Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Boron-11 trifluoride (MSDS No. P-4820-B)	**Trade Names:** Boron-11 Trifluoride
Chemical Name: Boron-11 trifluoride	**Synonyms:** Boron-11 fluoride
Chemical Family: Inorganic halide	**Product Grades:** 1.5, 2.0, 3.0

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! Poisonous, corrosive high-pressure gas
May be fatal if inhaled.
Can cause eye, skin, and respiratory tract burns.
May cause kidney damage.
Self-contained breathing apparatus and protective clothing must be worn by rescue workers.
Under ambient conditions, this is a colorless gas with a pungent, suffocating 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. May be fatal if inhaled at high concentrations. Extremely irritating to the mucous membranes and the upper respiratory tract. May cause coughing, a choking sensation, chills, chest pain, pulmonary edema, and death.

Skin Contact. Severely irritates the skin, producing marked local redness and swelling. High concentrations may cause burns, which could result in absorption of potentially harmful amounts of material.

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

Eye Contact. Severely irritating; causes mild excess redness and swelling of the conjunctiva. High concentrations may cause corneal burns.

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Effects of Repeated (Chronic) Overexposure. Repeated overexposure may cause dryness of the nasal membranes, nosebleed, dental fluorosis (discoloration of the teeth), bronchiolitis (asthma), and pneumonitis (chemical pneumonia).

Other Effects of Overexposure. May damage the respiratory system and kidneys.

Medical Conditions Aggravated by Overexposure. Inhalation may aggravate asthma and inflammatory or fibrotic pulmonary disease.

CARCINOGENICITY: Boron-11 trifluoride is not listed by NTP, OSHA, and 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
Boron-11 trifluoride	20654-88-0	>99%*

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

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. **Warning: To avoid possible chemical burns, rescuer should avoid breathing any exhaled air from victim.** Qualified personnel should give oxygen at half-hour intervals for 3 to 4 hours. Call a physician immediately.

SKIN CONTACT: Do not breathe vapor. Immediately remove contaminated clothing and shoes, and flush skin with plenty of water for at least 15 minutes. Soak burned areas in an iced aqueous Epsom salt ($MgSO_4$) solution for at least 30 minutes. Call a physician. Wash clothing before reuse.

SWALLOWING: This product is a gas a 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: *Boron trifluoride hydrolyzes to hydrofluoric acid. There is no specific antidote; direct treatment to control of symptoms and the clinical condition of the patient. Keep victims of exposure under medical observation for 72 hours for delayed onset of pulmonary edema. For skin exposure, the affected area should be covered with 20% magnesium oxide in glycerine. The development of severe burns has been prevented by infiltrating the skin and subcutaneous tissues with 10% calcium glycolate solution, along with a local anesthetic.*

Contact the Poison Control Center in your area for additional information on patient management and follow-up.

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Nonflammable.

SUITABLE EXTINGUISHING MEDIA: Boron-11 trifluoride cannot catch fire. Use media appropriate for surrounding fire. ***Note:*** *Contact with water causes violent reaction.*

PRODUCTS OF COMBUSTION: Not applicable. See section 10 for hazardous decomposition products.

PROTECTION OF FIREFIGHTERS: DANGER! Poisonous, corrosive high-pressure 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. (See section 16.) On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Nonflammable, poisonous, corrosive gas. 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). Boron-11 trifluoride cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.) Vapors are extremely irritating and may burn skin and eyes on contact.

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! Poisonous, corrosive high-pressure 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. (See section 16.) Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area. Prevent runoff from contaminating surrounding environment. Poisonous, corrosive vapors may spread from spill. Before entering area, especially a confined area, check atmosphere with an appropriate device.

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 vapors. Do not get vapors in eyes, on skin, or on clothing. (See section 3.) Have safety showers and eyewash fountains immediately available. 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 Boron-11 trifluoride, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store away from any water and moisture in a cool, dry

area 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. Refer to section 16 for a list of other available publications.

8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2005)
Boron trifluoride	1 ppm (c)*	1 ppm (c)*

*(c) – ceiling. Ceiling values are not Time-Weighted-Average (TWA).

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 = 25 ppm

ENGINEERING CONTROLS:

Local Exhaust. Use a corrosion-resistant local exhaust ventilation system.

Mechanical (General). See Special.

Special. Use only in a closed system.

Other. See Special.

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear Neoprene gloves and metatarsal shoes for cylinder handling, and protective clothing where needed. Select per OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

Eye/Face Protection. Wear safety glasses when handling cylinders. Select per OSHA 29 CFR 1910.133.

Respiratory Protection. Use an air-supplied respirator or a full-face, positive-pressure, self-contained breathing apparatus. Respiratory protection must conform to OSHA 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas
ODOR:	Pungent, suffocating
ODOR THRESHOLD:	Not available.
PHYSICAL STATE:	Gas at normal temperature and pressure
pH:	Not applicable.
MELTING POINT at 1 atm**:**	-196.78°F (-127.1°C)
BOILING POINT at 1 atm**:**	-147.64°F (-99.8°C)
FLASH POINT (test method)**:**	Not applicable.
EVAPORATION RATE:	Not applicable.
FLAMMABILITY:	Nonflammable
FLAMMABLE LIMITS IN AIR:	**LOWER:** Not applicable. **UPPER:** Not applicable.
VAPOR PRESSURE:	Not applicable.

VAPOR DENSITY at 70°F (21.1°C) and 1 atm**:**	0.1753 lb/ft^3 (2.808 kg/m^3)
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm**:**	2.341
SOLUBILITY IN WATER:	Appreciable in cold water; reacts with hot water
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	Not applicable.
DECOMPOSITION TEMPERATURE:	Not available.
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	68 (approximate)
MOLECULAR FORMULA:	$^{11}BF_3$

10. Stability and Reactivity

CHEMICAL STABILITY: ☐ Unstable ☒ Stable

CONDITIONS TO AVOID: Exposure to water, moist air or other incompatible materials.

INCOMPATIBLE MATERIALS: Water, rubber, many plastics, organics, alkali metals, alkaline earth metals (except magnesium), calcium oxide, silver

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition may produce boron and fluorine. Reacts with water to form hydrates of Boron-11 trifluoride and other toxic fluorides.

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

Gas reacts violently with water, producing heat and toxic chemicals. Reaction with moisture in the atmosphere forms a fuming, white cloud that thickens with increased humidity.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC_{50}, 1 hr, rat = 806 ppm (time adjusted).

STUDY RESULTS: None known.

12. Ecological Information

ECOTOXICITY: No known effects.

OTHER ADVERSE EFFECTS: No adverse ecological effects expected. Boron-11 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: Boron trifluoride

HAZARD CLASS: 2.3	**PACKING GROUP/Zone:** None/B	**IDENTIFICATION NUMBER:** UN1008	**PRODUCT RQ:** None

SHIPPING LABEL(s): POISON GAS **

PLACARD (when required): POISON GAS **

**The words in the POISON GAS diamond are INHALATION HAZARD.*

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.

Additional Marking Requirement: INHALATION HAZARD

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: Boron-11 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: 500 lb (226.8 kg)
EHS RQ (40 CFR 355): 500 lb (226.8 kg)

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 **PRESSURE:** Yes
DELAYED: Yes **REACTIVITY:** No
FIRE: No

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

Boron-11 trifluoride is subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and 40CFR Part 372.

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.

Boron-11 trifluoride is listed as a regulated substance in quantities of 5,000 lb (2,268 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Boron-11 trifluoride is listed on the TSCA inventory.

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.

Boron-11 trifluoride is listed in Appendix A as a highly hazardous chemical in quantities of 250 lb (113.4 kg) or greater.

STATE REGULATIONS:

CALIFORNIA: Boron-11 trifluoride is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: Boron-11 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: ***Poisonous, corrosive high-pressure gas.*** Use piping and equipment adequately designed to withstand pressures to be encountered. Store and use with adequate ventilation at all times. ***Use only in a closed system constructed of corrosion-resistant materials and kept scrupulously dry.*** Purge system with a dry, inert gas before and after use. ***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. ***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 cap/plug tightly. ***Never place a compressed gas cylinder where it may become part of an electrical circuit.***

NOTE: *Prior to using any plastics, confirm their compatibility with Boron-11 trifluoride.*

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	= 4	HEALTH	= 3
FLAMMABILITY	= 0	FLAMMABILITY	= 0
INSTABILITY	= 1	PHYSICAL HAZARD	= 3
SPECIAL	= None		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-330 connection is standard
PIN-INDEXED YOKE:	Not applicable.
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-642

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.

AV-1	*Safe Handling and Storage of Compressed Gases*
P-1	*Safe Handling of Compressed Gases in Containers*
SB-2	*Oxygen-Deficient Atmospheres*
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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