TEACH, the students well …

learning should not by accident!

Ms Lisa Stevens
Dip OHS, Grad Dip Rehab. Studies, MOSH GradCert L&T(HE)
FAIHS, ChOHSP, FRACI, CChem, MHFESA
Principal Health and Safety Consultant

and

Dr Neale Jackson
BSc, BA(Psych), Mapp Sc (Tox) MPET, PhD (Chem)
FRSC FRACI CChem, FACTRA, FAIHS.
Director and Principal Chemist and Toxicologist

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& ASSOCIATES

TEACH, your children well …

Teach your children well.
Children are born knowing absolutely nothing.
They are taught to lie or tell the truth.
They are taught to steal or give back.
They are taught to be thoughtful or selfish
We are their teachers.
Teach them to be good, loving, caring, giving, warm, humble, human beings.
What you teach children is a direct reflection on you.
Teach them well.

- **Joseph Andrus**

RAINBOW FLAME

- Small quantities of flammable liquid
- Correct grade of glassware (borosilicate)
- Incorrect choice of flammable liquid
- Remove the solvent away from the experiment before igniting beakers
- Use a metre ruler to ignite each beaker
- Do not pour solvent back onto hot beaker
- Students should not sit close to the demonstration bench
- Use of barriers between demonstrators and students
- Alterative - use wooden sticks soaked in the solution of metal salts and pass it through a flame,

BLACK SNAKE

CHARCOAL SNAKE

CARBON SUGAR SNAKE

SODA SNAKE

SUGAR SNAKE

MANLY WEST PUBLIC SCHOOL CHARCOAL / SUGAR SNAKE EXPERIMENT

Students at Manly West Public School gather outside the school after the explosion. *CREDIT: NINE*

Mitchell said the department would provide support to the school, including counselling for students and staff, in coming days.

November 21, 2022

LisaJStevens & ASSOCIATES

UNIVERSITY OF SYDNEY

Garbage truck in Sydney forced to dump load as toxic vapour cloud emits from rubbish

By Danuta Kozaki | Recycling and Waste Management

4h ago

Police said the toxic plume was caused by 150 kilograms of bleach dumped in to the back of the truck reacting to another substance. *(Supplied: NSW Fire and Rescue)*

In short:

A garbage truck was forced to dump its load on to a suburban Sydney street after a toxic vapour plume erupted from its rear bin.

Authorities say the 150 kilograms of powdered bleach reacted with another substance in the bin and caused the cloud.

What's next?

The Environment Protection Authority has been asked to investigate a potential threat to local waterways.

…. And the reason why we do not put chemicals in the garbage…

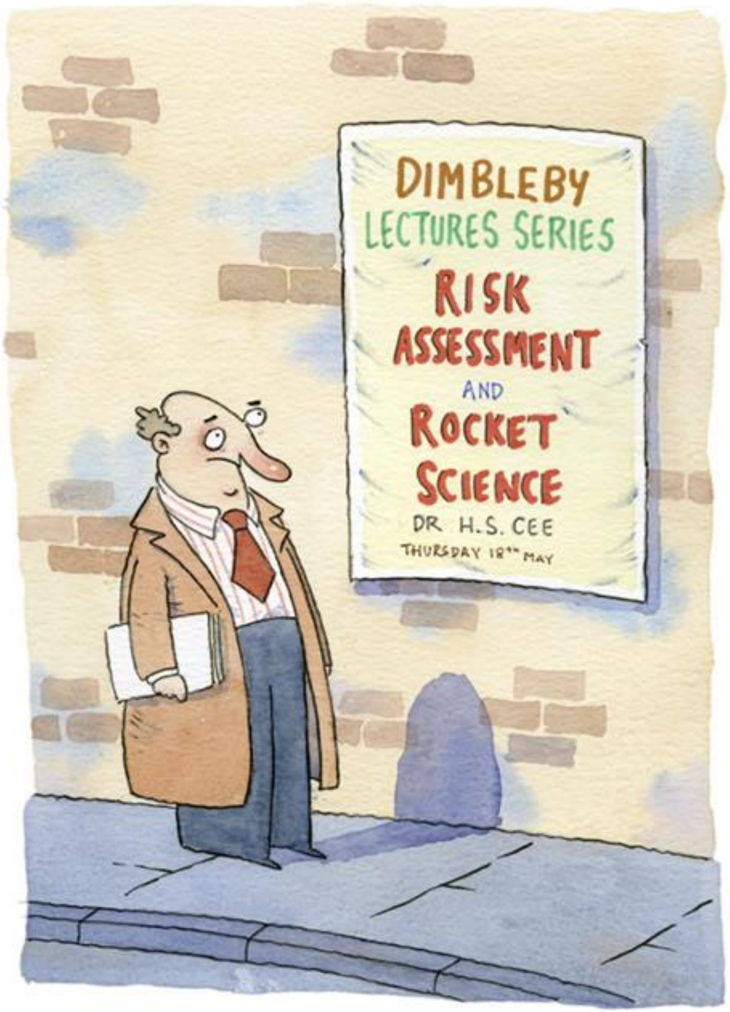
Six fire trucks
22 firefighters
Including specialist hazardous materials experts trained in managing chemical emergencies dealt with the incident.

WHY DO A RISK ASSESSMENT?

Identify	the hazards and which workers/students are at risk of exposure
Determine	what sources and processes are causing that risk
Identify	what kind of control measures should be implemented
Check	the effectiveness of existing control measures.

MYTH: RISK ASSESSMENT IS TOO COMPLICATED FOR ME TO DO!

- Risk assessments should be straightforward.
- Focus on the hazards
- Focus on the real risks.
- Identify actions needed to take control of them.



WHAT IS RISK MANAGEMENT ?

It is **NOT** about being a barrier to doing things!

It Is **ABOUT** have we done everything we can **“So Far As Reasonably Practicable”**

“Turning a degree of uncertainty into a degree of certainty”

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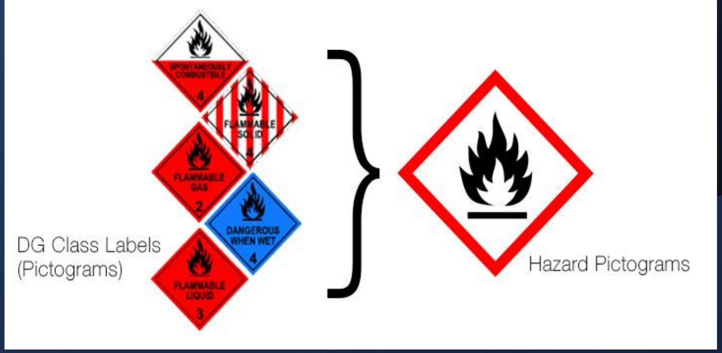
WHAT DOES THE LEGISLATION SAY…..?

OHS REGULATIONS -**Part 4.2—Hazardous Substances**

r163 - Control the risk

r164 - Review of risk control measures

HAZARDOUS CHEMICAL vs DANGEROUS GOOD



GHS means the Globally Harmonised System of Classification and Labelling of Chemicals, Seventh revised edition, published by the United Nations as modified under Schedule 6.

Note for this definition:
The Schedule 6 Tables replace some tables in the GHS.

hazard category means a division of criteria within a hazard class in the GHS;

hazard class means the nature of a physical, health or environmental hazard under the GHS.

Dangerous Goods List means the Dangerous Goods List in the ADG Code Chapter 3.2 as read with the other provisions in the ADG Code Part 3.

HAZARD SUBSTANCES

hazardous substance means a substance that satisfies the criteria for hazard classification set out in Part 3 (Health Hazards) of the GHS, but does not include a substance that satisfies the criteria solely for one of the following hazard classes—

(a) acute toxicity—oral—category 5;

(b) acute toxicity—dermal—category 5;

(c) acute toxicity—inhalation—category 5;

(d) skin corrosion/irritation—category 3;

* * * * *

(f) aspiration hazard—category 2;

WHO SHOULD DO THE RISK ASSESSMENT?

Assessments are based on a thorough understanding of what happens, or might happen, in the workplace and should be carried out by a person or persons who have:

- a practical understanding of the WHS/OHS laws, codes of practice and relevant guidance materials
- an understanding of the work processes involved at the workplace
- enough resources to gather information, consult the appropriate people, review existing records and examine the workplace.

A single person such as a supervisor may be suitably competent to perform simple assessments.

In more complex cases, several persons representing a variety of skills may need to be involved in collecting and assessing the information.

Whether a single person or multiple people undertake the assessment, they should consult with workers and their health and safety representatives.

WHAT SORT OF RISK ASSESSMENT IS APPROPRIATE.

Basic assessment

- reviewing the labels and the SDS of the hazardous chemicals
- assessing the risks involved in their use
- deciding whether controls already exist within the workplace as per the SDS or other reliable sources,
- assessing whether further control measures are needed.

WHAT SORT OF RISK ASSESSMENT IS APPROPRIATE.

Generic Assessment

- an assessment is made of a particular workplace, area, job or task
- the assessment is then applied to similar work activities that involve the use of the chemical being assess

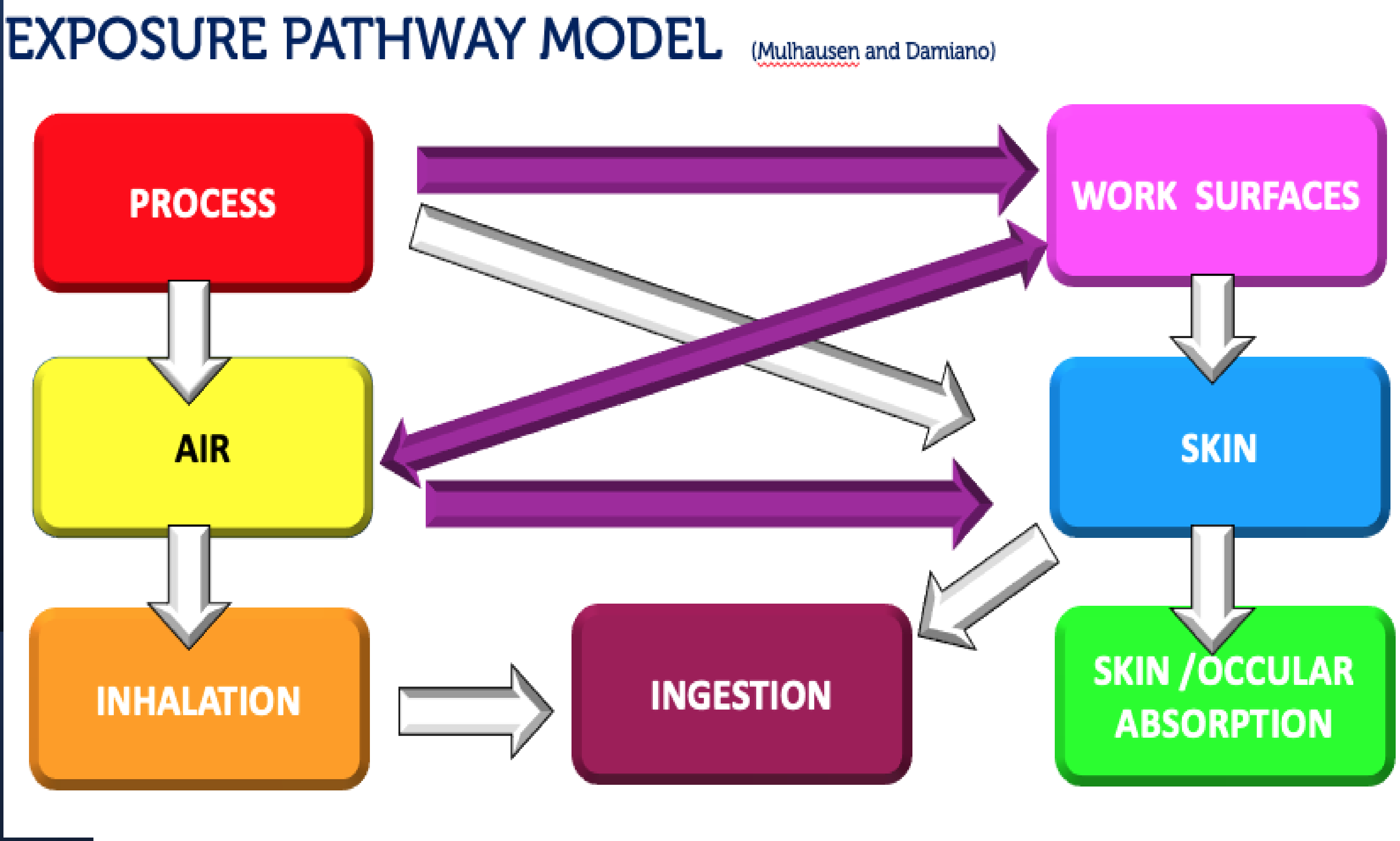
WHAT SORT OF RISK ASSESSMENT IS APPROPRIATE.

Detailed Assessment

- When there is a risk to health and for very high-risk chemicals such as
  - carcinogens,
  - mutagens,
  - reproductive toxicants
  - sensitisation agents in the case of health hazards.
- Hazardous chemicals that are restricted or prohibited for use.
- A more detailed assessment may also be required when there is uncertainty as to the risk of exposure or health.

- To complete a detailed assessment, further information may be sought and decisions taken to:
  - Eliminate the uncertainty of any risks
  - Select appropriate control measures
  - Ensure that control measures are properly used and maintained
  - Determine if air monitoring or health monitoring is required.

WHAT DO WE NEED TO CONSIDER?



WHAT ARE WE TRYING TO ASSESS?

CHEMICAL

- Health hazards – Sensitiser, Irritant, carcinogen
- Exposure Route – inhalation, absorption, ingestion
- Physical properties - explosive, corrosive, flammable
- Form (liquid, gas, solid)
- Stability and reactivity
- Poisons (toxic)

HANDLING

- Who could be exposed
- Fume hoods/gloveboxes
- Actual Experiment
- Transport between prep area and classroom
- Potential adverse reactions
- Potential waste products
- Disposal of waste
- Equipment required
- Unintentional spills

STORAGE

- Special requirements
- Flammable liquid cabinet, corrosive cabinet
- Separation and segregation
- Ventilation requirements
- Security requirements

OTHER CONSIDERATIONS

Biological Health Monitoring

- Periodic health surveillance
- Atmospheric monitoring

Additional Hazards

- Biological
- Cytotoxic
- Ergonomic
- Electrical
- Lasers
- Manual Handling
- Mechanical
- Radiation

Required Personal Protective

- Eye protection
- Face mask/face shield
- Gloves
- Special first aid equipment
- Protective Clothing
- Fume hood/biosafety cabinet

Particularly with HF, phenol

RISK ASSESSMENT PROCESS

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APPENDIX 5 WA CODE OF PRACTICE - Managing Hazardous Chemicals in the Workplace

An overview of the process for the assessment of health risks arising from the use of hazardous chemicals in the workplace is provided below.

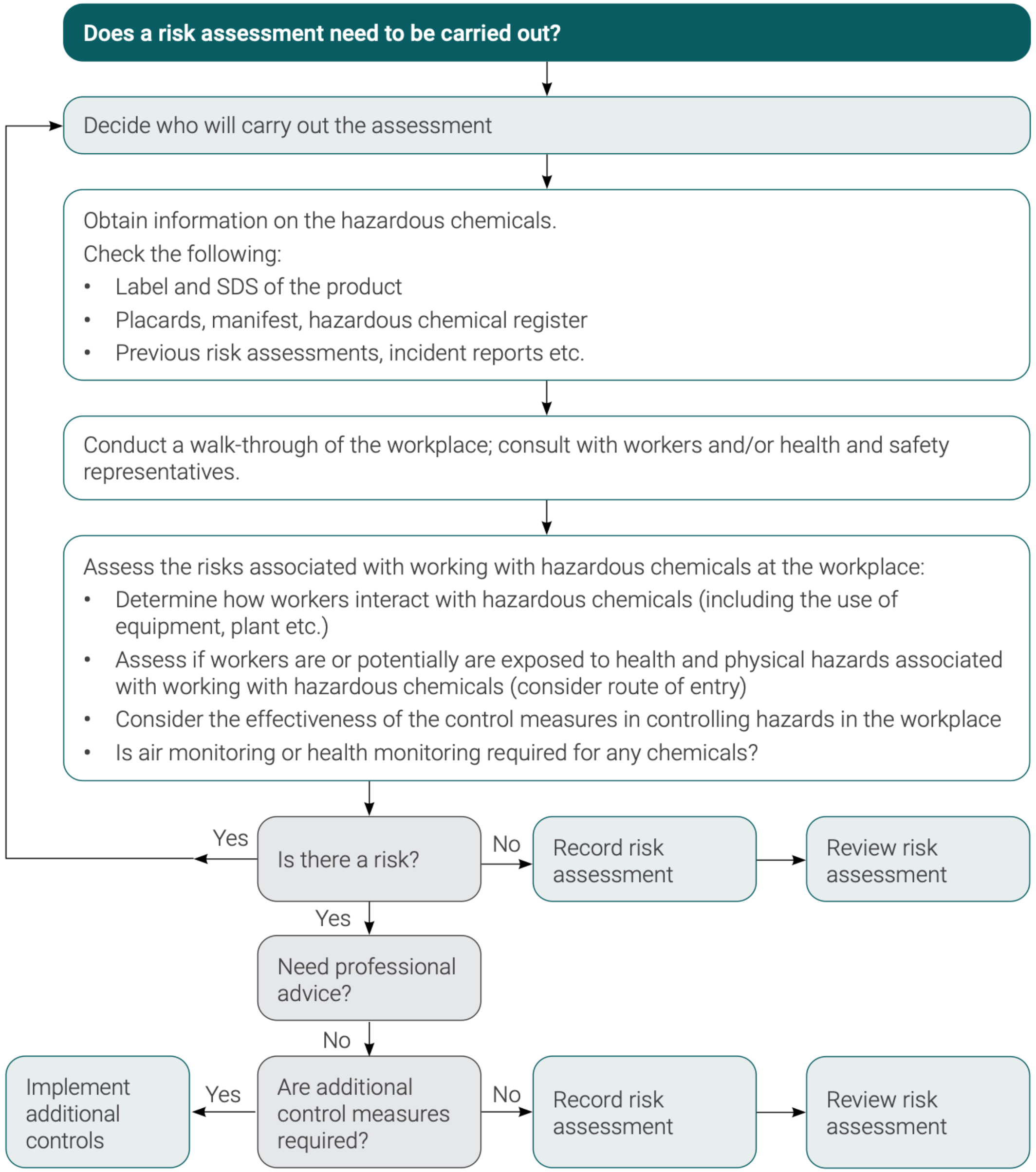

Figure 3 Overview of the process for the assessment of health risks arising from the use of hazardous chemicals in the workplace

https://www.commerce.wa.gov.au/sites/defau
t/files/atoms/files/221178_cp_hazardouschem
cals.pdf

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FOOD SCIENCE EXPERIMENT

SUBSTANCE 1

water, protein, lipids (mainly triglycerides, lecithin [phospholipids] and cholesterol), iron, phosphorus, calcium, manganese, iodine, copper, zinc.

SUBSTANCE 2

Fat, Proteins, Lactose, Ash, Calcium, Magnesium, Sodium, Potassium, Chloride.

SUBSTANCE 3

Fat, Water, Salt, lactose.

SUBSTANCE 4

heat, oxygen, fuel.

FOOD SCIENCE EXPERIMENT VARIABLES

INGREDIENTS

- Quality
- Quantity
- Feedstock

METHODOLOGY

- Manual vs automated
- Differing methods
- Equipment used – manual handling issues
- Heating source
- Order of chemicals/ingredients
- Process time

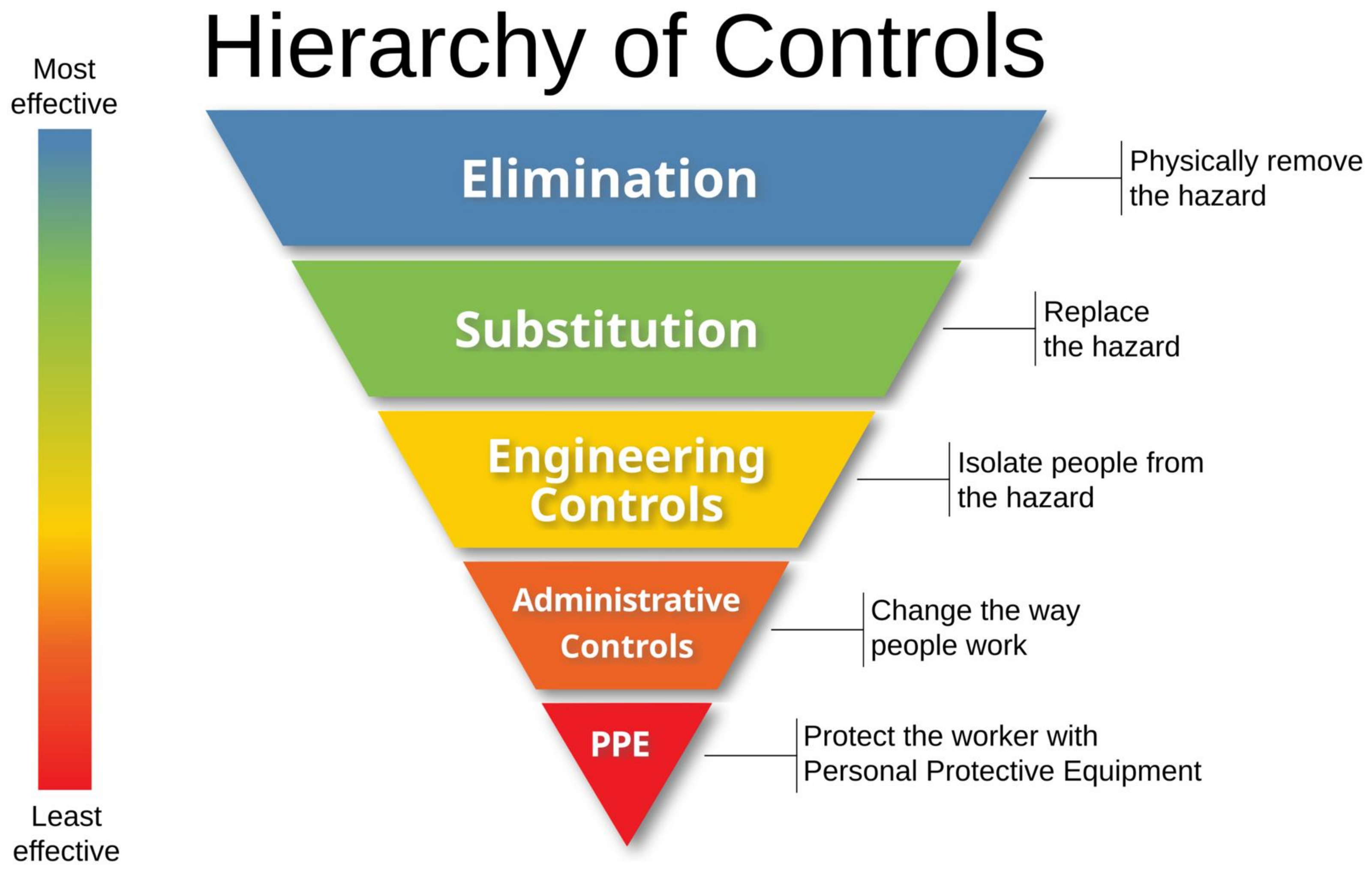
OTHER VARIABLES

- Scale of experiment
- Experience of staff or students
- Number of students
- Student Behaviour
- Time availability
- Timing
- Waste

WHAT ARE THE HAZARDS ?

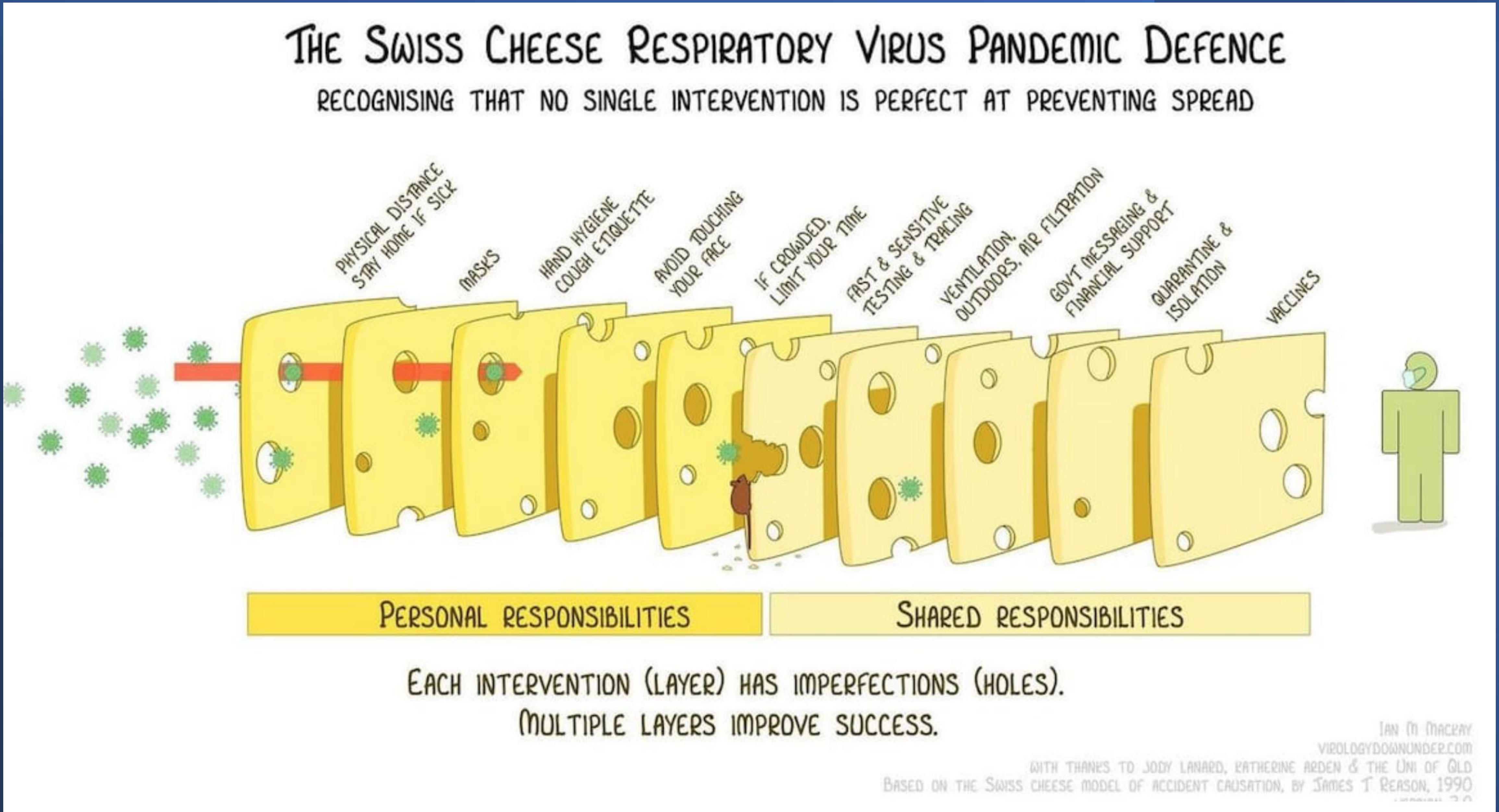
- Broken Glass due to bowl being dropped or cracked
- Sharp motorised blades – Beaters/mixer
- Electrocution due to faulty electrical equipment (mixer/hotplate)
- Eye irritation/damage – due to butter being over heated and spitting in pan
- Exposure to heat –Burns due to open flame or hot plate
- Explosion - due to faulty/leaking gas appliance
- Hazardous manual handling - lifting or reaching for bowls/saucepans/stirring.
- Ingestion/exposure to allergen - milk/eggs/butter
- Ingestion of contaminated chemical - milk/eggs
- Ingestion of contaminated chemical - uncooked/improperly cooked eggs
- Ingestion of foreign object - egg shell in mix
- Inhalation of gas – if using a gas stove top has been left on
- Skin contact - if not spills not cleaned off the bench
- Slip hazard - Spilt milk on floor
- Slip hazard - Broken eggs/egg whites on the floor/bench

HOW DO WE CONTROL THE RISKS



REASON'S SWISS CHEESE MODEL

- Works on the premise of protection.
- Each slice of cheese represents a barrier or a layer of protections
- When there are weaknesses or holes in the barriers and the holes are allowed to line up, active failure contribute to the hazard trajectory .
- Often used in accident investigation, can be used to prevent accidents by considering the barriers that are needed to be put in place


THE SWISS CHEESE RESPIRATORY VIRUS PANDEMIC DEFENCE
RECOGNISING THAT NO SINGLE INTERVENTION IS PERFECT AT PREVENTING SPREAD
PHYSICAL DISTANCE
STAY HOME IF SICK
MASKS
HAND HYGIENE
COUGH ETIQUETTE
AVOID TOUCHING
YOUR FACE
IF CROWDED,
LIMIT YOUR TIME
FAST & SENSITIVE
TESTING & TRACING
VENTILATION,
OUTDOORS, AIR FILTRATION
GOVT MESSAGING &
FINANCIAL SUPPORT
QUARANTINE &
ISOLATION
VACCINES
PERSONAL RESPONSIBILITIES
SHARED RESPONSIBILITIES
EACH INTERVENTION (LAYER) HAS IMPERFECTIONS (HOLES).
MULTIPLE LAYERS IMPROVE SUCCESS.
IAN M MACKAY
VIROLOGYDOWNUNDER.COM
WITH THANKS TO JODY LANARD, KATHERINE ARDEN & THE UNI OF QLD
BASED ON THE SWISS CHEESE MODEL OF ACCIDENT CAUSATION, BY JAMES T REASON, 1990

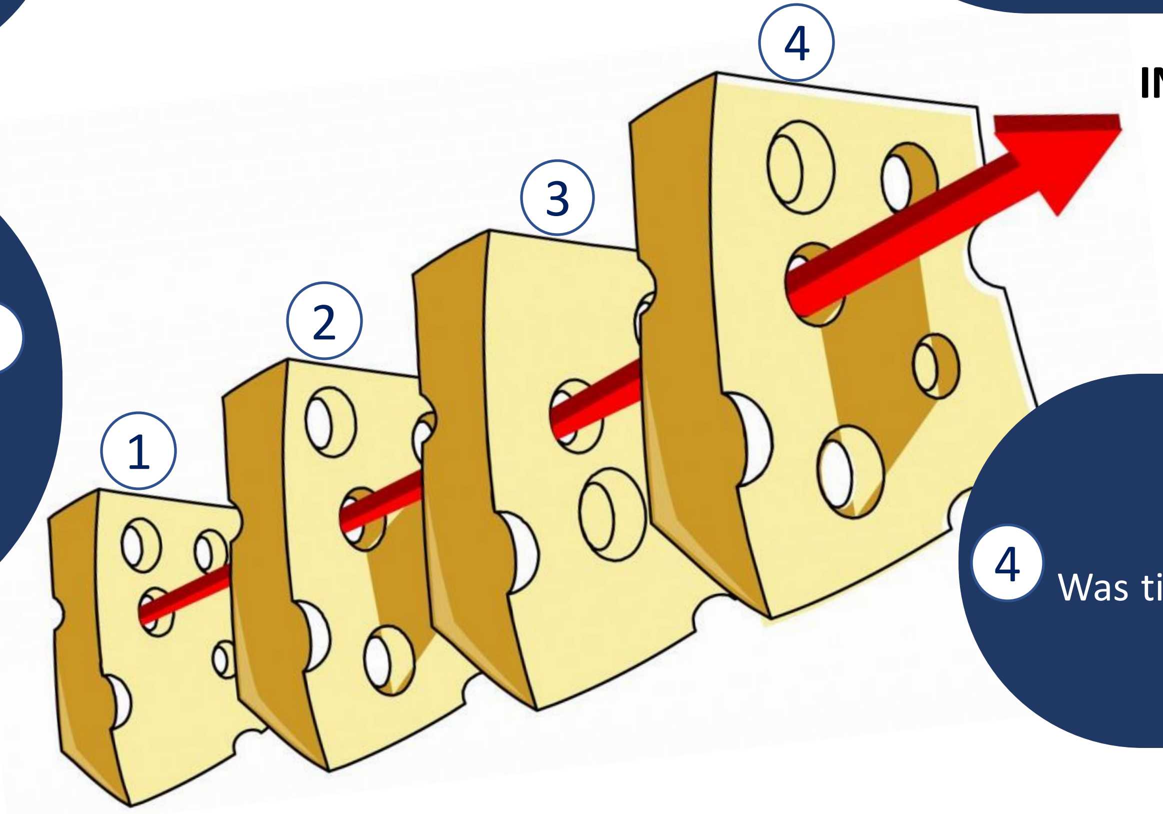
Reason's Swiss Cheese Model

ORGANIZATIONAL FACTORS
Lack of planning for safety
Excessive cost cutting
Inadequate or unavailable safety policies
Design issues (equipment, workstation, workflow)
Poor buying decisions
1

PRE-CONDITIONS FOR UNSAFE ACTS
No training, induction or work instructions
Hazard(s) not reported
Ineffective training or induction
No safe equipment or clothing available
Mental fatigue, conflicting priorities taking precedent over safety
Safety signs or warnings taken off or not available
2

UNSAFE SUPERVISION
Distracted or inadequate supervision
Safety reliant on time available and money
Not enforcing safety policies and systems
No follow up or safety inspections
Poor management role models
3

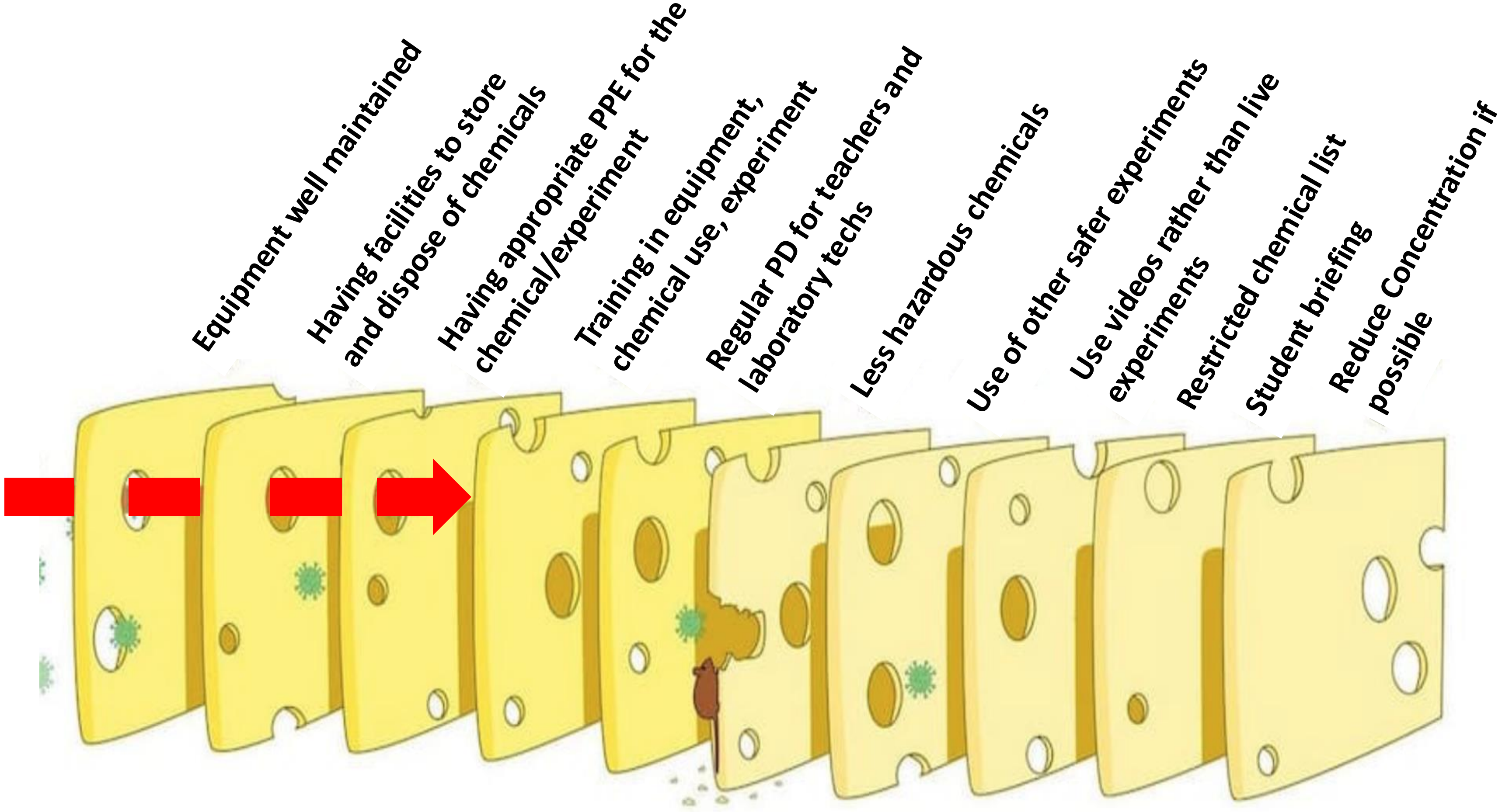
INCIDENT



HAZARD

UNSAFE ACTS
Incorrect use of equipment
Reckless behaviour
Was tired, distracted, in a hurry etc.
Ignored procedure
4

SUT (2006).
Image Source: http://www.dfwhcfoundation.org/what-is-the-swiss-cheese-model-of-harm Reason after Stevens. SUT (2006)



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GOOD BAD AND THE UGLY

WHAT DOES A GOOD CHEMICAL RISK ASSESSMENT LOOK LIKE?

- **Living document**
  - Risk assessment
  - Details of the experiment/chemicals/equipment
  - Connects with the Safety Data Sheet

- **Considers the**
  - information on the SDS
  - environment the the chemical is being used/stored/disposed of
  - storage, handling and disposal of the chemical(s) being used

- **Focuses on**
  - Prevention and barriers between the hazard and potential incident.

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IF OR WHEN?

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WHAT DOES A BAD CHEMICAL RISK ASSESSMENT LOOK LIKE?

Does not

- cover potential exposure
- Look beyond the experiment to disposal of waste
- Consider
  - equipment being used
  - chemical concentration
  - the context of the usage
  - legislative requirements

Uses Vague statements

- “ensure that...”
- “Appropriate PPE”
- “Appropriate training”
- Adds ingredients or equipment not listed in the documented experiment
- Considers safety showers and eye wash as a control

Focuses on

- Labelling controls in accordance with the hierarchy of controls
- Focuses to much on the risk rating or level rather than barriers to protect workers/students.

WHAT DOES A BAD CHEMICAL RISK ASSESSMENT LOOK LIKE?

Example - Experiment using newspaper

Potential Hazard - easily flammable

Standard handling procedures – avoid using near naked flame

Example - Experiment using a plastic cup

Potential Hazard easily flammable, may release toxic fumes

Standard handling procedures – use insulating foam cups for hot liquids

Making a pH Indicator

- **Boil** about 100 cm3 of tap water in a **beaker.**
- Add three to **four pieces** of red cabbage to the boiling water.
- Boil for about 5 minutes. The water should have turned blue or green.
- Turn off the **Bunsen burner** and allow the beaker to cool for a few minutes.
- Place three test-tubes in a rack. Half fill one with **alkali**, one with **acid** and one with **de-ionised water.**
- Decant approximately 2–3 cm height of cabbage solution into each test-tube.
- Test solutions A and B with the cabbage solution to see if they are neutral, alkaline or acidic.

Source: https://edu.rsc.org/experiments/making-a-ph-indicator-using-red-cabbage/422.article

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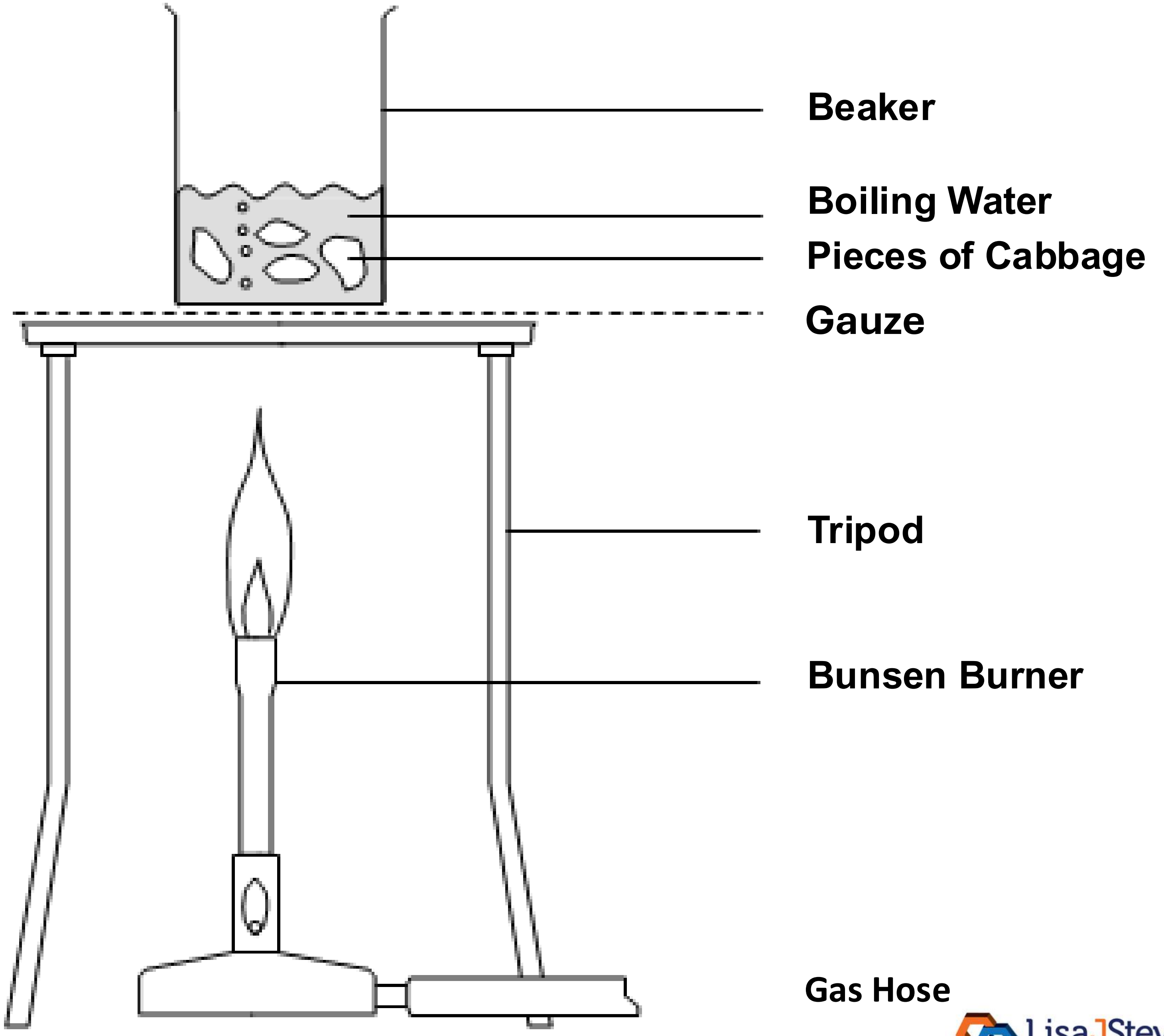

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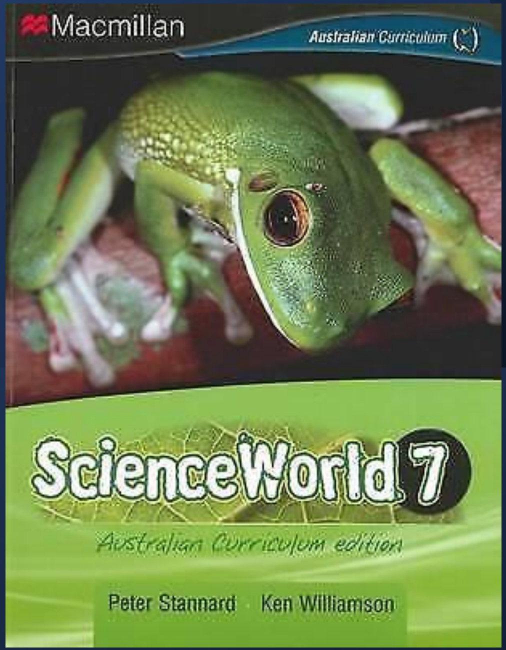
ACTIVITY MAKING HYDROGEN



Investigate

8 MAKING HYDROGEN

Aim

To make and test hydrogen gas.

Materials

- test tube rack
- 3 test tubes
- 1 cm of magnesium ribbon
- dilute **hydrochloric acid** (1 M)
- taper and matches
- test tube holder

Corrosive

Planning and Safety Check

Read the investigation carefully.

- Why is it essential that you wear safety glasses when doing this experiment?
- Why do you turn the collecting test tube upside down over the first test tube?

Method

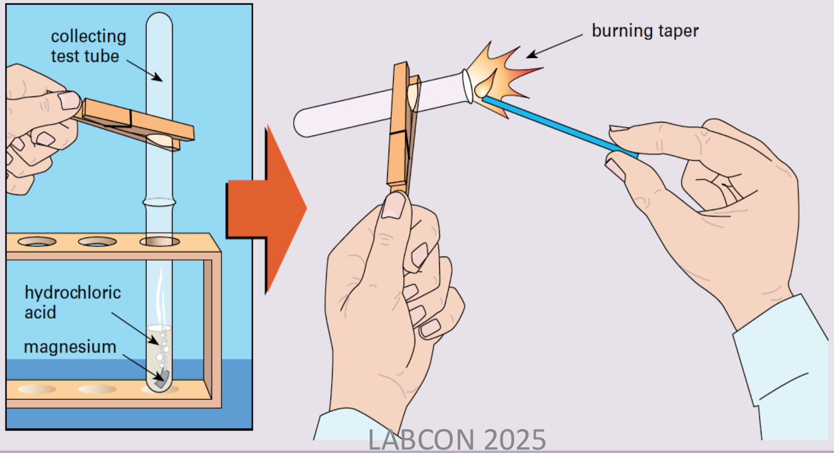
1. Put a test tube in the test tube rack and one-third fill it with dilute hydrochloric acid.
2. Put the magnesium ribbon into the acid. Then use a test tube holder to hold the empty test tube upside down over the mouth of the first test tube, as shown.
3. Ask another person to light a taper. Then remove the top test tube and *immediately* put the burning taper near its mouth. A 'pop' or 'squeak' indicates that the gas in the tube is hydrogen.

   What do you observe on the inside of the test tube?
4. If necessary, repeat the experiment.

Discussion

1. What evidence is there that a chemical reaction occurred in the test tube?
2. After a while no more hydrogen is produced. Why is this?
3. How can you explain the presence of water inside the test tube after you 'pop' the hydrogen?
4. Why did you tilt the test tube upwards before bringing the burning taper near?
5. Suggest why you didn't hold the collecting test tube in your hand when you tested for hydrogen.

Wear safety glasses.



Making Hydrogen
Science World 7
3rd Edition
page 54
Stannard and Williamson

LisaJStevens & ASSOCIATES	**RISK ASSESSMENT AND CONTROL FORM – CHEMICALS**

RISK ASSESSMENTS ARE ONLY VALID FOR 5 YEARS. IF THE PROCEDURE OR THE RISK CHANGES A NEW ASSESSMENT IS REQUIRED			
Chemical Name/Procedure Title	**Making Hydrogen from Science World 7 - 3rd Edition page 54 – Making Hydrogen (Stannard and Williamson)**		
Assessment conducted by	Lisa Stevens	**Assessment date**	November 2024
PROCEDURE DESCRIPTION			

Equipment

- Test tube rack
- 3 test tubes
- Test tube holder

Chemicals

- 1 cm magnesium ribbon
- Dilute hydrochloric acid (1M)
- Taper and matches

Methodology

1. Put a test in the test tube rack and one third fill it with a dilute hydrochloric acid.
2. Put the magnesium ribbon into the acid.
3. Then use the test tube holder to hold the empty test tube upside down over the mouth of the 1st test tube as shown.
4. Ask another person to light a taper.
5. Then remove the top test tube and immediately put the burning taper near its mouth.
6. A pop or a squeak indicates that the gas in the tube is hydrogen.
7. If necessary, repeat the experiment.

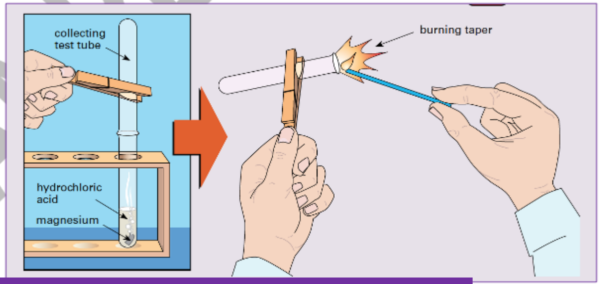


Image from Science World 7 - 3rd Edition page 54 – Making Hydrogen (Stannard and Williamson)

The following additional equipment may be useful but was not cited in the published experiment

- Tweezers (may be used for placing magnesium strips into test tube)
- Container for lit taper (information not included in the experiment)

Note experiment does not indicate how a hot taper should be disposed of nor does it talk about residual waste

WHAT ARE THE HAZARDS ?

Cuts from broken glass ware

- Chips and cracks in glassware

Tipping over test tube stand

- Laboratory bench cluttered
- Too many students around bench
- Students misbehaving
- Test tube rack not suitable for test tube size
- Test tube dropped during experiment

Matches/taper

- Using short matches

Exposure to Chemicals

- magnesium ribbon
- Exposure to concentrated HCl (during preparing 1% solutions)
- Potential for spills and leaks when transferring chemicals into reagent bottles

Burns from matches/taper

- Tapers break
- Broken matches
- Matches to short
- Matches fail to strike

- Manual handling - working above shoulder height
- Tipping over retort stand if too high
- Potential fall if using a step stool to reach top of burette

WHAT ARE THE CONTROLS?

Cuts from broken glass ware

- Check glassware before being used
- Use Polycarbonate pipettes(if compatible with chemical)
- Train staff and students how to handle glass and broken glass

Tipping over test tube rack

- Make sure only required items are on the bench top at the time of the experiments
- Bags etc. should be place underneath bench or in an area away from the bench

Matches/taper

Exposure to Chemicals

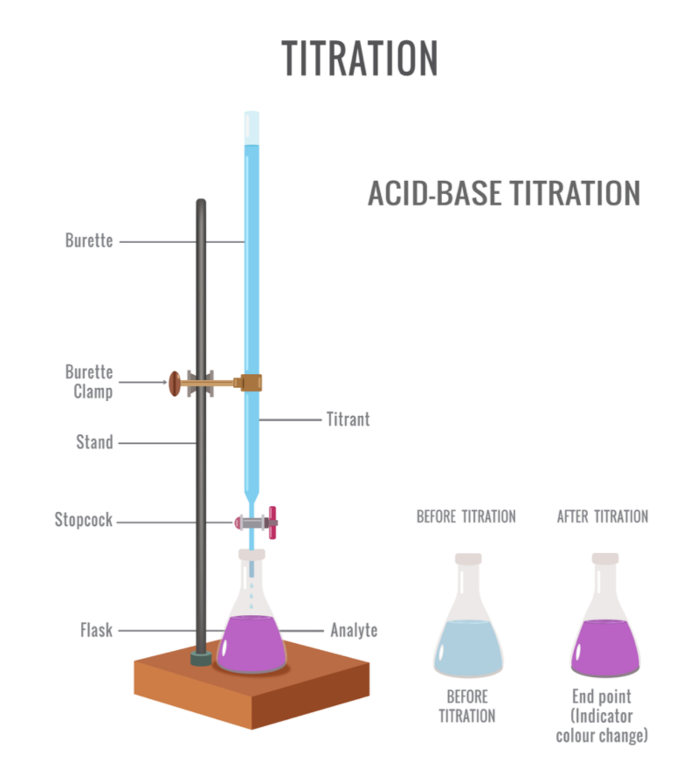
- **Always add concentrated acid to water (never water to acid).**
- Follow standard operating procedures
- Do not make up a dilution for the first time without seeking practical advice from an experienced colleague
- Make up solution only in facilities available i.e. running water, fume cupboard, chemical safety/eyewash station and relevant Personal Protective Equipment (PPE).
- Use PPE that is appropriate to the chemical. (Safety glasses, lab coat, laboratory gloves)
- Always make up dilutions in a fume cupboard.
- Ensure that glassware is free from chips and cracks before use.

Manual handling

- Storage of equipment between shoulder and knee height
- Always carry large bottles of concentrated acid either in an approved carrier or by firmly grasping the body of the bottle with one hand and placing the other hand underneath the bottle.
- Do not carry by the neck or lid.
- Do not rush.

ACTIVITY

TITRATION



1 x 500 mL bottle each of approx. 0.1mol.L-1 HCl and 0.1 mol.L-1 CH_3COOH (acetic acid)

1 x 1000 mL bottle of 0.1 mol/L NaOH

1 x bottle phenolphthalein

3 x Pasteur pipettes

3 x wash bottles and a supply of deionised water

3 x 20 or 25 mL volumetric pipettes

3 x 50 mL burettes, retort stands and clamps

6 x 250 mL conical flasks

9 x 100 or 250 mL beakers

3 x pipette fillers

3 x funnels for filling burettes

3 x white sheets of paper or white tiles

3 x burette reading cards

https://www.raci.org.au/education-outreach/school-competitions/titration-competition

WHAT ARE THE HAZARDS ?

- Cuts from broken glass ware
  - Wrong clamp used
  - Clamp over tightened
  - Chips and cracks in glassware
  - Dropped beakers/pipettes
- Tipping over retort stand
  - if too high
  - laboratory bench cluttered
  - Too many students around bench
  - Students misbehaving
  - using a funnel
- Broken pipette putting on bulb
- Perished bulb

- Exposure to phenolphthalein (during preparing 1% solutions)
- Exposure to concentrated HCl (during preparing 1% solutions)
- Potential for spills and leaks when transferring chemicals into reagent bottles
- Potential spills when students transferring chemicals to burette
- Fire due to use of ethanol to prepare solution
- Wrong concentration of chemicals
- Spill due to stopcock leaking

- Manual handling - working above shoulder height
- Tipping over retort stand if too high
- Potential fall if using a step stool to reach top of burette

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WHAT ARE THE CONTROLS?

Cuts from broken glass ware
- Check glassware before being used
- Use Polycarbonate pipettes(if compatible with chemical
- Train staff and students how to handle glass and broken glass

Tipping over retort stand
- Reduce height of retort stand

(place in sink or on low trolley/stand)
- Only required equipment and write up material on bench
- Reduce number of students in group
- Students misbehaving

Broken pipette putting on bulb
- Train staff how to correct way to put bulbs on pipettes
- Use Polycarbonate pipettes(if compatible with chemical)

Perished bulb
- Check bulbs on a regular basis – discard perished or damaged bulbs
- Encourage students to report damaged items

Exposure to concentrated chemicals
- Buy in solutions at reduced or required %
- Undertake prep work in a fume hood
- Wear PPE as required by SDS (gloves, lab coat, safety glasses)
- Work in well ventilated area
- Follow experiment in respect of concentrations
- Follow Standard Operating Procedure for preparation of solutions
- **Always add concentrated acid to water (never water to acid).**

Spills and leaks when transferring chemicals into reagent bottles
- Use funnels

Students transferring chemicals to burette
- Training
- Use of funnels
- Burette are right height

Exposure due to Stopcock leaking
- Encourage students to report faulty equipment
- Run a small amount of solution

Manual handling
- Storage of equipment between shoulder and knee height
- Burette located either in a sink or low table/trolley

Potential fall if using a step stool to reach top of burette
- Lower the burette rather than use a step stool.
- Do not use a chair to stand up on.

QUESTIONS

LisaJStevens & ASSOCIATES

THANK YOU

POSTAL ADDRESS

Post Office Box 3028

NEWPORT, VIC, 3015

CONTACT NUMBERS

Dr Neale Jackson	0414949340
Lisa Stevens	0417843798

WEBSITE

www.labsafety.com.au

info@labsafety.com.au

LisaJStevens & ASSOCIATES

Chemical Management and Laboratory Safety Specialist

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