



## Learning by Accident

**Learning by Accident** is an ongoing *Crucible* feature, in which real-life lab accidents or incidents are recounted and explained. The goal is to highlight the consequence of ignoring safety rules so that science educators will be further encouraged to become knowledgeable, and to take appropriate action, in areas of safety that affect their daily activities in the science classroom. Submissions are encouraged. Anonymity will be guaranteed. Please send written descriptions to Ian Mackellar, STAO Safety Committee Past-Chair, Box 191, MAITLAND, ON K0E 1P0, or email: [ian\\_mackellar@stao.org](mailto:ian_mackellar@stao.org)

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### *Submitted by a member of the Safety Committee.*

Early in my career, before I obtained work as a full time teacher, I taught night school to a Grade 11 chemistry class. I wished to show them how white phosphorous was a waxy solid and could be cut with a knife. My cylinder of phosphorus lay in a pneumatic trough safely covered by water but I had not prepared a knife ahead of time. All I could find was a pair of scissors. I thought I might be able to cut a piece of the phosphorus off with them and proceeded to do that by lifting the cylinder out of the water and cutting. However, a good deal of scissor pressure was required to make any impression on the phosphorus. Little did I realize that this pressure would raise the temperature high enough to reach the low ignition point of 40°C. In a few moments the first flames occurred and so, instinctively I stepped to the sink and turned on the tap to put out the flames. Big mistake! The water stream just caused flaming bits of phosphorus to break off and land on the desk, on the floor and on my hand! We all watched wide-eyed as the flames burned all they touched, including my hand. The class was almost over anyway so I dismissed the students and drove myself to the hospital with, as I later learned, third degree burns. Nobody there knew what to do, especially as they saw white smoke still emanating from under my fingernails. I knew that carbon disulfide was a solvent for phosphorus so I drove back to the school and soaked my hand in it. I'm not sure how

effective this was, as white smoke still came out from under the fingernails, but perhaps not quite as much.

### ***Comments from the STAO Safety Committee***

Because of its extreme hazardous nature, the STAO Safety Committee does not generally recommend the use of white phosphorus in schools. Indeed, in many District School Boards, this chemical may be banned by the employer's local rules. Carbon disulfide (EXTREMELY FLAMMABLE, TOXIC and SUSPECTED CARCINOGEN) is now banned by most Boards.

Both forms of phosphorus, red and white, are **highly flammable** but the white form is very easily ignited at temperatures as low as 30°C in moist air. White phosphorus is **corrosive** and causes severe burns to skin and eyes and is **extremely toxic** if swallowed or if vapour or smoke from burning phosphorus is inhaled. Long-term absorption of small amounts by inhalation and by mouth is very dangerous. The red form of phosphorus is of very low toxicity, but the oxide fumes from burning phosphorus are extremely toxic. (see *STAO Hazardous Chemicals CD*)

Teachers who choose to use white phosphorus despite our recommendation should wear eye protection, protective gloves and a laboratory coat. Also they should use tongs to handle the white phosphorus, keeping it under cold water until required. Large pieces should never be exposed to



air. It should be cut with a sharp knife while it is immersed in cold water in a strong vessel such as a mortar. White phosphorus is very hard and the knife can easily slip, breaking a glass vessel.

Although carbon disulfide is a solvent for phosphorus, its use as described above is inappropriate. Instead, a solution of 0.1 mol/L copper (II) sulfate (LOW HAZARD) should

be available for treating any spills of phosphorus. If spilled on the skin, the area of the spill should be washed well with water and then swabbed with the prepared copper (II) sulfate solution to form a black copper salt which can be seen and removed. Any contaminated clothing should be removed and washed. Medical attention should be obtained as soon as possible.

