Phosphorus pentoxide

sc-203187

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
Phosphorus pentoxide

STATEMENT OF HAZARDOUS NATURE

SUPPLIER
Company: Santa Cruz Biotechnology, Inc.
Address: 2145 Delaware Ave
Santa Cruz, CA 95060
Telephone: 800.457.3801 or 831.457.3800
Emergency Tel: CHEMWATCH: From within the US and Canada: 877-715-9305
Emergency Tel: From outside the US and Canada: +800 2436 2255 (1-800-CHEMCALL) or call +613 9573 3112

PRODUCT USE
Dehydrating agent; preparation of phosphorous oxychloride and metaphosphoric acid; surfactants; condensing agent in organic synthesis; sugar refining; laboratory reagent; fire extinguishing; special glass.

SYNONYMS
O5-P2, P2O5, "phosphoric anhydride", "phosphorous oxide", "phosphorous pentoxide", "phosphorous (V) oxide", "phosphorous (V) oxide", "diphosphorous pentoxide", "phosphoric acid anhydride"

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS

EMERGENCY OVERVIEW
RISK
Reacts violently with water.
Toxic by inhalation.
Causes severe burns.
Risk of serious damage to eyes.

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS

SWALLOWED
The material can produce severe chemical burns within the oral cavity and gastrointestinal tract following ingestion.

Accidental ingestion of the material may be damaging to the health of the individual.

Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and esophagus. Immediate pain and difficulties in swallowing and speaking may also be evident. Swelling of the epiglottis may make it difficult to breathe which may result in suffocation. More severe exposure may result in vomiting blood and thick mucus, shock, abnormally low blood pressure, fluctuating pulse, shallow respiration and clammy skin, inflammation of stomach wall, and rupture of esophageal tissue. Untreated shock may eventually result in kidney failure. Severe cases may result in perforation of the stomach and abdominal cavity with consequent infection, rigidity and fever. There may be severe narrowing of the esophageal or pyloric sphincters; this may occur immediately or after a delay of weeks to years. There may be coma and convulsions, followed by death due to infection of the abdominal cavity, kidneys or lungs.

As absorption of phosphates from the bowel is poor, poisoning this way is less likely. Effects can include vomiting, tiredness, fever, diarrhea, low blood pressure, slow pulse, cyanosis, spasms of the wrist, coma and severe body spasms.

**EYE**

- The material can produce severe chemical burns to the eye following direct contact. Vapors or mists may be extremely irritating.
- If applied to the eyes, this material causes severe eye damage.
- Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns. Mild burns of the epithelium generally recover rapidly and completely. Severe burns produce long-lasting and possibly irreversible damage. The appearance of the burn may not be apparent for several weeks after the initial contact. The cornea may ultimately become deeply opaque resulting in blindness.

**SKIN**

- The material can produce severe chemical burns following direct contact with the skin.
- Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.
- The material may cause moderate inflammation of the skin either following direct contact or after a delay of some time. Repeated exposure can cause contact dermatitis which is characterized by redness, swelling and blistering.
- Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue.
- Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

**INHALED**

- Inhalation of dusts, generated by the material, during the course of normal handling, may produce toxic effects.
- The material can cause respiratory irritation in some persons. The body’s response to such irritation can cause further lung damage.
- Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness. Swelling of the lungs can occur, either immediately or after a delay; symptoms of this include chest tightness, shortness of breath, frothy phlegm and cyanosis. Lack of oxygen can cause death hours after onset.

**CHRONIC HEALTH EFFECTS**

- Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and or ulceration of mouth lining. Irritation of Airways to lung, with cough, and inflammation of lung tissue often occurs. Chronic exposure may inflame the skin or conjunctiva.
- Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.
- Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray. Sodium phosphate dibasic can cause stones in the kidney, loss of mineral from the bones and loss of thyroid gland function.

### HAZARD RATINGS

| Flammability: | 0 | 3 |
| Toxicity: | 2 | 3 |
| Body Contact: | 4 | 1 |
| Reactivity: | 2 | 1 |
| Chronic: | 2 | 4 |

**NAME**

| phosphorus pentoxide | 1314-56-3 | >98 |

**CAS RN**

| phosphoric acid | 7664-38-2 |

### Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

**HAZARD RATINGS**

- Flammability: 0
- Toxicity: 3
- Body Contact: 4
- Reactivity: 2
- Chronic: 2

**NAME**

- phosphorus pentoxide: 1314-56-3 >98
- phosphoric acid: 7664-38-2

**Section 4 - FIRST AID MEASURES**

- For advice, contact a Poisons Information Center or a doctor at once.
- Urgent hospital treatment is likely to be needed.
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. Give water to rinse out mouth, then provide liquid slowly and as much as casually can comfortably drink. Transport to hospital or doctor without delay.

**EYE**
- If this product comes in contact with the eyes:
  - Immediately hold eyelids apart and flush the eye continuously with running water.
  - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
  - Continue flushing until advised to stop by the Poisons Information Center or a doctor, or for at least 15 minutes.
  - Transport to hospital or doctor without delay.
  - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**SKIN**
- If skin or hair contact occurs:
  - Immediately flush body and clothes with large amounts of water, using safety shower if available.
  - Quickly remove all contaminated clothing, including footwear.
  - Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Center.
  - Transport to hospital, or doctor.

**INHALED**
- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor, without delay.

**NOTES TO PHYSICIAN**
- For acute or short term repeated exposures to strong acids:
  - Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
  - Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling
  - Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
  - Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the dessicating action of the acid on proteins in specific tissues.

**INGESTION:**
- Immediate dilution (milk or water) within 30 minutes post ingestion is recommended.
- DO NOT attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
- Be careful to avoid further vomit since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
- Charcoal has no place in acid management.
- Some authors suggest the use of lavage within 1 hour of ingestion.

**SKIN:**
- Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- Deep second-degree burns may benefit from topical silver sulfadiazine.

**EYE:**
- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. DO NOT use neutralizing agents or any other additives. Several liters of saline are required.
- Cycloplegic drops, (1% cyclopentolate for short-term use or 5% homatropine for longer term use) antibiotic drops, vasoconstrictive agents or artificial tears may be indicated dependent on the severity of the injury.
- Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

[Ellenhorn and Barceloux: Medical Toxicology]

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**Section 5 - FIRE FIGHTING MEASURES**

<table>
<thead>
<tr>
<th>Vapour Pressure (mmHG):</th>
<th>Not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Explosive Limit (%):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Specific Gravity (water=1):</td>
<td>2.39</td>
</tr>
<tr>
<td>Lower Explosive Limit (%):</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**EXTINGUISHING MEDIA**
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

**FIRE FIGHTING**
- Use water delivered as a fine spray to control fire and cool adjacent area.
- DO NOT approach containers 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.

**GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS**
- Non combustible.
Not considered to be a significant fire risk.
- Acids may react with metals to produce hydrogen, a highly flammable and explosive gas.
- Heating may cause expansion or decomposition leading to violent rupture of rigid containers.
- May emit corrosive, poisonous fumes. May emit acrid smoke.

**Decomposition may produce toxic fumes of: phosphorus oxides (POx).**

**FIRE INCOMPATIBILITY**
- None known.
- Keep dry.
- NOTE: May develop pressure in containers; open carefully. Vent periodically.

**PERSONAL PROTECTION**

**Glasses:**
- Chemical goggles.
- Full face- shield.

**Gloves:**
- Respirator:
- Type B-P Filter of sufficient capacity

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**Section 6 - ACCIDENTAL RELEASE MEASURES**

**MINOR SPILLS**
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Control personal contact by using protective equipment.
- Use dry clean up procedures and avoid generating dust.
- Place in a suitable, labelled container for waste disposal.

**MAJOR SPILLS**
- Clear area of personnel and move upwind.
- Alert Emergency Responders 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 water course.
- Consider evacuation (or protect in place).
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Neutralize/decontaminate residue.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

**PROTECTIVE ACTIONS FOR SPILL**

**FOOTNOTES**
1. PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.

2. PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.

3. INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.

4. SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). LARGER SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a “one-tonne” compressed gas cylinder.


6. IERG information is derived from CANUTEC - Transport Canada.

**ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)**

| AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could | Isolation Distance | Downwind Protection
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>From IERG (Canada/Australia)</td>
<td>25 meters</td>
<td>250 meters</td>
</tr>
</tbody>
</table>
experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

**EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)**

The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing

<table>
<thead>
<tr>
<th>life-threatening health effects is:</th>
<th>phosphorus pentoxide</th>
<th>50mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:</td>
<td>phosphorus pentoxide</td>
<td>10mg/m³</td>
</tr>
<tr>
<td>other than mild, transient adverse effects without perceiving a clearly defined odour is:</td>
<td>phosphorus pentoxide</td>
<td>1mg/m³</td>
</tr>
</tbody>
</table>

American Industrial Hygiene Association (AIHA)

Ingredients considered according exceed the following cutoffs

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Very Toxic (T+)</th>
<th>Toxic (T)</th>
<th>Corrosive (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt;= 0.1%</td>
<td>&gt;= 3.0%</td>
<td></td>
</tr>
<tr>
<td>R50</td>
<td>&gt;= 0.25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R51</td>
<td>&gt;= 2.5%</td>
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</tr>
<tr>
<td>else</td>
<td>&gt;= 10%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

where percentage is percentage of ingredient found in the mixture

**Section 7 - HANDLING AND STORAGE**

**PROCEDURE FOR HANDLING**

- DO NOT use aluminium, galvanised or tin-plated containers
- Avoid all personal contact, including inhalation.
- Use in a well-ventilated area.
- WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
- Avoid smoking, naked lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Launder contaminated clothing before re-use.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

**RECOMMENDED STORAGE METHODS**

- Glass container.
- Lined metal can, Lined metal pail/drum.
- Plastic pail.
- Polyliner drum.
- Packing as recommended by manufacturer.
- Check all containers are clearly labeled and free from leaks.

**STORAGE REQUIREMENTS**

- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer’s storing and handling recommendations.

**SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS**
**Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION**

### EXPOSURE CONTROLS

<table>
<thead>
<tr>
<th>Source</th>
<th>Material</th>
<th>TWA ppm</th>
<th>TWA mg/m³</th>
<th>STEL ppm</th>
<th>STEL mg/m³</th>
<th>Peak ppm</th>
<th>Peak mg/m³</th>
<th>TWA F/CC</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada - British Columbia Occupational Exposure Limits</td>
<td>phosphoric acid (Phosphoric acid)</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - Ontario Occupational Exposure Limits</td>
<td>phosphoric acid (Phosphoric acid)</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>US - Minnesota Permissible Exposure Limits (PELs)</td>
<td>phosphoric acid (Phosphoric acid)</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>US ACGIH Threshold Limit Values (TLV)</td>
<td>phosphoric acid (Phosphoric acid)</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TLV Basis: upper respiratory tract, eye &amp; skin irritation</td>
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<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
<td>phosphoric acid (Phosphoric acid)</td>
<td>1</td>
<td>3</td>
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<td></td>
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<td></td>
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<tr>
<td>Canada - Alberta Occupational Exposure Limits</td>
<td>phosphoric acid (Phosphoric acid)</td>
<td>1</td>
<td>3</td>
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<tr>
<td>US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants</td>
<td>phosphoric acid (Phosphoric acid)</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants</td>
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<td>3</td>
<td></td>
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<tr>
<td>US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants</td>
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<td>3</td>
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<td>US - California Permissible Exposure Limits for Chemical Contaminants</td>
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<tr>
<td>US - Idaho - Limits for Air Contaminants</td>
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<td>1</td>
<td></td>
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<td>US OSHA Permissible Exposure Levels (PELs) - Table Z1</td>
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<td>US - Hawaii Air Contaminant Limits</td>
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<td>3</td>
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<tr>
<td>US - Alaska Limits for Air Contaminants</td>
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<td>1</td>
<td>3</td>
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</tr>
</tbody>
</table>

Note: X: Must not be stored together
O: May be stored together with specific preventions
+: May be stored together
<table>
<thead>
<tr>
<th>Material</th>
<th>Revised IDLH Value (mg/m³)</th>
<th>Revised IDLH Value (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>phosphoric acid</td>
<td>1,000</td>
<td></td>
</tr>
</tbody>
</table>

**EMERGENCY EXPOSURE LIMITS**

**PHOSPHORUS PENTOXIDE:**
- No exposure limits set by NOHSC or ACGIH.
- OES STEL: 2 mg/m³
- CEL TWA: 2 mg/m³
- STEL: 2 mg/m³

**PHOSPHORIC ACID:**
- The saturated vapour concentration of phosphoric acid exceeds the TLV. The TLV-TWA is based by analogy from comparable experience and data for sulfuric acid. Exposure at or below this limit is thought to prevent throat irritation amongst unacclimatised workers.

<table>
<thead>
<tr>
<th>Material</th>
<th>Revised IDLH Value (mg/m³)</th>
<th>Revised IDLH Value (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>phosphoric acid</td>
<td>1,000</td>
<td></td>
</tr>
</tbody>
</table>

**PERSONAL PROTECTION**
- Consult your EHS staff for recommendations
- **EYE**
  - Chemical goggles.
  - Full face shield.
- Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

**HANDS/FEET**
- Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
  - frequency and duration of contact,
  - chemical resistance of glove material,
  - glove thickness and
dexterity
- Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).
- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.
- Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
- Elbow length PVC gloves.

**OTHER**
- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.

**RESPIRATOR**
- Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.
- Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration of contaminant that requires the use of a respirator.
- Use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination of a flash facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

<table>
<thead>
<tr>
<th>Breathing Zone Level ppm (volume)</th>
<th>Maximum Protection Factor</th>
<th>Half-face Respirator</th>
<th>Full-Face Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>10</td>
<td>B-1 P</td>
<td>-</td>
</tr>
<tr>
<td>1000</td>
<td>50</td>
<td>-</td>
<td>B-1 P</td>
</tr>
<tr>
<td>5000</td>
<td>50</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5000</td>
<td>100</td>
<td>-</td>
<td>B-2 P</td>
</tr>
<tr>
<td>10000</td>
<td>100</td>
<td>-</td>
<td>B-3 P</td>
</tr>
<tr>
<td>100+</td>
<td>Airline*</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* - Continuous Flow ** - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

<table>
<thead>
<tr>
<th>Type of Contaminant:</th>
<th>Air Speed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>solvent, vapors, degreasing etc., evaporating from tank (in still air).</td>
<td>0.25-0.5 m/s (50-100 f/min.)</td>
</tr>
<tr>
<td>aerosols, fumes from pouring operations, intermittent container filling, low speed conveyor transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)</td>
<td>0.5-1 m/s (100-200 f/min.)</td>
</tr>
<tr>
<td>direct spray, spray painting in shallow booths, drum filling, conveyor loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)</td>
<td>1-2.5 m/s (200-500 f/min.)</td>
</tr>
<tr>
<td>grinding, abrasive blasting, tumbling, high speed wheel generated ducts (released at high initial velocity into zone of very high rapid air motion).</td>
<td>2.5-10 m/s (500-2000 f/min.)</td>
</tr>
</tbody>
</table>

Within each range the appropriate value depends on:

<table>
<thead>
<tr>
<th>Lower end of the range</th>
<th>Upper end of the range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Room air currents minimal or favorable to capture</td>
<td>1: Disturbing room air currents</td>
</tr>
<tr>
<td>2: Contaminants of low toxicity or of nuisance value only.</td>
<td>2: Contaminants of high toxicity</td>
</tr>
<tr>
<td>3: Intermittent, low production.</td>
<td>3: High production, heavy use</td>
</tr>
<tr>
<td>4: Large hood or large air mass in motion</td>
<td>4: Small hood-local control only</td>
</tr>
</tbody>
</table>

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.
Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES
Solid.
Corrosive.
Acid.
Reacts violently with water.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>Divided solid</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>141.96</td>
</tr>
<tr>
<td>Melting Range (°F)</td>
<td>1076-1085</td>
</tr>
<tr>
<td>Boiling Range (°F)</td>
<td>&gt;572 (sublimes)</td>
</tr>
<tr>
<td>Decomposition Temp (°F)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Boiling Range (°F)</td>
<td>572 (sub)</td>
</tr>
<tr>
<td>Autoignition Temp (°F)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Volatile Component (%vol)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Solubility in water (g/L)</td>
<td>Reacts violently</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>pH (1% solution)</td>
<td>&lt;7</td>
</tr>
<tr>
<td>Vapour Pressure (mmHG)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>pH (as supplied)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Specific Gravity (water=1)</td>
<td>2.39</td>
</tr>
<tr>
<td>Relative Vapor Density (air=1)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

APPEARANCE
Soft, deliquescent white powder with slight phosphorous-like odour. Readily absorbs moisture from the air with avidity forming meta-, pyro- or ortho-phosphoric acid, depending upon amount of water absorbed and upon conditions of absorption. Soluble in sulfuric acid: insoluble in acetone and ammonia. Violent exothermic reaction with water.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY
- Contact with alkaline material liberates heat

STORAGE INCOMPATIBILITY
- In presence of moisture, the material is corrosive to aluminium, zinc and tin producing highly flammable hydrogen gas.
- Contact with moisture or water may generate heat causing ignition
- Avoid strong bases.
- Inorganic acids are generally soluble in water with the release of hydrogen ions. The resulting solutions have pH's of less than 7.0.
- Inorganic acids neutralize chemical bases (for example: amines and inorganic hydroxides) to form salts.
- Neutralization can generate dangerously large amounts of heat in small spaces.
- The dissolution of inorganic acids in water or the dilution of their concentrated solutions with additional water may generate significant heat.
- The addition of water to inorganic acids often generates sufficient heat in the small region of mixing to cause some of the water to boil explosively. The resulting “bumping” can spatter the acid.
- Inorganic acids react with active metals, including such structural metals as aluminum and iron, to release hydrogen, a flammable gas.
- Inorganic acids can initiate the polymerization of certain classes of organic compounds.
- Inorganic acids react with cyanide compounds to release gaseous hydrogen cyanide.
- Inorganic acids generate flammable and/or toxic gases in contact with dithiocarbamates, isocyanates, mercaptans, nitriles, sulfides, and strong reducing agents. Additional gas-generating reactions occur with sulfites, nitrites, thiosulfates (to give H2S and SO3), dithionites (SO2), and even carbonates.
- Acids often catalyze (increase the rate of) chemical reactions.
- Segregate from alcohol, water.
- Phosphates are incompatible with oxidizing and reducing agents.
- Phosphates are susceptible to formation of highly toxic and flammable phosphine gas in the presence of strong reducing agents such as hydrides.
- Partial oxidation of phosphates by oxidizing agents may result in the release of toxic phosphorus oxides.
- Keep dry
- NOTE: May develop pressure in containers; open carefully. Vent periodically.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

phosphorus pentoxide

TOXICITY AND IRRITATION
- unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

<table>
<thead>
<tr>
<th>Route of Exposure</th>
<th>Toxicity</th>
<th>Irritation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation (rat)</td>
<td>LC50: 1217 mg/m³/1h</td>
<td>Eye: SEVERE</td>
</tr>
<tr>
<td>Inhalation (Rabbit)</td>
<td>LC: 5000 mg/m³/2h</td>
<td>Skin : SEVERE</td>
</tr>
</tbody>
</table>

- The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
- The material may cause skin irritation after prolonged or repeated exposure and may produce on contact skin redness,
swelling, the production of vesicles, scaling and thickening of the skin. Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopie individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:
PHOSPHORIC ACID:
PHOSPHORUS PENTOXIDE:
■ DO NOT discharge into sewer or waterways.
■ Prevent, by any means available, spillage from entering drains or watercourses.
PHOSPHORUS PENTOXIDE:
Reacts with water. After reaction, harmful effect on aquatic organisms.
Aquatic organisms LC50: 100 mg/l/96h
PHOSPHORIC ACID:
■ Fish LC50 (96hr.) (mg/l):
  138
■ May cause long-term adverse effects in the aquatic environment.
■ Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
Wastes resulting from use of the product must be disposed of on site or at approved waste sites.
■ On the basis of available evidence concerning either toxicity, persistence, potential to accumulate and or observed environmental fate and behaviour, the material may present a danger, immediate or long-term and/or delayed, to the structure and/or functioning of natural ecosystems.
   ■ Ecotoxicity:
The tolerance of water organisms towards pH margin and variation is diverse. Recommended pH values for test species listed in OECD guidelines are between 6.0 and almost 9. Acute testing with fish showed 96h-LC50 at about pH 3.5.
■ The principal problems of phosphate contamination of the environment relates to eutrophication processes in lakes and ponds. Phosphorus is an essential plant nutrient and is usually the limiting nutrient for blue-green algae. A lake undergoing eutrophication shows a rapid growth of algae in surface waters. Planktonic algae cause turbidity and flotation films. Shore algae cause ugly muddying, films and damage to reeds. Decay of these algae causes oxygen depletion in the deep water and shallow water near the shore. The process is self-perpetuating because anoxic conditions at the sediment/water interface causes the release of more adsorbed phosphates from the sediment. The growth of algae produces undesirable effects on the treatment of water for drinking purposes, on fisheries, and on the use of lakes for recreational purposes.

Ecotoxicity

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Persistence: Water/Soil</th>
<th>Persistence: Air</th>
<th>Bioaccumulation</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>phosphorus pentoxide</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
<tr>
<td>phosphoric acid</td>
<td>HIGH</td>
<td>LOW</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions
A. General Product Information
Corrosivity characteristic: use EPA hazardous waste number D002 (waste code C)
Disposal Instructions
All waste must be handled in accordance with local, state and federal regulations.

■ Recycle wherever possible.
■ Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
■ Treat and neutralize at an approved treatment plant.
■ Treatment should involve: Mixing or slurring in water Neutralization with soda-lime or soda-ash followed by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)
■ Decontaminate empty containers with 5% aqueous sodium hydroxide or soda ash, followed by water. Observe all label safeguards until containers are cleaned and destroyed.

For small quantities:
■ Neutralize an aqueous solution of the material.
■ Filter solids for disposal to approved land fill.
■ Flush solution to sewer (subject to local regulation)
■ Heat and fumes evolved during reaction may be controlled by rate of addition.
■ Puncture containers to prevent re-use and bury at an authorized landfill.

Section 14 - TRANSPORTATION INFORMATION
<table>
<thead>
<tr>
<th>DOT:</th>
<th>Symbols:</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hazard class or Division:</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>UN/ID Number:</td>
<td>1807</td>
</tr>
<tr>
<td></td>
<td>Special provisions:</td>
<td>Non-bulk:</td>
</tr>
<tr>
<td></td>
<td>ICAO/IATA Subrisk:</td>
<td>8</td>
</tr>
<tr>
<td>Air Transport IATA:</td>
<td>UN Number:</td>
<td>1807</td>
</tr>
<tr>
<td></td>
<td>EMS Number:</td>
<td>F-A,S-B</td>
</tr>
<tr>
<td></td>
<td>Limited Quantities:</td>
<td>1 kg</td>
</tr>
<tr>
<td></td>
<td>Shipping Name:</td>
<td>PHOSPHORUS PENTOXIDE</td>
</tr>
</tbody>
</table>

**Maritime Transport IMDG:**

- **ICAO/IATA Class:** 8
- **ICAO/IATA Subrisk:** None
- **UN Number:** 1807
- **Packing Group:** II
- **EMS Number:** F-A,S-B
- **Special provisions:** None
- **Limited Quantities:** 1 kg
- **Shipping Name:** PHOSPHORUS PENTOXIDE

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**Section 15 - REGULATORY INFORMATION**

**phosphorus pentoxide (CAS: 1314-56-3) is found on the following regulatory lists:**

- "Canada Domestic Substances List (DSL)"
- "Canada Ingredient Disclosure List (SOR/88-64)"
- "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)"
- "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)"
- "International Council of Chemical Associations (ICCA) - High Production Volume List, OECD Representative List of High Production Volume (HPV) Chemicals"
- "US - California Air Toxics 'Hot Spots' List (Assembly Bill 2588)"
- "US - Massachusetts Oil & Hazardous Materials Material List"
- "US - New Jersey Right to Know Hazardous Substances"
- "US - Pennsylvania - Hazardous Substance List"
- "US DOE Temporary Emergency Exposure Limits (TEELs)"
- "US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide"
- "US Toxic Substances Control Act (TSCA) - Inventory"
- Regulations for ingredients

**phosphoric acid (CAS: 7664-38-2,16271-20-8) is found on the following regulatory lists:**

- "Canada - Alberta Occupational Exposure Limits"
- "Canada - British Columbia Occupational Exposure Limits"
- "Canada - California Permissible Exposure Limits for Chemical Contaminants"
- "Canada - California Toxic Air Contaminant List - Category II"
- "Canada - California Toxic Air Contaminant List - Category I""
- "Canada - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List"
- "Canada - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELS)"
- "Canada - Montana Permissible Exposure Limits for Chemical Contaminants"
- "Canada - Minnesota Permissible Exposure Limits for Chemical Contaminants"
- "Canada - New Jersey Right to Know Hazardous Substances"
- "Canada - Oregon Permissible Exposure Limits (Z1)"
- "Canada - Pennsylvania - Hazardous Substance List"
- "Canada - Rhode Island Hazardous Substance List"
- "Canada - Tennessee Occupational Exposure Limits - Limits For Air Contaminants"
- "Canada - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants"
- "Canada - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants"
- "Canada - Washington Permissible exposure limits of air contaminants"
- "Canada - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants"
- "US ACGIH Threshold Limit Values (TLV)"
- "US CWA (Clean Water Act) - List of Hazardous Substances"
- "US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances"
- "US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardious Substances Other Than Radionuclides"
- "US DOE Temporary Emergency Exposure Limits (TEELs)"
- "US EPA High Production Volume Chemicals Additional List"
- "US FDA Food Additive Database"
- "US List of Lists - Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act"
LIMITED EVIDENCE

- Skin contact and/or ingestion may produce health damage*.
- Cumulative effects may result following exposure*.

* (limited evidence).

Ingredients with multiple CAS Nos

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>phosphoric acid</td>
<td>7664-38-2, 16271-20-8</td>
</tr>
</tbody>
</table>

Reasonable care has been taken in the preparation of this information, but the author makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The author makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use. For additional technical information please call our toxicology department on +800 CHEMCALL.

Classification of the mixture and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references. A list of reference resources used to assist the committee may be found at: www.chemwatch.net/references.

The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.