Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Nitrogen trifluoride (MSDS No. P-4854-E)	**Trade Names:** Nitrogen Trifluoride
Chemical Name: Nitrogen trifluoride	**Synonyms:** Nitrogen fluoride, trifluoroamine, trifluoroammonia
Chemical Family: Inorganic halide	**Product Grades:** None assigned.

Telephone: **Emergencies:** 1-800-645-4633* **Company Name:** Praxair, Inc.
CHEMTREC: 1-800-424-9300* 39 Old Ridgebury Road
Routine: 1-800-PRAXAIR Danbury, CT 06810-5113

**Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).*

2. Hazards Identification

EMERGENCY OVERVIEW

DANGER! High-pressure, oxidizing gas.
Acts on blood causing damage to central nervous system.
May cause kidney, liver, spleen, and other organ damage.
Possibly fatal even with adequate oxygen.
Symptoms may be delayed.
May cause eye irritation, possibly severe in high concentrations.
Vigorously accelerates combustion.
Self-contained breathing apparatus must be worn by rescue workers.
Under ambient conditions, this colorless gas has a mold-like odor.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Causes breathing difficulty, eye irritation, formation of methemoglobin in the blood and cyanosis (blue discoloration) of the skin, particularly the lips, fingernails, and ears. High concentrations cause lung damage and delayed pulmonary edema. Odor and irritation cannot be used as warning signs of dangerous toxicity. Lack of oxygen can kill.

Skin Contact. No harm expected.

Swallowing. An unlikely route of exposure. This product is a gas at normal temperature and pressure.

A vertical line in the left margin indicates revised or new material.

Eye Contact. May cause conjunctival redness and pain, chemical burns, and permanent damage to vision.

Effects of Repeated (Chronic) Overexposure. Damages the heart, lungs, liver, and kidneys. Causes enlargement of the spleen and fluorosis (damage to teeth and bones).

Other Effects of Overexposure. None known.

Medical Conditions Aggravated by Overexposure. Hypoxia from methemoglobin formation may aggravate established coronary and circulatory insufficiency.

CARCINOGENICITY: Nitrogen trifluoride is not listed by NTP, OSHA, or IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: None known. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

COMPONENT	CAS NUMBER	CONCENTRATION
Nitrogen Trifluoride	7783-54-2	>99%*

**The symbol > means "greater than."*

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician. Symptoms may be delayed.

SKIN CONTACT: Wash with soap and water; if discomfort persists, seek medical attention.

SWALLOWING: A highly unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

***NOTES TO PHYSICIAN*:** *Methemoglobinemia following brief exposure is reversible on removal from exposure. Methemoglobinemia from prolonged exposure may cause Heinz body hemolytic reaction and anemia. Methylene blue injection, U.S.P., administered intravenously (1-2 mg/kg) is therapeutic for methemoglobinemia.*

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Oxidizing agent. May accelerate combustion.

SUITABLE EXTINGUISHING MEDIA: Use media appropriate for surrounding fire.

PRODUCTS OF COMBUSTION: Not applicable. See section 10 for effects of decomposition.

PROTECTION OF FIREFIGHTERS: DANGER! High-pressure, oxidizing gas. Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Immediately cool cylinders with water spray from maximum distance; then move them away from fire if without risk. If cylinders are leaking,

reduce toxic vapors with water spray or fog. Shut off leak if without risk. Reverse flow into cylinder may cause rupture. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Heat of fire can build pressure in cylinder and cause it to rupture. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). Nitrogen trifluoride cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.)

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

DANGER! High-pressure, oxidizing gas.

Personal Precautions. Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Reduce vapors with fog or fine water spray. Reverse flow into cylinder may cause rupture. Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING: Do not breathe gas. Avoid contact with eyes, skin, and clothing. ***Gas may ignite if released abruptly at high pressure.*** Have safety showers and eyewash fountains immediately available. Store and use with adequate ventilation at all times. Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using nitrogen trifluoride, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation, away from oil, grease, and other combustibles. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

RECOMMENDED PUBLICATIONS: For further information on storage, handling, and use, see Praxair publication P-14-153, *Guidelines for Handling Gas Cylinders and Containers*. Obtain from your local supplier.

8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2008)
Nitrogen Trifluoride	10 ppm	10 ppm

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = 1000 ppm

ENGINEERING CONTROLS:

Local Exhaust. See SPECIAL.

Mechanical (General). Inadequate. See SPECIAL.

Special. Use in a closed system. A corrosion-resistant, canopy-type forced-draft fume hood is preferred.

Other. None

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear work gloves for cylinder handling.

Eye/Face Protection. Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or wherever contact with product is possible. Select in accordance with OSHA 29 CFR 1910.133. Metatarsal shoes for cylinder handling; protective clothing where needed. Select per OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

Respiratory Protection. A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas			
ODOR:	Mold-like			
ODOR THRESHOLD:	Not available.			
PHYSICAL STATE:	Gas at normal temperature and pressure			
pH:	Not applicable.			
MELTING POINT at 1 atm**:**	-340.22°F (-206.79°C)			
BOILING POINT at 1 atm**:**	-200.31°F (-129.06°C)			
FLASH POINT (test method)**:**	Not available.			
EVAPORATION RATE (Butyl Acetate = 1)**:**	Not available.			
FLAMMABILITY:	Nonflammable			
FLAMMABLE LIMITS IN AIR, % by volume**:**	**LOWER:**	Not applicable.	**UPPER:**	Not applicable.
VAPOR PRESSURE at 68°F (20°C)**:**	Not available.			

VAPOR DENSITY at 70°F (21.1°C) and 1 atm**:**	0.1836 lb/ft^3 (2.941 kg/m^3)
SPECIFIC GRAVITY (H_2O = 1) at 19.4°F (-7°C)**:**	Not available.
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm**:**	2.46
SOLUBILITY IN WATER 68°F (20°C)**:**	Slight
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	Not applicable.
DECOMPOSITION TEMPERATURE:	Not available.
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	71.0
MOLECULAR FORMULA:	NF_3

10. Stability and Reactivity

CHEMICAL STABILITY: ☐ Unstable ☒ Stable

CONDITIONS TO AVOID: High temperatures, incompatible materials

INCOMPATIBLE MATERIALS: Ammonia, carbon monoxide, diborane, hydrogen, hydrogen sulfide, methane, tetrafluorohydrazine, natural rubber, oil, grease, flammable materials, and reducing agents

HAZARDOUS DECOMPOSITION PRODUCTS: On decomposition may produce fumes of fluorides. May be decomposed by an electric spark. The presence of certain metals at elevated temperatures may form tetrafluorohydrazine (N_2F_4), a material sensitive to heat and shock.

POSSIBILITY OF HAZARDOUS REACTIONS: ☒ May Occur ☐ Will Not Occur

The presence of certain metals at elevated temperatures may form tetrafluorohydrazine (N_2F_4), a material sensitive to heat and shock.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC_{50}, 1 hr, rat = 6700 ppm

STUDY RESULTS: None known.

12. Ecological Information

ECOTOXICITY: No known effects.

OTHER ADVERSE EFFECTS: Nitrogen trifluoride does not contain any Class I or Class II ozone-depleting chemicals.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Nitrogen trifluoride

HAZARD CLASS:	2.2	**PACKING GROUP/Zone:**	NA/NA*	**IDENTIFICATION NUMBER:**	UN2451
PRODUCT RQ:	None				

SHIPPING LABEL(s): NONFLAMMABLE GAS, OXIDIZER

PLACARD (when required): NONFLAMMABLE GAS, OXIDIZER

**NA= Not applicable.*

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

MARINE POLLUTANTS: Nitrogen trifluoride is not listed as a marine pollutant by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: None
EHS RQ (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes
DELAYED: No
PRESSURE: Yes
REACTIVITY: No
FIRE: Yes

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Nitrogen trifluoride is not subject to reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Nitrogen trifluoride is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Nitrogen trifluoride is listed on the TSCA inventory.

CAUTION: This material is intended for research and development purposes only. It may not be used to produce commercial products.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Nitrogen trifluoride is listed in Appendix A as a highly hazardous chemical in quantities of 5,000 lb (2268 kg) or greater.

STATE REGULATIONS:

CALIFORNIA: Nitrogen trifluoride is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: Nitrogen trifluoride is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: ***High-pressure, oxidizing gas. Use piping and equipment adequately designed to withstand pressures to be encountered.*** Use only in a closed system constructed of corrosion-resistant materials. ***Prevent reverse flow.*** Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. ***All materials and components must be free of oil, grease, and other contaminants.*** Clean them thoroughly with a solvent and purge them dry with an inert gas prior to use. Avoid use of rapidly opening valves such as ball valves. Use a pressure-reducing regulator or separate control valve to safely discharge gas from cylinder. Shield valves that must be operated at high pressure or locate them away from personnel and operate them remotely. ***Close cylinder valve after each use; keep closed even when empty.*** Be sure to read and understand all labels and instructions supplied with all containers of this product. ***Never work on a pressurized system.*** If there is a leak, close the cylinder valve. Blow the system down in an environmentally safe manner in compliance with all federal, state, and local laws; then repair the leak. ***Follow safe practices when returning cylinder to supplier.*** Be sure valve is closed; then install valve outlet plug tightly. ***Never place a compressed gas cylinder where it may become part of an electrical circuit.***

Mixtures. When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

RECOMMENDED EQUIPMENT: In semiconductor process gas and other suitable applications, Praxair recommends the use of engineering controls such as gas cabinet enclosures, automatic gas panels (used to purge systems on cylinder changeout), excess-flow valves throughout the gas distribution system, double containment for the distribution system, and continuous gas monitors.

HAZARD RATING SYSTEMS:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH	= 1	HEALTH	= 1
FLAMMABILITY	= 0	FLAMMABILITY	= 0
INSTABILITY	= 0	PHYSICAL HAZARD	= 3
SPECIAL	= OX		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-670 is standard; CGA 330, limited standard
PIN-INDEXED YOKE:	Not applicable.
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-640

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information can be found in the following materials published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, http://www.cganet.com/Publication.asp.

G-4.1	*Cleaning Equipment for Oxygen Service*
P-1	*Safe Handling of Compressed Gases in Containers*
V-1	*Compressed Gas Cylinder Valve Inlet and Outlet Connections*
—	*Handbook of Compressed Gases, Fourth Edition*

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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