

Dr Hal @ ASE 2013

Barking dog

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.

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	6 th Jan 2013 Barking Dog

HAZARDS

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

Barking Dog

Description:

This experiment will be carried out three times in three large 2M tubes, the volume of the is 5300 mL. Each tube will previously have been filled with nitrous oxide, N₂O which will be achieved by use of a cylinder of N₂O and collecting over water. The benign nature of this gas makes it suitable for this filling before the event. As part of the demo, the operator (Dr Hal) will add the appropriate amount of carbon disulfide, CS₂) (1 cm³, 3 cm³ and 10 cm³ respectively) *. The tubes will be prepared before the demo, then set in a bespoke stand on the stage. The bung will be removed and a long lit candle taper held to the open top of the tube top at which point a blue flame will commence working its way down the tube. Halfway down the tube the front compresses the gas ahead of it and the burn reverts to an explosion with a characteristic barking sound and flash of blue light (which incidentally is the only example of gas phase chemiluminescence). The tube is then seen to be coated with sulphur. The lid is replaced immediately to contain the small amount of sulphur dioxide produced by the reaction.

Hazards:

1. Nitrous oxide;
2. Carbon disulfide;
3. Sulphur dioxide;
4. Explosion hazard leading to the tube shattering;
5. Tubes being knocked over on stage;
6. Sound due to detonation;

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

RISK ASSESSMENT

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

General:

(i) Since this experiment involves a controlled explosion Hal, Dave C. and other presenters to wear safety glasses, fastened lab coats and ear defenders. All others to wear safety glasses.

(ii) Dr Hal Sosabowski has carried out this experiment many times previously. He will demonstrate/explain to satisfaction of all.

(iii) Audience clearly warned not to attempt to emulate the experiment in any form (audience at home are unlikely to be able to obtain these gases since is not widely available except from specialist suppliers).

1. Nitrous oxide;

Nitrous oxide (aka) laughing gas is non-toxic but can act as an anaesthetic, filling the tubes must be carried out in a well ventilated area, and control measures in place if a tube is knocked over and breaks. Depending on which tube it is that breaks. The smallest would require avoiding the area for a short time, the largest that a fan be deployed to disperse the gas. Due to large auditorium there would negligible risk from any effects of the gas.

2. Carbon disulfide;

CS₂ is a flammable volatile liquid which smells like raw sewage. Its indications are: Stable. Extremely flammable. Highly volatile. Note low flash point and very wide explosion limits. Protect from heat, friction, shock, sunlight. Reacts violently with fluorine, azide solutions, zinc dust, liquid chlorine in the presence of iron. Incompatible with strong oxidizing agents, azides, aluminium, zinc, most common metals, nitrogen oxides, chlorine, fluorine, hypochlorites.

Toxicology: Poison - may be fatal if swallowed or inhaled. Serious health hazard, affecting the CNS. Readily absorbed through the skin. Sufficient material may be absorbed through the skin to be fatal. May cause reproductive damage. Chronic exposure may cause liver, kidney and CNS damage, or impaired vision. Causes burns. Severe eye and respiratory irritant. Skin irritant. Typical PEL 7 ppm.

The small amounts used (largest amount is 10cm³) mean that the CS₂ can be used without additional control measures. Care should be taken when adding the CS₂ to the tube, when inverting each tube care must be taken to point the open but sealed end away from anyone and gently vent the excess pressure which inevitably forms. The tube must be resealed with the rubber bung after the reaction and the waste water in the tube disposed of as hazardous waste.

3. Sulphur dioxide;

SO₂ is an acidic gas and a by product of the reaction. The amounts produced are small, and the appropriate control measure is to replace the stopper after the reaction.

Toxicology: Corrosive. Toxic - high concentrations are fatal. Typical exposure limit 2 ppm (8 hr TWA), 5 ppm (10 min TWA).

4. Explosion hazard leading to the tube shattering;

The explosion occurs when the flame reaches halfway down the tube. Therefore since the atmosphere is pressing down the top of the tube in the unlikely even that the tube shatters it will do so at the bottom. The bottom half of the tube will therefore be shielded with twin safety shields and the whole tube wrapped with Cling Film.

5. Tubes being knocked over on stage

A Standard Operating Procedure will be adopted whereby the tubes will be kept together in a taped-off controlled area. The tubes will be brought out by Hal as required, used then replaced in the controlled area. Tubes to be handled by D.Campbell/Hal or technical team members.

6. Barking sound due to detonation;

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?
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Yes

RESULT - T=Trivial Risk /A=Adequately controlled

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