

GOVT. MODEL ENGINEERING COLLEGE

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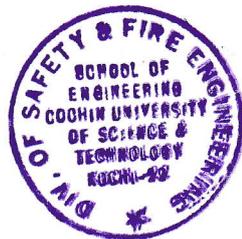
ENVIRONMENTAL HEALTH AND SAFETY MANUAL

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Verified and
found to be in
order.




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SAFETY & FIRE ENGINEERING
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GOVT. MODEL ENGINEERING COLLEGE

VISION

To evolve into an academy of excellence to serve the emerging knowledge based society

MISSION

To mould engineers in the field of information and communication technology to bridge the digital divide.

PREFACE

Established in 1989, Govt. Model Engineering College (MEC) was the first college under the auspices of IHRD and is affiliated to Cochin University of Science And Technology (CUSAT) and APJ Abdul Kalam Technological University(KTU) . The college offers 4 undergraduate and 5 postgraduate courses. MEC also bears the title of being the first recognized research center under CUSAT.

This Health and Safety handbook is intended for Government Model Engineering College employees and students of all category. Institution is firmly committed to conduct all educational, research, service and campus activities in a safe manner and protects the health of students, faculty, staff and the public while preserving its environments. The widely accepted standards and guidelines that should be followed to keep accidents to a minimum are described within this manual.

Please take few minutes to read the contents of this manual and decide which part you need to read and understand for your safety and the safety of others with whom you are working.

Responsibilities of EHS Committee

Environment Health and Safety (EHS) committee is assumed to deliver the following responsibilities for the well wish of MEC:

Table 1. Responsibilities of EHS committee

Responsibility	Detailed Tasks
Environment & Safety	Attend to and assist in general, occupational, and chemical Safety issues throughout MEC Conduct bimonthly general safety rounds Ensure availability of Emergency medicines at all laboratories
Sanitarian & Bio-safety	Attend to Sanitation and Bio-safety issues throughout MEC Conduct Waste Management Plan training sessions Prepare yearly reports on Waste Management, Bio-safety and Sanitation Attend to issues of Life Safety and Hygiene
Risk Management	Report on all non-patient related incidents Develop and review risk related policies & procedures Develop and implement wellness activities to the community Report all potential & actual claims to the insurance
Fire Protection	Attend to Life Safety and Fire issues throughout MEC Conduct annual fire safety round Initiate steps to maintain the fire extinguishers in time
General	Revise Safety Manual by incorporating the updated safety rules and procedures Prepare annual report of all activities of EHS Committee

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CHAPTER 1

INTRODUCTION

The Govt. Model Engineering College (MEC) is committed to provide and maintain a safe and healthy environment for its faculty, staff, students, visitors, and the general public. For this reason, the Environmental Health and Safety (EHS) manual is prepared. All MEC employees and students are responsible and accountable for EHS performance and its protection as outlined in this manual. The mission of EHS is to protect resources in support of the institute's teaching, research, healthcare, community outreach, and service learning goals and objectives.

The heads of departments, laboratory in-charges, workshop superintendent, instructors, etc., are responsible for the environmental health and safety of faculty, staff, students, and visitors engaged in activities under their direction or supervision. They must ensure that faculty, staff, students, and subordinates comply with all relevant regulations and standards and that work activities are performed in a safe and considerate manner.

Each faculty, staff, and student member is responsible for complying with the applicable provisions of environmental health and safety standards and regulations promulgated by regulatory agencies whose codes and standards will be utilized in conducting institute operations and is also responsible and accountable for EHS performance and its protection as outlined in this manual.

Faculty, staff and students are responsible for the following:

- Eliminating and/or reporting workplace hazards
- Reporting accidents, incidents, and unsafe practices or conditions to the Head of Department
- Ensuring proper disposal of or transfer of all hazardous materials before leaving the institute
- Know the safety procedures, potential hazards and precautions for each experiment before teaching or conducting a laboratory exercise
- Know the location and operation of emergency equipment, what emergency procedures are appropriate and how to summon assistance if needed

- Explain each experiment and alert others to possible hazards before they begin the laboratory exercise
- Foster a serious attitude toward lab content and safety. Supervise students closely while encouraging respect for safety.

CHAPTER 2

EMERGENCY SITUATIONS

Emergency Numbers

Table 2.1 Emergency Numbers

Thrikkakara Police Station	0484 2422365
Ambulance	108
Sunrise Hospital	0484 4160000
Thrikkakara municipal co operative Hospital	0484 2423310
Medical College, Kalamassery	0484 275 4000
Primary Health Centre	0484 242 1417
Police Station	100
Water Emergency	101
Electrical Emergency	1912
Fire and rescue,Thrikkakara	0484 242 3100
Women Helpline	9388700999
MEC Office	0484-2577379

All accidents, injuries, or near-misses should be reported to your Head of the Department/laboratory superintendent and then to the EHS Committee without any delay. If the incident occurred in the lab, superintendent is required to submit a Report of Accident, Injury, or Occupational illness and send it to the Head of the Department. Students and lab superintendent should understand that the purpose of reporting and

documenting accidents is not to affix blame, but instead to determine the cause of the accident so that similar incidents may be prevented in the future.

Minor injuries many times are not reported because they are perceived to be embarrassing or that "careless actions" lead to the accident. However, minor injuries can sometimes lead to more serious complications that only become evident at a later time. Taking corrective action as a result of a minor accident may keep a major incident from happening. Without knowledge of all minor accidents, the desirable investigation and resulting corrective actions are circumvented.

CHAPTER 3

EMERGENCY PROCEDURES

3.1 INTRODUCTION

During the course of normal operations there is always a chance for an emergency situation to arise. These emergencies can be the result of a fire, chemical exposure, chemical spill, or the need for medical assistance. In the event of an emergency, an emergency response plan should be implemented. This plan would include evacuation of the facility if deemed appropriate.

Internal communication is very important during any emergency situation. It is essential that all employees and students know how to act and react during the emergency. To accomplish this, it is necessary that a written Emergency Response Plan be developed and that all employees are trained on how to act accordingly. All accidents, regardless of severity, should be reported and investigated.

3.2 FIRES

3.2.1 BUILDING FIRES

The following steps are recommended if a fire occurs in a building:

- Initiate a building evacuation using the emergency alarm.
- If the fire is small and you have been trained in the use of portable fire extinguishers, you may attempt to extinguish the fire. Fight the fire from a position where you can escape.
- If your clothing catches fire, drop to the floor and roll to smother the fire. If a co-worker's clothing catches fire, lower the person to the floor and roll him or her to smother the flames. Use a safety shower immediately thereafter.
- Use the nearest safe exit route to exit the building. Close all doors on the way out to prevent the spread of smoke and fire.
- After exiting, immediately proceed to a safe location at least 30 meters away from the building.
- Do not re-enter the building until the all clear is given by the fire department.

3.2.2 LABORATORY FIRES

Fires are a common emergency in any laboratory and specifically in a laboratory with flammable materials. In the event of a fire, do the following things:

- Assist any person in immediate danger to safety, if it can be accomplished without risk to you.
- Immediately activate the building fire alarm system.
- If the fire is small and you have been trained in the use of portable fire extinguishers, you may attempt to extinguish the fire. Fight the fire from a position where you can escape.
- DON'T fight the fire if either of these conditions exists: The fire is too large or out of control. The atmosphere is toxic.
- If first attempts to put out the fire do not succeed, evacuate the building immediately.
- Doors, and if possible, windows, should be closed as the last person leaves a room or area of a laboratory.
- When they hear the fire alarm sound, all personnel in the affected areas shall evacuate the building immediately.
- Upon evacuating the building, personnel shall proceed to a designated area at least 50 meters away from the affected building.
- No personnel will be allowed to re-enter the building without permission.
- You must report all fires to your supervisor.

3.3.3 FIRE SAFETY REMINDERS

- Never use an elevator if the building fire alarm is activated.
- Use stairwells to evacuate the building. Be aware of your egress routes.
- Never block open corridor/hallway doors in a building.
- Check all appliances in your office before leaving. Turn them off. □
- Use electrical extension cords properly. Examine the cords periodically for safe service.

3.3.4 CHEMICAL EXPOSURES

The following procedures should be followed in the event of a chemical exposure. In all cases the incident should be reported to your laboratory chief, technician or principal investigator, regardless of severity.

CHEMICALS ON SKIN OR CLOTHING

- Immediately flush with water for no less than 15 minutes (except for hydrofluoric acid).
- While rinsing, quickly remove all contaminated clothing or jewelry.
- Use caution when removing pullover shirts or sweaters to prevent contamination of the eyes.
- Check the MSDS (Material Safety Data Sheet) to determine if any delayed effects should be expected.
- Discard contaminated clothing or launder them separately from other clothing.
- Leather garments or accessories cannot be decontaminated and should be discarded.

- **Do not use solvents to wash skin.** They remove the natural protective oils from the skin and can cause irritation and inflammation. In some cases, washing with a solvent may facilitate absorption of a toxic chemical.
- **For flammable solids on skin,** first brush off as much of the solid as possible, then proceed as described above.
- **For hydrofluoric acid,** rinse with water for 5 minutes and apply calcium gluconate gel, then get immediate medical attention. If no gel is available, rinse for 15 minutes and consult a doctor immediately.

CHEMICALS ON EYES

- Immediately flush eye(s) with water for at least fifteen minutes. The eyes must be forcibly held open to wash, and the eyeballs must be rotated so all surface area is rinsed.
- Remove contact lenses while rinsing. **Do not lose time removing contact lenses before rinsing.** Do not attempt to reinsert contact lenses.
- Seek medical attention regardless of the severity or apparent lack of severity. Contact for an ambulance or transportation to a health center if it is needed. Explain carefully what chemicals were involved.

CHEMICAL INHALATION

- Close containers, open windows or otherwise increase ventilation, and circulate fresh air.
- If symptoms, such as headaches, nose or throat irritation, dizziness, or drowsiness persist, seek medical attention by calling emergency or going to a health center. Explain carefully what chemicals were involved.
- Review the MSDS to determine what health effects are expected, including delayed effects.

ACCIDENT INGESTION OF CHEMICALS

- Immediately go to a health center or contact Ambulance at 108 for instructions.
- Do not induce vomiting unless directed to do so by a health care provider.

ACCIDENT INJECTION OF CHEMICALS

Wash the area with soap and water and seek medical attention, if necessary immediately go to a health center or contact Ambulance at 108. Explain carefully what chemicals were involved.

3.3.5 CHEMICAL SPILLS

All chemical spills, regardless of size, shall be reported in writing to your supervisor. The report shall include the date, time, location, chemical(s) and their volume, and names of all persons involved, including any visitors who were exposed and personnel involved in the cleanup.

3.3.6 EMERGENCY SPILLS

Chemical spill is classified as an Emergency Spill whenever it:

- Causes personal injury or chemical exposure that requires medical attention.
- Causes a fire hazard or uncontrollable volatility
- Requires a need for breathing apparatus of the supplied air or self-contained type to handle the material involved
- Involves or contaminates a public area
- Causes airborne contamination that requires local or building evacuation
- Causes a spill that cannot be controlled or isolated by laboratory personnel
- Causes damage to college property that will require repairs
- Involves any quantity of metallic mercury
- Cannot be properly handled due to lack of local trained personnel and/or equipment to perform a safe, effective cleanup
- Requires prolonged or overnight cleanup
- Involves an unknown substance.

The following tactics are prioritized in terms of usual preferred action sequences. However, each spill incident is unique and involves persons with varying levels of spill expertise and experience. Thus, for any individual incident, isolation of the spill and/or securing the area might best occur prior to or simultaneously with contacting Police/Fire by dialling 100 /101. The following general procedures should be used for all emergency spills:

- Contact the Campus Security for Assistance. Notify the police dispatcher of location of the spill and, if known, the chemical spilled.
- If the spill presents an immediate danger, leave the spill site and warn others, control entry to the spill site.
- Remove contaminated clothing. Flush skin/eyes with water at least 15 to 30 minutes; use soap for intermediate and final cleaning of skin areas.
- Protect yourself, and then remove injured person(s) to fresh air, if safe to do so.
- Notify nearby persons and evacuate as necessary. Prevent entry, as necessary, by posting a guard in a safe area and/or shutting doors.

- If flammable vapors are involved, do not operate electrical switches unless to turn off motorized equipment. Try to turn off or remove heat sources, where safe to do so.
- If the substance involved is an unknown, then emergency spill response procedures are limited to self-protection, notification of Campus Security for response, isolation of the chemical, evacuating and securing the area involved.
- Do not touch the spill without protective clothing.
- Where the spill does not present immediate personal danger, try to control the spread or volume of the spill. This could mean shutting a door, moving nearby equipment to prevent further contamination, repositioning an overturned container or one that has a hole in the bottom or side, creating a dike by putting an absorbent around a spill or opening the sashes on the fume hoods to facilitate removal of vapors.
- Never assume gases or vapors do not exist or are harmless because of lack of smell.
- Increase ventilation by opening closed fume hood sashes to the 12 inch or full open position. Exterior doors may be opened to ventilate non-toxic vapors.
- Use absorbents to collect substances. Reduce vapor concentrations by covering the surface of a liquid spill with absorbent. Control enlargement of the spill area by confining with absorbent.

3.3.7 MINOR SPILLS

Minor spills are those spills that do not fit the requirements for Emergency Spills. The following general procedures should be used for all minor spills:

- Attend to any persons who may have been contaminated. If these persons require medical attention this is an Emergency Spill (see above).
- Notify persons in the immediate area about the spill.
- Evacuate all nonessential personnel from the spill area.
- If the spilled material is flammable, turn off ignition and heat sources.
- Avoid breathing vapors of the spilled material. If respiratory protection is necessary this is an Emergency Spill (see above).
- Leave on or establish exhaust ventilation if it is safe to do so.
- Secure supplies to effect cleanup.
- Put on appropriate personnel protective equipment.
- Spilled Liquids:
- Confine or contain the spill to a small area. Do not let it spread.

For small quantities of inorganic acids or bases, use a neutralizing agent or an absorbent mixture (e.g., soda ash or liatomaceous earth). For small quantities of other materials absorb the spill with a noncreative material (such as vermiculite, clay, dry sand, or towels).

- For larger amounts of inorganic acids and bases, flush with large amounts of water (providing the water will not cause additional damage). Flooding is not recommended in store rooms where violent spattering may cause additional hazards or in areas where water-reactive chemicals may be present.
- Carefully pick up and clean any cartons or bottles that have been splashed or immersed.
- Generally, sweep spilled solids into a dustpan and places them into a container suitable for that chemical.
- Dispose of residues according to safe disposal procedures. Remembering that personal protective equipment, brooms, dustpans, and other items may require special disposal procedures.

Mercury handling and spill clean up

Storage and handling

- Always store mercury in unbreakable containers and stored in a well-ventilated area.
- When breakage of instruments or apparatus containing mercury is a possibility, the equipment should be placed in an enameled or plastic tray or pan that can be cleaned easily and is large enough to contain the mercury.
- Transfers of mercury from one container to another should be carried out in a hood, over a tray or pan to confine any spills.
- If at all possible, the use of mercury thermometers should be avoided. If a mercury thermometer is required, many are now available with a Teflon coating that will prevent shattering.
- Always wash hands after handling mercury.

Protective Clothing

For small spills, a laboratory coat, safety glasses, and gloves should be used. Gloves made of the following have been rated as excellent for protection against elemental mercury:

- Chlorinated polyethylene (CPE)
- Polyvinyl Chloride (PVC)
- Polyurethane
- Nitrile Rubber (also known by several brand names)
- Butyl Rubber
- Neoprene

If mercury has been spilled on the floor, the workers involved in cleanup and decontamination should wear plastic shoe covers. Laboratory Superintendent or Tradesman should be called immediately if a spill is extensive enough to require workers to kneel or sit where mercury has been spilled since impermeable clothing will be required.

Spill Kits

Special spill kits are available from a variety of sources. If a spill kit is purchased, follow the manufacturer's directions. Alternatively, a kit can be assembled with the following components:

- protective gloves
- mercury suction pump or disposable pipettes to recover small droplets □
elemental zinc powder
- dilute sulphuric acid (5-10%) in spray bottle □
- sponge
- plastic trash bag
- plastic container
- plastic sealed vial for recovered mercury

Clean Up Procedures

- Wearing protective clothing, pools and droplets of metallic mercury can be pushed together and then collected by a suction pump.
- After the gross contamination has been removed, sprinkler the entire area with zinc powder. Spray the zinc with the dilute sulphuric acid.
- Using the sponge, work the zinc powder/sulphuric acid into a paste consistency while scrubbing the contaminated surface and cracks or crevices.
- After the paste has dried, it can be swept up and placed into the plastic container for disposal.

Medical Emergencies

Personal injury is not uncommon in laboratories. These injuries are usually minor cuts or burns but can be as severe as acute effects of chemical exposure or incidents such as heart attacks or strokes. Prevention of injuries should be a major emphasis of any laboratory safety program. Proper training will help prevent injuries from glassware, toxic chemicals burns and electrical shock. In the event of any personal injury, the initial responsibility for first aid rests with the first persons at the scene, who should react quickly but in a calm and reassuring manner. The person assuming responsibility should: The following details should be posted at each laboratory:

The names of person(s) with telephone number in the area trained in CPR (cardio pulmonary resuscitation) and First Aid.

General First Aid

First aid equipment should be readily available in each laboratory.

Following any First Aid, a nurse or physician qualified to handle chemical emergencies should provide further examination and treatment. The location and phone number of emergency services should be clearly posted.

It is recommended that each Department have at least one person trained in basic First Aid and Cardio Pulmonary Resuscitation (CPR).

Someone knowledgeable about the accident should always accompany the injured person to the medical facility and provide a copy of any appropriate MSDS if the accident resulted from chemical exposure.

Minor injuries requiring first aid should always be reported to a supervisor and recorded reasons for this are as follows.

- A minor injury may indicate a hazardous situation that should be corrected to prevent a serious future injury.

Personal Protection during First Aid

Persons responding to a medical emergency should be protected from exposure to blood and other potentially infectious materials. Protection can be achieved through adherence to work practices designed to minimize or eliminate exposure and through the use of personal protective equipment (i.e., gloves, masks, and protective clothing), which provide a barrier between the worker and the exposure source. For most situations in which first aid is given, the following guidelines should be adequate.

- For bleeding control with minimal bleeding and for handling and cleaning instruments with microbial contamination, disposable gloves alone should be sufficient.
- For bleeding control with excessive blood, disposable gloves, a coat, a mask, and protective eyewear are recommended.
- For measuring temperature or measuring blood pressure, no protection is required.

After emergency care has been administered, hands and other skin surfaces should be washed immediately and thoroughly with warm water and soap if contaminated with blood, other body fluids to which universal precautions apply, or potentially contaminated articles. Hands should always be washed after gloves are removed, even if the gloves appear to be intact.

3.3.8 LEAKING COMPRESSED GAS CYLINDERS

Occasionally, a cylinder or one of its component parts develops a leak. Most such leaks occur at the top of the cylinder in areas such as the valve threads, safety device, valve stem, and valve outlet.

If a leak is suspected, do not use a flame for detection; rather, a flammable-gas leak detector or soapy water or other suitable "snoop" solution should be used. If the leak cannot be remedied by tightening a valve gland or a packing nut, emergency action procedures should be affected. Laboratory workers should never attempt to repair a leak at the valve threads or safety device; rather, they should consult with the supplier for instructions.

CHAPTER 4

FIRE SAFETY

The Four Elements of Fire

- Fuel (such as wood, paper, cloth, propane, gasoline, kerosene)
- Oxygen (16% of the air)
- Heat (for instance, a match or spark)
- The chemical reaction that results from fuel, oxygen and heat mixing in the right quantity, at the right time

4.1 DIFFERENT TYPES OF FIRE EXTINGUISHERS

Class of Fire	Type of fire
A	Wood, Paper and clothing which produce glowing embers or char.
B	Flammable Gases, Liquids and Greases Including Gasoline And Most Hydrocarbon Liquids Which Must Be Vaporized For Combustion To Occur
C	Electrical Equipment Or In Materials Near Electrically Powered Equipment
D	Combustible metals, such as magnesium, zirconium, potassium, and sodium

- Water
- Carbon dioxide
- Dry chemical powder
- Mechanical Foam Type
- Specialized fire extinguishers for metal fires

CLASS	A	B	B	C	D	K
PICTURE SYMBOL						
TYPE	Common Combustibles Solids (wood, paper, cloth, etc.)	Flammable liquids Gasoline and solvents	Flammable gases Propane	Live electrical equipment Computers, fax machines	Combustible Metals Magnesium, Lithium, Titanium	Cooking Media Cooking oils and fats
Water	✓ Yes	✗ No	✗ No	✗ No	✗ No	✗ No
Foam	✓ Yes	✓ Yes	✗ No	✗ No	✗ No	✓ Yes <small>(ABF Foam Only)</small>
Dry Powder	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ No	✗ No
M28/L2	✗ No	✗ No	✗ No	✗ No	✓ Yes	✗ No
Carbon Dioxide CO2	✗ No	✓ Yes	✗ No	✓ Yes	✗ No	✗ No
Wet Chemical	✓ Yes	✗ No	✗ No	✗ No	✗ No	✓ Yes

FIG.4.1 FIRE TYPE AND EXTINGUISHER CHART

4.1.1 Water (CO2 cartridge) type fire extinguisher



FIG.4.2 WATER (CO2 CATRIDGE)TYPE EXTINGUISHER

- Cools burning material. Very effective against fires in furniture, fabrics, etc. (including deep seated fires), and can be safely used only in the absence of electricity.
- Its inner container is filled with water & cap assemble is fixed with the CO2 cartridge. It is used for class-A fires only.
- Air-pressurized water (APW) type extinguisher cools the burning material by absorbing heat from the same. Effective on class-A fires, it has the advantage of being inexpensive, harmless, and relatively easy to clean up.

4.1.2 Mechanical Foam Extinguishers



FIG. 4.3 FORM TYPE EXTINGUISHER

Foam Extinguisher contains a foam solution and CO₂ cartridge connected to cap. The discharge hose fixed nozzle with aeration provision.

When foam extinguisher is used the foam should not be allowed to strike the surface of burning liquid, but should be directed against a side wall or any vertical surface of the container so that the foam runs down and forms a blanket which will spread over the liquid.

Where the liquid is not confined the foam should be allowed to fall gently on it such a way as to build up a blanket which will flow over the burning surface

4.1.3 Dry chemical powder (DCP) extinguisher



FIG.4.4 DRY CHEMICAL POWDER(DCP)TYPE EXTINGUISHER

Dry chemical extinguishers are intended for use on CLASS A, CLASS B, and CLASS C fires.

It is mainly filled with any of the following chemical powder and pressurizes with CO₂ cartridge or air:

1. Sodium bicarbonate (NaHCO₃)
2. Potassium bicarbonate (KHCO₃)
3. Urea based potassium bicarbonate
4. Mono Ammonium phosphate (NH₄) H₂PO₄

- The discharge should be directed at the base of the flames.
- Attack the near edge of the fire and progressing forward, moving the nozzle rapidly with a side-to-side sweeping motion for best results.
- Do not blast flaming liquid around the area.
- To prevent possible re-flash continue discharge after flames are extinguished.

4.1.4 CO₂ Fire Extinguisher



FIG.4.5 CARBON DIOXIDE (CO₂)TYPE EXTINGUISHER

Carbon Dioxide extinguishers are designed for Class B and C (flammable liquid and electrical) fires only.

They are filled with non-flammable carbon dioxide gas under extreme pressure. You can recognize a CO₂ extinguisher by its hard horn and lack of pressure gauge. The pressure in the cylinder is so great that when you use one of these extinguishers, bits of dry ice may shoot out of the horn.

These extinguishers are intended primarily for use on CLASS B and CLASS C fires.

- Initial application must start reasonably close to the fire.
- On all fires the discharge should be directed at the base of the flames.
- CO₂ discharge should be applied to the burned surface even after the flames are extinguished, to prevent possible re-flash.

In case of flammable liquid fires, apply the discharge from the fire extinguisher first at the near edge of the fire and gradually progressing forward in order to get the best results. Carbon Dioxide is a non-flammable gas that extinguishes fire by displacing oxygen, or taking away the oxygen element of the fire triangle. The carbon dioxide is also very cold as it comes out of the extinguisher, so it cools the fuel as well. CO₂s may be ineffective at extinguishing Class A fires because they may not be able to displace enough oxygen to successfully put the fire out. Class A materials may also smoulder and re-ignite.

Role of Discharge Horn

Its main duty to stop the entrainment of air with CO₂ and reduce the velocity of. CO₂ Without the horn, the jet of CO₂ acts like a blow torch and may by velocity increase the intensity of fire.

4.1.5 Specialized fire extinguishers for metal fires (class D)



FIG. 4.6 METAL FIRE (L2) EXTINGUISHER

Specialist fire extinguishers are required to tackle Class D flammable metal fires. As you might expect when dealing with such volatile and specialist materials, you need the correct agent for the metal being extinguished.

Specialist fire extinguishers for metal fires work by smothering the fire with a nonreactive agent, which forms a crust and excludes air from contact with the metals.

- Sodium Chloride fire extinguishers are designed for use on Class D fires involving magnesium, sodium, and potassium. When a sodium chloride fire extinguisher is applied to a fire, the heat of the fire makes the sodium chloride cake together and forms an air-excluding crust
- Copper powder metal fire extinguishers are designed for use on Class D fires involving lithium. Graphite powder metal fire extinguishers can also be used on lithium fires.
- Lithium fires must be tackled with a specialist lithium extinguisher only, commonly sold as a L2 extinguisher
- Graphite powder can also be applied to burning metal powders, where even the gentle blast from a fire extinguisher could lift up the powder and cause a dust cloud explosion. Graphite powder has the added advantage of drawing heat away from the fire as well as smothering it.
- Sodium bicarbonate and sodium carbonate fire extinguishers can both be used on Class D fires. Sodium bicarbonate extinguishers can be used on most metal alkyls, plus liquids that ignite on contact with air. Sodium carbonate fire extinguishers can be used to extinguish fires involving sodium, potassium, or their alloys

4.1.6 Wet chemical Fire extinguishers



FIG.4.7 WET CHEMICAL TYPE EXTINGUISHER

Also known as Class F' fire extinguishers, Class ABF' fire extinguishers – some versions only

Wet chemical fire extinguisher uses:

- Fires involving cooking oils and fats, such as lard, olive oil, butter and vegetable oil
- Fires involving flammable solids, such as paper, wood, and textiles ('class A' fires)

Some wet chemical fire extinguishers are also cleared for use on class B fires – those involving flammable liquids, such as petrol, diesel, and paint. Check the label or ask your fire safety professional before using wet chemical extinguishers on this type of fire.

Do not use wet chemical fire extinguishers for:

- Fires involving flammable liquids ('class B' fires) UNLESS they are specifically cleared for this use
- Fires involving flammable gases, such as methane and butane ('class C' fires)
- Electrical fires

How to identify a wet chemical fire extinguisher:

- YELLOW coloured label stating 'Wet Chemical'
- Has a longer than usual hose with a 'lance' attachment
- Should be identified by an extinguisher ID sign fixed nearby – 'Wet Chemical Extinguisher'

The 'chemical' element of wet chemical fire extinguishers is potassium.

Potassium salts are sprayed out as a fine mist (gently, so as not to spread the burning oil or fat), and these react to create a soapy film on the surface of the substance on fire.

This smothers the fire, with the added benefit that the mist also creates a cooling effect.

4.2 RULES OF FIGHTING FIRES

- Fires can be very dangerous and you should always be certain that you will not endanger yourself or others when attempting to put out a fire
- Assist any person in immediate danger to safety, if it can be accomplished without risk to you.
- Only after having done these things, if the fire is small, you may attempt to use an extinguisher to put it out.

However, before deciding to fight the fire, keep these rules in mind:

- Do Not Fight the Fire If you don't have adequate or appropriate equipment
You might inhale toxic smoke
- The final rule is to always position yourself with an exit or means of escape at your back before you attempt to use an extinguisher to put out a fire.

4.3 LOCATION AND MARKING

Extinguishers should be properly located clearly visible and easily accessible for immediate use in the case of fire. Directional arrows will be provided to indicate the location of extinguishers, in locations where visual obstruction cannot be completely avoided. All extinguishers should be labelled indicating clearly the type of fire used for.

4.3.1 Distribution and Mounting of Extinguishers

Extinguishers must be distributed in such a way that the amount of time needed to travel to their location and back to the fire does not allow the fire to get out of control

Extinguishers will be installed on hangers, brackets, in cabinets, or on shelves.

Extinguishers having a gross weight not exceeding 40 pounds will be so installed that the top of the extinguisher is not more than 3-1/2 feet above the floor.

Extinguishers mounted in cabinets or wall recesses or set on shelves will be placed so that the extinguisher operating instructions face outward.

4.3.2 Maintaining Portable Fire Extinguishers

- Must maintain in a fully charged and operable condition.
- Must keep in their designated places at all times except during use.
- Must conduct an annual maintenance check.
- Must record the annual maintenance date and retain this record for one year after the last entry or the life of the shell, whichever is less.
- The extinguisher should be mounted on the wall.
- The area in front of the extinguisher shall be clear with no obstructions.
- The pressure gauge should be in the green zone.
- The inspection tag should show that the extinguisher has been inspected within the last year.

4.4 PROPER USE OF FIRE EXTINGUISHERS

- All extinguishers have simple instructions on them, and they are usually some variation of these simple steps:
 - Pull the pin.
 - Aim the extinguisher hose or nozzle at the base of the fire.
 - Squeeze the handle.
 - Sweep it slowly back and forth in order to cover the entire fire with the extinguishing substance.

4.5 FIRE ALARM

- In the event of a fire emergency, an emergency alarm will sound for the building.
- Upon hearing three consecutive alarms, all persons shall evacuate the building and assemble in the designated assembly point.
- All persons shall evacuate, unless a testing of the alarm system is announced.

- The person setting off the alarm should call the fire department and campus security (+91_____), and verify the emergency.
- Emergency alarms shall be tested once per month.

4.6 FIRE DRILLS



Fire drills should be performed at least once per year. All personnel and Users shall participate, with NO exceptions. All personnel involved in the fire drill should be informed ahead of time. All personnel shall evacuate, as in a real fire, to the designated assembly area.

4.7 FIRE EMERGENCY PROCEDURES

The safety procedures discussed here are in line with the Indian Standard IS14435/1997

If you discover a fire:

- Activate the nearest fire alarm.
- Notify the fire department by dialling 101. Give your location, the nature of the

fire, and your name.

- Notify Head of the Department and other occupants.

Fight the fire ONLY if:

- The fire department has been notified of the fire
- The fire is small and confined to its area of origin
- You have a way out and can fight the fire with your back to the exit
- You have the proper extinguisher, in good working order and know how to use it. If you are not sure of your ability or the fire extinguisher capacity to contain the fire, leave the area.

If you hear a fire alarm:

- Evacuate the area. Close windows, turn off gas jets, and close doors as you leave.
- Leave the building and move away from exits and out of the way of emergency operations.
- Assemble in a designated area.
- Report to the campus security so he can determine that all personnel have evacuated your area.
- Remain outside until competent authority states that it is safe to re-enter.
- Evacuation Routes
 - Learn at least two escape routes, and emergency exits from your area.
 - Learn to activate an emergency alarm.
 - Learn to recognize alarm sounds.
 - Take an active part in fire evacuation drills.

CHAPTER 5

CHEMICAL HAZARD

5.1 INTRODUCTION

The specific rules and procedures for working with hazardous chemicals, outlined in this chapter, give an insight into the proper methods for handling materials, which pose significant hazards due primarily to their chronic toxicity. However, these specific rules and procedures, along with the general rules for working with chemicals, do not address some of the basic physical hazards, which may stem from acute exposure to different types of laboratory chemicals. This chapter offers some specific guidelines for working with common laboratory chemicals that, for varying reasons, are acutely toxic in the sense that they may cause considerable harm to human life and health pending short term exposures. The Chapter addresses five fundamental classes of laboratory chemicals: flammables, corrosives, oxidizers, reactive and compressed gases. These classes of chemicals may include chemicals that are also covered in the previous section regarding their property of toxicity.

The National Fire Protection Association (NFPA) has developed a color-coded numerical system for indicating the **health (blue)**, **flammability (red)** and **reactivity (yellow)** hazards of chemicals. The degree and type of hazard are summarized in Fig. 3.1. NFPA labels are required on all chemicals in the some purchased chemicals already have these markings (or their equivalents) on the container. Other ones don't have such markings and should have a NFPA label put on them **immediately**. Labeling is shown in fig 3.2. The degree of hazard associated with a particular substance ranges between 0 to 4 with 4 being extremely dangerous and 0 indicates no harm.

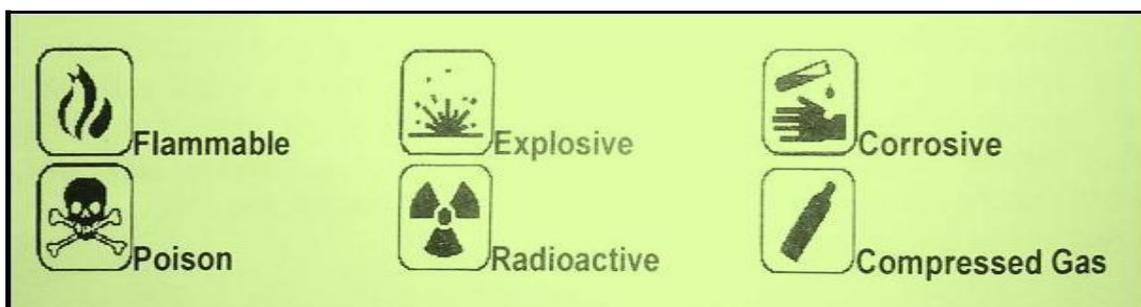


Fig.5.1. The degree and type of hazard

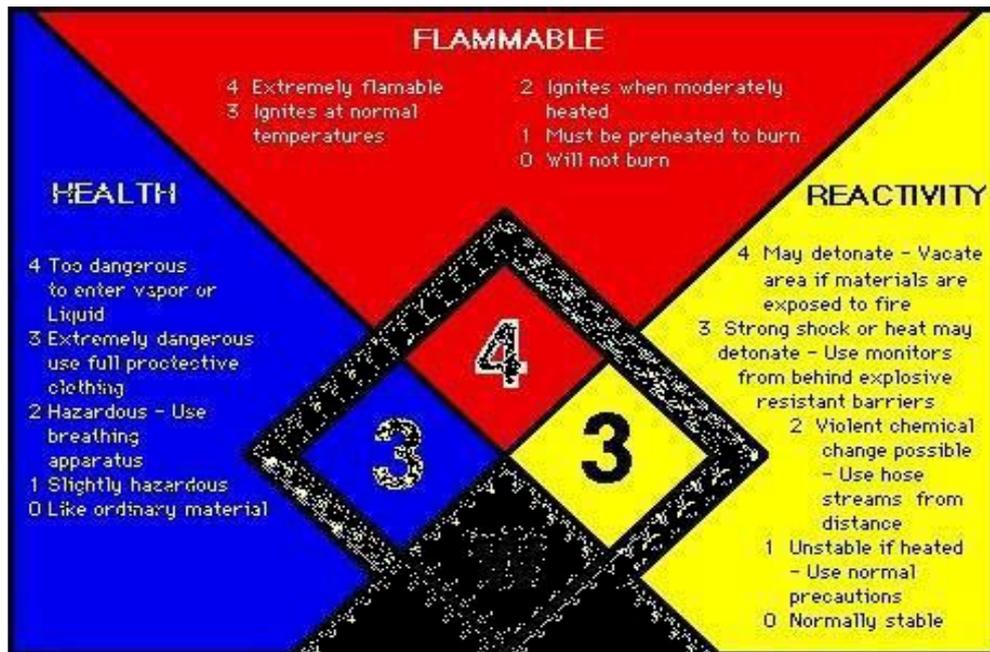


Fig.5.2. NPFA Health Hazard of chemicals

Health Hazard

0. Material offers no health hazard.
1. Material only slightly hazardous to health. Exposure could cause irritation if not treated.
2. Exposure could cause injury. Exposure requires prompt treatment. Appropriate protective equipment should be worn.
3. Exposure could cause serious injury. Appropriate protective equipment should be worn.
4. Could cause serious injury or death. Only special protective equipment designed specifically to protect against the specific hazard should be worn.

Flammability Hazard

0. Will not burn.
1. Ignites after considerable heating.
2. Ignites if moderately heated.
3. Can be ignited at all normal temperatures.
4. Highly flammable gases or highly volatile flammable liquids

Reactivity (Stability) Hazard

0. Normally stable. Not reactive with water.
1. Normally stable. Unstable at high temperature and pressure. Reacts with water.
2. Normally unstable but will not detonate. Materials can undergo chemical change with rapid release of energy.
3. Can detonate or explode, but requires strong initiating force or heating under containment.
4. Readily detonates or explodes.

5.2 FLAMMABLE SOLVENTS

Flammable liquids are the most common chemicals found in a laboratory. The primary hazard associated with flammable liquids is, of course, their ability to readily ignite and burn. One should note that it is the vapor of a flammable liquid, not the liquid itself that ignites and causes a fire. Examples of flammable liquids are acetone, ethyl ether, toluene, methyl formate, etc. In general, the vapors of many flammables are irritating to mucous membranes of the respiratory system and eyes, and in high concentrations are narcotic.

1. The rate at which a liquid vaporizes is a function of its *vapor pressure*. In general, liquids with high vapor pressures evaporate at a higher rate compared to liquids of lower vapor pressure. It should be noted that the vapor pressure increases rapidly as the temperature is raised, as does the evaporation rate. A reduced-pressure environment also accelerates the rate of evaporation.
2. The *flash point* of a liquid is the lowest temperature at which a liquid gives off vapor at such a rate as to form an air: vapor mixture that will ignite, but will not sustain ignition. Many commonly used flammable solvents have flashpoints significantly lower than room temperature. The table 3.1 shows the flash point of few commonly used solvents.

Compound	Flash Point (°C)
Diethyl ether	-45.0
Acetone	-17.8
Isopropyl alcohol	11.7

Table 5.1. Flash point of few commonly used solvents

3. The *limits of flammability* or *explosivity* define the range of fuel air mixtures that will sustain combustion. The lower limit of this range is called the *Lower Explosive Limit* or LEL, and the higher limit of this range is called the *Upper Explosive Limit*

or UEL. Materials with very broad flammability ranges (e.g. acetylene, LEL = 3%, UEL = 65%) are particularly treacherous due to the fact that virtually any fuel air combination may form an explosive atmosphere.

4. The *vapor density* of a flammable material is the density (mass to volume ratio) of the corresponding vapor relative to air under specific temperature and pressure conditions. Flammable vapors with densities greater than unity (and thus "heavier" than air) are potentially lethal because they will accumulate at floor level and flow, with remarkable ease, in much the same manner that a liquid would. The obvious threat is that these mobile vapors may eventually reach an ignition source, such as an electrical outlet or a Bunsen burner at another student's bench.

5.2.1 Use and storage

1. Flammable liquids that are not in active use must be stored in safe containers inside fire resistant storage cabinets designed for flammables, or inside storage rooms.
2. Minimize the amount of flammable liquids stored in the lab.
3. Use flammables only in areas free of ignition sources.
4. The transfer of material to or from a metal container is generally accompanied by an accumulation of static charge on the container. This fact must be kept in mind when transferring flammable liquids, since the discharge of this static charge could generate a spark, thereby igniting the liquid. To make these transfers safer, flammable liquid dispensing and receiving containers must be bonded together before pouring. Large containers such as drums must also be grounded when used as dispensing or receiving vessels. All grounding and bonding connections neighbours must be metal to metal. (The aforementioned bonding and grounding wires may be found in most lab safety catalogs).
5. Never heat flammables with an open flame. Instead, use steam baths, water baths, oil baths, hot air baths, sand baths or heating mantles.
6. Do not store flammable liquids in a refrigerator unless it is approved for such storage. Such refrigerators are designed with non-sparking components to avoid an explosion.

5.2.2 First aid

The first aids to be given to a person in case of exposure to flame/ flammable solvents are presented in table below.

Inhalation Exposures	<ul style="list-style-type: none"> • Remove person from the contaminated area if it is safe to do so. • Get medical attention and do not leave person unattended
Ingestion Exposures	<ul style="list-style-type: none"> • Remove the person, if possible, from the source of contamination. • Get medical attention
Dermal Exposures	<ul style="list-style-type: none"> • Remove person from source of contamination. • Remove clothing, jewellery, and shoes from the affected areas. • Obtain medical attention.
Eye Contact	<ul style="list-style-type: none"> • Remove person from the source of contamination. • Flush the eyes with water for at least 15 minutes. • Obtain medical attention.

5.2.3 Personal protective equipment

Always use a fume hood while working with flammable liquids. Nitrile and neoprene gloves are effective against most flammables. Wear a non-flammable lab coat to provide a barrier to your skin and goggles if splashing is likely to occur.

5.3 OXIDIZERS

Oxidizers or oxidizing agents pose fire and explosion hazards on contact with combustible materials. Depending on the class, an oxidizing material may increase the burning rate of combustibles with which it comes in contact; It cause the spontaneous ignition of combustibles with which it comes in contact; or undergo an explosive reaction when exposed to heat, shock, or friction. Oxidizers are generally corrosive and many are highly toxic. Some examples of common oxidizers include peroxides, nitrites, nitrates, perchlorates, chlorates, chlorites, hypochlorites, dichromates, among others.

Use and storage

1. In general, store oxidizers away from flammables, organic compounds, and combustible materials.
2. Strong oxidizing agents like chromic acid should be stored in glass or some other inert container, preferably unbreakable. Corks and rubber stoppers should not be used.

3. Reaction vessels containing appreciable amounts of oxidizing material should never be heated in oil baths, but rather on a heating mantle or sand bath.

Use and storage of perchloric acid

Per chloric acid is an oxidizing agent of particular concern. The oxidizing power of perchloric acid increases with an increase in concentration and with an increase in temperature. Cold, 70% perchloric acid is a strong, non-oxidizing corrosive. A 72% perchloric acid solution at elevated temperatures is a strong oxidizing agent. An 85% perchloric acid solution is a strong oxidizer at room temperature.

1. Do not attempt to heat perchloric acid if you do not have access to a properly functioning perchloric acid fume hood. Perchloric acid can only be heated in a hood specially equipped with a washdown system to remove any perchloric acid residue. The hood should be washed down after each use and it is preferred to dedicate the hood to perchloric acid use only.
2. Whenever possible, substitute a less hazardous chemical for perchloric acid.
3. Perchloric acid can be stored in a perchloric acid fume hood. Keep only the minimum amount necessary for your work. Another acceptable storage site for perchloric acid is on a metal shelf or in a metal cabinet away from 45 organic or flammable materials. A bottle of perchloric acid should also be stored in a glass secondary container to contain leakage.
4. Do not allow perchloric acid to come in contact with any strong dehydrating agents such as sulphuric acid. The dehydration of perchloric acid is a severe fire and explosion hazard.
5. Do not order or use anhydrous perchloric acid. It is unstable at room temperature and can decompose spontaneously with a severe explosion. Anhydrous perchloric acid will explode upon contact with wood.

First aid

In general, if a person has inhaled, ingested, or come into direct contact with these materials, the person must be removed from the source of contamination as quickly as possible when it is safe to do so. Medical help must be obtained. In the case of an exposure directly to the skin or eyes it is imperative that the exposed person be taken to an emergency shower or eyewash immediately. Flush the affected area for a minimum of 15 minutes, and then get medical attention.

Personal protective equipment

In many cases, the glove of choice will be neoprene, polyvinyl chloride (PVC), or nitrile. Be sure to consult a glove compatibility chart to ensure the glove material is appropriate for the particular chemical you are working with. Goggles must be worn if the potential for splashing exists or if exposure to vapor or gas is likely. Always use these materials in a chemical fume hood as most pose a hazard via inhalation. Cylinders of compressed gases should be kept in ventilated cabinets.

5.4 CORROSIVES

5.4.1 General characteristics

1. Corrosives are most commonly acids and alkalis, but many other materials can be severely damaging to living tissue.
2. Corrosives can cause visible destruction or irreversible alterations at the site of contact. Inhalation of the vapor or mist can cause severe bronchial irritation. Corrosives are particularly damaging to the skin and eyes.
3. Certain substances considered non-corrosive in their natural dry state are corrosive when wet such as when in contact with moist skin or mucus membranes. An example of these materials is lithium chloride, halogen fluorides, and allyl iodide.
4. Sulphuric acid is a very strong dehydrating agent and nitric acid is a strong oxidizing agent. Dehydrating agents can cause severe burns to the eyes due to their affinity for water.

Examples of corrosives include sulphuric acid, chromic acid, ammonium bifluoride, bromine, ammonium hydroxide, among others. All corrosives possess the property of being severely damaging to living tissues and also attack other materials such as metal. Skin contact with alkali metal hydroxides, e.g. sodium hydroxide and potassium hydroxide, is more dangerous than with strong acids. Contact with alkali metal hydroxides normally causes deeper tissue damage because there is less pain than with an acid exposure. The exposed person may not wash it off thoroughly enough or seek prompt medical attention. All hydrogen halides are acids that are serious respiratory irritants and also cause severe burns. Hydrofluoric acid is particularly dangerous. At low concentrations, hydrofluoric acid does not immediately show any signs or symptoms upon contact with skin. It may take several hours for the hydrofluoric acid to penetrate the skin before you would notice a

burning sensation. However, by this time permanent damage, such as second and third degree burns with scarring, can result.

5.4.2 Use and storage

1. Always store acids separately from bases. Also, store acids in acid storage cabinets away from flammables since many acids are also strong oxidizers.
2. Do not work with corrosives unless an emergency shower and continuous flow eyewash are available.
3. Add acid to water, but never add water to acid. This is to prevent splashing from the acid due to the generation of excessive heat as the two substances mix.
4. Never store corrosives above eye level. Store on a low shelf or cabinet.
5. It is a good practice to store corrosives in a tray or bucket to contain any leakage.
6. When possible, purchase corrosives in containers that are coated with a protective plastic film that will minimize the danger to personnel if the container is dropped.
7. Store corrosives in a wooden cabinet or one that has a corrosion-resistant lining. Corrosives stored in an ordinary metal cabinet will quickly damage it. If the cabinet supports that hold up the shelves become corroded, the result could be serious. Acids should be stored in acid storage cabinets specially designed to hold them and Nitric acid should be stored in a separate cabinet or compartment.

5.4.3 Use and storage of hydrofluoric acid

1. Hydrofluoric acid is extremely hazardous and deserves special mention. Hydrofluoric acid can cause severe burns and inhalation of anhydrous hydrogen fluoride can be fatal. Initial skin contact with hydrofluoric acid may not produce any symptoms.
2. Only persons fully trained in the hazards of hydrofluoric acid should use it.
3. Always use hydrofluoric acid in a properly functioning fume hood. Be sure to wear personal protective clothing!
4. If you suspect that you have come in direct contact with hydrofluoric acid: wash the area with water for at least 15 minutes, remove clothing, then promptly seek medical attention. If hydrogen fluoride vapors are inhaled, move the person immediately to an uncontaminated atmosphere (if safe to do so), keep the person warm, and seek prompt medical attention.

5. Never store hydrofluoric acid in a glass container because it is incompatible with glass.
6. Store hydrofluoric acid separately in an acid storage cabinet and keep only that amount necessary in the lab. Creams for treatment of hydrofluoric acid exposure are commercially available.

5.4.4 First Aid

The first aids to be provided to a person in case of exposure to hydrochloric acid are presented in table below.

Inhalation	<ul style="list-style-type: none"> • Remove person from source of contamination if safe to do so. • Get medical attention. • Keep person warm and quiet and do not leave unattended.
Ingestion	<ul style="list-style-type: none"> • Remove person from source of contamination. • Get medical attention and inform emergency responders of the name of the chemical swallowed.
Skin Contact	<ul style="list-style-type: none"> • Remove person from source of contamination and take immediately to an emergency shower or source of water. • Remove clothing, shoes, socks, and jewelry from affected Skin Contact areas as quickly as possible, cutting them off if necessary. • Be careful not to get any chemical on your skin or to inhale the vapors. • Flush the affected area with water for a minimum of 15 minutes. Get medical attention.
Eye Contact	<ul style="list-style-type: none"> • Remove person from source of contamination and take immediately to an eyewash or source of water. • Rinse the eyes for a minimum of 15 minutes. Have the person look up and down and from side to side. • Get medical attention. Do not let the person rub their eyes or keep them tightly shut.

5.4.5 Personal protective equipment

Always wear the proper gloves when working with acids. Neoprene and nitrile gloves are effective against most acids and bases. Polyvinyl chloride (PVC) is also effective for most acids. A rubber coated apron and goggles should also be worn. If splashing is likely to occur, wear a face shield over the goggles. Always use corrosives in a chemical fume hood.

5.5 REACTIVES

5.5.1 General characteristics

Reactive chemicals are grouped as a category primarily because of the safety hazards associated with their use and storage and not because of similar acute or chronic health effects. For health hazard information on specific reactive materials consult the MSDS, or the manufacturer. However, there are some hazards common to the use of reactive materials. Injuries can occur due to heat or flames, inhalation of fumes, vapors, and reaction products, and flying debris.

Polymerization reactions:

Polymerization is a chemical reaction in which two or more molecules of a substance combine to form repeating structural units of the original molecule. This can result in an extremely high or uncontrolled release of heat. An example of a chemical which can undergo a polymerization reaction is styrene.

Water reactive materials:

1. When water reactive materials come in contact with water, one or more of the following can occur: liberation of heat which may cause ignition of the chemical itself if it is flammable, or ignition of flammables that are stored nearby; release of a flammable, toxic, or strong oxidizing gas; release of metal oxide fumes; and formation of corrosive acids.
2. Water reactive chemicals can be particularly hazardous to firefighting personnel responding to a fire in a lab, because water is the most commonly used fire extinguishing medium. Examples of water reactive materials include lithium, sodium, potassium, magnesium, zinc, alkyl-aluminums, among others.

Peroxide-forming materials:

Peroxides are very unstable and some chemicals that can form them are commonly used in laboratories. This makes peroxide-forming materials some of the most hazardous substances found in a lab. Peroxide-forming materials are chemicals that react with air, moisture, or impurities to form peroxides. The tendency to form peroxides by most of these materials is greatly increased by evaporation or distillation. Organic peroxides are extremely sensitive to shock, sparks, heat, friction, impact, and light. Many peroxides formed from materials

used in laboratories are more shock sensitive than TNT. Just the friction from unscrewing the cap of a container of ether that has peroxides in it can provide enough energy to cause a severe explosion. Examples of peroxide-forming materials (the first group listed is the most hazardous): diisopropyl ether divinylacetylene, sodium amide, potassium amide, dioxane diethyl ether, tetrahydrofuran vinyl ethers, acrylonitrile styrene, among others.

Other shock-sensitive materials:

These materials are explosive and sensitive to heat and shock. Examples of shock sensitive materials: chemicals containing nitro groups, fulminates, hydrogen peroxide (30%+), ammonium perchlorate, benzoyl peroxide (when dry), compounds containing the functional groups: acetylide, azide, diazo, halamine, nitroso, and ozonide.

5.5.2 Use and storage

1. A good way to reduce the potential risks is to minimize the amount of material used in the experiment. Use only the amount of material necessary to achieve the desired results.
2. Always substitute a less hazardous chemical for a highly reactive chemical whenever possible. If it is necessary to use a highly reactive chemical, order only the amount that is necessary for the work.
3. Store water-reactive chemicals in an isolated part of the lab. A cabinet far removed from any water sources, such as sinks, emergency showers, and chillers, is an appropriate location. Clearly label the cabinet "Water-Reactive Chemicals - No Water".
4. Store pyrophoric in an isolated part of the lab and in a clearly marked cabinet. Be sure to routinely check the integrity of the container and have the material disposed of through EH&S if the container is corroded or otherwise damaged.
5. Do not open the chemical container if peroxide formation is suspected. The act of opening the container could be sufficient to cause a severe explosion. Visually inspect liquid peroxide forming materials for crystals or unusual viscosity before opening. Pay special attention to the area around the cap. Peroxides usually form upon evaporation, so they will most likely be formed on the threads under the cap.
6. Date all peroxide forming materials with the date received, and the expected shelf life. Chemicals such as diisopropyl ether, divinyl acetylene, sodium amide and

vinylidene chloride should be discarded after three months. Chemicals such as dioxane, diethyl ether, and tetrahydrofuran should be submitted to EHSC for disposal after one year.

7. Store all peroxide-forming materials away from heat, sunlight, and sources of ignition. Sunlight accelerates the formation of peroxides.
8. Secure the lids and caps on containers of peroxide-forming materials to discourage the evaporation and concentration of these chemicals.
9. Never store peroxide-forming materials in glass containers with screw cap lids or glass stoppers. Friction and grinding must be avoided. Also, never store these chemicals in a clear glass bottle where they would be exposed to light.
10. If you notice crystal formation in the container or around the cap, do not attempt to open or move the container. Proper disposal should be carried out.
11. Never distill ether unless it is known to be free of peroxides.
12. Store other shock sensitive materials separately from other chemicals and in a clearly labelled cabinet.
13. Never allow picric acid to dry out, as it is extremely explosive. Always store picric acid in a wetted state.

5.5.3 First aid

1. If someone is seriously injured the most important step to take is to contact emergency responders as quickly as possible. This is best accomplished by directly calling them at 108. Explain the situation and describe the location clearly and accurately.
2. If someone is severely bleeding, apply a sterile dressing, clean cloth, or handkerchief to the wound. Then put protective gloves on and place the palm of your hand directly over the wound and apply pressure and keep the person calm. Continue to apply pressure until help arrives.
3. If a person's clothes are on fire, he or she should drop immediately to the floor and roll. If a fire blanket is available, put it over the individual. An emergency shower, if one is immediately available, can also be used to douse flames.
4. If a person goes into shock, have the individual lie down on their back if safe to do so and raise the feet about one foot above the floor.

5.5.4 Personal protective equipment

1. Wear appropriate personal protective clothing while working with highly reactive materials. This might include: impact resistant safety glasses or goggles, a face shield, gloves, a lab coat (to minimize injuries from flying glass or an explosive flash), and a shield.
2. Conduct work within a chemical fume hood as much as possible and pull down the sash as far as is practical. While the experiment does not require you to reach into the fume hood, keep the sash closed.
3. Barriers can offer protection of personnel against explosions and should be used. Many safety catalogs offer commercial shields which are commonly polycarbonate and are weighted at the bottom for stability. It may be necessary to secure the shields firmly to the work surface.

5.6 LABORATORIES

Laboratory safety

All students must read and understand the information in this document with regard to laboratory safety and emergency procedures prior to the first laboratory session. Students must adhere to written and verbal safety instructions throughout the academic term. Since additional instructions may be given at the beginning of laboratory sessions, it is important that all students arrive at each session on time

Personal and General laboratory safety

1. Never eat, drink, or smoke while working in the laboratory.
2. Read labels carefully.
3. Do not use any equipment unless you are trained and approved as a user by your supervisor.
4. Wear safety glasses or face shields when working with hazardous materials and/or equipment.
5. Wear gloves when using any hazardous or toxic agent.
6. Clothing: When handling dangerous substances, wear gloves, laboratory coats, and safety shield or glasses. Shorts and sandals should not be worn in the lab at any time. Shoes are required when working in the machine shops.
7. If you have long hair or loose clothes, make sure it is tied back or confined.

8. Keep the work area clear of all materials except those needed for your work. Coats should be hung in the hall or placed in a locker. Extra books, purses, etc. should be kept away from equipment, which requires air flow or ventilation to prevent overheating.
9. Disposal- Students are responsible for the proper disposal of used material if any in appropriate containers.
10. Equipment Failure- If a piece of equipment fails while being used, report it immediately to your lab assistant or tutor. Never try to fix the problem yourself because you could harm yourself and others.
11. If leaving a lab unattended, turn off all ignition sources and lock the doors.
12. Never pipette anything by mouth.
13. Clean up your work area before leaving.
14. Wash hands before leaving the lab and before eating.

Chemical safety

1. Treat every chemical as if it were hazardous.
2. Make sure all chemicals are clearly and currently labeled with the substance name, concentration, date, and name of the individual responsible.
3. Never return chemicals to reagent bottles. (Try for the correct amount and share any excess.)
4. Comply with fire regulations concerning storage quantities, types of approved containers and cabinets, proper labeling, etc. If uncertain about regulations, contact the building coordinator.
5. Use volatile and flammable compounds only in a fume hood. Procedures that produce aerosols should be performed in a hood to prevent inhalation of hazardous material.
6. Never allow a solvent to come in contact with your skin. Always use gloves.
7. Never "smell" a solvent!! Read the label on the solvent bottle to identify its contents.
8. Dispose of waste and broken glassware in proper containers.
9. Clean up spills immediately.
10. Do not store food in laboratories.

5.6.1 Chemical Exposures

The following procedures should be followed in the event of a chemical exposure. In all cases the incident should be reported to your laboratory chief, technician or principal investigator, regardless of severity.

Chemicals on skin or clothing

1. Immediately flush with water for no less than 15 minutes (except for hydrofluoric acid).
2. While rinsing, quickly remove all contaminated clothing or jewelry.
3. Use caution when removing pullover shirts or sweaters to prevent contamination of the eyes.
4. Check the MSDS (Material Safety Data Sheet) to determine if any delayed effects should be expected.
5. Discard contaminated clothing or launder them separately from other clothing. Leather garments or accessories cannot be decontaminated and should be discarded.

Do not use solvents to wash skin. They remove the natural protective oils from the skin and can cause irritation and inflammation. In some cases, washing with a solvent may facilitate absorption of a toxic chemical.

For flammable solids on skin, first brush off as much of the solid as possible, then proceed as described above.

For hydrofluoric acid, rinse with water for 5 minutes and apply calcium gluconate gel, then get immediate medical attention. If no gel is available, rinse for 15 minutes and consult a doctor immediately.

Chemicals in eyes

1. Immediately flush eye(s) with water for at least fifteen minutes. The eyes must be forcibly held open to wash, and the eyeballs must be rotated so all surface area is rinsed.
2. Remove contact lenses while rinsing. **Do not lose time removing contact lenses before rinsing.** Do not attempt to reinsert contact lenses.

3. Seek medical attention regardless of the severity or apparent lack of severity. Contact for an ambulance or transportation to a health center if it is needed. Explain carefully what chemicals were involved.

Chemical Inhalation

1. Close containers, open windows or otherwise increase ventilation, and circulate fresh air.
2. If symptoms, such as headaches, nose or throat irritation, dizziness, or drowsiness persist, seek medical attention by calling emergency or going to a health center. Explain carefully what chemicals were involved.
3. Review the MSDS to determine what health effects are expected, including delayed effects.

Accidental ingestion of chemicals

1. Immediately go to a health center or contact Ambulance at 108 for instructions.
2. Do not induce vomiting unless directed to do so by a health care provider.

Accidental injection of chemicals

Wash the area with soap and water and seek medical attention, if necessary immediately go to a health center or contact Ambulance at 108. Explain carefully what chemicals were involved.

5.6.2 Chemical Spills

All chemical spills, regardless of size, shall be reported in writing to your supervisor. The report shall include the date, time, location, chemical(s) and their volume, and names of all persons involved, including any visitors who were exposed and personnel involved in the cleanup.

Emergency spills

Chemical spill is classified as an Emergency Spill whenever it:

- Causes personal injury or chemical exposure that requires medical attention
- Causes a fire hazard or uncontrollable volatility

- Requires a need for breathing apparatus of the supplied air or self-contained type to handle the material involved
- Involves or contaminates a public area
- Causes airborne contamination that requires local or building evacuation
- Causes a spill that cannot be controlled or isolated by laboratory personnel
- Causes damage to college property that will require repairs
- Involves any quantity of metallic mercury
- Cannot be properly handled due to lack of local trained personnel and/or equipment to perform a safe, effective cleanup
- Requires prolonged or overnight cleanup
- Involves an unknown substance.

Minor spills

Minor spills are those spills that do not fit the requirements for Emergency Spills. The following general procedures should be used for all minor spills:

1. Attend to any persons who may have been contaminated. If these persons require medical attention this is an Emergency Spill (see above).
2. Notify persons in the immediate area about the spill.
3. Evacuate all nonessential personnel from the spill area.
4. If the spilled material is flammable, turn off ignition and heat sources.
5. Avoid breathing vapors of the spilled material. If respiratory protection is necessary this is an Emergency Spill (see above).
6. Leave on or establish exhaust ventilation if it is safe to do so.
7. Secure supplies to effect cleanup.
8. Put on appropriate personnel protective equipment.
9. Spilled Liquids:
 - Confine or contain the spill to a small area. Do not let it spread.
 - For small quantities of inorganic acids or bases, use a neutralizing agent or an absorbent mixture (e.g., soda ash or liatomaceous earth). For small quantities of other materials absorb the spill with a noncreative material (such as vermiculite, clay, dry sand, or towels).

- For larger amounts of inorganic acids and bases, flush with large amounts of water (providing the water will not cause additional damage). Flooding is not recommended in store rooms where violent spattering may cause additional hazards or in areas where water reactive chemicals may be present.
- Carefully pick up and clean any cartons or bottles that have been splashed or immersed.
- If the spilled material is extremely volatile, let it evaporate and be exhausted by the laboratory hood (provided that the hood is authorized for use with the spilled chemical).

10. Spilled Solids:

- Generally, sweep spilled solids into a dustpan and places them into a container suitable for that chemical.
- Dispose of residues according to safe disposal procedures. Remembering that personal protective equipment, brooms, dustpans, and other items may require special disposal procedures.
- Report the chemical spill in writing as required above.

Mercury handling and spill clean up

1. Storage and handling

- Always store mercury in unbreakable containers and stored in a well ventilated area.
- When breakage of instruments or apparatus containing mercury is a possibility, the equipment should be placed in an enameled or plastic tray or pan that can be cleaned easily and is large enough to contain the mercury.
- Transfers of mercury from one container to another should be carried out in a hood, over a tray or pan to confine any spills.
- If at all possible, the use of mercury thermometers should be avoided. If a mercury thermometer is required, many are now available with a Teflon coating that will prevent shattering.
- Always wash hands after handling mercury.

2. Protective Clothing

For small spills, a laboratory coat, safety glasses, and gloves should be used. Gloves made of the following have been rated as excellent for protection against elemental mercury:

- Chlorinated polyethylene (CPE)
- Polyvinyl Chloride (PVC)
- Polyurethane
- Nitrile Rubber (also known by several brand names)
- Butyl Rubber
- Neoprene

If mercury has been spilled on the floor, the workers involved in cleanup and decontamination should wear plastic shoe covers.

3. Spill Kits

Special spill kits are available from a variety of sources. If a spill kit is purchased, follow the manufacturer's directions. Alternatively, a kit can be assembled with the following components:

- Protective gloves
- Mercury suction pump or disposable pipettes to recover small droplets
- Elemental zinc powder
- Dilute sulphuric acid (5-10%) in spray bottle
- Sponge
- Plastic trash bag
- Plastic container
- Plastic sealed vial for recovered mercury

4. Clean Up Procedures

- Wearing protective clothing, pools and droplets of metallic mercury can be pushed together and then collected by a suction pump.
- After the gross contamination has been removed, sprinkle the entire area with zinc powder. Spray the zinc with the dilute sulphuric acid.

- Using the sponge, work the zinc powder/sulphuric acid into a paste consistency while scrubbing the contaminated surface and cracks or crevices.
- After the paste has dried, it can be swept up and placed into the plastic container for disposal.
- Rags, shoe covers, sponges, and anything used for the cleanup should be placed in the trash bag to be disposed of as contaminated material.

CHAPTER 6

ELECTRICAL SAFETY

In many laboratories, electrically powered equipments can pose a significant hazard to laboratory workers, particularly when mishandled or not well maintained. Many laboratory electrical devices have high voltage or high power requirements, carrying even more risk. Electrical shock and fire are the major hazards associated with electricity.

6.1 ELECTRICAL HAZARDS

The severity and effects of an electrical shock depend on a number of factors, such as:

- The pathway through the body
- The amount of current
- The length of time of the exposure
- Whether the skin is wet or dry.

The table shows the general relationship between the degree of injury and amount of current for a 50-60 cycle hand-to-foot path of one second's duration of shock. While reading this chart, keep in mind that most electrical circuits can provide, under normal conditions, up to 20,000 milliamperes of current flow. Keeping in mind that the electrical shock hazards and sparks from electrical equipment can serve as an ignition source for flammable or explosive vapors or combustible materials.

Current	Reaction
1 Milliampere	Perception level
5 Milliamperes	Slight shock felt; not painful but disturbing
6-30 Milliamperes	Painful shock; "let-go" range
50-150 Milliamperes	Extreme pain, respiratory arrest, severe muscular contraction
1000-4,300 Milliamperes	Ventricular fibrillation
10,000+ Milliamperes	Cardiac arrest, severe burns and probable death

Table 6.1 General relationship between the degree of injury and amount of current

Power loss

The following hazardous situations can be created due to the Loss of electrical power:

- If magnetic or mechanical stirrers fail to operate, safe mixing of reagents may be compromised.
- Fume hoods may cease to operate, allowing vapors to be released into the laboratory
- Flammable or toxic vapors may be released as a chemical warms when a refrigerator or freezer fails.



Fig 6.1 Two prong plug

Preventing Electrical Hazards

There are various ways of protecting people from the hazards caused by electricity, guarding insulation, guarding, grounding, and electrical protective devices.

1 Insulation

All electrical cords should have sufficient insulation to prevent direct contact with wires. In a laboratory, it is particularly important to check all cords before each use, since corrosive chemicals or solvents may erode the insulation. Damaged cords should be repaired or taken out of service immediately.

2 Guarding

Live parts of electric equipment operating at 50 volts or more must be guarded against accidental contact. Proper shields may be used to protect against exposed live parts.

3 Grounding

Only equipment with three-prong plugs (Fig 7.2) should be used in the laboratory instead of a two prong plug (Fig 7.1). The third prong provides a path to ground for internal electrical short circuits, thereby protecting the user from a potential electrical shock.



Fig 6.2 Three prong plug

4 Circuit protection devices

Circuit protection devices, such as fuses, circuit breakers, ground-fault circuit interrupter, are designed to automatically shut off the flow of electricity in the event of a ground-fault, overload or short circuit in the wiring system.

- Fuses and circuit breakers like the one shown in figure prevent over-heating of wires and components that might otherwise create fire hazards. They disconnect the circuit when it becomes overloaded. This overload protection is very useful for equipment that is left on for extended periods of time, such as stirrers, vacuum pumps, drying ovens, and other electrical equipment.
- The ground-fault circuit interrupter, or GFCI, is designed to shutoff electric power if a ground fault is detected, protecting the user from a potential electrical shock. The GFCI is particularly useful near sinks and wet location.



Fig 6.3 MCB

Motors

All newly purchased equipment should have spark free induction motors. Any switches located on the device should be removed and insert a switch on the cord near the plug end. Laboratory workers can significantly reduce electrical hazards by following some basic precautions:

- Inspect wiring of equipment before each use. Replace damaged or frayed electrical cords immediately.
- Use safe work practices every time electrical equipment is used.
- Know the location and how to operate shut-off switches and/or circuit breaker panels. Use these devices to shut off equipment in the event of a fire or electrocution.
- Limit the use of extension cords. Use only for temporary operations and then only for short periods of time. In all other cases, request installation of a new electrical outlet.
- Multi-plug adapters must have circuit breakers or fuses.
- Place exposed electrical conductors (such as those sometimes used with electrophoresis devices) behind shields.
- Minimize the potential for water or chemical spills on or near electrical equipment.

6.2 SAFE WORK PRACTICES

The following are a list of rules for working with electrical equipment:

- Turn off the power to equipment before inspecting it.
- Check circuits for proper grounding with respect to the power source.
- Never change wiring with circuit plugged into power source.
- Never plug leads into power source unless they are connected to an established circuit.
- Keep access to electrical panels and disconnect switches clear and unobstructed.
- Tools and equipment with non-conducting handles should be used when working with electrical devices.
- All current transmitting parts of any electrical devices must be enclosed.
- When checking an operating circuit, keep one hand either in a pocket or behind your back to avoid making a closed circuit through the body.
- Avoid contacting circuits with wet hands or wet materials.
- Wet cells should be placed on a piece of non-conducting material.
- Do not insert another fuse of larger capacity if an instrument keeps blowing fuses -this is a symptom requiring expert repairs.
- Extension cords must be connected to a power strip equipped with a fuse.
- Maintain a workspace clear of extraneous material such as books, papers, and clothes.

- Do not use or store highly flammable solvents near electrical equipment.
- Multi-strip outlets (cube taps) should not be used in place of permanently installed receptacles. If additional outlets are required have them installed by an electrician.

Static Electricity and Spark Hazards

Proper grounding of equipment and containers is necessary to avoid sparks. Sparks may result in explosions in areas where flammable liquids are being used. Some common potential sources of sparks are:

- The making and braking of an electrical circuit when the circuit is energized.
- Metal tanks and containers.
- Plastic lab aprons.
- Metal clamps, nipples, or wire used with no conducting hoses.
- High-pressure gas cylinders upon discharge.

CHAPTER 7

MECHANICAL SAFETY

The prime rule of safety within a mechanical workshop as well as with other labs is that of good housekeeping and general tidiness. In addition students are not permitted entrance to the mechanical workshop and labs unless approval has been obtained from the lab superintendent or technician. The tools and equipment are for student use in conducting class experiments or building approved projects. Safe operation is important to ensure successful project or experiment completion, but most importantly to ensure the personal safety of the operator and those observing. The following procedure will help to ensure the safe operation and avoid injury.

7.1 GENERAL SAFE WORKING PROCEDURE

- Only use tools and machines for their intended purpose.
- Report all damaged equipment and do not use it until a qualified person has repaired it.
- Do not operate a machine if you are wearing loose clothing.
- Where machine guards are provided they must be kept in place.
- Long hair needs to be properly restrained.
- Always use clamps to hold a work piece in the drilling machine table. Do not attempt to hold the work piece by hand. Brass is particularly liable to seize on the drill bit unless the correct type of bit is used and the bit kept sharp. Get advice from trained technical staff if you are at any time unsure. Do not take risks. Return all drill bits to their proper holder.
- Do not use hand tools of the wrong size and ensure that the hand tool (whether spanner or screwdriver etc.) fits the work correctly.
- Never use hand files unless they have a proper handle fitted. The pointed tang of a file can slip and pierce the palm of the hand.
- Ensure that hand-cutting tools are sharp - a blunt hand tool will slip easily and can cause injury. When using a hand tool remember to apply the force for cutting or filing in a direction away from the body.
- Keep machine tools, workbenches and surrounding areas clean of loose metal swarf and chippings.
- If the machining operation requires you to do so, (e.g. drilling, grinding a tool) always use safety glasses as well as the machine guard.

- Abrasive grind wheels can cause serious eye injuries due to grit being thrown from the grind wheel - wear appropriate eye protection. Grinding wheels are subject to additional legislation and must only be mounted and adjusted by a trained workshop technician.
- Never use compressed air for cleaning clothing and machinery.
- Only one person will operate a machine at any one time.
- Ensure the safety of yourself and others by being aware of your surroundings.

If you see someone committing an unsafe act, report it to the supervisor immediately. As the machine operator you are responsible for the safety of the people in your immediate area. It is your responsibility to look around and be sure that everyone within your range is wearing safety glasses. Likewise a welder must be sure not to start welding if people without welding helmets are watching him.

- Use hoisting and lifting equipment when moving heavy weights around. Make sure that slings are correctly placed. If you are not sure, ask and do not take risks.
- Always ensure that when you leave a machine or piece of equipment that it is in a safe condition for the next person to approach and use.
- You may not wear gloves while operating machinery. Holding objects with a rag near moving machinery is also not permitted. Gloves, rags, etc. can be easily caught in machines that are in motion, pulling the operator into the equipment.
- Machinery may not be left running unattended. You must be at the controls of the machine you are using whenever it is in motion.
- Observers must not distract the operator of a machine as this may cause serious injury to the operator or the observers.
- Observe the limitations of all machines.

7.2 SHEET METAL SHEAR

Follow the manufacturer's specifications as to gauge of sheet metal that can be safely cut.

- Keep fingers and measuring scales out of the way of the blade.
- Do not cut round stock or anything except sheet metal in the shear.
- Place the sheet against the guide and then clamp it in position with the clamp on the machine.
- The treadle is operated with one foot, and the other foot must be kept clear as the treadle comes down.

- Return the treadle to the up position slowly with foot pressure. Do not let it make a rapid return.
- Pick up the scrap pieces when you have completed cutting.
- Before using any wood tools you must inspect your material for foreign metal objects; such as nails, screws, staples, etc.

7.3 HAND TOOLS

Hand tools are non-powered. They include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance.

- Hammers or mallets with broken handles or loose heads should not be used.
- Mushroom heads on chisels and punches should be "dressed" properly or the tool should be discarded.
- While chipping, use prescribed type of goggles and chip in a direction where flying chips can do no harm. Use a screen if necessary.
- When cutting with pliers, be sure cuttings do not fly.
- A wood saw or hacksaw should be started by drawing the saw blade backward if fingers are used to guide it at the cutting edge.
- All files should be equipped with handles.
- Use wrenches properly sized for the job. Be sure wrench jaws are not sprung, chipped, or have worn teeth. Never use a wrench as a hammer.
- Clean grease and oil from hands before using tools to prevent slipping. To prevent injury or damage to your project use only tools that are in good condition.
- Use tools only for the job that they were designed for. Screwdrivers are for turning screws; hammers are for striking objects; parallel bars are for holding material in place until clamped; etc.
- A chisel or punch head that becomes mushroomed should be given to the supervisor for repair. Mushroomed heads can chip off and cause injuries.
- Cut away from your hands and body when using a knife or sharp object.
- Use a wrench on nuts and bolts, not pliers.
- Use open-end or adjustable wrenches that fit the nut snugly to prevent slipping and injuring fingers or damaging parts.
- Use the correct size tool for the job. That includes screwdrivers.

- All power tools must be turned off and have come to a complete stop before the operator can set them down.

7.4 DRILL PRESS

- Check the drill press head and table for security and condition before starting.
- A centre punch will help locate the hole to be drilled in the correct place.
- Clamp material to be drilled securely to the drill-table before starting the machine.
- Tighten the chuck of the drill press and remove the release key before starting the machine or your arm may be twisted around the spindle. Never leave the key in the chuck.
- Use drills properly sharpened to cut the right size.
- Run drills only at the correct speed and do not force or feed too fast. Broken drills can cause serious injury.
- If your work should slip from the clamp, never attempt to stop it with your hands. Stop machine to make any adjustment or repair.
- Drill presses should never be forced by exerting excess pressure on the feed lever.
- Drive belts should be covered.
- Hands are to be kept clear of the revolving spindle, chuck, drill and chips. When drilling large holes drill a pilot hole with a small appropriate drill and then step up in size to prevent drill chatter.
- Be sure the drill press is stopped before removing the work piece, chips or cuttings.

7.5 ENGINE LATHE

- Make sure that all gear and belt guards are in place.
- Never leave a chuck wrench in a chuck.
- Keep your hands off the chuck rims when a lathe is in operation.
- Do not attempt to screw the chuck onto the lathe spindle with the power on, as it may get cross-threaded and cause injury. Stop the machine, place a board under the chuck, and then screw on by hand.
- Steady rests should be properly adjusted to conform to the material being worked on.
- See that tailstock, tool holder, and work are properly clamped before turning on power.
- Never attempt to adjust a tool while the lathe is running.
- Never apply a wrench to revolving work or parts.
- Always use a brush to remove chips-never your hands.

- Roll up loose sleeves, and do not wear loose clothes such as sweaters or neckties while operating the lathe.
- Be certain the work piece is set up securely and tightly when using chucks and collets.
- Keep hands away from chips as they are very sharp and possibly hot.
- Complete cuts that are close to the chuck or against a shoulder by hand feeding to prevent machinery or work piece damage.
- Never move the speed selector controls while the spindle is rotating.
- Never push the reverse switch while a chuck is moving forward as this could cause the chuck to unscrew itself and fall off and cause serious injury.
- Regulate the depth of cut according to the size and type of material.
- Use tools that are properly ground for the particular job.
- You may never check measurements or surface finishes of the work piece while it is spinning.
- After you have chucked up your work piece and completed your tool setup you must spin the chuck by hand to ensure that the jaws of the chuck and the work piece will not hit the carriage of the lathe or the tool rest between the turning centers.
- Use only a Live Center Chuck and Faceplate Turning.
- Counterbalance work piece on the faceplate if it is irregular in shape.
- Stand to one side of the revolving faceplate to avoid being hit by flying objects.

7.6 MILLING MACHINE

- Secure the work piece firmly in the vice or with appropriate clamps.
- Check the work piece, milling machine table, and holding device for clearance of the quill during the cutting.
- Set the machine for the proper depth of cut.
- Select the correct spindle speed for the type of material and the cutter being used.
- Select the proper direction of rotation for the cutter.
- Feed the work piece against or opposite the direction of rotation of the cutter.
- Keep hands on the controls while the machine is running.
- Never try to feel the finished surface while the cut is being taken.

- The milling machine is a precision piece of equipment so it is important to not damage the table. The table is not a workbench or a place to put tools.
- Be sure you know how to stop the milling machine quickly before operating the machine.
- Be sure the power feed controls are in their "Neutral" position before turning on the machine.
- Handle cutters carefully. They are sharp. If they can cut metal, they can cut you.
- Use a soft hammer or mallet to seat the work piece against the parallel bars or bottom of the vice.

7.7 ELECTRIC WELDING

- A proper welding helmet, long sleeves or leather apron, long pants and leather gloves (or cotton gloves if TIG welding) are required to protect the welder and observers from eye and skin damage due to the intense ultraviolet (UV) radiation that emanates from the arc.
- Do all welding in the welding area if at all possible. Shields and fire hazard precautions will need special attention if welding in other areas.
- Check for adequate ventilation before welding.
- Welding on zinc-plated metals is hazardous to your health, and can be fatal. Do not weld on zinc-plated metal (galvanized metal). For assistance in setting up the welding equipment ask the supervisor.
- After your weld is complete, quench the work piece in water.
- Before you begin welding, you must set up the welding shields to protect others from the effects of the UV radiation on their eyes and skin.

CHAPTER 8

HAZARDOUS WASTE DISPOSAL

The purpose of environmentally sound disposal methods is to prevent harm to the water, land, and air.

8.1 DEFINITIONS OF WASTE

Any useless and valueless material that is to be discarded.

Solid waste

Any garbage, refuse, sludge from a waste treatment plant, water treatment plant, or air pollution control facility or other discarded material. Solid waste can be solid, liquid, semi-solid, or contained gaseous material resulting from industrial, municipal, commercial, mining and agricultural operations, and from community and institutional activities.

Hazardous waste

Waste that poses substantial or potential threats to public health or the environment. It is any solid waste material exhibiting the characteristics of ignitability, corrosivity, reactivity or toxicity.

Mixed waste

Mixed-waste contains both radioactive and (chemically) hazardous waste

Disposal

The discharge, deposit, injection, dumping, spilling, or placing of any solid waste or hazardous waste (whether containerized or non-containerized) into or on any land or water so that such solid waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any water, including ground waters.

Types of Hazardous Waste

An item is considered waste when the owner determines that the material is no longer useful and needs to be discarded. An item is considered to be hazardous waste if it meets one or more of the following characteristics: A chemical component is listed as hazardous by Material Safety Data Sheet (MSDS); for example, see the website, www.msds.com. Mixture contains a listed hazardous waste and a non-hazardous waste. Material meets the definition of one of the following:

Ignitability (flashpoint $<60^{\circ}\text{C}$ or supports combustion)

Reactivity (e.g., water reactive, cyanides, explosives, unstable chemicals)

Corrosivity ($\text{pH} < 4$ or > 10)

Environmental Protection (EP) toxicity (e.g., pesticides, heavy metals, poisons)

8.2 CONTAINERS AND TAGS

Proper containment, tagging, collection and disposal are essential to the success of the Hazardous Waste Program. The following sections discuss these areas.

Containers

Hazardous waste collection containers must be in good condition, must not leak, and must be compatible with their hazardous contents (e.g., do not use metal containers for corrosive waste or plastic containers for organic solvents). All containers must have suitable screw caps or other secure means of closure.

If you are reusing a container to accumulate waste, destroy the original product label. EPA regulations require that waste containers be labelled with the accumulation start date, the identity of the contents, and the words "Hazardous Waste". Use a new label to identify the hazardous waste: do not use the disposal tag for this purpose.

- Hazardous waste containers for liquids are generally rated by volume capacity.
- Allow extra room in liquid containers to allow for contents expansion.
- Do not fill jugs and bottles past the shoulder of the container.
- Fill closed head cans (5 gallons or less) to leave approximately two inches of space between the liquid level and the top of the container.
- Fill closed head drums (Larger than 5 gallons) to leave approximately four inches of space.
- Generally hazardous waste containers for solids are rated by their weight capacity and volume capacity. Take care not to exceed the weight capacity of a solid container. Weight is generally not a problem for jars and open head cans (5 gallons or less), but it can be a problem for open head drums (larger than 5 gallons). Depending on weight requirement, you may fill containers for solids within two inches of the closure.
- Important: Keep all waste collection containers closed except when adding or removing material.

Disposing of Empty Containers

- The disposing of empty containers must meet the following requirements:
- Product labels must be defaced or removed.
- Container lids or caps must be removed.
- Containers must not contain free liquid or solid residue.
- Containers must be triple rinsed.
- It is not necessary to break empty glass containers.
- Punch holes in the bottom of metal containers and plastic jugs before disposing of them in the regular trash.
- Important: Containers that do meet the requirements mentioned here must be treated as hazardous waste.

8.3 WASTE MINIMIZATION TECHNIQUES

Lab Superintendents should follow these techniques to reduce hazardous waste:

- Review waste streams and recommend waste minimization procedures.

- Do not mix different types of waste.
- Do not put non-hazardous waste, such as a mixture of water, sodium bicarbonate, and acetic acid, into a waste container of hazardous waste.
- Do not combine inorganic heavy metal waste with organic solvents waste.
- Segregate halogenated waste solvents from non-halogenated waste solvents, accidental contamination. Store waste containers separate from reagent containers being used to avoid accidental contamination. Decontaminate empty containers to make them non-hazardous
- Neutralize or dilute acids and bases to make them non-hazardous and suitable for drain disposal.
- When possible, redesign experimental protocols so that harmful by products are detoxified or reduced.
- Recycle chemicals via purification.

Waste Segregation

Many hazardous wastes, when mixed with other waste or materials, can produce effects which are harmful to human health and the environment, such as Heat or pressure, Fire or explosion, Violent reaction, Toxic dusts, mists, fumes, or gases, or Flammable fumes or gases. Segregated waste is safer and easier to dispose of than non-segregated waste. Mixed waste as indicated above can result in severe consequences. Each lab superintendent who generates waste is personally responsible for the following: Ensuring that hazardous wastes are accumulated in safe, transportable containers. Ensuring that hazardous wastes are stored properly to prevent possible exposure.

Incompatible Waste

Given below are the examples of potentially incompatible wastes, waste components, and materials, along with the harmful consequences, which result from mixing materials in one group with materials in another group. This list is not intended to be exhaustive. A waste generator must, as the regulations require, adequately control his wastes so that he can avoid creating uncontrolled substances or reactions of the type listed below, whether they are listed below or not. It is possible for potentially incompatible wastes to be mixed in a way that precludes a reaction (e.g., adding acid to water rather than water to acid) or that neutralizes them (e.g., a strong acid mixed with a strong base), or that controls substances produced (e.g., by generating flammable gases in a closed tank equipped so that ignition cannot occur, and burning the gases in an incinerator).

CHAPTER 9

SAFETY TRAINING

9.1 INFORMATION AND TRAINING PROGRAM

The Govt. Engineering College Trichur requires that all individuals that work in laboratory are adequately informed about the physical and health hazards present in the laboratory, the known risks and what to do if an accident occurs.

Every laboratory/workshop worker must be trained to know the location and proper use of available personal protective clothing and equipment. See chapter 4 of this manual for information on the use of personal protective clothing and equipment. The laboratory superintendent and/or technician is/are responsible for providing information to his or her superior personnel and EHS Committee about any hazards present in the lab or workshop. This information must be provided at the time of a lab or workshop person's initial assignment and prior to any assignments involving new potential hazards situation. The following lists the information that should be provided by the lab superintendent and technician.

- The location and availability of this manual.
- The Occupational Safety and Health Administration (OSHA) Occupational Exposure to Hazardous Chemicals in Laboratories standard
<http://www.osha.gov/>
- The location and availability of known reference material on the hazards, safe handling, storage, and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets (MSDS) received from the chemical supplier.
- The Permissible Exposure Limits (PEL) for Occupational Safety and Health Administration (OSHA) regulated substances or recommended exposure limits (for example, Threshold Limit Value- TLV) for other hazardous chemicals where there is no applicable OSHA standard (see OSHA Permissible Exposure Limits of some common laboratory chemicals). Other significant values may be found on the appropriate MSDS.
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.

- Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as continuous monitoring devices, and visual appearance or odor of hazardous chemicals when being released);
- The physical and health hazards of chemicals in the work area.
- The applicable details of this manual.

Lab superintendents and technicians must be re-trained when new equipment or chemical hazards are introduced into their workplace, as well as upon reassignment to different workplaces that involve new equipment or chemical hazards. The lab superintendent or technician must conduct site-specific training. Basic safety training is required for all employees of the College, including faculty, staff, and students who have the potential for exposure to hazardous chemicals. Training is required before the employee can be assigned work in or around hazardous chemicals. The training takes approximately one hour and includes:

- Central requirements of the basic, including training, chemical labels, and Material Safety Data Sheets (MSDS);
- Spill clean-up and chemical disposal procedures;
- Chemical storage guidelines; and
- Hazards specific to different chemical groups.

9.1.1 Laboratory Safety Training

Laboratory safety training is required for all employees of the College, including faculty, staff, and students who may work in a laboratory that contains hazardous equipment or using hazardous chemicals or biological materials. This training must be received prior to the beginning of a laboratory assignment. The training takes approximately one hour and should include:

- Safety equipment and practices.
- Emergency procedures.
- Emergency equipment.
- Waste disposal.

9.1.2 Fire Extinguisher Training

Fire extinguisher training, with live fire suppression, is required for all laboratory superintendents, technicians. This training covers what to do in the event of a fire, the behaviour of fire and how it spreads, the classes of fires, and the proper selection and use of a fire extinguisher. This training program will familiarize laboratory workers with the general principles of fire extinguisher use; give them confidence in their ability to operate the extinguisher; and remove some of the fear associated with putting out a fire by showing them that fire extinguishers do work in putting out fires. The safety committee should plan once a year for a fire drill (fire fighting work shop).

9.1.3 Waste Management Training

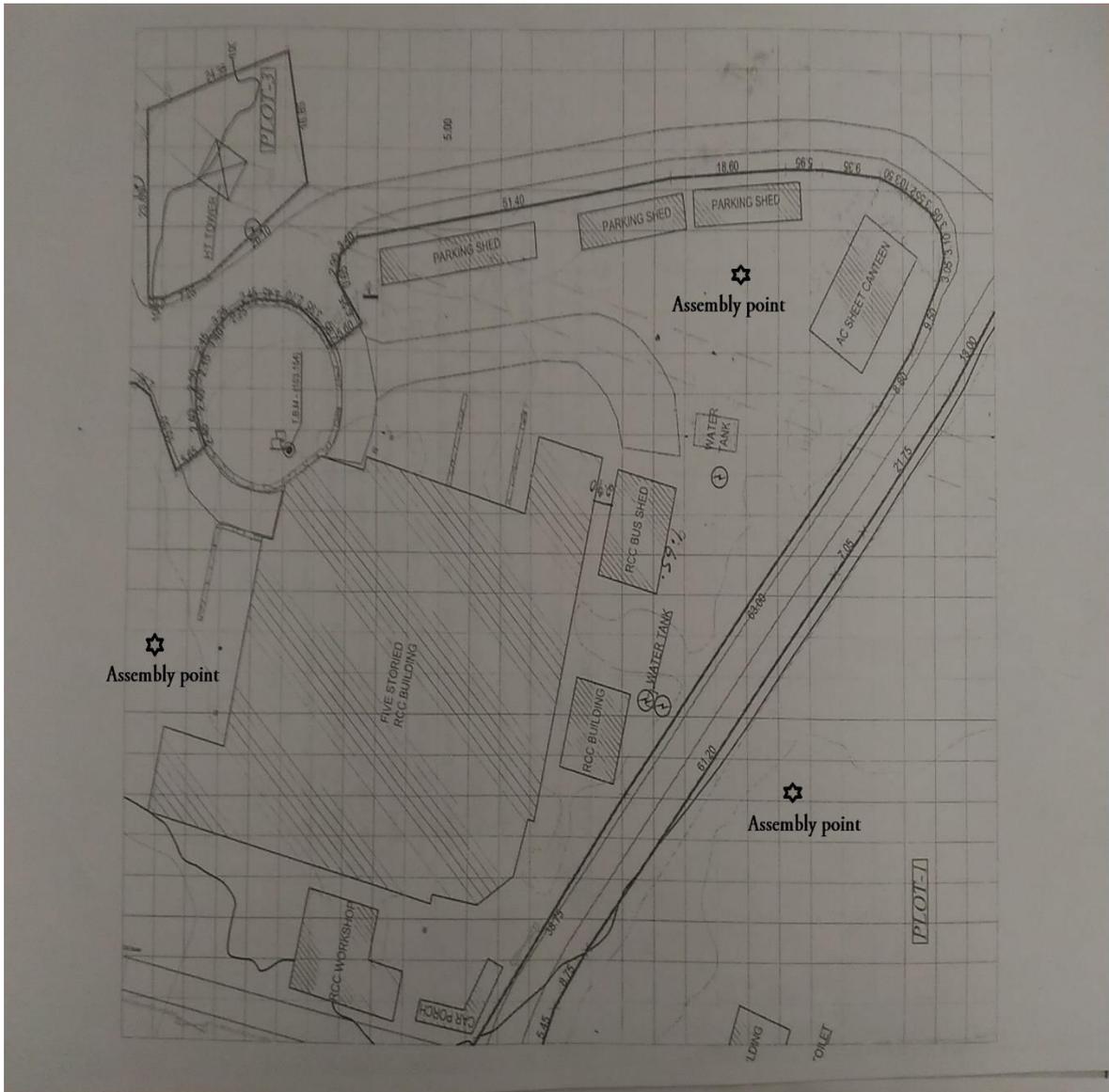
Waste management training is required for selected employees of the College, including faculty, staff, who are in laboratory supervisory positions where hazardous chemicals are in use. All staff members that have any coordination responsibilities for teaching labs must receive this training. Every teaching lab must have one or more individuals who have received this training and are responsible for following the procedures included in the training.

- Hazardous waste definitions and regulatory environment.
- Spill clean-up and chemical waste disposal procedures.
- Chemical waste storage and segregation guidelines.
- Waste minimization and drain disposal.

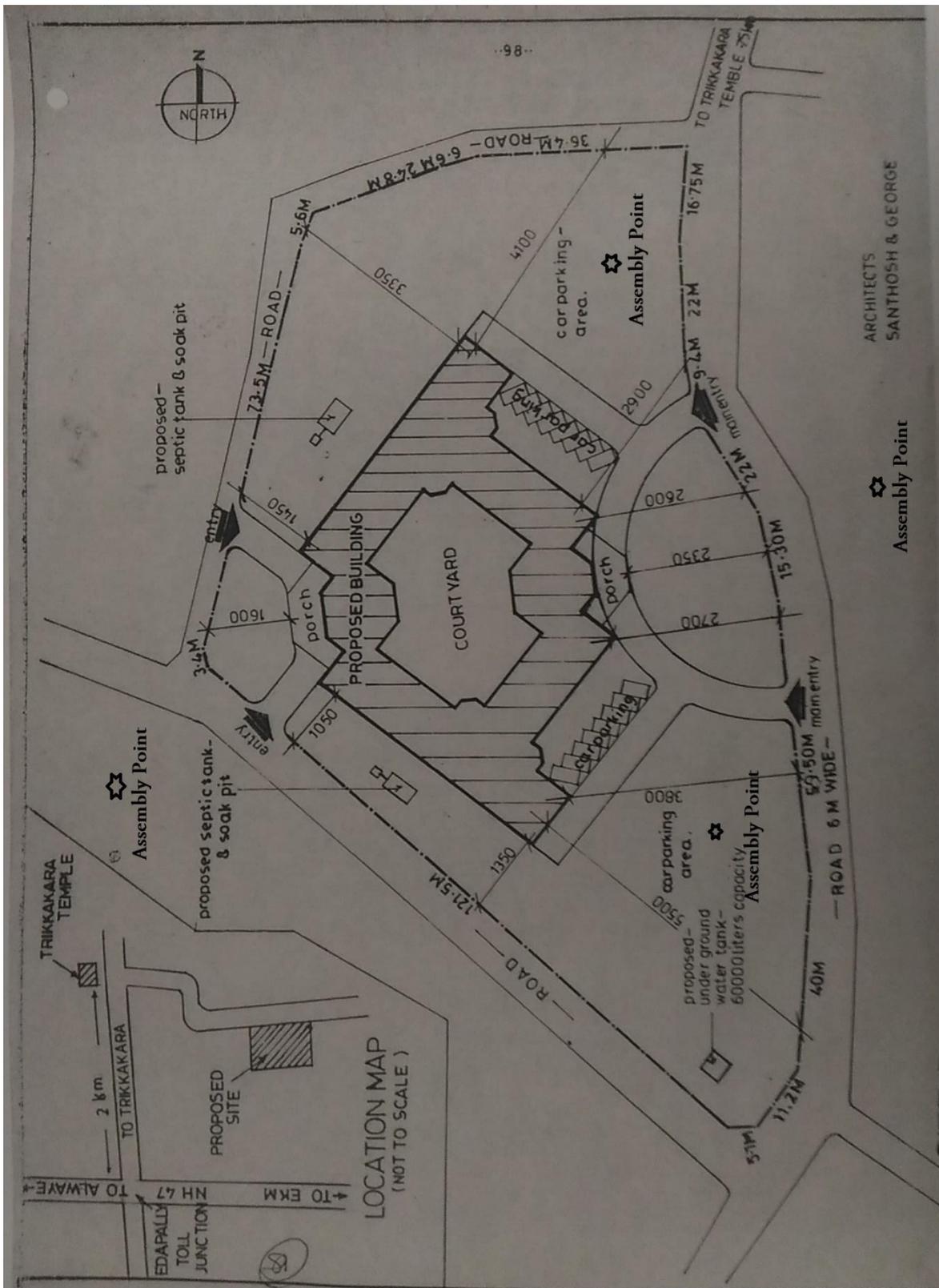
CHAPTER 10

ESCAPE PLAN

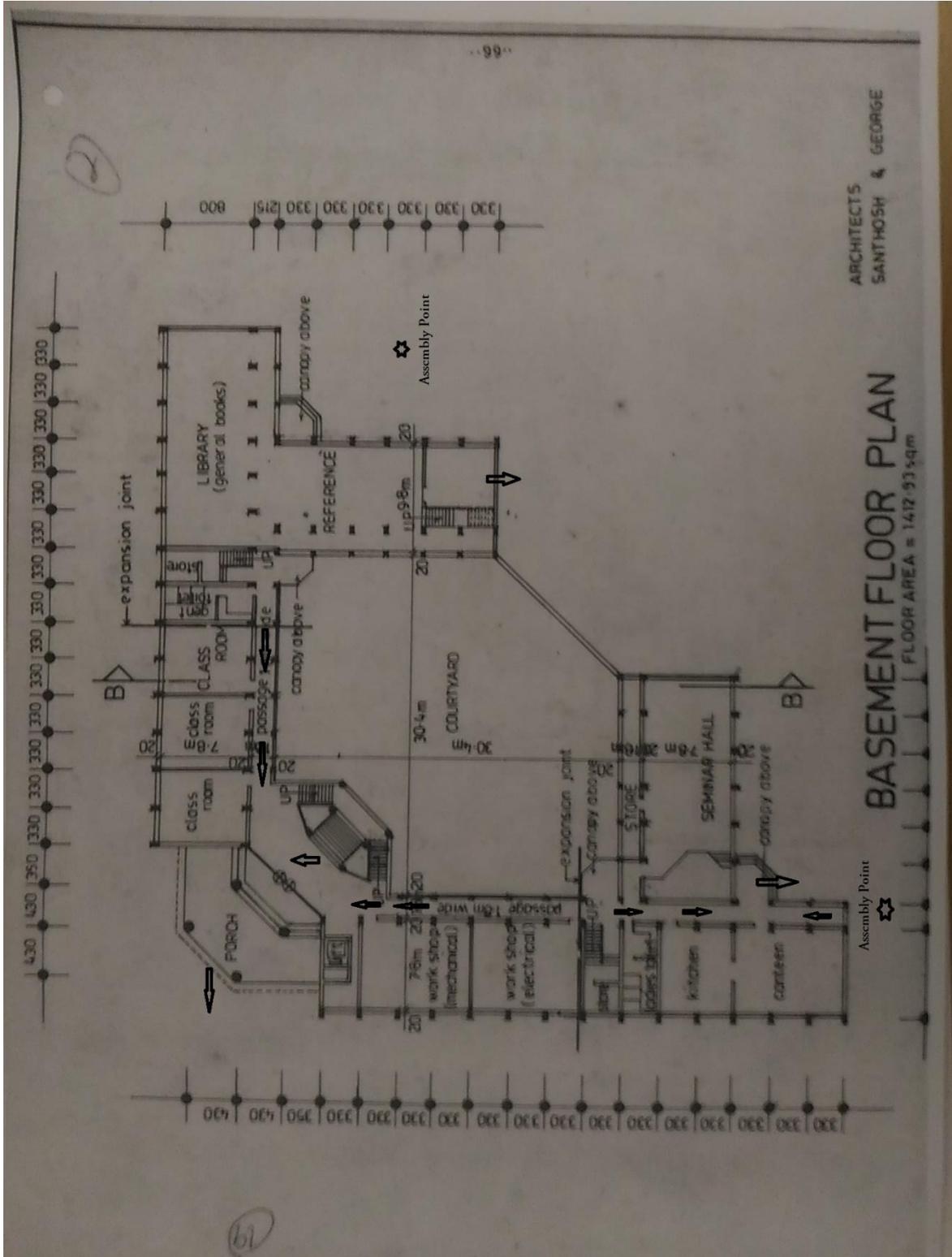
PLAN 1 - LOCATION



PLAN 2 - LOCATION



PLAN 3 – BASEMENT FLOOR PLAN



APPENDIX -1

Indian Standard

FIRE SAFETY IN EDUCATIONAL INSTITUTIONS — CODE OF PRACTICE

1 SCOPE

This code covers the fire safety requirements in educational institutions.

2 NORMATIVE REFERENCES

The Indian Standards listed in Annex A contain provisions which, through reference in the text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards are given in Annex A.

3 CLASSIFICATION

3.1 For the purpose of the standard, the classification of educational buildings should be as given in 3.1.1.

3.1.1 All buildings shall be classified according to the use or the character of occupancy and shall be in accordance with IS 1641.

Buildings and structures under Group B shall be further subdivided as follows:

- a) *Subdivision B-1 schools up to higher secondary level*

This subdivision shall include any building or a group of buildings under single management which is used for students not less than 20 in number.

- b) *Subdivision B-2 all others/training institutions*

This subdivision shall include any building or a group of buildings under single management which is used for students not less than 100 in number.

NOTE — If residential accommodation is provided in the schools/institutions, it should be classified as building in subdivision A-3.

4 TYPES OF CONSTRUCTION

4.1 All educational buildings of permanent nature shall be of Type I construction having external shell and load bearing elements of 4 h fire resistance rating, while internal/non load bearing walls shall have 2 h fire resistance rating. Floors shall have same fire resistance as that of external shells, and false ceiling, if any shall have rating as laid down in

IS 1642. Basements, if constructed should not be used for classrooms or laboratories/libraries and assembly halls.

4.2 All educational buildings not of permanent nature, may have constructions conforming to Type II or Type III construction as per IS 1642. All such buildings shall be restricted to ground and one upper floor only and the floor area not exceeding to 1 000 m² on each floor.

NOTE — Temporary structures such as tents or with thatched construction should not be allowed for housing educational institutions.

5 OCCUPANT LOAD

5.1 Occupant load shall be in accordance with IS 1644.

6 ARRANGEMENT OF EXIT

6.1 Exits from the upper floor should be so located that no point in the floor is more than 22.5 m from the nearest exit, for the Type I, Type II and Type III construction.

NOTE — Type IV construction is not allowed for construction of educational buildings.

6.2 Exits should be so arranged that at least two separate exits are available in every floor area. Exits shall be as remote from each other as practicable and so arranged that there are no pockets or dead ends of appreciable size in which occupants may be trapped.

6.3 Every room with a capacity of 45 persons in area shall have at least two doorways.

6.4 Elevators, lifts and escalators shall not be counted as exits.

6.5 Fire escapes constitute only means of the required exit and should not be taken into account in calculating the evacuation time of the building. Fire escapes shall always be kept in sound operating conditions.

7 CORRIDOR AND PASSAGE WAYS

7.1 Exit corridors and passage ways shall be of width not less than the aggregate required width of exit doorways leading from them in the direction of travel to the exterior.

7.2 Where stairways discharge through corridors and passageways, the height of corridors and passageways shall be not less than 2.4 m.

7.3 All internal staircase, lift, lobbies and corridors should be adequately ventilated and illuminated.

8 DOORWAYS

8.1 No exit doorway shall be less than 1 m in width except assembly halls where door width should not be less than 2 m.

8.2 The height of door shall not be less than 2 m.

8.3 These shall be opening outwardly.

8.4 Overhead or sliding door shall not be installed.

NOTE — In case of buildings where there is Central Corridor the door shall open inwards to allow smooth flow of traffic in the corridor.

8.5 These shall be openable from inside and shall not be opening immediately on flight.

9 STAIRCASE

9.1 Any building having area more than 500 m² on each floor and 15 m or more in height shall have minimum two staircases of enclosed type; at least one of these shall be on external wall and shall directly open to exterior, interior open space or to an open place of safety. Further the provision or otherwise of alternative staircase shall be subject to the requirements of travel distance being complied with.

9.2 Internal Staircases

9.2.1 Internal stairs shall be constructed of non-combustible materials throughout. Hollow combustible construction shall not be permitted.

9.2.2 Internal staircases shall be constructed as a self-contained unit with an external wall constituting at least one of its sides and shall be completely enclosed.

9.2.3 Staircase shall not be arranged round a lift shaft.

9.2.4 No gas piping shall be laid in the stairway.

9.2.5 Notwithstanding, the detailed provision for exits in the educational buildings, the width of staircase shall not be less than 1.5 m up to a height of 30 m.

NOTE — Buildings above 30 m height are not permitted.

9.2.6 Minimum width of treads shall not be less than 300 mm. The treads should be constructed and maintained in a manner to prevent slipping.

9.2.7 Maximum height of riser shall not be more than 150 mm and number shall be limited to 15 per flight.

9.2.8 Height of railing shall be more than 1 m. Gap between verticles should not exceed 200 mm. The gap should be reduced to 150 mm where small children are likely to use the staircase.

9.2.9 The number of people in between floor landings in staircase shall not be less than the population on each floor for the purpose of design of staircase.

The other main parameters for the design of staircase are as given below:

- a) The minimum head room in a passage under the landing of a staircase and under the staircase shall be 2.2 m.
- b) For building 15 m in height or more, access to main staircase shall be through a fire smoke check door or 1 h fire resistance rating. Fire resistance rating may be reduced to half an hour for residential buildings.
- c) No living space, store or other fire risk shall open directly into the staircase or staircases.
- d) External exit door of staircase enclosure at ground level shall open directly to the open spaces or through a draught lobby, if necessary.
- e) The main staircase and external staircase shall be continuous from ground floor to the terrace level.
- f) No electrical shafts/AC ducts or gas pipe, etc, shall pass through the staircases. Lift shall not open in staircase.
- g) No combustible material shall be used for decoration/ wall panelling in the staircase.
- h) Beams/columns and other building feature shall not reduce the head room/width of the staircase.
- j) The exit sign with arrow indicating the way to the escape route shall be provided at a suitable height from the floor level on the wall and shall be illuminated by electric light connected to corridor circuits. All exit way marking signs shall be flush with the wall and so designed that no mechanical damage shall occur to them due to moving of furniture or other heavy equipments. Further, all landings of floor shall have floor indicating boards prominently indicating the number of floor as per bye-laws.
The floor indication board shall be placed on the wall immediately facing the flight of stairs and nearest to the landing. It shall be of size not less than 0.5 × 0.5 m.
- k) Individual floors shall be prominently indicated on the wall facing the staircases.

- m) In case of single staircase it shall terminate at the ground floor level and the access to the basement shall be by a separate staircase. However, the second staircase may lead to basement levels provided the same is separated at ground level by ventilated lobby with discharge points to two different ends through enclosures.

9.3 External Stairs

9.3.1 All external stairs shall be directly connected to the ground.

9.3.2 Entrance to the external staircases shall be separate and remote from the internal staircase.

9.3.3 Care shall be taken to ensure that no wall opening or window opens on to or close to a external staircase.

9.3.4 The route to the external stairs shall be free from obstructions at all times.

9.3.5 The external staircase shall be constructed of non-combustible materials, preferably of masonry and any doorway leading to it should have the required fire resistance.

9.3.6 No external staircase, used as a fire escape, should be inclined at an angle greater than 45° to the horizontal.

9.3.7 External stairs shall have straight flight not less than 1 m wide with 200 mm treads and risers not more than 190 mm. The number of risers shall be limited to 15 per flight.

9.3.8 Hand rails shall be of a height not less than 1 m and not exceeding 1.2 m.

9.4 In case the educational building has got a mixed occupancy such as auditorium, etc, necessary recommendations for exits as per the requirements as given in SP 7 : 1983 shall be followed.

10 AIR CONDITIONING

10.1 In some educational institutions, a part of it may be having air conditioning arrangement. In case of room air conditioning, no extra precautions than laid down are required. In cases, like auditorium and laboratories having central air conditioning system, the measures as laid down in IS 1642 should apply.

11 CHIMNEYS

11.1 Where chimneys are used, the requirements shall be as laid down in IS 1642 and IS 1649.

12 RESTRICTION OF SPREAD OF FIRE AND SMOKE

12.1 The vertical shafts/ducts meant for electrical wiring, drainage pipes, etc, shall be effectively

sealed at all floor levels and shall be enclosed by 2 h fire resistance enclosures. Wherever inspection doors are required, these shall be of not less than 1 h fire resistance.

12.2 The material chosen for other use shall be as far as non-combustible and the wood/other material shall be treated with fire retardant composition if its use is unavoidable.

12.3 The laboratories which are likely to have highly flammable material/chemicals, etc, should be located in separate block and adequate precautions shall be taken to have separate stores for keeping hazardous chemicals.

12.4 The adequate care shall be taken while using any gas for burners, etc, in laboratory/kitchens and necessary precaution shall be taken for storage of gas in form of bullet, tanks, battery or cylinders, etc, as per rules.

13 ELECTRICAL EQUIPMENT AND SAFETY RULES

13.1 Transformer building/HT and LT control panels having aggregate oil capacity greater than 2 000 litres shall be housed in separate rooms/enclosures 6 m away, properly fenced.

13.2 Staircases and corridors lighting shall have separate circuits.

13.3 Miniature Circuit Breakers/Earth Leakage Circuit Breakers shall be provided in the circuits.

13.4 Earth connection shall be provided in building which are 15 m or more in height.

13.5 The lighting protection system for the buildings shall generally conform to IS 2309.

14 FIRE SAFETY MEASURES

14.1 The requirements of wet riser, down comer installations and capacity of water storage tanks and fire pumps should be as given below:

- a) For buildings less than 15 m in height:

<i>Installations</i>	<i>Minimum Requirements</i>
Hose reel	To be provided (For more than 2 storeyed buildings and covered area exceeding $1\ 000\ m^2$)
Wet riser	—
Down comer	To be provided
Yard hydrant	—
Automatic sprinkler system	To be provided (In case of the buildings having basement area $200\ m^2$ and more)
Manually operated electric fire alarm system	—

<i>Installations</i>	<i>Minimum Requirements</i>
Automatic detection and alarm system	—
Underground static water storage tank	50 000 l (If total covered area exceeds 1 500 m ²)
Terrace tank	10 000 l (In case of hose reel and 20 000 l in case the buildings having basement area 200 m ² and more)
Near underground static tank, (fire pump with) minimum pressure of 0.3 N/mm ² at terrace level	One electric pump and one diesel pump of capacity 1 620 l/min and one electric pump of capacity 180 l/min
Pump at terrace level with minimum pressure of 0.3 N/mm ²	450 l/min, in case of hose reel (900 l/min in case of hose reel and in case the buildings having basement area 200 m ² and more)
b) 15 m and above but not exceeding 30 m in height	
<i>Installation</i>	<i>Minimum Requirements</i>
Hose reel	To be provided
Wet riser	To be provided
Down comer	To be provided
Yard hydrant	To be provided
Automatic sprinkler system	To be provided (In case the building is having a basement area 200 m ² and more)
Manually operated electric fire alarm system	To be provided
Automatic detection and alarm system	Not to be provided
Under ground static water storage tank	10 000 l for every 100 m ² with a minimum of 5 000 l up to maximum of 1 00 000 l
Terrace tank	20 000 l (30 000 l in case of the buildings having basement area 200 m ² and more)
Near underground static tank, fire pump with minimum pressure of 0.3 N/mm ² at terrace level	One electric and one diesel pump of capacity 2 850 l/min and one electrical pump of capacity 180 l/min
Pump at terrace level with minimum pressure of 0.3 N/mm ²	900 l/min (1 620 l/min in case the buildings having basement area 200 m ² and more)

14.2 Fire Detection and Alarm System

If automatic fire detection and alarm system is employed, the installation shall conform to IS 2189. The detectors, if provided, shall conform to IS 2175 and IS 11360.

14.3 First aid fire fighting appliances shall be provided and installed and maintained in accordance with IS 2190.

15 EMERGENCY AND ESCAPE LIGHTING

15.1 Emergency lighting shall be powered from a source independent of that supplying normal lighting.

15.2 The emergency lighting shall be provided to be put on within 5 second (preferably within 1 second) of the failure of the normal lighting supply.

15.3 Emergency lighting luminaries and their fittings shall be non-flammable.

15.4 It is essential that the wiring and installations of the emergency lighting systems are of high quality so as to ensure their perfect serviceability at all times.

15.5 The emergency lighting system shall be capable of continuous operation for a minimum duration of 1 h 30 min even for smallest premises.

15.6 It shall be ensured that the emergency lighting system is well maintained by periodical inspections and tests so as to ensure their perfect serviceability at all times.

15.7 Escape lighting shall be capable of:

- Indicating clearly and unambiguously the escape routes,
- Providing adequate illumination along such routes to allow safe movement of persons towards and through exit, and
- Ensuring that fire alarm call point and fire-fighting equipments provided along the escape routes can be readily located.

15.8 Escape lighting luminaries shall be sited to cover the following locations:

- Near each intersection of corridors,
- At each exit door,
- Near each change of direction in the escape route,
- Near each staircases so that each flight of stair receives direct light,
- Near any other change of floor level,
- Outside each final exit and close to it,
- Near each fire alarm call point,
- Near fire-fighting equipment, and
- To illuminate exit and safety signs as required by the enforcing authority.

NOTE — For the purpose of this clause 'near' is normally considered to be within 2 m measured horizontally.

APPENDIX 2

Chemicals used in the laboratory of an engineering institution

Sodium Hydroxide

IMPORTANT PROPERTIES

<i>PHYSICAL APPEARANCE</i>	Viscous liquid and flakes
<i>COLOR</i>	Colorless to slightly colored
<i>BOILING POINT</i>	145°C (50%)
<i>UPPER EXPLOSIVE LIMIT</i>	Non-flammable
<i>LOWER EXPLOSIVE LIMIT</i>	Non-flammable
<i>CHEMICAL REACTIVITY</i>	Stable
<i>FLAMMABILITY OF THE PRODUCT</i>	Non-flammable.

HEALTH HAZARDS

Very hazardous in case of skin contact, of eye contact (irritant, corrosive), of ingestion, of inhalation. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

FIRST AID

Eye Contact: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Get medical attention immediately.

Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention. Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation.

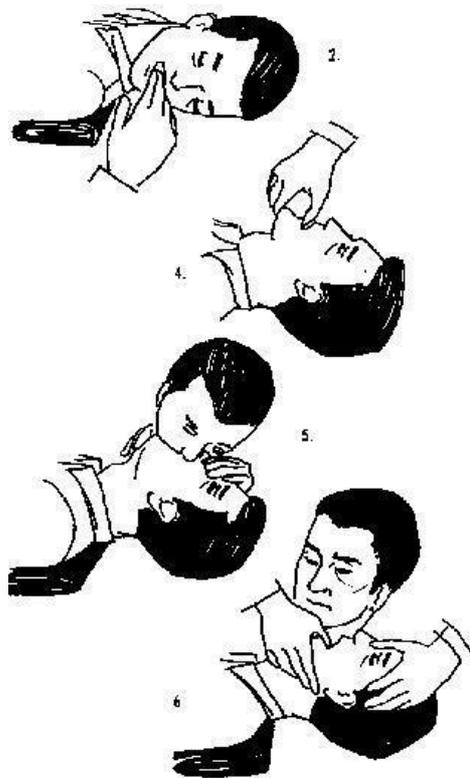


Fig 11.1 Artificial Breathing **CARDIO PULMONARY**

RESUSCITATION:

1. **CALL:** Check the victim for unresponsiveness. If the person is not responsive and not breathing or not breathing normally. Call Emergency number and return to the victim. If possible bring the phone next to the person and place on speaker mode.
2. **PUMP:** If the victim is still not breathing normally, coughing or moving, begin chest compressions. Push down in the center of the chest 2-2.4 inches 30 times. Pump hard and fast at the rate of 100 - 120/minute, faster than once per second.
3. **BLOW:** Tilt the head back and lift the chin. Pinch nose and cover the mouth with yours and blow until you see the chest rise. Give 2 breaths. Each breath should take 1 second. It is shown in fig 11.xx **CONTINUE WITH 30 PUMPS AND 2 BREATHS UNTIL HELP ARRIVES**

WARNING: *It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.*

Ingestion: *Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.*

Oxalic Acid

IMPORTANT PROPERTIES

<i>PHYSICAL APPEARANCE</i>	Solid Powder, dust Granular
<i>COLOR</i>	White
<i>BOILING POINT</i>	149-160°C (300-320°F)
<i>CHEMICAL REACTIVITY</i> conditions and recommended use	Stable under normal temperature
<i>TOXIC DOSE 1 - LD 50</i>	7500 mg/kg (oral rat)

HEALTH HAZARDS

Skin Contact: Skin contact may cause irritation with symptoms of redness, swelling, itching and pain.

Eye Contact: Eye contact may cause irritation with symptoms of redness, swelling, itching and pain. May cause corneal injury.

Inhalation: Inhalation of Oxalic Acid produces irritation of respiratory tract, cough and vomiting

PERSONAL PROTECTION

Eyes: Use chemical safety goggles or eyeglasses. A face shield may also be necessary. Maintain eye wash fountain and safety showers in the immediate work area.

Skin: Wear impervious protective clothing including apron, boots and rubber gloves as appropriate.

Ventilation : Use local ventilation if dusting is a problem, to maintain air levels below the recommended exposure limit.

FIRST AID

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid immediately.

Skin: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.

Inhalation: If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult give oxygen. Get medical aid immediately

FIRE AND EXPLOSION HAZARDS

Oxalic Acid is combustible below 101°C (215 °F). Decomposition products include carbon monoxide and formic acid which are toxic and flammable. Reacts explosively with strong oxidizing materials and some silver compounds.

Sodium thio sulphate

IMPORTANT PROPERTIES

<i>PHYSICAL</i>	<i>Solid Powder, dust</i>
<i>APPEARANCE COLOR</i>	<i>Granular White</i>
<i>BOILING POINT</i>	<i>100 deg C (212.00°F)</i>
<i>UPPER EXPLOSIVE LIMIT LOWER</i>	<i>Not available</i>
<i>EXPLOSIVE LIMIT</i>	<i>Not available</i>
CHEMICAL REACTIVITY	Stable under normal temperature conditions and recommended use.

HEALTH HAZARDS

Eye: May cause eye irritation.

Skin: May cause skin irritation. May be harmful if absorbed through the skin.

Ingestion:

May cause irritation of the digestive tract. May be harmful if swallowed. **Inhalation:** May cause respiratory tract irritation. May be harmful if inhaled. **Chronic:** Prolonged or repeated skin contact may cause dermatitis.

PERSONAL PROTECTION

Eyes: Wear chemical splash goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

FIRST AID

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin:

Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion: Get medical aid. Wash mouth out with water.

Inhalation:

Remove from exposure and move to fresh air immediately. Get medical aid.

FIRE AND EXPLOSION HAZARD

Fire: Not considered to be a fire hazard.

Explosion: Not considered to be an explosion hazard.

Carbon Tetra Chloride**IMPORTANT PROPERTIES****PHYSICAL**

APPEARANCE COLOR

Liquid

Clear, colorless

BOILING POINT

76 deg C @ 760 mm Hg

UPPER EXPLOSIVE LIMIT

No data available

LOWER EXPLOSIVE LIMIT

No data available

CHEMICAL REACTIVITY

Stable under normal temperature conditions and recommended use.

HEALTH HAZARDS

INHALATION: irritation, digestive disorders, headache, drowsiness, dizziness, loss of Co-ordination, lung congestion, effects on the brain, convulsions, coma **SKIN**

CONTACT: irritation, rash, absorption may occur, digestive disorders, headache, drowsiness, dizziness, loss of coordination, lung congestion, effects on the brain, convulsions, and coma.

EYE CONTACT: irritation

INGESTION: irritation, digestive disorders, headache, drowsiness, dizziness, loss of coordination, lung congestion, effects on the brain, convulsions, coma

FIRST AID

Inhalation: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

Skin contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

Eye contact: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

Ingestion: If swallowed, drink plenty of water, do NOT induce vomiting. Get immediate medical attention. Induce vomiting only at the instructions of a physician. Do not give anything by mouth to unconscious or convulsive person.

PERSONAL PROTECTION

Eye/face protection Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

SKIN PROTECTION

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

FIRE AND EXPLOSION HAZARDS: Slight fire hazard.

EXTINGUISHING MEDIA: regular dry chemical, regular foam, water

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Fight large fires from a protected location or safe distance. Stay away from the ends of tanks. dike for later disposal. Do not scatter

Hydrochloric acid

IMPORTANT PROPERTIES

PHYSICAL APPEARANCE	Liquid
COLOR	Clear, colorless
BOILING POINT	76 deg C @ 760 mm Hg (168.80fF)
UPPER EXPLOSIVE LIMIT	No data available
LOWER EXPLOSIVE LIMIT	No data available
CHEMICAL REACTIVITY	Stable under normal temperature conditions and recommended use.
TOXIC DOSE TOXICITY:	
LD50 (ORAL-RAT)(MG/KG)	2800
LD50 (ORAL-MOUSE)(G/KG)	12.8
LD50 (IPR-RAT)(MG/KG)	1500
LD50 (SKN-RAT) (MG/KG)	5070

HEALTH HAZARDS

Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System,

teeth. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation.

PERSONAL PROTECTION

Ventilation: *Provide local exhaust, preferably mechanical.*

Respiratory protection: *If necessary use an approved respirator with acid vapor cartridges.*

Eye protection: *Wear chemical safety glasses with a face shield for splash protection.*

Skin and body protection: *Wear neoprene or rubber gloves, apron and other protective clothing appropriate to the risk of exposure.*

FIRST AID

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

FIRE AND EXPLOSION HAZARDS

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks

Potassium Hydroxide

IMPORTANT PROPERTIES

PHYSICAL APPEARANCE
COLOR

, Liquid
Clear to slightly turbid

BOILING POINT	271 - 293 F
UPPER EXPLOSIVE LIMIT	No data available
LOWER EXPLOSIVE LIMIT	No data available
Chemical Stability:	Stable. Readily absorbs carbon dioxide and moisture from the air and deliquesces.

HEALTH HAZARDS

Eye: Causes severe eye burns. May cause irreversible eye injury. Contact may cause ulceration of the conjunctiva and cornea. Eye damage may be delayed.

Skin: Causes skin burns. May cause deep, penetrating ulcers of the skin.

Ingestion: Harmful if swallowed. May cause circulatory system failure. May cause perforation of the digestive tract. Causes severe digestive tract burns with abdominal pain, vomiting, and possible death.

Inhalation: Harmful if inhaled. Irritation may lead to chemical pneumonitis and pulmonary edema. Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma.

Chronic: Prolonged or repeated skin contact may cause dermatitis. Prolonged or repeated eye contact may cause conjunctivitis.

PERSONAL PROTECTION

Eyes: Chemical goggles, full-face shield, or a full-face respirator is to be worn at all times when product is handled. Contact lenses should not be worn; they may contribute to severe eye injury.

Respiratory: If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protective equipment including approved respiratory protection.

Gloves: Impervious gloves of chemically resistant material (rubber or PVC) should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse.

Clothing: Body suits, aprons, and/or coveralls of chemical resistant material should be worn. Wash contaminated clothing and dry thoroughly before reuse.

Footwear: No special footwear is required other than what is mandated at place of work.

FIRST AID

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion: DO NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

FIRE AND EXPLOSION HAZARDS

UNUSUAL FIRE/EXPLOSION HAZARDS: This material is corrosive to all human tissue. It will react violently with many organic chemicals, especially nitro carbons and chlorocarbons. Caustic potash reacts with zinc, aluminum, tin, and other active metals liberating flammable hydrogen gas. Dilution with water evolves large amounts of heat.

Acetic acid

IMPORTANT PROPERTIES

PHYSICAL APPEARANCE	Colorless liquid
COLOR	Clear, colorless liquid
FLASH POINT	39 ⁰ C
UPPER EXPLOSIVE LIMIT	No data available
LOWER EXPLOSIVE LIMIT	No data available

HEALTH HAZARDS

Eye: Causes severe eye irritation. Contact with liquid or vapor causes severe burns and possible irreversible eye damage.

Skin: Causes skin burns. May be harmful if absorbed through the skin. Contact with the skin may cause blackening and hyperkeratosis of the skin of the hands. **Ingestion:** May cause severe and permanent damage to the digestive tract. Causes severe pain, nausea, vomiting, diarrhea, and shock. May cause polyuria, oliguria and anuria. Rapidly absorbed from the gastrointestinal tract.

Inhalation: Effects may be delayed. Causes chemical burns to the respiratory tract. Exposure may lead to bronchitis, pharyngitis, and dental erosion. May be absorbed through the lungs.

PERSONAL PROTECTION

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Synthetic apron. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves (impervious).

FIRST AID

Inhalation: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get immediate medical attention. Thoroughly clean and dry contaminated clothing and shoes before reuse. Destroy contaminated shoes.

Eye contact: Immediately flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

Ingestion: If swallowed, drink plenty of water, do NOT induce vomiting. Get immediate medical attention.

FIRE AND EXPLOSION HAZARDS

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat. Slightly flammable in presence of oxidizing materials of metals.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of oxidizing materials.

FIRE FIGHTING MEASURES

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Use water spray to cool fire-exposed containers. For large fires, use water spray, fog or alcohol-resistant foam.

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Avoid contact with heat, sparks and flame. Do not get on skin or in eyes. Do not ingest or inhale.

Discard contaminated shoes. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage: Keep away from heat, sparks, and flame. Keep from freezing. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Corrosives area. Do not store near alkaline substances. Acetic acid should be kept above its freezing point (62°F), since it will expand as it solidifies and may break container.

Sulphuric acid

PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE AND APPEARANCE: ODOR:	Liquid.(Thick oily liquid.)Odorless, but has a choking odor when hot.
TASTE:	Marked acid
COLOR:	taste.(Strong.)Colorless.
BOILING POINT:	270°C (518°F) - 340 deg. C
MELTING POINT:	Decomposes at 340 deg. C - 35°C (-31°F) to 10.36 deg. C (93% to 100% purity)
SOLUBILITY:	Easily soluble in cold water. Sulphuric is soluble in water with liberation of much heat. Soluble in ethyl alcohol.
FLAMMABILITY OF THE PRODUCT:	Non-flammable.
STABILITY:	The product is stable.

Corrosivity:

Extremely corrosive in presence of aluminum, of copper, of stainless steel. Highly corrosive in presence of stainless steel(304). Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Hygroscopic.Strong oxidizer. Reacts violently with water and alcohol especially when water is added to the product Incompatible (can react explosively or dangerously) with the following: ACETIC ACID, ACRYLIC ACID, AMMONIUM HYDROXIDE, CRESOL, CUMENE, DICHLOROETHYL ETHER, ETHYLENE CYANOHYDRIN, ETHYLENEIMINE, NITRIC ACID, 2-NITROPROPANE, PROPYLENE OXIDE, SULFOLANE, VINYLIDENE CHLORIDE, DIETHYLENE GLYCOL MONOMETHYL ETHER, ETHYL ACETATE, ETHYLENE CYANOHYDRIN, ETHYLENE GLYCOL MONOETHYL ETHERACETATE, GLYOXAL, METHYL ETHYL KETONE.

HEALTH EFFECTS:

Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, of inhalation. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

FIRST AID MEASURES

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Fire Hazards in Presence of Various Substances: Combustible materials

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of oxidizing materials.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Metal acetylides (Monocesium and Monorubidium), and carbides ignite with concentrated sulphuric acid. White Phosphorous +boiling Sulphuric acid or its vapor ignites on contact. May ignite other combustible materials. May cause fire when sulphuric acid is mixed with Cyclopentadiene, cyclopentanone oxime, nitroaryl amines, hexalithiumdisilicide, phosphorous (III) oxide, and oxidizing agents such as chlorates, halogens, permanganates.

ACCIDENTAL RELEASE MEASURES**Small Spill:**

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If

necessary: Neutralize the residue with a dilute solution of sodium carbonate.

HANDLING AND STORAGE**Precautions:**

Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/vapor/spray. Never add water to this product In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage:

Hygroscopic. Reacts violently with water. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 23°C (73.4°F).

PERSONAL PROTECTION**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Mercuric sulfate

PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE AND APPEARANCE:	Solid.
BOILING POINT:	Not available.
SOLUBILITY:	Not available.
STABILITY:	The product is stable.
CORROSIVITY:	Non-corrosive in presence of glass
Flammability of the Product:	Non-flammable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

CARCINOGENIC EFFECTS: Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, lungs, the nervous system, mucous membranes.

Health Effects:

Extremely hazardous in case of ingestion. Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator). Severe over-exposure can result in death.

FIRST AID MEASURES

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention.

Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waist band. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

PERSONAL PROTECTION**Engineering Controls:**

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

ACCIDENTAL RELEASE MEASURES

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

HANDLING AND STORAGE**Precautions:**

Keep locked up. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes.

Storage:

Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Sodium carbonate**PHYSICAL AND CHEMICAL PROPERTIES**

PHYSICAL STATE AND APPEARANCE:	Solid. (Solid powder.)
ODOR:	Odorless.

TASTE: Alkaline.
BOILING POINT: Not available.
MELTING POINT: 851°C (1563.8°F)
SOLUBILITY: Soluble in hot water, glycerol.
Partially soluble in cold water.
Insoluble in acetone, alcohol.

Flammability of the Product: Non-flammable.
Fire Hazards in Presence of Various Substances: Not applicable

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Sodium carbonate can ignite and burn fiercely in contact with fluoride. Sodium Carbonate in contact with fluorine decomposed at ordinary temperature with incandescence.

Special Remarks on Explosion Hazards:

Reacts explosively with red-hot aluminum metal. Sodium carbonate + ammonia in arabic gum solution will explode.

HEALTH EFFECTS

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation (lung irritant).

FIRST AID MEASURES

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

DO NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

ACCIDENTAL RELEASE MEASURES

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

PERSONAL PROTECTION**Engineering Controls:**

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Stability: The product is stable.

Special Remarks on Reactivity: Hygroscopic. Combines with water with evolution of heat.

Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation (lung irritant).

HANDLING AND STORAGE**Precautions:**

Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as acids.

Storage:

Hygroscopic. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 24°C (75.2°F). Hygroscopic

Cobalt Octoate**PHYSICAL AND CHEMICAL PROPERTIES**

APPEARANCE:	Purple color
PHYSICAL STATE :	Liquid 313-390°F for Mineral Spirits
Explosion Limits in Air-Lower (%)	0.7 for mineral spirits
Explosion Limits in Air-Upper (%)	8.9 for mineral spirits

Auto-ignition Temp (° F)

445 for mineral spirits

TOXICOLOGICAL INFORMATION

There is no specific data for this product

HAZARDS IDENTIFICATION

Combustible liquid. Keep away from heat and all sources of ignition. May cause sensitization by skin contact which may produce allergic contact dermatitis. May cause sensitization by inhalation which may produce occupational asthma. May cause eye, skin and respiratory tract irritation. May be harmful if inhaled or swallowed. Aspiration hazard if swallowed. Can enter lungs and cause damage.

HEALTH EFFECTS

Inhalation: Although no data exists for this product, Cobalt metal powder is known allergen that produces characteristic symptoms of asthma, such as wheezing, dry cough, and labored breathing. Usually the asthma symptoms appear 4-6 hours after exposure and often worsen again later in the same day.

Ingestion: May cause headache, dizziness, nausea, and vomiting, gastrointestinal irritation and central nervous system depression. Swallowing small amounts during handling is not likely to cause harmful effects; swallowing large amounts may be harmful. Symptoms may include gastrointestinal irritation (nausea, vomiting, diarrhea), central nervous system depression (dizziness, drowsiness, weakness, fatigue, nausea, headache, unconsciousness). This material can enter the lungs during swallowing or vomiting and cause lung inflammation and/or damage. Small amounts of this product aspirated into the respiratory system during ingestion or vomiting may cause mild to severe pulmonary injury, possibly progressing to death.

Skin Contact: Based on data for Cobalt metal powder, may cause allergic contact dermatitis if there is prior sensitization. Most rashes associated with cobalt occur on the hands and appear within the first year of occupational exposure to cobalt. Exposure may cause skin irritation. Prolonged or repeated exposure may dry the skin. Symptoms may include redness, burning, drying and cracking, and skin damage. Pre-existing skin disorders may be aggravated by exposure to this material. May cause skin defatting with prolonged exposure.

Eye Contact: May cause eye irritation.

FIRST AID MEASURES

Inhalation: Move the exposed person to fresh air at once. If indicated, a qualified pre-hospital medical provider (such as a first responder or EMT) may give oxygen. Contact a physician.

Ingestion: Aspiration hazard. Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. If the victim is drowsy or unconscious, place on left side with head down. If possible, do not leave victim unattended. Seek immediate medical attention.

Skin Contact: Wash thoroughly with soap and plenty of clean water. If irritation occurs, contact a physician.

Eye Contact: Flush immediately with large amounts of water and continue flushing for 15 minutes or until irritation subsides, whichever is longer.

FIRE FIGHTING MEASURES

Fire: Flash point (°F): 100, minimum

Explosion: Explosion Limits in Air-Lower (%) 0.7 for mineral spirits

Explosion Limits in Air-Upper (%) 8.9 for mineral spirits **Auto-ignition Temp (° F)** 445 for mineral spirits

Fire Extinguishing Media: Dry chemical, carbon dioxide, Halon, or foam. Waterspray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters. Halon may decompose into toxic materials. Carbon dioxide can displace oxygen. Use caution when applying Halon or carbon dioxide in confined spaces. Avoid spraying water directly into storage containers due to danger of boil-over.

Special Information: During fire, a water spray can scatter flames and should be used by experienced fire-fighters. Fire-fighters should wear self-contained breathing apparatus with a full face piece operated in the positive pressure demand mode when fighting fires. In addition, wear appropriate protective equipment as conditions warrant. Isolate damage area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Move undamaged containers from danger area if it can be done with minimal risk. Water spray may be useful in minimizing or dispersing vapors. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

ACCIDENTAL RELEASE MEASURES

Eliminate all ignition sources. Spilled material may be absorbed into an appropriate absorbent material. Prevent spilled material from entering sewers, storm drains, other authorized treatment drainage systems, and natural waterways. Stop spill/release if it can be done with minimal risk. Stay upwind and away from spill/release. Isolate danger and keep unauthorized personnel out. Use non-sparking tools and explosion-proof equipment. Recover by pumping (use an explosion-proof or hand pump) or with a suitable absorbent. Consult an expert on disposal of recovered material and ensure conformity to local disposal regulations.

HANDLING AND STORAGE

Cobalt carboxylates may cause the ignition of rags or paper goods or other oxidizable materials. Keep container closed. Handle and open containers with care. Open container slowly to relieve any pressure.

Storage:

Keep container(s) tightly closed. Use and store this material in a cool, dry, well-ventilated area away from heat, direct sunlight, hot metal surfaces, and all sources

of ignition. Post "NO SMOKING OR OPEN FLAME." Store only in approved containers. Keep away from any incompatible material. Protect container(s) against physical damage.

PERSONAL PROTECTION

Ventilation System: Provide sufficient mechanical (general and/or local exhaust)ventilation to maintain exposure below TLV(S).

Personal Respirators: When exposures are not adequately controlled, userespirator approved for protection from organic vapors. If workplace exposure limit(s) of product or any component is exceeded, a NIOSH approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH respirators (negative pressure type) under specified conditions (See your industrial hygienist). Engineering or administrative controls should be implemented to reduce exposure.

Skin Protection: Appropriate disposable gloves are acceptable. Resistant glovessuch as Nitrile rubber can be worn. Consult your safety equipment supplier.

Eye Protection: Wear safety glasses or goggles to protect against exposure.Chemical splash goggles in compliance with OSHA regulations are advised; however, OSHA regulations also permit other types of safety glasses. Consult your safety representative.

Other Protective Equipment:

Eye wash and quick-drench shower facilities. Impervious clothing and boots are recommended. Thoroughly clean shoes and wash contaminated clothing before reuse.

Benzoyl peroxide

PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE AND APPEARANCE:

Solid.

Decomposition temperature

BOILING POINT:

103°C (217.4°F)

MELTING POINT:

104.5°C (220.1°F)

SOLUBILITY:

Very slightly soluble in cold water.

Incompatibility with various substances:

Highly reactive with acids, alkalis. Reactive with combustible materials, metals. The product may undergo hazardous decomposition, condensation or polymerization, it may react violently with water to emit toxic gases or it may become self reactive under conditions of shock or increase in temperature or pressure.

Special Remarks on Reactivity: Not available.

Toxic Effects on Humans:

Extremely hazardous in case of ingestion.Very hazardous in case of skin contact (irritant) or inhalation.

Special Remarks on other Toxic Effects on Humans: Not available.

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 80°C (176°F)

Fire Hazards in Presence of Various Substances: Flammable in presence of combustible materials.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of heat. Slightly explosive in presence of shocks, of combustible materials

Health Effects:

Extremely hazardous in case of ingestion. Very hazardous in case of skin contact (irritant), of eye contact (irritant), inhalation. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Personal Protection

Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves (impervious).

FIRST AID MEASURES

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

FIRE FIGHTING MEDIA AND INSTRUCTIONS:

Oxidizing material. Do not use water jet. Use flooding quantities of water. Avoid contact with organic materials.

Special Remarks on Fire Hazards: Not available. **Special**

Remarks on Explosion Hazards: Not available.

HANDLING AND STORAGE

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Keep away from direct sunlight or strong incandescent light. Empty containers pose a fire risk; evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid shock and friction. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as combustible materials, metals, acids, alkalis.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Do not store above 40°C (104°F).

Ammonia Solution

PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE :	A clear colourless liquid
COLOUR :	<5 Hazen Units
ODOUR :	Pungent
BOILING POINT :	23 ^o C @ 33.5% (w/w), 40oC @ 25% w/w)
FLAMMABLE LIMITS :	16% to 27% (v/v)
SOLUBILITY IN WATER :	Miscible
STABILITY:	Ammonia solution is stable under normal conditions of storage, handling and use. Hazardous Reactions and Can react violently if in contact with acids, halogens, hypochlorite or mercury

HEALTH HAZARDS

Eye Contact: Corrosive. Causes severe burns to all parts of the body

Inhalation Ammonia vapor is toxic by inhalation

FIRST AID

IN ALL CASES OF CONTAMINATION OBTAIN IMMEDIATE MEDICAL ATTENTION

Skin contact.

Drench with large quantities of water whilst removing contaminated clothing. Continue to wash the affected area until medical attention arrives.

Eye contact.

Immediately irrigate with eyewash solution or clean water. Obtain assistance to hold eyelids apart. Continue irrigation until medical attention arrives.

Ingestion.

Do not induce vomiting. Wash out mouth with water and give 200-300ml (half a pint) of water to drink.

Inhalation.

Remove patient from source of exposure wearing breathing protection as appropriate to the prevailing conditions. Keep warm and at rest in fresh air. Apply artificial resuscitation if breathing has ceased or shows of failing.

Handling

Avoid contact with skin and eyes. Provide adequate ventilation and use only in well ventilated areas. Atmospheric levels should be controlled in compliance with the Workplace Exposure Limit, (WEL). Eye wash equipment must be provided at handling points.

Basic personal protective equipment, (PPE), includes PVC or rubber gloves, chemical goggles, Wellingtons or rubber boots and PVC overalls or apron. Individuals should make a judgement as to whether equivalent items are suitable for avoiding contact. Respiratory protection should be worn where there is a risk of breathing vapors.

Storage Keep storage equipment properly closed and vented to a safe location. Keep away from all heat and ignition sources of ignition. Provide adequate containment, either by means of a bund or a „double-skinned“ storage tank.

Suitable containers can be manufactured from a range of materials including mild steel, stainless steel, polyethylene and polypropylene. Containers made from, or containing copper, copper alloy, zinc or zinc alloy are unsuitable.

Sodium Sulfate Anhydrous

PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE AND APPEARANCE:	Solid.(Crystals solid.Crystalline powder.Granular solid.Powdered solid.)
BOILING POINT:	1100°C (2012°F)
MELTING POINT:	888°C (1630.4°F)
SPECIFIC GRAVITY:	2.671 (Water = 1)
SOLUBILITY:	Soluble in cold water, hydrogen iodide, and glycerol.. Insoluble in alcohol

Flammability of the Product: Non-flammable.

Health Hazards:

Hazardous in case of eye contact (irritant). Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

FIRST AID**Eye Contact:**

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:

Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. get medical attention if symptoms appear.

FIRE AND EXPLOSION DATA

Auto-Ignition Temperature:	Not applicable
Flash Points:	Not applicable
Flammable Limits:	Not applicable
Products of Combustion:	Not available
Fire Hazards in Presence of Various Substances:	Not applicable

Explosion Hazards in Presence of Various Substances:	Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Not applicable.
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Fire Fighting Media and**Instructions:**

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards

: At a temperature of 800 C, sodium sulfate and aluminum will explode.

HANDLING AND STORAGE**Precautions:**

Do not ingest. Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Hygroscopic

PERSONAL PROTECTION

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Exposure Limits: Not available.

Methyl alcohol

PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE AND APPEARANCE:	Liquid.
ODOR: Alcohol like.	Pungent when crude.
BOILING POINT:	64.5°C (148.1°F) -
MELTING POINT:	97.8°C (-144°F)
SPECIFIC GRAVITY:	0.7915 (Water = 1)
SOLUBILITY:	Easily soluble in cold water, hot water

Potential Acute Health Effects: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator). Severe over-exposure can result in death.

FIRST AID

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

FIRE AND EXPLOSION DATA

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 464°C (867.2°F)

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam water spray or fog.

Special Remarks on Fire Hazards:

Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition, it emits acrid smoke and irritating fumes. CAUTION: MAY BURN WITH NEAR INVISIBLE FLAME

Special Remarks on Explosion Hazards:

Forms an explosive mixture with air due to its low flash point. Explosive when mixed with Chloroform + sodium methoxide and diethyl zinc. It boils violently and explodes.

HANDLING AND STORAGE

Precautions: Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, metals, acids.

Storage: Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

PERSONAL PROTECTION:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Benzene

PHYSICAL AND CHEMICAL PROPERTIES Physical

state and appearance: Liquid

Boiling Point:	80.1 (176.2°F)
Melting Point:	5.5°C (41.9°F)
Solubility:	Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone. Very slightly soluble in cold water.
Health Effects:	Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

FIRST AID

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion: DO NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

FIRE AND EXPLOSION DATA

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials. Non-flammable in presence of shocks.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

ACCIDENTAL RELEASE MEASURES

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill: Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas. Be careful that the product is not present at a concentration level above TLV.

HANDLING AND STORAGE

Precautions: Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage: Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

PERSONAL PROTECTION

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill: Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product.

Acetone

PHYSICAL AND CHEMICAL PROPERTIES

Physical state and appearance:	Liquid
Boiling Point:	56.2°C (133.2°F)
Melting Point:	-95.35 (-139.6°F)
Critical Temperature:	235°C (455°F)
Solubility:	Easily soluble in cold water, hot water.

Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

FIRST AID

Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

FIRE AND EXPLOSION DATA

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 465°C (869°F)

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances: Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

Fire Fighting Media and Instructions: Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

ACCIDENTAL RELEASE MEASURES

Small Spill: Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

HANDLING AND STORAGE

Precautions: Keep locked up. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

Storage: Store in a segregated and approved area (flammables area) . Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

PERSONAL PROTECTION:

Splash goggles, Lab-coat, Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Turpentine

PHYSICAL AND CHEMICAL PROPERTIES

Physical state and appearance:	Liquid.
Boiling Point:	165°C (329°F)
Melting Point:	-55°C (-67°F)
Solubility:	Very slightly soluble in methanol, diethyl ether, n-octanol. Insoluble in cold water, hot water.
Health Effects:	Very hazardous in case of ingestion. Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator).

FIRST AID

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

FIRE AND EXPLOSION DATA

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 253°C (487.4°F)

Fire Hazards in Presence of Various Substances: Flammable in presence of oxidizing materials.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of oxidizing materials.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water. **SMALL FIRE:** Use DRY chemical powder. **LARGE FIRE:** Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, auto-ignition or explosion.

ACCIDENTAL RELEASE MEASURES

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill: Toxic flammable liquid, insoluble or very slightly soluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal.

HANDLING AND STORAGE

Precautions: Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage: Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

PERSONAL PROTECTION:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill: Splash goggles. Full suit. Vaporrespirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Methyl methacrylate

PHYSICAL AND CHEMICAL PROPERTIES

Physical state and appearance:	Liquid.
Boiling Point:	100°C (212°F)
Melting Point:	-48°C (-54.4°F)
Solubility:	Partially soluble in cold water.
Stability and Reactivity Data:	
Stability:	The product is stable.
Instability Temperature:	Not available.
Conditions of Instability:	Not available.
Incompatibility with various substances:	Reactive with metals, acids, alkalis
Corrosivity:	Non-corrosive in presence of glass.
Special Remarks on Reactivity:	Not available.
Special Remarks on Corrosivity:	Not available.
Polymerization:	Yes

Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

FIRST AID

Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact: After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cold water may be used. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

FIRE AND EXPLOSION DATA

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 421°C (789.8°F)

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks.

Explosion Hazards in Presence of Various Substances: Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of heat.

Fire Fighting Media and Instructions: Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

ACCIDENTAL RELEASE MEASURES

Small Spill: Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill: Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources.

HANDLING AND STORAGE

Precautions: Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as metals, acids, alkalis.

Storage: Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

PERSONAL PROTECTION:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill: Splash goggles. Full suit. Vaporrespirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Methyl Ethyl Ketone Peroxide (MEKP)

PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR:	Water white liquid with a slight odor.
BOILING POINT:	Unknown
SOLUBILITY IN WATER:	Slightly soluble in water.

STABILITY AND REACTIVITY

Stability: Stable when kept in original, closed container, out of direct sunlight attemperatures below 80°F (27°C).

Conditions to avoid: Contamination. Direct sunlight. Open flames. Prolonged storage above 100°F (38°C). Storage above SADT. Storage near flammable or combustible materials.

Materials to avoid: Dimethylaniline, cobalt napthenate and other promoters, promoted resins, accelerators, oxidizing and reducing agents, strong acids, bases, metals, metal alloys and salts, sulphur compounds, amines or any hot material.

FIRE-FIGHTING MEASURES

Flash point >200°F (93°C) C.O.C

Flammable limits: Unknown

Auto-ignition: POINT Unknown

Extinguishing media: Water from a safe distance—preferably with a fog nozzle. In case of very small fires, other means such as carbon dioxide, foam or dry chemical extinguishers may be effective. Dry chemical combined with MEKP formulations may re-ignite. Light water additives may be particularly effective at extinguishing MEKP fires

HEALTH HAZARDS

Skin contact: Severe skin irritant causes redness, blistering, and edema. **Eye Contact:** Eye contact causes severe corrosion and may cause blindness.

Ingestion: Human systemic effects by ingestion: changes in structure or function of esophagus, nausea, or vomiting, and other gastrointestinal effects.

Inhalation: Moderately toxic by inhalation.

EFFECTS OF OVEREXPOSURE

Prolonged inhalation of vapors may cause mucous membrane irritation and vertigo.

FIRST AID

Skin: Immediately remove any contaminated clothing. Wash contaminated area thoroughly with soap and copious amounts of water for at least 15 minutes. If irritation or adverse symptoms develop seek medical attention.

Eyes: Remove any contact lenses at once. Flush eyes with water for at least 15 minutes. Ensure adequate flushing by separating the eyelids with fingers. If irritation or adverse symptoms develop seek medical attention.

Ingestion: Do Not induce vomiting. Drink plenty of water. Immediately call a physician. For aid to physician, suggest local Poison Control Center.

Inhalation: Remove to fresh air, if coughing, breathing becomes labored, irritation develops or other symptoms develop, seek medical attention at once, even if symptoms develop.

ACCIDENTAL RELEASE MEASURES

Steps to be taken in event of spill: Dike spill to prevent runoff from entering drains, sewers, streams, etc. Wet spilled material with water and absorb with an inert absorbent material such as perlite, vermiculite, or sand. Sweep up using non-sparking tools and place in a clean polyethylene drum or a polyethylene pail. DO NOT place into a steel container, lined or unlined, as a decomposition may occur. Treat any contaminated cardboard packaging as hazardous waste. Wet container contents with additional water prior to sealing.

HANDLING AND STORAGE

HANDLING

Rotate stock using the oldest material first. Avoid contact with skin, eyes and clothing. Keep containers closed to prevent contamination. Keep away from sources of heat, sparks or flame. Do not add to hot solvents or monomers as a violent decomposition and/or reaction may result. When using spray equipment, never spray raw MEKP onto curing or into raw resin or flues. Keep MEKP in its original container. DO NOT USE NEAR FOOD OR DRINK. Wash thoroughly after handling.

STORAGE

The stability of MEKP formulations is directly related to the shipping and storage temperature history. Cool storage at 80°F or below is recommended for longer shelf life and stability. Prolonged storage at elevated temperatures of 100°F and

higher will cause product degradation, gassing and potential container rupture which can result in a fire and/or explosion. Store out of direct sunlight in a well ventilated area away from combustible and incompatible materials.

PERSONAL PROTECTION

Respiratory protection If airborne concentrations are expected to exceed acceptable levels wears an approved air-purifying respirator with an organic vapor cartridge or canister

eye protection Safety goggles recommended. Permanent eyewash is highly recommended.

Hand protection Protective gloves recommended, solvent resistant, such as butyl rubber, nitrile or neoprene.

Polyvinyl alcohol

PHYSICAL AND CHEMICAL PROPERTIES

Physical state and appearance: Solid. (Powdered solid. Amorphous solid powder.)

Boiling Point: Not available.

Melting Point: Decomposition @ Softens at about 200°C with decomposition. 228 deg. C.

Solubility: Soluble in cold water, hot water. Insoluble in diethyl ether, acetone, petroleum solvents, aromatic hydrocarbons, esters. Practically insoluble in animal and vegetable oils and chlorinated hydrocarbons.

Reactivity: Incompatible with oxidizing agents (perchlorates, nitrates, etc.), reactive metals (sodium, calcium, zinc. etc.), sodium or calcium hypochlorite, materials reactive with hydroxyl compounds. Reaction with peroxides may result in violent decomposition of peroxide possibly creating and explosion.

Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

FIRST AID

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used. **Serious Skin Contact:** Not available.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. **Serious Inhalation:** Not available.

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

FIRE AND EXPLOSION DATA

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances: Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks.

Fire Fighting Media and Instructions: SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

ACCIDENTAL RELEASE MEASURES

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill: Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow evacuating through the sanitary system.

HANDLING AND STORAGE

Precautions: Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk; evaporate the residue under a fume hood. est. Do not breathe dust. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

PERSONAL PROTECTION

Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill: Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Glycerin

PHYSICAL AND CHEMICAL PROPERTIES

Physical state and appearance:	Liquid. (Viscous (Syrupy) liquid.)
Boiling Point:	290°C (554°F)
Melting Point:	19°C (66.2°F)

Solubility: Miscible in cold water, hot water and alcohol. Partially soluble in acetone. Very slightly soluble in diethyl ether (ethyl ether). Limited solubility in ethyl acetate. Insoluble in carbon tetrachloride, benzene, chloroform, petroleum ethers, and oils

Incompatibility with various substances: Highly reactive with oxidizing agents.

Special Remarks on Reactivity: Hygroscopic. Glycerin is incompatible with strong oxidizers such as chromium trioxide, potassium chlorate, or potassium permanganate. Glycerin may react violently with acetic anhydride, aniline and nitrobenzene, chromic oxide, lead oxide and fluorine, phosphorous triiodide, ethylene oxide and heat, silver perchlorate, sodium peroxide, sodium hydride.

Health Effects: Slightly hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

FIRST AID MEASURES

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used. **Serious Skin Contact:** Not available.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation: Not available.

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

FIRE AND EXPLOSION DATA

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 370°

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances: Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in the presence of oxidizing materials.

Fire Fighting Media and Instructions: SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

ACCIDENTAL RELEASE MEASURES

Small Spill: Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading

water on the contaminated surface and dispose of according to local and regional authority requirements.

HANDLING AND STORAGE

Precautions: Keep away from heat. Keep away from sources of ignition. Groundall equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Hygroscopic

PERSONAL PROTECTION

Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Formaldehyde

PHYSICAL AND CHEMICAL PROPERTIES

Physical state and appearance:	Liquid.
Boiling Point:	98°C (208.4°F)
Melting Point:	-15°C (5°F)
Solubility:	Easily soluble in cold water, hot water. Soluble in diethyl ether, acetone, alcohol
Stability:	The product is stable.
Instability Temperature:	Not available. Heat, ignition sources (flames, sparks), incompatible materials
Conditions of Instability:	
Incompatibility with various substances:	Reactive with oxidizing agents, reducing agents, acids, alkalis. Slightly reactive to reactive with metals.

FIRE AND EXPLOSION DATA

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 430°C (806°F)

Fire Hazards in Presence of Various Substances:

Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks, of oxidizing materials, of reducing materials, of combustible materials, of organic materials, of metals, of acids, of alkalis.

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, auto-ignition or explosion.

HEALTH EFFECTS:

Very hazardous in case of eye contact (irritant), of ingestion, .Hazardous in case of skin contact (irritant, sensitizer, permeator), of eye contact (corrosive).Slightly hazardous in case of skin contact (corrosive). Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching.

FIRST AID MEASURES

Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention immediately.

Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

ACCIDENTAL RELEASE MEASURES

Small Spill: Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill: Flammable liquid. Poisonous liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate

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