Praxair™ Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name:	Phosphine (MSDS No. P-4643-E)		**Trade Name:**	Phosphine
Chemical Name:	Phosphine		**Synonyms:**	Hydrogen Phosphine, Phosphorus Trihydride, Phosphuretted Hydrogen
Formula:	PH_3		**Chemical Family:**	Covalent Hydride
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. Composition / Information on Ingredients

For custom mixtures of this product request a Material Safety Data Sheet for each component. See Section 16 for important information about mixtures.

INGREDIENT NAME	CAS NUMBER	PERCENTAGE	OSHA PEL	ACGIH TLV-TWA
Phosphine	7803-51-2	>99%	0.3 ppm	0.3 ppm; Short Term Exposure Limit (STEL) 15 min, 1 ppm

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

3. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Toxic, flammable, high-pressure liquid and gas.
May be fatal if inhaled.
Causes irritation of respiratory tract.
May cause dizziness and drowsiness.
May cause liver, kidney, heart, nervous system, and respiratory system damage.
Symptoms may be delayed.
Liquid may cause frostbite.
May form explosive mixtures with air. Can ignite on contact with air.
Self-contained breathing apparatus must be worn by rescue workers.
Odor: Decaying fish

THRESHOLD LIMIT VALUE: 0.3 ppm TWA; 1 ppm TWA-STEL, 15 min (ACGIH 1997). TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION–Highly toxic. May be fatal if inhaled. Effects include irritation of the respiratory tract and lungs, chest pain, difficulty in breathing, fatigue, headache, abdominal pain, nausea, vomiting, diarrhea, drowsiness, dizziness, staggering, convulsions, and collapse. The interval between onset of exposure and symptoms is dependent on the concentration of gas and duration of exposure. Symptoms can be delayed up to 48 hours.

SKIN CONTACT–No harm expected from vapor. Liquid may cause frostbite.

SWALLOWING–An unlikely route of exposure, but frostbite of the lips and mouth may result from contact with the liquid. This product is a gas at normal temperature and pressure.

EYE CONTACT–No expected harm to eye tissue from vapor. Liquid may cause frostbite.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: When inhaled, phosphine releases inorganic phosphorus. Repeated overexposure to phosphorus can result in anemia, bronchitis, and gastrointestinal disturbances.

OTHER EFFECTS OF OVEREXPOSURE: May cause kidney, liver, and heart damage. Central nervous system depression and cardiac arrhythmia may also occur.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Breathing of vapor or mist may aggravate asthma and inflammatory or fibrotic pulmonary disease. Individuals with pre-existing kidney, heart, liver, or nervous system disease may be at increased risk

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: None known.

CARCINOGENICITY: Phosphine is not listed by NTP, OSHA, and IARC.

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.Get immediate medical attention even if no symptoms are present.

SKIN CONTACT: If exposed to liquid, avoid breathing vapor. Flush with water and warm frostbite area with warm water not to exceed 105°F (41°C). In case of massive exposure, remove clothing while showering with warm water.Get immediate medical attention

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

EYE CONTACT: In case of splash contamination, 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. Seek the advice of a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: *Phosphine is a severe pulmonary irritant; delayed onset of pulmonary edema can occur. Serious phosphine poisoning produces symptoms within several hours, however, symptoms can be delayed for up to 48 hours. Organs with the greatest oxygen requirements appear to be especially sensitive to damage. There is no specific antidote. Treatment of overexposure should be directed at the*

control of symptoms and the clinical conditions of the patient. Contact the Poison Control Center in your area for additional information on patient management and follow-up.

5. Fire Fighting Measures

FLASH POINT (test method)	Flammable gas	**AUTOIGNITION TEMPERATURE**	100° to 305°F (37.7° to 150°C)
FLAMMABLE LIMITS IN AIR, % by volume	**LOWER** Approximately 1-2%*	**UPPER**	Unknown

*Recent studies indicate that the lower flammable limit may range from 1.2 to 1.8% .

EXTINGUISHING MEDIA: CO_2, dry chemical, water spray, or fog.

SPECIAL FIRE FIGHTING PROCEDURES:
DANGER! Toxic, flammable, high-pressure liquid and gas (see section 3). 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, taking care not to extinguish flames. Solid streams of water may be ineffective. Remove ignition sources if without risk. If flames are accidentally extinguished, explosive reignition may occur. Reduce toxic vapors with water spray or fog. Stop flow of gas if without risk, while continuing cooling water spray. Remove all containers from area of fire if without risk. Allow fire to burn out. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Poisonous, flammable gas. May form explosive mixtures with air and oxidizing agents. Phosphine may ignite spontaneously on contact with air. Heat of fire can build pressure in cylinder and cause it to rupture. To provide maximum containment up to cylinder burst pressure, Phosphine cylinders are not equipped with a pressure relief device. No part of cylinder should be subjected to a temperature higher than 125°F (52°C).

If leaking or spilled phosphine catches fire, do not extinguish flames. Flammable and toxic vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check with an appropriate device. To protect persons from cylinder fragments and toxic fumes should a rupture occur, evacuate the area if the fire cannot be brought under immediate control.

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
DANGER! Toxic, flammable, high-pressure liquid and gas (see section 3). Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Gas forms explosive mixtures with air (see Section 5). Before entering area, especially a confined area, check atmosphere with an appropriate device. Remove all sources of ignition if without risk. Reduce vapors with fog or fine water spray. Shut off leak if without risk. Ventilate area of leak or move leaking cylinder to well-ventilated area. Prevent runoff from contaminating surrounding environment. Poisonous, flammable vapors may spread from spill.

EMERGENCY DISPOSAL: Phosphine can be slowly introduced into a gas disposal system containing adequate quantities of sodium hypochlorite, calcium hypochlorite, potassium permanganate, bromine water, or sodium hypobromite solution.Prevent waste from contaminating the surrounding environmentDiscard

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 STORAGE: Store and use with adequate ventilation. Separate phosphine cylinders from oxygen and other oxidizers by at least 20 feet or use a barricade of noncombustible material. This barricade should be at least 5 feet high and have a fire resistance rating of at least ½ hour. 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. Post "No Smoking or Open Flames" signs in storage and use areas. There must be no sources of ignition. All electrical equipment in storage areas must be explosion-proof. Storage areas must meet national electric codes for Class 1 hazardous areas.

PRECAUTIONS TO BE TAKEN IN HANDLING: Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide or drop. Electrical equipment must be non-sparking or explosion-proof. 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 phosphine, see section 16.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST–Use explosion-proof local exhaust ventilation with sufficient air flow to keep the phosphine concentration below the TLV in the worker's breathing zone.

MECHANICAL (general)–Not recommended as a primary ventilation system to control worker's exposure.

SPECIAL–A canopy type of forced-air fume hood equipped with an explosion-proof device may be more desirable for certain applications.

OTHER–Not applicable.

RESPIRATORY PROTECTION: Use air-supplied respirators for concentrations up to 10 times the applicable permissible exposure limit. For higher concentrations, a full-face, self-contained breathing apparatus is required. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134.

SKIN PROTECTION: Neoprene.

EYE PROTECTION: EYE 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 per OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: 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.

9. Physical and Chemical Properties

MOLECULAR WEIGHT: 33.998	**EXPANSION RATIO:** Not applicable
SPECIFIC GRAVITY (air=1): At 77°F (25°C) and 1 atm: 1.184	**SOLUBILITY IN WATER:** vol/vol at 62.6°F (17°C): 0.26
GAS DENSITY: At 68°F (20°C) and 1 atm: 0.0877 lb/ft^3 (1.405 kg/m^3)	**VAPOR PRESSURE:** AT 70°F (21.1°C): 583 psig (4020 kPa)
PERCENT VOLATILES BY VOLUME: 100	**EVAPORATION RATE (Butyl Acetate=1):** High
BOILING POINT (1 atm): -125.9°F (-87.7°C)	**pH:** Not applicable

MELTING POINT (1 atm): -207.4 °F (-133.8°C)

APPEARANCE, ODOR, AND STATE: Colorless gas at normal temperature and pressure; odor of decaying fish.

10. Stability and Reactivity

STABILITY:	**Unstable**	**X**	**Stable**	

INCOMPATIBILITY (materials to avoid): Halogenated hydrocarbons, oxidizing agents, especially oxygen and halogens, acids, as well as aluminum alloys and copper.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition or burning may produce hydrogen, phosphorus, phosphorus oxides.

HAZARDOUS POLYMERIZATION:	**May Occur**		**Will Not Occur**	**X**

CONDITIONS TO AVOID: Decomposition occurs at temperatures in excess of 689°F (365°C).

11. Toxicological Information

See section 3.

12. Ecological Information

No information available on ecological effects. Phosphine does not contain any Class I or Class II ozone-depleting chemicals. Phosphine is not listed as a marine pollutant by DOT.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier. For emergency disposal, see section 6.

14. Transport Information

DOT/IMO SHIPPING NAME: Phosphine	**HAZARD CLASS:** 2.3

IDENTIFICATION NUMBER: UN 2199	**PRODUCT RQ:** 100 lb
SHIPPING LABEL(s): TOXIC GAS, FLAMMABLE GAS	**PLACARD (When required):** TOXIC GAS, FLAMMABLE GAS

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)].

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, Compensationand Liability Act of 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): 100 lb

SARA: Superfund Amendmentand 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 (40 CFR Part 355):

  Threshold Planning Quantity (TPQ): 500 lb
  Extremely Hazardous Substances (40 CFR 355): 100 lb

- **SECTIONS 311/312:** Require submission of Material Safety Data Sheets (MSDSs) and chemical inventory reporting with identification of EPA hazard categories. The hazard categories for this products are as follows:

  IMMEDIATE: Yes
  DELAYED: Yes
  PRESSURE: Yes
  REACTIVITY: Yes
  FIRE: Yes

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

  Phosphine does not require 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.

Phosphine is listed as a regulated substance in quantities of 5,000 pounds (2268 kg) or greater.

TSCA: Toxic Substances Control Act: Phosphine 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.

Phosphine is listed in Appendix A as a highly hazardous chemical in quantities of 100 pounds (45.5 kg) or greater.

STATE REGULATIONS:

CALIFORNIA: This product is not listed by California under the Safe Drinking Water Toxic Enforcement Act of 1986 (Proposition 65).

PENNSYLVANIA: This product 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, flammable, liquefied gas under pressure.*** May be fatal if inhaled. Do not breathe gas. Do not get vapors or liquid in eyes, on skin, or on clothing. (See section 3.) Have safety showers and eyewash fountains immediately available. Use piping and equipment adequately designed to withstand pressures to be encountered. ***May form explosive mixtures with air.*** Keep away from heat, sparks or open flame. Ground all equipment. Use only spark-proof tools and explosion-proof equipment. Store and use with adequate ventilation at all times. Use only in a closed system. Close valve after each use; keep closed even when empty. Keep away from oxidizing agents and from other flammables***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.***When returning cylinder to supplier, be sure valve is closed,*** then install valve outlet plug tightly.***Never ground a compressed gas cylinder or allow it to become part of an electrical circuit.***

Recommended Equipment: 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.

NOTE: Prior to using any plastics, confirm their compatibility with phosphine.

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	= 4
FLAMMABILITY	= 4	FLAMMABILITY	= 4
REACTIVITY	= 2	REACTIVITY	= 2
SPECIAL	None		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED: CGA-350 connection is standard.

PIN-INDEXED YOKE: Not applicable

ULTRA-HIGH-INTEGRITY CONNECTION: CGA-632

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 referenced on the label for this product; you may also obtain copies by calling 1-800-PRAXAIR. Further information about phosphine can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 1725 Jefferson Davis Highway, Arlington, VA 22202-4102, Telephone (703) 412-0900.

P-1 *Safe Handling of Compressed Gases in Containers*
V-1 *Compressed Gas Cylinder Valve Inlet and Outlet Connections*
--- *Handbook of Compressed Gases, Third Edition*

Praxair asks users of this product to study this Material Safety Data Sheet (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 on 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.

Praxair MSDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current Praxair MSDSs for these products, contact your Praxair sales representative or local distributor or supplier. If you have questions regarding Praxair MSDSs, would like the form number and date of the latest MSDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (**Phone:** 1-800-PRAXAIR; **Address:** Praxair Call Center, Praxair, Inc., PO Box 44, Tonawanda, NY 14150-7891).

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