

Material Safety Data Sheet

[This sheet was made by Industrial Safety and Health Act, Article 41, in Korea]

Original Issue Date: 10/01/03

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Galvanized Sheet

Common Name: Galvanized Iron

Manufacturer: 5 Dongchon-dong, Nam-gu, Pohang-si, Gyeongsangbuk-do 790-360, Korea

General Information: 82-54-220-0114, 82-54-220-6000

Off-Hour Emergency Phone Number: 82-54-220-7021, 7046

Manufacturer: 700, Kumho-dong, Gwangyang, Chollanam-do 545-711, Korea

General Information: 82-61-790-0114, 82-61-790-7000

Off-Hour Emergency Phone Number: 82-61-790-2631

Section 2 - Composition / Information on Ingredients

Ingredient Name	CAS Number	Percentage by wt.	OSHA PEL ¹	ACGIH TLV ²
Fe (Iron)	7439-89-6	Balance	10 mg/m ³ - Iron oxide fume	5 mg/m ³ - Iron oxide dust and fume
Si (Silicon)	7440-21-3	0.05% max.	15 mg/m ³ - Total dust 5 mg/m ³ - Respirable fraction	10 mg/m ³
Mn (Manganese)	7439-96-5	0.5% max.	5 mg/m ³ (C) - Fume & Mn compounds	0.2 mg/m ³
Al (Aluminum)	7429-90-5	0.07% max.	15 mg/m ³ - Total dust 5 mg/m ³ - Respirable fraction	10 mg/m ³ - Metal Dust 5 mg/m ³ - Welding fume
Cu (Copper)	7440-50-8	0.03% max.	0.1 mg/m ³ - Fume (as Cu) 1 mg/m ³ - Dusts & mists (as Cu)	0.2 mg/m ³ - Fume 1 mg/m ³ - Dusts & mists (as Cu)
Cr (Chromium)	7440-47-3	0.03% max.	1 mg/m ³ - Chromium metal	0.5 mg/m ³ - Cr metal & Cr III compounds
Ni (Nickel)	7440-02-0	0.01% max.	1 mg/m ³ - Metal & insol. compounds (as Ni)	1.5 mg/m ³ - Elemental nickel (as Ni) 0.2 mg/m ³ - Insoluble compounds (NOS) ³
Pb (Lead)	7439-92-1	0.0015% max.	0.05 mg/m ³	0.05 mg/m ³
Zn (Zinc)	7440-66-6	1.20% max.	5 mg/m ³ - Fume 15 mg/m ³ - Total dust 5 mg/m ³ - Respirable fraction	5 mg/m ³ - Fume 10 mg/m ³ - Fume (STEL) 10 mg/m ³ - Dust

*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: antimony, arsenic, boron, cadmium, calcium, cobalt, columbium, molybdenum, 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 NOS. Not otherwise specified.

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, grinding, melting, sawing, brazing, or other similar machining activities, potentially hazardous airborne particulate and fumes may be generated and should be evaluated by an industrial hygienist. Avoid inhalation of metal dusts and fumes. Operations having the potential to generate airborne particulates should be performed in well ventilated areas and, if it is impossible, respiratory protection and other personal protective equipment should be used. The presence of nonmetallic coatings (for example, oils, paints, epoxies, laminates, etc.) on steel products should be considered when evaluating potential employee health hazards during handling, welding, grinding, sanding or other fume/dust generating activities.

Potential Health Effects

Primary Entry Routes: Inhalation. 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 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. Torching or burning operations on steel products with oil coatings 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 oil residue may cause skin irritation, dermatitis 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 or vomiting.

Chronic Effects:

Presented below are the potential health effects that have been identified for the ingredients listed that are of industrial hygiene significance.

. **IRON OXIDE:** Chronic inhalation of excessive concentrations of iron oxide fumes or dusts may result in the development of a benign lung conditions known as pneumoconiosis, called siderosis, which is observable as an X-ray change. But, no physical impairment of lung function has been associated with siderosis.

. **ALUMINUM:** Aluminum dusts/fines are a low health risk by inhalation and should be treated as a nuisance dust.

. **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 relatively low toxicity. Long term excessive inhalation of ferrochromium dusts and fumes may cause lung changes in exposed workers. Exposure to chromium metal does not give rise to pulmonary fibrosis or pneumoconiosis. The hexavalent form (Cr^{+6}), unlike chromium metal 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 respiratory cancer.

. **COPPER:** Chronic exposure to copper dusts may result in runny nose, irritation of mucous membranes, and atrophic changes with resultant dementia. Chronic inhalation of copper dust has caused, in animals, hemolysis of the red blood cells, deposition of hemofuscin in the liver and pancreas, injury to lung cells and gastrointestinal symptoms.

. **MANGANESE:** Manganese dust and fume can act as minor irritants to the eyes and respiratory tract.

Excessive inhalation exposure to manganese fume may result in a flu-like illness termed metal fume fever. Chronic exposure to high concentrations of manganese fumes and dusts may adversely affect the central nervous system (CNS) 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.

. **SILICON:** Silicon dusts are a low health risk by inhalation and should be treated as a nuisance dust.

. **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.

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 nickel compounds as Group 1 (sufficient evidence for carcinogenicity in humans) and metallic nickel as Group 2B (possibly carcinogenic for humans). NTP lists nickel as Group 2 (reasonably anticipated to be a human carcinogen). The American Conference of Governmental Industrial Hygienists (ACGIH) lists insoluble nickel compounds as A1 (confirmed human carcinogen) and elemental/metallic nickel as A5 (not suspected as a human carcinogen). IARC lists chromium metal and trivalent chromium compounds as Group 3 (not classifiable as to their human carcinogenicity). ACGIH lists chromium metal and trivalent compounds as A4 (not classifiable as a human carcinogen). IARC identifies welding fumes as a Group 2B carcinogen, a mixture that is possibly carcinogenic to humans.

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.

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: Treat for foreign body in the eye. Flush with large amounts of clean water to remove particles. Seek medical attention if irritation persists.

Skin Contact: Not anticipated to pose a significant skin hazard. However, should dermatitis develop, wash affected area thoroughly with mild soap and water. If irritation or other symptoms develop, seek medical attention. Remove contaminated clothing. If thermal burn has occurred, flush area with cold water and seek medical attention. If mechanical abrasion has occurred, seek medical attention.

Ingestion: Not considered an ingestion hazard.

Section 5 - Fire-Fighting Measures

Steel products do not present fire or explosion hazards under normal conditions. But, molten metal may react

violently with water. High concentrations of metallic fines in the air may present an explosion hazard. Fire fighters are to wear full protective equipment, including full bunker gear and SCBA respiratory protection.

Flash Point	Not applicable
LEL	Not applicable
UEL	Not applicable
Flash Point Method	Not applicable
Flammability Classification	Non-flammable, non-combustible
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.

Section 6 - Accidental Release Measures

Any excess product can be recycled for further use, disposed in an appropriately permitted waste landfill, or disposed by other methods in accordance with local, state, and federal regulations. Finely divided, dry particles should be removed by vacuuming or wet sweeping to prevent spreading dusts. Avoid using compressed air.

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. Use lifting and work devices, e.g., crane, hoist, etc., within rated capacities and in accordance with manufacturer's instructions when handling these products.

- (1) avoid breathing dust and fume
- (2) evaluate potential employee exposure
- (3) minimize generation of airborne emissions
- (4) maintain surfaces free as practical of accumulated material
- (5) use protective clothing as specified by an industrial hygienist or safety professional where exposure levels may be excessive
- (6) do not smoke in work area
- (7) wash hands before eating, drinking or smoking and after handling,
- (8) change contaminated clothing before leaving work premises.

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.

Skin and eye protection: 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.

Section 9 - Physical and Chemical Properties

Physical State	Solid	Water Solubility	Insoluble
Appearance and Odor	Metallic Gray, Odorless	Boiling Point	Not applicable
Vapor Pressure	Not applicable	Evaporation Rate	Not applicable
Vapor Density (Air=1)	Not applicable	Freezing/Melting Point	~2750 °F
Specific Gravity (H₂O=1, at 4 °C)	7.85	pH	Not applicable

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 steel products can produce fumes containing oxides of iron and manganese as well as other alloying elements.

Section 11 - Toxicological Information

No information is available for the product as a mixture.

Eye Effects: Eye contact with the individual components may cause particulate irritation. Implantation of iron particles in guinea pig corneas have resulted in rust rings with corneal softening about rust ring.

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

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). Aluminum LD50: No data. Copper TDLo: 120 ug/kg oral (human). Manganese LD50: 9 g/kg oral (rat). Phosphorous LD50: No data. Silicon LD50: 3160 mg/kg oral (rat). Sulfur LD50: >8437 mg/kg oral (rat).

Chronic Effects, Carcinogenicity: See Section 3. **Mutagenicity, Teratogenicity:** No data available

Section 12 - Ecological Information

Steel products in their usual form do not pose an ecological hazard.

Ecotoxicity: No data available for the product 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.

Environmental Fate: No data available.

Environmental Degradation: No data available.

Soil Absorption/Mobility: No data available for the product as a whole. However, individual components of the product have been found to be absorbed by plants from soil.

Section 13 - Disposal Considerations

Any excess product can be recycled for further use, disposed in an appropriately permitted waste landfill, or disposed by other methods in accordance with local, state, and federal regulations.

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

Not a hazardous material for DOT shipping.

Section 15 - Regulatory Information

Regulatory Information: *The following listing of regulations relating to a POSCO 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. And those followings are described (listed) by counting of first importance to USA.

Regulations in Korea:

Individual components of the product are regulated under Industrial Safety And Health Act, Toxic Chemicals Control Act and Fire Services Act.

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.

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: Copper (Reportable Quantity (RQ)-5000#). 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 is 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 in USA: 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, Copper and Manganese.

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

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

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

arsenic (inorganic), cadmium, lead 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.

Section 16 - Other Information

Prepared By: POSCO

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, POSCO 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, POSCO 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.

Galvanized Sheet

Contains:

Aluminum (CAS 7429-90-5), Chromium (CAS 7440-47-3), Copper (CAS 7440-50-8), Iron (CAS 7439-89-6), Manganese (CAS 7439-96-5), Nickel (CAS 7440-02-0) and Silicon (CAS 7440-21-3)

CAUTION

Hazards: Long-term excessive exposure to the fume or dust during welding, burning, cutting, grinding and machining activities may cause respiratory system effects. This product may be coated with materials that could result in skin irritation with prolonged contact. Studies have associated nickel and certain nickel compounds to an increased risk of cancer of the respiratory system.

Recommended Handling Procedures:

- Avoid creating and breathing or ingesting excessive dust or fume levels. Adequate mechanical ventilation or personal protective equipment during welding, burning, melting, cutting, brazing, grinding and machining (i.e., eye protection, protective clothing and NIOSH-approved respiratory protection) may be necessary during welding, burning, grinding and other dust/fume generating activities.
- The presence of nonmetallic coatings (for example, oils, paints, epoxies, laminates, etc.) on these products should be considered when evaluating potential employee health hazards. Removal of surface coatings should be considered prior to welding or other dust/fume generating activities. Avoid prolonged skin contact with nonmetallic coating oils.

FIRST AID AND MEDICAL EMERGENCY PROCEDURES

Eye Contact: Treat for foreign body in the eye. Seek medical attention.

Skin Contact: Not anticipated to pose a significant skin hazard. However, should dermatitis develop, wash affected area with mild soap and warm water. Seek medical attention if conditions persist.

Inhalation: Remove from excessive exposure levels. Seek medical attention. Give artificial respiration if breathing has stopped.

Ingestion: Not considered an ingestion hazard.

Oct 1, 2003

For more detailed health and safety information, read the Material Safety Data Sheet (MSDS) for this product.

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General Information: 82-54-220-0114, 82-54-220-6000

Off-Hour Emergency Phone Number: 82-54-220-7021, 7046

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