

## Sulfur and phosphorous

Substance	Hazard	Comment
<b>Sulfur</b> <i>Solid</i>	 <b>IRRITANT</b>	<p>WARNING: Causes skin irritation. Some suppliers may also classify it as a flammable solid. Under the Explosives Regulations it is illegal to make mixtures with potassium chlorate(V) or other chlorates, without the prior approval of the Health &amp; Safety Executive.</p> <p>Yellow crystals of sulfur occur in volcanic regions. In Victorian times, children were fed a mixture of brimstone (sulfur) and treacle, to do them good!</p> <p>Sulfur burns to form sulfur dioxide gas (TOXIC) (see CLEAPSS <i>Student Safety Sheet 52</i>). Asthmatics are particularly vulnerable.</p> <p>When melting sulfur or heating it, for example with iron, insert a plug of mineral wool in the mouth of the test tube to prevent sulfur vapour escaping and igniting.</p>
<b>Phosphorus (red)</b> <i>solid</i>	 <b>FLAMMABLE</b>	<p>DANGER: Flammable solid; harmful to aquatic life with long-lasting effects. Under the Explosives Regulations it is illegal to make mixtures with potassium chlorate(V) or other chlorates, without the prior approval of the Health &amp; Safety Executive.</p> <p>May be explosive when mixed with oxidising substances. It has been used in the heads of some matches.</p>
<b>Phosphorus (yellow/white)</b> <i>solid</i>	 <b>FLAMMABLE</b>  <b>TOXIC</b>   <b>CORROSIVE</b>  <b>ENVIRON. HAZARD</b>	<p>DANGER: catches fire spontaneously if exposed to air; fatal if swallowed or inhaled; causes severe skin burns and eye damage; very toxic to aquatic life. For a 15 minute exposure, the concentration in the atmosphere should not exceed 0.3 mg m<sup>-3</sup>. Under the Explosives Regulations it is illegal to make mixtures with potassium chlorate(V) or other chlorates, without the prior approval of the Health &amp; Safety Executive.</p> <p>It has a long history of causing poisoning, for example amongst workers using phosphorus to make matches. When handling it, have copper(II) sulfate(VI) solution (0.2 M to 0.5 M) available to remove specks on clothing, bench etc.</p> <p>It is used in incendiary bombs. When it burns, corrosive fumes are formed. Phosphorus fires are difficult to extinguish; smother with dry sand.</p> <p>It must be stored under water (or under an inert gas). When cutting phosphorus, do this under water, otherwise friction ignites it. It is hard to cut; do this in a strong container, for example a mortar or plastic bowl – not glass, which is too fragile.</p>

**Typical control measures to reduce risk**

- Wear eye protection when handling phosphorus or when heating or burning sulfur. Use small amounts.
- Avoid breathing fumes of sulfur dioxide, for example use a fume cupboard or prevent sulfur vapour from igniting by using a mineral wool plug in the mouth of a test tube.
- Wear protective gloves if handling yellow/white phosphorus; store and handle it in the absence of air.

**Assessing the risks**

- What are the details of the activity to be undertaken? What are the hazards?
- What is the chance of something going wrong?  
*eg could sulfur vapour form? Could it ignite?*
- How serious would it be if something did go wrong?  
*eg could people be exposed to sulfur dioxide gas?*
- How can the risk(s) be controlled for this activity?  
*eg can it be done safely? Does the procedure need to be altered? Should goggles or safety spectacles be worn?*

**Emergency action**

In all emergency situations, alert the responsible adult immediately. Be aware that actions may include the following:

- In the eye                      Irrigate the eye with gently-running tap water for at least 20 minutes. Call 999/111.
- Vapour breathed in        Remove the casualty to fresh air. Call 999/111 if breathing is even slightly affected.
- In the mouth/  
  swallowed                    Do no more than rinse and spit with drinking water. Do not induce vomiting. Call 999/111.
- Spilt on the floor,  
  bench, etc                    For sulfur or red phosphorus, brush up. For yellow/white phosphorus, cover with sand to prevent ignition. Soak in copper(II) sulfate(VI) solution until there is no further reaction, then brush up.