling operations.
Ventilation: Provide general or local exhaust ventilation systems to minimize airborne concentrations. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.
Administrative Controls: Do not use compressed air to clean-up spills.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear 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.

Protective Clothing/Equipment: 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, gloves and safety glasses to prevent skin and 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. Protective gloves should be worn as required for welding, burning or handling operations. Where the surface treatments are applied to the product, wear gloves when handling. Do not continue to use gloves or work clothing that has become saturated or soaked through with oil coating. Wash skin that has been exposed to oil with soap and water or waterless hand cleaner.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance and Odor: Metallic Gray, Odorless
Odor Threshold: Not applicable
Vapor Pressure: Not applicable
Vapor Density (Air=1) : Not applicable
Formula Weight: Not applicable
Density: 7.85 g/cc
Specific Gravity (H_2O=1, at 4 °C): 7.85
pH: Not applicable

Water Solubility: Insoluble
Other Solubilities: Not applicable
Boiling Point: Not applicable
Viscosity: Not applicable
Refractive Index: Not applicable
Surface Tension: Not applicable
% Volatile: Not applicable
Evaporation Rate: Not applicable
Freezing/Melting Point: Base Metal – 2750 °F
Metallic Coating – 800-900 °F

Section 10 - Stability and Reactivity

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 Products: Thermal oxidative decomposition of galvanized steel products can produce fumes containing oxides of zinc, iron and manganese as well as other elements. The acrylic resin in the ACRYZINC® coating may yield irritating particulates and noxious gases such as the oxides of carbon upon thermal oxidative decomposition.

Section 11 - Toxicological Information

No information is available for galvanized steel or ACRYZINC™ sheet as a mixture. The possible presence of chemical surface treatments and coatings should be considered when evaluating potential employee health hazards and exposures during handling and welding or other fume generating activities.

Eye Effects:
Eye contact with the individual components may cause particulate irritation. Implantation of iron particles in guinea pig corneas has resulted in rust rings with corneal softening about rust ring. Repeated or prolonged eye contact with zinc oxide fume may produce conjunctivitis.

Skin Effects:
Skin contact with the individual dust components may cause physical abrasion, irritation and dermatitis.

Toxicity Data:*

Acute Inhalation Effects:
Inhalation of the individual alloy components has been shown to cause various respiratory effects.

Acute Oral Effects:
No data available

Other: No LC50 or LD50 has been established for the mixture as a whole. Iron LD50: 30 g/kg oral (rat). Calcium LD50: No data. Carbon LD50: No data. Copper TD_{Lo}: 120 ug/kg oral (human). Manganese LD50: 9 g/kg oral (rat). Phosphorous LD50: No data. Silicon LD50: 3160 mg/kg oral (rat). Sulfur LD: >8437 mg/kg oral (rat). Aluminum LD50: No data. Antimony LD50: No data. Lead TD_{Lo}: 450 mg/kg/6 yrs. oral (human). Zinc TC_{LO}: 124 mg/m^3/50 min. inhalation (human).

Chronic Effects: See Section 3.

Carcinogenicity: Lead; Chromium (in surface passivation treatment, if specified).

Mutagenicity: No data available

Teratogenicity: No data available

* See NIOSH, *RTECS:* (NO4565500) for additional toxicity data on iron; (EV8040000) for calcium, (FF5250000) for carbon; (GL5325000) for copper; (OO9275000) for manganese; (VW0400000) for silicon, ((WS4250000) for sulfur; (BD0330000) for aluminum; (CC4025000) for antimony; (OF7525000) for lead; (ZG8600000) for zinc.

Section 12 - Ecological Information

Ecotoxicity: No data available for galvanized steel or ACRYZINC® sheet as a whole. However, individual components have been found to be toxic to the environment. Metal dusts may migrate into soil and groundwater and be ingested by wildlife. Lead can be bioaccumulated in plants and water organisms, especially shellfish.
Environmental Fate: No data available.
Environmental Degradation: No data available.
Soil Absorption/Mobility: No data available for galvanized steel or ACRYZINC® sheet as a whole. However, individual components have been found to be absorbed by plants from soil.

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.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Galvanized steel and ACRYZINC® sheet are not listed as hazardous substances under 49 CFR 172.101.

Shipping Name: Not applicable
Shipping Symbols: Not applicable
Hazard Class: Not applicable
ID No.: Not applicable
Packing Group: Not applicable
Label: Not applicable
Special Provisions (172.102): None

Packaging Authorizations
a) Exceptions: None
b) Non-bulk Packaging: Not applicable
c) Bulk Packaging: Not applicable

Quantity Limitations
a) Passenger, Aircraft, or Railcar: Not applicable
b) Cargo Aircraft Only: Not applicable

Vessel Stowage Requirements
a) Vessel Stowage: Not applicable
b) Other: Not applicable

Section 15 - Regulatory Information

Regulatory Information: *The following listing of regulations relating to a United States Steel Corporation 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-1-A): The product as a whole is not listed. However, individual components of the product are listed.

OSHA Specifically Regulated Substance: Lead (29 CFR 1910.1025).

EPA Regulations:

RCRA (40CFR261): Steel scrap is not regulated as a solid waste or a hazardous waste under this act. If product dusts and/or fumes from processing operations are not recycled, they are considered to be a solid waste and may be classified as a hazardous waste depending on the toxicity characteristics of the dust as defined within 40CFR261.24.

CERCLA Hazardous Substance (40 CFR 302.4): The product as a whole is not listed. However, individual components of the product are listed: Antimony (Reportable Quantity (RQ)-5000#), Copper (RQ-5000#), and Lead(RQ-10#). Manganese compounds are also listed although no reportable quantity is assigned to this generic or broad class.

SARA 311/312 Codes (40CFR370): Immediate (acute) health hazard and delayed (chronic) health hazard.

SARA 313 (40CFR372.65): Manganese and Zinc are subject to SARA 313 reporting requirements. . Please note that if you prepackage or redistribute this product to industrial customers, SARA 313 requires that a notice be sent to those customers.

State Regulations: The product as a whole is not listed in any state regulations. However, individual components of the product are listed in various state regulations.

Pennsylvania Right to Know: Contains regulated material in the following categories:

- Hazardous Substances: Calcium, Silicon and Sulfur.
- Environmental Hazards: Aluminum, Antimony, Copper, Lead, Manganese and Zinc.

New Jersey Right to Know: Contains regulated material in the following categories:

- Hazardous Substance: Aluminum (dust and fume), Antimony, Copper, Manganese and Sulfur.
- Special Health Hazard Substances: Lead.

California Prop. 65: This product may contain an extremely small amount of lead in the metallic coating. Per customer specification, an extremely small amount of hexavalent chromium passivation treatment may be applied to the surface of the galvanized steel product. Lead and hexavalent chromium are materials known to the State of California to cause cancer or reproductive toxicity. In addition, the product may also possibly contain trace quantities (generally much less than 0.1%) of other metallic elements known to the State of California to cause cancer or reproductive toxicity. These include arsenic (inorganic), cadmium and nickel.

Other Regulations: The product as a whole is not listed in any state regulations. However, individual components of the product are listed in various state regulations.
WHMIS Classification (Canadian): D-2

Section 16 - Other Information

Prepared By: United States Steel Corporation

Hazard Rating Systems:
NFPA Code: 1-0-0
HMIS Code: 1*-0-0 PPE: See Section 8 * Denotes possible chronic hazard if airborne dusts or fumes are generated.

Disclaimer: All information, recommendations, and suggestions appearing herein concerning this product are taken from sources or based upon data believed to be reliable. Although reasonable care has been taken in the preparation of this information, United States Steel Corporation extends no warranties or guarantees, express or implied, makes no representations, and assumes no responsibility as to the accuracy, reliability or completeness of the information presented. Since the actual use of the product described herein is beyond our control, United States Steel Corporation assumes no liability arising out of the use of the product by others. It is the user's responsibility to determine the suitability of the information presented herein, to assess the safety and toxicity of the product under their own conditions of use, and to comply with all applicable laws and regulations. Appropriate warnings and safe handling procedures should be provided to handlers and users.

HAZARDOUS COMMUNICATION LABEL

CARBON STEEL-METALLIC COATING

WARNING! CANCER HAZARD (CONTAINS LEAD AND/OR NICKEL).
EXPOSURE TO HIGH CONCENTRATIONS OF DUST OR FUME DURING WELDING, BURNING, MELTING, CUTTING, BRAZING, GRINDING AND POSSIBLY MACHINING, ETC., MAY PRODUCE IMMEDIATE OR DELAYED DAMAGE TO LUNGS OR OTHER ORGANS. EXPOSURE MAY ALSO CAUSE REPRODUCTIVE DISORDERS THROUGH INHALATION OR INGESTION OF LEAD.
EXCESSIVE INHALATION OF ZINC OXIDE FUMES FROM GALVANIZED PRODUCT (3C012) CAN PRODUCE AN ACUTE REACTION KNOWN AS "METAL FUME FEVER", WITH FLU-LIKE SYMPTOMS LASTING FROM 12 TO 48 HOURS.
THIS PRODUCT MAY BE COATED WITH MATERIALS THAT COULD RESULT IN SKIN IRRITATION WITH PROLONGED CONTACT.

PRECAUTIONS: AVOID BREATHING OR INGESTING DUST OR FUME. ADEQUATE VENTILATION IS REQUIRED WHILE WELDING, BURNING, MELTING, CUTTING, BRAZING, GRINDING AND MACHINING.
AVOID SKIN CONTACT IF MATERIAL IS COATED.

FIRST AID: FOR OVEREXPOSURE TO AIRBORNE DUST AND FUME, REMOVE EXPOSED PERSON TO FRESH AIR. IF BREATHING IS DIFFICULT OR HAS STOPPED, ADMINISTER ARTIFICIAL RESPIRATION OR OXYGEN AS INDICATED. SEEK MEDICAL ATTENTION PROMPTLY.
IF PRODUCT IS COATED AND EXCESSIVE SKIN CONTACT OCCURS, WASH WITH SOAP AND WATER. IF IRRITATION DEVELOPS, SEEK MEDICAL ATTENTION.

ADDITIONAL INFORMATION: REFER TO MATERIAL SAFETY DATA SHEETS USS CODE NOS. 3C012, 3C014, 3C015, FOR FURTHER INFORMATION ON SPECIFIC PRODUCTS.

United States Steel Corporation, 600 Grant Street, Room 2514H, Pittsburgh, PA 15219-2800

Steel Takes LEED® with Recycled Content

steel beams and columns

steel studs

steel roofing

steel decking

steel doors

ductwork

steel siding

corrugated steel pipe

other steel components

Designers and builders have long recognized and lauded steel for its strength, durability, and functionality. Increasingly, however, architects are recognizing steel's important environmental attributes—especially its high recycled content and high reclamation rate.

For many years, there has been a strong economic motive to incorporate recycling into the process for making steel, but today's environmental concerns make recycling even more important. Recycling saves money while conserving energy and resources, as well as reducing solid, liquid, and gaseous wastes. Recycling also helps to spread the energy impact of the original extraction and manufacturing of the material over infinite generations of new steel.

The efficiency with which a material is recycled can be measured by either its ***percentage of recycled content*** or its ***reclamation rate.*** Recycled content is a measure of how much recycled material is contained in a finished product. The reclamation rate is a measure of how often a product is actually recycled at the end of its useful life. Steel is an exceptional performer by both measurements. In the construction industry, recent interest in recycling has been driven largely by the U.S. Green Building Council's ***Leadership in Energy and Environmental Design*** (LEED®) rating system. The LEED rating system only promotes the use of materials with high levels of recycled content. The equally important reclamation rate of the materials is not currently considered.

Scrap consumption in the United States is maximized between the two types of modern steel mills, each of which generates products with varying levels of recycled content. One type of mill produces much of the steel for light flat-rolled steel products with about 30% ***recycled content.*** The other type of mill makes steel for a wide range of products, including flat-rolled, but is the only method used domestically for the production of structural shapes, which have about 80% ***recycled content.*** (These processes are covered in detail on the following pages.)

The amount of recycled content in steel products varies over time, both as a function of the cost of steel scrap and its availability. As the world-wide demand for steel increases, the available scrap will be stretched between more and more steel products, meaning that more raw steel will have to enter the production stream to meet the demand. Fortunately, steel is the country's most widely recycled material, and as more steel is used for construction and other products, more scrap is available for future recycling. At the end of their useful life, about 88% of all steel products and nearly 100% of structural steel beams and plates used in construction are recycled into new products—an amazing reclamation rate!

In addition to recycled content, steel can contribute toward several other LEED credits, either directly or indirectly. Steel is dimensionally stable and, when properly designed, can provide an exceptionally tight building envelope for less air loss and better HVAC performance over time. Steel is made to exact specifications, so on-site waste is minimized. Material from demolition or construction can be easily recycled, with the magnetic properties of steel greatly facilitating its separation from other materials. Thus, in addition to steel's outstanding recycled content and an enviable reclamation rate, steel's other functional properties contribute to the material's solid environmental performance.

As with any building process or material, there are areas for improvement. A great benefit of LEED is that it can help the steel industry recover even more scrap as contractors improve their recycling collection methods at the job site, so less incidental iron and steel scrap escapes to landfills. Similarly, commercial buildings and residential housing can have better disciplined recycling systems for increased recovery.

As steel products reach the end of their useful life, we want to see even more recycled into new steel products for future service to society.

On-Line Steel Recycling Resources

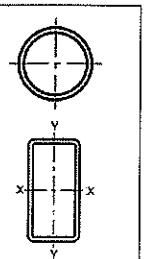
www.recycle-steel.org
Includes detailed information on recycling rates, recycling databases, and the environmental benefits of steel for homes, buildings, steel roofing, and bridges.

www.aisc.org/sustainability
Includes detailed information on how steel factors into the LEED® rating system, steel mill recycled content documentation, and articles about the use of steel in sustainable projects.

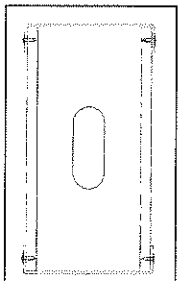
American Iron and Steel Institute

Modern Steel Production Technologies

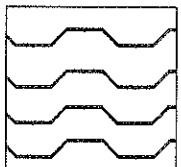
Typical BOF Products



hollow structural sections



steel studs



steel deck

plate

purlins

Steel is the most recycled material in North America and in the world, and in the United States alone, almost 83 million tons of steel were recycled or exported for recycling in 2007. This is done for economic as well as environmental reasons. It is always cheaper to recycle steel than to mine virgin ore and move it through the process of making new steel. However, it should also be clearly understood that many steel applications are durables, and even though two out of every three pounds of new steel are produced from old steel, the fact that cars, appliances, and bridges last a long time makes it necessary to continue to mine virgin ore to supplement the production of new steel. Economic expansion, domestically and internationally, creates additional demand that cannot be fully met by available scrap supplies.

Unlike other competing industries, recycled content in the steel industry is second nature. The North American steel industry has been recycling steel scrap for over 170 years through the growth of 2,500 scrap processors and some 12,500 auto dismantlers. Many of them have been in the business for more than 100 years. The pre-consumer, post-consumer, and total recycled content of steel products in the United States can be determined for the calendar year 2007 using information from the American Iron and Steel Institute (AISI), the Institute of Scrap Recycling Industries (ISRI), and the U.S. Geological Survey. Additionally, a study prepared for the AISI by William T. Hogan, S.A., and Frank T. Koelble of Fordham University is used to establish pre- and post-consumer fractions of purchased scrap.

Individual company statistics are not applicable or instructive because of the open loop recycling capability that the steel and iron industries enjoy, with available scrap typically going to the closest melting furnace. This open loop recycling allows, for example, an old car to be melted down to produce a new soup can, and then, as the new soup can is recycled, it is melted down to produce a new car, appliance, or perhaps a structural beam used to repair some portion of the Golden Gate Bridge.

Basic Oxygen Furnace

The basic oxygen furnace (BOF) facilities consumed a total of 14,552,500 tons of ferrous scrap in the production of 44,503,000 tons of raw steel during 2007. Based on U.S. Geological Survey statistics, 950,000 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. In the steel industry, these tons are classified as "home scrap," but are a mix of runaround scrap and pre-consumer scrap. Estimates by the Steel Recycling Institute identify about 80% of this home scrap as pre-consumer scrap, equating to 760,000 tons (950,000 × 80%). Additionally, these operations reported that they consumed 10,000 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this timeframe. This volume is classified as post-consumer scrap.

As a result of the above, based on the total scrap consumed, outside purchases of scrap equate to 13,592,500 tons [14,552,500 – (950,000 + 10,000)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4%, while 16.6% of these purchases would be pre-consumer. This equates to 2,256,400 tons of pre-consumer scrap (13,592,500 × 16.6%). This "prompt scrap" is mainly scrap generated by manufacturing processes for products made with steel.

Therefore, the **total recycled content** to produce the 44,503,000 tons of raw steel in the BOF is:

14,552,500 / 44,503,000 = 32.7%

(Total Tons Ferrous Scrap / Total Tons Raw Steel)

Also, the **post-consumer recycled content** is:

(13,592,500 – 2,256,400) + 10,000 = 11,346,100

and

11,346,100 / 44,503,000 = 25.5%

(Post-Consumer Scrap / Total Tons Raw Steel)

Finally, the **pre-consumer recycled content** is:

(760,000 + 2,256,400) / 44,503,000 = 3,016,400 / 44,503,000 = 6.8%

(Pre-Consumer Scrap / Total Tons Raw Steel)

Electric Arc Furnace

The electric arc furnace (EAF) facilities consumed a total of 57,199,300 tons of ferrous scrap in the production of 61,329,700 tons of raw steel during 2007. Based on U.S. Geological Survey adjusted statistics, 15,403,700 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. Again, in the steel industry, these tons are classified as "home scrap," but are a mix of run-around scrap and pre-consumer scrap. Estimates by the Steel Recycling Institute identify about 80% of this home scrap as pre-consumer scrap, equating to 12,323,000 tons (15,403,700 × 80%). Additionally, these operations reported that they consumed 85,000 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this time frame. This volume is classified as post-consumer scrap.

As a result, based on the total scrap consumed, outside purchases of scrap equate to 41,710,600 tons [57,199,300 – (15,403,700 + 85,000)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4%, while 16.6% of these purchases would be pre-consumer. This equates to 6,924,000 tons of pre-consumer scrap (41,710,600 × 16.6%). This "prompt scrap" is mainly scrap generated by manufacturing processes for products made with steel.

Therefore, the **total recycled content** to produce the 61,329,700 tons of raw steel in the EAF is:

57,199,300 / 61,329,700 = 93.3%

(Total Tons Ferrous Scrap / Total Tons Raw Steel)

Also, the **post-consumer recycled content** is:

(41,710,600 - 6,924,000) + 85,000 = 34,871,600

and

34,871,600 / 61,329,700 = 56.9%

(Post-Consumer Scrap / Total Tons Raw Steel)

Finally, the **pre-consumer recycled content** is:

(12,323,000 + 6,924,000) / 61,329,700 = 19,247,000 / 61,329,700 = 31.4%

(Pre-Consumer Scrap / Total Tons Raw Steel)

The above discussion and calculations demonstrate conclusively the inherent recycled content of today's steel in North America. To buy steel is to "Buy Recycled."

Understanding the recycled content of BOF and EAF steels, one should not attempt to select one steel producer over another on the basis of a simplistic comparison of relative scrap usage or recycled content. Rather than providing an enhanced environmental benefit, such a selection could prove more costly in terms of total life cycle assessment energy consumption or other variables. Steel does not rely on "recycled content" purchasing to incorporate or drive scrap use. It already happens because of the economics. Recycled content for steel is a function of the steelmaking process itself.

After its useful product life, regardless of its BOF or EAF origin, steel is recycled back into another steel product. Thus steel with more than 80% recycled content cannot be described as environmentally superior to steel with 30% recycled content. This is not contradictory because they are both complementary parts of the total interlocking infrastructure of steelmaking, product manufacture, scrap generation and recycling. The recycled content of EAF relies on the embodied energy savings of the steel created in the BOF.

Steel is truly the most recycled material.

Contact Us

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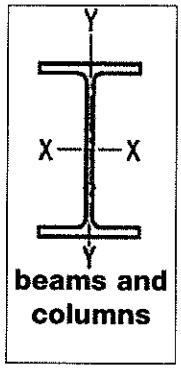
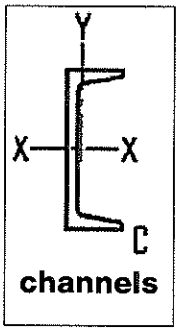
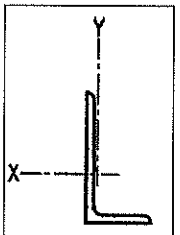
Typical EAF Products



beams and columns



channels



angles

plate

steel deck

piling

To: Architects, Engineers, Designers, and Specifiers
Re: LEED®-NC Version 2.2 and LEED®-NC 2009 Recycled Content Value of Steel Building Products

The U.S. Green Building Council Leadership in Energy & Environmental Design (LEED®) Green Building Rating System aims to improve occupant well-being, environmental performance and economic returns of buildings using established and innovative practices, standards, and technologies.

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Materials & Resources Credit 4: Recycled Content intends to increase demand for building products that incorporate recycled content materials, therefore reducing impacts resulting from extraction and processing of new virgin materials. As discussed and demonstrated below, steel building products contribute positively toward points under Credits 4.1 and 4.2. The following is required by LEED-NC Versions 2.2 and 2009:

> **Credit 4.1 (1 point)** "Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the project."
>
> **Credit 4.2 (1 point)** "Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 20% of the total value of the materials in the project."

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"The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value." Since steel (the material) and steel (the building product) are the same, the value of the steel building product is directly multiplied by steel's recycled content, or:

Steel Recycled Content Value = (Value of Steel Product) (Post-Consumer % + ½ Pre-Consumer %)

The information contained within this brochure provides post-consumer and pre-consumer recycled content percentages for North American steel building products. These percentages and values of steel building products are easily entered into LEED Letter Template spreadsheet for calculation. To illustrate the application of these steel recycled content values to LEED, manual calculations are shown below for typical Basic Oxygen Furnace (BOF) and Electric Arc Furnace (EAF) steel building products with nominal $10,000 purchases, using 2007 data. Steel building products include steel stud framing, structural steel framing (wide-flange beams, channels, angles, etc.), rebar, roofing, siding, decking, doors and sashes, windows, ductwork, pipe, fixtures, hardware (hinges, handles, braces, screws, nails), culverts, storm drains, and manhole covers.

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BOF Steel Recycled Content Value for Typical Product:
Steel Stud Framing
Value = ($10,000) (25.5% + ½ 6.8%) = ($10,000) (28.9%) = $2,890
(Positive net contributor to 10% and 20% goals)

EAF Steel Recycled Content Value for Typical Product:
Wide-Flange Structural Steel Framing
Value = ($10,000) (56.9% + ½ 31.4%) = ($10,000) (72.6%) = $7,260
(Positive net contributor to 10% and 20% goals)