Laboratory Safety Manual

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Institute of Advanced Study in Science and Technology (IASST)

(An Autonomous Institute under Department of Science and Technology, Govt. of India)

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Introduction:

Safety, security and health considerations are as important as any other materials taught in curriculum for science students. Working with chemicals, microbes, etc. poses continuous challenge to one's health and to the environment. Because each lab is different, and processes change routinely, each lab has the responsibility to maintain lab-specific safety information and documentation. The Principal Investigator is responsible for documenting lab-specific information. Lab-specific information must be reviewed and approved by the Principal Investigator when new processes are added, existing processes change significantly, or at least annually.

The purpose of this guide is to promote safety awareness and encourage safe working practices in the laboratory. These brief guidelines should serve as a reminder of things you can do to work more safely and are applicable to all users of the laboratory.

The requirements and recommendations of this 'Laboratory Safety manual' will not fully protect you unless you exercise diligence in your daily work, or at least stop periodically to assess your environment.

Step back and look carefully at your laboratory environment, looking at it as a first-time visitor and check:

Does it look safe, neat, and orderly?

Are chemicals stored properly?

Are you and other personnel taking appropriate precautions?

Can you see ways to make the lab safer?

Following certain discipline and working as a responsible human being, one can maintain a total hygiene working with chemicals. Below are few guidelines to ensure maximum safety of the IASST fraternity and its properties as well as of our society.

This guideline is designed following the standard guidelines followed by NCBS-TIFR, INSTEM, Bangalore, C-CAMP, Bangalore and ISSER Triputi.

Safety Googles

Labcoat

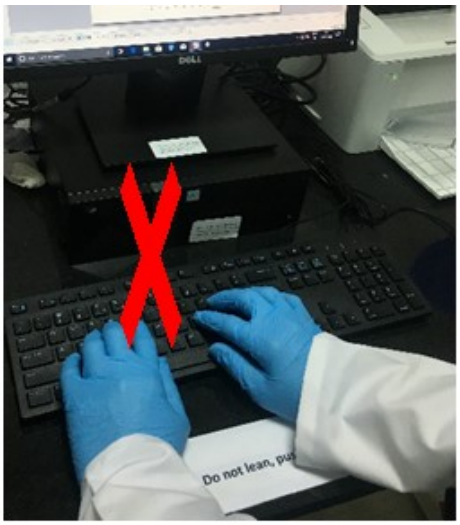
Gloves

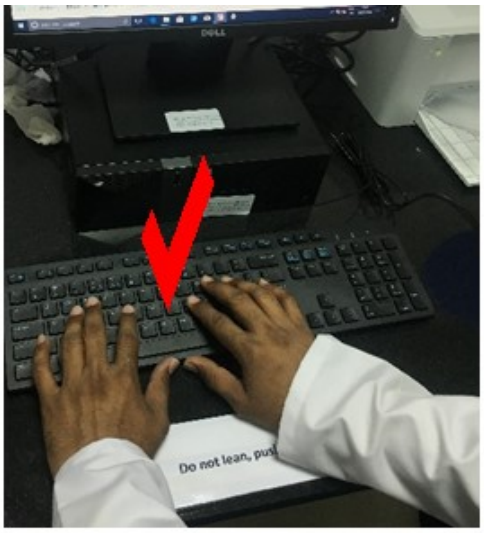
TABLE OF CONTENT

I. General Laboratory Protocols

Basic Rules

- Safety goggles are mandatory for all the lab workers
- Lab workers should not work alone inside the laboratory
- Everyone while working in the lab should wear lab coats and full pants.
- Lab-coats are not allowed in common areas like cafeteria, restrooms etc.
- Lab worker should be aware of the location and proper operation of laboratory safety equipment
- Know the exits in the laboratory and in the building
- Use of blast shields is strongly recommended while doing potential dangerous reactions (such as dealing with peroxides, diazo-compounds, high pressure vessels, distillation of high boiling substances).
- Gloves shall be worn while working in the lab and should be removed before touching surfaces outside the work area (i.e., doorknobs, computers etc).
- Feet should be covered completely with shoes containing reasonable heel heights.
- Open toe sandals and half pants/shorts should be avoided in the lab.

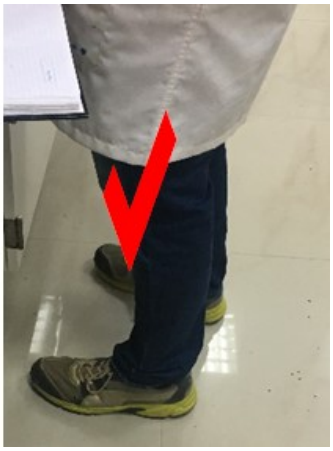




Good Personal Habits & Behavior

- Students should act in a professional manner at all times.
- Eating, drinking, gum and tobacco chewing, are not permitted in the laboratory.
- Using mobile phone is strictly prohibited inside the laboratory.
- Ice from the ice machines for laboratory use shall not be used for beverages, food or food storage.
- Do not smell or taste chemicals.
- Before handling any unknown chemicals/biological samples, students/researchers should consult respective PI/lab incharge.

- Skin contact with chemicals should be avoided.
- Hands should be washed thoroughly before leaving the lab.

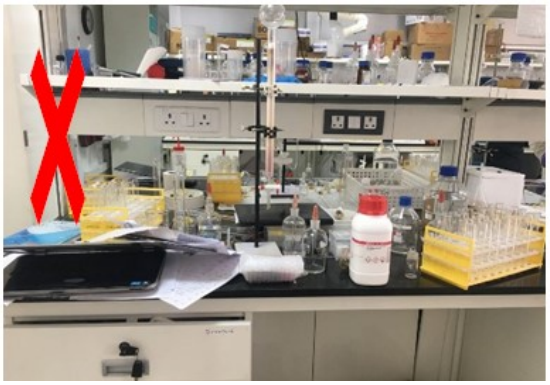


Housekeeping

- Lab areas are to be kept clean and uncluttered.
- Spills should be cleaned up immediately from work areas and floors.
- Equipment and instrumentation shall be cleaned to remove spillage and contamination before repair or calibration service is requested.
- Personnel must be able to see clearly through the protective glass sashes on fume hoods.
- Clear aisles, exits, and hallways for obstructions leading to slipping or tripping hazards (e.g., boxes, electrical cords or other items on the floor).
- Ensure unblocked access to all of the following:
    - Eyewash/safety showers
    - Electrical panels
    - Fire extinguishers
    - Chemical storage cabinets
    - Fume hoods
    - Waste containers

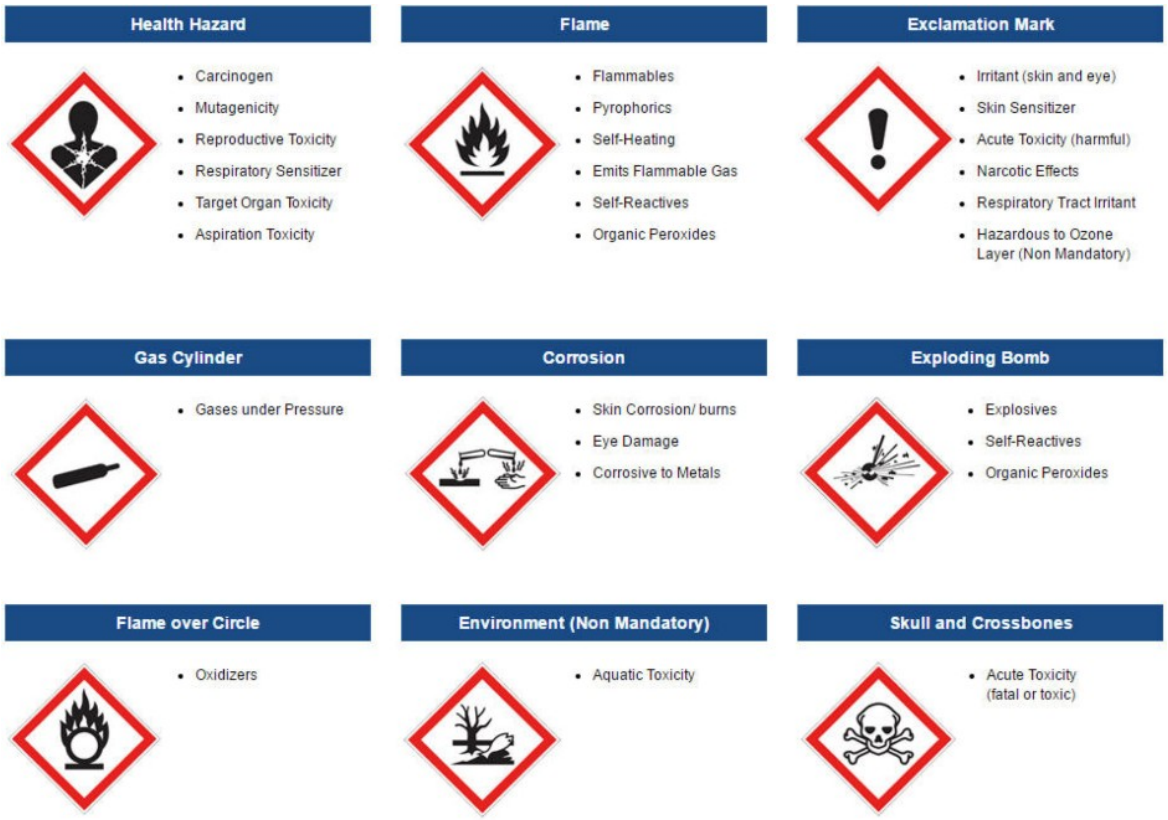
Possible ways to avoid clutters in Labs

- Laboratories that are cluttered present a variety of safety hazards to researchers, students, and visitors. Some common methods for controlling clutter in laboratories are as follows:
- Properly dispose of chemicals and equipment that are no longer needed
- Do not buy chemicals, solvents or other inventories in bulk unless there is space available to safely store the material.
- Before purchasing chemicals in bulks explore its availability in other concerned labs. Students should go through the lab inventory developed by each lab.
- Regularly schedule "lab clean-up days"
- Remove clutters from fume hoods, and ensure that they are not used for long- term storage of equipment, chemicals, or supplies that are not regularly used in the fume hood.
- Empty containers of unwanted materials (including trash) on a regular basis, and never allow them to overflow.
- Store excess materials in a neat, secure manner that provides easy access and reduces the potential for falling, collapsing, rolling, or spreading of the material.
- Limit overhead storage to lightweight, non-hazardous items.
- Chemical containers, supplies, and equipment are to be stored away from the edges of benches and shelves.
- Never stack chemical containers directly on top of one another (unless in original boxes that can be safely stacked) and/or with incompatible chemicals (such as acids with bases or flammables with oxidizers).
- Containers holding chemicals should not be stored on the floor. When this is unavoidable, store containers in plastic tubs or other secondary containment.
- Clearly mark bench areas containing radioactive materials with radiation tape and sorbent pads.
- Clean up all spills promptly. Never leave puddles, powders, or unknown materials on floors or work surfaces.
- Daisy-chaining of extension cords and/or power strips is not permitted. Store equipment, chemicals, glassware, and supplies not in regular use away from workstations.
- Do not use leg space beneath benches and desks in a way that prevents proper ergonomic posture.
- Keep personal desk spaces and other areas clean (free of all hazardous research materials).
- Neatly store lab coats and safety glasses away from potential sources of contamination.
- Never store hazardous materials in refrigerators that contain food.
- Only eat or store food in designated areas. Maintain sufficient open space within the laboratory to manage the acquisition and disposition of materials.



GHS (Globally Harmonized System)

GHS stands for the Globally Harmonized System of Classification and Labelling of Chemicals that defines and classifies the hazards of chemical products, and communicates health and safety information. The goal is that the same set of rules for classifying hazards, and the same format and content for labels and safety data sheets (SDS) will be adopted and used all around the world. It is important that those working with chemicals are aware of all the signs and symbols on the chemical containers. The following is the symbol and related hazard information that are commonly encountered in research labs.



II. GENERAL SAFETY

People who work in scientific laboratories are exposed to various hazards. Most workplaces have hazards that are well recognized (those of ordinary fire, for example) with well-defined actions to control the situation. Laboratories, however, involve a greater variety of possible hazards and some of these hazards need precautions not ordinarily encountered. An introduction to safe practices for a variety of widely used laboratory procedures is listed below.

- GENERAL SAFETY AND OPERATIONAL RULES

1. No running or jumping in a laboratory is permitted. Stored items or equipment shall not block access to the fire extinguisher(s), safety equipment, or other emergency items. Stairways, hallways, passageways/aisles and access to emergency equipment and/or exits must be kept dry and unobstructed; i.e., no storage, no equipment, phone or other wiring. No combustible material such as paper, wooden boxes, pallets, etc., shall be stored under stairwells or in hallways. Hallways shall be kept free of boxes and materials so that exits and normal paths of travel are not blocked.

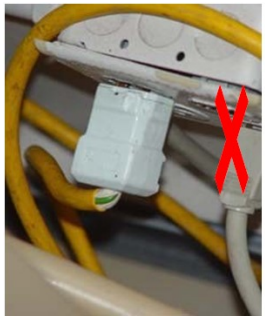
2. Eating or drinking within laboratories is not permitted. In all laboratories specific office areas may be designated for food in coordination with the Safety Committee. They must be physically separated from any laboratory operations. In the specified office areas no consumables, reagents or any tools should be shared with work areas.

3. No food or beverage may be stored in the cold rooms/Laboratory refrigerators and freezers.

4. Working core hours at IASST are 9am – 5:30pm (Monday-Friday). No employee shall work alone in a laboratory or chemical storage area outside the core working hours. Permission for students and staff to work outside of the core time has to be granted by the PI in charge in writing.
5. Animals, except those that are the subject of experimentation (approved by the Animal Ethical Committee) are to be excluded from all laboratory areas.
6. Clothing worn in the laboratory should offer protection from splashes and spills, should be easily removable in case of an accident. Nonflammable, nonporous aprons offer the most satisfactory and the least expensive protection. Lab jackets or coats should have snap fasteners rather than buttons so that they can be readily removed. These coats are to be fastened closed while working and removed prior to exit from the laboratory. It is highly recommended that no sandals or open-toed shoes shall be worn by laboratory personnel in the laboratory. Laboratory clothing should be kept clean and replaced when necessary. In procedure performed in biosafety level 2 and chemical operations it is required that lab coats, gloves, closed shoes and safety glasses are worn.
7. Mouth pipetting is never allowed.

A. Electrical Safety

Electrical equipment and wiring comprises a major part of the laboratory, thus posing a new set of possible laboratory hazards. Periodic laboratory inspections should pay particular attention to electrical safety.




A list of possible wiring hazard are as follows:

- Spliced cables
- Worn-out cables
- Tripping hazards from poorly draped cables near hot plates etc.
- Sliced cables near sinks or other wet locations.

Should you be concerned with high voltage or high current? In fact, it is a bit of both! If the voltage is not high enough, it may be relatively safe to touch an electrical circuit which can deliver high current. On the other hand, if the voltage is very high, but the current that the supply can deliver is very low, you might still be safe. Let us see why!

The electricity is nothing but the flow of charged particles. In most of our everyday life situations, it is the flow of electrons. The electrons flow from a high potential to a lower potential. What happens when you get a shock is that the electricity flows through your body from an electrical circuit carrying a high potential to the ground.

Your body has certain electrical resistance. From the tip of your finger to your feet, it is about 100 kΩ under normal circumstances. However, if you are wet, the resistance can drop to about one kilo-ohm! Thus, if you are touching a 100 V terminal, the current that can flow through your body is about one milliamp under normal conditions. The resultant shock is barely perceptible (See the table below)! However, once the current passes through the body, its resistance decreases and more current starts flowing, which is indeed dangerous. If your body is wet, the initial current can be up to 100 mA, which is indeed fatal! However, if the power supply can deliver a maximum of one milliamp of current, and if it is not faulty, you are very likely safe! If there is some failure in the grounding of the power supply, the resultant current can be lethal! Therefore, do not touch any electrical terminals that look suspicious.

One important thing to note at this point is that once the electricity starts flowing through your body, your resistance will decrease drastically facilitating more current to flow. Given below in a box is a description of how human body responds to various amounts of currents [Source: Fish, R. M. & Geddes, L. A. Conduction of electrical current to and through the human body: a review. Eplasty 9, e44 (2009).]

1 mA	Barely perceptible
16 mA	Maximum current an average man can grasp and "let go"
20 mA	Paralysis of respiratory muscles
100 mA	Ventricular fibrillation threshold
2 Amps	Cardiac standstill and internal organ damage
15/20 Amps	Common fuse or breaker opens circuit*

*Contact with 20 milliamps of current can be fatal. As a frame of reference, a common household circuit breaker may be rated at 15, 20, or 30 amps.

Lethal voltages present in the labs can be identified by the following symbol.

Electricity can kill. Respect it!

B. Vacuum Operations

In an evacuated vacuum system, the higher pressure is on the outside, rather than the inside, so that a break causes an implosion rather than an explosion. The resulting hazards consist of flying glass, spattered chemicals, and possibly fire.

1. When working with a vacuum be aware of implosion hazards. Apply vacuum only to glassware specifically designed for this purpose, i.e., heavy wall filter flasks, desiccators, etc.
2. Never evacuate scratched, cracked, or etched glassware. Always check for stars or cracks before use.
3. Vacuum glassware which has been cooled to liquid nitrogen temperature or below should be annealed prior to reuse under vacuum.
4. Rotary evaporator condensers, receiving flasks, and traps should be taped or kept behind safety shields when under a vacuum.
5. When a vacuum is supplied by a compressor or vacuum pump to distill volatile solvents, a cold trap should be used to contain solvent vapors. Cold traps should be of sufficient size and low enough temperature to collect all condensable vapors present in a vacuum system. If such a trap is not used, the pump or compression exhaust must be vented to the outside using explosion proof methods.
6. After completion of an operation in which a cold trap has been used, the system should be vented. This venting is important because volatile substances that have been collected in the trap may vaporize when the coolant has evaporated and cause a pressure buildup that could blow the apparatus apart.

7. After vacuum distillations, the vessel must be cooled to room temperature before it is vented.
8. All desiccators under vacuum should be completely enclosed in a shield or wrapped with friction tape in a grid pattern that leaves the contents visible and at the same time guards against flying glass should the vessel collapse. Various plastic (e.g., polycarbonate) desiccators now on the market reduce the implosion hazard and may be preferable.

C. Handling Glassware

1. Glass breakage is a common cause of injuries in laboratories. Only glass in good condition should be used.
2. Clean all glassware before sending for repair. Glassware that has been in contact with infectious agents shall be disinfected before disposal or repair.
3. Protect hands with leather gloves when inserting glass tubing. Hold elbows close to the body to limit movement when handling tubing.
4. Use glassware of the proper size. Allow at least 20% free space. Grasp a three-neck flask by the middle neck, not a side neck.
5. Conventional laboratory glassware must never be pressurized or used with vacuum.

D. Fume Hood Safety and Ventilation

General laboratory ventilation shall provide airflow into the laboratory from non- laboratory areas and out to the exterior of the building. Laboratory doors should remain closed, except for exit and entrance. All reactions must be performed within a fume hood. The hood sash should remain closed or at minimal safe height while working in the lab. Ventilation problems or fume hood alarms should be reported to the concerned lab supervisor who shall submit repair requests to facilities maintenance.

III - Safe Handling of Chemicals

General Guidelines.

Working with potentially harmful chemicals is an everyday occurrence in a laboratory. Employees are requested to inform themselves about toxicological information and procedures for handling and storage of chemicals used. For most commercially available substances, detailed instructions are available in the Material Safety Data Sheet (MSDS). A hardcopy of MSDS for each lab is required.

A. Gathering General Information on Chemicals

The Material Safety Data Sheet (MSDS) describes properties, reactivities, potential chemical hazards, and safe handling procedures for commercially available chemicals you are working with. These sheets must be archived in a specified folder; all lab personnel must know where it is kept. This MSDS log must be updated at regular intervals. Information that is contained in the Material Safety Data Sheets is also required by law to be conveyed to employees on a chemical-by-chemical basis.

MSDSs are generally written for chemicals that are used in the industrial setting therefore some of the information provided on the MSDS may not be applicable to laboratory usage.

The use of chemicals in a laboratory is generally in a more controlled environment than in the industrial setting and much smaller quantities of the chemical are being used at any one time. Nevertheless, a great deal of information on hazards associated with laboratory chemicals can be obtained by reading the MSDS.

Familiarize yourself with the pictograms and Hazard codes widely used to mark risks.

Figure source: http://www.sigmaaldrich.com/sigma-aldrich/help/help-welcome/risk-and-safety-statements/risk-and- safety.html#pictograms

Risk and Safety Phrases are widely used and should be known by any user when handling chemicals in the course of laboratory procedures. Further information upon chemical stability can be obtained from **Fluka Brand F Code.**

B. Handling and Transportation of Chemicals

1. Many laboratory accidents occur by carrying chemicals from one place to another or transferring them from one container to another. The chemicals used in a laboratory are often corrosive, toxic or flammable and any accident involving these has the potential for personal injury. Therefore, it is good practice to assume that all chemicals are potentially hazardous.
2. When large bottles of acids, solvents, or other liquids are transported within the laboratory without a cart, only one bottle should be carried at a time. The bottle should be carried with both hands, one on the neck of the bottle and the other underneath. Do not hook a finger through the glass ring on top of the bottle, allowing it to dangle while being transported. Never carry or attempt to pick up a bottle by the cap.
3. Large quantities of concentrated mineral acids, e.g., sulfuric, nitric and hydrochloric acids, shall be kept in specific storage rooms or cabinets for corrosive substances.

C. Chemical Storage

Proper storage of chemicals is necessary to maximize employee safety with regard to chemical compatibility, spill control, fire/explosion control, to provide security,

identification, and provide a "user friendly" system with respect to point-of-use.

1. All containers used for storage (even short term) shall be labeled.
2. Quantities greater than one litre of highly flammable liquids (Methanol, Chloroform) should be stored in specified metal cabinets. Quantities smaller than or equal to one litre of chemicals may be held at individual work stations but only one of the same kind. Chemicals should be stored as close as feasible to the point of use in order to maximize efficiency and minimize transport distance.
3. Out-of-date chemicals shall be disposed of on a periodic basis to reduce overall hazard potential and minimize inventory tracking and updating. Contact Laboratory Support Office.
4. Reduce large inventory of chemicals in the laboratory.
5. **Never** pipette by mouth. **Always** use a bulb to pipette.
6. Chemical containers that have been emptied have to be cleaned off remaining residues by triple rinsing with water or other suitable solvent and air-dried before disposal.

D. Chemical Spills

Any chemical is a possible threat to your personal health and your colleagues. In case of accident causing the release of hazardous chemicals a calm and determined action is required to prevent an escalation of the emergency situation.

Thus, for any individual incident, isolation of the spill and/or securing the area is best prior to or simultaneously with contacting concerned personnel. This should be done according to all available information on the chemical nature of the spill. Under all circumstances, a laboratory coat, safety glasses, and gloves should be used for self- protection.

A. Spill Kits may be obtained from Stores

1. Always send for help first and report the necessary information.
   a) Where did the incident happen?
   b) How many people are injured?
   c) What is the chemical?
   d) Is there an intermediate risk of fire, explosion, intoxication or suffocation known?

2. If the spill presents an immediate danger, leave the spill site and warn others, control entry to the spill site, and report to reception.

3. Remove contaminated clothing. Flush skin/eyes with water at least 15 to 30 minutes; use soap for intermediate and final cleaning of skin areas.
4. Protect yourself, then remove injured person(s) to fresh air, if safe to do so.
5. Notify nearby persons and evacuate as necessary. Prevent entry, as necessary, by posting a guard in a safe area and/or shutting doors.

6. 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. TURN OFF ELECTRIC AT THE MAINS, NOT AT SWITCHES INSIDE THE LABORATORY.
7. Do not touch the spill without protection, gloves etc.

B. 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 over-turned 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.

C. Never assume gases or vapors do not exist or are harmless because of lack of smell.

D. 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.

E. 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 diking with absorbent.

F. Spilled Liquids

1. Confine or contain the spill to a small area. Do not let it spread.
2. For small quantities of inorganic acids or bases, use a neutralizing agent or an absorbent mixture (e.g., soda ash or diatomaceous earth). For small quantities of other materials, absorb the spill with a nonreactive material (such as vermiculite, clay, dry sand, or towels).
3. For larger amounts of inorganic acids and bases, flush with large amounts of water (provided, the water will not cause additional damage refer to MSDS for this information). Flooding is not recommended in storerooms where violent spattering may cause additional hazards or in areas where water-reactive chemicals may be present.
4. Mop up the spill, wringing out the mop in a sink or a pail equipped with rollers.
5. Carefully pick up and clean any cartons or bottles that have been splashed or immersed.
6. If needed, vacuum the area with a HEPA filtered vacuum cleaner designed and approved for the material involved.
7. 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).

G. Spilled Solids

Generally, sweep spilled solids of low toxicity into a dust pan and place them into a container suitable for that chemical. Additional precautions such as the use of a vacuum cleaner equipped with a HEPA filter may be necessary when cleaning up spills of more highly toxic

solids.

1. Dispose of residues according to safe disposal procedures. Remembering that personal protective equipment, brooms, dust pans, and other items may require special disposal procedures.
2. Report the chemical spill in writing as required above to laboratory incharge.

- Guidelines for Mercury Handling and Spill Clean Up

A. Health Effects

Mercury vapors are odorless, colorless, and tasteless. Mercury poisoning from exposure by chronic inhalation can cause emotional disturbances, unsteadiness, inflammation of the mouth and gums, general fatigue, memory loss, and headaches.

B. Storage and Handling

Because of the health effects of mercury, the extremely difficult and time-consuming procedures required to properly clean spills, every effort should be taken to prevent accidents involving mercury. Always store mercury in unbreakable containers and store 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 to prevent skin absorption or irritation.

Always wear nitrile gloves while handling mercury. If mercury has been spilled on the floor, the workers involved in cleanup and decontamination should wear plastic shoe covers. Spill Kit for Mercury is available from the Laboratory PI.

- Guidelines for Ethidium Bromide (EtBr) Waste Management & Disposal

Ethidium bromide (*3,8 diamino-5-ethyl-6-phenyl phenanthridinium bromide, dromilac, CAS #1239-45-8*), is a compound used in many laboratories. Ethidium bromide is available as a dark red, crystalline, non-volatile solid and is moderately soluble in water. Since it fluoresces readily with a reddish-brown color when exposed to ultraviolet (UV) light and with increased brightness when bound to double stranded-DNA and single-stranded RNA, it is commonly used in gel electrophoresis applications for visualization of these molecules. For these applications, liquid ethidium bromide solutions are incorporated into the electrophoresis gel as a dye for the DNA, RNA, or other molecules to be visualized.

Ethidium bromide is mutagenic and moderately toxic and must be handled with care. The

powder form is considered an irritant to the upper respiratory tract, eyes, and skin. Preparation of stock solutions and any operations capable of generating ethidium bromide dust or aerosols should be conducted in a fume hood to prevent inhalation. Nitrile gloves, a lab coat, and eye protection must be worn at all times.

When working with ethidium bromide, minimize the potential for spills. Where practical, purchase pre-mixed stock solutions from chemical manufacturers in lieu of preparing solutions. If solutions of ethidium bromide must be prepared, perform this process in a fume hood. Perform all processes that generate ethidium bromide dusts or mists inside the fume hood to minimize inhalation exposures. Prevent accidents by transporting small quantities of ethidium bromide in secondary containment.

***Do Not Use sodium** hypochlorite (bleach) to treat ethidium bromide. Bleach treatment can produce mutagenic products and leave behind up to 20% of the original ethidium bromide.

Ethidium Bromide Waste Disposal

Ethidium bromide waste should **NOT** be poured down the drain or thrown in the trash, unless the waste has been deactivated or filtered. The following are the recommended disposal procedures for ethidium bromide.
NOTE - Ethidium bromide DOES NOT go in red bags or red containers, should not be labeled with a biosafety symbol, and especially should not be treated in an autoclave.

A. Electrophoresis Gels, Contaminated Gloves and EtBr contaminated Solids

Handle ethidium bromide gels, contaminated gloves just as you would chemical hazardous waste. Use sealable, disposable plastic baggies to store ethidium bromide gel waste. Minimize free flowing liquids in these bags when they are brought for disposal.

A bin is kept for gloves and gels contaminated with EtBr
1) at the Centrifuge Room in the first floor near the Gel documentation system.
2) at the Common equipment room ground floor next to the Gel documentation system.

B. EtBr disposal

Intermediate storage and collection of EtBr waste is the responsibility of the individual laboratory**. A log book must be maintained listing: concentration, volume, date and the person who generated it.** The liquid EtBr waste should be collected in an appropriately labeled 2- or 5- liter glass reagent bottle.
A Bind-ET Ethidium Bromide Removal System (Elchrom Scientific) for final disposal of liquid EtBr waste is located near the wash basin of the laboratory**. For further details please refer to section IX of this manual.** A log-book entry has to be generated for every disposal entering LAB-number, volume, concentration and date.

C. Sharps Contaminated with Ethidium Bromide

If contaminated blades or sharps need to be discarded they should be carefully rinsed with water into the intermediate liquid waste container. **No disposal of sharps or blades is permitted into regular biohazard red bins or blue glass bins**. We recommend reusing the labeled blades specifically for EtBr work.

D. Ethidium Bromide Alternatives

Consider switching to less-toxic alternatives to ethidium bromide (GelRed, SYBR SafeTM DNA gel stain, Biotium) to reduce potential hazardous exposures in the lab.

- Guidelines for Bis-Acrylamide

When handling Bis-Acrylamide formulations gloves, eye protection and Lab coat are required.

Dispose remaining acrylamide in original chemical containers by polymerization. For that add 100µl TEMED and 100µl of 10% Ammonium Persulfate (APS) and shake it thoroughly and allow to react over night. Dispose the container in the red biohazard bin.

- Guidelines for Phenol/Chloroform

Handle Phenol or Phenol/Chloroform formulation only with gloves, eye protection and Lab coats. These liquids have to be disposed in dedicated organic solvent containers.

The tubes should be collected separately and allowed to dry in the chemical fume hoods in common equipment rooms.

- COMPRESSED GAS SAFETY

A. Identification

1. The contents of any compressed gas cylinder shall be clearly identified for easy, quick, and complete determination by any laboratory worker. Such identification should be stenciled or stamped on the cylinder or a label, provided that it cannot be removed from the cylinder. If the labeling on a cylinder becomes unclear or an attached tag is defaced to the point the contents cannot be identified, the cylinder should be marked "contents unknown" and returned directly to the manufacturer. Users are requested to inform themselves through the Material safety data sheets (MSDS) about safe handling of the specific technical gas.

Examples of color code used in India for identification of gas cylinders:

1. Argon : Peacock Blue
2. Nitrogen : French Grey with a black band on the shoulder of the cylinder
3. Helium : Light Brown
4. CO2 : Black with a silver band on the shoulder of the cylinder
5. Oxygen : Black
6. Zero Air : French Grey

(Ambient air filtered to contain less than 0.1 parts per million (PPM) of total hydrocarbons.)

7. Hydrogen : Signal Red
8. D.A : Maroon (Dissolved Acetylene)

B. Safe Use of High pressure cylinders

1. Gas cylinders shall be secured at all times to prevent tipping. Cylinders may be attached to a bench top, individually to the wall, placed in a holding cage, or have a non-tip base attached.
2. When new cylinders are received, they should be inspected; insure the proper cap is securely in place and the cylinder is not leaking. Cylinders shall have clear labels indicating the type of gas contained. If the cylinders are acceptable, they shall be stored in a proper location.
3. Standard cylinder-valve outlet connections have been devised to prevent mixing of incompatible gases. Cylinders should be placed with the valve accessible at all times. Cylinder valves should be opened slowly. Main cylinder valves should never be opened all the way. Valves should not be closed with force.
4. Regulators are gas specific and not necessarily interchangeable. Always make sure that the regulator and valve fittings are compatible. Never use oil or grease on the regulator of a cylinder valve.
5. For transportation of high pressures cylinders general precautions are required. To protect the valve during transportation, the cover cap should be screwed on hand tight and remain on until the cylinder is in place and ready for use. When moving large cylinders, they should be strapped to a properly designed wheeled cart to ensure stability. Cylinders should be moved only with dedicated trolleys. Cylinders should never be rolled or dragged.

C. Leaking of compressed gas cylinders

If a leak is suspected, do not use a flame for detection; rather, a flammable-gas leak detector or soapy water should be used. If the leak cannot be remedied by tightening a valve gland or a packing nut, emergency action procedures should be initiated. 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.

- Safe handling of Cryogenic Liquids (liquid Nitrogen)

In the context of the IASST campus this refers largely to liquid nitrogen. Usage of other cryogenic liquids has to be performed under supervision of trained individual and such operations should be reported to PI in charge and the Lab manager (if available).

The transfer of liquefied gases from one container to another should not be attempted for the first time without the direct supervision and instruction of someone experienced in the operation. In all procedures involving liquid nitrogen cryo-gloves and eye protection (preferably a face shield) should be worn at all times. Gloves should be chosen that are impervious to the fluid being handled and loose enough to be tossed off easily.

Fire/Explosions; Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture.

Adequate ventilation must always be used to avoid suffocation or the possibilities of build up to explosive gas mixtures.

Only appropriate impact-resistant containers must be used that have been designed to withstand the extremely low temperatures for handling and storage of larger quantities of cryogenic liquids. Only dedicated Polyurethane Foam Ice Buckets are permitted for usage with liquid nitrogen. Styrofoam boxes (thermo col) are NOT allowed for handling liquid nitrogen at any time.

- Safe Handling of Dry Ice

Dry ice is solidified carbon dioxide (CO2). Dry ice sublimates (changes directly from solid to gas), releasing CO2. Carbon dioxide vapor is substantially heavier than air. In confined, poorly ventilated spaces it can displace air, causing asphyxiation. It is even possible for CO2 vapor to accumulate in low-lying areas, out-of-doors. Gloves and eye protection (preferably a face shield) should be worn at all times when handling dry ice.

Dry Ice is obtained in blocks and has to be crushed for usage. Use only provided tools, during this procedure eye protection and gloves are a must.

Never store dry ice in glass or other sealed (airtight) containers or coolers. Storage in a sealed container can result in a rupture or explosion of the container from over-pressurization.

A. Disposal of Unused Dry Ice

Allow the dry ice to sublimate or evaporate to the atmosphere in a well-ventilated area where no build-up of carbon dioxide vapor can occur.

Do not dispose of dry ice in sewers, sinks or toilets. The extreme cold will harm sink disposal, toilet parts and pipes. Do not dispose of dry ice in garbage receptacles or garbage chutes.

- Guidelines for Imaging Stations

When an ultraviolet (UV) light source is used in work with ethidium bromide, added caution is required. As a general rule, avoid exposing unprotected skin and eyes to intense UV sources. Eye protection must be worn if a face shield is not available.

Leave the imaging station in a clean and EtBr-free state.

IV. BIOLOGICAL SAFETY

Four bio-safety levels are established to regulate laboratory practices, techniques and safety equipment appropriate for handling of biological agents. Biological agents in that context are:

a) Microorganisms
b) Arthropods
c) Toxins of different origin and those produced using rDNA technology
d) Viruses

e) Allergens of different origins and those produced using rDNA technology

At IASST, the area of biological safety is under the guidance of the Institutional BioSafety Committee (IBSC) and Bioethics Committee. For Biological Safety levels 1 and 2, researchers are bound to follow the Committee guidelines and inspections. **Bio-safety levels III & IV are not applicable to IASST.**

Bio-safety Level I:
Practices and safety facilities are appropriate for working with well-defined biological agents. These biological agents are not known to cause disease in healthy adult humans and pose only a minimal potential hazard for laboratory personnel and the environment. *Bacillus subtilis*, *Naegleria gruberi*, infectious canine hepatitis virus and non infectious *E. coli* are representative of those microorganisms meeting these criteria. Many agents not ordinarily associated with disease processes in humans are, however, opportunistic pathogens and may cause infection in the young, the aged, immunodeficient or immunosuppressed individuals.

Bio-safety Level II:
Practices and safety facilities must meet the perquisites to deal with a broad spectrum of indigenous moderate-risk agents. These agents are known to cause diseases but immunization or antibiotic treatment is available. Examples are Hepatitis B virus, the *Salmonellae*, *Toxoplasma* spp. and infectious *E. coli* strains. Primary hazards to personnel working with these agents may include accidental autoinoculation, ingestion, and skin or mucous membrane exposure to infectious materials. Procedures with aerosol potential that may increase the risk of exposure to personnel, must be conducted in primary containment equipment or devices.

Bio-safety Level II+:
The term 'Infectious Material' applies to blood, any other body fluid, and other potentially infectious material like biopsies. All body fluids shall be considered as infectious materials. Research involving Biological Safety Levels II+ shall contact the Biological Safety Committee for appropriate authorization, guidelines and inspections.
Such work can only be performed in the Biohazard laboratory.

Bio-safety level III:
Biosafety level III (BSL-3) is applicable to clinical, diagnostic, teaching, research, or production facilities where work is performed with agents that may cause serious or potentially lethal disease through inhalation, to the personnel, and may contaminate the environment. It requires that laboratory personnel receives specific training in handling pathogenic and potentially lethal agents, and be supervised by scientists competent in handling infectious agents and associated procedures. All work is performed in biocontained

environments using appropriate engineering controls.

Bio-safety level IV:

Biosafety level 4 (BSL-4), the highest level, is required for working with dangerous and exotic infectious agents that pose a high individual as well as environment risk of life-threatening disease, aerosol transmission, or a related agent with unknown risk of transmission. Laboratory personnel receive specific training in handling pathogenic and potentially lethal agents, and have to mandatorily work wearing positive pressure BSL-4 suits. (Information source-IJMR)

Ministry of Environment and Forests Notification (New Delhi, the 5th December, 1989)- Rules for the Manufacture, use, import, export and storage of hazardous micro organisms, genetically engineered organisms or cells. file:///C:/Users/ACER/Downloads/GeneticOrganisms1989.pdf

Bio-safety Levels III and IV are not applicable to IASST.

V. Basic Working Principles in Bio-safety laboratories

The primary principle of biological safety is containment. This refers to a series of safety procedures which have to be conducted to reduce or eliminate human and environmental exposure to potentially harmful biological agents. While working in IASST laboratories one might handle specimens, cultures and agents without full knowledge of the biohazard risk; these materials may contain infectious agents. To minimize exposure, observe universal precautions when handling any biological specimen.

While working in any of the above defined bio-safety levels it is required of any personnel at IASST to follow the regulations listed below:

A. Wash your hands thoroughly:

1. Before and after working with any biohazard
2. After removing gloves, laboratory coat, and other contaminated protective clothing
3. Before eating, drinking, smoking, or applying cosmetics
4. Before leaving the laboratory area
5. Do not touch your face when handling biological material 6.Never eat, drink, smoke, or apply cosmetics in the work area

B. Clothing Guidelines:

1. Always wear appropriate lab clothes and gloves when working with biological agents.
2. Wear gloves over gown cuffs.
3. Remove gloves by peeling them from the inside out.
4. Never wear contact lenses when dealing with infectious agents.
5. Do not wear potentially contaminated clothing outside the laboratory area.
6. Additional appropriate protective clothing should be selected and worn based upon the task and degree of exposure anticipated.

C. Handling Procedures liquid infectious materials:

1. Use mechanical pipetting device (examples; pipette aid, pipetteman or bulb).
2. Minimize aerosol generation. Decanting culture supernatants, opening of culture and streaking of plates should only be done in Safety cabinets or in a circular area around a burner of 0.5 meter radius. Decanting/Transferring of cultures in common equipment rooms outside of safety cabinets is forbidden.
3. Add disinfectant to water baths for infectious substances.
4. Use only closed tubes for centrifuging procedures. Inspect the tubes before use.
5. Use secondary leak-proof containers when transporting samples, cultures, inoculated petri dishes, and other containers of biohazardous materials within the institute.
6. Avoid using syringes and needles whenever possible. Special care has to be taken when usage of needles is not avoidable: Use a needle-locking or disposable needle unit.
    - Take care not to stick yourself with a used needle.
    - Place used syringes into a pan of disinfectant without removing the needles.
    - Do not place used syringes in pans containing pipettes or other glassware that require sorting. Do not recap used needles.
    - Dispose of needles in an approved sharps container.

D. Work Area:

1. Keep laboratory doors shut when experiments are in progress.
2. Limit access to laboratory areas when experiments involving biohazardous agents are being performed.
3. Ensure that warning signs are posted on laboratory doors. These signs should include the universal biohazard symbol and the approved biosafety level for the laboratory.
4. Transport contaminated materials in leak-proof containers.
5. Keep miscellaneous material (i.e., books, journals, etc.) away from potentially contaminated working areas.
6. Follow a rigorous disinfection plan:
    - Completely decontaminate equipment before having maintenance or repair work done. Decontaminate work surfaces daily and after each spill.
    - Decontaminate all potentially contaminated equipment.
    - Decontamination should only be performed with these disinfection solutions such as 70%Ethanol or 5-10% Sodium hypochlorite (bleach) solutions

Work of Bio-safety Level II has to be performed at assigned workbenches. Ensure that warning signs are posted accordingly. All procedures generating aerosols have to be performed in safety cabinets. Minimize traffic in the area where Bio-safety Level II work is done.

E. Safety Equipment (Containment Barriers)

Safety equipment includes a variety of personal protection items and laboratory devices which provide the ability to keep infectious agents in a specified contained area that is easily accessible. The biological safety cabinet is the principal device used to provide containment of infectious aerosols generated by many laboratory procedures. Open-fronted Class I and Class II biological safety cabinets are partial containment cabinets which offer significant levels of protection to laboratory personnel and the environment when used with good microbiological techniques. As part of the individual familiarization with laboratory procedures individual PIs are asked to ensure proper handling of the Safety cabinets.

F. Disposal of liquid cultures:

1. All culture supernatants in conical plastic tube never more than 25ml can be disposed in the red biohazard bin.
   Tubes have to be closed but not overly tight.

2. All cultures ≥ 25ml must be put in a glass beaker or Erlenmeyer flask and treated to become 10% with bleach **in a biosafety cabinet**. Examples; 30 ml culture/3-4 ml of straight bleach, 250 ml culture/25-30 ml straight bleach, let stand at least 30 minutes. Dispose off in sink: Turn on the water faucet, pour treated culture in, keep water running for a minute or two after you have finished pouring the culture.

3. Cultures with other hazardous chemicals and/or heavy metals must be disinfected as above and then disposed of according to the method prescribed in the MSDS.

VI. Biohazard spills

Biological spills outside biological safety cabinets will generate aerosols that can be dispersed in the air throughout the laboratory. These spills can be very serious if they involve microorganisms that require Biosafety Level II and above containment. The Biosafety lab has its own procedures to follow.

General reaction plan for a biological spill:

1. Cordon off the area to stop anyone from spreading the contamination throughout the laboratory.
2. Cleaning procedures should be started in a timely manner by a person from the lab where the spill has occurred. Before starting to clean the spill, Personal Protection Equipment (gloves, face mask, safety goggles, long sleeve lab coat and shoe covers) must be obtained and put on.
3. Disinfect the area, all surfaces using 70% Ethanol in a spray bottle. Any material used to wipe up the spill must be placed in a biohazard bag and decontaminated using an autoclave.

Decontamination should only be performed with these disinfectants: 70%Ethanol or 10% Chlorox

A. Spills on the Body

1. Remove contaminated clothing.
2. Apply disinfection solution. Vigorously wash exposed area with soap and water for one minute.
3. Obtain medical attention.
4. Report the incident to the Laboratory in-charge

B. Bio-safety Level I Organism Spill decontamination procedure

1. Wear disposable gloves.
2. Soak paper towels in disinfectant (70% ethanol or 10% chlorox) and place over spill. Allow a 30-minute contact period on the spill.
3. Place towels in a biohazard bag and decontaminate using an autoclave before disposal.
4. Clean up spill area with fresh towels soaked in disinfectant.

C. Biosafety Level 2 Organism Spill

1. Shut down the air conditioning units for your laboratory or section of the building. (inform PI immediately)
2. Alert people in immediate area of spill.
3. Put on protective equipment, a laboratory coat with long sleeves, back-fastening gown or jumpsuit, disposable gloves, disposable shoe covers, safety goggles, mask or full-face shield.
4. Cover spill with paper towels or other absorbent materials.
5. Carefully pour a freshly prepared disinfectant around the edges of the spill and then into the spill.

Avoid splashing. Allow a 30-minute contact period. We recommend using a spray bottle.

6. After the spill has been absorbed, clean up the spill area with fresh towels soaked in disinfectant.
7. Place towels in a biohazard bag and decontaminate in an autoclave. Please inform the laboratory kitchen to autoclave infected material before being sent for final disposal.

VII. Specialty Laboratories

- Working with Radioactive Materials

IASST is not handling any Radioactive materials/compound so far. Still the institute will develop general guidelines for handling and disposal of Radioactive waste for future research. In the current facility available, the institute may support only Type I radioactive laboratory (Rad Lab).

Each lab should take permission from the authority before starting any research related to

Radioactive Materials. The process to become a Radioactive Laboratory user will be to fill out an application form available with lab in-charge/reception, pass labsafety test conducted by IASST (under preparation) and go through orientation programme under the supervision of the IASST faculty. One of the most important aspects of the orientation program and tests is that the candidates must be aware of are the specific protocols for disposal of waste materials generated during experiments performed in the Rad Lab. Once cleared the test and passed through the orientation, the user must obtain permission before starting to use the Radioactive Laboratory. Initially for 1-2 months, student must be under the supervision of a PI/senior Rad Lab user.

- Laser Laboratory

A special training process must be undertaken to use lasers in the laboratory. Please contact your PI for appropriate instruction. Safety glasses have to be worn at all times within Laser Laboratories.

VIII. Waste Disposal and Management in IASST

A. Types of waste at IASST

With its usual day to day activities, following four types of waste are generated at IASST.

1. **Organic waste:** Organic materials generally make up the largest portion of waste. Organic wastes are created during every meal. Clearing of jungles, weeds and trimming of plants also produces green wastes. When properly disposed of, these materials can be picked up by trash removal services and transported to a facility where it will be turned into compost, which can actually be used as fertilizer. In some occasion this includes paper and paperboard products which cannot be used for compost production due to the presence of unwanted chemicals.
2. **Recyclables:** Recyclables are types of waste that are non-biodegradable and can be converted into reusable material. Things like plastics, metals, and glass are all harmful to the environment when placed into landfills, but proper disposal can eliminate the need to manufacture even more of these materials, which are instead be reused in more products.
3. **Toxic Chemical Waste:** This section includes EtBr removal procedure. Since it fluoresces readily with a reddish-brown colour when exposed to UV light and with increased brightness when bound to double stranded-DNA and single-stranded RNA, it is commonly used in gel electrophoresis application for visualization of these molecules. EtBr may present a hazard if it is poured down the drain untreated or placed in the trash.
4. **E-waste:** This type of waste has become far more of an issue in recent years with the surge in technology, such as computers and other sophisticated instruments with electronic circuits. This is related to regular recyclables in that most of these products are composed of plastics, metals, and glass.

B. Procedure of waste disposal & management system

It has been decided to follow a specific and well laid down wastes collection and management system at IASST till the classified materials are disposed by the authority.

In IASST, it is decided that there will be four types of waste bins of appropriate sizes at different places. These are:

1. For Bio-degradable waste.
2. Toxic Chemical Waste
3. For Plastics (all types from recyclable type 1 to 7)
4. Sharp materials like metal and glass.

C. Management of bio-degradable waste

Organic and bio-degradable wastes are produced from dry leaf of trees, vegetable waste, food material remaining etc. Effort is to be made to educate people so that they grow the habit of depositing this type of waste in the specific bin excluding food materials. Dry leaves and vegetable waste collected from these bin are to be weighed using balance and to be processed to produce vermin compost. The i/c Vermin compost unit will guide the workers for the purpose.

These bins are labelled or coloured green and to be placed in the specified areas including the IASST lobby, Canteen, laboratories and also near the staircases.

Foods remaining are to be stored in a special type of covered trench with cement lining and metal container behind the existing Canteen of IASST. Food waste from Student and Scientist Home are also to be placed here and for this special hand trolley will be provided to the caterer. After few days, when this food waste are reduced and ideal for making compost, it will be shifted to vermin compost pit for further processing.

D. Management of toxic chemical waste- *Ethidium Bromide*

1. Any EtBr waste should **NOT** be poured down the drain, or thrown in the trash, unless the waste has been deactivated or filtered.
2. Handle EtBr gels, contaminated gloves similar to chemical hazardous waste. Use sealable disposable plastic begs to store ethidium bromide gel waste.
3. Minimize free flowing liquids in these bags when they are brought for disposal. A bin is kept for gloves and gels contaminated with EtBr.
4. The liquid EtBr waste should be collected in an appropriately labeled 2-5 ltrs glass reagent bottles.A bind-ET ethidium bromide (EtBr) removal system (Elchrom Scientific) for final disposal of liquid EtBr waste is kept near the wash basin of the laboratory. The Bind-ET^{TM} is a closed system which removes EtBr from aqueous solutions in the safest and simplest way. The most important part of the system is an ion exchange column with a binding capacity of more than 2g of ethidium. The aqueous solution flowing out of the column contains no detectable amount of EtBr and can be treated as normal effluent. Because it is closed, the ion exchange column can be sent for incineration. This convenient way of disposing EtBr solution is not only safe, efficient and cost effective,

but fulfils ecological demands and regulations by completely removing EtBr from solutions.

5. Caution: Gel particles in the solution (usually from the agarose gels) would clog any packed column. Make sure that the solution is poured into the reservoir through the sieve. Never change the outlet position by attaching silicon tubes to the outlet port.
6. Change the cartridge after six months of continuous use, since after six month its capacity might get exhausted. Any maintenance/ service should be performed by authorized personnel only.

   For further details please refer to the standard operating procedures developed by Dr. Debajit Thakur and group, for the Microbial Biotechnology Laboratory (LSD)

E. Management of plastic wastes

All types of recyclable plastic are to be kept in this specified bin. Waste materials collected from these bins are to be stored in the Central big size dust bin and will be transferred to the Guwahati Municipality Corporation or their assigned agency's Garbage carrying vehicle on regular basis. Security Guards who are present at the time of entrance of the Garbage carrying vehicle will be responsible to oversee proper cleaning of the bin and should take utmost care so that no waste material litter the surrounding of the bins during waste unloading the bins. The detail procedure for this part of waste disposal system will be specified later.

These bins are labelled or coloured blue and to be placed in the specified areas including the IASST lobby, Canteen, laboratories and also near the staircases.

F. Regular picking up of inadvertently littered plastics

Although, plastic littering is prohibited strictly inside the campus, few plastics found spread due to inadvertent littering and wind action. A casual workeris engaged for two halves 9:30 AM to 11:00 AM and 2:30 PM to 4:00 PM daily to pick up such litter plastic by taking a round in the campus. This is being extended with a proper interval round by the worker and monitoring by the EMO.

G. Management of Sharp Materials Like Metal and Glass

Any sharp material, other than organic/biodegradable and plastic material are to be stored here mainly of metal and glasses. These are to be collected and transferred to the Central big sized dustbin. It will be cleaned by the Municipality Garbage carrying vehicle on regular basis. Security Guard who are present at the time of entrance of the Garbage carrying vehicle will oversee for maintaining cleanliness of the bins and should take utmost care so that no waste material litter the surrounding of the bins.

These bins are labelled or coloured red and to be placed in the specified areas including the IASST lobby, canteen, laboratories and also near the staircases.All these bins are to be marked with their uses and numbered accordingly.

Waste bins of above types will also be placed in selected places in all around the campus in specific locations according to the need. A location map for all the outside waste bins and those of within buildings is attached with this write up.

H. Wastes in the Laboratory Works

There are two types of wastes generated in the laboratories and disposal of these wastes will be done as follows:

1. Wastes of plastics, glass, sharp materials etc. will be kept in a box/bin inside the lab and at the end of the day these will be placed in designated bins placed in the corridor by the lab worker.
2. Waste materials of chemicals, reagents, toxic substance, gel, radioactive substances etc. will be disposed by the scientists concerned following prescribed technical procedure.

I. Manpower involved in waste disposal

1. The concerned staff members/workers have been assigned with duties for collection of wastes from the dustbins placed at different locations of the institute and to place these wastes in the specified garbage boxes in the Central wastes enclosure.
2. The Estate officer and his supervisory staff will monitor the waste disposal work done by the workers on daily basis and maintain a register duly signed with his/her comment.
3. In academic building, the students' representatives volunteered/engaged and other staff members as given below will follow up and take action for proper maintenance of the Waste Management System in different laboratories and different wings of the administrative building and lobby:
   i. Laboratory, Ground Floor, Left wing: Student representative from PSD
   ii. Laboratory, Ground Floor, Right wing: Student representative from LSD
   iii. Laboratory, First Floor, Left wing: Student representative from CCNS
   iv. Laboratory, First Floor, Right wing: Student representative from LSD
   v. Laboratory, Second Floor, Left wing: Student representative from PSD
   vi. Laboratory, Second Floor, Right wing: Student representative from LSD
   vii. Administration, Left wing: Technical Assistant or from similar post
   viii. Administration, Right wing: Superintendent or from similar post
   ix. Library: Librarian and other member nominated by the Librarian
   x. Lobby: Receptionist

The volunteers will have to enter register and report regularly to the Registrar, IASST or the person nominated by the Director of IASST on the status of implementation.

i. Each laboratory will keep record of the approximate amount (by weight) of waste materials of different categories (i.e., paper, sharp materials, and plastics wastes) in a register on day to day basis and total in a month.

ii. The In-charge/caretaker engaged in vermicompost unit will arrange to collect the waste materials from the specified bins/pits earmarked for the purpose through their workers and utilize the materials as per the procedure.

J. Timings and procedure of clearance of wastes

From dustbins of laboratories

Waste clearance from	Time (Every day)	To be done by	To be deposited at	To be Supervised/ monitored by
Laboratories	11.00 am	Cleaners	Respective dustbins placed at Corridors of each wing/block of Administrative and Academic buildings.	In-charge assigned by Director/Estate Officer.
Dustbins of corridors	2.00 pm	Casual workers	Central waste/garbage enclosure	-do-

K. From dustbins kept outside building within campus

Waste clearance from (for items like paper, plastics and sharp materials)	Time	To be done by	To be deposited at	To be Supervised/ monitored by
SSH, Canteen, Old hostel, Old staff quarter, Essential workers' staff quarter, Security barrack, Main gate, BCH, Old animal house, Engr. Unit etc.	11.30 am	Casual workers	Central waste/garbage enclosure	In-charge assigned by Director/Estate Officer.

L. For biodegradable waste materials/items

Waste clearance from (for items like leftover food materials, kitchen wastes etc.)	Time	To be done by	To be deposited at	Supervision by
SSH, Canteen, Old hostel, Old staff quarter, Essential workers' staff quarter, Security barrack etc.	Two or more times in a day	Staff/Casual workers of the concerned establishment	Central pits	In-charge assigned by Director/Estate Officer.
Central pits	As decided by the vericompost unit	Staff of Vermicompost unit	Vermi-compost unit	In-charge of Vermicopmpost unit assigned by Director.

M. From central waste/garbage enclosure dustbins

For all waste materials from	Time	To be done by	To be deposited at	To be monitored by for timely disposal
Central waste/garbage enclosure	Any time as per schedule	GMC/NGO workers	Assigned garbage disposal locations of GMC	In-charge assigned by Director/Estate Officer/Security personnel.

Timings for collection of wastes from different waste bins and transfer of the materials by the concerned workers will be worked out/assigned by the Estate management as per their work schedule. However, the job will be done preferably two times in a day depending upon the quantum of wastes. Estate officer would also engage his staff for regular monitoring of the whole system.

N. Special Attention for Waste Disposal on the Occasion of Large Gathering in the IASST Campus

1. On occasion of Foundation day, sports events etc., gathering of large number of people cause littering of waste due to lack of sufficient number of dustbins as well as attendant to take special care for it, and diverse people attending the functions with no habit of proper waste disposal. To negotiate such a situation, strategy will be worked out thoughtfully before the beginning of event/gathering so that sufficient number of dustbins is placed and required personnel can be deployed with proper instruction, placard or banner.
2. When an event is organized in the campus, the organizer will keep a slot at the end of the programme for cleanliness drive where everybody will participate.
3. There may be a cleanliness drive by all sections of staff and students for an hour or so after the programme is over and it should be kept as an integral part of the programme.

O. Extension of IASST's cleanness drive of the campus to outside

Recently, one casual worker is engaged to collect all the plastics and paper litter from the approach avenue road of about 250 meters towards the main gate of IASST. On back sides of this 250 meters approach, IASST has also planted nerium treesof different types.

IX. EMERGENCY RESPONSE

A. FIRES

- **Fire Safety**

Fire is the most common safety hazard in any organization. Therefore, it is very essential for everyone to know how to survive a building fire and what to do in case of a fire. The following section briefly explains some common protocols and procedures that may be followed during a fire emergency.

How to Survive a Building Fire

- Go out of the building immediately through the nearest exit.
- Always use stairs, not an elevator
- Close doors from outside in case of severe fire to prevent the fire from spreading
- In case of heavy smoke, crawl low and if possible tie a wet cloth on your nose
- Use a fire extinguisher, if the fire is very small and you know how to use it safely

If you are on fire - Stop, Drop and Roll If you get trapped:

- Close the door
- Open the windows if safe
- Do not jump out of a tall building
- Signal for help and call 101

Fire Extinguishers:

Fire, depending on its origin, is classified as:

1. Class A: Combustible materials: Wood, paper, furniture etc.
2. Class B: Flammable Liquids
3. Class C: Flammable Gas
4. Class D: Metal Fire
5. Class E: Electrical equipment
6. Class K: Oil, greases

If FIRE occurs:

It may not be necessary to evacuate the building for a small fire. If, however, there is any chance that the fire may endanger others or may cause serious damage, confine or control the fire only if possible.

Use an appropriate extinguisher:

- *Dry Powder (for all type of fire)*: Dry powder containing extinguishers are recommended for putting off all types of fire.
- *CO_2 (for B and C type fire)*: Because the use of dry powder leaves a messy surrounding, CO_2 based extinguishers are often recommended for small fire of chemical origin.
- If fire breaks out close to a flammable gas supply or close to electrical power source, turn off gas supplies and electrical power sources.

Immediately after a fire extinguisher has been used, make a report of it and inform the EMC/Registrar.

If a solvent in a beaker catches fire, covering the beaker and depriving the fire of oxygen can easily extinguish the fire than using a fire extinguisher on the same beaker, which may cause the solvent to spill, thus increasing the hazard!

ACTION TO BE TAKEN IN CASE OF FIRE

If Emergency Occurs: Pull The Fire Alarm And Evacuate The Building.

If there are injured victims, provide the minimum necessary first aid '*Only If You Are Sure That There Is No Danger To Yourself*'. If providing assistance will endanger you, *DO NOT* attempt intervention and move the victim immediately to the nearest hospital. In case of urgency, call:

1. Ambulance - 108
2. Fire station - 101
3. Disaster management – 112/ Assam State Disaster Management Authority (ASDMA)- +91- 361- 2237221
4. Assam State Emergency Service And Fire Station, Guwahati - 0361-2637680, 2734191 & 2735935 94359-60618 (M)

The above list is not complete and there could be many other scenarios, not listed here. In such cases your response should be based on the given scenario.

B. If CHEMICAL EMERGENCY OCCURS

Chemical emergencies such as large spills, spills involving highly hazardous or flammable materials, releases of toxic or corrosive gasses or substances should be treated as other types of emergencies. **PULL THE FIRE ALARM AND EVACUATE THE BUILDING.**

The above list is not complete and there could be many other scenarios, not listed here. In such cases your response should be based on the given scenario.

C. ACCIDENT REPORTING

ALL injuries shall be reported to concerned PI/ Lab Manager. 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. In addition, all minor accidents should be investigated by safety and management personnel. Taking corrective action as a result of a minor accident may prevent major incident from happening. Without knowledge of all minor accidents, the desirable investigation is circumvented.
Employees 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.

X. INSTITUTE POLICIES REGARDING SAFETY

Safety Audits / Inspections
Safety officers along with few students (on rotation) will visit each laboratory to ensure all the basic safety rules are in place. For life science, chemical science and physical science laboratories, the following eight areas have been identified for observing and maintaining safety of highest standard:

1. Safe working practices 2. Safety equipment 3. Fire handling and evacuation process 4. Ventilation of chemical vapor 5. Safety in conducting experiments 6. Laboratory equipment 7. Storage and labeling 8. Disposal of biological and chemical liquid and solid waste.

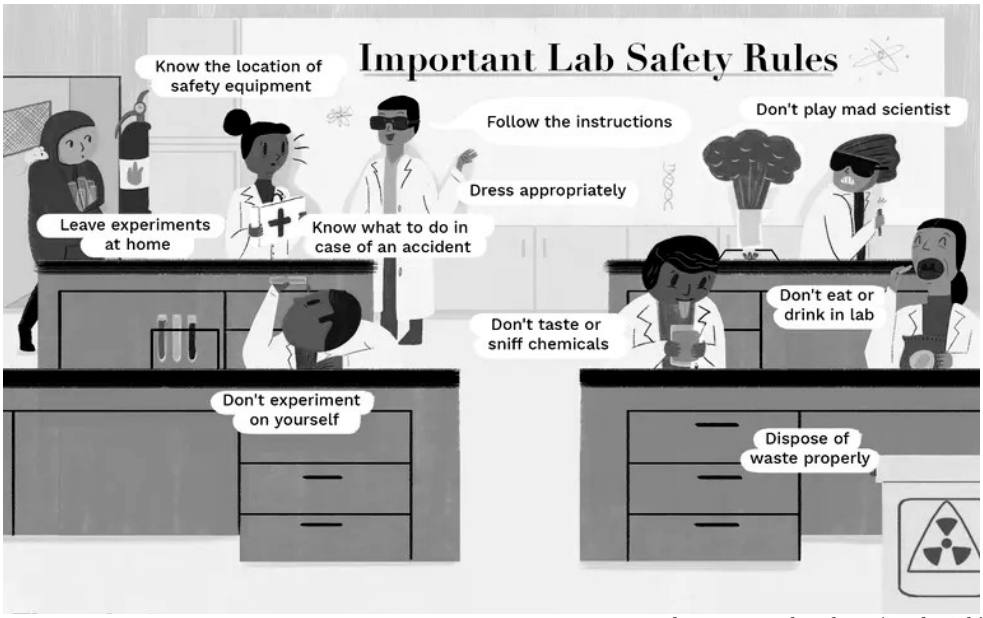


Photo source: ThoughtCo / Nusha Ashjaee

Revision of Safety Manual

Safety Manual will be reviewed whenever there is a necessity for a certain policy change.

A ***quick run through*** of lab safety rules/policies:

- Report "All" accidents, no matter how minor, to the Supervisor/Safety In- Charge immediately
- Do not work alone in the laboratory.
- Know the location of the (i) "**Emergency Exits** in the lab and instrument room and (ii) **fire extinguishers**.
- Student with medical/Health concerns should seek the advice of a Doctor before attending labs.
- Wear safety goggles and lab coat at all times. If you have spilled chemical in your eyes, flush with water in an eye wash station for 10 to 15 minutes. Use safety shower in case of chemical spillage on body. Notify the incident to Supervisor and Safety In-Charge.
- Always wear full sleeves and a lab coat while working in the lab
- Wear appropriate shoes while working in the lab. Feet must be adequately covered. Open toed shoes or sandals are not permitted in the laboratory.
- Confine long hair whenever working in the laboratory.
- NO tobacco products in the laboratory.
- Ensure safe handling of chemicals by referring to Material Safety Data Sheet (MSDS) or ask the supervisor
- Report all spills especially mercury spill to Supervisor and Safety in Charge.
- Segregate the waste solvents and solid wastes appropriately for proper disposal.
- Do not use broken or chipped glassware and dispose them in the glass disposal box.
- Used syringe needles should be dropped in syringe disposal box, and do not dump waste paper in the broken glass/needle disposal boxes.
- Do not perform unauthorized experiments in the lab.
- Avoid crowding in lab benches (not more than **6** in each work bench)
- Do not use earphones/headphones while working in lab
- Follow all the special instructions and be careful while handling & disposing bio hazardous samples.

XII. Committees

Institutional BioSafety Committee:

1. Director- Chairman
2. Dr. Debajit Thakur- member Secretary
3. Dr. Pranita Saikia- Biosafety Officer
4. Dr. Probodh Borah- Expert
5. Dr. M. R. Khan- Member
6. Dr. Romi Wahengbam- Member
7. Dr Rajlakshmi Devi- Member
8. DBT nominee

Bioethics Committee

Chemical Safety committee

Radiological Safety Committee:

XIII. Emergency contact numbers

1. Estate Management Consultant (EMC)- 94018-86403
2. Registrar- +91-361-2273061/9435402190
3. Medical Consultant (IASST)- 9957491652
4. Dy. Registrar (Academic)- 9402148997
5. Head PSD- +91-361-2270095
6. Head LSD- +91-361-2273200
7. Head CCNS- 9864022447
8. Fire Service- 0361 227 9907 (ISBT)
9. Police Helpline- 0361 227 0151 (Gorchuk)
10. Ambulance- 108