



United States Steel Corporation

Granulated Blast Furnace Slag

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

USS IHS Number: 75687

(Replaces USS Code Number: N/A)

Locations: Gary, Fairfield, and Lake Erie

Original Issue: 06/28/2011

Revised: 03/31/2014

Expiration: 31/31/2017

Section 1 – Chemical Product and Company Identification

GHS Product Identifier: Granulated Blast Furnace Slag

Other means of identification: Granulated Slag

CAS Number: 65996-69-2

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

Granulated Blast Furnace Slag is hazardous according to the criteria specified in European Directives 67/548/EEC and 1999/45/EC and OSHA 29 CFR 1910.1200 Hazard Communication Standard. 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. Refer to Section 3, 8 and 11 for additional information.

Hazard Classification	Hazard Category	Hazard Symbols	Signal Word	Hazard Statement
Acute Hazards to the Aquatic Environment (covers Categories 1-3)	1		Warning	R50-Very toxic to aquatic life
Acute Toxicity: Inhalation (covers Categories 1-5)	2		Danger	Fatal if inhaled
Skin Irritation (covers Categories 1-3)	2		Warning	Causes Skin Irritation R38-Irritating to skin
Eye Damage/ Irritation (covers Categories 1, 2A and 2B)	1		Danger	Causes serious eye damage R41-Risk of serious damage to eyes
Specific Target Organ Systemic Toxicity (STOST) Following Single Exposure (covers Categories 1-3)	3		Warning	May cause respiratory irritation R36/37/38 - Irritating to eyes, respiratory system and skin.

Precautionary Statement/Emergency Overview: **S28-** After contact with skin, wash immediately with plenty of water. **S37/39** -Wear protective gloves and eye/face protection. **S61- Avoid release to the environment.** **S23-** Do not breathe dusts/fume/gas/mist/vapor/spray. Use only outdoors or in a well ventilated area. Wear respiratory protection. **R31** - Contact with acids liberates toxic gas.

Section 3 – Composition/Information on Ingredients

Chemical identity of the substance:

Ingredient Name	EC Number	CAS Number	% weight
Metallic Silicates*	Various	Various	94-100
Iron Oxide	215-721-8	1345-25-1	0.4-2.6
Calcium Sulfide	234-873-5	20548-54-3	2-4

EC - European Community

CAS - Chemical Abstract Service

* The majority of components in Granulated Blast Furnace Slag are various glassy Metallic Silicates (Iron, Calcium, Magnesium, Aluminum, and Titanium Silicates), including: Dicalcium Silicate (Ca₂SiO₄) 14284-23-2, Merwinite (Ca₃MgSi₂O₈) 13813-64-4, and Gehlenite (Ca₂Al₂SiO₇) 1302-56-3

Granulated Blast Furnace Slag contains small amounts of various constituents in addition to those listed. These small quantities are frequently referred to as "trace" or "residual" constituents that generally originate in the raw materials used. **Granulated Blast Furnace Slag** may contain the following trace or residual constituents: Iron, manganese oxide, sodium oxide, potassium oxide, carbon, and zinc oxide.

Granulated BF Slag

Section 4 - First Aid Measures

Description of necessary first aid measures:

- **Inhalation: IF INHALED:** Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.
- **Eye Contact: IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.
- **Skin Contact: IF ON SKIN:** Wash with plenty of soap and water **If skin irritation occurs:** Get medical advice/attention. Take off contaminated clothing and wash before reuse.
- **Ingestion:** Do NOT induce vomiting. Call a POISON CENTER or doctor/physician if you feel unwell.

Most important acute and chronic symptoms/effects:

Primary Entry Routes: Inhalation. **Granulated BF Slag presents a contact hazard** and may result in the following effects if exposures exceed recommended limits as listed in Section 8.

Target Organs: respiratory system, skin, and eye

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.
- **Eye:** Contact may cause irritation/abrasion to the eyes.
- **Skin:** Skin contact with dusts may cause irritation, physical abrasion or sensitization, possibly leading to dermatitis.
- **Ingestion:** **Ingestion of dust/fume may cause nausea or vomiting.**

Acute Effects by component:

- **MERWINITE:** Causes mild skin irritation, eye irritation and potentially respiratory irritation.
- **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 and may cause burns.
- **CALCIUM SULFIDE:** **Causes irritation to respiratory system, eyes and skin. Fatal if inhaled.** Contact with stomach acids may liberate toxic hydrogen sulfide gas.

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 lung disease, 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)
- **CALCIUM SULFIDE:** Not Reported/ Not Classified

Long-term inhalation exposure to high concentrations (over-exposure) of agents that produce lung disorders may act synergistically with inhalation of oxides, vapors or dusts of this product to cause toxic effects.

Carcinogenicity: This product is not listed by IARC, NTP or OSHA as a 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 5 – Fire and Explosion Hazard Information

Suitable Extinguishing Media: Use extinguishers appropriate for surrounding materials.

Specific Hazards arising from the chemical: Not applicable for solid product. Avoid breathing dust. Contact with acids liberates toxic gas.

Explosion hazard: Not applicable for solid product.

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: 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: 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: Wash thoroughly after handling. Do not eat, drink or smoke when using this product. 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: Whenever feasible, store locked up. Store away from incompatible materials.

Granulated BF Slag

Section 8 - Exposure Controls / Personal Protection

Occupational Exposure Limits (OELs):

Ingredients	OSHA PEL ¹	ACGIH TLV ²	NIOSH REL ³	IDLH ⁴
Metallic Silicates*	15 mg/m ³ (total dust, PNOR) ⁵ 5.0 mg/m ³ (as respirable fraction, PNOR)	10 mg/m ³ (as inhalable fraction ⁶ , PNOS ⁷) 3.0 mg/m ³ (as respirable fraction ⁸ , PNOS)	NE	NE
Iron Oxide	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
Calcium Sulfide	NE	NE	NE	NE

NE - None Established

Notes:

Granulated Blast Furnace Slag contains 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. Slag may contain the following trace or residual elements: Iron, iron oxides, manganese, manganese oxide, carbon, sodium oxide, zinc, and potassium oxide.

- OSHA PEL (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.
- 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.
- 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.
- 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-1970s 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.
- PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by a 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.
- 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.
- PNOS (Particulates Not Otherwise Specified). Particulates identified under the PNOS heading are "nuisance dusts" containing no asbestos and <1% crystalline silica.
- 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 ACGIH 2009 TLVs[®] and BEIs[®] Appendix D, paragraph C.

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. A face shield should be used when appropriate to prevent contact with splashed materials. Chemical goggles, face shields or glasses should be worn to prevent eye contact. Contact lenses should not be worn where industrial exposure to this material is likely.
- Skin:** Wear appropriate personal protective clothing to prevent skin contact. Protective gloves should be worn as required for welding, burning or handling operations. Wear protective gloves.
- 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: Light to dark, glassy, slight sulfur odor

Odor Threshold: ND

Vapor Pressure at 20°C (68°F): NA

Vapor Density (Air = 1): NA

Formula Weight: ND

Density: ND

Specific Gravity (H₂O = 1, at 4°C): ND

pH: NA

Flash Point (closed cup): ND

Auto-ignition Temperature: ND

Decomposition Temperature: ND

Water Solubility: Insoluble

Fat Solubility: ND

Other Solubilities: ND

Boiling Point: ND

Viscosity: ND

Refractive Index: ND

Surface Tension: ND

% Volatile by volume: NA

Evaporation Rate: NA

Freezing Point: ND

Melting Point: ~ 2600°F

Granulated BF Slag

Section 9 - Physical and Chemical Properties

Partition Coefficient n-octanol/water: ND	UEL: ND
Flammability (solid, gas): Non-flammable	LEL: ND
Explosive Properties: ND	Oxidizing Properties: ND
NA - Not Applicable	ND - Not Determined for product as a whole

Section 10 - Stability and Reactivity

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

Stability: **Granulated Blast Furnace Slag** is stable under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Acids, ammonium salts and aluminum metal

Conditions to Avoid: Unintentional contact with water and acids

Hazardous Decomposition/Combustion Products: Hydrogen sulfide gas may be released when moist or wet when it is heated. Can react with water to form calcium hydroxide.

Sensitivity to Mechanical Impact: ND

Sensitivity to Static Discharge: ND

Section 11 - Toxicological Information

The following toxicity data have been determined for **Granulated Blast Furnace Slag** using the information available for its components applied to the guidance on the preparation of an SDS under the requirements of the GHS:

- a. No LC₅₀ or LD₅₀ has been established for **Granulated Blast Furnace Slag**. The following data has been determined for the components:
 - **Silicon Dioxide:** LD₅₀ > 15,000 mg/kg (Oral/Rat), LD₅₀ > 5000, mg/kg (Dermal/Rat) LC₅₀ 0.69 mg (Inhalation/Rat/1/4 hour)
 - **Iron Oxide:** LD₅₀ > 10,000 mg/kg (Oral/Rat)
 - **Calcium Sulfide:** LC₅₀ = 444 ppm
- b. No skin irritation data available for **Granulated Blast Furnace Slag** as a mixture. The following skin irritation information was found for the components:
 - **Merwinite:** Causes mild skin irritation
 - **Iron Oxide:** Moderately irritating
 - **Calcium Sulfide:** Regarded as a skin irritant
- c. No eye irritation data available for **Granulated Blast Furnace Slag** as a mixture. The following eye irritation information was found for the components:
 - **Merwinite:** Causes eye irritation
 - **Iron Oxide:** Severely irritating, may cause burns.
 - **Calcium Sulfide:** Regarded as a skin irritant
- d. Carcinogenicity: IARC, NTP, and OSHA do not list **Granulated Blast Furnace Slag** as carcinogens. The following carcinogenicity information was found for the components:
 - **Iron Oxide:** IARC-3, TLV-A4
- e. No Germ Cell Mutagenicity data available for **Granulated Blast Furnace Slag** as a mixture. The following Germ Cell Mutagenicity information was found for the components:
 - **Iron Oxide:** Both positive and negative data
- h. No Specific Target Organ Systemic Toxicity (STOST) following Single Exposure data available for **Granulated Blast Furnace Slag** as a mixture. The following STOST following Single Exposure information was found for the components:
 - **Calcium Sulfide:** Regarded as a respiratory irritant.

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: Category 1 Very Toxic to Aquatic Life (Calcium Sulfide)

Hazard Symbol:



Signal Word: Warning

Ecotoxicity: No data available for the product. 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 (as iron oxide):** LC₅₀: >1000 mg/L; Fish

Mobility: No Data Available

Persistence & Degradability: No Data Available

Bioaccumulative Potential: No Data Available

Note: The 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.

Granulated BF Slag

Section 15 - Regulatory Information

State Regulations: The product, **Granulated Blast Furnace Slag** 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: Iron Oxide and Calcium Silicate
- Environmental Hazards: None listed
- Special Hazardous Substance: None listed

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.

New Jersey: Contains regulated material in the following categories:

- Hazardous Substance: none listed
- Special Health Hazard Substances: none listed

Minnesota: none listed

Massachusetts: Calcium Silicate and Iron Oxide

Other regulations:

WHMIS Classification (Canadian): Granulated Blast Furnace Slag is not listed as a whole. However individual components are listed.

Ingredients	WHMIS Classification
Iron	D2A
Dicalcium Ferrite	D26

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:

6/28/11 – Develop Sheet

Hazardous Material Identification System (HMIS) Classification

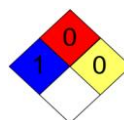
Health Hazard	1
Fire Hazard	0
Physical Hazard	0

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.



United States Steel Corporation

Granulated Blast Furnace Slag

Signal Word: **WARNING**

Symbols:



HAZARD STATEMENTS:

May cause damage to lungs through prolonged or repeated exposure.

PRECAUTIONARY STATEMENTS

Do not breathe dusts/ fumes.

Get medical advice/attention if you feel unwell.

Dispose of contents in accordance with federal, state and local regulations.