Dr Hal @ ASE 2013

Phosphorus sun

Risk Assessment

Please note that this risk assessment was written to cover the demonstration of this experiment at the ASE Conference in January 2013. For any other use, this risk assessment should be reviewed to see whether there is a need to modify or adapt it in any way to suit the particular conditions under which the experiment will be carried out.

OCR

Risk Assessment: Professor Hal Sosabowski

Written By: **Professor Hal Sosabowski**	Location: University of Reading

Date Of Assessment: 30th October 2012

CATEGORY/ACTIVITY

RISK CATEGORY	DESCRIPTION OF ACTIVITY TO BE ASSESSED
Medium	6th Jan 2013 **Phosphorus Sun**

HAZARDS

List hazards here. List only hazards which could reasonably be expected to result in significant harm under the conditions in your workplace.

Phosphorous Sun:
Dr Sosabowski will charge a 50 Litre flask with an appropriate amount of liquid oxygen ($10cm^3$ via test tube, from a stainless steel Dewar). He will then place +/- 0.25g of white phosphorous on a crucible, light it with a hot copper rod and place it suspended in the flask. A bright light will ensue for about 20 seconds with some P_2O_5 released.

Hazards:
1. Intense light;
2. Phosphorous;
3. P_2O_5 (acid mist) which can be harmful if inhaled in large quantities;
4. Risk of burning P falling to base of flask and cracking it;
5. Pure O_2 atmosphere in flask/Hazards associated with liquid oxygen;
6. White phosphorous.

WHO MAY BE HARMED

List here groups of people who are especially at risk from the hazards that you have identified.
You may list individuals but think of groups of people doing similar work

1. All operatives in vicinity of experiment/audience.

IS THE RISK ADEQUATELY CONTROLLED

List existing precautions & controls here or note where information can be found

General:
(i) Dr Hal Sosabowski will have carried out demonstration previously and will oversee and direct the experiment;
(ii) Experiment demonstrated and explained by Dr Hal to satisfaction of all;
(iii) Operators to wear safety glasses, laboratory coats and gloves (the latter for which will be discarded after the item) at all times during demonstration,
(iv) If reaction is too vigorous, to be removed by a trained technician from venue immediately by a pre-arranged route to a sterile/taped-off area outside.

1. Intense light;
(i) All warned not to stare directly at light for excessive time; the large floor area of the venue obviates this risk for most of the audience anyway;

2. White phosphorous to fall onto floor;
If P falls to floor, damp sand used to cover it and contain the reaction. P is ignited below the level of the neck of the flask so if it falls, will fall into the flask;

3. P_2O_5 (acid mist) which can be harmful if inhaled in large quantities;
Most P_2O_5 remains in flask. The apparatus contains an exhaust tube which vents the P_2O_5 into NaOH, the P_2O_5 forms phosphoric acid immediately which then reacts with the NaOH to produce sodium phosphate. If necessary, fire doors to either side of stage open to create through draft. Audience warned to expect smoke at start of lecture. Small amount of P used is limiting and will stop excessive P_2O_5. Past experience shows that any P_2O_5 dissipates to either side of auditorium where the doors are open, so most will be vented. After demo flask will be taken outside the venue.

4. Risk of burning P falling to base of flask and cracking it;
Dry sand base added to flask, will shield glass from excess heat.

5. Pure O_2 atmosphere in flask/Hazards associated with liquid oxygen;
Liquid oxygen is the ultimate oxidant. It will be prepared beforehand (by trained Technician) in the open air on a concrete apron outside the venue and only sufficient made for the item (plus some slippage to take into account evaporation. The liquid O_2 will locally stored in a sterile and taped off area in a stainless steel Dewar marked 'liquid oxygen' - away from any sources of heat, sparks or materials that will readily react with oxygen.

6. White phosphorous;
White phosphorous is a toxic which can spontaneously combust in air. It is stored under water. Sufficient white phosphorous for the item will be stored at the venue, under water in an appropriately marked container. When transferring from the container to the apparatus, appropriate tools will be used which will then be collected up and in turn stored as phosphorous-contaminated waste. The operator must wear nitrile gloves for the item which must then be discarded after the item. They must wash their hands and face after the event. If its felt necessary they should examine their clothing in a dark room afterward for the green glow of any P, but P will react with air anyway and any speck of white P would be oxidised.

Toxicology: the white (yellow) allotrope of phosphorus is very toxic if swallowed or inhaled, and may causes severe burns.

WHAT FURTHER ACTION IS NECESSARY
List all risks that are not adequately controlled and the action that you will take, where it is practicable, to do more

None

Have all necessary precautions and procedures been included in the assessment?	**Yes**

RESULT - T=Medium Risk /A=Adequately controlled

Operators:

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Dave Campbell