



# Red Phosphorus



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## Recognizing "Red-P"

**Appearance:** Red phosphorus (Red-P) is a solid at room temperature. It is found as crystalline or amorphous granules, or as pills or powder (Figure 1, A.). The color varies from orange-red, to violet, dark red-purple, or dark reddish brown.

**Odor & Odor Threshold:** Not applicable. Red-P is not volatile. It is odorless at room temperature.

**Odor Safety Class:** Red-P is odorless. **Note:** Odor provides no warning of hazard.

## Containers & Packaging

**Commercial:** Red-P is a component of matchbook strike plates (Figure 1, B.). Clandestine methamphetamine lab cooks may use scrapings from matchbook strike plates as a source of Red-P. Red-P is available from chemical supply houses (Figure 1, C.), but it is a U.S.

Drug Enforcement Agency List I chemical and sales are subject to record keeping and reporting requirements. Red-P is also used in electroluminescent coatings, in flame retardants for polymers, in the production of safety matches, pyrotechnics, incendiary shells, smoke bombs, and tracer bullets; as well as in the manufacture of fertilizers, pesticides, and semiconductors. It is also used in organic synthesis reactions and in the manufacture of phosphoric acid, phosphine gas and other phosphorus-containing chemicals.

**Pharmaceutical:** There are no pharmaceutical uses of Red-P.

## Role in Drug Synthesis

Red phosphorus is combined with elemental iodine to produce hydriodic acid (HI). HI is used to convert pseudoephedrine or ephedrine to methamphetamine.

## Health Hazards

**General:** Pure Red-P does not usually represent a significant health hazard. It is essentially non-volatile, insoluble in water, and poorly absorbed into the body. Red-P does react with water vapor and oxygen in air to form extremely toxic phosphine gas, phosphorus oxyacids, white phosphorus, and phosphoric acid. Red-P may also be contaminated with white phosphorus (White-P) and/or yellow phosphorus (Yellow-P), which are toxic. Yellow-P is a form of White-P that contains impurities.

**Inhalation Exposure:** Inhalation of Red-P dust causes respiratory tract irritation, coughing, and bronchitis. If contaminated with White-P, it can also cause liver or kidney damage.

**Skin (Dermal) Exposure:** Prolonged and/or repeated contact with Red-P may cause irritation or dermatitis. If White-P is present, deep, slow healing chemical burns may result. If ignited, Red-P may cause thermal burns.

**Eye Contact:** Red-P can produce eye irritation and corneal injury. If White-P is present, severe irritation and burns may result.

**Ingestion:** Pure Red-P is considered non-toxic. However, if contaminated with White-P, it may cause systemic poisoning. Systemic symptoms include a garlic odor on the breath, irritation of the digestive tract, stomach pains, vomiting, diarrhea, liver and kidney damage, anemia and other blood disorders, and cardiovascular effects, or death. Long term ingestion of Red-P contaminated with White-P may cause jaw bone degeneration ("phossy-jaw").

**Special Concerns for Children:** Children may not recognize the chemical dangers and may be more susceptible to accidental or purposeful exposures.



**Figure 1:** Red phosphorus is easily recognizable as a dark red to purple solid powder [A]. It can be obtained from scrapings off match box strike plates [B] and other incendiary products or from commercial chemical supply companies [C]. Photos Courtesy of CA Department of Justice. Photographer, Charles Salocks.

## Chemical Hazards

**Reactivity:** Red-P reacts with water vapor and oxygen in air to form extremely toxic phosphine gas, phosphorus oxyacids, white phosphorus, and phosphoric acid. These reactions are accelerated by higher temperatures or trace amounts of metals, including those found in household plumbing.

**Flammability:** Red-P is a flammable solid and may pose a moderate explosion hazard by chemical reaction or on contact with organic materials. Though stable, it is readily combustible. It will not ignite spontaneously, but may be ignited by heat, friction, static electrical spark, oxidizing agents, or physical impact. It may re-ignite after being extinguished. The auto ignition temperature for Red-P is 260°C (500°F). At high temperatures, even in the absence of air, Red-P can burn, producing White-P.

**Chemical Incompatibilities:** Red-P reacts with oxidizing agents, reducing agents, peroxides, strong alkalis (e.g., sodium hydroxide or potassium hydroxide), halogens, halides, and organic matter. If it comes in contact with oxidants (e.g., chlorine, fluorine, or bromine), Red-P may burn spontaneously or explode. Red-P reacts vigorously with cesium, lithium, potassium, rubidium, sodium, and sulfur. It explodes when combined with ammonium nitrate and moist chlorates. Red-P is incompatible with metals including aluminum and magnesium powders, beryllium, copper and copper containing alloys, manganese, metal oxides (copper oxide manganese dioxide, lead oxide, mercury (II) oxide, silver oxide, and chromium trioxide), metal peroxides (lead peroxide, potassium peroxide, and sodium peroxide), and metal sulfates (barium sulfate and calcium sulfate). Red phosphorus is also incompatible with nitric acid.

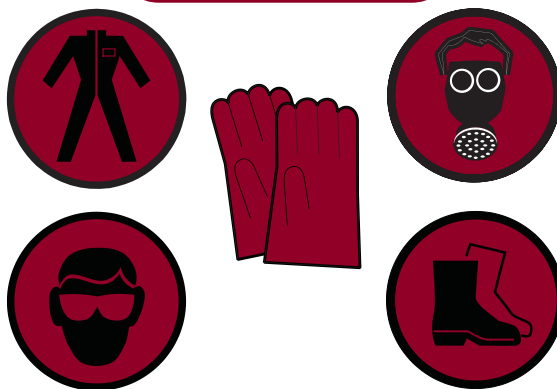
**Conditions to Avoid:** Avoid light, ignition sources, dust generation, excess heat, oxidizers, flammable materials, friction, and physical impact. Under wet alkaline conditions, red phosphorus slowly releases phosphine gas, which is highly toxic and highly flammable.

## Environmental Concerns

**General:** Red phosphorus will slowly degrade to highly toxic phosphine gas (PH<sub>3</sub>) and phosphorus acids in the environment. Phosphine is reactive and usually undergoes rapid oxidation. The final products, phosphates, are harmless. In wastewater, Red-P will adsorb to sewage sludge. Red phosphorus is harmful to aquatic organisms.

**Indoors:** If contamination occurs, Red-P would be expected to persist. On indoor surfaces it would be found as a solid where spilled. Skin contact and ingestion resulting from hand-to-mouth activity could occur.

## Handling &amp; Safety



## First Aid

**Inhalation Exposure:** Move to fresh air. If victim has difficulty breathing, give oxygen; if not breathing, give artificial respiration. Keep victim in a half upright position. Get medical attention immediately.

**Contact with Eyes:** Flush eyes with water for at least 15 minutes. Get medical attention.

**Contact with Clothing or Skin (Dermal Exposure):** Remove contaminated clothing and shoes. Flush exposed areas with water for 15 minutes or more. Get medical attention.

**Ingestion (Oral) Exposure:** Do not induce vomiting. If victim is conscious, give 2-4 cups of water or milk. Seek immediate medical attention.

## Exposure Limits

**Occupational Exposure Limits (NIOSH, OSHA, & ACGIH):** not established.

**Preliminary Remediation Goals (PRGs) (U.S. EPA, Reg. 9):** Air, Soil & Water: not established

## More Information

Office of Environmental Health  
Hazard Assessment (OEHHA)  
[www.OEHHA.CA.Gov](http://www.OEHHA.CA.Gov)

Department of Toxic  
Substances Control (DTSC)  
[www.DTSC.CA.Gov](http://www.DTSC.CA.Gov)