PHOSPHOROUS RED

(PHOSPHORUS, RED)

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
PHOSPHORUS, RED

OTHER NAMES
P, "elemental phosphorus", "amorphous red phosphorus"

PROPER SHIPPING NAME
PHOSPHORUS, AMORPHOUS

PRODUCT USE
Manufacture of phosphorus trichloride, phosphor bronzes, metallic phosphides. Additive in semiconductors, electroluminescent coatings. Component of safety matches.

SUPPLIER
Company: S D FINE - CHEM LIMITED
Address:
315- 317, T.V.IND.ESTATE,
248 WORLI ROAD,
MUMBAI- 400 030, INDIA
technical@sdfine.com
Telephone: 91- 22 24959898
Telephone: 91- 22 24959899
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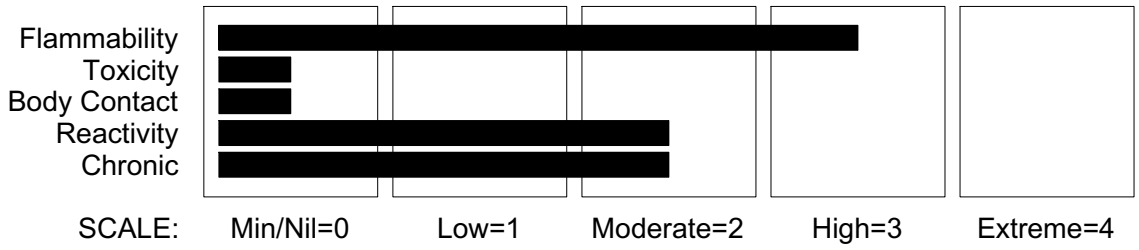
Section 2 - HAZARDS IDENTIFICATION

HAZARD RATINGS



GHS Classification

Acute Aquatic Hazard Category 1
Acute Toxicity (Oral) Category 1
Chronic Aquatic Hazard Category 3
Flammable Solid Category 2

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EMERGENCY OVERVIEW

HAZARD
DANGER
Determined by using GHS criteria:
H228 H300 H412 H400
Flammable solid
Fatal if swallowed
Harmful to aquatic life with long lasting effects
Very toxic to aquatic life

PRECAUTIONARY STATEMENTS

Prevention
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting equipment
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Avoid release to the environment.
Wear protective gloves/protective clothing/eye protection/face protection.

Response
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
Rinse mouth.
Collect spillage.

Storage
Store locked up.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
phosphorus, red	7723-14-0	> 99

Section 4 - FIRST AID MEASURES

SWALLOWED
• Immediately give a glass of water.
• First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

EYE
■ If this product comes in contact with eyes:
• Wash out immediately with water.

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• If irritation continues, seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If dust is inhaled, remove from contaminated area.
• Encourage patient to blow nose to ensure clear passage of breathing.
• If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
■ For SMALL FIRES:
Dry chemical, CO2, water spray or foam.
For LARGE FIRES:
Water-spray, fog or foam.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves.
• Prevent, by any means available, spillage from entering drains or water course.
• Fight fire from a safe distance, with adequate cover.
• If safe, switch off electrical equipment until vapour fire hazard removed.
• Use water delivered as a fine spray to control fire and cool adjacent area.
• Avoid spraying water onto liquid pools.
• 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.

FIRE/EXPLOSION HAZARD
• Flammable solid which burns and propagates flame easily, even when partly wetted with water.
• Any source of ignition, i.e. friction, heat, sparks or flame, may cause fire or explosion.
• May burn fiercely
• May form explosive mixtures with air.
• May REIGNITE after fire is extinguished.
• Containers may explode on heating.
• Solids may melt and flow when heated or involved in a fire.
• Runoff may pollute waterways.
• Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.
• Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport, thereby providing a source of ignition.
• Decomposition products may be irritating, poisonous or corrosive.
Decomposition may produce toxic fumes of: phosphorus oxides (POx).

FIRE INCOMPATIBILITY
■ None known.

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PERSONAL PROTECTION

Glasses:
Chemical goggles.

Respirator:
Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

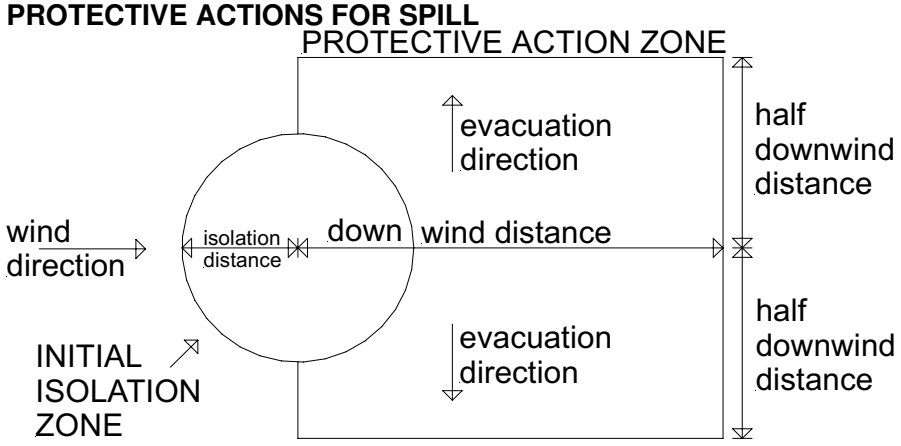
MINOR SPILLS

- Remove all ignition sources.
- DO NOT touch or walk through spilled material.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Prevent dust cloud.
- With clean shovel (preferably non-sparking) place material into clean, dry container and cover loosely.
- Move containers from spill area.
- Control personal contact by using protective equipment.

MAJOR SPILLS

- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- DO NOT touch or walk through spilled material.
- Control personal contact by using protective equipment.
- Prevent, by any means available, spillage from entering drains or water course.
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Contain or cover with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labelled containers for recycling.
- Collect solid residues and seal in labelled drums for disposal.
- Wash area with water and dike for later disposal; 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



From IERG (Canada/Australia)

Isolation Distance	25 metres
Downwind Protection Distance	250 metres
IERG Number	20

FOOTNOTES

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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 packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills".
LARGE 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.
5 Guide 133 is taken from the US DOT emergency response guide book.
6 IERG information is derived from CANUTEC - Transport Canada.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Avoid all personal contact, including inhalation.
• Wear protective clothing when risk of overexposure occurs.
• Use in a well-ventilated area.
• Prevent concentration in hollows and sumps.
• DO NOT enter confined spaces until atmosphere has been checked.
• DO NOT allow material to contact humans, exposed food or food utensils.
• Avoid smoking, naked lights or ignition sources.
• When handling, DO NOT eat, drink or smoke.
• Avoid contact with incompatible materials.
• Keep containers securely sealed when not in use.
• Avoid physical damage to containers.
• Always wash hands with soap and water after handling.
• Working clothes should be laundered separately. Launder contaminated clothing before re-use.
• Use good occupational work practice.
• Observe manufacturer's storing/handling recommendations.
• Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

SUITABLE CONTAINER
■ Store in a dark glass or other suitable light resistant container.
For low viscosity materials and solids:
Drums and jerricans must be of the non-removable head type.
Where a can is to be used as an inner package, the can must have a screwed enclosure.
For materials with a viscosity of at least 2680 cSt. (23 deg. C):
• Removable head packaging and
• cans with friction closures may be used.
-
Where combination packages are used, there must be sufficient inert absorbent material to absorb completely any leakage that may occur, unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.
All combination packages for Packing group I and II must contain cushioning material.

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STORAGE INCOMPATIBILITY

■ White phosphorus has an autoignition temperature only slightly above ambient; dispersed it will soon heat itself to that by the slow oxidation responsible for its glow. Red phosphorus is not spontaneously combustible, however, if it does catch fire, white will be produced, so that the fire, once extinguished, may spontaneously reignite. Both can produce phosphine, amongst other products, by slow reaction with water.
Whereas white phosphorus consists of P4 molecules, spontaneously ignites near room temperature and is highly toxic, red phosphorus is an allotropic modification of elemental phosphorus which is mostly an amorphous polymer so that the physico-chemical properties of red phosphorus are very different from white phosphorus.
The three forms of phosphorus (white, red and black) when heated under normal conditions of pressure produce a vapour made of P4 molecules. Above 1073 K, a dissociation occurs with the formation of P2 molecules. Other polyatomic phosphorus molecules, P3, P6 and P8 are observed under special conditions.
White phosphorus:
- reacts violently in contact with halogens and halides, sulfur, oxidising agents, copper and copper alloys, oxygen.
- reacts with alkali hydroxides to produce highly toxic fumes of phosphine.
- is incompatible with sulfur, iodine, oil of turpentine, potassium chlorate
- emits a week green light and emits white acidic fumes of phosphorus oxides when exposed to air
- readily ignites in air if warmed, finely divided or if held under conditions in which the heat of reaction can build up
- may ignite in contact with finely divided charcoal or lampblack probably as a result of absorbed oxygen
- may ignite on contact with amalgamated aluminium
- when exposed to sunlight or when heated in its own vapour to 250 deg C (in the absence of oxygen), is converted to the red variety, which does not phosphoresce in air as does the white variety (this form does not ignite spontaneously and it is not as dangerous as the white variant; it should, however, be handled with care as it does convert to the white form at some temperatures and it emits highly toxic fumes of the oxides of phosphorus when heated - the red modification is fairly stable, sublimes with a vapor pressure of 1 atm at 417 deg C)

Sealed containers of damp phosphorus (white is often stored under water) may pressurise with highly toxic, pyrophoric, gas mixtures.
White and red phosphorus are similar in terms of reactivity. The crystalline state of each, however, determines their reaction rates.The chemistry of red phosphorus parallels that of yellow/ white phosphorus, but in every case the reactions are less violent. Elemental phosphorus is thermodynamically unstable in the presence of water and oxygen, and red phosphorus will very slowly react via intermediates such as hypophosphorous acid (H_3PO_2), phosphorous acid (H_3PO_3), and phosphine (PH_3) to phosphoric acid (H_3PO_4). These reaction products dissolve in water and contribute to a concentration of total phosphorus compounds (calculated as phosphorus) of 1 mg/L after 24 hours starting from 100 mg/L. Even after 4 months and starting from 10 000 mg/L the concentration of phosphorus compounds reaches only 270 mg/L corresponding to a conversion rate of the red phosphorus of only 2.7 % . Since these disproportionating and hydrolysis reactions proceed at a very slow rate, even critical products like phosphine (not readily soluble in water) will be finally converted to phosphoric acid in oxygen containing environments.
Experiments indicate that the traces of white phosphorus (< 200 mg/kg) present as a contaminant in red phosphorus cannot be readily extracted by water.
Phosphorus, amorphous, red
- is less reactive than white/ yellow phosphorus
- can decomposes into the more hazardous white form at 290 C
- may ignite or explode on contact with oxidisers, or produce shock-sensitive compounds
- is ignited, by strong impact, in air
- when mixed with an oxidiser becomes quite sensitive to friction and ignites or explodes easily
- may contain traces of yellow phosphorus which oxidises to phosphoric acid after exposure to air (it may also, as a result, absorb moisture); this acid corrodes many metals, cotton and other materials - stainless steel may be used for storage.
- also reacts with reducing agents
- reacts with hot alkalies forms toxic and highly flammable phosphine, which usually ignites
- on contact with moisture and oxygen may produce toxic phosphine
- is said to be a mixture of violet phosphorus, imperfect violet phosphorus and amorphous phosphorous
- reacts, possibly violently, with many substances including ammonium nitrate, antimony pentachloride, antimony pentafluoride, ,barium bromate, barium chlorate, barium iodate, barium sulfate, beryllium, boron

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triiodide, bromates, bromine, bromine pentafluoride, bromine trifluoride, bromo azide, calcium chromate, calcium chlorate, calcium iodate, calcium sulfate, caesium acetylene carbide, caesium nitride, chlorates, chlorine, chlorine dioxide, chlorine trifluoride, chlorine monoxide, chlorine trioxide, chlorosulfonic acid, chromic acid, chromic anhydride, chromyl chloride, copper and its alloys, cyanogen iodide, fluorine, dichlorine oxide, dinitrogen pentoxide, halides, halogen azides, hydrogen peroxide, hydriodic acid (forms phosphine gas), iodates, iodine, iodine pentafluoride, iodine trichloride, lead dioxide, lead peroxide, lithium carbide, lithium, lithium silicide, magnesium bromate, magnesium chlorate, magnesium iodate, magnesium perchlorate, manganese, mercuric oxide, mercurous nitrate, metal oxides, nitrates, nitric acid, nitrogen bromide, nitrogen dioxide, nitrogen halides, nitrogen oxide, nitrogen tribromide, nitrogen trichloride, nitrosyl fluoride, nitryl fluoride, oxygen, oxygen difluoride, peroxides, peroxyformic acid, potassium bromate, potassium chlorate, potassium hydroxide, potassium iodate, potassium nitride, potassium permanganate, potassium peroxide, rubidium acetylene carbide, selenium, selenium oxychloride, sliver nitrate, silver oxide, sodium bromate, sodium carbide, sodium chlorate, sodium chlorite, sodium hydroxide, sodium iodate, sodium nitrate, sodium peroxide, sulfates, sulfur, sulfur trioxide, sulfuric acid, thorium, zinc bromate, zinc chlorate, zinc iodate, zirconium

White phosphorus reduces chlorosulfonic acid at 25-39 C and the vigorous reaction accelerates to explosion.
Red phosphorus produces a similar response but at a higher initial temperature.
Both yellow and red phosphorus ignite on contact with fluorine and chlorine; red ignites in liquid bromine.
yellow phosphorus explodes in liquid bromine or chlorine and ignites on contact with bromine vapour or solid iodine. Interaction of bromine and white phosphorus in carbon disulfide gives a slimy by-product which explodes violently on heating. Interaction of phosphorus and iodine in carbon disulfide is rapid.
Dry finely divided mixtures of red (or white),phosphorus with chlorates, bromates or iodates of barium, calcium, magnesium, potassium, sodium or zinc will explode readily on initiation by friction, impact or heat.
Addition of a little water to a mixture white or red phosphorus and potassium iodate causes a violent or explosive reaction.
Phosphorus ignites on contact with antimony pentachloride and explodes with chromyl chloride in the presence of moisture at ambient temperature.

- Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous.
- Avoid contamination with strong oxidising agents as violent reaction may occur, with spontaneous decomposition or explosion.

STORAGE REQUIREMENTS

■ FOR MINOR QUANTITIES:

- Store in an indoor fireproof cabinet or in a room of noncombustible construction.
- Provide adequate portable fire-extinguishers in or near the storage area.

FOR PACKAGE STORAGE:

- Store in original containers in approved flame-proof area.
- No smoking, naked lights, heat or ignition sources.
- DO NOT store in pits, depressions, basements or areas where vapours may be trapped.
- Keep containers securely sealed.
- Store away from incompatible materials in a cool, dry, well ventilated area.
- Protect containers against physical damage and check regularly for leaks.
- Protect containers from exposure to weather and from direct sunlight unless: (a) the packages are of metal or plastic construction; (b) the packages are securely closed are not opened for any purpose while in the area where they are stored and (c) adequate precautions are taken to ensure that rain water, which might become contaminated by the dangerous goods, is collected and disposed of safely.
- Ensure proper stock-control measures are maintained to prevent prolonged storage of dangerous goods.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

+	X	X	X	X	+

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continued...

+: May be stored together
O: May be stored together with specific preventions
X: Must not be stored together

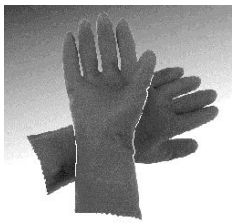
Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

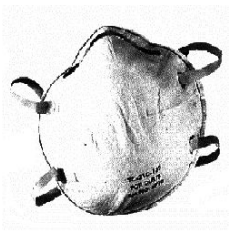
EXPOSURE CONTROLS

Source	Material	TWA mg/m³
Australia Exposure Standards	phosphorus, red (Phosphorus (yellow))	0.1

MATERIAL DATA
PHOSPHORUS, RED:
■ It is the goal of the ACGIH (and other Agencies) to recommend TLVs (or their equivalent) for all substances for which there is evidence of health effects at airborne concentrations encountered in the workplace.
At this time no TLV has been established, even though this material may produce adverse health effects (as evidenced in animal experiments or clinical experience). Airborne concentrations must be maintained as low as is practically possible and occupational exposure must be kept to a minimum.
NOTE: The ACGIH occupational exposure standard for Particles Not Otherwise Specified (P.N.O.S) does NOT apply.
CEL TWA: 0.1 mg/m3 [compare ES TWA: Yellow Phosphorus (Australia)]

PERSONAL PROTECTION






EYE
• Safety glasses with side shields
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

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.

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• 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.
• Wear physical protective gloves, eg. leather.
• Wear safety footwear.

OTHER
• Overalls.
• Eyewash unit.
• Barrier cream.
• Skin cleansing cream.
• Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
• For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets), non sparking safety footwear.

• Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
• The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
• Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory . These may be government mandated or vendor recommended.
• Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
• Use approved positive flow mask if significant quantities of dust becomes airborne.
• Try to avoid creating dust conditions.

RESPIRATOR

Protection Factor	Half- Face Respirator	Full- Face Respirator	Powered Air Respirator
10 x ES	P1 Air- line*	- -	PAPR- P1 -
50 x ES	Air- line**	P2	PAPR- P2
100 x ES	-	P3	-
		Air- line*	-
100+ x ES	-	Air- line**	PAPR- P3

* - Negative pressure demand ** - Continuous flow.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. For further information consult your Occupational Health and Safety Advisor.

ENGINEERING CONTROLS
■ For large scale or continuous use:
• Spark-free, earthed ventilation system, venting directly to the outside and separate from usual ventilation systems
• Provide dust collectors with explosion vents.
• Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
• Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
• If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:

continued...

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks
• Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.
• Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.
Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to efficiently remove the contaminant.

Type of Contaminant:	Air Speed:
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1- 2.5 m/s (200- 500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5- 10 m/s (500- 2000 f/min.)

Within each range the appropriate value depends on:

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

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 4-10 m/s (800-2000 f/min) for extraction of crusher dusts generated 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. 2 m

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Odourless red to violet amorphous polymorpic powder; insoluble in water and most solvents. Soluble in phosphorus tribromide. Slight "fishy" odour.
Red phosphorus is stable and non volatile at room temperature, i.e. not requiring storage under water for safety, as does yellow / white phosphorus.
Red phosphorus may be contaminated with minor amounts of yellow phosphorus.
Converts to the white modification when distilled at 290 degree C.

PHYSICAL PROPERTIES
Solid.
Does not mix with water.

continued...

Sinks in water.

State	Divided solid	Molecular Weight	30.97
Melting Range (°C)	Not available.	Viscosity	Not Applicable
Boiling Range (°C)	280	Solubility in water (g/L)	Immiscible
Flash Point (°C)	Not applicable	pH (1% solution)	Not applicable.
Decomposition Temp (°C)	290	pH (as supplied)	Not applicable
Autoignition Temp (°C)	259	Vapour Pressure (kPa)	Not applicable.
Upper Explosive Limit (%)	Not applicable	Specific Gravity (water=1)	2.34
Lower Explosive Limit (%)	Not applicable	Relative Vapour Density (air=1)	4.77
Volatile Component (%vol)	Not applicable.	Evaporation Rate	Not applicable

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY
• Presence of shock and friction.
• Presence of incompatible materials.
• Product is considered stable.
• Hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED
■ Ingestion may cause stomach pains, vomiting and diarrhoea. Red phosphorus is relatively low-toxicity unless contaminated with white or yellow phosphorus.
■ The material has NOT been classified by EC Directives or other classification systems as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence. The material may still be damaging to the health of the individual, following ingestion, especially where pre-existing organ (eg. liver, kidney) damage is evident. Present definitions of harmful or toxic substances are generally based on doses producing mortality rather than those producing morbidity (disease, ill-health). Gastrointestinal tract discomfort may produce nausea and vomiting. In an occupational setting however, ingestion of insignificant quantities is not thought to be cause for concern.

EYE
■ Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may cause transient discomfort characterised by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result. The material may produce foreign body irritation in certain individuals.

SKIN
■ The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting.
■ Open cuts, abraded or irritated skin should not be exposed to this material.
■ 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.

continued...

INHALED

■ The material is not thought to produce adverse health effects or irritation of the respiratory tract (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.
■ Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.
If prior damage to the circulatory or nervous systems has occurred or if kidney damage has been sustained, proper screenings should be conducted on individuals who may be exposed to further risk if handling and use of the material result
in excessive exposures.

CHRONIC HEALTH EFFECTS

■ Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.
Chronic minor exposure may result in stomach pains, vomiting and diarrhoea. Chronic accidental minor ingestion may produce systemic poisoning characterised by cachexia (general ill-health and malnutrition), anaemia, bronchitis, and necrosis of the mandible and maxilla, the so-called "phossy" or Lucifer's" jaw.
Complaints of possible overexposure among phosphorus workers may be toothache and excessive salivation; there may be dull red appearance of the oral mucosa; one or more teeth may loosen, followed by pain and swelling of the jaw; healing may be delayed following dental processes such as extraction. With necrosis of the bone, sequestra may develop with sinus tract formation. In a series of 10 cases, the shortest period of exposure to phosphorus fume, leading to bone necrosis was 10 months (2 cases) and the longest was 18 years.
Other bones may also be involved as demonstrated by chronic systemic administration to animals which produces dense growth lines in all extremities proximal to the epiphyses (phosphoschicht).
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.

TOXICITY AND IRRITATION

■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY	IRRITATION
Unreported (man) LDLo: 4.41 mg/kg	Nil Reported

REPROTOXIN

phosphorus, red	ILO Chemicals in the electronics industry that have toxic effects on reproduction	Reduced fertility or sterility	H s

Section 12 - ECOLOGICAL INFORMATION

phosphorus, red 96 hr LC50 (0.019) mg/L Channel catfish Fish Source:

Refer to data for ingredients, which follows:

PHOSPHORUS, RED:
■ Hazardous Air Pollutant: Yes

■ Harmful to aquatic organisms, 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.
■ For phosphorus (elemental and amorphous forms);
Environmental fate and ecotoxicity:
Elemental forms appear to be extremely toxic to aquatic species whereas amorphous forms are not.
White phosphorus is hardly soluble in water (about 3 mg/L) so that it can be stored and transported under a

continued...

protective aqueous layer. If white phosphorus is exposed to both water and air under conditions in which it will not ignite, a complex mixture of oxyacids of phosphorus and phosphine is slowly formed at room temperature.
The following chemical reactions occur in water (only qualitative description):
P4 + H2O + O2 -> H3PO2 + H3PO3 + H3PO4 + PH3
Laboratory measurements have failed to detect any phosphine in aqueous extracts of white phosphorus (detection limit of 1 mg/L). As far as the white phosphorus itself is concerned it is not clear whether the solubility of 3 mg/L is due to completely dissolved phosphorus or partly suspended colloidal particles. In either case, this may be the reason for the extraordinary toxicity of white phosphorus to aquatic animals, because it might be incorporated in elemental form. It is claimed that elemental P4 has been detected in the organs of cod fish.
This is a fundamental difference to red phosphorus were no elemental phosphorus in water can be observed. Even the amount of white phosphorus detected in the red phosphorus can not be extracted or dissolved in water. Due to these differences the reaction velocity of red phosphorus with water is much slower compared to white phosphorus, but the main reaction products are also phosphorus containing acids. If the total amount of white phosphorus contained in commercial red phosphorus (upper limit 200 mg/kg) were to dissolve in water,less than 20 ug/l concentration of white phosphorus would be achieved. Bearing in mind that white phosphorus also reacts with water these calculated amounts of white phosphorus can only be achieved theoretically. If traces of white phosphorus are released from the red phosphorus, they probably quickly react to phosphorus containing acids. Laboratory experiments revealed that the yellow phosphorus contained in red phosphorus is not readily extractable with water.
■ DO NOT discharge into sewer or waterways.
■ The material is classified as an ecotoxin* because the Fish LC50 (96 hours) is less than or equal to 0.1 mg/l
* Classification of Substances as Ecotoxic (Dangerous to the Environment)
Appendix 8, Table 1
Compiler's Guide for the Preparation of International Chemical Safety Cards: 1993 Commission of the European Communities.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
phosphorus, red			HIGH	

GESAMP/EHS COMPOSITE LIST - GESAMP Hazard Profiles

Name / Cas No / RTECS No	EHS	TRN	A1a	A1b	A1	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3
- CAS:7723-14-0 / TH3500000	1139	568	Inorg	(3)	(3)	Inorg	6	4	0	0	0	2	1			S	2

Legend:
EHS=EHS Number (EHS=GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships) NRT=Net Register Tonnage, A1a=Bioaccumulation log Pow, A1b=Bioaccumulation BCF, A1=Bioaccumulation, A2=Biodegradation, B1=Acuteaquatic toxicity LC/ECIC50 (mg/l), B2=Chronic aquatic toxicity NOEC (mg/l), C1=Acute mammalian oral toxicity LD50 (mg/kg), C2=Acutemammalian dermal toxicity LD50 (mg/kg), C3=Acute mammalian inhalation toxicity LC50 (mg/kg), D1=Skin irritation & corrosion, D2=Eye irritation& corrosion, D3=Long-term health effects, E1=Tainting, E2=Physical effects on wildlife & benthic habitats, E3=Interference with coastal amenities,
For column A2: R=Readily biodegradable, NR=Not readily biodegradable.
For column D3: C=Carcinogen, M=Mutagenic, R=Reprotoxic, S=Sensitising, A=Aspiration hazard, T=Target organ systemic toxicity, L=Lunginjury, N=Neurotoxic, I=Immunotoxic.
For column E1: NT=Not tainting (tested), T=Tainting test positive.

continued...

For column E2: Fp=Persistent floater, F=Floater, S=Sinking substances.
The numerical scales start from 0 (no hazard), while higher numbers reflect increasing hazard.
(GESAMP/EHS Composite List of Hazard Profiles - Hazard evaluation of substances transported by ships)

Section 13 - DISPOSAL CONSIDERATIONS

■ Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:
• Reduction
• Reuse
• Recycling
• Disposal (if all else fails)
This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.
• DO NOT allow wash water from cleaning or process equipment to enter drains.
• It may be necessary to collect all wash water for treatment before disposal.
• In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
• Where in doubt contact the responsible authority.
• Recycle wherever possible.
• Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
• Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
• Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

Labels Required: FLAMMABLE SOLID

HAZCHEM:
□ 1Z

Land Transport UNDG:

Class or division:	4.1	Subsidiary risk:	None
UN No.:	1338	UN packing group:	III

Shipping Name:PHOSPHORUS, AMORPHOUS

Air Transport IATA:

ICAO/IATA Class:	4.1	ICAO/IATA Subrisk:	None
UN/ID Number:	1338	Packing Group:	III
Special provisions:	None		

Shipping Name: PHOSPHORUS, AMORPHOUS

continued...

Section 14 - TRANSPORTATION INFORMATION

Maritime Transport IMDG:

IMDG Class:	4.1	IMDG Subrisk:	None
UN Number:	1338	Packing Group:	III
EMS Number:	F- A, S- G	Special provisions:	None
Limited Quantities:	5 kg		

Shipping Name: PHOSPHORUS, AMORPHOUS

GESAMP hazard profiles for this material can be found in section 12 of the MSDS.

Section 15 - REGULATORY INFORMATION

REGULATIONS

phosphorus, red (CAS: 7723-14-0) is found on the following regulatory lists;

"Australia - Australian Capital Territory - Environment Protection Regulation: Pollutants entering waterways taken to cause environmental harm (Aquatic habitat)","Australia Exposure Standards","Australia Hazardous Substances","Australia High Volume Industrial Chemical List (HVICL)","Australia Illicit Drug Precursors/Reagents - Category I","Australia Inventory of Chemical Substances (AICS)","Australia National Pollutant Inventory","Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Appendix E (Part 2)","Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Appendix F (Part 3)","Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Appendix G","Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 7","GESAMP/EHS Composite List - GESAMP Hazard Profiles","IMO IBC Code Chapter 17: Summary of minimum requirements","IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk","OECD Representative List of High Production Volume (HPV) Chemicals"

Section 16 - OTHER INFORMATION

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by using available literature 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.

The above information is believed to be accurate and represent the best information currently available to us, but does not represent any warranty expressed or implied of the properties of the product. User should make their own investigation to determine the suitability of the information for their particular purpose.

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