Material Safety Data Sheet Collection
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Phosphine
PHO3520

Section 1 - Chemical Product and Company Identification 61

Material Name: Phosphine
CAS Number: 7803-51-2
Chemical Formula: H_3P
Structural Chemical Formula: H_3P
EINECS Number: 232-260-8
ACX Number: X1003336-8
Synonyms: CELPHOS; DELICIA; DETIA; FOSFOROWODOR; GAS-EX-B; HYDROGEN PHOSPHIDE; PHOSPHINE; PHOSPHORATED HYDROGEN; PHOSPHORETTED HYDROGEN; PHOSPHORUS HYDRIDE; PHOSPHORUS TRIHYDRIDE; PHOSPHORWASSERSTOFF
General Use: Used as grain fumigant, rodenticide when produced by action of a moist atmosphere on aluminum phosphide, zinc phosphide or magnesium phosphide.
Such baits are highly dangerous if wet with water.
Phosphine is corrosive to copper and fumigation may severely damage electrical equipment.
Used as doping agent for solid state electronic components.
Electronic grade phosphine may be diluted and compressed with nitrogen, the hazard potential is unchanged.
Phosphine may be liberated during the following industrial processes.
-dismantling of aluminum melting furnaces [ALCOA] -acid leaching of certain arsenic bearing ores (particularly cobalt) -action of moisture on dross produced by the refining of certain nonferrous metals (tin and cobalt, for example) -action of moisture on ferrosilicones -action of moisture on impure calcium cyanamide and calcium carbide

Section 2 - Composition / Information on Ingredients

Name	CAS	%
phosphine	7803-51-2	99.999

OSHA PEL
TWA: 0.3 ppm; 0.4 mg/m^3.

NIOSH REL
TWA: 0.3 ppm (0.4 mg/m^3); STEL: 1 ppm (1 mg/m^3).

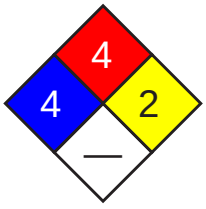
DFG (Germany) MAK
TWA: 0.1 ppm; PEAK: 0.1 ppm.

ACGIH TLV
TWA: 0.3 ppm; STEL: 1 ppm.

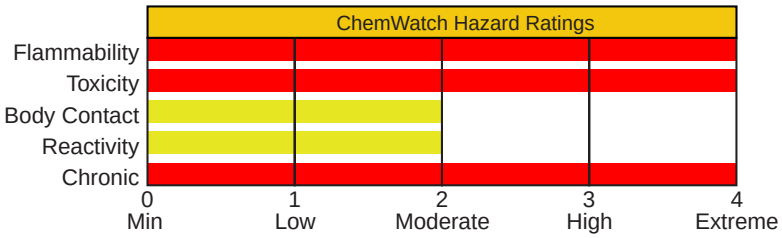
IDLH Level
50 ppm.

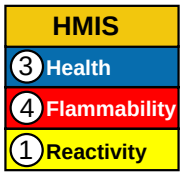
EU OEL
TWA: 0.14 mg/m^3 (0.1 ppm);
STEL: 0.28 mg/m^3 (0.2 ppm).

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Poison Explosive Flammable Compressed Gas

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas; garlic odor. Stored as a compressed gas which can cause frostbite. Poison. Other Acute Effects: coughing, wheezing, pulmonary edema, convulsions, coma. Chronic Effects: injury to bone/kidney/CNS. Flammable. Pyrophoric. Explosive.

Potential Health Effects

Target Organs: skin, eyes, respiratory system, kidneys, central nervous system (CNS)
Primary Entry Routes: inhalation, skin contact

Acute Effects

Inhalation: DANGER. Highly Toxic.
The gas is highly discomforting and may be fatal if inhaled.
Reactions may not occur on exposure but response may be delayed with symptoms only appearing many hours later. The only signs during exposure may be mild respiratory irritation although some victims report dyspnea, weakness, tremor and convulsions.
Overexposure may cause tightness of chest and cough, headache, dizziness, nausea, vomiting, tremor, loss of coordination, diarrhea.
More severe poisoning may result in pulmonary edema, cardiovascular collapse, cardiac dysrhythmias, myocardial injury, disordered liver function. Mortality from severe poisoning is high. Death has resulted from exposure to 8 ppm phosphine for 1-2 hours per day over several days.
Asthma and inflammatory or fibrotic pulmonary disease will be aggravated.
Acute phosphorus poisoning results in fatality rates of almost 50% once hypoglycemia, azotemia, hepatomegaly or delirium appear. The mean-time to death is 5 to 6 days. Phosphorus is eliminated in exhaled air, urine and feces and death results from gastroenteritis, hepatic and renal failure and, in some cases, acute myocardial infarction.

Eye: The gas is highly discomforting to the eyes and is capable of causing pain and severe conjunctivitis.
Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

Skin: The gas is moderately discomforting to the skin.

Ingestion: Not normally a hazard due to physical form of product.
Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic phosphorus intoxication is characterized by anemia, cachexia, bronchitis and skeletal necrosis.

Section 4 - First Aid Measures

Inhalation: Avoid becoming a casualty. Remove victim to uncontaminated site.
Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush with fresh running water.
Ensure irrigation under the eyelids by occasionally lifting upper and lower lids. If pain persists or recurs seek medical attention.
Removal of contact lenses after an eye injury should only be undertaken by skilled personnel. Symptoms of exposure may be delayed.
Immediately transport to hospital or doctor. DO NOT delay.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.
Symptoms of exposure may be delayed.
Immediately transport to hospital or doctor. DO NOT delay.

Ingestion: Not normally a hazard due to physical form of product. DO NOT delay. Immediately transport to hospital or doctor.

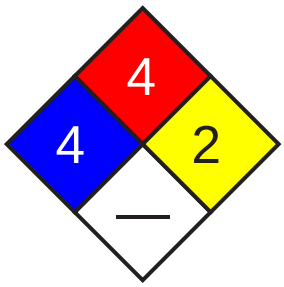
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For severe acute or short-term repeated exposures to phosphine:
1.There is no antidote. Clinical manifestations include headache, fatigue, nausea, vomiting, cough, dyspnea, parethesias, jaundice, ataxia, intention tremor, weakness and diplopia.
2. Care is supportive and all obviously symptomatic patients should be monitored in an intensive care setting. Watch for dysrhythmias. Replace fluids/electrolytes. Follow blood chemistries (calcium, phosphorus, glucose, prothrombin time, CBC) at least daily. Follow renal and hepatic function at least daily. Avoid any alcohol intake.
3. The risk of pulmonary edema after severe exposure requires observation for 24-48 hours but can appear several days later. Initial X-ray may be useful in assessing development of edema. If edema develops, nurse with trunk upright and administer oxygen at atmospheric pressure. Diuretics, morphine, theophylline derivatives are of little benefit since edema is exudate rather than transudate.
Bronchodilators by nebulizer or metered aerosol may reduce bronchospasm and dyspnea. Where immediate respiratory symptoms suggest lower airway exposure, steroids may be beneficial, with intravenous injection of methylprednisolone up to 30 mg/kg body weight initially with subsequent smaller doses. Prophylactic antibiotics are indicated in all but mild cases.
Intermittent positive pressure ventilation with bronchial toilet and suction may be important elements of treatment.

Section 5 - Fire-Fighting Measures

Flash Point: Flammable gas
Autoignition Temperature: 100 to 150 °C
LEL: 1.79% v/v
UEL: 1.79% v/v
Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).
Carbon dioxide.
General Fire Hazards/Hazardous Combustion Products: EXTREME HEALTH HAZARD. Flammable gas. May emit poisonous fumes.
Severe vapor explosion hazard, when exposed to flame or spark.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
Decomposes on heating and produces acrid and toxic fumes of phosphorus oxides (PO_x).

See DOT ERG



Fire Diamond

Fire Incompatibility: WARNING: May decompose violently or explosively on contact with other substances.
This substance is one of the relatively few compounds which are described as "endothermic" i.e. heat is absorbed into the compound, rather than released from it, during its formation.
The majority of endothermic compounds are thermodynamically unstable and may decompose explosively under various circumstances of initiation.
Many but not all endothermic compounds have been involved in decompositions, reactions and explosions and, in general, compounds with significantly positive values of standard heats of formation, may be considered suspect on stability grounds.
Explosion hazard may follow contact with incompatible materials.
Avoid contact with oxidizing agents, oxygen gas, fluorine, chlorine, nitrates, alkalies and alkali metals e.g. sodium, potassium, lithium.
Fire-Fighting Instructions: EXTREME HEALTH HAZARD. Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Do not extinguish burning gas.
Fight fire from a safe distance, with adequate cover.
If safe to do so, switch off electrical equipment until vapor fire hazard is removed.
Use water delivered as a fine spray to control the fire and cool adjacent area. Water spray or fog may be used to disperse vapor.
Do not approach cylinders suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: EXTREME HEALTH HAZARD. Clear area of personnel and move upwind.
Restrict access to area.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse / absorb vapor.
Do not exert excessive pressure on valve; do not attempt to operate damaged valve.
Remove leaking cylinders to a safe place. Fit vent pipes. Release pressure under safe, controlled conditions by opening valve. Burn issuing gas at vent pipes.
Use only spark-free shovels and explosion proof equipment.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

See DOT ERG

Large Spills: EXTREME HEALTH HAZARD. Clear area of personnel and move upwind.
Restrict access to area.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor.
Do not exert excessive pressure on valve; do not attempt to operate damaged valve.

Remove leaking cylinders to a safe place. Fit vent pipes. Release pressure under safe, controlled conditions by opening valve. Burn issuing gas at vent pipes.
Use only spark-free shovels and explosion proof equipment.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Used in closed pressurized systems, fitted with safety relief valve.
Vented gas is flammable, denser than air and will spread. Vent path must not contain ignition sources, pilot lights, bare flames.
Atmospheres must be tested and O.K. before work resumes after leakage.
Obtain a work permit before attempting any repairs.
Do not attempt repair work on lines, vessels under pressure.
Handle and open container with care.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions. Technical material is transported as liquified gas under pressure. Packed as liquid under pressure and remains liquid only under pressure. Sudden release of pressure or leakage may result in rapid vaporization with generation of large volume of highly flammable/explosive gas.

Recommended Storage Methods: Cylinder. Ensure the use of equipment rated for cylinder pressure.
Ensure the use of compatible materials of construction.
Valve protection cap to be in place until cylinder is secured, connected.
Cylinder must be properly secured either in use or in storage.
Cylinder valve must be closed when not in use or when empty.
Segregate full from empty cylinders.
WARNING: Suckback into cylinder may result in rupture.
Use back-flow preventive device in piping.
Check that containers are clearly labeled.
Packaging as recommended by manufacturer.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Areas where cylinders are stored/used must have discrete, controlled exhaust ventilation.
Operators should be trained in correct use and maintenance of respirators. Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Close fitting gas tight goggles and DO NOT wear contact lenses.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Respiratory Protection:
Exposure Range >0.3 to 15 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range >15 to <50 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range 50 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Other: Overalls. PVC apron. PVC protective suit may be required if exposure severe.
Eyewash unit. Ensure there is ready access to a safety shower.
Rescue gear: Two sets of SCUBA breathing apparatus, rescue harness, lines, etc.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Flammable colorless gas at normal temperature and pressure.
EXTREME HEALTH HAZARD. Pure phosphine has no odor and is flammable. So-called phosphine odor of Technical grade gas, i.e. decaying fish, is from contaminants i.e. up to 5% diphosphine in the gas.
Phosphine released from fumigants may contain diphosphine, ammonia, methyl phosphine, arsine.

Physical State: Liquefied gas
Odor Threshold: 0.03 ppm
Vapor Density (Air=1): 1.17
Formula Weight: 34
Specific Gravity (H_2O=1, at 4 °C): 0.746 liquid
Evaporation Rate: Very fast
pH: Not applicable

pH (1% Solution): Not applicable.
Boiling Point: -87.7 °C (-126 °F)
Freezing/Melting Point: -133 °C (-207.4 °F)
Volatile Component (% Vol): 100
Decomposition Temperature (°C): 375
Water Solubility: 0.26 vol at 20 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous. Gas containing diphosphine may be PYROPHORIC, may ignite spontaneously or accumulate and explode without a source of ignition.
Product is considered stable under normal handling conditions.

Storage Incompatibilities: WARNING: May decompose violently or explosively on contact with other substances.
This substance is one of the relatively few compounds which are described as "endothermic" i.e. heat is absorbed into the compound, rather than released from it, during its formation.
The majority of endothermic compounds are thermodynamically unstable and may decompose explosively under various circumstances of initiation.
Many but not all endothermic compounds have been involved in decompositions, reactions and explosions and, in general, compounds with significantly positive values of standard heats of formation, may be considered suspect on stability grounds. Segregate from oxidizing agents, ammonia, alkalies, chlorine, nitrates and alkali metals e.g. sodium, potassium, lithium.
Materials of construction restriction: Incompatible with aluminum, copper, copper alloys. Do not use with natural rubber, neoprene, polyethylene, PVC.

Section 11 - Toxicological Information

Toxicity
Inhalation (human) LC_{Lo}: 1000 ppm/5m
Inhalation (rat) LC_{50}: 11 ppm/4h

Irritation
Nil reported

See *RTECS* SY7525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: Toxicity to microorganisms: Bacillus subtilis growth inhib. EC_{50} 2.7

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Phosphine
ID: UN2199
Hazard Class: 2.3 - Poisonous gas
Packing Group:
Symbols:
Label Codes: 2.3 - Poison Gas, 2.1 - Flammable Gas
Special Provisions: 1
Packaging: **Exceptions:** None **Non-bulk:** 192 **Bulk:** 245

Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** Forbidden
Vessel Stowage: **Location:** D **Other:** 40

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed P096
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Listed
RQ: 100 lb
TPQ: 500 lb
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.