



MATERIAL SAFETY DATA SHEET

PRODUCT NAME: NITROGEN TRIFLUORIDE

1. Chemical Product and Company Identification

**BOC Gases,
Division of
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974**

**BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6**

**TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE
NUMBER: CHEMTREC (800) 424-9300**

**TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE
NUMBER: (905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101**

**PRODUCT NAME: NITROGEN TRIFLUORIDE
CHEMICAL NAME: Nitrogen Trifluoride
COMMON NAMES/SYNONYMS: Nitrogen Fluoride (NF₃)
TDG (Canada) CLASSIFICATION: 2.3 (5.1)
WHMIS CLASSIFICATION: A, D1A, C, D2B**

**PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/1/99**

2. Composition, Information on Ingredients

EXPOSURE LIMITS¹:

INGREDIENT	% VOLUME	PEL-OSHA²	TLV-ACGIH³	LD₅₀ or LC₅₀ Route/Species
Nitrogen Trifluoride FORMULA: NF ₃ CAS: 7783-54-2 RTECS #: QX1925000	> 97	10 ppm TWA	10 ppm TWA	LC ₅₀ 6700 ppm inhalation/rat (1H)

¹ Refer to individual state or 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 1998-1999 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

3. Hazards Identification

EMERGENCY OVERVIEW

Colorless gas which may have musty odor. Nonflammable. Oxidizer. Contact with reducing agents may cause severe fire or explosion. Chemical Asphyxiant. When inhaled, this substance reduces the ability of the blood to carry oxygen. Effects due to reduced oxygen carrying capacity include headache, weakness, dizziness, and mental confusion. Contents under pressure. Use and store below 125 °F.

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ROUTE OF ENTRY:

Skin Contact No	Skin Absorption No	Eye Contact No	Inhalation Yes	Ingestion No
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HEALTH EFFECTS:

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

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

EYE EFFECTS:

Minor irritation at high concentrations. Toxic effects from inhalation will occur before eye effects.

SKIN EFFECTS:

No hazard from skin contact has been recognized.

INGESTION EFFECTS:

None known. Ingestion is unlikely.

INHALATION EFFECTS:

Odor will not provide sufficient warning of exposure. Potentially dangerous amounts may be inhaled before odor is detected. Inhalation causes breathing difficulties, chest pains, and nausea. Reacts with hemoglobin in the blood to form a hemoglobin complex, similar to carbon monoxide. The altered hemoglobin cannot take part in oxygen transport. Suffocation from exposure to this product can occur in the presence of sufficient oxygen to support respiration.

Effects of oxygen deficiency may include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgement, depression of all sensations, emotional instability, fatigue, nausea, vomiting, prostration, loss of consciousness, and death.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

Repeated exposure may adversely affect the liver and kidneys. Long-term exposure to fluorides can adversely affect the bones (including the teeth).

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known. Individuals with pre-existing conditions of the blood may be more susceptible to exposure.

NFPA HAZARD CODES

Health: 1
Flammability: 0
Instability: 0
OXIDIZER

HMIS HAZARD CODES

Health: 1
Flammability: 0
Reactivity: 0

RATINGS SYSTEM

0 = No Hazard
1 = Slight Hazard
2 = Moderate Hazard
3 = Serious Hazard
4 = Severe Hazard

4. First Aid Measures

EYES:

None normally required.

SKIN:

None normally required.

INGESTION:

None normally required.

INHALATION:

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. An individual exposed to nitrogen trifluoride should be removed from the contaminated area as quickly as possible. If there is evidence of chemical cyanosis, administer oxygen. Headache or other symptoms may also be alleviated by oxygen. Seek medical assistance promptly.

NOTE TO PHYSICIAN: Human data on nitrogen trifluoride are limited. Methemoglobin production and hemolysis are non-specific effects which require monitoring and appropriate supportive measures. Close observation for pulmonary and renal impairment is indicated.

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: Fluoride compounds		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

FIRE AND EXPLOSION HAZARDS:

Non-flammable gas but will support combustion. May form flammable or explosive mixtures with gaseous fuels. Above 1830 °F (1000 °C) it should ignite most materials on contact. Cylinder may rupture violently from pressure when involved in a fire situation.

EXTINGUISHING MEDIA:

Use any extinguishing media which is suitable for the surrounding fire.

FIRE FIGHTING INSTRUCTIONS:

Fires supported by nitrogen fluoride as the oxidizer generate toxic fluoride compounds. Stop the flow of gas supporting/accelerating fire. Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear with additional chemical protective clothing as necessary to protect against toxic decomposition products. Continue to cool fire-exposed cylinders until well after flames are extinguished.

6. Accidental Release Measures

Extinguish all ignition sources and evacuate all personnel from affected area. A leak near reducing agents, flammables, combustibles, or other incompatible materials may represent a severe fire or explosion hazard. Use appropriate protective equipment. Do not allow unprotected individuals to enter hazard area. Consult a HAZMAT specialist, the emergency telephone number in Section 2 and your closest BOC location. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs.

7. Handling and Storage

Electrical Classification:

Nonhazardous

Most metals are satisfactory for handling nitrogen trifluoride up to temperatures of approximately 160°F (70°C). Nickel and Monel ® are recommended for higher temperatures. Wetted surfaces should be passivated with an "active" fluorine compound to establish a metal fluoride coating as additional protection. Teflon ® and Kel-F ® are the preferred gasket materials.

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 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 (<3000 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 system.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas, emergency exits, flammables, and combustibles. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "NO SMOKING OR OPEN FLAMES" signs in storage and use areas. There should be no sources of ignition in areas where this product is being used or stored.

Never carry a compressed gas cylinder or a container of a gas in cryogenic 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.

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

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS:

Hood with forced ventilation. Local Exhaust: To prevent accumulation above the exposure limit.

EYE/FACE PROTECTION:

Safety glasses or goggles.

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SKIN PROTECTION:

Protective gloves as appropriate for the job.

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.

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: Gas, above crit. temp	psia
Vapor density @ STP (Air = 1)	: 2.48	
Evaporation point	: Not Available	
Boiling point	: -200.0	°F
	: -129.0	°C
Freezing point	: -340.2	°F
	: -206.8	°C
PH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H ₂ O)	: Slightly	
Odor threshold	: Not Available	
Odor and appearance	: A colorless gas, trace quantities of impurities can impart a musty or pungent odor.	

10. Stability and Reactivity

STABILITY:

Stable below 500°F (260°C).

INCOMPATIBLE MATERIALS:

Incompatible with water, oil, grease, oxidizable materials, ammonia, carbon monoxide, methane, hydrogen, hydrogen sulfide, and diborane. Incompatible with plastics, hydrocarbons and other organic materials. Reacts explosively with reducing agents. Absorption on to activated granular charcoal at -100 °C has caused an explosion.

HAZARDOUS DECOMPOSITION PRODUCTS:

Tetrafluorohydrazine (N₂F₄) and active fluoride radicals.

HAZARDOUS POLYMERIZATION:

Will not occur.

11. Toxicological Information

INHALATION:

The toxicity of nitrogen trifluoride is related to its capacity to form methemoglobin, a modified form of hemoglobin incapable of transporting oxygen, and its ability to destroy red blood cells (hemolysis). Upon cessation of exposure, methemoglobin spontaneously reverts to hemoglobin. However, at high levels of conversion, therapeutic intervention may be indicated (oxygen, methylene blue, exchange transfusion). The occurrence of hemolysis requires careful monitoring for degree of anemia and the potential for impaired liver and kidney function.

SKIN AND EYE:

Dogs exposed to 9600 ppm for 1 hour exhibited slight eye irritation.

MUTAGENIC:

The results of the Ames Tests conducted on NF_3 are reported as negative, without metabolic activation; weakly positive, with metabolic activation. Examination of these results and those of previously conducted tests suggests that the activity shown is attributable to N_2F_2 , a recognized contaminant of NF_3 . NF_3 is currently manufactured with a minimal N_2F_2 content.

CHRONIC:

Subchronic studies in animals at 100 ppm or greater indicate that repeated exposure may affect the kidney, spleen, liver, and myocardium. Repeated exposure to fluorides may cause characteristic mottling of the teeth and degenerative bone disease.

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	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Nitrogen Trifluoride, compressed	Nitrogen Trifluoride
HAZARD CLASS:	2.2	2.3 (5.1)
IDENTIFICATION NUMBER:	UN 2451	UN 2451
SHIPPING LABEL:	NONFLAMMABLE GAS, OXIDIZER	POISON GAS, OXIDIZER

15. Regulatory Information

SARA TITLE III - HAZARD CLASSES:

Acute Health Hazard

Fire Hazard

Sudden Release of Pressure Hazard

Chronic Health Hazard

16. Other Information

ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

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:

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