

Fluid Mechanics Laboratory Safety Plan

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1. Introduction to Laboratory Safety

Laboratory settings are essential for research and education, but because of the inherent dangers of chemicals, biological agents, machinery, and other elements, they can be extremely dangerous. This handbook's objective is to provide an overview of the safety procedures required to safeguard everyone in the laboratory. By reducing hazards and averting mishaps, these protocols guarantee a secure and effective atmosphere for students, employees, and guests.

2. General Laboratory Safety Rules

- **Personal Protective Equipment (PPE):**
 - Lab coats, gloves, and safety goggles must be worn at all times.
 - Specific PPE (e.g., face shields, respirators) must be used depending on the hazards present (e.g., working with corrosive materials, biological substances, or volatile chemicals).
 - Always inspect PPE before use for damage or contamination.
- **No Eating or Drinking:**
 - No food or beverages are allowed in the laboratory. This reduces the risk of chemical ingestion or contamination.
 - Ensure that hands are thoroughly washed before leaving the laboratory.
- **Work Area Organization:**
 - Keep workspaces clean and uncluttered to reduce the risk of spills, accidents, and contamination.
 - Avoid leaving hazardous materials unattended.
- **Access to the Laboratory:**
 - Access to restricted areas (e.g., chemical storage rooms, biohazard labs) should only be granted to authorized personnel who have received appropriate safety training.

- **Chemical Hygiene:**

- Always check the labels on containers to verify their contents.
- Use fume hoods and ventilated spaces when handling volatile or toxic substances.

- **Equipment Handling and Training:**




- Proper training is required before operating any equipment.
- Only use equipment for its intended purpose. Ensure all equipment is in good working condition and properly calibrated.





- **Waste Disposal:**

- Dispose of hazardous materials according to specific guidelines (chemical, biological, radioactive, or general waste).
- Label waste containers clearly with contents and hazard class.




3. Laboratory Safety Symbols, Signs, and Meanings








Understanding the various symbols and signs used in the laboratory is crucial for personal safety. Each symbol represents specific hazards that can be dangerous to health.

| Name of the symbol | Symbols | Meaning |
|--------------------|--|--|
| General Warning |  General Warning | Presence of possibly hazardous materials/environment |
| Health Hazard |  Health Hazard | Presence of chemical, physical, or biological factors with the potential to have a negative effect on our health |
| High Voltage |  High Voltage | Supply of high-voltage electricity |







| Name of the symbol | Symbols | Meaning |
|--------------------|--|--|
| Electric Hazard |  | Risk of getting electric shock. (The device might give mild to severe electric shock.) |
| Flammable Material |  | Presence of combustible materials (a substance that can easily burn) |
| Explosive Material |  | Presence of explosive and/or self-reactive substances |
| Hot Surface |  | Risk of burning if you touch with naked hands |

Entry/Working requirement symbols in the lab

| Name of the symbol | Symbols | Meaning |
|-------------------------|---|--|
| Gloves Required |  | Must use protective gloves in this area/while working in this area |
| Safety Glasses Required |  | Must use protective/safety goggles in this area/while working in this area |
| Safety Shoes Required |  | Must use closed-toe shoes in this area/while working |

| Name of the symbol | Symbols | Meaning |
|------------------------------|--|---|
| Lab Coat Required |  Lab Coat Required | Must wear lab coat (apron) while in this area |
| Protective Clothing Required |  Protective Clothing Required | Must wear full protective clothing |
| Respirator Required |  Respirator Required | Must wear a breathing mask/respirator; the presence of contaminated air |
| Face/Safety Mask Required |  Face Mask Required | Must wear face/dust/safety masks |
| Face Shield Required |  Face Shield Required | Must wear face shield while working |
| Hair Protection Required |  Hair Protection Required | Must wear hair protection before working |
| Hearing Protection Required |  Hearing Protection Required | Must wear a hearing protection device while working |

Location symbols of a specific object in the lab

| Name of the symbol | Symbols | Meaning |
|--------------------|--|--|
| Fire Extinguisher |  Fire Extinguisher | The location where the fire extinguisher is placed |
| First Aid |  First Aid | The place with the first aid box and materials |
| Drinking Water |  Drinking Water | Indicates safe water for drinking |
| Fire Blanket |  Fire Blanket | The location where the fire blanket is placed |
| Fire Hose |  Fire Hose | The location where the hose with water or any fire retardant is placed |
| Emergency Bell |  Emergency Bell | Bell to be pressed during an emergency like fire or accident. |

6. Emergency Procedures

Lab safety relies on preparedness. In case of an emergency, knowing what to do can save lives.

- **General Emergency Response:**

- **Remain Calm:** Try to keep a clear mind and follow emergency procedures.
- **Alert Others:** Call for help and alert everyone in the lab of the emergency.
Activate the nearest emergency alarm if necessary.
- **Evacuation:** Follow evacuation protocols as per the building's emergency plan.
Do not use elevators during a fire emergency.

- **Fire Safety:**

- **Fire Prevention:** Regularly inspect lab equipment and wiring to prevent electrical fires. Ensure that combustible materials are stored properly.
- **Evacuation Plans:** Familiarize yourself with escape routes and emergency exits.
Conduct regular fire drills to practice evacuation procedures.
- **Fire Extinguisher Types:** Know the difference between extinguishers (e.g., water, CO₂, foam) and which ones are suitable for different types of fires (A, B, C, D, K).
 - A fire extinguisher is a "first aid" tool (It's not meant for controlling large fires).
 - Suitable only for small, contained fires (Do not attempt to fight a large fire).
 - Limited duration: Depending on size, it sprays for 10 to 30 seconds.
 - Limited range: Typically, 5 to 10 feet, depending on the type and size.
 - Fire in front, exit behind: Always position yourself between the fire and your exit route.
 - Have a backup extinguisher and an observer: Ensure you have someone watching with an extra extinguisher for support.
 - If you're unsure, evacuate! If you don't feel confident in handling the fire, don't attempt it.
 - How to use a portable fire extinguisher: Follow the "P.A.S.S." method to tackle the flames:
 - **P – Pull the Pin**

This unlocks the extinguisher, ensuring it's ready for use.

- **A – Aim at the Base of the Flames**

Direct the nozzle towards the fire's source, where it's most effective. Aiming at the flames themselves won't do the trick!

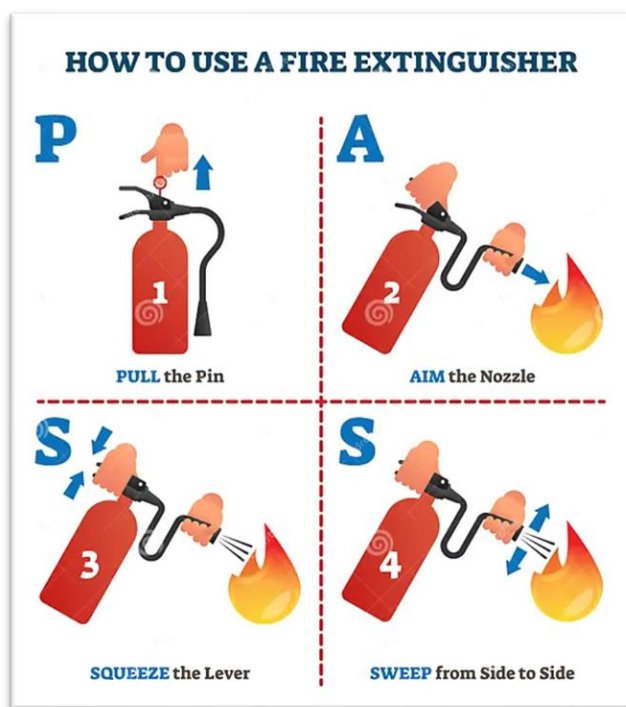
- **S – Squeeze the Trigger**

Gently press the trigger to release the extinguishing agent, all while keeping the extinguisher upright for optimal performance.

- **S – Sweep Side to Side**

Move the nozzle in a sweeping motion, covering the entire fire area. Continue until the fire is fully out, or you need to retreat for safety.

- By following these four easy steps, you can take control of small fires and prevent them from escalating. Always remember: safety comes first-if in doubt, evacuate and call for help!



- **Chemical Spill Response:**

- **Small Spills:** For minor chemical spills, use spill kits available in the lab. Contain the spill and neutralize or absorb with appropriate materials.

- **Large Spills:** Evacuate the area and contact the emergency response team immediately. Use the emergency eyewash and safety shower if necessary.
- **Explosion or Chemical Reaction:**
 - In case of an explosion, immediately evacuate and do not attempt to extinguish the fire unless trained to do so.
 - Isolate the area and inform emergency responders of the substances involved.
- **Medical Emergencies:**
 - **Cuts or Burns:** Clean the wound with water and apply bandages. For burns, apply cool water but avoid ice.
 - **Chemical Exposure:** For chemical splashes, rinse the affected area with water for 15 minutes and seek medical attention.
 - **Cardiopulmonary Resuscitation (CPR):** If someone stops breathing due to a shock or injury, call for medical help and begin CPR if you are trained to do so.

7. Earthquake Response Procedures

While laboratory accidents are common, natural disasters like earthquakes can pose unique challenges.

- **Before an Earthquake:**
 - Secure heavy equipment to prevent it from falling.
 - Know where your emergency supplies are located.
- **During an Earthquake:**
 - **Drop, Cover, and Hold On:** Drop to the ground, cover your head, and hold onto furniture until the shaking stops.
 - Move away from windows, shelves, and overhead equipment.
- **After an Earthquake:**
 - **Check for Injuries:** Assess yourself and others for injuries and provide first aid.
 - **Inspect the Lab:** Check for chemical spills, broken glass, and equipment malfunctions.
 - **Evacuate:** Follow the building's evacuation protocols and wait for further instructions from emergency personnel.

8. First Aid Procedures for Common Injuries

- **Eye Exposure to Hazardous Chemicals:**
 - Use the nearest eyewash station immediately. Flush eyes for at least 15 minutes, lifting the eyelids to ensure thorough rinsing.
 - Seek medical attention if irritation persists.
- **Cuts, Punctures, and Lacerations:**
 - Clean the wound with antiseptic, apply pressure to stop bleeding, and cover with a sterile dressing.
 - For severe injuries, seek immediate medical attention.
- **Electrical Shock:**
 - **Do not touch the person** if they are still in contact with the power source. Cut off the power if safe to do so.
 - Begin CPR if necessary and call for emergency medical assistance.

Safety in Laboratories for Fluid Mechanics Lab

Sessional Courses: ME 326, ME 422

The experiments of ME 326 as well as ME 422 are conducted in Fluid Mechanics Laboratory, on the ground floor of ME Building.

Fluid Mechanics and Machineries Laboratory

Location: ME Building, Ground Floor

Fluid Mechanics lab conducts experiments based on the fundamentals of fluid mechanics. Students of level-03, term-02 and level-04, term-01 are taught here.

Fluid Mechanics lab and Fluid Mechanics extension lab conduct courses and research in Aerodynamics, Fluid Dynamics and Fluid Machinery. It provides facilities for undergraduate teaching, final year projects and for research work leading to postgraduate degrees.

This lab consists of several experimental setups for verifying the basic laws of fluid mechanics and some flow measuring devices. It also has two wind tunnels. This tunnel together with its auxiliary equipment is ideal for studies of flow around objects, aero foils and model studies

of wind turbines. It may also be used to do basic studies on the structure of wake-flows and turbulent boundary layers.

This lab houses experimental setups of a Pelton wheel and a Kaplan turbine which facilitate the study and performance test of turbines. Experimental setups for several pumps also serve the same.

It also serves the needs of the industries through consultancy services. Examples of consultant services include testing of centrifugal pump, submersible pump, turbine pump, fan performance and so on. It houses a large pump testing rig to serve these purposes. The availability of these equipment and technical support accorded by the laboratory staff members greatly facilitates the research work and potential of the Fluid Mechanics Division.

Experiments conducted in this laboratory under ME 326: Fluid Mechanics Sessional and ME 422: Fluid Machinery Sessional:

1. Study of flow through a circular pipe.
2. Study of pipe friction.
3. Study of flow meters.
4. Study of minor losses.
5. Study of flow over a circular cylinder.
6. Study of dynamic pressure and velocity measurement by pitot tube.
7. Study and performance test of a Pelton wheel.
8. Identification of various parts of a hermetically sealed compressor.
9. Performance test of a centrifugal pump.
10. Study of centrifugal pumps in series and parallel connections.
11. Study and performance test of a submersible pump.
12. Dismantling and assembling of a centrifugal pump.
13. Study and performance test of a positive displacement pump.

Apparatus



Flow meters setup



Positive displacement pump setup



Flow through circular pipe setup

Apparatus




Flow over a circular cylinder setup



Compressor setup



Pipe friction measuring setup

| Apparatus | |
|---|---------------------------|
|  | <p>Pelton wheel setup</p> |

Safety Requirements

Some of the safety requirements while doing these experiments are enlisted but not limited to the followings:

1. Always wear shoes and Apron before entering lab.
2. Do not touch anything without the permission of instructor/lab assistant.
3. Read carefully the lab manual before performing experiments.
4. Check electrical connections before starting the equipment.
5. Do not put your hands while the machine is in operation.
6. Do not tamper measuring instruments.
7. Do not open the casing of the equipment.
8. Do not unplug any electrical connection.
9. Switch off the power supply to the experimental setup on completion of the experiment.
10. Do not leave the dye container on the working tables.
11. Use safety goggles wherever necessary.
12. Familiarize yourself with emergency shut-off procedures for main electric switches in case of accidents.
13. Have a first aid kit readily available and ensure personnel are trained in basic first aid.
14. Ensure all personnel are aware of fire exit routes and procedures in case of an emergency.

15. Keep fire extinguishers readily accessible and ensure personnel are trained in their use.

References

1. **U.S. Occupational Safety and Health Administration (OSHA):** *Laboratory Safety Standards.* <https://www.osha.gov>
2. **Centers for Disease Control and Prevention (CDC):** *Biosafety in Microbiological and Biomedical Laboratories.* <https://www.cdc.gov>
3. **National Fire Protection Association (NFPA):** *Fire Safety in Laboratories.* <https://www.nfpa.org>
4. **American Chemical Society (ACS):** *Guidelines for Chemical Safety.* <https://www.acs.org>
5. **American National Standards Institute (ANSI):** *Laboratory Safety Guidelines.* <https://www.ansi.org>
6. <https://microbenotes.com/laboratory-safety-symbols/>
7. <https://www.ou.edu/>
8. <https://www.dreamstime.com/>

Emergency Contact List

| Designation | Name | Phone No. |
|-----------------------------|-------------------|--|
| Head of the Department (ME) | Dr. Md. Afsar Ali | Office: 880-2-9665636 Mobile: 01552415088 |

| BUET telephone operator (PABX) | Phone No. | BUET Office |
|-----------------------------------|-----------|-------------|
| | 55167100 | 0 |

Medical Center:

| | |
|-----------------------|------------------|
| Emergency | 6666/01726698851 |
| Medical Centre office | 7798 |
| Reception | 2222 |

| Designation | Name | Phone No. | BUET Office |
|------------------------|-----------------------------|-------------|-------------|
| Chief Medical officer | Dr. Abu Hena Abid Zafr | 01309005333 | 7344 |
| Senior medical officer | Dr. Md. Hasib Iskandar | 01720960997 | 7817 |
| Senior medical officer | Dr. SK. Hasanul Banna | 01737392095 | 7823 |
| Medical officer | Dr. Josmina Akter Chowdhury | 01980090205 | 7729 |
| Medical officer | Dr. Rokeya Sultana Sumi | 01763494945 | 6863 |
| Medical officer | Dr. Sazzad Hossain Razib | 01710960241 | |

Fire service and civil defense:

| | |
|--------------------------------|-----|
| Fire Brigade Emergency/Enquiry | 199 |
|--------------------------------|-----|

| Place | Mobile | Phone |
|-------------|-------------|------------|
| Polashi | 01716354370 | 02-8628688 |
| Mirpur Road | 01730002229 | 02-9001055 |

| | | |
|-------------|-------------|------------|
| Mohammadpur | 01712970093 | 02-9112078 |
|-------------|-------------|------------|

Police & Security:

| Designation | Phone |
|----------------------|---------------------|
| Emergency Call | 999 |
| DMP Police Emergency | 01713398311/9551188 |
| DMP Control Room | 01817602050/9575500 |

University security & other

| Designation | BUET Office |
|--------------------------------|--------------------|
| Security Emergency Call | 7777 |
| Security officer | 7482 |
| Electricity & Plumbing | 7323 /01997902626 |
| Shaheed Minar Gate (Main Gate) | 7812 |
| West Palashi (Main Gate) | 6592 |
| Bakshi Bazar R/A Gate | 7825 |
| Dhakeswari R/A Gate | 7759 |
| Palashi R/A Gate | 7692 |
| Azad R/A Gate | 7760 |
| 71,72 No. Building Gate | 6330 |