BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: FLUORINE

1. Chemical Product and Company Identification

BOC India Ltd.
Oxygen House,
P-43 Taratala Road,
Kolkata -7000888
India

TELEPHONE NUMBER: 91 (033) 24014708-20
Customer Service Center – 1800 2345678

PRODUCT NAME: FLUORINE
CHEMICAL NAME: Fluorine
COMMON NAMES/SYNONYMS: Fluorine, Compressed
TDG CLASSIFICATION: 2.3
WHMIS CLASSIFICATION: A, D1A, C, E, D2B, F

2. Composition, Information on Ingredients

INGREDIENT	% VOLUME	PEL-OSHA[1]	TLV-ACGIH[2]	LD_{50} or LC_{50} Route/Species
Fluorine FORMULA: F_2 CAS: 7782-41-4 RTECS #: LM6475000	> 98.0	0.1 ppm TWA	1 ppm TWA 2 ppm TWA	LC_{50} 185 ppm/1H (rat)

[1] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[2] As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agents

3. Hazards Identification

EMERGENCY OVERVIEW

Corrosive to exposed tissues. Inhalation of vapors may result in pulmonary edema and chemical pneumonitis. Fluorine penetrates deeply into body tissues and will continue to exert toxic effects unless neutralized. Nonflammable. Reacts violently and decomposes to hydrofluoric acid on contact with moisture.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	Yes	Yes	Yes	No

HEALTH EFFECTS:

Exposure Limits Yes	Irritant Yes	Sensitization No
Teratogen No	Reproductive Hazard No	Mutagen Yes
Synergistic Effects None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
Corrosive and irritating to the eyes. Contact with the liquid or vapor causes painful burns and ulcerations. Burns to the eyes result in lesions and possible loss of vision.

SKIN EFFECTS:
Fluorine is corrosive and irritating to the skin and all living tissue. It hydrolyzes very rapidly yielding hydrofluoric acid so that skin burns are like that from exposure to acid. Toxic level exposure to dermal tissue causes hydrofluoric acid burns and skin lesions resulting in early necrosis and eventual scarring. Hydrofluoric acid burns exhibit severe pain, redness, possible swelling and early necrosis. Burns are progressive while any residual active fluoride remain.

INGESTION EFFECTS:
Ingestion is unlikely as fluorine is a gas at room temperature.

INHALATION EFFECTS:
Corrosive and irritating to the upper and lower respiratory tracts. The irritation extends to the chest causing lacrimation, cough, labored breathing, excessive salivary and sputum formation. Excessive irritation to the lungs causes acute pneumonitis and pulmonary edema, which could be fatal. Chemical pneumonitis and pulmonary edema may result from exposure to the lower respiratory tract and deep lung. Residual pulmonary malfunction might also occur.

Extended low level systemic absorption of fluorine may cause fluorosis, an abnormal calcification pattern of the skeletal system.

NFPA HAZARD CODES	**HMIS HAZARD CODES**	**RATINGS SYSTEM**
Health: 4	Health: 4	0 = No Hazard
Flammability: 0	Flammability: 0	1 = Slight Hazard
Reactivity: 2	Reactivity: 2	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

4. First Aid Measures

EYES:
PERSONS WITH POTENTIAL EXPOSURE SHOULD NOT WEAR CONTACT LENSES. Flush contaminated eyes immediately with copious quantities of water. Part eyelids to assure complete flushing. Continue for a minimum of 30 minutes. Seek immediate medical attention.

SKIN:
Remove contaminated clothing as rapidly as possible. Flush affected area with copious quantities of water. Dermal burns may be treated with a calcium gluconate gel or slurry in water or glycerine. This compound binds the active fluorides in an insoluble form and limits burn extension and relieves pain. Seek immediate medical attention.

INGESTION:
None required as ingestion is unlikely.

INHALATION:
PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious persons should be assisted to an area with fresh uncontaminated air. Unconscious victims should be moved to an area with fresh uncontaminated air. Quick removal from the contaminated area is most important. If breathing has stopped administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive. Keep victim warm and quiet. Assure that mucus or vomited material does not obstruct the airway by positional drainage. Delayed pulmonary edema may occur. Keep patient under medical supervision for at least 24 hours.

5. Fire Fighting Measures

Conditions of Flammability: Nonflammable, Oxidizer		
Flash point: None	Method: Not Applicable	Autoignition Temperature: None
LEL(%): None	UEL(%): None	
Hazardous combustion products: Hydrogen Fluoride, Oxygen Difluoride		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

FIRE AND EXPLOSION HAZARDS:
Combustion products from a fire with fluorine as an oxidizer are generally extremely toxic and reactive. The products usually include hydrogen fluoride and oxygen difluoride.

FIRE FIGHTING INSTRUCTIONS:
Fires with fluorine as the oxidizer can only be extinguished by shutting off the source of fluorine. Do not use water, carbon dioxide, or other extinguishing media; these will only add more fuel to the fire.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Most metals form a passive fluoride film with low pressure fluorine that protects the metals from further corrosion. The reaction with metals and fluorine is relatively slow at room temperature, but becomes vigorous and self-sustaining if the temperature is elevated. Monel ® and nickel are preferred for higher temperature applications. Teflon ® is the preferred gasket material.

Keep equipment scrupulously dry. Many of the metal fluorides are water soluble so that the passive film corrosion protection may be destroyed if wetted with water.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve protection outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<500 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full & empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time.

Process valves should be opened and closed with remote controlled extensions passing through a suitable barricade for additional protection. Double valving should be employed to facilitate the reduction in pressure from high pressure sources of fluorine.

For additional storage and handling recommendations, consult Compressed Gas Association Pamphlet P-1.

Never store the compressed gas or liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Fluorine FORMULA: F_2 CAS: 7782-41-4 RTECS #: LM6475000	> 98.0	0.1 ppm TWA	1 ppm TWA 2 ppm TWA	LC_{50} 185 ppm/1H (rat)

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

IDLH: 25 ppm

ENGINEERING CONTROLS:
Hood with forced ventilation. Use local exhaust ventilation to prevent accumulation above the exposure limit. Mechanical (Gen.): In accordance with electrical codes.

EYE/FACE PROTECTION:
Gas-tight safety goggles and face shield or full-face respirator.

SKIN PROTECTION:
Plastics or rubber gloves.

RESPIRATORY PROTECTION:
Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION
Safety shoes, safety shower, eyewash "fountain", neoprene apron.

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: Gas, above crit. temp	psia
Vapor density at STP (Air = 1)	: 1.31	
Evaporation point	: Not Available	
Boiling point	: -306.6	° F
	: -188.1	° C
Freezing point	: -363.5	° F
	: -219.7	° C
pH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H20)	: Reacts violently	
Odor threshold	: Not Available	
Odor and appearance	: Pale yellow gas with choking ozone-like odor.	

10. Stability and Reactivity

STABILITY:
Stable.

INCOMPATIBLE MATERIALS:
Fluorine is the most powerful oxidizer known. It reacts with virtually all inorganic and organic substances, except some inert gases, perfluorinated hydrocarbons and some metals which have been "passivated".

HAZARDOUS DECOMPOSITION PRODUCTS:
Hydrofluoric acid and oxygen difluoride.

HAZARDOUS POLYMERIZATION:
Will not occur.

11. Toxicological Information

Extended low level systemic absorption of fluorine may cause fluorosis, an abnormal calcification pattern of the skeletal system.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	India	
PROPER SHIPPING NAME:	Fluorine, Compressed	
HAZARD CLASS:	2.3	
IDENTIFICATION NUMBER:	UN 1045	
SHIPPING LABEL:	POISON GAS, OXIDIZER	

Additional Marking Requirement: "Inhalation Hazard"
Additional Shipping Paper Description Requirement: "Poison-Inhalation Hazard, Zone A"

15. Regulatory Information

Fluorine is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 1,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION
The presence of fluorine in quantities in excess of the threshold planning quantity (TPQ) of 500 pounds requires certain emergency planning activities to be conducted.

Releases of fluorine in quantities equal to or greater than the reportable quantity (RQ) of 10 pounds are subject to reporting to the National Response Center under CERCLA, Section 304 SARA Title III.

SARA TITLE III - HAZARD CLASSES:
Acute Health Hazard
Chronic Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard
Reactivity Hazard

SARA TITLE III - SECTION 313 SUPPLIER NOTIFICATION:
This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

CAS NUMBER	INGREDIENT NAME	PERCENT BY VOLUME
7782-41-4	Fluorine	> 98.0

This information must be included on all MSDSs that are copied and distributed for this material.

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).