



Food and Agriculture
Organization of the
United Nations

Raising confidence in
quality measurements
from soil laboratories
in Sub-Saharan Africa
Dakar, 23-27 October

Health and Safety
in Soil Laboratory



**LESEGO MOOKETSI-SELEPE
AFRILAB CHAIR**



Health and Safety in the lab.

Why does it matter?

Safe working protects :

- You
- Other lab workers
- Cleaners
- Visitors
- Your work



Health and Safety in the lab.

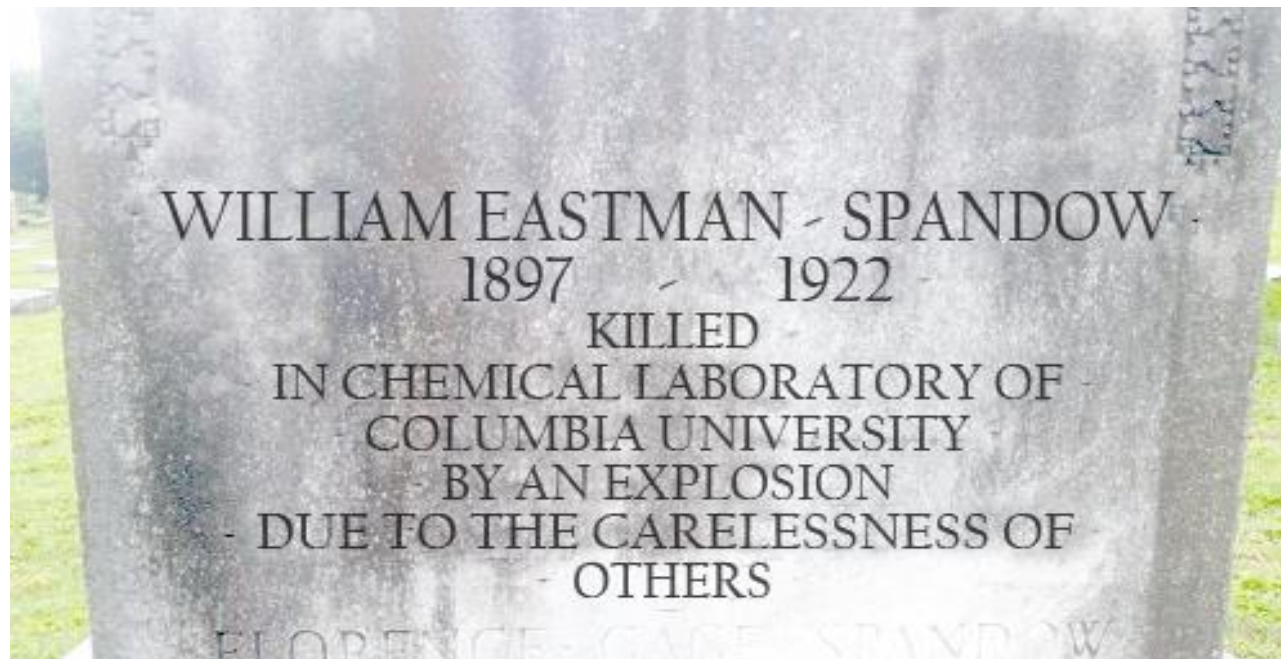
Why does it matter?

Safe working protects :

- You
- Other lab workers
- Cleaners
- Visitors
- Your work

Who is responsible ?

- Every one



1922 Lab Explosion

<https://www.labsafety.org/1922-lab-explosion-with-clues-for-today>

What is Health and Safety?

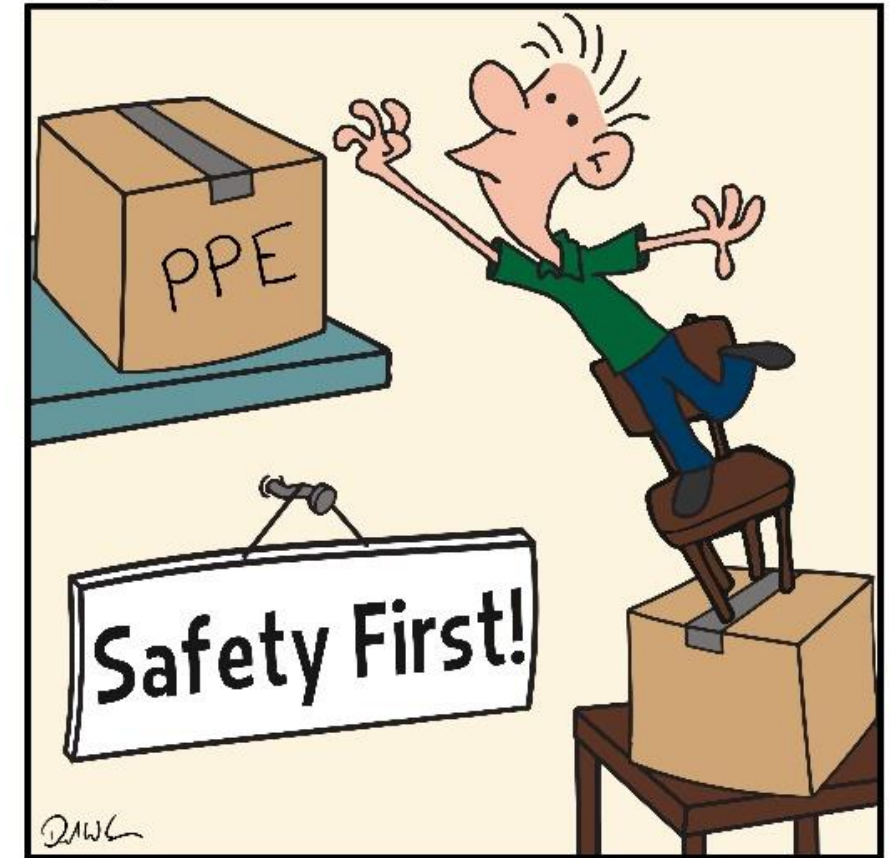
The laws, rules, and principles that are intended to keep people safe from injury or disease at work and in public places (cf. Cambridge dictionary)

Hazard and Risk -- What's the difference?

A *hazard* is **any source of potential damage or harm** to an individual's health or life under certain conditions.

Risk is **the chance or probability of a person being harmed or experiencing** an adverse health effect if exposed to a hazard.

Enlightened EH&S



Risks can be reduced by taking measures to minimize or control the hazard.

1. **Recognize** the Hazards
2. **Assess** the Risks of the Hazards
3. **Minimize or control** the Risks of the Hazards
4. **Prepare** for Emergencies from Uncontrolled



1. Recognize the Hazards

- i. Know what hazards are present in your lab.

What are the general hazards in a laboratory?

- Fire
- Breakage of glassware
- Spillages
- Pressure equipment and gas cylinders
- Extremes of heat cold
- Chemical hazards
- Biological hazards
- Radiation

And many more!!!!

ii. Know the signs and meaning

Think safety

- Environmental Hazards
- Health Hazards
- Physical Hazards

Hazard Classes



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1. Recognize the Hazards cont.

Match the pictogram to the hazard

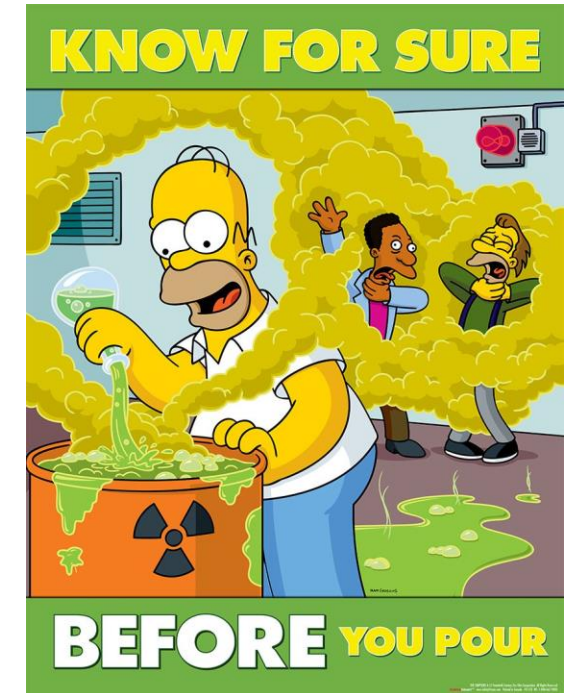


2. Assess the Risks of the Hazards

- *Risk assessment* : the process of estimating the probability of harm from a hazard, by considering the process or the laboratory procedure that will be used with the hazard.

Risk assessment = severity of the hazard x probability of exposure to the hazard

When ? Before, during and after an Experiment.



2. Assess the Risks of the Hazards

How to do a Risk Assessment?

Quantifying laboratory risk assessment

You can not manage what you don't measure

Types of risk assessment

I. Qualitative Risk Assessments

The assessors will use their personal judgement to identify hazards around the workplace, assess risks and plan control measures.

II. Quantitative Risk Assessments

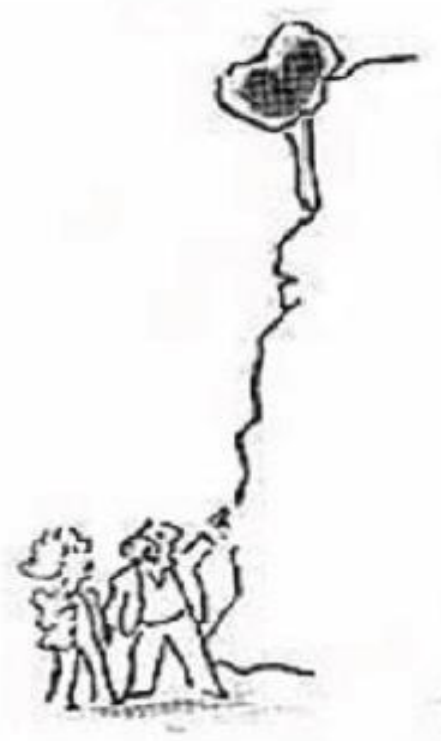
Assessors use risk matrix

Types of risk assessment in laboratory:

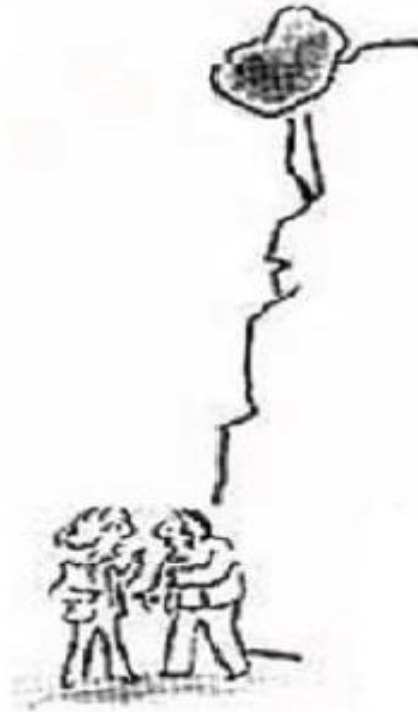
- Quality risk assessment (quality of data)
- Environmental risk assessment
- Health and safety risk assessment
- Economic risk assessment (equipment, and incomes of the laboratory)

Steps of Risk Assessment

Risk identification



Risk analysis



Risk treatment



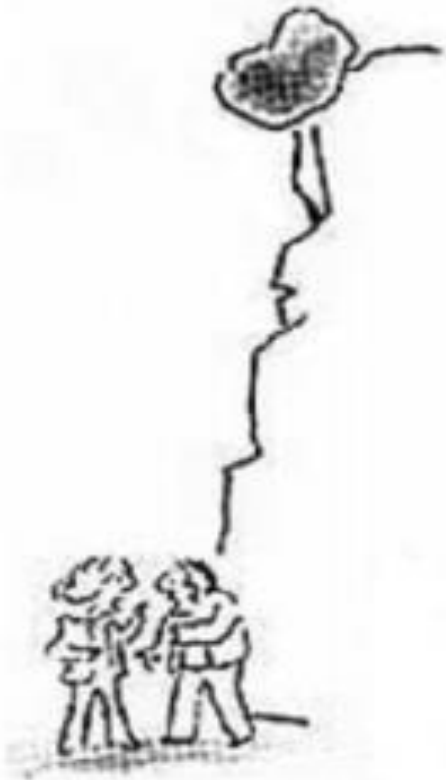
Risk identification



Risk Identification:

- Purpose: find, recognize and describe risks that might prevent an organization achieving its objectives.
- Relevant, appropriate and up-to-date information

Risk analysis



Risk Analysis:

Risk Rating= severity \times likelihood \times Frequency

Or

Risk rating= severity \times likelihood

Risk Matrix

Quantitative Likelihood	consequences				
	Minor skills impact	Minor impact to capability	Unavailability of core skills affecting services	Unavailability of critical skills or personnel	Protracted unavailability of critical skills /people
Has occurred on an annual basis in this organization in the past or circumstances are in the train that will cause it to happen	Minor injury or first aid treatment	Injury requiring treatment by medical practitioner	Major injury/hospitalization	Single death and or multiple major injuries	Multiple deaths
Has occurred in the last few years in this organization or has occurred recently in other similar organizations or circumstances have occurred that will cause it to happen in the near few years	Insignificant 1	Negligible 2	Moderate 3	Extensive 4	Significant 5
Has occurred at least once in the history of this organization or is considered to have a 5% chance of occurring in the near few years					
Has never occurred in this organization but has occurred infrequently in other similar organizations or is considered to have a 1% chance of occurring in the next few years					
Is possible but has not occurred to date in any similar organization and is considered to have very much less than a 1% chance of occurring in the next few years					

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Measuring the Acceptability of the Risks

	Insignificant 1	Negligible 2	Moderate 3	Extensive 4	Significant 5
Almost Certain 5	5	10	15	20	25
Likely 4	4	8	12	16	20
Possible 3	3	6	9	12	15
Unlikely 2	2	4	6	8	10
Rare 1	1	2	3	4	5

	Acceptable
	Medium
	High

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Examples of risky activities in the lab(the photo is fake)



	Insignificant 1	Negligible 2	Moderate 3	Extensive 4	Significant 5
Almost Certain 5					
Likely 4					
Possible 3					
Unlikely 2					
Rare 1					

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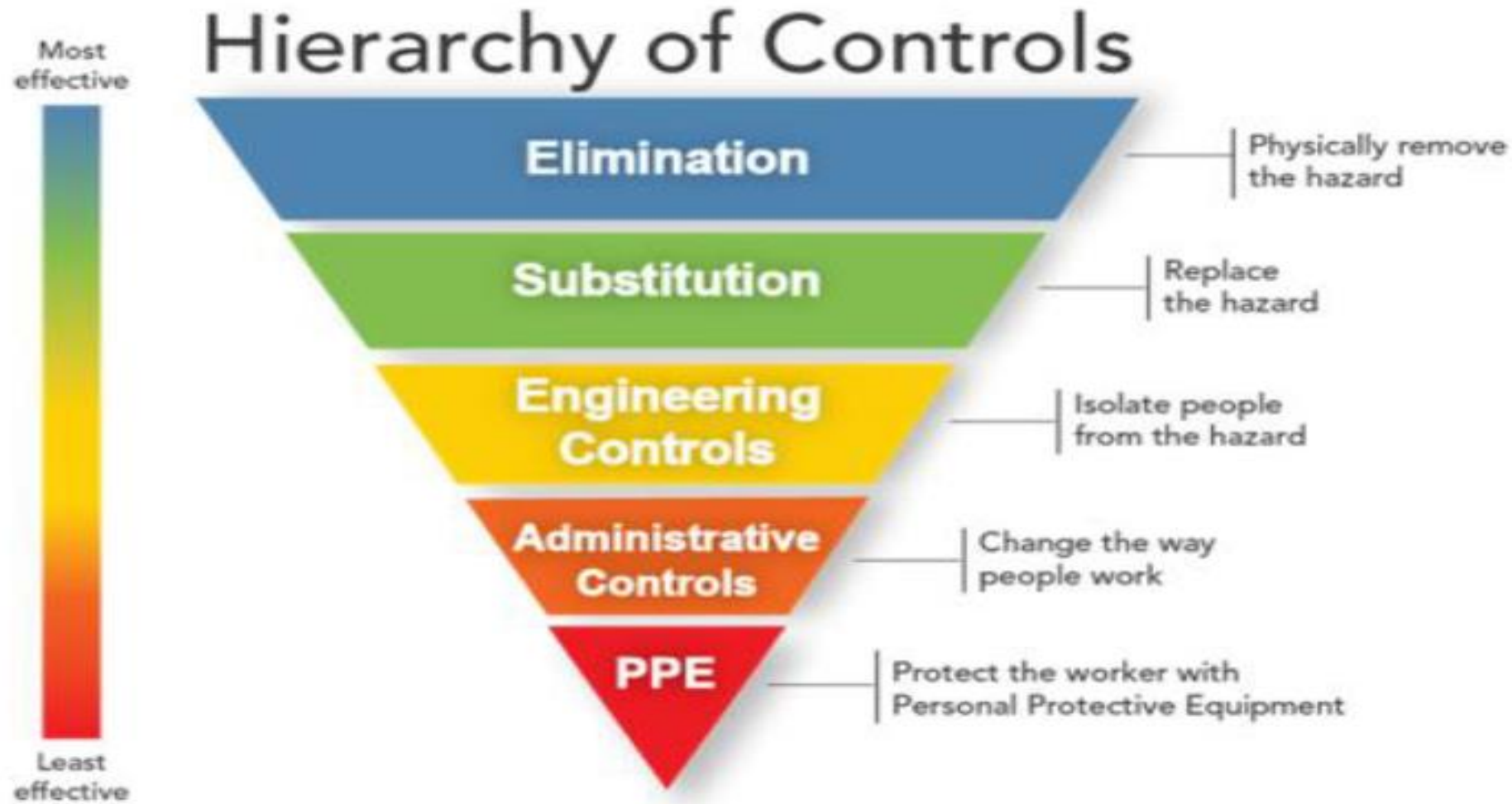
Risk treatment



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Risk treatment



Examples of Risk Treatment : control or minimize

Elimination



Substitution



Administrative Control



Examples of Risk Treatment : control or minimize



What risk treatment actions has been done in second photo?

Risk assessment template : Determine hazards and evaluate risks

What are the hazards?	Who might be harmed and how?	What are you already doing to control the risks?	What further action do you need to take to control the risks?	Who needs to carry out the action?	When is the action needed by?	Done

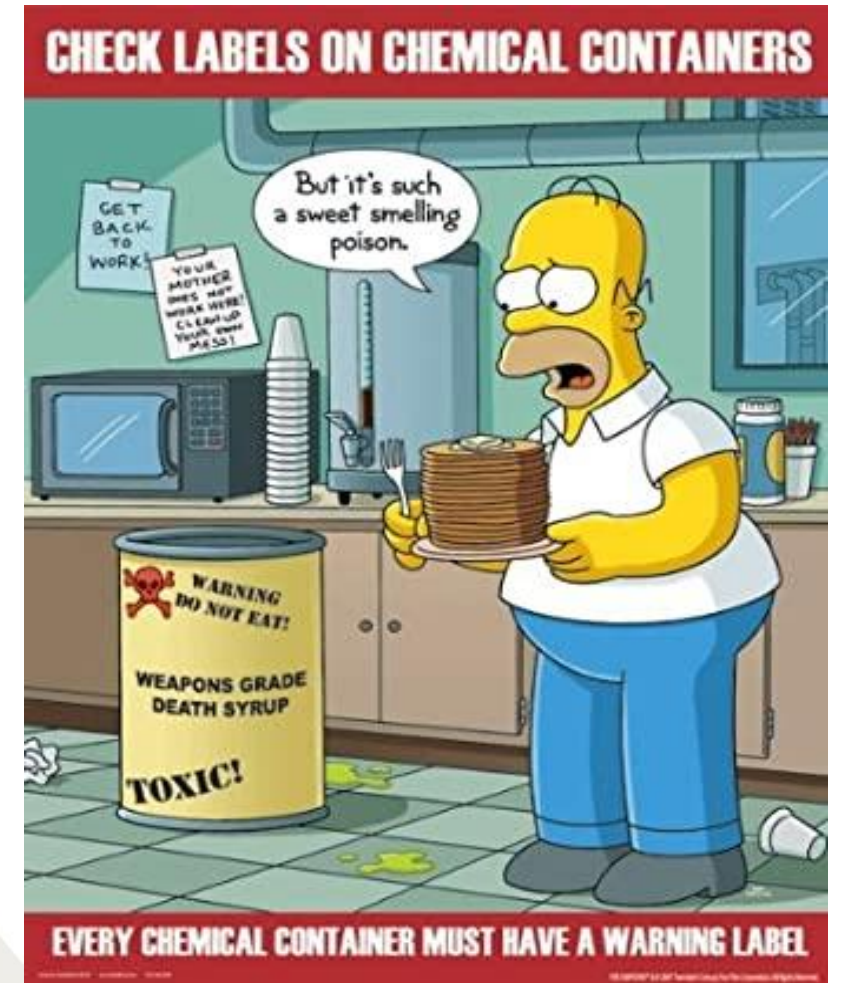
- Do it with your colleagues
- Agree it with your supervisor



3. Minimize or control the Risks of the Hazards

Use the safe practices

- Know details and location of the vital laboratory information.
- Labeling : It is important to know as much about a chemical as possible.



3. Minimize (or control) the risks of the hazards cont.

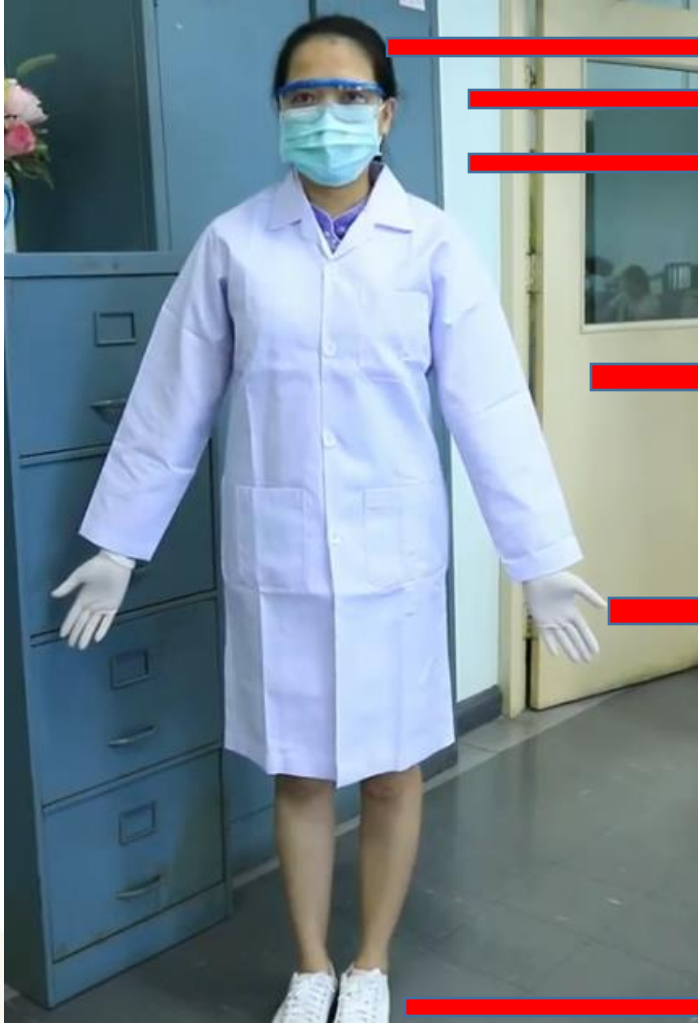
Protecting yourself and your colleagues

- Proper use of safety equipment (ex:fumehood)
- Proper use of Personal Protective Equipment (PPE)



When using the safety device, remember to also use the proper personal protective equipment.

3. Minimize (or control) the risks of the hazards Personal Protective Equipment (PPE)



long hair must be tied back

eye protection

mask

Lab coat, must be kept fastened

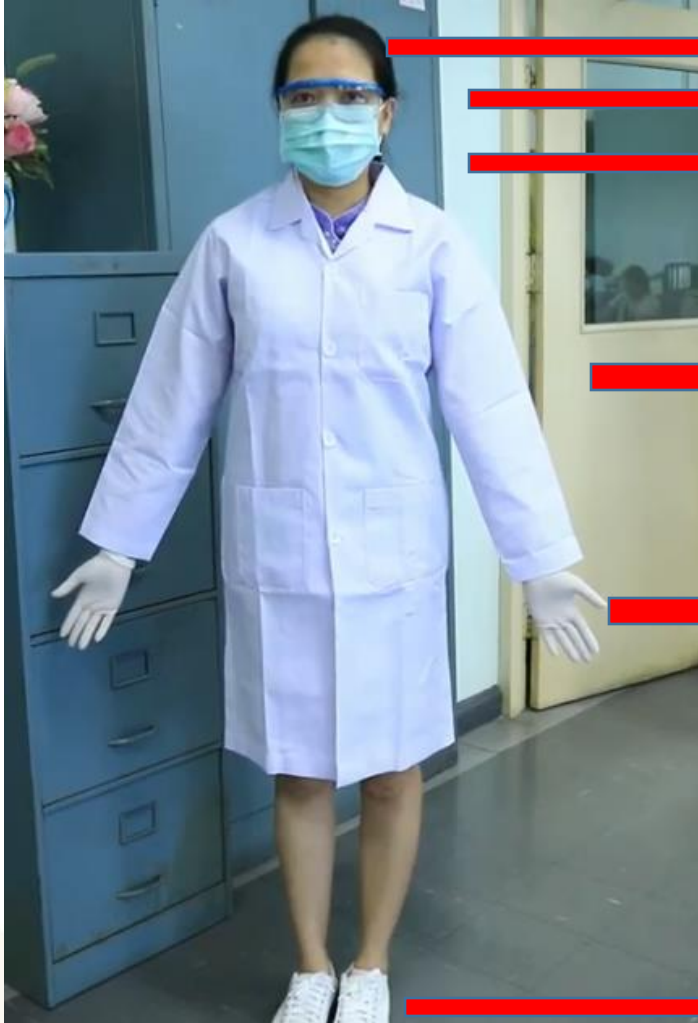
gloves

Closed shoes, Don't wear sandals or open shoes

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3. Minimize (or control) the risks of the hazards Personal Protective Equipment (PPE)



long hair must be tied back

eye protection

mask

Lab coat, must be kept fastened

gloves

Closed shoes, Don't wear sandals or open shoes




Wear the clothing and protective wear identified in your risk assessment

Knowing

“what to use and when to use”
is the key to properly protecting yourself.

3. Minimize (or control) the risks of the hazards

Personal Protective Equipment (PPE)

Glove material	Intended use	Advantages and disadvantages	Example Photos
Latex (natural rubber)	Incidental contact	<ul style="list-style-type: none"> • Good for biological and water-based materials. • Poor for organic solvents. • Little chemical protection. • Hard to detect puncture holes. • Can cause or trigger latex allergies 	
Nitrile	Incidental contact (disposable exam glove) Extended contact (thicker reusable glove)	<ul style="list-style-type: none"> • Excellent general use glove. Good for solvents, oils, greases, and some acids and bases. • Clear indication of tears and breaks. • Good alternative for those with latex allergies. 	
Polyvinyl chloride (PVC)	Specific use	<ul style="list-style-type: none"> • Good for acids, bases, oils, fats, peroxides, and amines. • Good resistance to abrasions. • Poor for most organic solvents. 	

Example : gloves

There are many different types of protective glove

Use the correct ones for the job you will be doing :
CHEMICAL COMPATIBILITY

Remove your gloves **before** using **instruments, telephone, and leaving the laboratory**

3. Minimize (or control) the risks of the hazards

Safety Equipment

- Fume hoods

Use Properly:

- keep sashes down
- don't store flammable liquids, equipment in hood
- limit traffic behind you



3. Minimize (or control) the risks of the hazards

Safety Equipment

- Canopy and snorkel fume extraction



It is important to know when this equipment is to be used and how to properly use it.

3. Minimize (or control) the risks of the hazards

Safety Equipment



Chemical Storage



- Ensure that all chemicals are stored according to compatibility. Acids are incompatible with bases, flammable solvents, oxidizers
- Water reactive materials should be stored separately
- All chemical products must be dated when opened

3. Minimize (or control) the risks of the hazards

Safety Equipment



Chemical Storage



- The storage area and cabinets should be labeled to identify the hazardous nature of the products stored within.
- Food containers **MUST NEVER BE USED** for chemical storage.

Spark from pressure gauge caused University of Hawaii explosion :Postdoc, who lost an arm in the incident, was using a gauge not specified for work with flammable



3. Minimize (or control) the risks of the hazards

Signs and labeling

- Signs are a way of communicating important information. It is a way to heighten awareness about hazards that exist.



- The label should describe what the content is and also any precautions.



Labels should display this universal biohazard symbol.

Escherichia coli

Precautions:

Must use Eye protection, lab coat, gloves

Only use under BSC

3. Minimize (or control) the risks of the hazards

Know the properties of chemicals and biological agents before you use or transport them

- Toxicity
- Flammability
- Reactivity/Incompatibilities
- Corrosive
- Unstable
- Radioactive
-

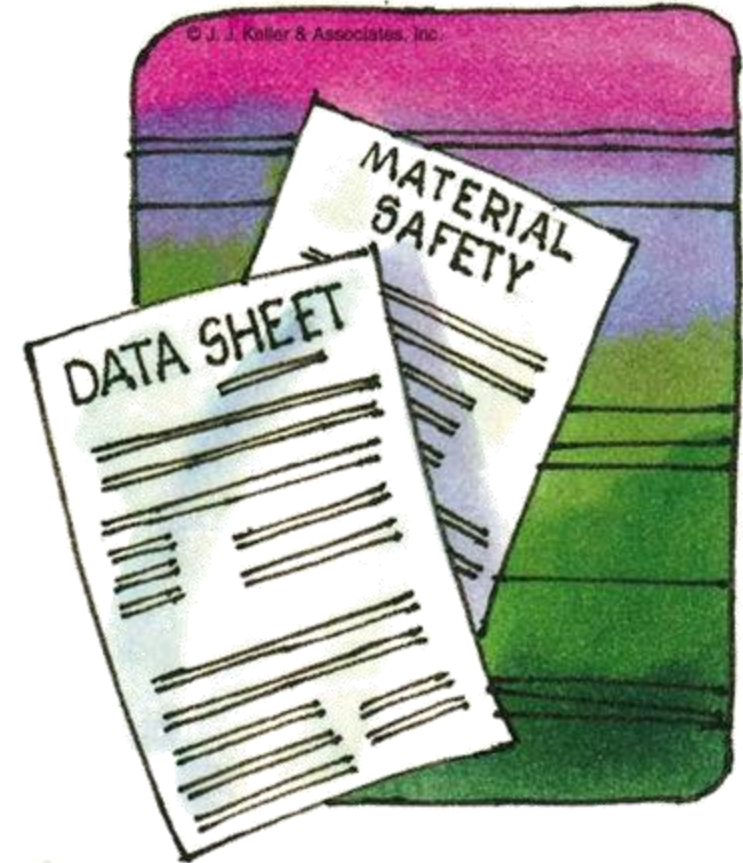
Where you can find this information ?

3. Minimize (or control) the risks of the hazards

MSDS: Material Safety Data Sheets

MSDS provide you with the following :

- Chemical and Physical properties
- Toxicity Information
- Computability/Incompatibility
- Appropriate spill and fire response
- **Information needed for first aid**
- ...



3. Minimize (or control) the risks of the hazards

Example: MSDS for potassium Dichromate

Sigma-Aldrich www.sigmaaldrich.com

SAFETY DATA SHEET Version 8.0
according to Regulation (EC) No. 1907/2006 Revision Date 14.07.2021
Print Date 17.08.2021
GENERIC EU MSDS - NO COUNTRY SPECIFIC DATA - NO OEL DATA

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers
 Product name : Potassium dichromate solution
 Product Number : 24-4520
 Brand : Katayama
 REACH No. :


1.2 Relevant identified uses of the substance or mixture and uses advised against
 Identified uses : Scientific research and development

1.3 Details of the supplier of the safety data sheet
 Company : Sigma-Aldrich Pte Ltd
 (Co. Registration No. 199403788W)
 1 Science Park Road
 #02-14 The Capricorn, S'pore Sci. PkII
 SINGAPORE 117528
 SINGAPORE
 Telephone : +65 6779-1200
 Fax : +65 6779-1822

1.4 Emergency telephone
 Emergency Phone # : 1-800-262-8200

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture
Classification according to Regulation (EC) No 1272/2008
 Germ cell mutagenicity (Category 1B), H340
 Carcinogenicity (Category 1B), H350
 Reproductive toxicity (Category 1B), H360FD
 Long-term (chronic) aquatic hazard (Category 3), H412
 For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 Label elements
Labelling according Regulation (EC) No 1272/2008
 Pictogram 
 Signal word : **Danger**


Katayama- 24-4520 Page 1 of 11
The life science business of Merck operates as MilliporeSigma in the US and Canada

Hazard statement(s)
 H340 May cause genetic defects.
 H350 May cause cancer.
 H360FD May damage fertility. May damage the unborn child.
 H412 Harmful to aquatic life with long lasting effects.

Precautionary statement(s)
 P201 Obtain special instructions before use.
 P202 Do not handle until all safety precautions have been read and understood.
 P273 Avoid release to the environment.
 P280 Wear protective gloves/ protective clothing/ eye protection/ face protection/ hearing protection.
 P308 + P313 IF exposed or concerned: Get medical advice/ attention.
 P405 Store locked up.

Supplemental Hazard Statements
 none

Contains: potassium dichromate. May produce an allergic reaction. Restricted to professional users.

Reduced Labeling (<= 125 ml)
 Pictogram 

Signal word
 Danger

Hazard statement(s)
 H340 May cause genetic defects.
 H350 May cause cancer.
 H412 Harmful to aquatic life with long lasting effects.
 H360FD May damage fertility. May damage the unborn child.

Precautionary statement(s)
 P201 Obtain special instructions before use.
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 P280 Wear protective gloves/ protective clothing/ eye protection/ face protection/ hearing protection.
 P308 + P313 IF exposed or concerned: Get medical advice/ attention.
 P405 Store locked up.

Supplemental Hazard Statements
 none

2.3 Other hazards
 This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

SECTION 3: Composition/information on ingredients

3.2 Mixtures
 Formula : Cr₂K₂O₇
 Molecular weight : 294.18 g/mol

Katayama- 24-4520 Page 2 of 11
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Component	Classification	Concentration
potassium dichromate	Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)	
CAS-No. 7778-50-9 EC-No. 231-906-6 Index-No. 024-002-00-6 Registration number 01-2119454792-32-XXXX	Ox. Sol. 2; Acute Tox. 3; Acute Tox. 2; Acute Tox. 4; Skin Corr. 1B; Eye Dam. 1; Resp. Sens. 1; Skin Sens. 1; Muta. 1B; Carc. 1B; Repr. 1B; STOT SE 3; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H272, H301, H330, H312, H314, H318, H334, H317, H340, H350, H360FD, H335, H372, H400, H410 Concentration limits: >= 5 %: STOT SE 3, H335; M-Factor - Aquatic Acute: 10 - Aquatic Chronic: 1	>= 0.3 - < 1 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
 Consult a physician. Show this material safety data sheet to the doctor in attendance.

If inhaled
 If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
 Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
 Flush eyes with water as a precaution.

If swallowed
 Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
 The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
 No data available

Katayama- 24-4520 Page 3 of 11
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3. Minimize (or control) the risks of the hazards

Waste Management



Hazardous and biohazardous waste has special guidelines for proper disposal. It is important to properly dispose of waste to ensure human and environmental health. Waste can be classified as either hazardous or biohazardous.

How to Properly Dispose of Chemical Waste

Aqueous Waste (<40% Organic Chemicals)	Organic (>40% Organic Chemicals)	Solid Waste	Special Cases
 <ol style="list-style-type: none"> 1. Acidic (pH < 4) 2. Neutral (pH ~4-10) 3. Basic (pH > 10) 	 <ol style="list-style-type: none"> 1. Non-chlorinated (e.g. THF, ethyl acetate, hexanes, toluene, methanol, etc.) 2. Chlorinated (e.g. DCM, chloroform, chlorobenzene, etc.) 3. Chemicals in a commercial bottle <u>Undamaged bottle:</u> Dispose in original bottle (no label necessary) <u>Damaged bottle:</u> Arrange disposal with Chem Stores 	 <ol style="list-style-type: none"> 1. Lightly Contaminated <ul style="list-style-type: none"> • No visible loose powders • Collect in unlabeled green pails • Empty into the solid waste drums on the 7th floor <u>Examples:</u> Gloves, Kimwipes, paper towels, empty vials/centrifuge tubes, etc. 2. Chemical <ul style="list-style-type: none"> • Loose powders • Heavily contaminated solid materials <u>Examples:</u> Used filter paper, unwanted samples, heavily contaminated gloves/kimwipes/paper towels, etc. 3. Silica gel <ul style="list-style-type: none"> • Dispose in separate container • May not be combined with other types of chemical wastes 4. Chemicals in a commercial bottle <u>Undamaged bottle:</u> Dispose in original bottle (no label necessary) <u>Damaged bottle:</u> Place in secondary container with a waste label 	 <ol style="list-style-type: none"> 1. Sharps (e.g. needles, razor blades, etc.) 2. Inorganic Oxidizing <ul style="list-style-type: none"> • Place in a container with a disposal label <u>Examples:</u> Peroxides, chromates, etc. 3. Violently Reactive <ul style="list-style-type: none"> • Contact Ken Greaves and Mike Dymarski <u>Examples:</u> LAH, nBu-Li, HF, Piranha, etc. 4. Mercury Thermometers <ul style="list-style-type: none"> • Labeled separate puncture resistant container 5. Any uranium, thorium or mercury containing compounds <ul style="list-style-type: none"> • Contact Ken Greaves and Mike Dymarski

A Note on Labeling:

- Indicate the content in the disposal container.
- Write out all chemical names
- If the content is a mixture of chemicals, indicate the major components and list the most hazardous component(s)

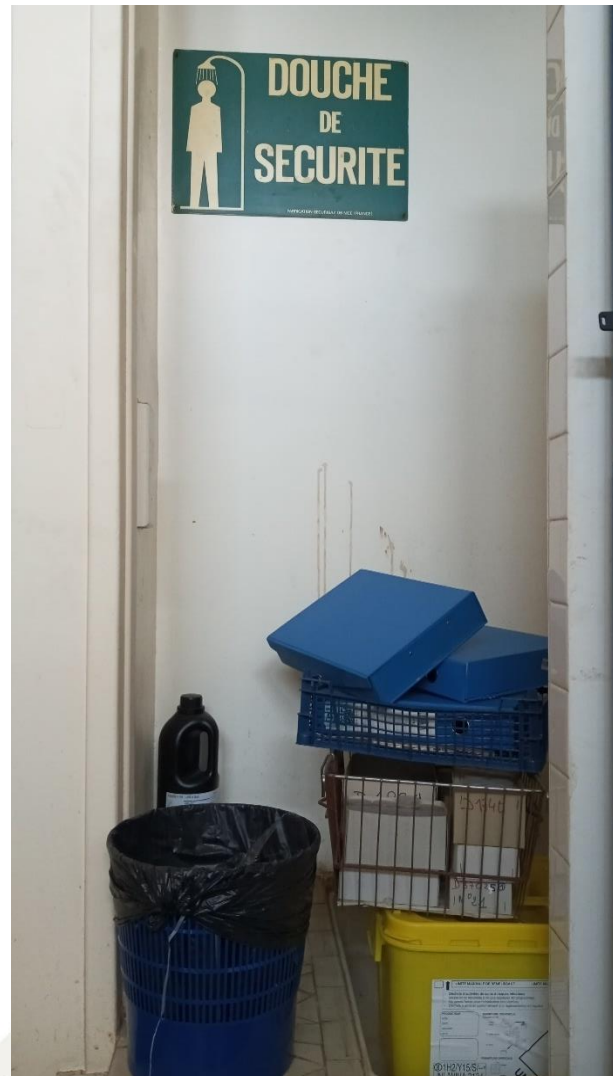
Dispose of all waste (hazardous, chemical and biological waste) properly and according to instructions

This document was created by Green Chemistry Initiative (GCI) in partnership with Environmental Health and Safety (EHS).

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What's Wrong With This Picture?



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What's Wrong With This Picture?



Fake picture and situation

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Fake picture and situation

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What's Wrong With This Picture?

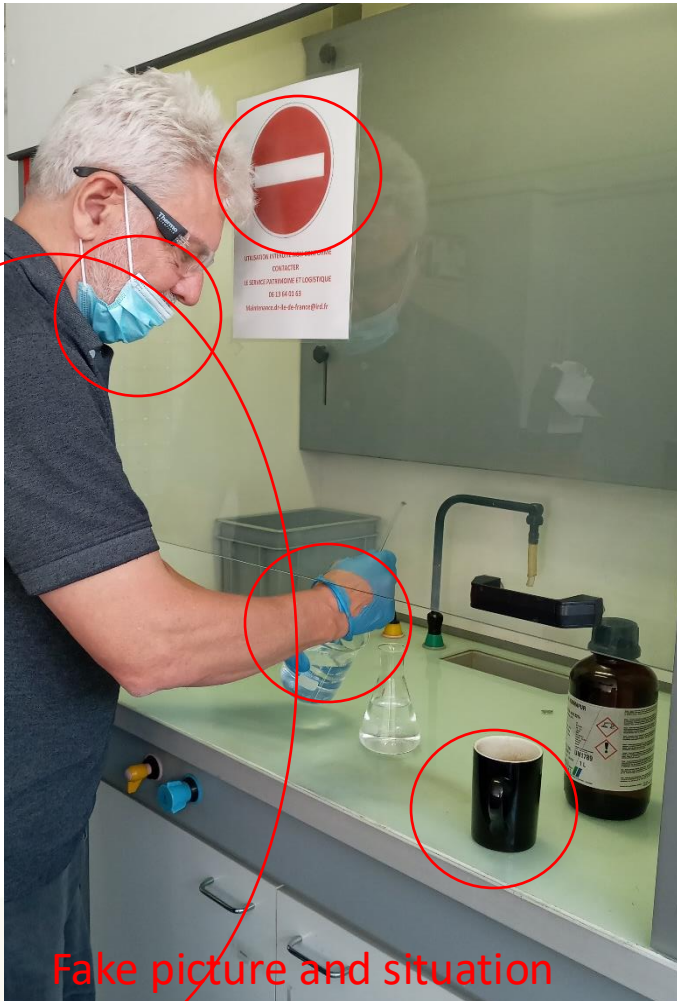


Fake picture and situation

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3. Minimize (or control) the risks of the hazards

Laboratory hygiene

- Keep your workplace tidy
- Clear up waste, deal with washing up and put things away as you finish with them
- Make sure everything is safe before you leave things unattended



<https://lab-training.com/2015/12/05/laboratory-accidents-prevention-your-top-priority/>



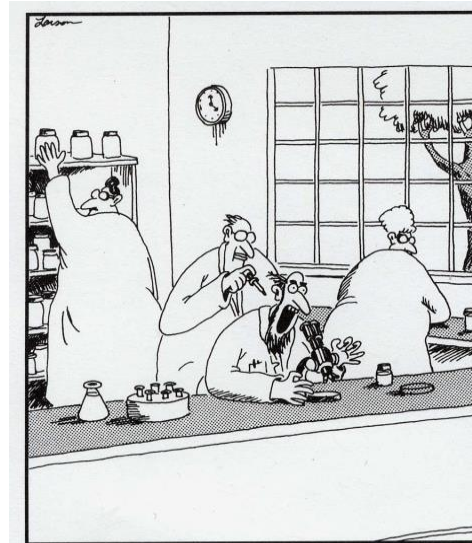
<https://www.greelane.com/fr/science-technologie-math%C3%A9matiques/science/important-lab-safety-rules-608156/>

A Cluttered Lab is a Dangerous Lab! Keep your lab clean!

3. Minimize (or control) the risks of the hazards

Laboratory hygiene

- Never eat, drink or smoke in a laboratory
- Never apply cosmetics
- Never touch your face, mouth or eyes
- Never suck pens or chew pencils
- Never use cell phones and/or earbuds/headphones
- Never Engage in practical jokes



Professor Glickman, the lab practical joker, deftly places a single drop of hydrochloric acid on the back of Professor Bingham's neck.



The favourite practical joke amongst Big Bang theorists.

4. Prepare for Emergencies from Uncontrolled Hazards

What to do???

The best measure to take in order to protect yourself and your colleagues is to be prepared. There should be Standard Operating Procedures (SOP) for this type of situation in your lab.

- Recommended Safety Equipment
- Exits and Emergency Drills
- Emergency Response

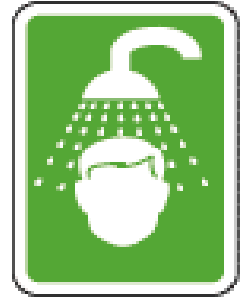


4. Prepare for Emergencies from Uncontrolled Hazards

In case of an emergency...



- Know the locations of:
 - fire extinguisher
 - fire blanket
 - body shower
 - eyewash station
 - first aid kit



Know Your Surroundings

4. Prepare for Emergencies from Uncontrolled Hazards

Special Considerations

- Fires
- Spills
- Gas cylinders
- Electrical equipment



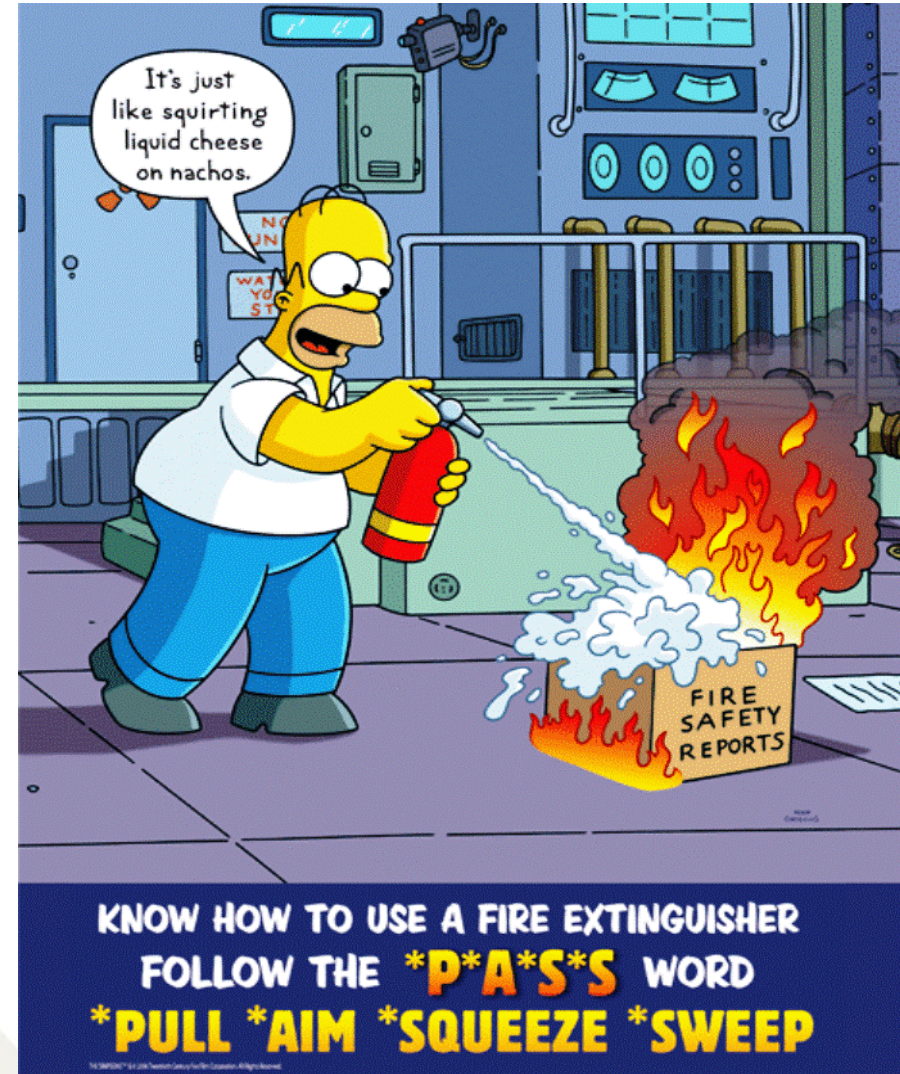


4. Prepare for Emergencies from Uncontrolled Hazards : Fire

1. Avoiding Fires

Flammable substances :

- Use minimum quantity
- Store in special storage cabinet
- Use temperature-controlled heating sources



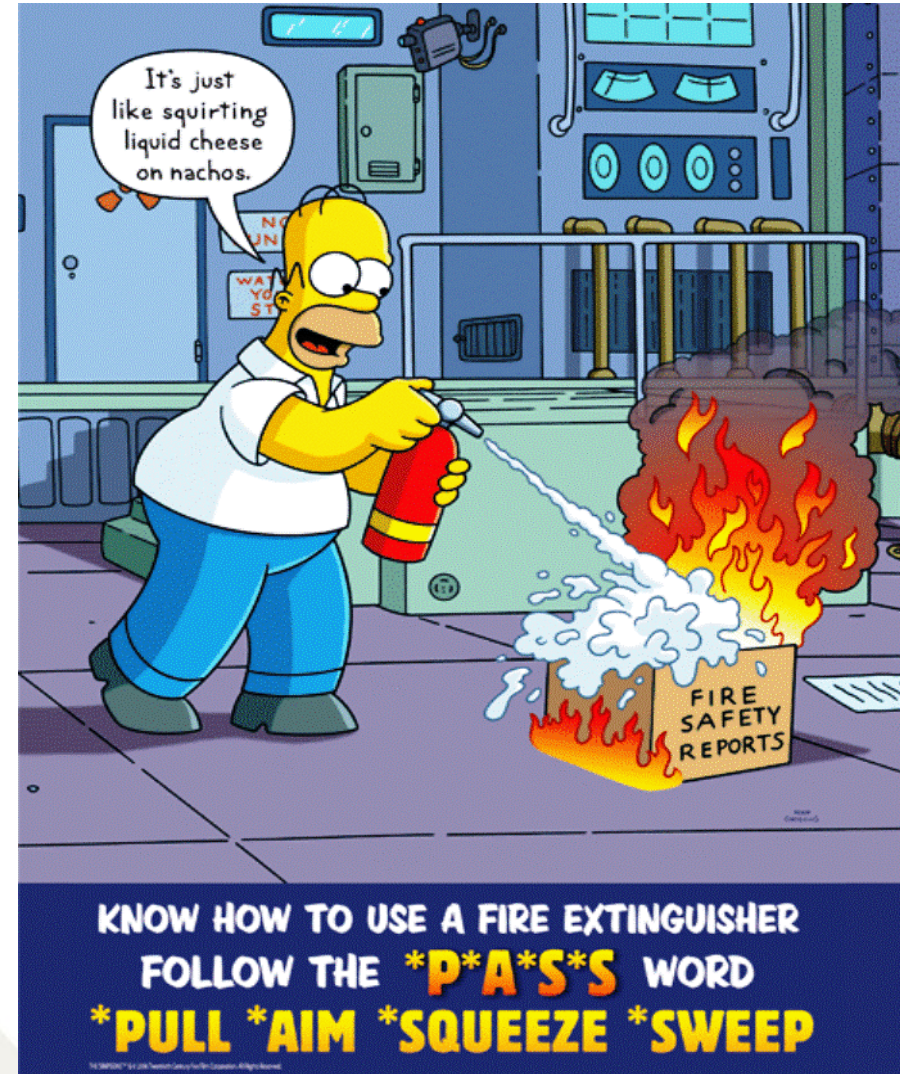


4. Prepare for Emergencies from Uncontrolled Hazards : Fire

2. Fire Safety

Make sure that you know what to do :

- If you have a fire
- If you hear a fire alarm
- A member of staff must attend fire training annually

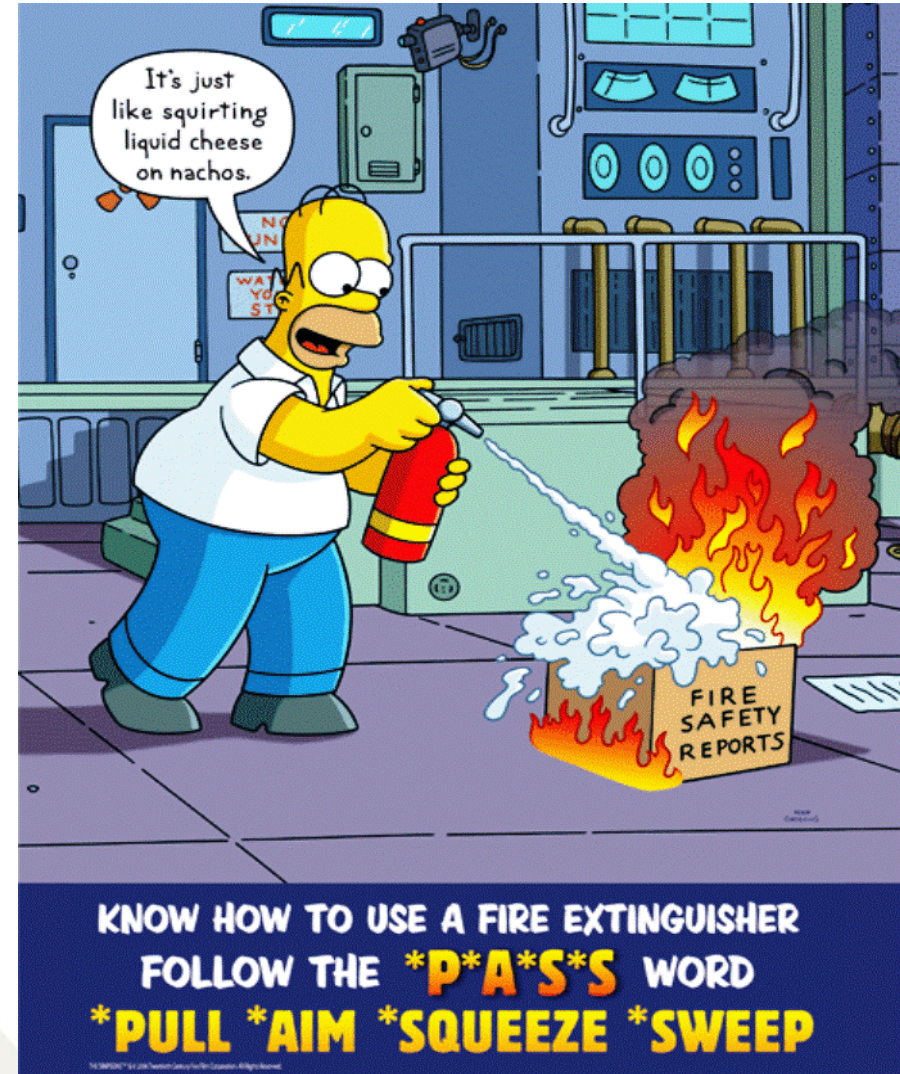




4. Prepare for Emergencies from Uncontrolled Hazards : Fire

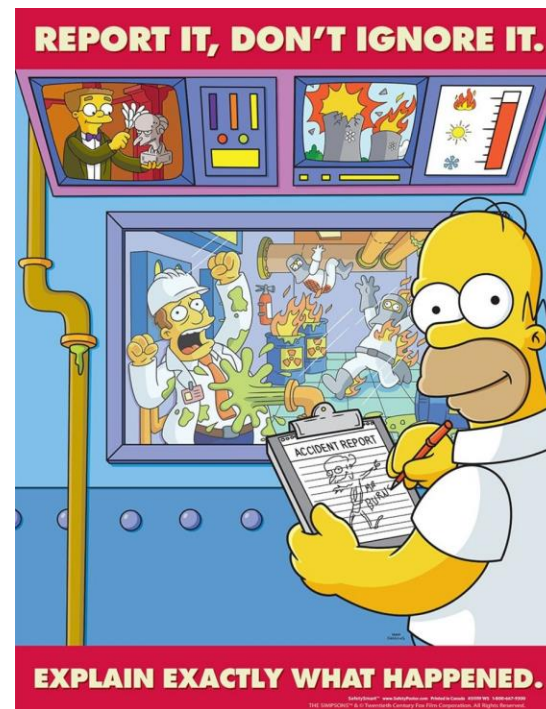
Emergency Response

- If your clothing catches on fire, drop and roll to put out the flames
- Immediately notify your supervisor of the incident and report it



4. Prepare for Emergencies from Uncontrolled Hazards

Report it!!!



When an accident occurs, it must be recorded **in the lab register**. The main purpose of the register is to track an exposure in case of future illness/injury, and report it to your supervisor.

Last, not Least.....

Create a Laboratory Safety Manual



Writing a clear and concise policy regarding all lab rules and best practices

New staff members read the manual and ask that they sign it

What's Wrong With This Picture?

What are the hazards?	Who might be harmed and how?	What are you already doing to control the risks?	What further action do you need to take to control the risks?	Who needs to carry out the action?	When is the action needed by?	Done
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Fake picture and situation

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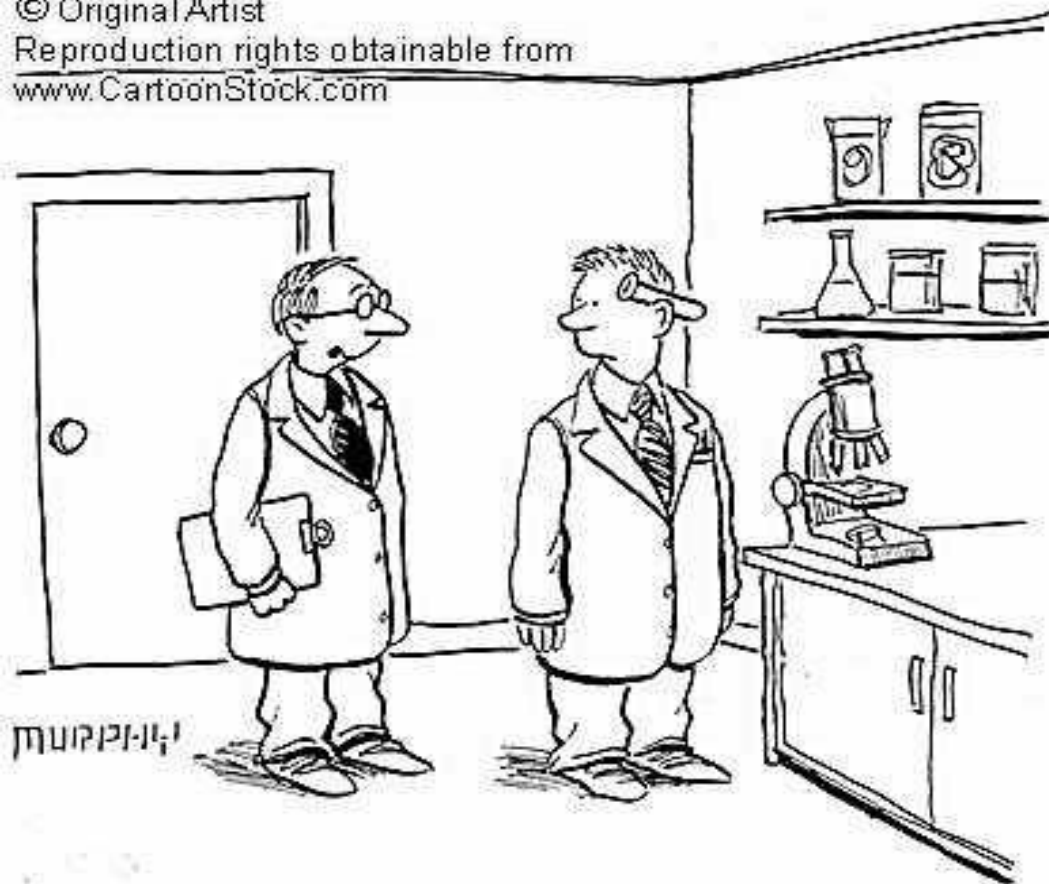


Food and Agriculture
Organization of the
United Nations

Thank you



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www.CartoonStock.com



"They hate it when you carry the testtubes that way."

