



Product 50% Silicon Briquettes **Date Prepared** February 12, 2004

Miller and Company LLC
9700 W. Higgins Road
Suite 1000
Rosemont, Illinois 60018

Emergency Telephone Number: 847-696-2677
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The subject product is a mechanical blend of the following ingredients:

<u>Component</u>	<u>% in Mixture</u>
<u>75% Ferrosilicon</u>	<u>0 – 70%</u>
<u>50% Ferrosilicon</u>	<u>0 - 80</u>
<u>Silicon Metal</u>	<u>0 – 80%</u>
<u>Portland Cement</u>	<u>8 - 12%</u>

Custom blended per chemical analysis of specific ingredients inventoried at time of blending so as to meet customer specifications.

Since the mixture presents no greater hazard than any of the individual components, and since the burden of information lies with the primary producer, the data sheets for the individual components are attached and will satisfy the requirements of the standard for a data sheet for the mixture. This interpretation comes from an OSHA field directive to compliance officers, "Appendix A, Clarifications and Interpretations of the Hazard Communication Standard (HCS)," OSHA CPL 2-2.38B, 15 August 1988.

MATERIAL SAFETY DATA SHEET

Ferrosilicon 75%

MSDS No.: FS75

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: 75% Ferrosilicon Alloys

Product Code: FS7500 to FS7599, FS9175

Synonyms/Trade Names: Ferrosilicon, FeSi, (75% Si)

CAS No.: 37322-17-1 (8049-17-0)

MANUFACTURER

Miller and Company LLC

9700 West Higgins Road Suite 1000

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EMERGENCY TELEPHONE NUMBERS:

CHEMTREC (847) 696-2677

2. COMPOSITION/INFORMATION ON INGREDIENTS ¹

	wt. %	CAS Registry #
Silicon (Si)	70 to 80	7440-21-3
Iron (Fe)	20 to 30	7439-89-6
Chromium (Cr)	<0.5	7440-47-3
Nickel (Ni)	<0.5	7440-02-0
Aluminum (Al)	<2.0	7429-90-5
Calcium (Ca)	<2.0	7440-70-2

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200):

	EXPOSURE LIMITS 8 hrs. TWA (mg/m ³)	
	OSHA PEL	ACGIH TLV
Silicon	15(total) 5 (respirable)	10(total)
Chromium	1	0.5
Nickel	1	1
Aluminum	15	10

¹ Elemental analysis of the alloy. The manufacturer can provide a more detailed analysis, including other trace elements.

3. HAZARDS IDENTIFICATION

The product does not represent a hazard to health, safety or environment when handled and stored as advised. (See Section 7). Flammable and noxious gases may be formed in contact with moisture, acids or bases. (See Section 10 and 11). Ferrosilicon Alloy-dust suspended in air may under certain conditions cause dust explosions. (See Section 10).

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3. HAZARDS IDENTIFICATION (Con't)

POTENTIAL HEALTH EFFECTS:

This product contains chromium in the metallic state. The International Agency for Research on Cancer has determined that chromium and certain chromium compounds are "causally associated with cancer in humans" but "the compounds responsible for the carcinogenic effect in humans cannot be specified". This requires that chromium in all forms be identified as carcinogenic under OSHA. The American Conference of Governmental Industrial Hygienists has reviewed the available data and concluded that specific water-soluble and insoluble hexavalent chromium compounds are carcinogenic to humans. (Also see section 11.)

NIOSH/OSHA "Guide for Chemical Hazards" conclusions are consistent with ACGIH; however, NIOSH recommended that all hexavalent chromium compounds be considered carcinogenic until proven otherwise. No recommendations have been made by ACGIH or NIOSH to include chromium metal or chromous and chromic salts as carcinogenic.

Ferrosilicon Alloy may contain small quantities of nickel. The International Agency for Research on Cancer has determined that nickel and certain nickel compounds are "probably carcinogenic to humans" but the nickel compounds responsible for the effect have not been specified. This requires that nickel in all forms be identified as carcinogenic under OSHA. The American Conference of Governmental Industrial Hygienists has reviewed the available data and concluded that not all forms of nickel are carcinogenic. The American Industrial Hygiene Association has also concluded that there is no epidemiological evidence of increased risk of respiratory cancer in the refining of oxide ores or "in any other specifically nickel occupational exposures".

4. FIRST AID MEASURES

INHALATION:

Irritation caused by dust: Move exposed individual to fresh air. See a physician on persistent feeling of discomfort. Phosphine/arsine intoxication: Seek medical attention. (See Section 11).

SKIN CONTACT:

Wash skin with water and/or mild detergent.

EYE CONTACT:

Rinse eyes with water/saline solution. See a physician on persistent feeling of discomfort.

INGESTION:

Remove the person affected from dust-exposed area. See inhalation.

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5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA:

Dry sand, CO₂ or dry powder. Dry Ferrosilicon Alloy in the form of granules is not combustible. Ferrosilicon Alloy-dust suspended in air may under certain conditions cause dust explosions. (See Section 10.)

6. ACCIDENTAL RELEASE MEASURES

Avoid handling that generates dust build-up. Material in the form of dust should be collected in suitable containers. Damp product must be kept away from dry, and must not be collected and stored in closed containers. Dry dust can be vacuumed or swept up.

7. HANDLING AND STORAGE

HANDLING:

Avoid handling that generates dust build-up. Avoid inhalation of dust. (See Section 8). Avoid ignition sources (e.g. welding) in areas with high dust concentrations. Addition of wet product to molten metal may cause explosions. (See Section 10.)

STORAGE:

Ferrosilicon Alloy must be kept in a dry and well-ventilated place, and away from acids and bases.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye protection, such as safety glasses or face shield and eye flushing facilities are recommended. If hand protection is desired, use gloves designed to protect against dust and abrasion such as cotton or leather.. Ensure adequate ventilation. Wear an appropriate particulate respirator in accordance with 29 CFR 1910.134 or CSA Standard Z94.4-M1982 for dust exposure that may exceed exposure limits. If exposure to phosphine and arsine is suspected (see section 10), or if adequate ventilation is not possible, then a self contained breathing apparatus or an air supplied respirator is recommended.

OCCUPATIONAL EXPOSURE LIMITS (OSHA and ACGIH):

	8hr TWA mg/m ³	
	OSHA PEL	ACGIH TLV
Total inhalable dust	15	10
Respirable dust	5	3
Phosphine gas (PH ₃)	0.4	0.42
Arsine gas (AsH ₃)	0.2	0.16

The low occupational exposure limit for arsine gas is due to the evidence for carcinogenicity in humans of inorganic arsenic compounds in general (IARC). Exposure levels for dust do not cover possible arsine/phosphine absorption from dust deposited on mucous membranes.

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9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid Granules, Powder or Lump
Color:	Silvery gray, metallic surface
Odor:	Odorless
Solubility (Water):	Insoluble to slightly soluble.
Melting Point (°C):	Approx. 1100
Specific Gravity (water = 1):	Approx. 4.5

10. STABILITY AND REACTIVITY

CONDITIONS TO AVOID:

Avoid generating sparks and other ignition sources (e.g. welding) in areas with high dust concentrations. Ferrosilicon Alloy-particles suspended in air at concentrations above 100-300 g/m³ can cause dust explosions. For a given particle size, the ignition sensitivity and the violence of explosion decrease with decreasing Si/Fe ratio. Addition of wet material to molten metal may cause explosions.

MATERIALS TO AVOID:

Water/excessive humidity, acids and bases.

HAZARDOUS DECOMPOSITION PRODUCTS:

Highly flammable hydrogen gas (H₂) and the highly flammable and very toxic gases phosphine and arsine (garlic-like smell), both heavier than air, may be formed if Ferrosilicon Alloy comes in contact with moisture, acids or bases. A reaction with hydrofluoric acid (HF) or nitric acid (HNO₃) leads to the formation of toxic gases such as silicon tetrafluoride (SiF₄) or nitrous gases (NO_x). Wet product will form highly flammable hydrogen gas if added to molten metal, due to decomposition of water.

11. TOXICOLOGICAL INFORMATION

ACUTE EFFECTS:

INHALATION:

Finely divided dust may irritate and dehydrate mucous membranes. Phosphine/arsine may be absorbed from dust deposited on mucous membranes. The toxic mechanism for phosphine is not clear. Phosphine irritates exposed mucous membranes, depresses the central nervous system (CNS) and can cause edema of the lungs. Acute, non-fatal poisoning with phosphine gives temporary effects, among others headache, malaise, vomiting, stomach pains, cough, and difficulty in breathing. Symptomatic treatment: corticosteroids, prophylactic for edema of the lungs.

SKIN CONTACT:

Dust may irritate the skin.

EYE CONTACT:

Dust may irritate and lead to dryness.

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11. TOXICOLOGICAL INFORMATION (con't)

INGESTION:

Dust may irritate and dehydrate mucous membranes. Possible phosphine/arsine absorption.

CHRONIC EFFECTS:

Prolonged exposure (years) to phosphine may lead to chronic effects such as difficulty in movement and speech problems. Epidemiological studies in the Norwegian ferroalloy industry, have neither shown an increased rate of mortality, nor an increased incidence of cancer. (Also see section 3.)

12. ECOLOGICAL INFORMATION

Ferrosilicon Alloy is not characterized as dangerous for the environment.

13. DISPOSAL CONSIDERATIONS

Avoid repackaging wet material in sealed containers. Dispose of in accordance with applicable federal, state, and local regulations. Ferrosilicon Alloy is not a listed RCRA Hazardous Wastes (40 CFR 261).

14. TRANSPORT INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION):

Proper Shipping Name: Ferrosilicon
Hazard Class: Not regulated
I.D. Number and Initials: Not regulated
Packing Group: Not regulated
Label(s): Not regulated

15. REGULATORY INFORMATION

OSHA (Occupational Safety and Health Administration)

Hazardous by definition of hazardous communication standard (29 CFR 1910.1200)

TSCA (Toxic Substance Control Act):

Components of this product are listed on the TSCA Inventory.

CERCLA (Comprehensive Response Compensation, and Liability Act):

Ferrosilicon Alloy is not listed in 40 CFR 302.4.

RCRA (Resource Conservation/Recovery Act):

Ferrosilicon Alloy is not a listed hazardous waste.

SARA TITLE III (Superfund Amendments and Reauthorization Act):

311/312 Hazard Categories:

Immediate Health, Delayed Health, Fire.

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15. REGULATORY INFORMATION (Con't)

313 Reportable Ingredients:

Chromium, Nickel

CALIFORNIA PROPOSITION 65: This product contains chemical(s) known to the State of California to cause cancer or reproductive toxicity:

Nickel

16. OTHER INFORMATION

APPLICATION OF FERROSILICON ALLOY:

Additive to metal in steel plants and iron foundries for production of steel, other metals and foundry products.

Literature references are available upon request from the manufacturer.

THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET RELATES TO THIS SPECIFIC MATERIAL. IT MAY NOT BE VALID FOR THIS MATERIAL IF USED IN COMBINATION WITH ANY OTHER MATERIALS OR IN ANY PROCESS. IT IS THE USER'S RESPONSIBILITY TO VERIFY THE SUITABILITY AND COMPLETENESS OF THIS INFORMATION FOR THE PARTICULAR USE INTENDED.

SRM Number: 59 (Renewals)
MSDS Number: 59
SRM Name: Ferrosilicon
Issued: November, 1993

MATERIAL SAFETY DATA SHEET

National Institute of Standards and Technology
Standard Reference Materials Program
Gaithersburg, Maryland 20899
(301) 975- 2019

SECTION I. MATERIAL IDENTIFICATION

Material Name: Ferrosilicon (48% Si)

Description: This SRM consists of 50 grams of powdered ferrosilicon. Ferrosilicon is an alloy of iron and silicon used to add silicon to steel and iron.

Other Designations: Silicon (N/A)

Iron (ferrium, carbonyl iron, **Ancor En 80/150*, **Armco Iron, Loha*, **Suy B-2*)

Chemical Formula: FeSi

CAS Reg. No.: 8049-17-0

DOT Classification: Ferrosilicon (Dangerous When Wet)
ID#: UN 1408

Manufacturer/Supplier: Available from a number of suppliers.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration	Limits and Toxicity Data
Silicon	50%	OSHA TLV-TWA (respirable dust): 5 mg/m ³ OSHA TLV-TWA (total dust): 15 mg/m ³ ACGIH TLV-TWA (total dust): 10 mg/m ³ Rabbit, Intratracheal: TD _{LO} : 25 mg (produced slight pulmonary lesions)
Iron	50%	OSHA PEL-TWA:* 10 mg/m ³ ACGIH TLV-TWA:* 5 mg/m ³ NIOSH REL:* 5 mg/m ³ Rabbit, Intraperitoneal: LD _{LO} : 20 mg/kg (no toxic effect noted)

*Limits set for iron oxide fumes.

SECTION III. PHYSICAL/ CHEMICAL CHARACTERISTICS

Silicon

Appearance and Odor: Black to grey, lustrous, needle-like crystals or octahedral platelets. The amorphous form is a dark brown powder.

Atomic Weight: 28.0855

Density: 2.32

Boiling Point: 2355 °C

Melting Point: 1410 °C

Vapor Pressure (1724 °C): 1 HHmg

Average Heat Capacity: 16 - 100 °C

Lattice Constant: 5.41987 x 10⁻⁸ cm

Compressibility V/V₀ at 25 x 10³ kg/cm²: 0.978
100 x 10³ kg/cm²: 0.940

Dielectric Constant: 13

Covalent Bond Ionization Energy (at 0° K): 1.2 ev.

Band Gap: 1.106 ev

Impurity Atom Ionization Energy: -0.04 ev.

Intrinsic Resistivity (at 300 °K): 0.23 megohm

Electron Mobility (at 300 °K): 1500 cm²/volt/sec

Hole Mobility (at 300 °K): 500 cm²/volt/sec

Intrinsic Charge Density (at 300 °K): 1.5 x 10¹⁰

Electron Diffusion Constant (at 300 °K): 38

Hole Diffusion Constant (at 300 °K): 13

Solubility in Water: Practically insoluble.

Solubility in Other Compounds: Soluble in molten alkali oxides and hydrofluoric + nitric acid.

Iron

Appearance and Odor: The powder form is black-grey. The solid is a silver-white metal with soft, malleable properties.

Atomic Weight: 55.847

Density: Pure 7.86
Cast 7.76
Wrought 7.25 - 7.78
Steel 7.6 - 7.78

Boiling Point: 2750 - 3000 °C

Melting Point: Pure 1535 °C
Cast 1000 - 1300 °C
Wrought 1500 °C
Steel 1300 °C

Vapor Pressure (at 1787 °C): 1 mmHg

Electrical Resistivity: 9.71 μΩ/cm

Solubility in Water (vol/vol at 0 °C): Insoluble in water.

Solubility/Reactivity in Other Compounds: Iron is readily attacked by dilute mineral acids and attacked or dissolved by organic acids. This metal is not readily attacked by cold concentrated sulfuric or nitric acid, but is attacked by these hot acids.

Note: Ferrosilicon:

Appearance and Odor: A crystalline, metallic solid.

Density: 5.4

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: Ferrosilicon is flammable solid.

(Method Used): N/A

Autoignition Temperature: N/A

Flammability Limits in Air (Volume %): UPPER: N/A
LOWER: N/A

Extinguishing Media: Use dry chemical, carbon dioxide or water spray.

Special Fire Procedures: Fire-fighters should wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-mode and other protective clothing.

Unusual Fire and Explosion Hazards: Ferrosilicon containing 30-70% silicon reacts with water or moisture releasing flammable hydrogen gas, and toxic arsine and phosphine.

Ferrosilicon will form ignition and/or explosive reactions with the following materials:

Chemical	Comments
acids	May evolve highly toxic and flammable arsine, phosphine and acetylene gases if impurities are present.
alkalis	May evolve highly toxic and flammable arsine, phosphine and acetylene gases if impurities are present.
caustic soda	May release flammable hydrogen gas.

See the following individual components.

Silicon: Silicon will burn in fluorine and in chlorine. An ignition reaction will occur with silicon and the following materials:

Chemical	Comments
bromine trifluoride gaseous chlorine fluorine	An ignition reaction. Ignition on contact at ambient temperatures. Ignites at room temperature; attains temperatures above 1400 °C.
sodium potassium alloy	This reaction forms sodium silicide, which is spontaneously flammable in air.
peroxyformic acid	Traces of manganese dioxide may promote oxidation with ignition.

Silicon with the following chemicals will explode:

Chemical	Comments
aluminum and lead oxide	Mixture may explode during heating.
iridium hexafluoride molybdenum hexafluoride osmium hexafluoride rhenium hexafluoride uranium hexafluoride	During the reduction to the pentafluoride, the hexafluoride material must not be condensed directly onto undiluted silicon powder or an explosion may occur.
water	When heated, it reacts exothermically and may become combusive or explosive at sufficiently high temperatures and pressures.

Iron: Finely divided iron powder is pyrophoric and ignites upon exposure to air at ambient temperatures; fire and dust explosions can occur in ducts or separators used to remove the dust during grinding and polishing operations. Iron will form an ignition and/or explosion with the following materials:

Chemical	Comments
bromine pentafluoride	Forms a violent reaction with possible ignition.
ammonium nitrate	Forms a violent or explosive reaction.
chloric acid	Forms an explosive compound.
chlorine gas	Will ignite.
chlorine trifluoride	Forms a violent reaction and possible ignition.
chloroformamidinium nitrate	An explosive ignition will occur.
dinitrogen tetraoxide	An ignition reaction results.
fluorine	Will ignite.
potassium dichromate	Ignites on contact.
potassium perchlorate + manganese dioxide	Forms an ignition reaction.
sodium peroxide	Will ignite under friction at 240 °C.
sulfuric acid	A possible explosion hazard.

SECTION V. REACTIVITY DATA

Stability: X Stable Unstable

Conditions to Avoid: Keep this material from excessive heat and incompatible materials.

Incompatibility (Materials to Avoid): Ferrosilicon will react with oxidizing materials.

See the following individual components.

Silicon: Silicon is attacked by hydrofluoric acid; with silver fluoride a violent reaction occurs. Rubidium acetylide and silicon reacts vigorously on warming.

Silicon with the following materials reacts with high temperatures or incandescence:

Chemical	Comments
alkali metal carbonates	A vigorous reaction with possible incandescence.
cesium acetylide	A vigorous reaction upon heating.
calcium	A violently incandescent reaction above 1050 °C after a short delay.
cobalt trifluoride	An exothermic reaction attaining red heat on warming.
iodine pentafluoride	An incandescent reaction.
lead oxide	An initiating mixture of silicon and lead dioxide (2:1) attains a temperature around 1100 °C after ignition by small flame.
metal carbonates	An exothermic reaction upon heating attaining incandescence and evolving carbon monoxide.
nitrosyl fluoride	Reacts with incandescence.

Iron: Iron with the following materials forms adverse reactions:

Chemical	Comments
sodium acetylide	Forms a possible violent reaction
polystyrene	Forms a possible static ignition
phosphorus	Forms incandescence when heated.
nitrogen dioxide	Forms incandescence when heated.

See Section IV: Fire and Explosion Hazard Data.

Hazardous Decomposition or Byproducts: Silicon: No hazardous byproducts are associated with silicon.

Iron: Thermal oxidative reduction of iron can produce toxic iron oxide fumes.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

Health Hazards (Acute and Chronic): Silicon dust seems to have little hazardous effects. Exposure to the dust may cause irritation of the *mucous membranes* and *conjunctivitis* (inflammation of the mucous membrane that lines the inner surface of the eyelids and is continued over the forepart of the eyeball). Silicon dust appears to have little adverse effects on the lungs and does not seem to produce significant organic disease or toxic effects when exposures are repeated.

Inhalation of iron dust may be irritating to the respiratory tract. Iron dust can cause conjunctivitis, *choroiditis* (inflammation of the vascular membrane containing large branched pigment cells that lies between the retina and the sclera), *retinitis* (inflammation of the sensory membrane that lies in the eye, receives the image formed by the lens, is the intermediate instrument of vision, and is connected with the brain by the optic nerve) and *siderosis* (spotting) of tissues if iron remains in these tissues. Deposition of iron particles can leave a *rust ring* or brownish stain on the cornea. Acute toxicity of this material usually results from accidental or suicidal ingestions (an over-

dose of iron-containing vitamin pills). Initially the victim may experience vomiting, abdominal pain, bloody diarrhea, *hematemesis* (the vomiting of blood), lethargy and shock. Some initial improvements may be observed but toxicity may progress to the point of profound shock, severe acidosis (the increased acidity of the blood), cyanosis (the bluish discoloration of the skin due to deficient oxygenation of the blood), and fever. Two to four days after exposure, liver damage may occur; several weeks after exposure, in several rare cases, *gastrointestinal fibrosis* (hardening of the walls of the GI tract) has occurred with obstruction of the digestive tract.

Chronic inhalation of iron can produce mottling siderosis (spotting of the lungs). This condition often occurs without symptoms and is referred to as *benign radiopaque pneumoconiosis*. Ingestion of greater than 50 to 100 mg of iron per day may result in pathological iron deposition in body tissues. Symptoms may include fibrosis of the pancreas (scarring and hardening of the pancreas), *diabetes mellitus* (a familial constitutional disorder of carbohydrate metabolism characterized by inadequate secretion or utilization of insulin, by excessive urine production, excessive amounts of sugar in the blood and urine, and by thirst, hunger and loss of weight), and *liver cirrhosis* (fibrosis with hardening of the liver, caused by excessive formation of connective tissue followed by contraction). Repeated iron ingestion can produce cardiac toxicity.

Signs and Symptoms of Exposure: See Health Hazards (Acute and Chronic).

Medical Conditions Generally Aggravated by Exposure: N/A

Listed as a Carcinogen/Potential Carcinogen (Silicon):

	<u>Yes</u>	<u>No</u>
In the National Toxicology Program (NTP) Report on Carcinogens	___	<u>X</u>
In the International Agency for Research (IARC) Monographs	___	<u>X</u>
By the Occupational Safety and Health Administration (OSHA)	___	<u>X</u>

Listed as a Carcinogen/Potential Carcinogen (Iron):

	<u>Yes</u>	<u>No</u>
In the National Toxicology Program (NTP) Report on Carcinogens	___	<u>X</u>
In the International Agency for Research (IARC) Monographs	___	<u>X</u>
By the Occupational Safety and Health Administration (OSHA)	___	<u>X</u>

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Contact medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Contact medical assistance if necessary.

Inhalation: If inhaled, remove the victim to fresh air. If breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration. Contact medical assistance if necessary.

Ingestion: If ingested, wash out mouth with water. Contact medical assistance if necessary.

TARGET ORGAN(S) OF ATTACK: **Silicon:** Skin, eyes and mucous membranes.

Iron: The skin, eyes, pancreas, liver and upper respiratory tract.

MATERIAL SAFETY DATA SHEET

Silicon Metal

MSDS No.: SI10

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: Silicon Metal (all grades) including SiPearl® and Silgrain® 200 mesh or larger

Product Code: SI1005 to SI1058, SI1060 to SI1099, SI1132 to SI1250, SI2000 to SI2050, SI2065 to SI2092, SI2800, SI9210 to SI9220, SI9310 to SI9317, SI9615

Synonyms/Trade Names: Silicon Metal

CAS No.: 7440-21-3

MANUFACTURER
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(847) 696-2400

EMERGENCY TELEPHONE NUMBERS:
(847) 696-2677

2. COMPOSITION/INFORMATION ON INGREDIENTS 1

	wt. %	CAS Registry #
Silicon (Si)	> 97	7440-21-3
Iron (Fe)	< 2	7439-89-6
Aluminum (Al)	< 2	7429-90-5

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200):

	EXPOSURE LIMITS 8 hrs. TWA (mg/m ³)	
	OSHA PEL	ACGIH TLV
Silicon	15(total) 5 (respirable)	10(total)
Aluminum	15	10

1 Elemental analysis of the alloy. The manufacturer can provide a more detailed analysis, including other trace elements.

3. HAZARDS IDENTIFICATION

Improper handling of Silicon Metal can cause fire or deflagration. (See Section 5). Silicon Metal should be handled in accordance with National Fire Protection Association recommendations. This product can be handled safely if appropriate handling precautions are followed. The product does not represent a hazard to health, safety or environment when handled and stored as advised. (See Section 7). Flammable and noxious gases may be formed in contact with moisture, acids or bases. (See Section 10 and 11). Silicon Metal dust suspended in air may under certain conditions cause dust deflagrations. (See Section 10)

MATERIAL SAFETY DATA SHEET

Silicon Metal

MSDS No.: SI10

4. FIRST AID MEASURES

INHALATION:

Emergency Responders should use the appropriate respiratory protection when removing an affected victim to fresh air. Give artificial respiration if breathing has stopped. Call for prompt medical attention. (See Section 11)

SKIN CONTACT:

Wash skin with water and/or mild detergent. If irritation develops, seek medical attention.

EYE CONTACT:

Rinse eyes with large amounts of water/saline solution until no particles remain in eye. See a physician on persistent feeling of discomfort or if irritation occurs.

INGESTION:

If large amounts are swallowed, get prompt medical attention.

5. FIRE FIGHTING MEASURES

COMBUSTIBILITY:

When suspended in air, powders, fines or dust of Silicon Metal can readily be ignited, will propagate flame, and may generate considerable pressure and/or deflagrate. Silicon Metal should be handled so that fines do not become airborne in concentration that exceed the Minimum Explosive Concentration. Avoid generating sparks or ignition sources in areas of high airborne dust levels or in areas with accumulated dust. The degree of combustibility in air is dependent upon particle size, oxide coating, and quality of dispersion. The potential for silicon metal to combust in air increases with decreasing particle size. Thoroughly clean areas or equipment to be maintained prior to dust disturbing or ignition source generation activities. (See Section 10.)

AUTO IGNITION TEMPERATURE (dust layer):

Silicon Metal - 1650°F (900°C)

LOWER EXPLOSIVE LEVEL:

Silicon Metal - Greater than 160 g/m³

COMBUSTION PRODUCTS:

Oxides of constituent elements.

MINIMUM IGNITION ENERGY:

780 millijoules

EXTINGUISHING MEDIA:

Class D fire: Use dry powder, dry sand, or CO₂ to smother fire. Fire may also be isolated and allowed to burn itself out. Do not disturb metal while extinguishing the fire.

MATERIAL SAFETY DATA SHEET

Silicon Metal

MSDS No.: SI10

6. ACCIDENTAL RELEASE MEASURES

LAND SPILL:

Silicon Metal spilled on the land represents minimal hazard. Cleanup personnel should wear appropriate respiratory protective equipment when addressing fine material. Avoid the use of compressed air to maneuver spills or leaks of fine material. Fine material should be swept up or vacuumed using explosion-proof equipment. Keep dry material and wet material separated. Place cleaned up material in disposal container. Avoid repackaging wet materials in sealed containers.

WATER SPILL:

Remove spilled product from water body by dipping or other appropriate means. Avoid repackaging wet materials in sealed containers.

7. HANDLING AND STORAGE

HANDLING:

Silicon Metal powders or fines can explode or deflagrate and should be handled to prevent fines from becoming airborne in concentration that exceed the Minimum Explosive Concentration. Avoid handling that generates dust build-up. Avoid inhalation of dust. (See Section 8). Avoid ignition sources (e.g. welding) in areas with high dust concentrations. Addition of wet product to molten metal may cause explosions. (See Section 10.)

STORAGE:

Silicon Metal must be kept in a dry and well-ventilated place, and away from acids and bases.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye protection, eye flushing facilities and protective gloves are recommended. Ensure adequate ventilation. Wear an appropriate particulate respirator in accordance with 29 CFR 1910.134 or CSA Standard Z94.4-M1982 for dust exposure that may exceed exposure limits. If adequate ventilation is not possible, then a self-contained breathing apparatus or an air supplied respirator is recommended.

OCCUPATIONAL EXPOSURE LIMITS (OSHA and ACGIH):

	8hr TWA mg/m ³	
	OSHA PEL	ACGIH TLV
Total inhalable dust	15	10
Respirable dust	5	3
Silicon	15 (total) 5 (respirable)	10(total)
Aluminum	15	10

MATERIAL SAFETY DATA SHEET

Silicon Metal

MSDS No.: SI10

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Granular or Lump, 200 mesh or larger
Color:	Silvery metallic
Odor:	Odorless
Solubility (Water):	Insoluble
Melting Point (°C):	Approx. 1440 °C
Specific Gravity (water = 1):	Approx. 2.3

10. STABILITY AND REACTIVITY

CONDITIONS TO AVOID:

Silicon Metal powders or fines can explode or deflagrate and should be handled to prevent fines from becoming airborne in concentration that exceed the Minimum Explosive Concentration. Silicon particles suspended in air can cause dust deflagrations. Avoid generating sparks and other ignition sources (e.g. welding) in areas with high dust concentrations. Addition of wet material to molten metal may cause explosions.

MATERIALS TO AVOID:

Acids and strong bases.

HAZARDOUS DECOMPOSITION PRODUCTS:

Contact with acids may result in the generation of silane gas (SiH_4), a spontaneously combustible gas. Highly flammable hydrogen gas (H_2) may be formed if Silicon Metal comes in contact with moisture, acids or bases. A reaction with hydrofluoric acid (HF) or nitric acid (HNO_3) leads to the formation of toxic gases such as silicon tetrafluoride (SiF_4) or nitrous oxide gases (NO_x). Wet product will form highly flammable hydrogen gas if added to molten metal, due to decomposition of water.

11. TOXICOLOGICAL INFORMATION

ACUTE EFFECTS:

INHALATION:

Finely divided dust may irritate and dehydrate mucous membranes.

SKIN CONTACT:

Dust may irritate the skin.

EYE CONTACT:

Dust may irritate and lead to dryness.

INGESTION:

Dust may irritate and dehydrate mucous membranes.

CHRONIC EFFECTS:

This material is not known to be a reproductive toxin, teratogen or mutagen.

MATERIAL SAFETY DATA SHEET

Silicon Metal

MSDS No.: S110

12. ECOLOGICAL INFORMATION

Silicon Metal is not characterized as dangerous for the environment.

13. DISPOSAL CONSIDERATIONS

Avoid repackaging wet material in sealed containers. Dispose of in accordance with applicable federal, state, and local regulations. Silicon Metal is not a listed RCRA Hazardous Wastes (40 CFR 261).

14. TRANSPORT INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION):

Proper Shipping Name: Not regulated

Hazard Class: Not regulated

I.D. Number and Initials: Not regulated

Packing Group: Not regulated

Label(s): Not regulated

15. REGULATORY INFORMATION

OSHA (Occupational Safety and Health Administration)

Hazardous by definition of hazardous communication standard (29 CFR 1910.1200)

TSCA (Toxic Substance Control Act):

Components of this product are listed on the TSCA Inventory.

CERCLA (Comprehensive Response Compensation, and Liability Act):

Silicon Metal is not listed in 40 CFR 302.4.

RCRA (Resource Conservation/Recovery Act):

Silicon Metal is not a listed hazardous waste.

SARA TITLE III (Superfund Amendments and Reauthorization Act):

311/312 Hazard Categories:

Immediate Health, Delayed Health, Fire.

313 Reportable Ingredients:

None

CALIFORNIA PROPOSITION 65:

This product contains chemical(s) known to the State of California to cause cancer:

None

16. OTHER INFORMATION

APPLICATION OF SILICON METAL

Additive to metal in steel plants and iron foundries for production of steel, other metals and foundry products. Additive for ceramic production.

MATERIAL SAFETY DATA SHEET

Silicon Metal

MSDS No.: SI10

16. OTHER INFORMATION (Con't)

Literature references are available upon request from the manufacturer.

THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET RELATES TO THIS SPECIFIC MATERIAL. IT MAY NOT BE VALID FOR THIS MATERIAL IF USED IN COMBINATION WITH ANY OTHER MATERIALS OR IN ANY PROCESS. IT IS THE USER'S RESPONSIBILITY TO VERIFY THE SUITABILITY AND COMPLETENESS OF THIS INFORMATION FOR THE PARTICULAR USE INTENDED.

Material Safety Data Sheet

Section 1: PRODUCT AND COMPANY INFORMATION

Product Name(s): Lafarge Portland Cement (cement)

Product Identifiers: Cement, Portland Cement, Hydraulic Cement, Oil Well Cement, Trinity[®] White Cement, Antique White Cement, Portland Cement Type I, IA, IE, II, I/II, IIA, II L.A., III, IIIA, IV, IVA, V, VA, 10, 20, 30, 40, 50, GU, MS, MH, HE, LH, HS, OWH, OWG Cement, OW Class G HSR

Manufacturer:
Lafarge North America Inc.
12950 Worldgate Drive, Suite 500
Herndon, VA 20170

Information Telephone Number:
703-480-3600 (9am to 5pm EST)

Emergency Telephone Number:
1-800-451-8346 (3E Hotline)

Product Use: Cement is used as a binder in concrete and mortars that are widely used in construction. Cement is distributed in bags, totes and bulk shipment.

Note: This MSDS covers many types of Portland cement. Individual composition of hazardous constituents will vary between types of Portland cement.



Section 2: COMPOSITION/INFORMATION ON INGREDIENTS

Component	Percent (By Weight)	CAS Number	OSHA PEL -TWA (mg/m ³)	ACGIH TLV-TWA (mg/m ³)	LD ₅₀ (mouse, intraperitoneal)	LC ₅₀
Portland Cement*	100	65997-15-1	15 (T); 5 (R)	10 (R)	NA	NA
Calcium Sulfate*	2-10	13397-24-5	15 (T); 5 (R)	10 (T)	NA	NA
Calcium Carbonate*	0-5	1317-65-3	15 (T); 5 (R)	10 (T)	NA	NA
Calcium Oxide	0-5	1305-78-8	5 (T)	2 (T)	3059 mg/kg	NA
Magnesium Oxide	0-4	1309-48-4	15 (T)	10 (T)	NA	NA
Crystalline Silica	0-0.2	14808-60-7	[(10) / (%SiO ₂ +2)] (R); [(30) / (%SiO ₂ +2)] (T)	0.05 (R)	NA	NA

Note: Exposure limits for components noted with an * contain no asbestos and <1% crystalline silica

Cement is made from materials mined from the earth and is processed using energy provided by fuels. Trace amounts of chemicals may be detected during chemical analysis. For example, cement may contain trace amounts of calcium oxide (also known as free lime or quick lime), free magnesium oxide, potassium and sodium sulfate compounds, chromium compounds, nickel compounds, and other trace compounds.

Section 3: HAZARD IDENTIFICATION

	WARNING	
<p>Corrosive - Causes severe burns. Toxic - Harmful by inhalation. (Contains crystalline silica)</p> <p>Use proper engineering controls, work practices, and personal protective equipment to prevent exposure to wet or dry product.</p> <p>Read MSDS for details.</p>		

Section 3: HAZARD IDENTIFICATION (continued)

Emergency Overview: Cement is a solid, grey, off white, or white odorless powder. It is not combustible or explosive. A single, short-term exposure to the dry powder presents little or no hazard. Exposure of sufficient duration to wet cement, or to dry cement on moist areas of the body, can cause serious, potentially irreversible tissue (skin, eye, respiratory tract) damage due to chemical (caustic) burns, including third degree burns.

Potential Health Effects:

Eye Contact: Airborne dust may cause immediate or delayed irritation or inflammation. Eye contact with large amounts of dry powder or with wet cement can cause moderate eye irritation, chemical burns and blindness. Eye exposures require immediate first aid and medical attention to prevent significant damage to the eye.

Skin Contact: Cement may cause dry skin, discomfort, irritation, severe burns, and dermatitis.

Burns: Exposure of sufficient duration to wet cement, or to dry cement on moist areas of the body, can cause serious, potentially irreversible damage to skin, eye, respiratory and digestive tracts due to chemical (caustic) burns, including third degree burns. A skin exposure may be hazardous even if there is no pain or discomfort.

Dermatitis: Cement is capable of causing dermatitis by irritation and allergy. Skin affected by dermatitis may include symptoms such as, redness, itching, rash, scaling, and cracking.

Irritant dermatitis is caused by the physical properties of cement including alkalinity and abrasion.

Allergic contact dermatitis is caused by sensitization to hexavalent chromium (chromate) present in cement. The reaction can range from a mild rash to severe skin ulcers. Persons already sensitized may react to the first contact with cement. Others may develop allergic dermatitis after years of repeated contact with cement.

Inhalation (acute): Breathing dust may cause nose, throat or lung irritation, including choking, depending on the degree of exposure. Inhalation of high levels of dust can cause chemical burns to the nose, throat and lungs.

Inhalation (chronic): Risk of injury depends on duration and level of exposure.

Silicosis: This product contains crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica from this product can cause silicosis, a seriously disabling and fatal lung disease. See Note to Physicians in Section 4 for further information.

Carcinogenicity: Cement is not listed as a carcinogen by IARC or NTP; however, cement contains trace amounts of crystalline silica and hexavalent chromium which are classified by IARC and NTP as known human carcinogens.

Autoimmune Disease: Some studies show that exposure to respirable crystalline silica (without silicosis) or that the disease silicosis may be associated with the increased incidence of several autoimmune disorders such as scleroderma (thickening of the skin), systemic lupus erythematosus, rheumatoid arthritis and diseases affecting the kidneys.

Tuberculosis: Silicosis increases the risk of tuberculosis.

Renal Disease: Some studies show an increased incidence of chronic kidney disease and end-stage renal disease in workers exposed to respirable crystalline silica.

Section 3: HAZARD IDENTIFICATION (continued)

Ingestion: Do not ingest cement. Although ingestion of small quantities of cement is not known to be harmful, large quantities can cause chemical burns in the mouth, throat, stomach, and digestive tract.

Medical Conditions Aggravated by Exposure: Individuals with lung disease (e.g. bronchitis, emphysema, COPD, pulmonary disease) or sensitivity to hexavalent chromium can be aggravated by exposure.

Section 4: FIRST AID MEASURES

Eye Contact: Rinse eyes thoroughly with water for at least 15 minutes, including under lids, to remove all particles. Seek medical attention for abrasions and burns.

Skin Contact: Wash with cool water and a pH neutral soap or a mild skin detergent. Seek medical attention for rash, burns, irritation, dermatitis, and prolonged unprotected exposures to wet cement, cement mixtures or liquids from wet cement.

Inhalation: Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.

Ingestion: Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention or contact poison control center immediately.

Note to Physician: The three types of silicosis include:

- Simple chronic silicosis – which results from long-term exposure (more than 20 years) to low amounts of respirable crystalline silica. Nodules of chronic inflammation and scarring provoked by the respirable crystalline silica form in the lungs and chest lymph nodes. This disease may feature breathlessness and may resemble chronic obstructive pulmonary disease (COPD).
- Accelerated silicosis – occurs after exposure to larger amounts of respirable crystalline silica over a shorter period of time (5-15 years). Inflammation, scarring, and symptoms progress faster in accelerated silicosis than in simple silicosis.
- Acute silicosis – results from short-term exposure to very large amounts of respirable crystalline silica. The lungs become very inflamed and may fill with fluid, causing severe shortness of breath and low blood oxygen levels.

Progressive massive fibrosis may occur in simple or accelerated silicosis, but is more common in the accelerated form. Progressive massive fibrosis results from severe scarring and leads to the destruction of normal lung structures.

Section 5: FIREFIGHTING MEASURES

Flashpoint & Method:	Non-combustible	Firefighting Equipment:	Cement poses no fire-related hazard. A SCBA is recommended to limit exposures to combustion products when fighting any fire.
General Hazard:	Avoid breathing dust. Wet cement is caustic.	Combustion Products:	None.
Extinguishing Media:	Use extinguishing media appropriate for surrounding fire.		

Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Skin Protection: Wear gloves, boot covers and protective clothing impervious to water to prevent skin contact. Do not rely on barrier creams, in place of impervious gloves. Remove clothing and protective equipment that becomes saturated with wet cement and immediately wash exposed areas.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid (powder).	Evaporation Rate:	NA.
Appearance:	Gray, off white or white powder.	pH (in water):	12 – 13
Odor:	None.	Boiling Point:	>1000° C
Vapor Pressure:	NA.	Freezing Point:	None, solid.
Vapor Density:	NA.	Viscosity:	None, solid.
Specific Gravity:	3.15	Solubility in Water:	Slightly (0.1 - 1.0%)

Section 10: STABILITY AND REACTIVITY

Stability: Stable. Keep dry until use. Avoid contact with incompatible materials.

Incompatibility: Wet cement is alkaline and is incompatible with acids, ammonium salts and aluminum metal. Cement dissolves in hydrofluoric acid, producing corrosive silicon tetrafluoride gas. Cement reacts with water to form silicates and calcium hydroxide. Silicates react with powerful oxidizers such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride, and oxygen difluoride.

Hazardous Polymerization: None.

Hazardous Decomposition: None.

Section 11 and 12: TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For questions regarding toxicological and ecological information refer to contact information in Section 1.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of waste and containers in compliance with applicable Federal, State, Provincial and Local regulations.

Section 14: TRANSPORT INFORMATION

This product is not classified as a Hazardous Material under U.S. DOT or Canadian TDG regulations.

Section 15: REGULATORY INFORMATION

OSHA/MSHA Hazard Communication: This product is considered by OSHA/MSHA to be a hazardous chemical and should be included in the employer's hazard communication program.

CERCLA/SUPERFUND: This product is not listed as a CERCLA hazardous substance.

EPCRA SARA Title III: This product has been reviewed according to the EPA Hazard Categories promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and is considered a hazardous chemical and a delayed health hazard.

EPCRA SARA Section 313: This product contains none of the substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Section 15: REGULATORY INFORMATION (continued)

- RCRA:** If discarded in its purchased form, this product would not be a hazardous waste either by listing or characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.
- TSCA:** Portland cement and crystalline silica are exempt from reporting under the inventory update rule.
- California Proposition 65:** Crystalline silica (airborne particulates of respirable size) and Chromium (hexavalent compounds) are substances known by the State of California to cause cancer.
- WHMIS/DSL:** Products containing crystalline silica and calcium carbonate are classified as D2A, E and are subject to WHMIS requirements.


Section 16: OTHER INFORMATION
Abbreviations:

>	Greater than	NA	Not Applicable
ACGIH	American Conference of Governmental Industrial Hygienists	NFPA	National Fire Protection Association
CAS No	Chemical Abstract Service number	NIOSH	National Institute for Occupational Safety and Health
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	NTP	National Toxicology Program
		OSHA	Occupational Safety and Health Administration
CFR	Code for Federal Regulations	PEL	Permissible Exposure Limit
CL	Ceiling Limit	pH	Negative log of hydrogen ion
DOT	U.S. Department of Transportation	PPE	Personal Protective Equipment
EST	Eastern Standard Time	R	Respirable Particulate
HEPA	High-Efficiency Particulate Air	RCRA	Resource Conservation and Recovery Act
HMIS	Hazardous Materials Identification System	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	T	Total Particulate
		TDG	Transportation of Dangerous Goods
LC ₅₀	Lethal Concentration	TLV	Threshold Limit Value
LD ₅₀	Lethal Dose	TWA	Time Weighted Average (8 hour)
mg/m ³	Milligrams per cubic meter	WHMIS	Workplace Hazardous Materials Information System
MSHA	Mine Safety and Health Administration		

This MSDS (Sections 1-16) was revised on March 3, 2005.

An electronic version of this MSDS is available at: www.lafarge-na.com under the Products section.

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NO WARRANTY IS MADE, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled: Notify safety personnel of major spills and/or leaks. Shut off all sources of ignition and use non-sparking tools. Avoid dust generation by cleaning small spills with a damp mop. Since finely divided material is an explosion hazard, take special care during cleanup.

Waste Disposal: Contact a licensed contractor for detailed recommendations. Follow all Federal, state and local regulations.

Handling and Storage: Persons handling this material should wear a self contained breathing apparatus with a full facepiece and operated in a pressure-demand or other positive pressure mode. The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator. Protective garments such as rubber gloves, goggles or face-shield, lab coats, etc., should be worn based on conditions of exposure.

Note: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the lab.

Store this material in a cool, dry, well ventilated area away from moisture. An eye wash station and a quick drench shower should be readily available.

SECTION VIII. SOURCE DATA/ OTHER COMMENTS

Sources: Occupational Health Services, Inc., *Silicon*, October 9, 1990.
Fisher Scientific, MSDS *Iron*, July 12, 1990.
Occupational Health Services, Inc., *Ferrosilicon*, March 24, 1993.
Hawley's Condensed Chemical Dictionary, 11th ed., 1987.
The Merck Index, 11th ed., 1989.
Webster's Ninth New Collegiate Dictionary, 1990.

Carmelita S. Davis (301) 975-6439
National Institute of Standards and Technology
Standard Reference Materials Program
Gaithersburg, Maryland 20899

Note: Physical and chemical data contained in this MSDS are provided for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references, however NIST does not certify the data on the MSDS. The certified values for this material are given only on the NIST Certificate of Analysis.