

# UltraPhos<sup>®</sup> LoFlo Fumigant System Operations Manual



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# 1.Safety

## UltraPhos Phosphine Fumigant Hazards

- Extremely toxic and flammable gas – Dangerous Goods 2.3 (2.1)
- Contains gas under pressure; may explode if heated.
- Fatal if inhaled.
- Causes severe skin burns and eye damage.
- Very toxic to aquatic life.



## Precautionary Statements

- Keep cylinders away from heat/sparks/open flames/hot surfaces - No smoking. Do not spray on an open flame or other ignition source.
- Pressurized container: Do not pierce or burn, even after use.
- Do not breathe gas. Use only outdoors or in a well-ventilated area.
- Wear respiratory protection.
- Wash exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Avoid release to the environment.

UltraPhos only to be used in accordance with APVMA label attached.

UltraPhos only to be used by Trained and Licensed fumigators.

Read UltraPhos LoFlo System Operations Manual before use.

**System only to be used with UltraPhos phosphine. Other phosphine may damage the System and create hazardous situations.**

**Refer and read SDS attached before using the System. (Current SDS can be found at [www.specialtygases.com.au](http://www.specialtygases.com.au))**

## 2. System Overview

The UltraPhos LoFlo System comprises:

1. 2 x UltraPhos phosphine gas cylinders (17 kg pure phosphine per cylinder)
2. UltraPhos LoFlo phosphine mixer
3. Carbon Dioxide (gas withdraw) with less than 50 ppm oxygen.

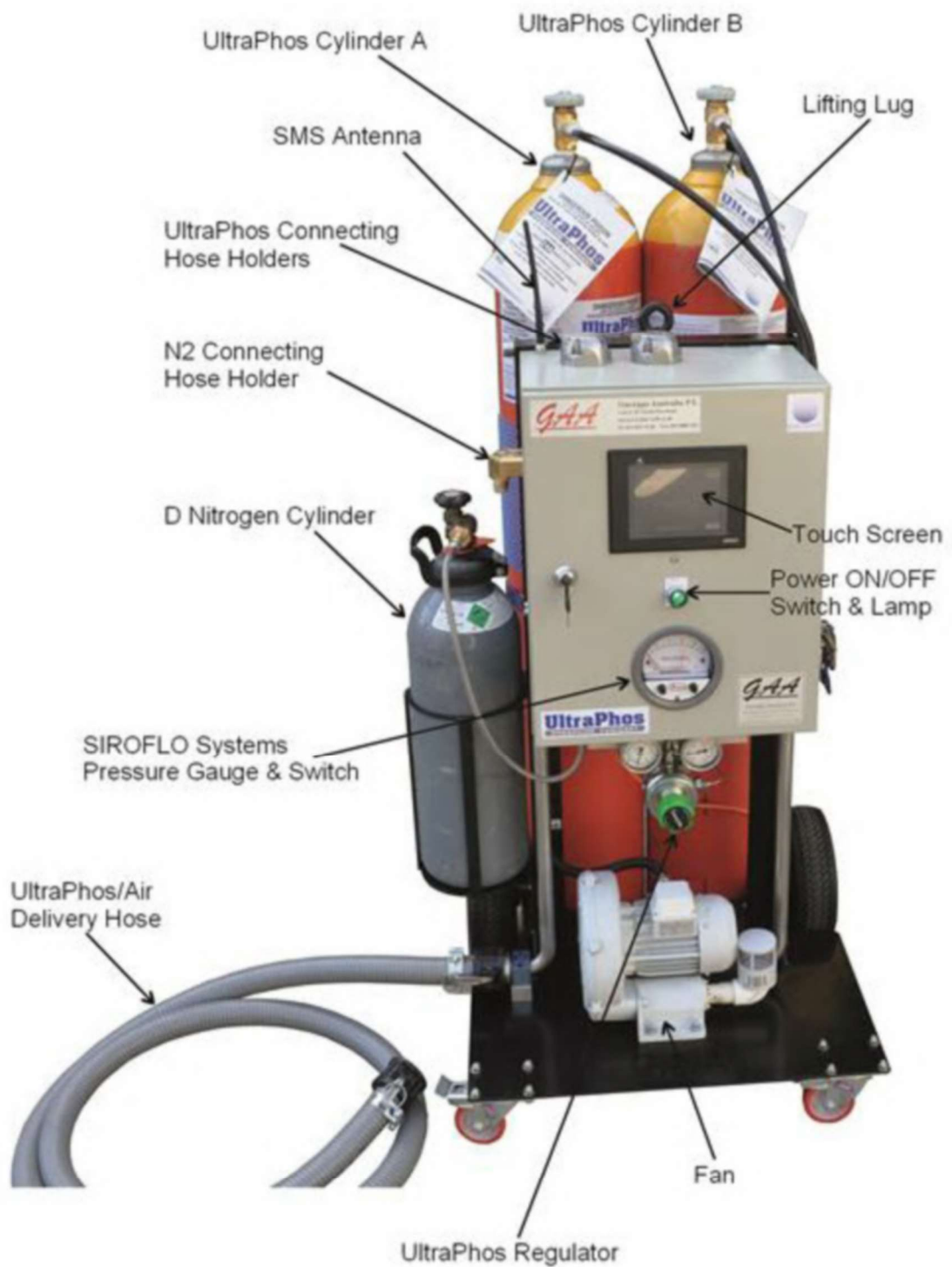
The System produces a non-flammable phosphine and air mixture which can be further diluted by an external fan. The System can safely dispense phosphine at maximum 3 grams/minute or 180 grams per hour in air at 1% (v/v) or 10,000 ppm. The dispensing rate can be reduced using the UltraPhos Regulator.

A single power source is required for the LoFlo system.

Features of the System:

- Multiple interlocks that will shut the System down in adverse situations.
- Easy to use Touch Screen allowing input of dispensing time (decimal days).
- Automatic change over allows cylinders to be completely emptied resulting no part cylinders.
- High purity phosphine providing superior fumigation performance.
- Automatic pre and post system purges using carbon dioxide
- Automatic high pressure leak test

# UltraPhos LoFlo System



### 3. Safety Interlocks

The System will shut down in the situations listed in the table below. These are detailed in the PLC screens listed later in the Manual.

SAFETY INTERLOCK
System air flow below required flowrate
High Temperature in System mixing head
Power failure
Leak test failure
UltraPhos cylinders empty
Carbon Dioxide cylinder pressure low
UltraPhos cylinder valve open while trying to Post Purge

## 4. Product Specifications

<b>PHOSPHINE PURITY</b>	> 99% (weight)
<b>CYLINDER</b>	
Material & Water Capacity	Steel & 49 litres
PH <sub>3</sub> Fill Capacity	17 kg
Pressure @ 25 C	40 bar
Tare weight	63 kg
Dimensions (HxD) mm (excludes cap)	1500 x 235
Manufacturing Specification	DOT 3AA
<b>VALVE</b>	
Material & Type	Brass & Stainless Steel Diaphragms
Valve outlet	CGA 350
<b>STILLAGE</b>	
Dimensions (HxWxL) mm	1065 x 1050 x 815
Weight (approx)	100 kg
Cylinder Capacity	12

		HiFlo	LoFlo
PH <sub>3</sub> Flowrate	Grams/minute	100	3
Air Flowrate	Litres metres /minute	7100	260
PH <sub>3</sub> /Air Concentration	% v/v	1	1
Dimensions HxWxL (approx. & excludes cylinders)	mm	1400 x 800 x 800	1200 x 750 x 700
Weight (approx. & excludes cylinders)	Kilograms	230	100
Power Supply	Phase	Three 20 amp	Single 10 Amp
PH <sub>3</sub> Dispensing	Method	Weight	Time/ Concentration
Safety Interlocks & Alarms		Yes	Yes
Touch Screen Control		Yes	Yes
UltraPhos Cylinders		2	2
Purging Gas (<50 ppm oxygen)		Carbon Dioxide	Carbon Dioxide
Remote Messaging		No	Yes (SMS)
Cylinder Auto change over		Yes	Yes

## 5. UltraPhos Cylinder & Valve

UltraPhos is a cylinderised source of phosphine gas packaged in a high pressure steel cylinder.

The high pressure (40 bar) UltraPhos Cylinder (Tare weight: 63kg) is fitted with a CGA350 outlet brass valve and has capacity of 17kg of  $\text{PH}_3$  (Gross weight: 80 kg).





# 6. UltraPhos Cylinder Opening /Closing / Connection Instructions

BEFORE HANDLING ULTRAPHOS CYLINDERS REFER SDS FOR APPROPRIATE PPE TO BE USED

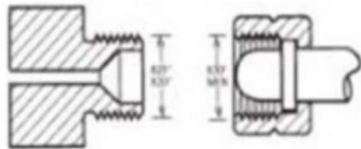
## A. Connecting Phosphine Hose from LoFlo System to Cylinder Valve Outlet

### Phosphine Hose Torque Wrench



This torque wrench is used with CGA 350 valve outlet and bull nose inlet connection attached to the LoFlo Phosphine Hose Nut. The torque wrench is set to 60 Nm to meet the Guidelines for Sealing CGA Valve Outlet Connections by the US Compressed Gas Association.

UltraPhos Valve Outlet      LoFlo Phosphine Hose



## Instructions A

1. Position UltraPhos cylinders securely on the weighing platforms using the chain provided before connection to LoFlo System.
2. Remove the Cylinder Caps.
3. Ensure the valve is closed using the Valve Handwheel Torque Wrench (Instructions C below).
4. Remove the Valve Outlet Cap with the 29 mm Short Spanner or alternative spanner (Instructions D below).
5. Check there is no damage to the threads of the Valve Outlet and Phosphine Hose Nut and they are clean.
6. Connect the Phosphine Hose Nut to the valve outlet and tighten anti clockwise by hand for approximately 4 turns.
7. When unable to tighten further by hand use the Phosphine Hose Torque Wrench (60 Nm) to tighten anti clockwise until the operator hears a “click” from the torque wrench. The “click” indicates the correct amount of torque has been reached ensuring a gas tight seal. Do not tighten further or damage to the valve can occur.
8. An alternative torque wrench can be used set to 60 Nm.

## **B. Opening UltraPhos Cylinder Valve**

### Instructions B

1. Do not open UltraPhos cylinder valves until the LoFlo System PLC screen instructs the operator to open.
2. To open the valves turn the handwheel to the fully open position on both cylinders which is approximately  $\frac{3}{4}$  of a turn and then close  $\frac{1}{4}$  turn leaving the Valve Handwheel to freely turn in either direction. This allows the operator to know the position of the valve is open. Never lock the valve in the fully open position.

## C. Closing UltraPhos Cylinder Valve

### Handwheel Torque Wrench



This torque wrench is set to 8 Nm to meet the valve manufacturer's requirement for tightening of the handwheel when closing the valve after use. The valve consists of a soft seat and over tightening will damage the valve and can result in the valve leaking.

### Instructions C:

1. The cylinder valves are ready to be closed when the LoFlo System PLC screen instructs the operator to do so.
2. Check handwheel is free to rotate in both directions before closing. This ensures the valve is not locked open.
3. Operator places the torque wrench in position on the valve handwheel and then turns the torque wrench clockwise until the operator hears a "click" from the torque wrench. The "click" indicates the valve is closed with the correct amount of torque applied. Do not tighten further or damage to the valve seat will occur.

## **D. Valve Outlet Cap Removal & Tightening**

### **Short Spanner 29 mm**



The Short Spanner 29 mm is to be used for tightening the Valve Outlet Cap after use and can be used for removing the Valve Outlet Cap. This spanner is used to minimise the risk of over tightening.

### **Instructions D**

1. Check there is no damage to the valve outlet or Valve Outlet Cap threads and they are clean.
2. Hand tighten the Valve Outlet Cap for approximately 4 turns anti-clockwise until unable to tighten further.
3. Use the Short Spanner 29 mm to “Nip” tighten the Valve Outlet Cap at the final stage.
4. An alternative spanner can be used.

# 7. System Procedures

## Set Up

Before operating the UltraPhos LoFlo System, the following Set Up procedure is to be followed.

### 1. Position LoFlo System

- a. System to be in a well ventilated area
- b. Out of direct sunlight.
- c. Located on stable surface.

### 2. Connect 2 UltraPhos Cylinders

- a. Always connect 2 UltraPhos cylinders. Locate and secure the 2 cylinders using the chains provided.
- b. Remove Cylinder Caps.
- c. Check the cylinder handwheel is in the closed position using the Handwheel Torque Wrench.
- d. Remove Valve Outlet Cap by turning clockwise.
- e. Hand Tighten LoFlo System connecting hoses to the cylinder valve outlet by turning anticlockwise for 4 turns. If resistance is encountered while tightening by hand disconnect the hose and re connect to avoid potential cross threading damaging the valve outlet. Continue tightening nut with Phosphine Hose Torque Wrench or alternative. **NEVER USE EXCESSIVE FORCE.**

### 3. Connect Carbon Dioxide Cylinder

- a. Hand tighten carbon dioxide connecting hose to the carbon dioxide cylinder valve outlet by turning clockwise for 4 turns. Continue tightening nut with suitable spanner to recommended torque by carbon dioxide cylinder supplier.
- b. Open carbon dioxide cylinder valve.

### 4. Connect UltraPhos/Air Delivery Hose to LoFlo System & External Storage

- a. Connect UltraPhos/air delivery hose to the Camlock fitting on the LoFlo System . The hose is 3 metres long and diameter of 1.5 inches nominal. If the length of the hose needs to be extended a larger diameter is required. Consult manufacturer.

- b. Connect delivery hose to the external storage and ensure no air blockages or restrictions.

#### **5. Power Connection**

- a. Connect power lead to single phase power source.
- b. Turn on power switch.

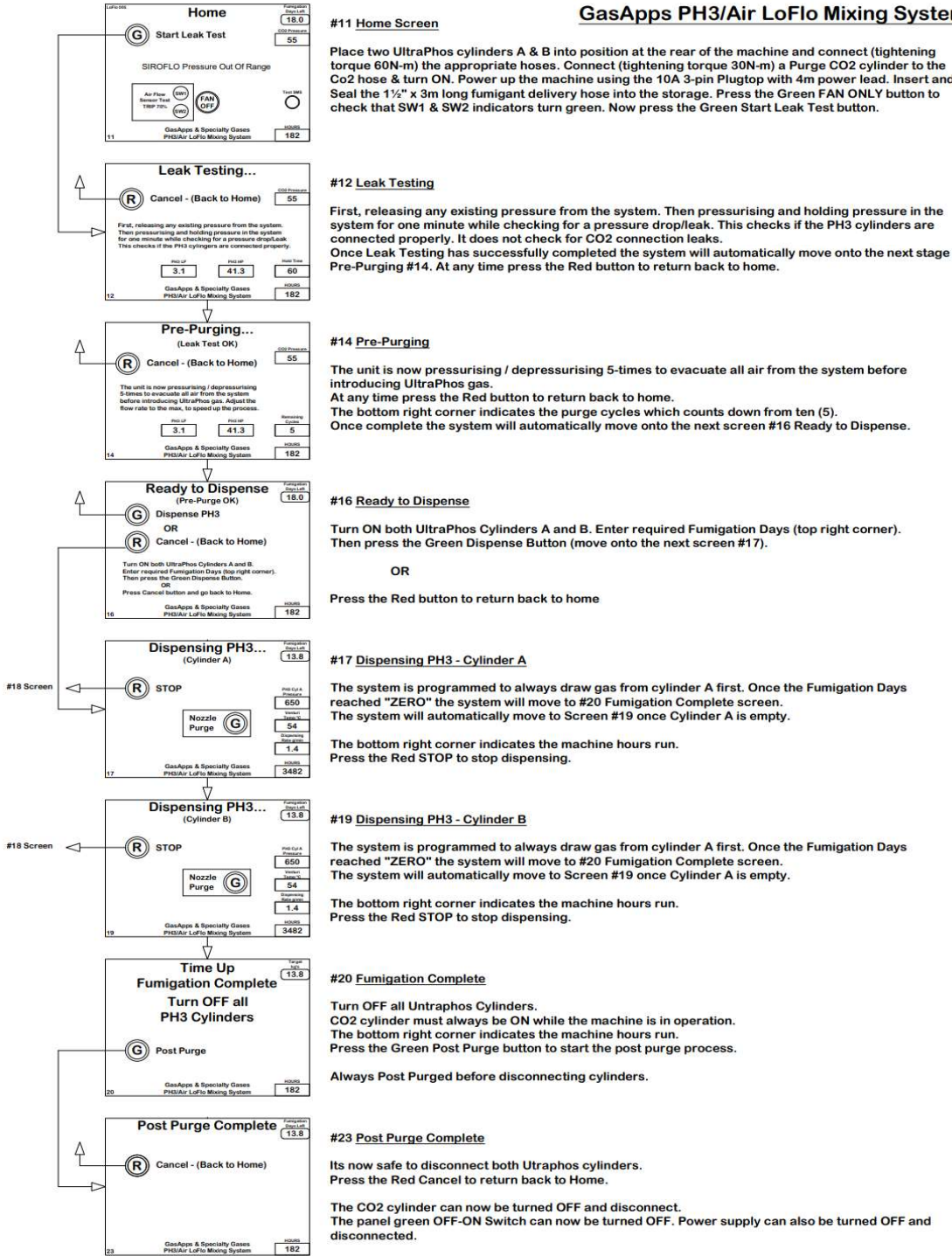
#### **6. Follow LoFlo System Screen Instructions**

Note: If external fan is not being used set the Photohelic gauge (Siroflo Pressure Gauge & Switch) low level adjustment (left knob) to minimum setting and high level adjustment (right knob) to maximum setting.

# Main LoFlo System Screens

The System allows the operator to control the fumigation process via a PLC touch screen. The 8 main system screens are shown in the following flow chart.

## GasApps PH3/Air LoFlo Mixing System

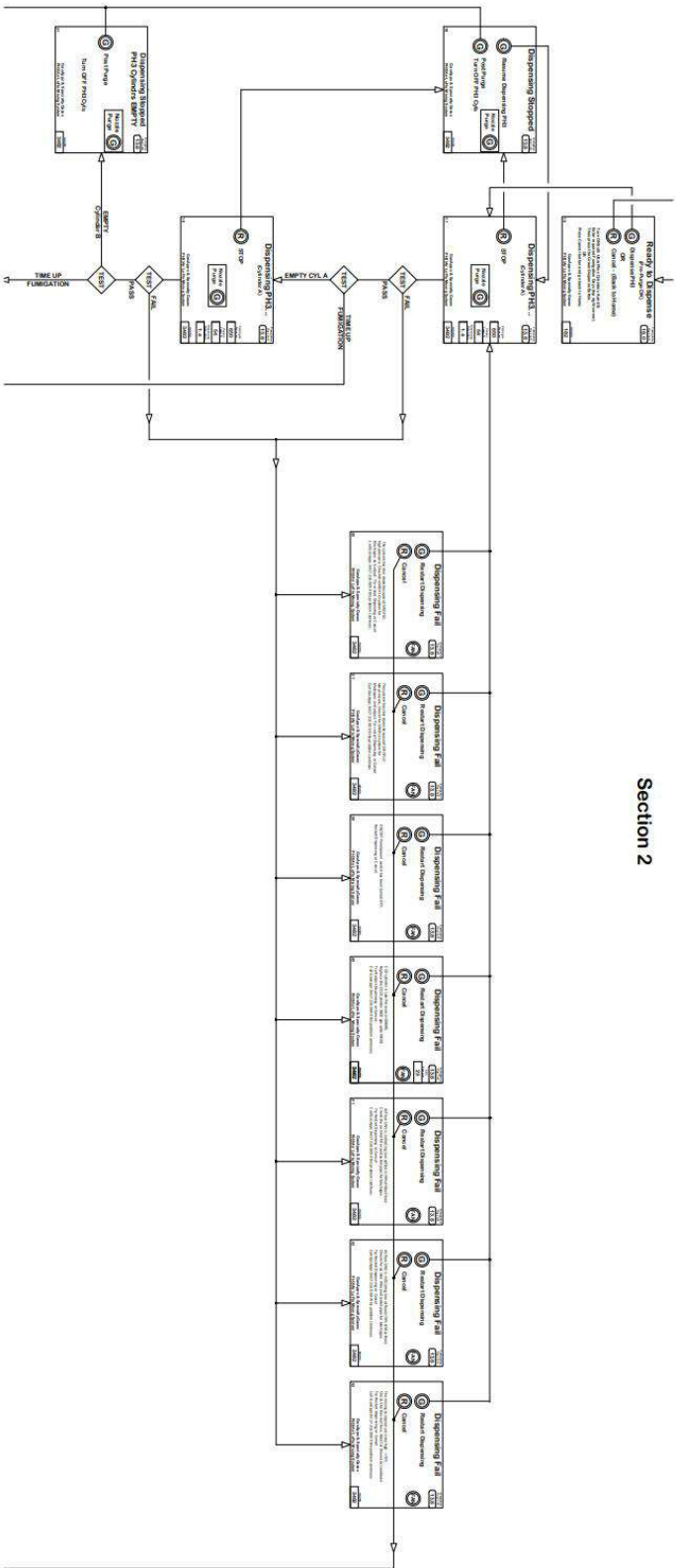


## **Complete LoFlo System Screens**

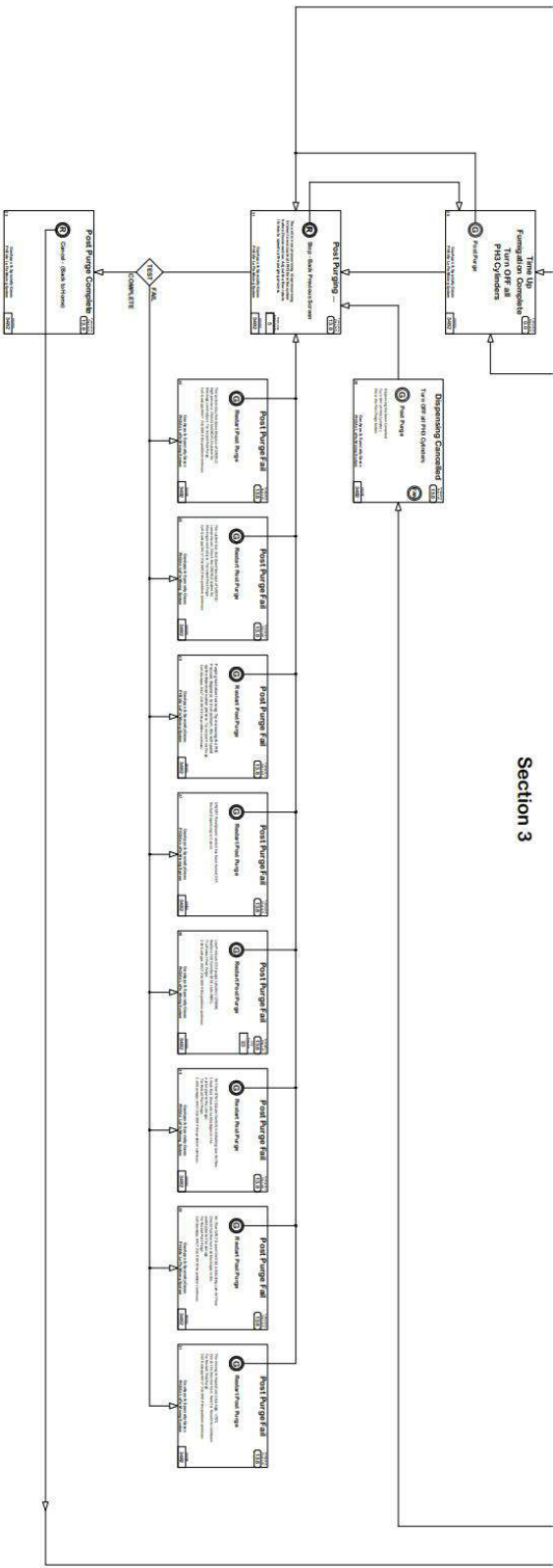
The following 3 flow charts show all the System Screens including errors.







Section 2



Section 3

## Shutdown Instructions

Follow instructions for shutdown of the System when Fumigation Complete screen reached (20).

- a. Close UltraPhos cylinder valves (refer instructions in section 5 C) and then press Post Purge button.
- b. On Post Purge Complete screen (23) press red Cancel button to return to Home screen (11).
- c. Turn off power.
- d. Disconnect UltraPhos cylinders A & B and replace hose plugs tightening using spanners. (Do not leave hand tightened as air can enter the hoses).
- e. Replace Valve Outlet Caps following Cylinder Handling Instructions in section 6 D.
- f. Replace Cylinder Caps.
- g. Turn off carbon dioxide cylinder and disconnect hose and replace carbon dioxide hose plug.
- h. Disconnect UltraPhos/air delivery line from the external storage.
- i. Remove delivery line from LoFlo System and replace Camlock Cap.
- j. Prior to moving LoFlo System ensure cylinders are unchained and removed from System. Never transport the LoFlo System with cylinders connected.

# SAFETY DATA SHEET

<b>Product:</b>	UltraPhos® Phosphine Fumigant	<b>Date Prepared:</b> 29 September 2022
<b>Company:</b>	Specialty Gases Pty Ltd	<b>Replaces:</b> 13 Dec 2021
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## 1 IDENTIFICATION

<b>Product Name:</b>	UltraPhos® Phosphine Fumigant
<b>Other Names:</b>	Phosphine gas
<b>Chemical Names:</b>	Phosphine
<b>Uses:</b>	Fumigant
<b>Supplier</b>	
<b>Name:</b>	Specialty Gases Pty Ltd
<b>Address:</b>	Suite 18, 12 Tryon Road, Lindfield, NSW 2070
<b>Telephone:</b>	1300 55 71 00
<b>Email:</b>	info@specialtygases.com.au
<b>Emergency Telephone:</b>	1300 55 71 00

Please ensure you refer to the limitations of this Safety Data Sheet as set out in Section 16 "Other Information."

## 2 HAZARDS IDENTIFICATION

The hazard information contained in this section is for non-users handling the product and its ingredients. Users should refer to the APVMA approved label on the container for advice in relation to use and handling of the product.

Classified as hazardous according to the criteria of the GHS as adopted in Australia. A Dangerous Good according to ADG 7.7.

### Hazard Class and Category:

Flammable Gas Category 1  
Gas Under Pressure, Liquefied Gas  
Acute Toxicity (Inhalation) Category 2  
Skin Corrosion/Irritation Category 1B  
Serious eye damage/eye irritation, Category 1  
Aquatic Toxicity Acute) Category 1

### Hazard Statements:

H220: Extremely flammable gas  
H280: Contains gas under pressure; may explode if heated  
H330: Fatal if inhaled  
H314: Causes severe skin burns and eye damage  
H400: Very toxic to aquatic life

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**Signal Word: Danger**  
**Poison Schedule: 7**



## Precautionary Statements:

### Prevention

- P210: Keep away from heat/sparks/open flames/hot surfaces - No smoking.
- P260 & P271: Do not breathe gas. Use only outdoors or in a well-ventilated area.
- P284: Wear respiratory protection.
- P264: Wash exposed skin thoroughly after handling.
- P280: Wear protective gloves/protective clothing/eye protection/face protection.
- P273: Avoid release to the environment.

### Response

- P377 & P381: **Leaking gas fire:** Do not extinguish, unless leak can be stopped safely. In case of leakage eliminate all ignition sources if safe to do so.
- P304 + P340 + P310: **IF INHALED:** Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor.
- P301 + P330 + P331: **IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting.
- P303 + P361 + P353: **IF ON SKIN (or hair):** Remove/Take off immediately all contaminated clothing. Rinse skin with water or shower.
- P304 + P340: Wash contaminated clothing before reuse.
- P305 + P351 + P338: **IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.
- P391: Collect spillage.

### Storage

- P410+ P403+ P233 + P405: Protect from sunlight. Store in a well-ventilated place. Keep container tightly closed. Store locked up.

### Disposal

- P501: Dispose of contents/container in accordance with local regulations.

### Other hazards

- May ignite spontaneously in contact with air.

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## 3 COMPOSITION AND INFORMATION ON INGREDIENTS

Substance Name	CAS Number	Concentration % (w/w)
Phosphine	7803-51-2	99

## 4 FIRST-AID MEASURES

**If poisoning occurs, contact a doctor or Poisons Information Centre.  
Phone 13 11 26.**

<b>First-Aid</b>	Eye wash facilities and safety shower should be available.
<b>Ingestion</b>	Not an expected route of exposure. If ingested: Immediately remove the patient/victim from the source of exposure. Ensure that the patient/victim has an unobstructed airway. Do not induce vomiting (emesis). See the Inhalation section for first aid recommendations. Seek medical attention immediately.
<b>Inhalation</b>	Immediately remove the patient/victim from the source of exposure to uncontaminated area. Evaluate respiratory function and pulse. Ensure that the patient/victim has an unobstructed airway.  Seek medical attention immediately.  First responders/rescuers must use personal protective equipment including respiratory protection (SCBA preferred) during rescue  Perform cardiopulmonary resuscitation if breathing stopped. Always use a barrier or bag-valve-mask device.
<b>Skin Contact</b>	Immediately remove the patient/victim from the source of exposure. In cases of contact with liquid agent (compressed gas), thaw frostbitten skin with lukewarm (NOT HOT) water; gently remove clothing from the affected area. Dry with clean towels and keep the victim warm and quiet. Apply a sterile dressing. Seek medical attention immediately.
<b>Eye Contact</b>	Immediately remove the patient/victim from the source of exposure. Immediately wash eyes with large amounts of tepid water for at least 15 minutes. If frostbite occurs from contact with liquid (compressed) phosphine, thaw with lukewarm water. Seek medical attention immediately.

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<b>Advice to Doctor:</b>	<p>If the patient is unconscious and breathing stops, immediately ventilate artificially and if the heart stops, begin cardiopulmonary resuscitation. In case of ingestion, after consideration of tracheal intubation, perform gastric aspiration and lavage with cold water and preferably sodium bicarbonate solution (2%). Do not give milk, fats or saline emetics. Administration of repeated doses of activated charcoal through the gastric tube may be useful. Monitor and support vital functions, particularly cardiopulmonary, G.I., renal and hepatic functions.</p> <p>Treat shock conventionally and correct acidosis based on blood gas analyses.</p> <p>No antidote is available for phosphine poisoning.</p> <p>Early recognition and management of the poisoning is essential.</p>
<b>Symptoms caused by exposure</b>	<p>May cause severe chemical burns to skin and cornea. Suitable first-aid treatment should be immediately available. Seek medical advice before using product.</p> <p>Delayed adverse effects possible.</p> <p>Material is destructive to tissue of the mucous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea.</p> <p>Refer to section 11.</p>

## 5 FIRE-FIGHTING MEASURES

<b>Suitable Extinguishing Equipment:</b>	<p>For small fires, use dry chemical, carbon dioxide, water spray, or alcohol-resistant foam.</p> <p>For large fires, use water spray, fog, or alcohol-resistant foam</p>
<b>Flash Point:</b>	Phosphine in air mixtures can be explosive.
<b>Explosion Limit</b> <b>Lower:</b> <b>Upper</b>	<p>1.6%</p> <p>98.0%</p>
<b>Hazards from Combustion Products:</b>	When burnt phosphine releases phosphorous oxides such as phosphorus pentoxide as a dense white cloud of a severe respiratory irritant.



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<b>Precautions for Fire-Fighters</b>	<p>Containers may rupture or explode. Leaking gas can be ignited from distance resulting in flash back.</p> <p>Vapours are heavier than air. They will spread along the ground and collect and stay in poorly-ventilated, low-lying, or confined areas (e.g., sewers, basements, and tanks). Hazardous concentrations may develop quickly in enclosed, poorly-ventilated, or low-lying areas. Keep out of these areas. Stay upwind.</p> <p>Fire-fighters should wear full protective equipment including chemical resistant clothing and SCBA. Fight fire from safe distance. Keep containers cool by spraying with water. Remove containers only if safe to do so.</p> <p>If a bulk tank or truck loaded with cylinders is involved in a fire, isolate it for at least 1500 m in all directions; also consider initial evacuation 1500 m in all directions.</p>
<b>HAZCHEM CODE</b>	2PE

## 6 ACCIDENTAL RELEASE MEASURES

### Personal Precautions, Protective Equipment and Emergency Procedures:

Do not enter potentially contaminated air unless monitoring has confirmed concentrations are below allowable exposure limits. If concentration is above acceptable exposure limit or is not known when handling the product wear suitable respiratory protection, eye and face protection and chemical resistant overalls, buttoned to the neck and wrist and chemical resistant gloves and chemical resistant, safety footwear. Self-contained breathing apparatus (SCBA) preferred if exposure limits might be exceeded.

#### Small spills

First isolate in all directions (60 m). Then protect persons downwind, during the day (0.7 km) and the night (3.0 km).

#### Large spills

First isolate in all directions: (450 m). Then protect persons downwind during the day (4.3 km) and the night (9.6 km).

### Environmental Precautions:

Take precautions to prevent gas escaping but only if safe to do so. Reduce vapour with fog or fine water spray.

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**Containment:**

Shut off leakage if safe to do so. Prevent entry into waterways, drains and confined areas. Use water spray, fog or vapour-suppressing foam to knock down vapours or divert vapour clouds. Do not direct water at source of spill or leak.

**Clean Up:**

Volatile substance. Provide ventilation. Forced air ventilation using explosion resistant fan may be required. Ensure all equipment used in clean-up is grounded. Keep area evacuated and free from ignition sources until any spilled liquid has evaporated (ground free from frost). Hose down area with water. Wash contaminated equipment or sites of leaks with copious quantities of water.

## 7 HANDLING AND STORAGE

**Handling:**

Do not breathe gas. Only use with adequate ventilation. Avoid release of product into atmosphere. Where concentration is not known or monitoring has confirmed levels are above permitted exposure limits wear full protective equipment including self-contained breathing apparatus (SCBA). Do not handle if there is risk of ignition. Keep away from ignition sources (including static discharges).

Only experienced and properly instructed persons should handle gases under pressure. Consider pressure relief device(s) in gas installations. Ensure the complete gas system is regularly checked for leaks before use.

Purge system with dry inert gas (e.g., nitrogen or carbon dioxide) before gas is introduced and when system is taken out of service. Avoid suck back of water, acid and alkalis.

Assess the risk of potentially explosive atmospheres and the need for explosion-proof equipment. Purge air from system before introducing gas. Take precautionary measures against static discharge.

Do not eat, drink or smoke when handling product.

Do not allow back flow into the cylinder. Protect cylinders from physical damage; do not drag, roll, slide or drop. Leave valve protection caps in place until the cylinder has been secured. If difficulty operating the valve occurs discontinue use and contact supplier. Never attempt to repair or modify cylinder valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Keep cylinder valve outlets clean and free from contaminants particularly oil and water.

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Replace valve outlet caps or plugs and cylinder caps where supplied as soon as cylinder is disconnected from equipment. Close cylinder valve after each use and when empty, even if still connected to equipment. Never attempt to transfer gases from one cylinder/container to another. Never use direct flame or electrical heating devices to raise the pressure of a cylinder. Do not remove or deface labels provided by the supplier for the identification of the content of the cylinder. Suck back of water into the cylinder must be prevented. Open valve slowly to avoid pressure shock.

### Requirements for Storage Areas and Containers:

Store to be locked up. Protect from sunlight. Store in a cool well-ventilated, fire-resistant place preferably outdoors away from sources of ignition. All electrical equipment in the storage areas should be compatible with the risk of a potentially explosive atmosphere. Store cylinders secured and upright. Keep cylinder valve closed and with valve outlet cap and valve protection cap in place. Keep away from combustible materials. Segregate from oxidant gases and other oxidants in store. Keep out of reach of children and unauthorised persons and away from dwellings, animals, food, feedstuffs, seeds and fertilisers.

## 8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Occupational Exposure Limits: Exposure limits have been established by Safe Work Australia for this product.

Substance	TWA (ppm)	TWA (mg/m <sup>3</sup> )	STEL (ppm)	STEL (mg/m <sup>3</sup> )	Comments
Phosphine	0.3	0.42	1	1.4	

### Engineering Controls:

Product to be handled in a closed system and under strictly controlled conditions. Preferably use permanent leak-tight installations (e.g. welded pipes). Systems under pressure should be regularly checked for leakages. Maintain vapour levels below the recommended exposure standard.

Where an inhalation risk exists, mechanical extraction/forced air ventilation is recommended if monitoring indicates levels above or could exceed permitted exposure levels. Gas detectors should be used when toxic gases may be released. Ensure ventilation equipment is explosion resistant.

Isolate all potential sources of ignition. Consider the use of a work permit system e.g., for maintenance activities.

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## Personal Protective Equipment:

A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select appropriate PPE. PPE compliant to the recommended AS/NZS standards should be selected.

## Respiratory Protection:

Use gas filters with full face mask, where exposure limits may be exceeded for a short-term period, e.g., connecting or disconnecting containers. AS/NZS 1715 recommends a cartridge change schedule be developed instead of relying on contaminant warning properties. It is recommended to consult a reputable filter supplier for a suitable filter such a Filter B (grey). Gas filters do not protect against oxygen deficiency. Keep self-contained breathing apparatus readily available for emergency use. Self-contained breathing apparatus is recommended, where unknown exposure may be expected, e.g., during maintenance activities on installation systems.

## Eye and Face Protection:

Full facepiece respirator with combined dust and gas cartridge or supplied air respirator – see respiratory protection. Provide eyewash and safety shower near potential areas of exposure.

## Skin and Body Protection:

Chemical resistant clothing buttoned to neck and wrist. Wear cold insulating and chemical resistant gloves when transfilling or breaking transfer connections. Consult glove manufacturer's product information on material suitability and material thickness. The breakthrough time of the selected gloves must be greater than the intended use period. Wear chemical resistant safety footwear. Provide eyewash and safety shower near potential areas of exposure.

## Thermal Hazards:

Keep suitable chemically resistant protective clothing readily available for emergency use. Consider the use of flame resistant anti-static safety clothing. Liquid can cause burns. Wear resistant gloves (see skin and body protection) if there is risk of exposure to liquid.

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## 9 PHYSICAL AND CHEMICAL PROPERTIES

<b>physical state/colour</b>	Colourless gas	<b>pH</b>	Not applicable
<b>odour</b>	Pungent. Fish or garlic like	<b>kinematic viscosity</b>	No reliable data available.
<b>melting point/freezing point</b>	-133°C	<b>solubility</b>	Slightly soluble in water (300 mg/L). Soluble in alcohol and ether.
<b>boiling point or initial boiling point and boiling range</b>	-87.7°C	<b>partition coefficient: n-octanol/water (log value)</b>	Not applicable for inorganic products.
<b>flammability</b>	Extremely flammable gas	<b>vapour pressure</b>	2.93 x 10 <sup>4</sup> mm Hg (3.9 x 10 <sup>6</sup> Pa) at 25°C
<b>lower and upper explosion limit/flammability limit</b>	1.6% - 98.0%	<b>density and/or relative density (water = 1)</b>	0.74
<b>flash point</b>	Not applicable for a gas	<b>relative vapour density,</b>	1.17
<b>Auto-ignition temperature</b>	38°C	<b>particle characteristics</b>	Not applicable
<b>decomposition temperature</b>	Not applicable	<b>Critical Temperature</b>	Phosphine: 51.6 °C

**Other information:** Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

Pure phosphine is unlikely to spontaneously ignite in air at 150°C, however, may ignite spontaneously in the presence of diphosphine P<sub>2</sub>H<sub>4</sub> impurities.

## 10 STABILITY AND REACTIVITY

### Reactivity:

No reactivity hazard other than the effects described in sub-sections below.

### Stability:

Stable under normal conditions and up to 55°C

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## Conditions to Avoid:

Can form explosive mixture with air. May react violently with oxidants. Can ignite spontaneously in air (fire cannot be put out). Can form spontaneous, violently explosive mixture in air.

## Incompatible Materials:

Air and oxidising agents. For additional information on compatibility refer to ISO 11114.

## Hazardous Decomposition Products:

Under normal conditions of storage and use, hazardous decomposition products should not be produced. In a fire phosphorous oxides and hydrogen are produced.

## 11 TOXICOLOGICAL INFORMATION

### Acute Toxicity:

#### Oral:

Not a likely source of exposure.

Rat LD<sub>50</sub> 5 mg/kg

Oral exposure to liquid can result to burns and inhalation of gas.

#### Inhalation:

Highly Toxic: LC50 4 hr: 34 mg/m<sup>3</sup> (rats). Fatal if inhaled. Delayed fatal pulmonary oedema possible.

#### Dermal toxicity:

Can cause burns.

#### Skin Corrosion/Irritation:

Exposure to liquid can cause burns.

#### Eye Irritation/corrosion:

Exposure to liquids can cause serious damage to eyes.

#### Sensitisation:

Not a sensitiser

#### Germ cell mutagenicity:

No known effects from this product.

#### Carcinogenicity:

No known effects from this product.

#### Reproductive toxicity:

No known effects from this product.

#### Specific Target Organ Toxicity:

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<p><b>Single exposure:</b> Severe corrosion to the respiratory tract at high concentrations. Damage to central nervous system. Irritation to the respiratory tract.</p> <p><b>Repeated exposure:</b> No known effects from this product.</p>
<p><b>Aspiration Hazard:</b> Not applicable for gases and gas mixtures.</p>
<p><b>Information on possible routes of exposure:</b> Inhalation, skin and eye contact.</p>
<p><b>Early onset symptoms related to exposure:</b> Acute (short-term) inhalation exposure to phosphine may cause headaches, dizziness, fatigue, drowsiness, burning substernal pain, nausea, vomiting, cough, laboured breathing, chest tightness, pulmonary irritation, pulmonary oedema, and tremors in humans. Convulsions may ensue after an apparent recovery</p>
<p><b>Delayed health effects from exposure:</b> Chronic (long-term) occupational exposure of workers to phosphine may cause inflammation of the nasal cavity and throat, weakness, dizziness, nausea, gastrointestinal, cardiorespiratory, and central nervous system symptomology, jaundice, liver effects, and increased bone density.</p>
<p><b>Exposure levels and health effects:</b> An air concentration of 0.3 ppm TWA is safe for long term exposure, 500 ppm is lethal in 30 minutes, and a concentration of 1,000 ppm is lethal after a few breaths</p>
<p><b>Interactive Effects:</b> No information found.</p>

## 12 ECOLOGICAL INFORMATION

<p><b>Ecotoxicity:</b> A fumigant that can be lethal to organisms if organisms are exposed to the gas. No specific toxicity data found.</p>
<p><b>Persistence and Degradability:</b> If released to air, phosphine will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; and has a reported atmospheric half-life of 5 hours. Phosphine will dissipate rapidly from soil and water surfaces. Studies have shown that sub-surface phosphine may bind to soil.</p>
<p><b>Bioaccumulation Potential</b> No data found:</p>
<p><b>Mobility in Soil:</b> Because of its high volatility, the product is unlikely to cause ground or water pollution. Laboratory studies suggest that phosphine present below the soil surface is quickly adsorbed, but interaction with soil is soil-type dependent. Partition into soil is unlikely.</p>

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**Results of PBT and vPvB assessment:**

Not classified as PBT or vPvB

## 13 DISPOSAL CONSIDERATIONS

**Disposal Methods:**

Cylinders remain the property of Specialty Gases Pty Ltd. Empty cylinders and return container to supplier. Before transporting cylinder ensure they are firmly secured and ensure cylinder valve is closed and not leaking, valve outlet cap nut is correctly fitted, valve protect cap is correctly fitted.

## 14 TRANSPORT INFORMATION

Consult the ADG 7.7, IMDG and ICAO/IATA Codes for all the transport requirements for the specified UN Number.

	Land Transport (ADG 7.7)	Sea Transport (IMDG)*	
<b>UN Number</b>	2199	2199	
<b>UN proper shipping name</b>	PHOSPHINE	PHOSPHINE	
<b>Transport Hazard Class</b>	2.3 (2.1)	2.3 (2.1)	
<b>Packaging Group</b>	None assigned	None assigned	
<b>Marine Pollutant</b>		No	

\* Consult IMDG Code for sea transport and IATA Code for air transport provisions and instructions

<b>Environmental hazards for transport purposes</b>	Classified as an aquatic acute hazard.
<b>Special Precautions for User:</b>	Store cylinders upright. Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. -



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	Ensure valve outlet cap is correctly fitted. - Ensure valve protection cap is correctly fitted.
<b>Hazchem Code:</b>	2PE

## 15 REGULATORY INFORMATION

<b>Poison Scheduling:</b>	S7
<b>APVMA Registration No:</b>	68499

## 16 OTHER RELEVANT INFORMATION

**This product is for use by authorised or licensed persons only.**

### Glossary:

<b>ADG</b>	Australian Code for the Transport of Dangerous Goods by Road & Rail Edition 7.5, 2017
<b>AS/NZS</b>	Australian Standard/New Zealand Standard
<b>BCF:</b>	<b>Bioconcentration Factor</b> - a measure for the characterization of the accumulation of a chemical in an organism. It is defined as the concentration of a chemical in an organism (plants, microorganisms, animals) divided by the concentration in a reference compartment (e.g. food, surrounding water).
<b>CAS Number:</b>	Unique Chemical Abstracts Service Registry Number
<b>EC<sub>50</sub>:</b>	Ecotoxic Concentration 50% – concentration in water which is fatal to 50% of a test population (e.g. daphnia, fish species).
<b>ErC<sub>50</sub></b>	The concentration of test substance which results in a 50 percent reduction in growth rate.
<b>Explosive Limits:</b>	The range of concentrations (% by volume in air) of a flammable gas or vapour that can result in an explosion for ignition in a confined space.
<b>GHS:</b>	Globally Harmonized System of classification and labelling of chemicals (GHS)
<b>Hazchem Code:</b>	Emergency action code of numbers and letters that provide information to emergency services, especially fire fighters
<b>HCIS:</b>	Hazardous Chemical Information System ( <a href="http://hcis.safeworkaustralia.gov.au/HazardousChemical">http://hcis.safeworkaustralia.gov.au/HazardousChemical</a> )
<b>IARC:</b>	International Agency for Research on Cancer
<b>IDLH:</b>	Immediately dangerous to life or health ( <b>IDLH</b> ) is <b>defined</b> by the US National Institute for Occupational Safety and Health (NIOSH)
<b>K<sub>oc</sub></b>	The organic carbon partition coefficient (mL soil water /g organic carbon).
<b>LC<sub>50</sub>:</b>	Lethal Concentration 50% – concentration in air which is fatal to 50% of a test population.
<b>LC<sub>50</sub></b>	The dose of a chemical that will kill 50% of the test animals receiving it.

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<b>NTP:</b>	National Toxicology Program (USA)
<b>pH:</b>	Measure of how acidic or alkaline a material is using a 1 - 14 scale. pH 1 is strongly acidic and pH 14 strongly alkaline
<b>P<sub>ow</sub>:</b>	The octanol-water partition coefficient. Commonly used to indicate potential the fate of chemicals in the environment
<b>SDS:</b>	Safety Data Sheet
<b>STEL:</b>	Short term exposure limit (STEL) means the time-weighted average maximum airborne concentration of a substance calculated over a 15-minute period.
<b>SWA:</b>	Safe Work Australia.
<b>TWA:</b>	8-hour Time-weighted average (TWA) means the maximum average airborne concentration of a substance when calculated over an eight-hour working day, for a five-day working week.
<b>WES:</b>	Workplace exposure standard
<b>UN Number:</b>	United Nations Dangerous Goods Number

## References:

Work Safe Australia Preparation of Safety Data Sheets for Hazardous Chemicals Code of Practice (2020). The exposure standards comply with the Australian Workplace Exposure Standards for Airborne Contaminants. The Dangerous Goods Classification complies with the Australian Code for the Transport of Dangerous Goods by Road & Rail Edition 7.7, 2020. Other information from Work Safe Australia HSIS database, ChemIDPlus and linked databases and the European Chemicals Agency Classification and Labelling database. USA NIOSH and component SDSs.

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## Disclaimer:

This Safety Data Sheet (SDS) has been prepared in compliance with the Work Safe Australia Preparation of Safety Data Sheets for Hazardous Chemicals Code of Practice). The information in this SDS should be provided to all who will use, handle, store, transport, or otherwise be exposed to this product. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Specialty Gases Pty Ltd. shall not be held liable for any damage resulting from handling or from contact with the above product.

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