



XENON DIFLUORIDE

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	XENON DIFLUORIDE
Product Code(s)	G-86, 1049
UN-Number	UN3085
Recommended Use	Etchant.
Synonyms	Xenon (II) Fluoride; Difluoroxenon
Supplier Address*	<p>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</p> <p>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</p> <p>Linde Canada Limited 5860 Chedworth Way Mississauga, Ontario L5R 0A2 Phone: 905-501-1700 www.lindecanda.com</p>

* 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		
Corrosive Oxidizer		
The product causes burns of eyes, skin and mucous membranes Accelerates combustion and increases risk of fire.		
Appearance White	Physical State Solid.	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. Ingestion.
Acute Toxicity	
Inhalation	Corrosive to respiratory system. Chemical pneumonitis and pulmonary edema result from exposure to the lower respiratory tract and deep lung. Residual pulmonary malfunction might occur.
Eyes	Corrosive to the eyes and may cause severe damage including blindness.
Skin	Contact causes severe skin irritation and possible burns. Symptoms may be delayed.
Skin Absorption Hazard	No known hazard by skin absorption.
Ingestion	Ingestion causes burns of the upper digestive and respiratory tract.
Chronic Effects	
Extended Exposure	Low level systemic absorption of fluorides may cause fluorosis, an abnormal calcification pattern of the skeletal system
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
Xenon fluoride (XeF ₂)	13709-36-9	>99	XeF ₂

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.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Call a physician immediately.
Ingestion	Immediate medical attention is required. Do not induce vomiting without medical advice. 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.
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.
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Suitable Extinguishing Media	Use: Only Water.
Unsuitable Extinguishing Media	Do not use dry chemical, carbon dioxide, or halogenated extinguishing agents.
Hazardous Combustion Products	Decomposes into Xenon and Fluorine gas at temperatures >500°C.
<u>Explosion Data</u>	
Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	None
Specific Hazards Arising from the Chemical	This is a strong oxidizer and will react vigorously or explosively with many materials including fuels.
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. Additional chemical protective clothing may be required to protect from toxic decomposition products. Large Fires, flood with water. Apply water from protected location or from a safe distance.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Ensure adequate ventilation. Evacuate personnel to safe areas. Use personal protective equipment.
Environmental Precautions	Do not flush into surface water or sanitary sewer system. Should not be released into the environment.
Methods for Containment	Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry.
Methods for Cleaning Up	Avoid dust formation. Take up mechanically and collect in suitable container for disposal.
Other Information	Refer to protective measures listed in Sections 7 and 8.

7. HANDLING AND STORAGE

Handling	<p>This product is shipped in either PTFE bottles or steel cylinders. Glass materials are not recommended as storage medium. Use under vacuum transfer. Use only in ventilated areas.</p> <p>Packaging to contain Xenon difluoride should be dry and free of hydrocarbons. Fluorine passivation may also be indicated.</p> <p>Handle in accordance with good industrial hygiene and safety practice.</p>
Storage	Protect from physical damage. Separate from water, combustibles and flammable materials. For further information on storage, handling, and use, see NFPA 430, Code for the Storage of Liquid and Solid Oxidizing Materials.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Xenon fluoride (XeF ₂) 13709-36-9	TWA: 2.5 mg/m ³ F	TWA: 2.5 mg/m ³ F	TWA: 2.5 mg/m ³ F

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.
Ventilation	Use under vacuum transfer.
<u>Personal Protective Equipment</u>	
Eye/Face Protection	Tightly fitting safety goggles. Face-shield.
Skin and Body Protection	Impervious gloves.
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. Emergency eye wash stations and drench showers should be in work area.
Hygiene Measures	Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing before re-use. Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. Regular cleaning of equipment, work area and clothing is recommended.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	White.	Odor	Pungent.
Odor Threshold	No information available	Physical State	Solid
Flash Point	No information available.	Autoignition Temperature	No information available.
Decomposition Temperature	No information available.	Boiling Point/Boiling Range	114 °C / 237.2 °F
Freezing Point	60 °C / 140 °F	Molecular Weight	169.3
Water Solubility	25 g/L @ 0 °C	Evaporation Rate	No information available
Vapor Pressure	0.073 PSIA @ 77°F	Vapor Density	No data available.
VOC Content (%)	Not applicable.	Flammability Limits in Air	
		Upper	Not applicable
		Lower	Not applicable

Note: Density: 4.32 kg/l

10. STABILITY AND REACTIVITY

Stability	Stable - Will react with water or moisture in air to yield HF.
Incompatible Products	Water. Moisture. Combustible materials. Strong reducing agents.
Conditions to Avoid	Heat, flames and sparks. Rapidly reacts with water or water vapor to form hydrofluoric acid which reacts with most metals and organic materials resulting in evolution of heat and hydrogen gas.
Hazardous Decomposition Products	Hydrogen fluoride.

Hazardous Polymerization Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

LD50 Oral:
90 mg/kg (mouse)

LD50 Dermal: No information available.

LC50 Inhalation: 445 mg/m³; (mouse); (2 hr.)

Repeated Dose Toxicity No information available.

Chronic Toxicity

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

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
Xenon fluoride (XeF ₂)		Group 3		

IARC: (International Agency for Research on Cancer)

Group 3: Not Classifiable as to its Carcinogenicity to Humans

Irritation Corrosive to eyes Corrosive to skin

Sensitization No information available.

Reproductive Toxicity No information available.

Developmental Toxicity No information available.

Synergistic Materials None known.

Target Organ Effects Eyes. Skin. Respiratory system.

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

Contaminated Packaging

Do not re-use empty containers. Return container to Linde or an authorized distributor.

14. TRANSPORT INFORMATION

DOT

Proper shipping name	Oxidizing solid, corrosive, n.o.s.*
Hazard Class	5.1
Subsidiary Class	8
UN-Number	UN3085
Packing Group	II
Description	UN3085, Oxidizing solid, corrosive, n.o.s.,(Xenon Difluoride), 5.1 (8), II
Emergency Response Guide Number	140

TDG

Proper Shipping Name	Oxidizing solid, corrosive, n.o.s.*
Hazard Class	5.1
Subsidiary Class	8
UN-Number	UN3085
Packing Group	II
Description	UN3085, Oxidizing solid, corrosive, n.o.s.,(Xenon Difluoride),5.1 (8), II

MEX

Not regulated

Proper Shipping Name	Oxidizing solid, corrosive, n.o.s.*
Hazard Class	5.1
Subsidiary Class	8
UN-Number	UN3085
Description	UN3085, Oxidizing solid, corrosive, n.o.s.,(Xenon Difluoride), 5.1 (8), II
Packing Group	II

IATA

UN-Number	UN3085
Proper Shipping Name	Oxidizing solid, corrosive, n.o.s.*
Hazard Class	5.1
Subsidiary Class	8
Packing Group	II
ERG Code	5C
Description	UN3085, Oxidizing solid, corrosive, n.o.s.,(Xenon Difluoride), 5.1 (8), II
Maximum Quantity for Passenger	5 kg
Maximum Quantity for Cargo Only	25 kg
Limited Quantity	2.5 kg

IMDG/IMO

Proper Shipping Name	Oxidizing solid, corrosive, n.o.s.*
Hazard Class	5.1
Subsidiary Class	8
UN-Number	UN3085
Packing Group	II
EmS No.	F-A, S-Q
Description	UN3085, Oxidizing solid, corrosive, n.o.s., (Xenon Difluoride), 5.1 (8), II

ADR

Proper Shipping Name	Oxidizing solid, corrosive, n.o.s.*
Hazard Class	5.1
UN-Number	UN3085
Packing Group	II
Classification Code	OC2
Description	UN3085, Oxidizing solid, corrosive, n.o.s., (Xenon Difluoride), 5.1 (8), II, (E)
ADR/RID-Labels	5.1 + 8

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Does not Comply
NDSL	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 does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

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

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, does not contain any regulated substances with specified thresholds under 40 CFR Part 68.
This product does not contain any substances regulated as Highly Hazardous Chemicals pursuant to the 29 CFR Part 1910.110.

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, does not contain any 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). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State RegulationsCalifornia 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 fluoride (XeF ₂)					X

International Regulations

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

C Oxidizing materials

E Corrosive material

F Dangerously reactive material



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<u>NFPA</u>	Health Hazard 3	Flammability 0	Stability 2	Physical and Chemical Hazards OX W
<u>HMIS</u>	Health Hazard 3*	Flammability 0	Physical Hazard 2	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.

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End of Safety Data Sheet