Laboratory Safety –
A Matter of Attitude

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Compiled by: SAFETY COMMITTEE, IPR
Case: 1

Two research students killed in BARC lab fire

Fire in N-hub: 2 researchers burnt alive in BARC lab
A fire broke out in a modular laboratory in India's top nuclear zone, the Bhabha Atomic Research Centre (BARC), at Trombay on 29\textsuperscript{th} December 2009 afternoon, killing two PhD students who were at work.

The laboratory usually houses over 60 research students and assistants of whom only two were present at the time of the incident.
Government’s Statement on 3rd January 2010:

✓ The fire at one of BARC's chemistry labs was an unfortunate accident. We have not yet been able to pinpoint what caused it.
Government’s Statement on 3rd January 2010:

✓ The two people who witnessed the event are no longer with us. Also, it was just an instrumentation lab, which doesn't store any chemicals, except for small quantities required to test the spectrophotometer.

✓ All our scientific establishments will have to reinforce their safety standards and work procedures; people cannot take things for granted.
BARC’s Statement on 2nd November 2010:

- Stop storage of chemicals in the lab.

- Start the process of scientifically disposing of all the old chemicals stored in the lab.
Barc's Statement on 2nd November 2010:

- Dr. R.K. Sinha, BARC Director, said the incident was very unfortunate and that the country cannot afford to lose young talent due to such irresponsibility.

- He said interns will be taken in, but in smaller numbers and along with other scientists they too will be given instructions and training for the safe usage of these chemicals.
Case: 2

A death in the lab.
At Yale University's Sterling Chemistry Laboratory in the lab's machine shop, a 22-year-old undergraduate student died as her hair tangled in a lathe. She had apparently died of asphyxiation in an accident.

In late 2008, 23-year-old research assistant sustained horrific burns in a lab fire at the University of California, Los Angeles (UCLA), and died of her injuries 18 days later.
Health and safety experts say that they have not seen a significant shift in the behaviour of bench scientists or the attitudes of lab heads, who are in the best position to improve safety culture.

"It's very difficult to change principal investigators' attitudes," says James Gibson, UCLA's director of environmental health and safety.
All too often, researchers in laboratories around the country still work alone, and without proper supervision or protection.

"In many cases, academic freedom is more important than safety," says Jim Kaufman, president of the Laboratory Safety Institute in Natick, Massachusetts.
Clip on “Importance of Chemical Safety”
HAZARDS

Normally, we may consider hazard of chemicals as Fire & Explosion.

Clip on “Fire & Explosion Hazard”

But, hazards associated with Chemicals handling and storage depends on:

1. Physical State of the Chemicals,
2. Chemical Nature of the Chemicals,
HAZARDS (Contd…)  

Chemical Nature of the chemicals:  

a. Flammable/Combustible Chemical,  

b. Explosive Chemical,  

c. Toxic Chemical,  

d. Corrosive Chemical,  

e. Oxidizing Chemical,  

f. Water Reactive Chemical,
HAZARDS ANALYSIS

Hazard Analysis before working with chemicals,

- Know how to perform experiments,
- Know chemical properties,
- Know how to clean up spills,
- Know emergency procedures,
- Know risks to community,
CONTROL MEASURES

- Eliminating flames, static electricity, & sparks from electrical circuits.,

- Temperature,

- Proper Ventilation,

- Grounding/Bonding,

- Spill Control/Emergency Response,

- Proper disposal of spent fuels,
CONTROL MEASURES

Golden Rule:

Minimise EXPOSURE and reduce the RISK!
FLAMMABLE/COMBUSTIBLE CHEMICALS

Few examples of Flammable/Combustible chemicals handled at IPR

1. Acetone
2. Carbon Tetrachloride
3. Methanol
4. Iso-Propyl Alcohol
5. Petroleum Ether
6. Hydrogen
7. Mineral Oil
8. Distilled Oil
NFPA HAZARD RATING DIAMOND

National Fire Protection Association (NFPA) Label

Rating of hazards
4 = Deadly Hazard
3 = Severe Hazard
2 = Moderate Hazard
1 = Slight Hazard
0 = No Hazard
NFPA HAZARD RECOGNITION

HEALTH HAZARD
4 - Deadly
3 - Extreme danger
2 - Hazardous
1 - Slightly hazardous
0 - Normal material

FIRE HAZARD
Flash Point
4 - Below 73° F
3 - Below 100° F
2 - Below 200° F
1 - Above 200° F
0 - Will not burn

SPECIFIC HAZARD
Oxidizer
Acid
Alkali
Corrosive
Use NO WATER
Radiation Hazard

REACTIVITY
4 - May detonate
3 - Shock and heat may detonate
2 - Violent Chemical change
1 - Unstable if heated
0 - Stable
HMIS LABELS

- Hazardous Material Information System (HMIS) Labels
- Same colour code/numerical rating system as the NFPA diamond,
  - Blue = Health
  - Red = Flammability
  - Yellow = Instability
  - White = Personal Protective Equipment or special protection information
  - Numerical Rating of 0-4
EXAMPLES - HAZARDS

Glacial Acetic Acid

Sodium Hydroxide

Hydrofluoric Acid

Lithium
MATERIAL SAFETY DATA SHEET (MSDS)

- MSDS shall be readily available for all flammable, toxic and caustic materials utilized within the facility.
- MSDS is used by chemical manufacturers and vendors to convey hazard information to users.
- MSDSs should be obtained when a chemical is purchased.
- A chemical inventory list and MSDS, for each chemical is required to be maintained by users.
- READING OF MSDS – 16 SECTIONS,
HEALTH EFFECT OF CHEMICALS ON PERSON

CHEMICAL

SKIN

Primary Damage to Skin

Get absorbed in Blood

INHALATION

Primary Damage to Respiratory system

Get absorbed in Blood

Deposition on lungs causing damage

Get absorbed in Blood

INGESTION

Primary Damage to digestion tract

Through blood circulation to all organs and cause damage
HEALTH EFFECT OF CHEMICALS ON PERSON

Clip on “Irritant-Health Effect”
Health Effect of any toxic chemical depends on –

1. **Dose**: The amount of a substance to which one is exposed,

2. **Time**: How often and for how long exposure occurs,

3. **Route of Exposure**: Inhalation, Ingestion, Absorption.

Many other factors such as gender, age, physical fitness, etc.
4. Toxicity of chemicals:

TLV (Threshold Limit Value)

STEL (Short Term Exposure Limit)
THANK YOU