

MATERIAL SAFETY DATA SHEET — 16 Sections

Sections 1-6: Peace Adeseye, Sections 7-11: Donald McIntyre, Sections
12-16: Anthony Lovett

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: Fluorine.			[WHMIS Classification]: Class A: Compressed gas.		
Product Use: Synthetic/Analytical chemistry.					
Manufacturer's Name: Airgas USA, LLC.			Supplier's Name: Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC.		
Street Address: 259 North Radnor-Chester Road Suite 100.			Street Address: 575 Mountain Ave.		
City: Radnor, PA.		Province: None.	City: Murray Hill, NJ 07974		Province: None.
Postal Code: 19087-5283.	Emergency Telephone: 1-866-734-3438.		Postal Code: 07974.	Emergency Telephone: 1-800-424-9300 for US/ 703-527-3887 outside US.	
Date MSDS Prepared: 10/09/2005 05:34 PM		MSDS Prepared By: Sciencelab.com, Inc.		Phone Number: 908-464-8100	

SECTION 2 — COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Ingredients (<i>specific</i>)	%	CAS Number	LD ₅₀ of Ingredient (<i>specify species and route</i>)	LC ₅₀ of Ingredient (<i>specify species</i>)
Fluorine	100	86-73-7	Oral LD50 (rat): 31 mg/kg.; Oral LD50 (mice): 44 mg/kg	>100 mg/L

[Emergency
Overview]

WHMIS Symbols]: Class A: Compressed gas.

Potential Health Effects: SHORT TERM EXPOSURE: irritation (possibly severe), chest pain, bluish skin color, lung congestion, kidney damage, liver damage, convulsions, death LONG TERM EXPOSURE: same as effects reported in short term exposure.

LONG TERM EXPOSURE: tooth discoloration

SKIN CONTACT: SHORT TERM EXPOSURE: burns

EYE CONTACT: SHORT TERM EXPOSURE: irritation (possibly severe), blindness LONG TERM EXPOSURE: same as effects reported in short term exposure



SECTION 3 — HAZARDS IDENTIFICATION

SECTION 4 — FIRST AID MEASURES

Skin Contact: After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Ingestion: Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

SAMPLE FORMAT PROVIDED BY THE WORKERS' COMPENSATION BOARD OF BRITISH COLUMBIA

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SECTION 5 — FIRE FIGHTING MEASURES

Flammable ☒ Yes ☐ No		If yes, under which conditions?: May be combustible at high temperature.	
Means of Extinction: DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED. It may be safer to allow the fire to burn itself out. Use water spray to knock down vapors and cool fire-exposed containers.			
Flashpoint (° C) and Method: 100°F		Upper Flammable Limit (% by volume): 21.7 %	Lower Flammable Limit (% by volume): 2.6 %
Autoignition Temperature (°C): 860 ° F		Explosion Data — Sensitivity to Impact: None.	Explosion Data — Sensitivity to Static Discharge: None.
Hazardous Combustion Products: Hydrogen fluoride. Oxygen difluoride			
[NFPA]: As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Corrosive hazard. Wear protective gloves/clothing and eye/face protection. Do not get water inside containers. For massive fire, use unmanned hose holders or monitor nozzles.			

SECTION 6 — ACCIDENTAL RELEASE MEASURES

-Environmental Precautions Prevent spreading of vapors through sewers, ventilation systems and confined areas. Should not be released into the environment.
-Methods for Containment Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.
-Personal Precautions Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Use personal protective equipment. Avoid contact with skin, eyes and clothing.
-Methods for Cleaning Up Return cylinder to Linde or an authorized distributor.

Leak and Spill Procedures:

-Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

-Large Spill: Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

SECTION 7 — HANDLING AND STORAGE

Handling procedures and Equipment: Teflon is the preferred gasket material when working with fluorine gas.
Keep equipment scrupulously dry. The reaction between metals and fluorine is relatively slow at room temperature, but becomes vigorous and self-sustaining if the temperature is elevated.
Store and use only in vented gas storage cabinets or fume hoods.
Storage requirements:

Use and store fluorine in a ventilated gas cabinet or fume hood. When a gas cabinet is warranted (e.g., cylinders larger than lecture bottle size that are used in a fume hood), install a fluorine gas monitoring system.

SECTION 8 — EXPOSURE CONTROL / PERSONAL PROTECTION

Exposure Limits	☒ ACGIH TLV	☒ OSHA PEL	☐ Other (specify)
Specific Engineering Controls (such as ventilation, enclosed process Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.			
Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.			
Personal Protective Equipment	☒ Gloves	☒ Respirator	☒ Eye Footwear
	☒ Clothing	☒ Other	
If checked, please specify type Respiratory protection			

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Solid. (Leaflets solid.) α - and β -fluorine	Odour and Appearance pale yellow, diatomic, highly corrosive, flammable gas, with a pungent odor	Odour Threshold (ppm) The odor threshold for fluorine is 0.10-0.20 ppm
Specific Gravity: 1.202 (Water = 1) 1.336	Vapour Density (air = 1) 1.696	Vapour Pressure (mmHg) 760mmHg
Evaporation Rate: 174.363 kJ/kg	Boiling Point (° C): 295°C (563°F) -188.11°C	Freezing Point (° C): -219.6°C
pH 5.5-6.5	Coefficient of Water/Oil Distribution unclassified	[Solubility in Water]: Soluble in diethyl ether. Insoluble in cold water.

SECTION 10 — STABILITY AND REACTIVITY

Chemical Stability ☒ Yes ☐ No	If no, under which conditions?
Incompatibility with Other Substances ☐ Yes ☒ No	If yes, which ones?

Reactivity, and under what conditions: Because of its reactivity, elemental fluorine is never found in nature and no other chemical element can displace fluorine from its compounds

Hazardous Decomposition Products: Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11 — TOXICOLOGICAL INFORMATION

Effects of Acute Exposure

Causes serious eye damage. Contact with rapidly expanding gas may cause burns or frostbite.

Effects of chronic exposure

chronic exposure to fluoride causes damage to the myocardium.

Irritancy of Product

Skin sensitization

Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite.

Respiratory sensitization

May give off gas, vapor or dust that is very irritating or corrosive to the respiratory system.

Carcinogenicity-IARC

not classifiable

Carcinogenicity - ACGIH

not classifiable

Reproductive toxicity

Burning of the reproduction systems

Teratogenicity

Not proved

Embrototoxicity

All substances were "non-embryotoxic", but SnF₂ and CuF₂ were close to the borderline of "weak embryotoxic"

Mutagenicity

fluorine is a mutagenic agent which can cause DNA and chromosomal damage

Name of synergistic products/effects: Pressure–temperature-induced transformations of fluorographite CF1.1 and homogeneous mixtures of CF1.1 with naphthalene under static pressure of 8.0 GPa have been investigated by X-ray diffraction, scanning and transmission electron microscopies, and energy-dispersive X-ray analysis. It was found that carbonization of neat CF1.1 occurs at temperatures above 500 °C. Formation of graphite showing high grade of crystalline perfection has been observed already at ~900 °C. The process of graphitization of carbon residue from CF1.1 is also characterized by high yield of planar graphite monocrystals of clear-cut polygonal shape. The formation of diamonds from CF1.1 at 8.0 GPa was not observed within all studied temperature range, up to 1500 °C. Thermal transformations of CF1.1 mixtures with naphthalene are distinguished by significantly reduced graphitization temperature threshold and a record low initiation temperature of diamond formation, 900 °C at 8.0 GPa, in comparison with various hydrocarbons. This can be explained by synergistic effect of fluorine and hydrogen on processes of graphite and diamond formation in a binary system studied. Another distinctive feature of diamond formation process in the systems composed of mixtures of CF1.1 and naphthalene is simultaneous production of both nano- and micrometer-sized diamond fractions

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[Aquatic Toxicity]

Waste Disposal

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SECTION 15 — REGULATORY INFORMATION

[WHMIS Classification]	[OSHA]
[SERA]	[TSCA]

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

[illegible]