

PRODUCT NAME: PHOSPHINE (5 PPM TO 50%) IN HYDROGEN**1. Chemical Product and Company Identification****BOC Gases,
Division of,
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974****TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE
NUMBER: CHEMTREC (800) 424-9300****BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6****TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE
NUMBER: (905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101****PRODUCT NAME: PHOSPHINE (5 PPM TO 50%) IN HYDROGEN****CHEMICAL NAME: Phosphine in Hydrogen****COMMON NAMES/SYNONYMS: Not Available****TDG (Canada) CLASSIFICATION: 2.3 (2.1)****WHMIS CLASSIFICATION: A, B6, D2B, D1A****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-OSHA ²	TLV-ACGIH ³	LD ₅₀ or LC ₅₀ Route/Species
Phosphine FORMULA: PH ₃ CAS: 7803-51-2 RTECS #: SY7525000	0.0005 to 50.0	0.3 ppm TWA	0.3 ppm TWA 1 ppm STEL	LD ₅₀ : 20 ppm Inhalation/rat (1 H, time adjusted)
Hydrogen FORMULA: H ₂ CAS: 1333-74-0 RTECS #: MW8900000	50.0 to 99.9995	Simple Asphyxiant	Simple Asphyxiant	Not Available

¹ Refer to individual state of 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.

IDLH (Phosphine): 50 ppm

3. Hazards Identification**EMERGENCY OVERVIEW**

Pyrophoric, flammable, colorless gas with repulsive odor. Irritating to the eyes, skin and mucous membranes. Mixtures which contain 0.4% or more phosphine are poisonous. Inhalation may result in pulmonary edema. Phosphine is a central nervous system depressant and toxic to the kidneys. Dangerous fire and explosion hazard. Avoid heat, sparks, and flames. Releases may spontaneously ignite. Contents under pressure. Use and store below 125 °F.

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ROUTE OF ENTRY:

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

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

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

EYE EFFECTS:

Contact may cause irritation, pain, and burning.

SKIN EFFECTS:

Contact with moisture on the skin may form irritating materials such as phosphoric acid. Pain, burning and irritation may result from contact.

INGESTION EFFECTS:

Ingestion is unlikely.

INHALATION EFFECTS:

Phosphine is a poison gas. Death can occur following inhalation of low concentrations. Severe respiratory irritation may occur. Exposure symptoms may include coughing, shortness of breath, wheezing, increased bronchial secretions and pulmonary edema.

Phosphine is also toxic to the central nervous system (CNS), exposure symptoms may include weakness, fatigue, headache, dizziness, fainting, drowsiness, tremors, disturbances of gait, convulsions, and coma. Abdominal pain, thirst, nausea, and vomiting may also occur. Exposure may result in toxicity to the kidneys.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: May aggravate pre-existing respiratory, kidney, and nervous system disorders.

NFPA HAZARD CODES

Health: 4 (as phosphine)
Flammability: 4
Instability: 2 (as phosphine)

HMIS HAZARD CODES

Health: 4 (as phosphine)
Flammability: 4
Reactivity: 2 (as phosphine)

RATINGS SYSTEM

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

4. First Aid Measures

EYES:

Flush contaminated eye(s) with copious quantities of fresh water. Part eyelids to assure complete flushing. Continue for minimum of 15 minutes. If irritation persists or systemic poisoning is suspected, seek immediate medical attention.

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SKIN:

Wash affected area with large quantities of water for 15 minutes. If irritation persists or systemic poisoning is suspected, seek immediate medical attention.

INGESTION:

Not required.

INHALATION:

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS OPERATED IN POSITIVE PRESSURE MODE AND BE AWARE OF THE EXTREME FIRE AND EXPLOSION HAZARD. RESCUE PERSONNEL SHOULD NOT ENTER AN EXPLOSIVE ATMOSPHERE. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. If breathing is difficult, give oxygen. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, and given artificial resuscitation and supplemental oxygen. Medical assistance should be sought immediately. Keep the victim warm and quiet and be sure that mucus does not obstruct the airway. Treatment should be symptomatic and supportive.

5. Fire Fighting Measures

Conditions of Flammability: This material spontaneously combusts in air at room temperature		
Flash point: Not Available	Method: Not Applicable	Autoignition Temperature: 38 °C (100.4 °F) (pure phosphine)
LEL(%): 1.6*		UEL(%): 98*
Hazardous combustion products: Phosphoric acid and phosphoric pentoxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

* Estimated as phosphine, NFPA 49-104, Fire Protection Guide to Hazardous Materials, 12th Ed., 1997.

FIRE AND EXPLOSION HAZARDS:

Flammable gas. Spontaneously combustible (pyrophoric). May spontaneously ignite in air or accumulate and explode without ignition source. Explosive decomposition may occur under fire conditions. Phosphine evolves hydrogen and ignites on contact with many materials. Low ignition energy. Hydrogen is very flammable and rises rapidly in air.

EXTINGUISHING MEDIA:

It may be safer to allow the fire to burn itself. Decomposition products are less toxic than phosphine. If possible, close off valves upstream to shut off gas supply. DO NOT use halogenated extinguishing agents. Use water spray to cool surrounding equipment and fire exposed containers.

FIRE FIGHTING INSTRUCTIONS:

If possible, stop the flow of gas and allow fire to “burn” itself out. Inerting the atmosphere to reduce oxygen levels may extinguish flame, allowing capping of leaking container. Do not attempt this unless specifically trained. Reduce the rate of flow and inject an inert gas, if possible, before completely stopping the flow to prevent flashback. Do not extinguish the fire until the supply is shut off as otherwise an explosive re-ignition may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Use non-sparking tools to close container valves.

The products of combustion are phosphorous pentoxide (which forms a dense white cloud), phosphoric acid, and water. Control the dispersion of phosphoric acid vapors with a water spray, being sure to collect runoff so as to prevent environmental contamination.

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Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. Direct 500 GPM water stream onto containers above liquid level with remote monitors. Limit the number of personnel in proximity of fire and evacuate surrounding areas in all directions.

Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear with additional chemical protective clothing as necessary to prevent exposure. Continue to cool fire-exposed cylinders until well after flames are extinguished.

Personnel and equipment should be decontaminated using a water spray as a minimum. Avoid contact with contaminated equipment as this may be corrosive due to contamination with phosphoric acid. Never enter a flammable atmosphere. Caution should be used when determining if the flame has been extinguished. Should the fire be extinguished and the flow of gas continues, increased ventilation must be used to prevent a buildup of gas, thus creating an explosion hazard.

6. Accidental Release Measures

Immediately evacuate all personnel from affected area and extinguish all ignition sources. Stop the flow of gas using a valve in a remote location if possible. No smoking, sparks, flames, or flares in hazard area. Increase ventilation to prevent buildup of flammable/explosive atmosphere. Use appropriate protective equipment. Deny entry to unauthorized and unprotected personnel. Stop or control leak if it can be done without risk. Use water spray to cool and absorb vapors and protect personnel. Dike runoff waters for later disposal. Consult a HAZMAT specialist and the appropriate emergency telephone number in Section 1 or your closest BOC location. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. All personnel involved in spill control should be equipped with self-contained breathing apparatus and other chemical protective clothing.

7. Handling and Storage

Earth-ground and bond all lines and equipment associated with the phosphine system. All equipment should be non-sparking or explosion proof. Consult the National Electric Code for details.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. 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 the storage or use area. There should be no sources of ignition in the storage or use area.

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 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 cylinder.

For additional storage requirements, consult Compressed Gas Association's Pamphlet P-1.

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.

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS:

As phosphine is heavier than air, venting areas from the bottom or floor may be more effective. Use local exhaust and enclosed processes as necessary to prevent accumulation above the exposure limits.

EYE/FACE PROTECTION:

Gas-tight chemical safety goggles or full-face piece respirator.

SKIN PROTECTION:

Protective gloves and chemical protective clothing as necessary to prevent exposure (Responder™ is effective for exposures greater than 8 hours).

RESPIRATORY PROTECTION:

Positive pressure air line with full facepiece mask, equipped with an escape air bottle, or self-contained breathing apparatus should be available for emergency use and routine use when concentrations are above exposure limits.

OTHER/GENERAL PROTECTION:

Safety shoes, safety shower, eyewash "fountain."

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: 522 *	psia
Vapor density (Air = 1)	: 1.27 *	
Evaporation point	: Not Available	
Boiling point	: -126 *	°F
	: -88 *	°C
Freezing point	: -208.8 *	°F
	: -133.8 *	°C
PH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H ₂ O)	: Slightly soluble	
Odor threshold	: 0.51 ppm	
Odor and appearance	: Unpleasant, decaying, fish-like odor; Colorless gas.	

* The data shown are for Phosphine

10. Stability and Reactivity

STABILITY:

Stable

INCOMPATIBLE MATERIALS:

Phosphine combines violently with oxygen and halogens and liberates hydrogen and forms phosphide when passed over heated metal. Bases, oxygen, halogens, nitric acid, chromium oxychloride, silver nitrate, mercuric nitrate and nitrogen trichloride. Hydrogen may react with oxidizers. Lithium metal will burn to the hydride in a hydrogen atmosphere.

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HAZARDOUS DECOMPOSITION PRODUCTS:

Phosphorous and hydrogen at approximately 1100°F (600°C).

HAZARDOUS POLYMERIZATION:

Will not occur.

11. Toxicological Information

INHALATION:

Respiratory, gastrointestinal, and central nervous system (CNS) symptoms were noted in workers exposed to mean phosphine concentrations less than 10 ppm. A 4 hour LC50 for rats of 11 ppm is cited in the ACGIH Documentation of TLVs and BEIs.

SKIN AND EYE:

May cause irritation.

CHRONIC:

Chronic phosphine poisoning is believed to be similar to chronic phosphorus poisoning (skeletal injury) although no cases are documented in the literature. Chronic absorption of phosphine may be associated with disturbances of sight, speech and motor functions.

OTHER:

Phosphine is toxic to the kidneys. Exposure may result in albuminuria and hematuria.

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:	Compressed gases, flammable, toxic, n.o.s. (Phosphine in Hydrogen)	Compressed gases, flammable, toxic, n.o.s. (Phosphine in Hydrogen)
HAZARD CLASS:	2.3	2.3 (2.1)
IDENTIFICATION NUMBER:	UN 1953	UN 1953
SHIPPING LABEL:	POISON GAS, FLAMMABLE GAS	POISON GAS, FLAMMABLE GAS

Additional Marking Requirement (For Phosphine \geq 4000 ppm): "Inhalation Hazard"

Additional Shipping Paper Description Requirement: "Poison-Inhalation Hazard, Zone A, B, C or D" depending on concentration of Phosphine as follows:

- Zone A (Phosphine \geq 10%),
- Zone B (10% > Phosphine \geq 2%),
- Zone C (2% > Phosphine \geq 6700 ppm),
- Zone D (6700 ppm > Phosphine \geq 4000 ppm)"

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Note: For Phosphine < 4000 ppm, ship as Compressed gases, flammable, n.o.s.
(Phosphine in Hydrogen), 2.1, UN 1954, FLAMMABLE GAS.

15. Regulatory Information

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:

Acute Health Hazard
Chronic Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard

SARA TITLE III – SECTION 313 SUPPLIER NOTIFICATION:

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and 40 CFR 372:

CAS NUMBER	INGREDIENT NAME	PERCENT BY VOLUME
7803-51-2	Phosphine	0.0005-50%

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:

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).