

Risk Assessment Form

This 50 – 60 minute long show contains the following demonstrations:

1. Flour Fireball
2. Friction books
3. The 'table cloth trick'
4. The egg trick
5. Inverted inflation
6. Can crush
7. Film canister rockets
8. Butane Bubbles
9. Burning Wire Wool
10. Using an E-match
11. A Butane Rocket

Task: Science in Schools Community Show

Method: Multiple – see details in Activity Section

Building: Schools around the country

Room(s) used: School halls

Likelihood		Severity of impact		Current risk	
Certain to happen	5	Death or total destruction	5	Multiply Likelihood and Severity of impact to get Current Risk rating	
High	4	Major injury or damage	4		
Medium	3	Serious injury or damage	3		
Low	2	Minor injury or damage	2		
Extremely unlikely	1	Negligible	1		

Action Rating	
22 and above	The work is too dangerous and should not be undertaken
18 to 22	The work is high risk. Those undertaking the work must be fully competent and experienced for the type of work, equipment to be used and fully understand all risks present.
12 to 18	Moderate risk Workers must be fully competent for the type of work and risks present, or under competent supervision.
9 to 12	Low risk. Those undertaking the work must be aware or be made aware of the risks and mitigation measures required.
5 to 9	Slight risk. Those undertaking the work should be aware or be made aware of the risks and mitigation measures required.
1 to 5	Minimal risk. Activity suitable for all workers

Those at risk (please tick)	Ri Staff	Contractors	Tenants	Visitors	Others
	<u>X</u>	<u>X</u>		X	X

Demonstration 1. Flour Fireball

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
A tablespoon of cornflour is placed on a shower head or funnel attached onto a pipe of short piping. It is then blown across the open flame of a blowtorch to create a vertical fireball.	The ball of flame may burn the face or hands of the presenter	Presenter must wear eye protection and a glove and also to angle the shower head away from their face. The fire ball will always travel upwards (unless there is considerable wind or draft) and so the presenter will position themselves below the blowtorch and blow the flour upwards into it. If necessary the presenter will also wear a heat proof gloves on the hand closest to the flame.	2	2	4
	The ball of flame presents a fire hazard to building, equipment and audience.	Ensure that the area around the demo is clear from all additional equipment and flammable objects. Ensure there is sufficient room (3m) above the flame without any overhanging objects. A fire extinguisher will be on stand-by.	1	5	5
	The open flame of the blowtorch presents a fire hazard.	Presenter to ensure that the blowtorch is steadily placed on the table and that the flame is angled away from other equipment. The blowtorch must be turned off as soon as the demo is complete. A fire extinguisher will be on stand-by.	2	2	4
	Working with Butane or Butane/ Propane mix	The gas used on the butane will either be butane or a butane/ propane mix. This will be in commercially available canisters. They will be stored in a non-conductive box. A maximum of four canisters will be carried at any one time	2	3	6

PPE Requirements

Item		Item		Item		Item	
Flameproof overalls		Gloves contact	Y	High visibility		Waterproof clothing	
Hardhat		Dust Mask		Gloves chemical		Wellington boots	

Hearing protection		Mask chemical vapour/mist		Safety shoes			
		Laboratory Coat		Eye protection	Y		

Demonstration 2. Friction Books Tug of War

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
<p>Two books (product catalogues) have their pages interleaved, in a way that makes it very difficult to separate them simply by pulling. The books have reinforced spines, with chains and ropes attached so that two teams of volunteers can have a tug-of-war, to try and pull the books apart.</p>	<p>Volunteers may sustain injury through falling during the tug-of-war, for instance, if a member of the other team suddenly lets go, or if a volunteer loses grip on the rope.</p>	<p>The presenter and assistants will be on hand to act as catchers in the event that any of the volunteers suddenly fall backwards. First aid trained staff should be on hand, in the unlikely event that injury is sustained.</p> <p>In addition the volunteers will be instructed to not pull each other and to concentrate on working together rather than as if they are separate team (it's both teams against the books). Also they will be instructed to pull only (not wiggle the books from side to side).</p>	2	4	4
	<p>Friction burns from rope.</p>	<p>The presenter should instruct the volunteers not to wrap the rope around their arms, which would increase the risk, and generally to manage and discourage risky and excessive tugging.</p>	2	2	4

PPE Requirements

Item	Item	Item	Item
Flameproof overalls	Gloves contact	High visibility	Waterproof clothing
Hardhat	Dust Mask	Gloves chemical	Wellington boots
Hearing protection	Mask chemical vapour/mist	Safety shoes	
	Laboratory Coat	Eye protection	

Demonstration 3. The 'table cloth trick'

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
A table cloth is set with a variety of objects to constitute a 'dining set' e.g. teapot, mug, saucer, bowl, plate etc. A volunteer from the audience is briefed on rapidly taking the table cloth away and the setting should remain.	Injury from flying crockery	<p>The presenter will brief the volunteer and audience on the correct method of demonstration (that is, rapidly remove the table cloth in a downwards fashion).</p> <p>The presenter will ensure the volunteers head is above the height of the table setting.</p> <p>The crockery is relatively heavy and the table cloth has a low friction coefficient, and as such the likelihood of flying crockery is very minimised.</p>	1	3	3

PPE Requirements

Item	Item	Item	Item
Flameproof overalls	Gloves contact	High visibility	Waterproof clothing
Hardhat	Dust Mask	Gloves chemical	Wellington boots
Hearing protection	Mask chemical vapour/mist	Safety shoes	
	Laboratory Coat	Eye protection	

Demonstration 4. The egg trick

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
<p>3 eggs are placed upon 3 tubes placed upon a placemat upon 3 tumblers filled with water.</p> <p>Using a rapid swing of the arm and hand the placemat is batted away, and the eggs fall into the tumblers.</p>	Egg allergy	<p>The teacher/ organiser is to notify the presenter/ the Ri at least 24hours prior to the performance if any of the attendees are severely allergic to eggs (i.e. cannot be in the same room as them).</p> <p>If this is the case, the eggs will be substituted for tomatoes.</p> <p>In addition the teacher/ organiser is to notify the presenter/ the Ri at least 24hours prior to the performance if any of the attendees are mildly allergic to eggs (i.e. cannot be in close to them) as this may affect them being used as volunteer in the other demonstrations.</p> <p>It will be ensured that the presenter does not have a touch allergy to eggs.</p>	1	4	4
	Water / egg spill	To avoid the eggs leaving a slippery surface on the stage/ performance area, they will be performed onto a tray to contain the egg fallout.	1	2	2

PPE Requirements

Item	Item	Item	Item
Flameproof overalls	Gloves contact	High visibility	Waterproof clothing
Hardhat	Dust Mask	Gloves chemical	Wellington boots
Hearing protection	Mask chemical vapour/mist	Safety shoes	
	Laboratory Coat	Eye protection	

Demonstration 5. Inverted inflation

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
<p>A small amount of pure ethanol is poured into a large long necked round bottom flask. The flask is shaken to saturate the air in the flask with ethanol vapour. Excess ethanol is poured off.</p> <p>A balloon which is fitted over a drilled through rubber bung is prepared by poking a wooden dowel through the hole into the balloon.</p> <p>The ethanol vapour is ignited, and once the flames are extinguished, the balloon is rapidly plunged into the round bottom flask.</p>	<p>Working with Ethanol</p> <p>UN1170</p> <p>Safety data sheet can be found here; http://www.timstar.co.uk/media/download/chemical_sds/timstar_chemical_sds_ET2634.pdf</p>	<p>The ethanol used will be obtained from a reputable supplier (Timstar).</p> <p>To extinguish an ethanol related fire any of the following fire extinguishers can be used: Water spray (not water jet), alcohol resistant foam, dry powder or carbon dioxide.</p> <p>Goggles and nitril gloves will be worn. Breathing in of vapours will be avoided.</p>	2	3	6
	<p>Transporting, Storing and Disposing of Ethanol</p>	<p>It will be stored in a non-conductive box (to prevent the build up of static electricity). It will be stored in areas that are well ventilated, cool and dry. It will be protected from direct sun and stored away from sources of ignition with containers kept closed when not in use. It will be kept well separated from oxidising agents (potassium chlorate).</p> <p>Excess ethanol will not be disposed of in places where it can add to the water or soil supply, therefore if necessary to be disposed of it will be burnt in a controlled manner, on a fire retardant surface.</p>	2	3	6
	<p>Burn</p>	<p>Burns could occur from either the lighting of the ethanol or contact with the bottle are lighting.</p> <p>To prevent the presenter being burnt they will wear a glove as they light.</p> <p>Goggles will be worn by the presenter throughout.</p>	2	1	2
	<p>Fire</p>	<p>Ethanol vapour is flammable, therefore there is risk of fire. To</p>	3	2	6

		<p>negate the risks involving flammable materials we will do the following:</p> <ul style="list-style-type: none"> - The ethanol will be stored within the appropriate lidded container (provided by supplier). With the lid always being replaced at the earliest opportunity. - Once poured into the round bottom flask and poured back out, both the ethanol bottle and the beaker of excess will be positioned at least 1m away from the launcher. - A fire extinguisher will be on stand by. <p>If ethanol is spilled, it will be mopped up using paper towels, the presenter ensuring that they do not get any on their clothes, ensuring that the paper towels are disposed on in the bin.</p> <p>If the ethanol is spilled in excess onto the clothes of the presenters, they should change clothes before conducting fire-based demonstrations. If not possible they should instead wear a lab coat for the other fire-based demonstrations.</p> <p>The presenter will wash their hands after performing this demonstration, before eating.</p>			
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PPE Requirements

Item		Item		Item		Item	
Flameproof overalls		Gloves contact	Y	High visibility		Waterproof clothing	
Hardhat		Dust Mask		Gloves chemical		Wellington boots	
Hearing protection		Mask chemical vapour/mist		Safety shoes			
		Laboratory Coat		Eye protection	Y		

Demonstration 6. Can crush

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
An empty drinks can is filled with 2 – 3 cm of water which is then boiled using either a portable Bunsen burner or blow torch. Once the water is boiled, the can is inverted and immersed into a bowl of cold water, causing the steam to return to water. The change in air pressure between inside the can and outside alters leading to the can imploding.	Burns from the Bunsen burner / gas burner and from the hot can.	<p>The blow torch / Bunsen burner will be lit more than 1 m away from the audience and the fabric of the building. The blowtorch will be returned to a safe storage place away from the public as soon as the experiment is over.</p> <p>The presenter will wear safety goggles throughout the demonstration.</p> <p>On dumping the can in cold water, the can will be instantly cooled to an appropriate temperature to touch.</p>	1	4	4
	Working with Butane	See RISK ASSESSMENT No. 8 for full details of working with Butane.			

PPE Requirements

Item	Item	Item	Item
Flameproof overalls	Gloves contact	High visibility	Waterproof clothing
Hardhat	Dust Mask	Gloves chemical	Wellington boots
Hearing protection	Mask chemical vapour/mist	Safety shoes	
	Laboratory Coat	Eye protection	Y

Demonstration 7. Film canister rockets

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
<p>Small containers are filled with a small amount of water and then an alka seltzer tablet is added and the container sealed.</p> <p>The alka seltzer reacts with the water to produce carbon dioxide gas, as this builds up eventually there will be enough pressure to fire the container into the air.</p>	<p>The container go into the air and presents a striking hazard to people or furniture. Once the containers land they may be a trip hazard.</p>	<p>Ensure all participants who load the containers step back from the launch zone.</p> <p>The containers are so light that if they do contact people (anywhere but the eye) they will not cause damage. The audience will be instructed that if the containers do come towards them to look away and protect their face.</p>	2	1	2
	<p>Water from the demonstration is a potential slip hazard .</p>	<p>All spillages to be wiped up as soon as possible.</p>	1	2	2
	<p>The chemicals in the alka seltzer are toxic if consumed in large quantities.</p>	<p>Warn adults not to drink contents of the bottles or to consume alka seltzer tablets</p>	1	1	1

PPE Requirements

Item	Item	Item	Item
Flameproof overalls	Gloves contact	High visibility	Waterproof clothing
Hardhat	Dust Mask	Gloves chemical	Wellington boots
Hearing protection	Mask chemical vapour/mist	Safety shoes	
	Laboratory Coat	Eye protection	

Demonstration 8. Butane Bubbles

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
<p>Butane will be piped from a domestic canister into soapy water such that butane bubbles are created. These bubbles will be lifted by a metal paddle and set on fire using a long handled gas lighter. A volunteer from the audience will be holding the paddle.</p>	<p>Fire. Butane is sustained flame.</p>	<p>The butane will be lit on a fire retardant panel. It will be lit not overhanging the remaining butane bubbles. Flammables items will be placed at least 1m away from the bubbles. The headspace above the bubbles will be checked for flammable items (3m clearance minimum). A fire extinguisher and blanket will be on stand. The smoke alarms will be isolated if present.</p> <p>In addition the table on which this demonstration is performed will be covered in a fire blanket. The volunteer will be wearing safety glasses and heat proof glove and will be verbally warned that the fire will be relatively long lasting and that they are to keep hold of the panel.</p>	1	5	5
	<p>Burn</p>	<p>The presenter and volunteer will wear goggles, perform the lighting with a long-handled lighter, and the volunteer hold the paddle at arms' length whilst wearing a heat proof glove.</p>	2	2	4
	<p>Working with Butane</p> <p>The Butane used will be from domestic canisters: UN 2037</p> <p>Safety data sheet can be found here; http://www.farneil.com/datasheets/1801831.pdf</p>	<p>The butane used is available domestically, it is used as a lighter refill, however it should still be treated with respect. It will be sourced from a reputable supplier and canisters inspected for damage before use.</p> <p>Googles will be worn when lighting the butane.</p> <p>Butane can be extinguished using either water spray, dry powder or carbon dioxide extinguishers, though these will only be used in an emergency, with oxygen restriction being used as our preferred method.</p>	1	4	4



	Storing and Transporting Butane	<p>It will be stored in a non-conductive box at a temperature below 50°C and away from sources of ignition.</p> <p>There will be a maximum of 4 canisters stored at one point.</p> <p>Due to the butane being domestic canisters and the small volume carried/ stored no special license or labelling is needed</p>	1	3	3
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PPE Requirements

Item		Item		Item		Item	
Flameproof overalls		Gloves contact	Y	High visibility		Waterproof clothing	
Hardhat		Dust Mask		Gloves chemical		Wellington boots	
Hearing protection		Mask chemical vapour/mist		Safety shoes			
		Laboratory Coat		Eye protection	Y		

Demonstration 9. Burning Wire Wool

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
Wire wool is held across the terminals of a battery to intentional short circuit the battery. As the electricity flow through the wire wool, the resistance is enough to cause the wire wool to catch light.	Fire spreading	This demonstration will be conducted either with a small piece of wire wool, or on a larger piece contained within a pyrex bowl. Either way the area in the immediate vicinity of the performance of his demonstration (1m) will be clear of other flammables. The fire/ smoke alarms should be isolated.	2	2	4
	Accidental ignition	The battery will be stored in a non-conductive box away from the wire and only positioned next to it during this demonstration.	1	4	4
	Shorting a battery In this demonstration, the battery is deliberate shorted. This could cause the battery to get hot.	The battery only need to be shorted for a very short period of time (1-2seconds). This short time is not enough to cause serious heating of the battery. However, before conducting the demonstration the battery used will be visually inspected to ensure that it is not damaged in any way.	2	2	4
	Wire wool in the eye	Wire wool is a fine material that can dissipate into the air, especially when on fire. As such, the presenter will wear safety glasses when burning the wire wool.	1	3	3

PPE Requirements

Item	Item	Item	Item
Flameproof overalls	Gloves contact	High visibility	Waterproof clothing
Hardhat	Dust Mask	Gloves chemical	Wellington boots
Hearing protection	Mask chemical vapour/mist	Safety shoes	
	Laboratory Coat	Eye protection	Y

Demonstration 10. Using an E-match

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
An e-match is taped to a clamp stand and ignited by placing the two ends of the wires onto terminals of a 9V battery. This will result in a temporary spark and a small amount of smoke.	E-match not firing correctly.	The e-match is sourced from a reputable supplier (easypro.com) and in general are consistent in their firing. As with any pyrotechnic device, it may fail to ignite after connecting the terminals. In this situation the presenter will rapidly reset the demonstration with a fresh e-match. The failed e-match will be doused in water and then disposed off in general waste.	1	1	1
	Storing and Transporting E-matches	The stock of e-matches will be stored in a non-conductive box at a temperature below 50°C and away from sources of ignition and securely with the presenter, either in their vehicle, or their personal bag when on site.	1	3	3
	Fire	E-matches create a momentary flame using a small amount of pyrotechnic material. As such the e-match will be ignited at least 1 M away from the fabric of the building, attached to a non-flammable device . A fire extinguisher will be on hand in case of emergency.	1	4	4
	Injury to presenter from fragmentation during ignition	Presenter will wear safety glasses while igniting the e-match.	1	4	4

PPE Requirements

Item	Item	Item	Item
Flameproof overalls	Gloves contact	High visibility	Waterproof clothing
Hardhat	Dust Mask	Gloves chemical	Wellington boots
Hearing protection	Mask chemical vapour/mist	Safety shoes	
	Laboratory Coat	Eye protection	Y

Demonstration 12. A butane rocket

Method Statement	Hazards	Mitigation	Likelihood	Severity of impact	Current Risk
<p>A rocket launching platform made from PTFE plumbing pipe is constructed, with an E-match threaded through a cork which is then inserted into the launch area.</p> <p>60 – 80 cm³ of butane gas is delivered into a 100 cm³ syringe and then rapidly injected into the bottle. The bottle is then sealed by placing it onto the cork.</p> <p>The rocket is aimed at a minimum of 45 degrees and above the heads of the audience.</p> <p>The air/butane mix is ignited using a key switch button igniter.</p>	<p>Working with Butane</p> <p>The Butane used will be from domestic canisters: UN 2037</p> <p>Safety data sheet can be found here; http://www.farneil.com/datasheets/1801831.pdf</p>	<p>The butane used is available domestically, it is used as a lighter refill, however it should still be treated with respect. It will be sourced from a reputable supplier and canisters inspected for damage before use.</p> <p>Googles will be worn when lighting the butane.</p> <p>Butane can be extinguished using either water spray, dry powder or carbon dioxide extinguishers, though these will only be used in an emergency, with oxygen restriction being used as our preferred method.</p>	1	4	4
	<p>Storing and Transporting Butane</p>	<p>It will be stored in a non-conductive box at a temperature below 50°C and away from sources of ignition.</p> <p>There will be a maximum of 4 canisters stored at one point.</p> <p>Due to the butane being domestic canisters and the small volume carried/ stored no special license or labelling is needed</p>	1	3	3
	<p>Hot burn</p>	<p>Burns could occur from either the lighting of the butane or contact with the bottle are lighting.</p> <p>To prevent the presenter ignite the rocket remotely using an e-match. And although the bottle will be warm after the burning, it will not be hot enough to cause injury. Nevertheless the audience will be warned to not to touch the bottle for long if it lands near them.</p>	2	2	4



		Goggles will be worn by the presenter throughout.			
	Impact Injury	The bottle is launched at speed, however the bottle will be aimed in the area above the audience rather than at the audience themselves. This means a lot of the speed of the bottle will be dissipated by the time the bottles fall into the audience (and so won't have enough speed to cause injury). In addition, the audience will be warned to protect themselves if the bottle falls towards them.	2	1	2
	Fire	Flammables items will be placed at least 1m away from the rocket. A fire extinguisher and blanket will be on stand. The smoke alarms will be isolated if present. In addition the table on which this demonstration is performed will be covered in a fire blanket. The fire from the rocket is momentary and very quickly extinguished as the oxygen supply in the rocket is consumed.	3	2	6
	Working with E-matches	See RISK ASSESSMENT No. 11 for mitigation.			

PPE Requirements

Item		Item		Item		Item	
Flameproof overalls		Gloves contact		High visibility		Waterproof clothing	
Hardhat		Dust Mask		Gloves chemical		Wellington boots	
Hearing protection		Mask chemical vapour/mist		Safety shoes			
		Laboratory Coat		Eye protection	Y		

Safe Working Procedures:

All Electrical Equipment should be PA Tested prior to being brought to site. Arrangements should be made for the HE to test/visually inspect all equipment before use as an additional safety precaution.

ACTIONS NEEDED BY VENUE:

- Isolate Smoke/ Fire Alarms in vicinity of demonstrations
- Ensure 1 x Fire Extinguisher is on Stand-by (only to be used in emergencies- should be either dry powder, carbon dioxide or water spray (not jet))
- Ensure presenter knows Fire Evacuations procedures
- Ensure presenter know location of nearest fire extinguishers
- To inform presenter/ Ri (at least 24hr prior to performance time) if any of the attendees suffer allergies to latex, eggs or tomatoes.

Prepared by: Dr Nate Adams

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