



>3.7% FLUORINE In ARGON, HELIUM, KRYPTON, NEON, NITROGEN or XENON

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name >3.7% FLUORINE In ARGON, HELIUM, KRYPTON, NEON, NITROGEN or XENON
Product Code(s) 1206
UN-Number UN3306
Recommended Use Excimer laser gas. Industrial use. Electronics.

Supplier Address*
Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC
575 Mountain Ave.
Murray Hill, NJ 07974
Phone: 908-464-8100
www.lindeus.com

Linde Gas Puerto Rico, Inc.
Las Palmas Village
Road No. 869, Street No. 7
Catano, Puerto Rico 00962
Phone: 787-641-7445
www.pr.lindegas.com

Linde Canada Limited
5860 Chedworth Way
Mississauga, Ontario L5R 0A2
Phone: 905-501-1700
www.lindecana.com

* May include subsidiaries or affiliate companies/divisions.

For additional product information contact your local customer service.

Chemical Emergency Phone Number Chemtrec: 1-800-424-9300 for US/ 703-527-3887 outside US

2. HAZARDS IDENTIFICATION

DANGER!		
Emergency Overview		
Fatal if inhaled. The product causes burns of eyes, skin and mucous membranes. Oxidizer Accelerates combustion and increases risk of fire. Contents under pressure Keep at temperatures below 52°C / 125°F		
Appearance Colorless.	Physical State Compressed gas.	Odor Pungent

OSHA Regulatory Status This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Potential Health Effects

Principle Routes of Exposure Eye contact. Skin contact. Inhalation.

Acute Toxicity

Inhalation Fatal if inhaled. Inhalation of corrosive fumes/gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate. Delayed pulmonary edema may occur. Pungent odor of fluorine provides warning of release.

Eyes Corrosive to the eyes and may cause severe damage including blindness. May cause redness and tearing.

Skin Causes burns. Hydrolyzes very rapidly yielding hydrofluoric acid. Toxic level exposure to dermal tissue causes hydrofluoric acid burns and skin lesions resulting in early necrosis and eventual scarring. Symptoms may be delayed.

Skin Absorption Hazard No known hazard by skin absorption.

Ingestion Not an expected route of exposure. Ingestion causes burns of the upper digestive and respiratory tract.

Chronic Effects Extended low level systemic absorption of fluorides may cause fluorosis, an abnormal calcification patten of the skeletal system. Emphysema.

Aggravated Medical Conditions Skin disorders. Pre-existing eye disorders. Respiratory disorders.

Environmental Hazard See Section 12 for additional Ecological Information.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Volume %	Chemical Formula
Krypton	7439-90-9	0-99	Kr
Neon	7440-01-9	0-99	Ne
Argon	7440-37-1	0-99	Ar
Helium	7440-59-7	0-99	He
Xenon	7440-63-3	0-99	Xe
Nitrogen	7727-37-9	0-99	N ₂
Fluorine	7782-41-4	3.7-99	F ₂

Additional information: Composition listed covers broad ranges rather than exact percentages for specific products.

4. FIRST AID MEASURES

General Advice	Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.
Eye Contact	Immediate medical attention is required. In case of contact with substance, immediately flush eyes with running water for at least 30 minutes. Keep eye wide open while rinsing.
Skin Contact	Immediate medical attention is required. Wash off immediately with soap and plenty of water for at least 30 minutes while removing all contaminated clothing and shoes. Dermal burns may be treated with calcium gluconate gel or slurry in water or glycerine. This compound binds the active fluorides in an insoluble form and limits burn extension and pain.
Inhalation	PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF INHALATION OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious inhalation victims should be assisted to an uncontaminated area and inhale fresh air. If breathing is difficult, administer oxygen. Unconscious persons should be moved to an uncontaminated area and, as necessary, given artificial resuscitation and supplemental oxygen. Treatment should be symptomatic and supportive.
Ingestion	Not an expected route of exposure. Immediate medical attention is required. Do NOT induce vomiting. Drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician or Poison Control Center immediately.
Notes to Physician	For dermal exposure, the use of 2.5-33% calcium gluconate or carbonate gel or slurry has been recommended. The gel is either placed into a surgical glove into which the affected extremity is then placed or applied directly on the burn. This compound binds with the active fluorides in an insoluble form and limits burn extension and pain. Calcium chloride should not be used. Delayed pulmonary edema may occur.
Protection of First-aiders	Use personal protective equipment. Avoid contact with skin, eyes and clothing.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Oxidizer. May vigorously accelerate combustion.
Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Hazardous Combustion Products	Hydrogen fluoride. Oxygen difluoride
Explosion Data	
Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	None

Specific Hazards Arising from the Chemical	Will support and accelerate combustion of combustible materials (wood, paper, oil, debris, etc). Continue to cool fire exposed cylinders until flames are extinguished. Cylinders may rupture under extreme heat. Damaged cylinders should be handled only by specialists.
Protective Equipment and Precautions for Firefighters	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.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Monitor oxygen level. Use personal protective equipment. Avoid contact with skin, eyes and clothing.
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.
Methods for Cleaning Up	Return cylinder to Linde or an authorized distributor.
Other Information	Refer to protective measures listed in Sections 7 and 8.

7. HANDLING AND STORAGE

Handling	<p>If using for high temperature application, consider the following: 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 high temperature applications. Teflon® is the preferred gasket material.</p> <p>Handle only in areas with extensive venting capabilities, preferably a gas handling cabinet. Consider installation of fluorine gas detection equipment in handling areas. Any detection of fluorine odor should trigger immediate response and corrective action.</p> <p>Mixtures of greater than 35% fluorine in inert gas should be handled in systems designed for 100% fluorine. Process valves should be opened and closed with remote controlled extensions passing through a suitable barricade for additional protection.</p> <p>Gas handling equipment must be cleaned for oxygen service if not better. Equipment must be dry, purged with dry nitrogen or other inert gas and meticulously leak checked before connecting cylinder to system. Open valve slowly. Prior to disconnecting cylinder from system, manifold and pigtails must be purged with inert gas. If handling fluorine mixes greater than 5%, it is recommended that equipment be passivated by exposing it to <3% fluorine at 100 psig for several hours.</p>
----------	---

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 ventilated areas. Never attempt to lift a cylinder by its valve protection cap. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Use equipment rated for cylinder pressure. Use backflow preventive device in piping. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. "NO SMOKING" signs should be posted in storage and use areas.

Use an adjustable strap wrench to remove over-tight or rusted caps. Close valve after each use and when empty. Never attempt to refill a compressed gas cylinder without the owner's written consent. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier.

Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.

Storage

Oxidizers must be separated from flammables by at least 20 feet (or fire wall). Protect from physical damage. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers. Outside or detached storage is preferred.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Fluorine 7782-41-4	STEL: 2 ppm TWA: 1 ppm	TWA: 0.1 ppm TWA: 0.2 mg/m ³ (vacated) TWA: 0.1 ppm (vacated) TWA: 0.2 mg/m ³	IDLH: 25 ppm TWA: 0.1 ppm TWA: 0.2 mg/m ³

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health.

Other Exposure Guidelines Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

Engineering Measures Showers. Eyewash stations. Ventilation systems. Exhaust gas should be vented to a gas treatment system.

Ventilation Use ventilation adequate to keep exposures below recommended exposure limits.

Personal Protective Equipment

Eye/Face Protection Tightly fitting safety goggles. Face-shield.

Skin and Body Protection Appropriate protective and chemical resistant gloves, clothing and splash protection, or fully encapsulating vapor protective clothing to prevent exposure. For materials of construction consult protective clothing manufacturer's specifications. (Teflon® is generally effective for exposures longer than 4 hours).

Respiratory Protection

General Use	If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
Emergency Use	Use positive pressure air line respirator or self-contained breathing apparatus for exposure over exposure limits or emergency use. For exposures above IDLH, an additional escape bottle is required.
Hygiene Measures	Avoid contact with skin, eyes and clothing. Remove and wash contaminated clothing before re-use. Contaminated work clothing should not be allowed out of the workplace. When using, do not eat, drink or smoke. Keep away from food, drink and animal feeding stuffs. Provide regular cleaning of equipment, work area and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Product Information

Appearance	Colorless.	Odor	Pungent.
Odor Threshold	0.02 - 0.126 ppm (Fluorine)	Physical State	Compressed gas
Flash Point	No information available.	Autoignition Temperature	No information available.
Flammability Limits in Air			
Upper	Not applicable		
Lower	Not applicable		

The following information is for the NON-INERT components of this mixture:

Chemical Name	Boiling Point	Melting Point	Molecular Weight	Evaporation Rate	Water Solubility	Vapor Pressure	Vapor Density (Air=1)	Gas Density Kg/m ³ @20°C
Fluorine	-188.2°C (-306.8°F)	-219.7°C (-363.4°F)	37.99	-	No information available	Above critical temperature	1.312	1.57

The following information is for the INERT components that may be part of this mixture:

Chemical Name	Boiling Point	Melting Point	Molecular Weight	Evaporation Rate	Water Solubility	Vapor Pressure	Vapor Density (Air=1)	Gas Density Kg/m ³ @20°C
Xenon	-108.2 °C	-111 °C	131.29	-	0.108 (vol/vol @ 20°C and 1 atm)	Above critical temperature	4.55	5.472
Argon	-185.9 °C	-189.4 °C	39.94	-	0.056 (vol/vol @ 0°C and 1 atm)	Above critical temperature	1.38	1.65
Helium	-268.94 °C	-272.0 °C	4.00	-	0.0089 (vol/vol @ 20°C and 1 atm)	Above critical temperature	0.138	0.166
Krypton	-153.4 °C	-157 °C	83.79	-	0.0594 (vol/vol @ 20°C and 1 atm)	Above critical temperature	2.89	3.479
Neon	-246.1 °C	-248.6 °C	20.17	-	0.014 (vol/vol @ 0°C and 1 atm)	Above critical temperature	0.694	0.922
Nitrogen	-196 °C	-210 °C	28.01	-	0.023 (vol/vol @ 20°C and 1 atm)	Above critical temperature	0.97	1.165

10. STABILITY AND REACTIVITY

Stability	Strong oxidizer. Contact with other material may cause fire.
Incompatible Products	Fluorine is the most powerful oxidizer known. It reacts with virtually all organic and inorganic substances, except some inert gases, perfluorinated hydrocarbons and some metals which have been "passivated". Combustible materials.

Conditions to Avoid Reacts with water to form hydrogen fluoride and oxygen. Heat, flames and sparks.

Hazardous Decomposition Products Hydrogen fluoride. Oxygen difluoride.

Hazardous Polymerization Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information

LD50 Oral: No information available.

LD50 Dermal: No information available.

LC50 Inhalation: No information available.

Inhalation Mice exposed to sublethal concentrations (LC50: 150 ppm/1 hr.) of fluorine experienced pulmonary irritation and delayed focal necrosis of the liver and kidney.

Repeated Dose Toxicity No information available.

Component Information

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Fluorine			= 185 ppm (Rat) 1 h

Chronic Toxicity

Chronic Toxicity Extended low level systemic absorption of fluorides may cause fluorosis, an abnormal calcification patten of the skeletal system. Emphysema.

Carcinogenicity Contains no ingredient listed as a carcinogen.

Irritation No information available.

Sensitization No information available.

Reproductive Toxicity No information available.

Developmental Toxicity No information available.

Synergistic Materials None known.

Target Organ Effects Eyes. Kidney. Liver. Respiratory system. Skin.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Harmful to aquatic organisms.

Ozone depletion potential; ODP; (R-11 = 1): Does not contain ozone depleting chemical (40 CFR Part 82).

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods	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 Linde for proper disposal.
Contaminated Packaging	Do not re-use empty containers.

14. TRANSPORT INFORMATION

DOT

Proper shipping name	Compressed gas, toxic, oxidizing, corrosive, n.o.s.
Hazard Class	2.3
Subsidiary Class	5.1, 8
UN-Number	UN3306
Packing Group	None
Description	UN3306, Compressed gas, toxic, oxidizing, corrosive, n.o.s. (Fluorine), 2.3, (5.1, 8)
Additional Description:	Shipments of mixtures of fluorine 3.7 to less than 6.7% must be described as Toxic-Inhalation Hazard Zone D; 6.7 to less than 18.5% as Toxic-Inhalation Hazard Zone C; 18.5 to less than 92.5% as Toxic-Inhalation Hazard Zone B; 92.5 to 99% as Toxic-Inhalation Zone A. If net weight of product is greater than or equal to 10 lbs., the shipping description must also contain the letters "RQ".
Additional Marking Requirements:	"Inhalation Hazard". If net weight of product is greater than or equal to 10 lbs., the container must also be marked with the letters "RQ".
Emergency Response Guide Number	124

TDG

Proper Shipping Name	Compressed gas, toxic, oxidizing, corrosive, n.o.s.
Hazard Class	2.3
Subsidiary Class	(5.1), (8)
UN-Number	UN3306
Description	UN3306, COMPRESSED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S. (Fluorine), 2.3(5.1), (8)

MEX

Proper Shipping Name	Compressed gas, toxic, oxidizing, corrosive, n.o.s.
Hazard Class	2.3
Subsidiary Class	5.1, 8
UN-Number	UN3306
Description	UN3306 Compressed gas, toxic, oxidizing, corrosive, n.o.s. (Fluorine), 2.3

IATA

UN-Number	UN3306
Proper Shipping Name	Compressed gas, toxic, oxidizing, corrosive, n.o.s.
Hazard Class	2.3
Subsidiary Class	5.1, 8

ERG Code 2CX
 Description UN3306, Compressed gas, toxic, oxidizing, corrosive, n.o.s.(Fluorine), 2.3(5.1, 8)
 Maximum Quantity for Passenger Forbidden
 Maximum Quantity for Cargo Only Forbidden
 Limited Quantity No information available.

IMDG/IMO

Proper Shipping Name Compressed gas, toxic, oxidizing, corrosive, n.o.s.
 Hazard Class 2.3
 Subsidiary Class 5.1, 8
 UN-Number UN3306
 EmS No. F-C, S-W
 Description UN3306, Compressed gas, toxic, oxidizing, corrosive, n.o.s.(Fluorine), 2.3(5.1, 8)

ADR

Proper Shipping Name Compressed gas, toxic, oxidizing, corrosive, n.o.s.
 Hazard Class 2.3
 UN-Number UN3306
 Classification Code 1TOC
 Description UN3306 Compressed gas, toxic, oxidizing, corrosive, n.o.s.(Fluorine), 2.3, 5.1, 8
 ADR/RID-Labels

15. REGULATORY INFORMATION

International Inventories

TSCA Complies
 DSL Complies
 EINECS/ELINCS Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
 DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
 EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372:

Chemical Name	CAS-No	SARA 313 - Threshold Values %
Fluorine	7782-41-4	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard Yes
 Chronic Health Hazard Yes
 Fire Hazard Yes
 Sudden Release of Pressure Hazard Yes
 Reactive Hazard No

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

Risk and Process Safety Management Programs

This material, as supplied, contains one or more regulated substances with specified thresholds under 40 CFR Part 68 or regulated as a highly hazardous chemical pursuant to the 29 CFR Part 1910.110 with specified thresholds:

Chemical Name	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Toxic Substances	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Flammable Substances	U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals
Fluorine	1000 lbs		1000 lb

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPS) (see 40 CFR 61)

This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments of 1990.

CERCLA/SARA

This material, as supplied, contains one or more substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355):

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	TPQ
Fluorine	10 lb	10 lb	500 lb TPQ

U.S. State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Xenon	-	X	-	-	-
Argon	X	X	X	-	X
Helium	X	X	X	-	X
Neon	X	X	X	-	X
Nitrogen	X	X	X	-	X
Fluorine	X	X	X	X	X

International Regulations

Chemical Name	Carcinogen Status	Exposure Limits
Fluorine		Mexico: TWA 1 ppm Mexico: TWA 2 mg/m ³ Mexico: STEL 2 ppm Mexico: STEL 4 mg/m ³

Canada

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

WHMIS Hazard Class
A Compressed gases
E Corrosive material
C Oxidizing materials
D1A Very toxic materials



Chemical Name	NPRI
Fluorine	X

Legend

NPRI - National Pollutant Release Inventory

16. OTHER INFORMATION

Prepared By Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501

Issuing Date 09-Jul-2010

Revision Date 16-Feb-2012

Revision Number 5

Revision Note (M)SDS sections updated. 7.

<u>NFPA</u>	Health Hazard 3	Flammability 0	Stability 2	Physical and Chemical Hazards OX
<u>HMIS</u>	Health Hazard 3	Flammability 0	Physical Hazard 4	Personal Protection -

Note: Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.

General Disclaimer

For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between Linde LLC, Linde Merchant Production, Inc. or Linde Gas North America LLC (or any of their affiliates and subsidiaries) and the purchaser.

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).

End of Safety Data Sheet