Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Boron trichloride (MSDS No. P-4566-F)	**Trade Names:** Boron Trichloride
Chemical Name: Boron trichloride	**Synonyms:** Boron chloride, trichloroborane
Chemical Family: Inorganic halide	**Product Grades:** 3.0, 3.6 Semiconductor Process Gas, 5.0

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 liquid and gas under pressure.
Harmful if inhaled.
Causes eye, skin, and respiratory tract burns.
May cause liver, kidney, and respiratory system 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, irritating 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. Overexposure to vapor concentrations moderately above 5 ppm irritates the upper respiratory tract. Intolerable concentrations range from 50-100 ppm. High concentrations (greater than 50 ppm) severely irritate the upper respiratory tract, causing the throat to burn and producing choking and coughing. Pulmonary edema; general lung injury; ulceration to the nose, throat, and larynx; and laryngeal spasm may also occur. Exposure to concentrations of 1500-2000 ppm for a few minutes is life-threatening. Liver and kidney injury have been reported after exposure to vapors. At higher concentrations, victim may suffocate from lack of oxygen.

Skin Contact. Boron trichloride gas may cause severe skin irritation, chemical burns with ulceration, and scarring. Repeated exposure may produce dermatitis. With prolonged or widespread contact, the skin may absorb potentially harmful amounts of material.

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

Swallowing. An unlikely route of exposure. This product is a gas at normal temperature and pressure. May cause chemical burns of the mouth, throat, esophagus, and stomach, with severe abdominal and chest pain. Nausea, diarrhea, vomiting, weakness, collapse, and coma may occur.

Eye Contact. Exposure causes immediate pain and irritation with excess tearing and blinking. Severity of injury depends on concentration and duration of contact and may range from slight redness and irritation of the conjunctiva to total corneal opacification and blindness.

Effects of Repeated (Chronic) Overexposure. Prolonged or repeated exposure to vapor may discolor and erode the teeth, ulcerate the nasal mucosa, and cause the nose and gums to bleed.

Other Effects of Overexposure. None known.

Medical Conditions Aggravated by Overexposure. Inhalation may aggravate asthma and inflammatory or fibrotic pulmonary disease. Skin irritation may aggravate an existing dermatitis.

CARCINOGENICITY: Boron trichloride 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 trichloride	10294-34-5	>99%*

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

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. **WARNING: Rescuer may receive chemical burns as a result of giving mouth-to mouth.** If breathing is difficult, qualified personnel may give oxygen. Keep patient warm. Call a physician.

SKIN CONTACT: Do not breathe vapor. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Discard clothing and shoes. Call a physician.

SWALLOWING: Rinse mouth with water; then give two glasses of water. Do not induce vomiting. Call a physician.

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 thoroughly flushed. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: *Boron trichloride rapidly hydrolyzes to hydrochloric acid. Keep victims of exposure under medical observation for 24 to 48 hours. The hazards of this material are mainly due to its severe irritant and corrosive properties. Injury occurs mainly to the skin and to mucosal surfaces. There is no specific antidote; direct treatment to control of symptoms and clinical condition.*

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

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Nonflammable, poisonous, corrosive gas.

SUITABLE EXTINGUISHING MEDIA: Boron trichloride cannot catch fire. Use media appropriate for surrounding fire. Note incompatibilities in section 10.

PRODUCTS OF COMBUSTION: See section 10.

PROTECTION OF FIREFIGHTERS: DANGER! Poisonous, corrosive liquid and gas under pressure. 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. Boron trichloride 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 liquid and gas under pressure.

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. 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 gas. Use only with adequate ventilation or respiratory protection. Do not get liquid or vapor in eyes, on skin, or on clothing. 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.

Slowly open valve. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using this mixture, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation, and use in closed systems. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Close cylinder valve after each use; keep closed even when empty. 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 (2009)
Boron trichloride	Not Established.*	Not Established.*

*Praxair recommends compliance with the OSHA limit of 5 ppm (ceiling) and the ACGIH (2009) limits of 2 ppm (ceiling) for hydrogen chloride, formed by the hydrolysis of boron trichloride.
NOTE: Ceiling limits 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 = 50 ppm (hydrogen chloride)

ENGINEERING CONTROLS:

Local Exhaust. Use a corrosion-resistant local exhaust ventilation system with sufficient air flow velocity to maintain concentration below all applicable exposure limits in the worker's breathing zone.

Mechanical (General). Not recommended as a primary ventilation system to control worker's exposure.

Special. A corrosion-resistant, canopy-type, forced-draft fume hood may be more desirable for certain applications.

Other. See SPECIAL.

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear neoprene gloves. 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. 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 that 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:	Pungent, irritating
ODOR THRESHOLD:	Not available.
PHYSICAL STATE:	Gas at normal temperature and pressure
pH:	Not applicable.
MELTING POINT at 1 atm**:**	-161.1°F (-107.3°C)
BOILING POINT at 1 atm**:**	54.5°F (12.5°C)
FLASH POINT (test method)**:**	Not applicable.
EVAPORATION RATE (Butyl Acetate = 1)**:**	Not available.
FLAMMABILITY:	Nonflammable
FLAMMABLE LIMITS IN AIR, % by volume**:**	**LOWER:** Not applicable. **UPPER:** Not applicable.
VAPOR PRESSURE at 70°F (21.1°C)**:**	19.1 psia (131.7 kPa, abs)
VAPOR DENSITY at 70°F (21.1°C) and 1 atm**:**	0.3030 lb/ft^3 (4.852 kg/m^3)
SPECIFIC GRAVITY (H_2O = 1) at 53.6°/39.2°F (12°/4°C)**:**	1.35
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm**:**	4.04
SOLUBILITY IN WATER:	Reacts
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	Not applicable.
DECOMPOSITION TEMPERATURE:	Not available.
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	117.7
MOLECULAR FORMULA:	BCl_3

10. Stability and Reactivity

CHEMICAL STABILITY: ☐ Unstable ☒ Stable

CONDITIONS TO AVOID: None known.

INCOMPATIBLE MATERIALS: Most common substances, including water, organics, hydrogen, ammonia, grease, oxygen, alcohols, nitrogen peroxide.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition will produce toxic fumes of chlorides. BCl_3 is hydrolized by water or moisture to form hydrochloric and boric acids (HCl and H_3BO_3).

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

Reacts with most common substances, including water, organics, hydrogen, ammonia, grease, oxygen, alcohols, nitrogen peroxide.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC_{50}, 1 hr, rat = 2541 ppm

STUDY RESULTS: None known.

12. Ecological Information

ECOTOXICITY: No known effects.

OTHER ADVERSE EFFECTS: No adverse ecological effects expected. Boron trichloride 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 trichloride

HAZARD CLASS:	2.3	**PACKING GROUP/Zone:**	C	**IDENTIFICATION NUMBER:**	UN1741	**PRODUCT RQ:**	None

SHIPPING LABEL(s):	POISON GAS, CORROSIVE*
PLACARD (when required):	POISON GAS, CORROSIVE*

**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 trichloride 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 (226.8 kg.)
EHS RQ (40 CFR 355): 500 (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
DELAYED: Yes
PRESSURE: No
REACTIVITY: Yes
FIRE: No

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

Boron trichloride 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 trichloride is listed as a regulated substance in quantities of 5,000 lb (2268 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Boron trichloride 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 trichloride is listed in Appendix A as a highly hazardous chemical in quantities of 2,500 lb (1134 kg) or greater.

STATE REGULATIONS:

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

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

16. Other Information

Read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: ***Poisonous, corrosive liquid and gas under pressure.*** Use piping and equipment adequately designed to withstand pressures to be encountered. Use a backflow prevention device in any piping. 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. Gas reacts with trace amounts of water to form highly corrosive acid. 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. Never work on a pressurized system. If there is a leak, close the cylinder valve. Blow down the system in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak. When returning cylinder to supplier, be sure valve is closed; then install valve outlet cap or plug, leak-tight. 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 trichloride.*

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.

HAZARD RATING SYSTEMS:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH	= 3	HEALTH	= 3
FLAMMABILITY	= 0	FLAMMABILITY	= 0
INSTABILITY	= 1	PHYSICAL HAZARD	= 1
SPECIAL	= None		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-660 Connection is standard.
PIN-INDEXED YOKE:	Not applicable.
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-634

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.

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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