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GLORIOUS YEARS OF EXCELLENCE
(1950 – 2025)

SAFETY MANUAL

CSIR-Central Glass & Ceramic Research Institute
196 Raja S C Mullick Road, Kolkata- 700 032

Dear All,

On behalf of CSIR-CGCRI family and on my personal behalf, I welcome you to read and understand the safety related guidelines.

Professionally, we are committed to having creativity and a passion for scientific discovery while maintaining highest degree of safety at all times. Here at CSIR-CGCRI, safety is an integral part of research; and all researchers, be it students or Technical Officers/ Technicians or Senior Scientists. All researchers of CSIR-CGCRI are responsible to strictly follow the safety and emergency protocols at all times, in order to ensure a safe working environment for all. A safe office environment starts with everyone being aware of potential hazards and following safety guidelines. I would like all of you to focus on keeping a clean workspace, reporting unsafe conditions, and using personal protective equipments (PPE), appropriately.

The ultimate responsibility of performing any experiment safely within the laboratory resides primarily with the experimenter herself/himself. The suggested guidelines can help prevent and mitigate accidents and minimize risk, which in turn support employee well-being and workplace effectiveness.

I hope that we will work together to make CSIR-CGCRI, a national institute of excellence with the best safety practices.

Whether you are working in research, technical services, or administration, your contributions will play a key role in shaping the future of advanced materials in India and beyond.

With best wishes,

[Bikramjit Basu]
Director

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SAFETY MANUAL

Version 2.0

This document contains safety protocols to be followed in all laboratories of CSIR-CGCRI. It also enlists steps to be taken during emergencies and all emergency contact telephone numbers.

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Safety Security and Disaster Management Committee, CSIR-CGCRI

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CSIR - Central Glass & Ceramic Research Institute (CSIR–CGCRI)

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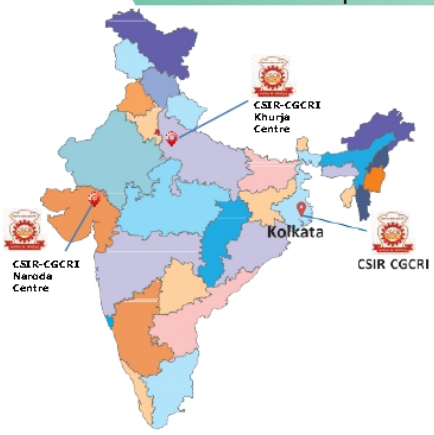
Key Facts:

* Established in 1950
* The only national lab with core competence in ceramics and glass for traditional to technologically challenging applications

Highlights:

Contribution in –

* Advanced Ceramics and glasses for strategic sectors
* Green energy technologies
* Ceramic membranes for water filtration
* Fiber lasers and sensors
* Skill development in potteries, tiles, clay products



Key Research Areas

- Advanced Ceramics & Composites
- Biomaterials & Medical Devices
- Energy Materials & Devices
- Fibre Optics & Photonics
- Functional Materials & Devices
- Membrane & Separation Technology
- Refractory & Traditional Ceramics
- Specialty Glass
- Multiscale Microstructure & Mechanics of Materials

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1. Introduction

The aim of this safety manual document is to spread awareness among all researchers of CSIR-CGCRI regarding the safety and emergency protocols to be followed at all times in order to ensure a safe working environment for all. The aim is to provide general guidelines about safe working practices to be followed to reduce chances of injury or illness of laboratory workers. Each Division of CSIR-CGCRI should have a copy of the Safety Manual available at an accessible place.

Although an attempt has been made to cover a wide variety of laboratory hazards, the document cannot cover each and every hazard and emergent situation that might arise during working in a laboratory. All users are instructed to be alert and vigilant while conducting experiments. The ultimate responsibility of performing any experiment safely within the laboratory resides primarily with the experimenter herself/himself.

CSIR-CGCRI needs to use several hazardous chemicals, high temperature furnaces, as well as precision equipments for its work mandate. The Institute allows us to work with considerable degree of autonomy within the laboratory and expects us to maintain the highest standards of safety at all times. Consistent and wilful violation of safety protocols could be penalized.

Safety is an integral part of research; and all researchers, be it students or Technical Officers/ Technicians or Senior Scientists. All are expected to remain vigilant regarding the safety of manpower and equipments.

Remember: Majority of laboratory accidents are avoidable and occur due to human carelessness or lack of knowledge about safe laboratory practices. Your alertness could save a life.

This safety manual provides general guidance and recommendations for safe practices. Laboratory-specific critical experiments may require separate safety protocols which should be strictly followed. It is the users' responsibility to ensure their own safety and the safety of their co-workers and to follow all applicable safety regulations and procedures.

2. General safety

This section enumerates few safe practices to be followed while working in any laboratory at CSIR-CGCRI.

2.1 Safe Laboratory Practices

1. The Head of the Division (HoD) is responsible for the overall safety of their whole group. Besides, each laboratory should have an overseeing Scientist who is responsible for ensuring safety in all day-to-day activities within the lab. Each laboratory should have a safety manual displayed as per the requirements at a prominently visible area.
2. All new users should be given training before starting work in the laboratory. Existing users should also be trained whenever any new equipment is installed or a hazardous chemical is introduced in the lab.
3. Equipment's in safe operating condition should be used. All equipment's that are malfunctioning, unsafe or undergoing maintenance should be clearly labelled as shown below.

4. Before undertaking a new experiment, please read the respective material safety datasheet (MSDS) of new chemicals and the user manual of the equipment. If in doubt, consult your lab in-charge before you start the experiment.
5. Emergency equipment, such as fire extinguishers and First-aid kits should be placed at easily visible and accessible locations and should be in proper working condition. Ensure that all items in First-aid kits are within their expiration date.

6. No food or drink should be allowed inside the laboratory to avoid contamination and health safety and proper instruction should be there in front of laboratory entrance. Ensure that foods and drinks

are not stored in refrigerators used for storing chemicals. Label the refrigerator clearly with an appropriate sticker indicating "For Chemical Storage Only".

7. All labs must maintain a list of all emergency contact numbers displayed at a prominent location. Each laboratory must have a functional landline telephone with emergency phone number clearly displayed beside the landline phone.
8. No cell phone or ear phone usage in the active portion of the laboratories, or during conducting of experiments to avoid distraction.

9. Never work alone in a lab after normal working hours or on weekends. You should always have another co-worker around who can take prompt action in case of any accident.
10. Keep all workbenches free from clutter. Put back all containers of chemicals or labware in their proper places after each use
11. Tie long hair, and do not wear loose-fitting clothes or dangling jewellery in the lab as these may snag and get pulled in moving machinery. Also avoid using body spray, cosmetics when you are working in the laboratory.

12. Always wash your hands properly with soap after working with chemicals.
13. Wear proper gloves as per work requirement, such as nitrile gloves while working with chemicals, heat-resistant gloves while working with furnaces and ovens and cryogen gloves while handling liquid nitrogen or liquid helium, etc.
14. Wear full-sleeve aprons, safety goggles, face shields and covered lab shoes while working with chemicals. Properly mark and store your personal protective equipment (PPE) at the designated place inside the laboratory. Avoid using PPE assigned to your lab mates.




r r t ent should be certification, l quipment.

16. Ensure that all laboratory buildings are equipped with a proper earthing system. Additionally, an emergency electrical switch must be installed to prevent any unwanted incidents.

3. Laboratory chemicals: safe handling and dealing with emergencies

A wide variety of hazardous chemicals are used in the laboratories of CSIR-CGCRI. Therefore, all users are expected to study relevant MSDS documents of the chemicals and be aware of potential hazards before starting an experiment. The main routes of entry of chemicals into the human body are through inhalation into the lungs, ingestion through mouth and absorption through bare skin.

3.1 Basic Safety Rules

Basic safety rules for laboratory conduct should be observed whenever working in a laboratory. Some of the most common safety rules are listed below:

- Know locations of laboratory safety showers, eye wash stations, and fire extinguishers.
- Know emergency exit routes.
- Avoid skin and eye contact with all chemicals.
- Minimize all chemical exposures.
- No horseplay will be tolerated inside the laboratory.
- Avoid distracting or startling persons working in the laboratory.
- All laboratory personnel should place emphasis on safety and chemical hygiene at all times.
- Do not taste or intentionally sniff chemicals.
- Never consume and/or store food or beverages or apply cosmetics in areas where hazardous chemicals are used or stored.
- Wash exposed areas of the skin prior to leaving the laboratory.
- No contact lenses should be worn around hazardous chemicals – even when wearing safety glasses.
- Laboratory safety glasses or goggles should be worn in any area where chemicals are used or stored. They should also be worn any time there is a chance of splashes or particulates to enter the

eye. Prescription glasses DONOT serve the purpose of high protection. Always wear safety goggles over your prescription glasses while working with hazardous chemicals. Closed toe shoes will be worn at all times in the laboratory. Perforated shoes or sandals are not appropriate.

- Clothing made of synthetic fibers should not be worn while working with flammable liquids or when a fire hazard is present as these materials tend to melt and stick to exposed skin.
- Laboratory coats should not be stored in offices or break rooms as this spreads contaminates to other areas.
- Use equipment only for its designated purpose. To prevent accidents, avoid using chairs with wheels when retrieving chemicals from the chemical rack.
- Hard copies of the Material Safety Data Sheets (MSDS) for all chemicals used in the laboratory should be organized and stored in a designated folder. This folder should be easily accessible to facilitate the identification of chemicals available in the laboratory and ensure safety and compliance.
- A chemical log book should be maintained in the following format

NO.	DESCRIPTION / Name	LIQUID / SOLID	CONTAINER TYPE & MATERIAL (box, bottle, jar, pail) (glass, metal, plastic)	SIZE EACH (oz, gal.,lbs.)	NUMBER OF CONTAINERS	MSDS Y/N	Supplier

- Assume that all chemicals of unknown toxicity are highly toxic.
- Post warning signs when unusual hazards, hazardous materials, hazardous equipment, or other special conditions are present.
- Combine reagents in their appropriate order, such as adding acid to water.
- Avoid adding solids to hot liquids.
- Never leave containers of chemicals open.
- Ensure all your reaction vessels are properly marked; specifically when it is unattended. All containers must have appropriate labels. Unlabeled chemicals should never be used. Ensure that no expired chemicals are used under any circumstances.
- If an unknown chemical is produced in the laboratory, the material should be considered hazardous.
- Exercise caution when handling Hydrofluoric Acid (HF), as it can cause severe burns and intense pain. Always wear gloves and a face shield to prevent accidents. Ensure that the first aid kit is stocked with appropriate ointments for treating HF exposure.
- Do not use mouth suction for pipetting or starting a siphon.
- Volatile or unstable materials should be stored in lab refrigerators in properly sealed containers.

- Procedures should be developed that minimize the formation and dispersion of aerosols.
- Do not pour chemicals down drains. Do NOT utilize the sewer for chemical waste disposal.
- Keep all sink traps (including cup sink traps and floor drains) filled with water by running water down the drain at least monthly.
- Do not utilize fume hoods for evaporations and disposal of volatile solvents.
- Perform work with hazardous chemicals in a properly working fume hood to reduce potential exposures. During using the fume hood, do not put your head inside the fume hood. Avoid keeping chemicals near the outer edges of the fume hood to avoid their falling on the laboratory floor.
- Access to laboratories and support areas such as stockrooms, specialized laboratories, etc. should be limited to approved personnel only.
- Designated and well-marked waste storage locations are necessary.
- Never carry bottles of chemicals by hand. Use bottle carriers or carts.
- Certain chemicals degrade certain container materials, ex. hydrofluoric acid degrades glass and cannot be stored in glass bottles; while organic solvents should be stored in fluorocarbon or glass bottles.
- Store larger or heavier bottles on lower racks.
- Toxic chemicals must be stored in ventilated cabinets.

3.2 Chemical Storage and Handling

There are many ways in which to work with chemicals to reduce the probability of an accident and to reduce the consequences of such an accident to minimal levels. Risk minimization depends upon safe practices, appropriate engineering controls, proper use of Personal Protective Equipment, the use of least quantity of chemicals necessary, and when possible, the substitution of hazardous chemicals. Essentially, chemical safety is inherently linked to other safety issues. By following a few simple guidelines, the risks associated with handling and storage of material within the laboratory can be reduced considerably.

- Laboratory workers should date containers with the day, month and year they are first opened and first received. This is required for materials that have potential to form organic peroxides and recommended for all other materials.
  - Laboratories should minimize chemical storage to only those chemicals which will be actively used. Laboratory doors should remain closed at all times.
  - Workers should not use chemicals or equipment if they have not been trained to do so.
  - Remember fume hoods are not for storing chemicals or waste, but meant for carrying out reactions.
  - Use appropriate symbols to store different chemicals as shown below:

- A liquid with a flash point below 60°C and a vapor pressure under 40 psi is considered flammable.
- A liquid with a flash point between 38°C and 94°C is classified as combustible.
- An oxidizer produces oxygen in chemical reactions, making fire burn much more vigorously.
- An oxidizer releases oxygen during chemical reactions, intensifying the combustion process and causing fire to burn more vigorously.
- Explosive materials are substances that can undergo violent reactions on their own, without requiring the presence of another chemical. These reactions are typically triggered by specific conditions such as moisture, heat, oxygen, or high pressure.

- Use the following chemical storage guidelines for work with specific chemical hazards:

Acids

- Store large bottles of acids on low shelves or on trays in acid cabinets or a cabinet marked "corrosives"
- Segregate oxidizing acids from organic acids, flammable and combustible materials.
- Segregate acids from bases, active metals such as sodium, potassium, magnesium, and other incompatible materials.
- Use bottle carriers or a cart to transporting acid bottles.
- Have spill control pillows or acid neutralizers available in the event of a spill. Do not use bases to neutralize acid spill.

Bases

- Segregate bases from acids and other incompatible materials.
- Store large bottles of liquid bases on trays in a cabinet marked "Bases" or "Corrosives".
- Store solutions of inorganic hydroxides in polyethylene containers.

- Have spill control pillows or caustic neutralizers available for caustic spills. Do not use acids to neutralize base spills.

Flammables

- Only store flammable liquids in a specially equipped flammable-safe refrigerator or flammables cabinet.
- Keep away from sources of ignition.
- Keep fire extinguishing and spill control equipment readily available.
- For flammable metals, have a Class-D fire extinguisher available. See “fire extinguishers” for more information.

Oxidizers

- Store in a cool, dry area
- Store away from flammable and combustible materials, such as paper, wood, etc.

Peroxide-Forming Chemicals

- Date the container when received and when opened.
- Store in airtight containers in a dark, cool, dry area.
- Check container for formation of peroxides, as needed, using appropriate indicator strips.
- Dispose of peroxide forming chemicals on or before expiration date or one year after opening, whichever is first.

3.2.1 Chemical handling guidelines

When working with chemicals:

1. Remove and use only the amount of chemicals needed for the immediate job at hand.
2. Properly seal, label, and store chemicals in appropriate containers.
3. Check stored chemicals for deterioration and broken containers.
4. Do not store chemicals near heat or sunlight or near substances which might initiate a dangerous reaction if combined.
5. Do not pour hazardous chemicals down sink drains.
6. Clean-up spills and leaks immediately, using only established spill procedures.

7. Be aware of emergency procedures which have implications for hazardous chemical exposures and spills.
8. Dispose of chemicals using only established disposal procedures.

3.3 Guidelines in case of laboratory emergencies

Regular laboratory inspection and equipment maintenance is beneficial to prevent laboratory accidents. However, once the emergency occurs, it is also essential to know what to do. Ensure your personal safety first and then call local emergency responders, when and if necessary. Alert people in the vicinity of the emergency and about its potential impact on them. Take proper actions to decrease damage or injuries The extent of your response will depend on the seriousness of the incident and documented laboratory protocols for dealing with such incidents. Stay calm and take proper actions according to the type and level of emergency. In case of chemical splashes on bare skin, the affected part must be immediately flushed under running water. If splash occurs on clothed body parts, the clothing is to be first removed, followed by flushing with running water. Chemical splash in the eyes should be treated with copious flushing of water. Refer to safety data sheets for more information. Seek medical assistance immediately.

Chemical Spills

Chemical spills are the most common accidents when working in a laboratory requiring chemicals. Improper or careless opening, handling, or storage of chemicals might lead to chemical spills. Large-volume spills of a non-hazardous chemical or even a small-quantity spill of a hazardous chemical spill might threaten the lives of laboratory personnel. Therefore, caution needs to be taken when working with chemicals and always wear proper personal protective equipment (PPE) to prevent bodily exposure.

1. Wear proper PPE first before taking any action. Care should be taken to avoid bodily exposure to chemicals.
2. If possible, modify the spill source to avoid further issues.
3. If possible, turn off any nearby heat or ignition source if the chemical is flammable.
4. Avoid breathing any vapours from spilled chemicals. This applies especially to chemicals that are toxic and volatile.
5. Locate the spill kit and use appropriate kit tools to confine and contain the spill area.
6. Use suitable adsorbent to cover the spill and neutralize the spill, if the chemicals are acidic or basic in nature.

7. Collect the residues and place them into in a suitable container.
8. Refill the spill kit.

4. Laboratory waste disposal

We should dispose off all chemical wastes as per Pollution Control Board rules. All spent chemicals should be put in suitable containers with screw-on caps and labelled clearly for disposal. As a general rule, store waste chemicals in similar type of containers in which it came packaged. Try to avoid large glass containers as they can easily shatter. Corrosive solutions (acids and alkalis) should not be stored in metal cans.

All hazardous chemicals are to be kept in the designated "Hazardous Chemical Store". Label all containers of hazardous chemicals clearly, such as corrosive acid, corrosive base, flammable, oxidiser, toxic, etc. CSIR-CGCRI enlists the services of a certified waste disposal vendor who collects the waste chemicals from time to time for safe disposal according to Government protocols.

5. Gases and cryogenics

Gas Safety

Compressed gases are stored under high pressure and may be inert, oxidizing, flammable, corrosive or toxic in nature. Thus appropriate caution should be exercised in handling, storage and transportation of gas cylinders. Main parts associated with pressure systems are gas cylinders, piping and hoses, pressure gauges and shut-off valves.

Hazards

Following hazards are associated with storage and handling of compressed gases in the laboratory:

1. Asphyxiation: Inert gases are colourless and odourless and hence often go undetected in case of leakages. They can quickly reduce the oxygen concentration in the vicinity to life-threatening levels and lead to asphyxiation of people working nearby.

2. Fire and explosion: Flammable gases, Hydrogen, Oxygen and other oxidizing gases can be potential sources of fire and explosion. Flammable gases can be easily ignited by an electric spark or open flame. Leakage of oxygen/ oxidizing gases will lead to the increase in oxygen concentration and faster rate of combustion and may cause fire hazard.

3. Chemical burns: Corrosive gases can cause serious damage to skin and eyes and can even attack fire-resistant clothing.

4. High pressure: All compressed gases are stored under high pressure in cylinders. A sudden release of pressure can cause serious damage to life and property by propelling the cylinder and great speed and force.

General Rules

1. All gas cylinders are to be clearly labelled. Flammable and toxic gases must be distinguishable by the colour tags and should be stored in segregated, well-ventilated areas. Appropriate gas sensors and alarms may be installed in such areas.

2. All cylinders should be kept chained individually to the wall either at half height or at one-third and two-third heights to ensure that they stay erect even in the event of failure of the cylinder valve.

Fig. Colour-coded gas cylinders in use

3. **Never** roll cylinders horizontally for transportation. Always use a cart to move it in a standing position.

4. Cylinders should not be located near any other potential hazards, such as fire or other heat sources, electricity, etc.

5. Always install gas cylinders with dedicated output pressure gauges and shut-off valves. This will enable to monitor line pressure and to turn off the gas supply during an emergency.

Fig. Gas regulator

6. Always use good quality piping, hoses and regulators of matched ratings to minimize chances of gas leakage.
7. Use only appropriate wrenches to open cylinder valves. Never use screwdrivers or pliers for this purpose.
8. Keep only minimum number of cylinders in the laboratory. Return empty or unused cylinders to Stores.
9. Get the gas lines tested for any leakage by an authorised person at regular intervals.
10. Inspect all piping at regular intervals and replace when necessary.
11. In case of leaking cylinders, move the cylinder to an isolated and well-ventilated area and inform the Gas Stores immediately.

Steps to use a gas cylinder

1. Attach a regulator that is specific to the particular gas to be used. Ensure that the threads of the cylinder outlet and the regulator inlet match properly. Never try to force mismatched threads.
2. Open the cylinder valve slowly until the inlet pressure gauge of the regulator shows the line pressure. If pressure is lower than expected, there might be a leakage at the cylinder outlet valve.
3. Open the flow control valve of the regulator until the desired delivery pressure is achieved.
4. Check for any leaks at all connections using soap solution.
5. When your job with the gas is done, close the cylinder valve and release the regulator pressure.

Cryogenic Safety

Cryogenic liquids are liquefied gases maintained under extremely low temperatures. Since these liquids are very cold and can expand to large volumes, they are categorized as hazardous. Special dewars and transfer cryocans are used for storing and handling cryogenic liquids.

Hazards

1. Extreme cold: Cryogenic liquids and their cold vapours can cause frostbite to human skin (cold burn). The skin appears waxy yellow. After initial contact, there is no pain, but extreme pain occurs when the frozen tissue thaws. Bare skin may stick to the metal cooled by these cryogenic liquids and the skin may tear when pulled away. Even brief exposure can cause serious damage to eyes. Prolonged breathing of very cold vapours can damage the lungs. Always use personal protective equipment such as face shields, gloves, apron, closed shoes, etc. while handling cryogens.
2. Asphyxiation: Vapours of cryogenic liquids are very cold and heavier than air. They tend to collect near the floor and displace the air present. Reduction in oxygen concentration in enclosed spaces may lead to asphyxiation and death. Small amounts of liquid can evaporate to very large volume of gases, eg. 1 lit. of liquid nitrogen can produce 695 lit. of nitrogen gas at room temperature (21°C).
3. Toxicity: Liquid carbon monoxide can release large amounts of CO gas, which can cause death almost immediately. Refer to the MSDS of each cryogen carefully before working with them.
4. Explosion: When cryogenic liquids are stored in containers without proper pressure relief devices, there can be enormous pressure build-up and result in "boiling liquid expanding vapour explosion". An external fire or break in the vacuum lining of the container can cause a rapid pressure rise which the pressure relief valves might not be able to handle. Therefore all containers must have another backup arrangement, such as a frangible or bursting disc.

General Rules

1. Use cryogenic liquids in a well-ventilated area.
2. Always wear proper personal protective equipment (PPE) while working with cryogenic liquids.
3. Use proper dewars and cryocans designed specifically for cryogenic liquids.

Fig. Liquid dewars of different capacities

4. Periodically inspect all containers and pressure relief valves for signs of defect and immediately remove defective containers from service.

5. Boiling and splashing of the liquids will occur while transferring to a warm container or while immersing an object into the liquid. These processes should be done slowly to minimize the boiling process.

6. Take care to avoid any direct contact with skin or eyes.

7. Never touch uninsulated metal pipes or vessels cooled by these liquids as unprotected skin may stick to these surfaces and result in flesh tears while pulling away.

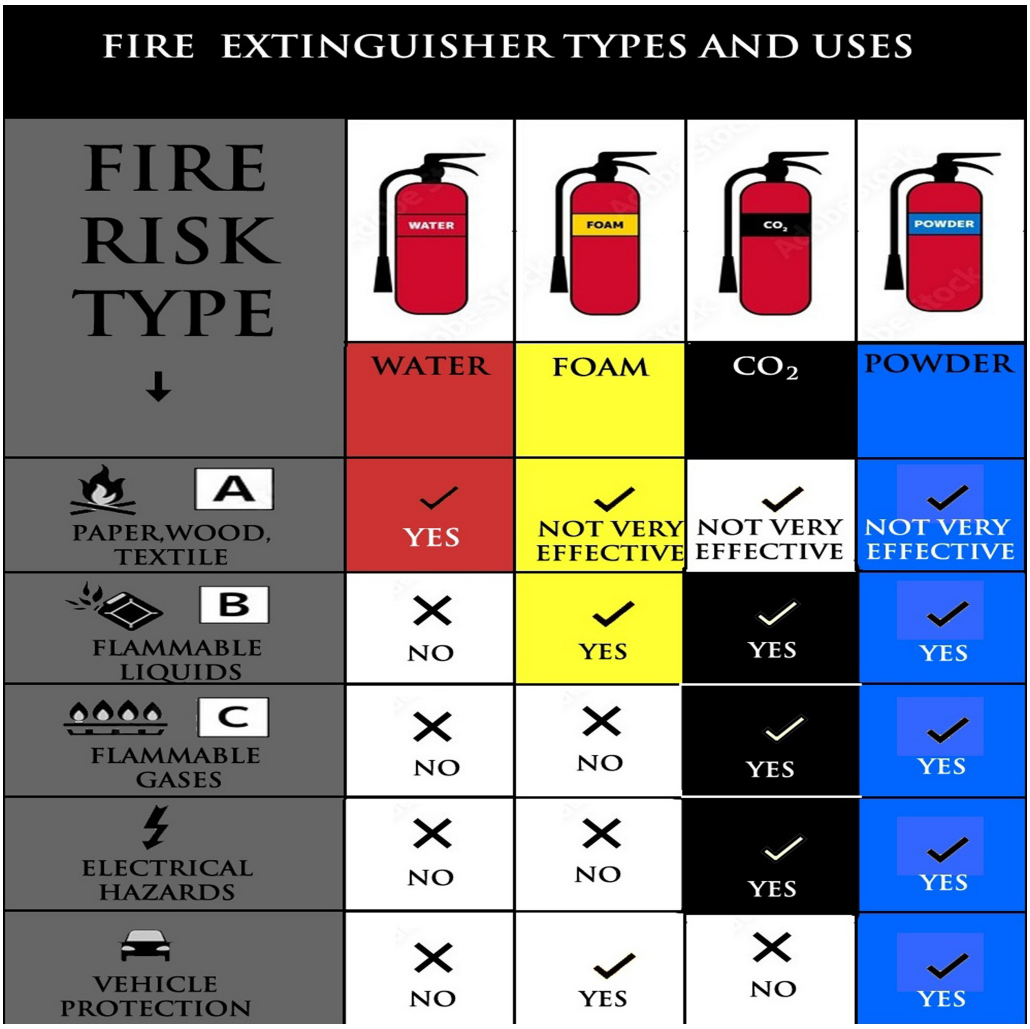
6. Fire and Electrical safety

The best defence against fire is to prevent it from starting. Everyone, including students, staff and contractual employees at CSIR-CGCRI are expected to know how to operate a basic fire extinguisher. Fire-fighting trainings are organized at regular intervals in the Institute and all members should participate and learn these basic skills. In case of fire, follow the evacuation plan as displayed in the building.

Fire extinguishers for Fire due to Electrical short circuit:

Fire extinguishers that are marked ‘suitable for use on electrical fires,’ are intended for use on circuits of a voltage lower than those encountered in traction, signal and industrial power supply installations. Fire extinguishers or fire hoses of any kind MUST NOT be used on live electrical apparatus in traction, signal and industrial power supply installations.

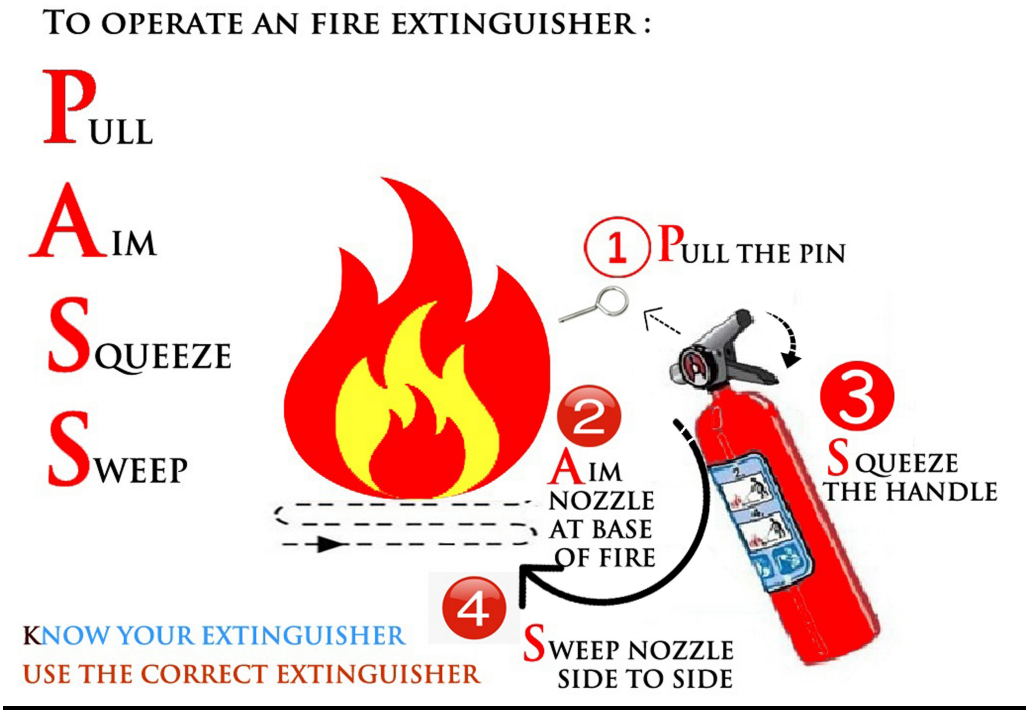
FOR EXTINGUISHING THE FIRE, Four main types of fire extinguishers are **water, foam, CO_2 and powder.** Each of the different types of fire extinguisher is suitable for different classes of fire.



At present, **Foam, CO_2 and ABC powder type fire extinguishers** are installed at designated areas of the CSIR-CGCRI premises.

Instructions for using fire extinguishers

- Sweep from side to side at the base of the fire – the fuel source – until the fire is extinguished.
- Never use a fire extinguisher on flames from a fire involving escaping gas only tackle a fire in its earliest stages.
- Do not move forward unless it is safe, and you should always remain at least one metre away from the fire.



Fire blankets, hoses and buckets

These methods of fire extinction are useful additions to extinguishers. Fire buckets can be used filled with water on Class A fires, or with sand to use as an absorbing agent for Class B fires, which are spilled flammable liquids. They must not be used with water on burning fat or oil or on electrical appliances. Fire hoses let out water at high pressure. They can be effective on Class A fires, but are very heavy. Fire blankets are effective in smothering small fires if a good seal is made, and for wrapping round people whose clothing is on fire. Made of fibreglass, they can withstand temperatures of up to 500° C and are compact and portable. They don't need any maintenance but can only be used once.

Electrical Safety:

Do's

1. Inspect electrical equipment before each use.
2. Report and electrical problems immediately.
3. Obey warnings to stay away from electrical circuits and locked-out equipment.
4. Read and follow manufacturer's instructions for safe use of electrical equipment.
5. Use extension cords only when authorized and of the right capacity.
6. Check cords and wires to make sure insulation is in good condition.
7. Keep Electrical equipments away from water.

8. Make sure there are no cuts or joints, cracks, abrasions on the cables or wires.
9. Ensure proper Earthing of electrical equipment.
10. Unplug or disconnect machines before servicing or repairing.

Don'ts

1. Run cords along the floor.
2. Touch anything electric with wet hands.
3. Put anything but a plug into an electrical outlet.
4. Leave machinery or electrical equipment running unattended after working hours.
5. Let cords get twisted or tangled.
6. Wear metal jewellery when working with electrical equipment.
7. Over Plug in a single outlet.
8. Use steel ladder during electrical works/connections.
9. Ignore any signs and electrical warnings.
10. Throw water towards electrical fires.
11. Bypass a safety device, such as, electrical fuse of equipment.

Work within electric and magnetic fields

Persons working within electric and magnetic fields shall be appropriately protected. This is due to electric discharge effects of strong electric fields, and the possible biological effects associated with extremely strong electric and magnetic fields. Persons using implantable medical devices, including cardiac pacemakers, should consult their doctors and the relevant organisational officer for information on possible electromagnetic interferences with the medical devices, prior to entering areas of strong electric and magnetic fields.

Unrestricted Less than	10 kV/m
Short term	10 kV/m to 30 kV/m
Alternative controls	Greater than 30 kV/m

No time limits apply for exposures below 10 kV/m. Short term exposure to fields from 10 kV/m to 30 kV/m is permitted, provided the strength (in kV/m) multiplied by the duration of exposure (in hours) does not exceed 80 for the whole day. For example, exposure to an electric field of 20 kV/m would be permitted for four hours. For work situations with field strengths greater than 30 kV/m, alternative controls shall be used. Such controls may include wearing appropriately earthed or bonded conducting suits, the screening and earthing of vehicles, the screening of work platforms and access ways, and de-energising adjacent electrical apparatus.

a. 50 Hz magnetic fields

Whole working day	0.5 milliTesla (5000 milliGauss)
Short term (Two hours per day)	5 milliTesla (50,000 milliGauss)
Limit for limbs (e.g. extended arm)	25 milliTesla (250,000 milliGauss)

b. Static or direct current (DC) magnetic fields

The 2009 International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines for limits a, b and c of occupational exposure to static or DC magnetic fields are as follows:

Head and trunk	2000 milliTesla
Limbs	8000 milliTesla

Notes:

1. Caution: due to the potential indirect adverse effects, ICNIRP recognises that practical policies need to be implemented to prevent inadvertent harmful exposure of persons with implanted electronic medical devices and implants containing ferromagnetic material. This requirement may lead to much lower restriction levels such as 0.5 milliTesla.

2. For specific work applications, exposure up to 8000 milliTesla can be justified, if the environment is controlled and appropriate work practices are implemented to control movement-induced effects.

Victim rescue

Persons shall be trained in victim rescue techniques appropriate to the job function being performed. Before performing victim rescue on or near live exposed conductors, the rescuer shall consider all hazards and methods to control the hazards to ensure the rescue can be performed safely. Immediately contact the Engineering Services Division (ESD) to arrange isolation or de-energisation of equipment, and wait for confirmation of de-energisation before attempting to move the victim. Victim rescue assessment and/or instruction shall be undertaken by relevant personnel in accordance with appropriate National Competency Standard Units.

Fire, smoke from high voltage apparatus

Breakdown of electrical equipment may result in fire and issue of a large amount of smoke. Fire or electrical breakdown of some types of electrical insulation may also result in release of toxic fumes. Fire extinguishers and hoses are not designed for use on live high voltage equipment. Immediately contact the ESD to arrange de-energisation and/or isolation of equipment

Negative and electrolysis return circuits

Consideration must be given when working on negative return circuits and electrolysis circuits, as hazardous voltages may be present in abnormal circumstances. Hence, some works on these circuits may need to be performed in accordance with the access authorities defined within these rules. Organisational procedures should be followed when working on such circuits.

7. Safe work practices with heavy machinery and furnaces

Do's:

1. Operation and maintenance manual must be made available near equipment/instruments. Read and understand them thoroughly before working on these machineries. Ask your supervisor in case of any doubt.
2. To be operated by trained persons only.
3. Follow proper SOP with startup procedure.
4. Display start up and shut down procedure in heavy equipment.
5. Check for proper earthing during installation and commissioning.
6. Proper safety precautions must be taken during operation of high temperature furnace such as safety goggles, heat protective face shield, recommended hand gloves, safety shoe and apron.
7. Proper exhaust /ventilation should be ensured during operation of high temperature furnace.
8. Proper ventilation shall be ensured in the UPS with large number of batteries.
9. Maintain recommended electric connection during installation of equipment. Ensure electrical circuit drawing is made available in operation and maintenance manual.
10. Maintain proper distance from rotating device or equipment and provide a shield to the rotating part/components. Only trained person should work on rotating equipment.
11. Follow proper procedure during maintenance of heavy equipment (more than **10 kW rating)** such as:
    a. Submit requisition for maintenance (to Electrical section)

b. Disconnect the electrical connection from main power prior to maintenance shut down (to Electrical section).

c. Place maintenance Tag during the period of maintenance.

d. Electrical section should restore electrical connection and then remove the Tag.

Don'ts

1. Do not allow unauthorized person near the furnace/ heavy equipment.

2. High power equipment should not be installed in single phase (that will create phase imbalance). Installation of such equipment should be carried out in prior intimation of Electrical Section.

3. Equipment should not be shut down by switching off directly from the electrical main (Push emergency button /follow emergency shutdown procedure if required).

4. Do not allow operation of furnace without safety precaution. Without using hand gloves, face shield, shoe etc. glass melting operation like batch charging, stirring, casting should not be performed.

5. Crowding during melting must be avoided. Keep only recommended person in the operation zone.

8. Biosafety guidelines: Mammalian Cells & Tissue Culture

Scope

In accordance with recognized biosafety standards and practices, the Biomaterials and Devices Division (BMDD) In vitro Tissue Culture Laboratory (ITCL) is classified as **Biosafety Level 2 (BSL-2) Laboratory**. All laboratory users and other personnel entering this BCCD-ITCL are required to know, understand the Biosafety Guidelines: Mammalian Cells (including human stem cells or primary cells) & Tissue Culture, follow safe operating procedures and practices described in this manual. All personnel, including Principal Investigator (PI) is required to conduct a risk assessment in support of any proposed work that is subject to review and approval by the Divisional Biosafety Officer (Dr. Vamsi Krishna Balla, vamsiballa@CSIR-CGCRI.res.in). All personnel must know and understand the potential biological and other hazards they might encounter, and be trained / qualified in appropriate safety precautions and procedures. Biological safety and laboratory operation training will be provided by Divisional Biosafety Officer and all users of the laboratory must demonstrate competence in laboratory safety, operations and policies before admittance to utilize the BCCD-ITCL facilities. This SOP provides guidance on conducting a risk assessment when the work

involves mammalian cell and tissue cultures. It also provides guidance on reducing risks of injury or exposure that may be identified through this process.

BSL-2 laboratories

Biosafety Level 2 laboratories are similar to general biological laboratories and are suitable for work involving agents that represent a moderate hazard for personnel and the environment. BSL-2 laboratories differ from general biological laboratories in that:

1. BSL-2 laboratory personnel have specific training in handling pathogenic agents and are directed by the principle investigator/laboratory manager.
2. Access to the BSL-2 laboratories is restricted to trained users only and is limited when work is being conducted. No unauthorized guests are allowed.
3. All BSL-2 laboratory users and other personnel must know, understand and follow all procedures and practices described within this manual. Also, must have knowledge on policies outlines in Divisional "Biosafety Manual" and other documents of BCCD-ITCL.
4. Conduct all procedures in certified biological safety cabinets or other physical containment equipment.
5. The following standard and special practices, safety equipment, and facilities apply to agents assigned to BSL-2:

Risk assessments

Following is a summary of considerations during the risk assessment process, which will result in an initial determination of the appropriate containment level to be selected for cell and tissue culture work. In general, potential presence of pathogenic agents must be considered, whether arising from the cells themselves or introduced through laboratory practices. Potential for pathogenic agents is of utmost concern.

1. **Species of the source cells.** The closer the genetic relationship of the cell line to humans, the higher the risk to humans. This concept is based on host range and human immunologic response factors. In decreasing order of risk: human heterologous > nonhuman primate > other mammalian sources > avian > invertebrate. Exceptions must be kept in mind, for example: lymphocytic choriomeningitis virus in rodent cells or, rabies virus infected canine cells, which would increase the risk.

2. **Tissue type of origin.** In decreasing order of risk: pluripotent stem cells > hematogenous cells and tissue, (blood, lymphoid tissue) > neural tissue > endothelium > gut mucosa, epithelial cells > fibroblasts.

3. **Culture type.** In decreasing order of risk: whole tissue > primary cell cultures > continuous cell lines (immortalized cells),> intensively characterized cells (including human diploid fibroblasts). Commercial suppliers will often provide biocontainment recommendations based on characterization of the cells. When manipulating primary human cells, risk assessments should also consider presence of recombinant or synthetic nucleic acids or vectors (along with subsequent product), the quantity of cells per specimen, the number of specimens from different individuals, and the level of risk represented by the population from which specimens are obtained.

4. **Media.** Cell culture media or supplements derived from humans or animals may have contaminants. When purchasing media or media supplements, such as animal serum, a reliable vendor is recommended to minimize the occurrence of contaminants. Consult the supplier's Certificate of Analysis to verify testing against toxins, mycoplasma, other viruses (Hepatitis-B, Rabies, etc.) or prions. Always prepare media aseptically, adhering to appropriate administrative and engineering controls.

5. **Growing conditions.** Changes in temperature, supplements, or growth surfaces can induce changes in oncogene expression, induce expression of endogenous viruses, or alter interactions between recombinant virus and endogenous genomic provirus.

6. **Viral Contamination.** The presence of viruses and/or viral genetic material used with a cell line must also be considered when selecting an appropriate containment level.

7. **Blood-borne Pathogens.** The Occupational Safety and Health Administration (OSHA) standard for Bloodborne Pathogens (BBP) (29 CFR 1210.1030) may apply to PIs and laboratory workers who handle human cell lines and animal cells intentionally infected with Bloodborne pathogens.

Standard safe microbiological practices

1. Access to the BSL-2 laboratory is limited or restricted when the work is in progress. Laboratory doors are kept closed when experiments are in progress. Do not leave doors propped open.
2. Work surfaces are decontaminated at least once a day and after any spill of bio-hazardous material.
3. All contaminated liquid or solid waste is decontaminated before disposal.
4. Mechanical pipetting devices are used; mouth pipetting is prohibited.
5. Eating, drinking, smoking, chewing gum or tobacco, and applying cosmetics or contact lenses are NOT permitted in the laboratory.
6. Persons must wash their hands before and after handling bio-hazardous agents and when entering and leaving the laboratory.
7. All procedures are performed carefully to minimize the creation of aerosols.

Laboratory clothing requirements

1. Laboratory coats and disposable gloves must be worn in this BSL-2 laboratory and must stay in the laboratory. The laboratory clothing or gloves must not be worn in non-laboratory areas such as corridors or galleys.
2. Minimal Personal Protective Equipment requirements are: a lab coat, gloves, goggles and mask.
3. Long hair must be pulled back (or use hair net) so that it is not obstructing the eyesight of the user and so that no loose hair can contaminate the work area.

Material handling

1. Contaminated materials leaving the labs must be bagged and kept outside the laboratory.
2. All items must be transported in and out of the lab in specially designated transfer chamber available in this BSL-2 laboratory.
3. All containers and items must be disinfected with a spray of 70% ethanol or an alternate disinfectant before they are used in biological safety cabinet or taking out of the laboratory.

Special practices

1. Waste materials for BSL-2 laboratory must be placed in a leak-proof container and closed before it can be removed from the laboratory for decontamination in other area.
2. When experiments are being conducted access to the BLS-2 laboratory is limited. Children, pregnant women, and individuals who are immuno-deficient or immuno-suppressed are not allowed in the laboratory. The lead laboratory personnel have the final responsibility for determining the access to the laboratory.
3. The lead BSL-2 laboratory personnel assure that only persons who have been advised of the potential hazard and who meet any specific entry requirements enter the BSL2 laboratories.
4. All laboratory access doors and other items such as equipment, containers, and materials, must posted with a hazard warning sign with universal biohazard symbol. The main access doors of the laboratory must list the name of the laboratory supervisor or other responsible person(s), and indicate any special requirements for entering the area (personal protection, respirators, etc.).
5. All wastes from laboratories must be appropriately decontaminated before being disposed.
6. Gloves must be worn for all procedures performed in the biological safety cabinets and when handling other tissue culture reagents/chemicals in BSL-2 laboratory. The used gloves must be disposed of as biohazardous waste.

7. All spills, accidents, and obvious or potential exposures to bio-hazardous materials must be immediately reported to the laboratory supervisor or other responsible person(s).
8. All work involving human derived materials including blood, tissues, primary cells and other human bodily samples must be reported to the laboratory supervisor or other responsible person(s) prior to being transported or used in the BCCD-ITCL. A special set of rules apply for these types of work.
9. A safety and operations document identifying known and potential hazards and which specifies practices and procedures to minimize or eliminate such risks is available on the inside face of the lab doors. Personnel are advised of special hazards and are required to follow standard practices and procedures.

Containment equipment

1. Biological safety cabinets (Class II) and other appropriate personal protective must be used all procedures such as centrifuging, blending, vigorous shaking or mixing, opening containers of bio-hazardous materials, handling animal/human derived tissue and bodily fluid samples.
2. All sharps such as needles, glass slides, cover glasses and chips must be put in the sharps bio-hazardous waste disposal containers.

Spills

1. Small amounts (50 milliliters or less) of less concentrated bio-hazardous spill can be cleaned by the user with gloved hands. Notify the other lab users present in the lab of the spill. Use a spray disinfectant such as solution of 10% bleach in water on the spill and place a sheet of absorbent paper on the spill. Leave the disinfectant for 15 minutes then clean the surface with absorbent paper again and discard it in regular waste. Remaining bleach residues can be removed with 70% ethanol wipes. Discard all your gloves in bio-hazardous waste and wash your hands.
2. If the amount of spill is high or the agents are highly concentrated and there is a potential risk for aerosolization, spray the spill with 10% (or full strength) bleach quickly, notify others in the lab, leave and call CSIR-CGCRI safety staff immediately. Emergency contacts are listed on the lab door posts. Air circulation might need to be stopped and also whole room disinfection may need to be performed.
3. Contaminated instruments can be sterilized either by autoclaving (preferred) or by chemical disinfection such as 10% bleach (minimal contact time 10 minutes) and the bleach residues can be removed with 70% ethanol wipe.

Bio-hazardous waste disposal

1. For the treatment of biohazardous materials prior to their disposal, please review Divisional "Biosafety Manual" available in the laboratory.
2. When the bio-hazardous waste bag/container is 2/3 full, change it. Tie the top of the bag and replace the old bag with a new one then transport the old full bag into the autoclave room. If there is a risk for leakage from the bag, then double bag the bio-hazardous waste. Once the autoclaving is complete and the containers are cool dispose them of in the regular trash.
3. Full sharp bio-hazardous waste boxes should be autoclaved.

Emergencies/Injuries

1. For emergencies and urgent medical needs, Call CSIR-CGCRI Security Office immediately.
2. Contact in-charge of the research or the contact person from the "Door Post" and report the incident.
3. You may also send an email to vamsiballa@CSIR-CGCRI.res.in or sbodhak@CSIR-CGCRI.res.in or contact Dr. Subhadip Bodhak, Mobile: 8910902562 for further clarification or suggestions.

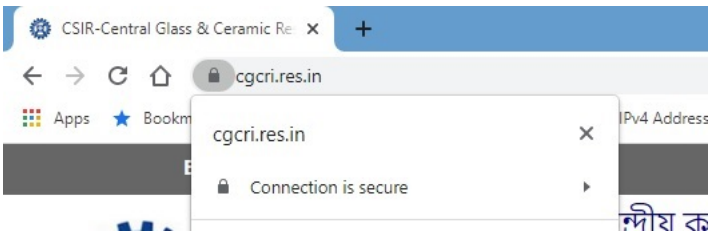
9. Cyber security

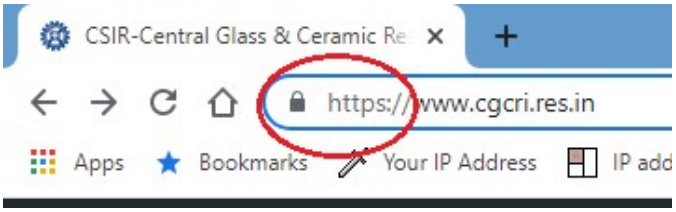
With the advent of Information Technology, it is nearly impossible to run any organisation without computers and the Internet. This has given rise to incidents of cyber fraud/crimes. Cybercrime is any criminal activity that involves a computer, networked device or a network. Cases of identity theft, malware attacks, ransomware attacks, copyright infringements, theft and sale of organisational data, cyber spying are not unheard of anymore. Cyber security is the protection of computer systems and networks from these cyber crimes. Some safety tips are listed below:

DO's

- Create strong passwords that are at least eight characters long using uppercase letters, lowercase letters, numbers, and special characters.
- Avoid creating common passwords such as your name, DOB, family member's names, address etc.
- Always use different passwords for different accounts. If one password gets hacked, your other accounts are not compromised.
- Change passwords every 45 days.
- DO keep your passwords or passphrases confidential. DON'T share them with others or write them down. You are responsible for all activities associated with your credentials.

- Perform regular backups of important data and maintain an offline backup of your critical data.
- Download and install open-source software only from online sources you trust. Further, use authorized and licensed software only.
- Close windows containing pop-up ads or unexpected warnings by clicking on the "X" button in the upper most right hand corner of that window, not by clicking within the window. Turn on pop up blocker settings on the web browsers for both your computer and mobile devices to prevent pop ups in the future.
- Install enterprise antivirus client offered by the government on your official desktops/laptops. Ensure that the antivirus client is updated with the latest virus definitions, signatures and patches.
- Keep your Operating System and BIOS firmware updated with the latest updates/patches.
- All portable media such as USB drives and DVDs must be scanned for malware.
- Learn about Phishing Scams – be very suspicious of emails, phone calls, and flyers. The attacker may pose as someone or something the sender is not to trick the recipient into divulging credentials, clicking a malicious link, or opening an attachment that infects the user's system with malware, trojan, or zero-day vulnerability exploit. This often leads to a ransomware attack.
- Disable GPS, bluetooth, NFC and other sensors when you don't need it. Devices can be hacked via these features and subsequently your private information can be stolen.
- Make Sure Your Internet Connection is Secure. Use a Secure VPN Connection.
- Use a Standard User (non-administrator) account for accessing your computer/laptops for regular work.
- While performing online purchases, banking or paying bills online, check if the website's URL begins with 'https' instead of 'http'. Also, look for the padlock icon, which indicates that the connection is secure and encrypted.





- Make Online Purchases from secure sites. Any time you make a purchase online, you need to provide credit card or bank account information—just what cybercriminals are most eager to get their hands on. Only supply this information to sites that provide secure, encrypted connections.
- Avoid saving your credit/debit card information on websites and web browsers.
- Observe caution while opening any shortened uniform resource locator (URLs) (ex: tinyurl.com/ab534/).
- Observe caution while opening any links shared through SMS or social media, etc., where the links are preceded by exciting offers/discounts, etc., or may claim to provide details about any current affairs. Such links may lead to a phishing/malware webpage, which could compromise your device.
- Be aware of your surroundings when printing, copying, faxing or discussing sensitive information. Pick up information from printers, copiers, or faxes in a timely manner.
- Use two-factor or multi-factor authentication, wherever available as it adds additional layers of security to the standard password method of online identification.
- Save your data and files on the secondary drive (ex: d:\).
- When you leave office, ensure that your computer and printers are properly shutdown.
- Setup unique passcodes for shared printers.
- Download Apps from official app stores of Google (for Android) and Apple (for iOS). Before downloading an app, check the popularity of the app and read the user reviews. Observe caution before downloading any app which has a bad reputation or less user base, etc.
- Adhere to the security advisories published by NIC-CERT and CERT-In.
- Always log out of online accounts when you are done. This is especially important when you are using a public computer.

- Always use Uninterruptible Power Source (UPS) for running a computer as it not only protects unsaved data from getting lost during a power outage but also protects the system from crashing during lightning to certain extent.

- Report suspicious emails or any security incident to IT Department.

DON'Ts:

- Never select the "Remember My Password", 'Keep me logged in' or 'Remember me' option on a shared or an unlocked computer.

- Don't write down any passwords, IP addresses or other sensitive information on any unsecured material such as sticky notes etc.)

- DON'T post any private or sensitive information, such as credit card numbers, passwords or other private information on public sites, including social media sites and DON'T send it through email unless authorized to do so. Use privacy settings on social media sites to restrict access to your personal information.

- Do not leave your device unattended without a screen lock or logging out.

- Never reply to e-mails requesting financial or personal information. Avoid making financial transactions in an unsecure network and public WiFi.

- Do not connect personal and unsecured devices to Institute's LAN.

- Do not install P2P file sharing programs which can illegally download copyrighted material such as µTorrent etc.

- Do not install and/or use pirated copies of software and Operating Systems.

- Don't upload or save any internal/restricted/confidential government data or files on any non-government cloud service (ex: google drive, dropbox, etc.).

- Don't use any 3rd party anonymization services (ex: Nord VPN, Express VPN, Tor, Proxies, etc.).

- Don't use any 3rd party toolbars (ex: download manager, weather tool bar, askme tool bar, etc.) in your internet browser.

- Don't use any unauthorized remote administration tools (ex: Teamviewer, Ammy admin etc.)

- Don’t use any unauthorized 3rd party video conferencing or collaboration tools for conducting sensitive internal meetings and discussions.
- Don’t use any external email services for official communication.
- Don’t use any external mobile App based scanner services (ex: Camscanner) for scanning internal government documents.
- Don’t use any external websites or cloud-based services for converting/compressing a government document (ex: word to pdf or file size compression).
- Avoid visiting inappropriate websites or websites that you are not fully aware of.
- Disable automatic file and media sharing and download as far as possible.
- Don’t jailbreak or root your mobile phone as it disables some of the built-in security features of the operating system.

10. LASER Safety:

LASER, an acronym for *Light Amplification by Stimulated Emission of Radiation,* is a crucial tool in modern scientific laboratories. Many machines incorporate lasers either as integral components or as standalone instruments. The primary characteristics that distinguish lasers are their monochromatic nature and coherence. Additionally, with proper collimation, laser light can travel long distances with minimal beam divergence, setting it apart from regular light sources.

Lasers are categorized based on several factors, including nature laser active medium (solid state, Excimer, Dye, Gas and Diode based), average power (low, medium, or high), operating wavelength (UV-Vis, IR, or NIR), mode of operation (continuous-wave [CW] or pulsed), and beam quality (single-mode or multimode). They are widely used across diverse fields such as modern science, biomedical research, industrial applications, and strategic sectors.

Laser Safety Guidelines for High-Power Laser Labs

Adhering to stringent safety protocols is essential when working with high-power lasers to ensure the safety of personnel and equipment. Below are the recommended measures for maintaining a safe laser-controlled environment:

1. **Authorized Access and Documentation**
    - Maintain an authorized *Laser User Notebook* for high-power laser labs.

- Strictly follow the user manual during all laser operations.

2. **Warning Systems and Access Control**
   - Ensure that "LASER ON" warning lights are activated whenever the laser is in use.
   - Install a door interlock system to restrict access to the high-power laser lab, preventing unauthorized personnel from entering the controlled area.
   - Display appropriate laser warning signs prominently at all entrances to the lab.

3. **Workspace Safety**
   - Remove all objects that could interfere with the beam path or pose a hazard.
   - Be vigilant about specular and diffuse reflections that could redirect laser beams unpredictably.
4. **Personal Safety Measures**
   - Use appropriate protective eyewear designed for the laser's specific wavelength and Optical Density (OD).
   - Ensure adequate skin protection against potential laser exposure.
   - Remove jewelry, ties, and any loose or dangling clothing or objects.
5. **Pre-Operation Checks**
   - Double-check all safety systems and confirm their functionality before powering on the laser.
   - Turn the key control switch to the “ON” position and follow the manufacturer’s recommended procedures for operation.
6. **Beam Alignment and Control**
   - For invisible laser beams, use suitable devices like IR viewers or alignment cards to locate the beam.
   - Operate the laser at the lowest possible power level during beam alignment.
   - Use beam blocks or protective barriers to prevent stray beams from entering uncontrolled areas.
   - Employ shutters or beam blocks behind optics to ensure stray beams do not escape during alignment.
7. **Beam Path Management**
   - In high-power application, proper precaution should be taken to terminate all beams and reflections.

- Maintain the beam path above or below eye level for both standing and sitting positions.
- Enclose the laser in a protective housing to minimize exposure risks.

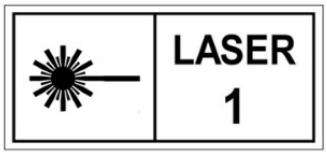
8. **Control Mechanisms and Barriers**
    - Use a master switch (key or coded access) to control the initiation and termination of the laser beam.
    - Install viewing windows and diffuse display screens to keep radiation levels below the Maximum Permissible Exposure (MPE) limit.
    - Utilize visible or audible warning devices, such as a single red light on the laser or control panel, to indicate the laser is active.
    - Ensure the warning light signal is visible through protective eyewear.
    - Use black curtains, screens, or blocking barriers to prevent the laser beam from exiting the controlled area.
9. **Operation Restrictions and Supervision**
    - Repairing and maintenance of Class 3B and Class 4 lasers should be performed only by trained and authorized personnel.
    - Spectators are permitted in the laser-controlled area only with the explicit approval of the laser supervisor.

By following these safety measures, laser-related risks can be minimized, creating a safer working environment for all personnel.

Classifications of Lasers and their safety:

Class 1:

This type of Lasers is safe since they are either have very low power or they are enclosed completely which cannot be accessed at normal condition.



Class 1M

Laser products operating within the wavelength span of 302.5 nm to 4000 nm, with output levels exceeding the standard limits for Class 1 laser products, are classified as Class 1M. These lasers are considered safe for normal use due to their low power density and compliance with Class 1M measurement standards.

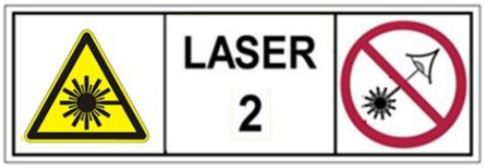
However, they can become hazardous if their beams are viewed through collimating optical instruments, such as binoculars or telescopes, which can concentrate the beam and significantly increase its intensity. Appropriate safety measures should be implemented to mitigate this risk.

Class 1C

Instrument or product specifically intended for direct contact with the skin or tissue, where ocular hazards are mitigated through engineering safeguards, is classified in this category. These safeguards ensure that the accessible emission is either clogged or abridged to below the Class 1 accessible emission limits when the instrument/product is detached from contact with the skin or tissue, thus preventing any potential eye hazards during operation.

Class 2

Lasers that operate in the visible region (400-700 nm) with output levels below the Class 2 accessible emission limit (AEL), are considered safe for accidental viewing. The eye's natural aversion responses, such as the blink reflex, provide sufficient protection against potential hazards.



Class 2M

1. Any instrument or product using Class 2M generally operate in the visible region (400-700 nm) whose total output can cross the limits typically allowed for Class 2 lasers, but operating at low power level, are considered harmless for accidental viewing during regular routine use. These lasers comply with the measurement conditions for a Class 2M product. Nonetheless,

they can pose a risk to the eyes under certain conditions if some optics are used to view them directly. Under these circumstances, eye protection is necessary to prevent potential harm.

Class 3R

In Class 3R Lasers, laser light emitting in the wavelength range of 180 nm to 1 mm pose a potential hazard for direct intrabeam viewing, though it exhibits less damage compared to that of Class 3B lasers. These lasers are subject to fewer manufacturing requirements and can be used with lesser stringent precautionary measures compared to class 3B lasers. Conventionally AEL for these lasers is 5 times compared to Class 2 laser operating at visible wavelengths more than 5 times than Class 1 operating in other wavelengths.

Class 3B

This particular class of lasers are generally hazardous under direct intrabeam exposure, specifically if the distance is less than the Nominal Ocular Hazard Distance (NOHD) or radiant exposure exceeds the Maximum Permissible Exposure limits are known as Class 3B lasers. However, viewing diffuse reflections is generally considered safe.

Class 4

This class is the most hazardous one and beyond AELs of class 3B that can produce hazardous diffuse reflections leading to skin injuries, a fire hazard, can produce hazardous fumes along with harmful hazard to the eyes. Accordingly using class 4 laser needs extreme attention.

Values of AELs:

For He-Ne lasers operating at 633 nm in CW mode with narrow beam the AELs values are as follows and can be typically apply to any other laser operating in the visible range (400-700 nm):

- For class 1 and 1M: Power is ~ 0.39 mW
- For class 2 and 2M: Power is ~ 1 mW
- For class 3R: Power is ~ 5 mW
- For class 3B: Power is ~ 500 mW

The potential hazards other than optical hazards are as follows:

• **Electrical Hazards** – High voltages and capacitors associated with pulsed lasers can pose significant risks, particularly during maintenance and servicing.

• **Radiation Hazards** – These involves x-rays, ultraviolet (UV), radiofrequency (RF), visible, and infrared (IR) radiation.

• **Fume Hazards** – Some fumes can form from burning of chemicals or other during surgery.

• **Fire and Explosion Hazards** – This is caused by Class-4 lasers only.

• **Mechanical Hazards** – Risks include handling gas cylinders, tripping on trailing cables or cuts from sharp objects.

• **Noise Hazards** – Some lasers, especially pulsed or air-cooled models, can generate loud noise, including from discharging capacitor banks.

11. Activities of CSIR-CGCRI security

Security Section of CSIR-CGCRI is headed by the Security Officer and assisted by one Security Assistant. Both the persons are telephonically connected for 24 hrs. Apart from regular office hours, they are available even in odd hours for patrolling or to attend other emergent situations. Security

Supervisors and Security Guards are functioning directly under the command of Security Officer and Security Assistant. Security Supervisors and Guards are deployed at CSIR-CGCRI for 24 hours at their respective posts in 8 hrs rotational shift. Security guards are performing their duties round the clock under the direct mandate given by the Security Supervisors. At CSIR-CGCRI, currently the strength of Security Supervisors is 03 and the strength of Security Guards is 19. Each shift consists of 5-6 Security Guards and one Security Supervisor.

From the aspect of physical security of CSIR-CGCRI, all the strategic locations of the Institute are covered under CCTV surveillance system. It has got strong gates, concrete perimeter wall with concertina wire on the top. The pedestrian entry gate is protected with Door frame metal detector. Security guards are equipped with hand held portable walkie- talkie sets, hand-held metal detectors and also with the under- vehicle search mirror. For protection from fire, smoke detectors are installed at different laboratories. Fire alarm has been installed at the Main gate Security kiosk of this Institute. Fire trainings are organized frequently for the employees and students of the Institute by the Security staff. To handle any unforeseen events or natural calamities, the essential phone numbers are provided at the security kiosk. A Safety and Security and Disaster Management Committee headed by a Chief Scientist has been constituted and is functioning to enhance the Safety and Security standards of the Institute.

APPENDIX A: IMPORTANT TELEPHONE NUMBERS (For CSIR-CGCRI Kolkata)

CSIR-CGCRI EMERGENCY EPBAX EXTENSION NUMBERS:

Security Officer: 3356

Engineering Services: 3247/3336

Electrical: 3211

Main Gate: 3353

Chairman SSDM Committee: 3252

Safety Officer: 3213

SIRSA Security Post: 8436029810

SIRPA Security Post: 7797049995

Emergency Vehicle: 9007917847

APPENDIX B: LIST OF HAZARDOUS CHEMICALS

Following is a list of some hazardous chemicals used at CSIR-CGCRI. Please exercise due caution while working with these. Also please note that this list is only an indicative one and not comprehensive. Always consult the MSDS before handling any new chemical.

- Aluminum phosphide
- Arsenic pentoxide
- Arsenous oxide
- Arsenous trichloride
- Arsine
- Boron trichloride
- Boron trifluoride
- Boron trifluoride compound with dimethyl ether (1:1)
- Bromadiolone
- Bromine
- Cadmium oxide
- Cadmium stearate
- Calcium arsenate
- Carbon disulfide
- Chloroacetic acid
- 2-chloroethanol
- Chloroform
- Chloromethyl ether
- Chloromethyl methyl ether
- Chromic chloride
- Cobalt carbonyl
- Diborane
- Diethyl chlorophosphate
- Dimethyl phosphorochloridothioate
- Formaldehyde
- Formaldehyde cyanohydrin
- Formetanate hydrochloride

- Gallium trichloride
- Hexamethylenediamine, N,N'-dibutyl-
- Hydrazine
- Hydrocyanic acid
- Hydrogen chloride (Hydrochloric Acid)
- Hydrogen fluoride (Hydrofluoric Acid)
- Hydrogen peroxide (conc > 52%)
- Hydrogen selenide
- Hydrogen sulfide
- Hydroquinone
- Manganese, tricarbonyl methylcyclopentadienyl
- Mercuric acetate
- Mercuric chloride
- Mercuric oxide
- Methyl bromide
- Methyl chloroformate
- Methyl hydrazine
- Methyl isocyanate
- Methyl isothiocyanate
- Methyl thiocyanate
- Methyl vinyl ketone
- Nickel carbonyl
- Nitric oxide
- Nitric Acid
- Nitrobenzene
- Nitrocyclohexane
- Nitrogen dioxide
- Peracetic acid
- Phenol
- Phenol, 2,2'-thiobis(4-chloro-6-methyl)-
- Phenol, 3-(1-methylethyl)-, methylcarbamate
- Phenylhydrazine hydrochloride

- Phenylmercury acetate
- Phosphonothioic acid, methyl-, O-ethyl O-(4-(methylthio)phenyl) ester
- Phosphonothioic acid, methyl-, S-(2-(bis(1-methylethyl)amino)ethyl) O-ethyl ester
- Phosphonothioic acid, methyl-, O-(4-nitrophenyl) O-phenyl ester
- Phosphoric acid, dimethyl 4-(methylthio)phenyl ester
- Phosphonothioic acid, O,O-dimethyl-S-(2-methylthio) ethyl ester
- Phosphorus
- Phosphorus oxychloride
- Phosphorus pentachloride
- Phosphorus trichloride
- Physostigmine, salicylate (1:1)
- Potassium arsenite
- Potassium cyanide
- Potassium silver cyanide
- Selenious acid
- Semicarbazide hydrochloride
- Silane, (4-aminobutyl)diethoxymethyl-
- Sodium arsenate
- Sodium azide
- Sodium cacodylate
- Sodium cyanide
- Sodium fluoroacetate
- Sodium pentachlorophenate
- Sodium selenate
- Sodium selenite
- Sulfur dioxide
- Sulfur tetrafluoride
- Sulfur trioxide
- Sulfuric acid
- Tellurium
- Tellurium hexafluoride
- Thallium sulfate
- Thiocarbazide

- Thiophenol
- Thiosemicarbazide
- Thiourea, (2-chlorophenyl)-
- Thiourea, (2-methylphenyl)-
- Titanium tetrachloride
- Toluene 2,4-diisocyanate
- Toluene 2,6-diisocyanate
- Trans-1,4-dichlorobutene
- Trichloro(chloromethyl)silane
- Trichloro(dichlorophenyl)silane
- Trichloroacetyl chloride
- Trichloroethylsilane
- Trichlorophenylsilane
- Triethoxysilane
- Trimethylchlorosilane
- Trimethylolpropane phosphite
- Trimethyltin chloride
- Vinyl acetate monomer
- Zinc phosphide

APPENDIX C: INCIDENT REPORT FORM

CSIR-Central Glass & Ceramic Research Institute
196,Raja S.C.Mullick Road,Kolkata-700032
West Bengal,India

INCIDENT REPORT

INSTRUCTION:

1. It is mandatory to use this form while reporting any accidents or incident at work place as soon as possible, but not later than 24 hours.
2. The examples of accidents/incidents include but not limited to: safety alarm triggers (true and false alarms); chemical spills; accidents involving humans or equipment; significant damage to hazardous equipment; explosions; fires; events that triggered an evacuation; gas-leaks; arcing; and unauthorized access.
3. All incident reports must be sent to Conveners/ Chairman of Safety, Security and Disaster Management Committee (SSDM) with a copy to Head, ESD and Security Officer.
4. Incident reports will be kept confidential, unless mandated otherwise by law or Institute administration.
5. After submission of incident report, investigation must be undertaken following an incident to initiate corrective actions.

1.	**Name of R&D Division / R&D Support Division / Administration**				
2.	**a. Name of person reporting the incident:**				
	b. Name of witnesses:				
3.	**Date and time of the incident:**				
4.	**Place of occurrence:**				
5.	**Brief details of the incident:**				
6.	**Type of incident** *(check what is applicable)*	Fire/Smoke		Gas leakage	
		Accident		Explosion	
		Chemical/ acid spillage		Other	
7.	***Was anybody injured***	Yes ☐	No ☐		

8.	*If yes, was first aid/medical treatment provided*	Yes ☐ No ☐ Not required ☐
9.	***Any Damage*** *Brief If Yes :-*	Yes ☐ No ☐
10.	**Current Status** *(Event is still active or resolved?)*	

ROOT CAUSE:

Human Error	Environment	Machines/Equipment	Methods
☐ Poor communication	☐ Heavy rain	☐ Poor maintenance	☐ Lack of policies or procedure
☐ Lack of skill/knowledge	☐ Pest infestation	☐ Malfunction	☐ Lack of training
☐ Lax attitude	☐ Lightning	☐ Insufficient capacity or incorrect usage	☐ Lack of structured safety planning
☐ Lack of team spirit	☐ Natural disaster	☐ Poor design	☐ Lack of periodic oversight/verification
☐ Poor management and oversight	☐ Excessive vegetation	☐ Subsystem failure	☐ Failure to follow procedures
☐ Lack of ownership	☐ Flooding	☐ Lack of safety infrastructure	
☐ Fatigue, stress, etc.		☐ Obsolence	

Divisional Safety Champion / Witnesses **Person reporting the incident**

Head of Division/Section

List of Emergency Contact numbers

- **CM helpline:** 1076
- **Police:** 112
- **Fire Brigade:** 101
- **Medical Helpline:** 108
- **Senior Citizen Helpline:** 14567
- **Child Helpline:** 1098
- **Women Helpline:** 1090
- **Traffic Helpline:** 103
- **Tourism Helpline:** 1363
- **Electricity Helpline:** 1912
- **Centralized Emergency Helpline:** 112

The **112** number is a unified emergency helpline introduced in India to provide a single point of contact for all emergency services, including police, fire, and medical assistance **.**

APPENDIX D: INVESTIGATION REPORT FORM

CSIR-Central Glass & Ceramic Research Institute
196,Raja S.C.Mullick Road,Kolkata-700032
West Bengal,India

SSDM INVESTIGATION REPORT

INSTRUCTIONS:

6. Use this form for investigation against accidents/incidents/near misses.
7. At the time of investigation, department safety champion/laboratories PIs, victims and eye witnesses should be available with SSDM officers on the incident site.
8. All Investigation reports must be sent to dept. safety champion /Concerned PIs either by email /hard copy
9. Investigation reports will be kept confidential, unless mandated otherwise by law or Institute administration.

Specifics

1	Name of department	
2	Date of incident	
3	Date of Investigation	
4	Location	
5	Type of incident *(check what is applicable)*	a) Violation b) Alarm c) Accident d) Other
6	Investigation Done by	
7	Was anybody injured	Yes☐ No☐
8	Was Medical treatment provided	Yes☐ No☐ Not required☐
9	*Any Damage* *Brief If Yes :-*	Yes☐ No☐
10	Current Status (*Event is still active or resolved?)*	
11	SSDM observations at the time of investigation on incident site	
12	SSDM Recommendations	

Brief Description of Event

With a reasonably detailed event timeline

Action Taken by department

Persons responsible for action against SSDM recommendations

Root Cause

What caused the event?

Investigation done by

CSIR-Central Glass and Ceramics Research Institute

Safety, Security and Disaster Management (SSDM) Committee

General Guidance on Personal Protective Equipment (PPE)

1 Generic classification of the common hazards

This document provides basic guidelines for the use of personal protective equipment (PPE) when working in laboratories at CSIR-CGCRI with one or more of the following occupational hazards:

i) Chemical hazards such as labs having chemicals, acids or gases;
ii) Laser radiation hazard;
iii) Electrical hazards such as high-voltages;
iv) Radiation hazards such as X-rays and/or radio-active material.
v) Biological hazards such as infectious molecules/organisms, blood samples, etc.
vi) Mechanical hazards such as in a mechanical workshop that involves material machining processes including turning, milling, drilling, sharp object, rotating equipment etc.; and
vii) High Temperature Hazard like Process involving furnace operation.

2 Minimum Laboratory PPE

When working in laboratories with at least one of the hazards listed in Section 1, SSDM recommends that the following minimum PPE be worn at all times.

Body Area	PPE
Eyes/face	Safety Glasses, face shield
Hands	Disposable thin-nitrile gloves. Avoid latex since it is permeable and allergic. High temperature gloves for high temperature process.
Body	Long pants or equivalent leg covering (no shorts). **Synthetic clothing not allowed when working with any fire hazard.**
Hair	**Tied Hair:** No loose long-hair anytime. All long beard and hair should be properly tied or covered.
Feet	Close toed shoes: Laboratory footwear should fully cover the feet. **No sandals or flip flops**.

Body	**Lab apron:** To protect body from acid or chemical.
Mouth	**Mask:** Chemical, powder, dust etc.

3 Additional PPE for Specialized Laboratories

In sections 4 to 10, PPE for specialized laboratories and/or situations are listed out with respect to certain common tasks expected in laboratories at CSIR-CGCRI. The PPE prescribed in sections 4 to 10 is in addition to the minimum PPE suggested in section 2. Any task that is not listed here does not necessarily mean that it is safe to perform without PPE. When in doubt, users are encouraged to use their judgement and follow best practices. Always err on more PPE!

4 PPE for General Safety

	Task	Potential Consequence	Additional PPE
1.	Working with equipment that directly exposes the user to pressures >2 bar or a vacuum of <400 mm of Hg. Examples include working with pressurized gas nozzles.	1. Skin damage 2. Eye damage 3. Implosion	1. Face: Face shield if no other implosion/explosion barrier exists. (also see section 9 on compressed gas safety for more specific guidelines)
2.	Working with high temperature equipment or objects	1. Burns 2. Fire 3. Splash	1. Hands: Gloves that are suitable for the working temperature. 2. Extra set of thermal gloves are required when directly handling hot objects at temperatures >50 ºC. 3. Body: Lab coat or apron suitable for the working temperature
3.	Working with inert cryogens (He, Ar, N_2, etc.)	1. Frostbite 2. Eye damage 3. Hypoxia in confined spaces	**For ≤ 10Liters** 1. Body: Lab coat or apron 2. Eyes: Safety goggles 3. Hands: Inner disposable nitrile gloves + outer insulated cryogenic gloves, when directly handling objects exposed to cryogens. **For ≥ 10 liters** 4. Eyes: Safety goggles 5. Face: Face shield 6. Hands: Inner disposable nitrile gloves + outer insulated cryogenic gloves 7. Body: Lab coat or cryogenic apron. 8. Note: Use only in well-ventilated area.

	Task	Potential Consequence	Additional PPE
4.	Working at elevated locations such as for example loading samples in an overhead sample loading dock.	1. Fall and subsequen t injury	**≤ 3m** 1. Use ladders with a stable base. Adhoc platforms, stools and chairs are not allowed. **> 3m** 1. Safety harness 2. Hard safety hat/ safety helmet. 3. Hard-toed safety shoes
5.	Possibility of falling objects such as in construction sites	1. Serious or fatal injuries to head and other body parts.	1. Hard safety hat/ safety helmet. 2. Hard-toed safety shoes
6.	High-speed machinery	1. Entangled hair. 2. Possibility of flying scrap or high speed particles	1. Tie long hair in a bun or use hair-nets. 2. Hard-toed safety shoes 3. Use of Safety Goggles

5 PPE for Chemical Safety

	Task	Potential Consequence	AdditionalPPE
1.	Working with solids of low hazard (NFPA 704 rating 0-1 in all quadrants)	1. Skin damage 2. Eye damage	Minimum PPE as described in section 2
2.	Working with moderate hazard chemicals (NFPA 704 rating ≤2 in all quadrants), small volumes (<100 ml.).	1. Skin damage 2. Eye damage	Minimum PPE as described in section 2
3.	Working with moderate hazard chemicals (NFPA 704 rating ≤2 in all quadrants), moderate volumes (<4000 ml.).	1. Skin damage 2. Eye damage	1. Eyes: Safety goggles 2. Body: Chemical resistant apron or Lab Coat.

4.	Working with moderate hazard chemicals (NFPA 704 rating ≤2 in all quadrants),large volumes (>4 litres).	1. Skin damage 2. Eye damage 3. Splash	1. Eyes: Safety goggles 2. Face: Face shield 3. Hands: Disposable chemical resistant gloves (thick) as a second glove 4. Body: Chemical resistant apron or Lab Coat.
5.	Working with high hazard chemicals (NFPA 704 rating >2 in any quadrant). E.g. corrosive (acids or caustics) or hazardous materials that may splash.	1. Skin damage 2. Eye damage 3. Splash 4. Toxic 5. Inhalation	1. Eyes: Safety goggles 2. Face: Face shield (if quantity is >4 lit or splash hazard) 3. Hands: Disposable chemical resistant gloves (thick) as a second glove 4. Body: Chemical resistant apron 5. Inhalation: Suitable face mask (if quantity is >4 lit. or materials is noxious)
6	Working with volatile solvents. E.g. • Ethanol, Isopropanol • Propylene • Oxide Xylene • Methanol • Chloroform • Phenol	1. Skin damage 2. Eye damage 3. Fire	1. Eyes: Safety goggles 2. Hands: Suitable chemical resistant gloves (thin) 3. Face: Face shield (if quantity is >4 lit or splash hazard) 4. Body: Lab coat or apron. 5. Gloves: a. Nitrile for alcohol b. Butyl for propylene oxide and Xylene. 6. Inhalation: Suitable face mask (if quantity is >4 lit. or materials is noxious)
7	Working with chemicals of acute toxicity (NFPA 704 Health rating =4) e.g., hydrogen fluoride, hydrogen cyanide.	1. Inhalation 2. Skin damage 3. Eye damage 4. Toxic by skin contact	1. Eyes: Safety goggles 2. Face: Face shield (if quantity is >4 lit or splash hazard) 3. Hands: Chemical resistant gloves (thick) as a second glove. Special gloves designed for that specific hazard are highly recommended. 4. Body: Chemical-resistant apron 5. Inhalation: Suitable face mask (if quantity is >1 lit/kg or if the material is

			noxious).
8	Working with long-term toxins like carcinogens, mutagens, nanoparticles, etc. (Example: agarose gels and ethidium bromide)	1. Inhalation 2. Skin damage 3. Eye damage 4. Toxic by skin contact	1. Eyes: Safety goggles 2. Hands: Appropriate chemical resistant gloves 3. Body: Chemical-resistant apron 4. Face: Face shield (if quantity is >1 lit/kg or splash hazard) 5. Inhalation: Suitable face mask (if quantity is >1 lit/kg
9	Working with air or water-reactive chemicals that form hazardous by products, or react violently.	1. The sudden release of gases or energy 2. Chemical hazards associated with by- products.	PPE appropriate for the by-products. Face shield if there is a chance of splash or splatter.

6 PPE for Biosafety

	Task	Potential Consequence	Additional PPE
1	Working with human blood, body fluids, cell lines (primary or established), tissues, or blood borne pathogens (BBP).	Exposure to infectious material	Face: Face mask or sheild Body: Lab coat or disposable gown/apron
2	Working with animal and/or human specimens preserved in fixative (such as formalin or Para formaldehyde solution) Preserving animal and/or human specimens with fixative (such as formalin or Paraformaldehyde	Exposure to fixative used to preserve the specimen. If tissue is fixed, there is no longer exposure to infectious material.	Eye: Safety goggles Hand: Impermeable glove for preserved specimens that is chemical- resistant to fixative use Face: Face mask Body: Lab coat or Disposable gown

	solution)		
3.	Manipulation of recombinant DNA, cell lines, viruses, bacteria, or other organisms classified as Risk Group 2 and requiring Biosafety Level 2 (BSL-2). Perform aerosol-generating procedure: Vortex, sonicate, pipette, tissue harvest.	Biological agents that pose a moderate potential for infection by injection, skin exposure, ingestion, or inhalation.	1. Eye: Safety googles 2. Hand: Nitrile gloves 3. Face: Face mask 4. Body: Lab coat or Disposable gown
4.	Manipulation of infectious materials classified as Risk Group 3 but manipulated in a BSL 2 facility with BSL-3 practices (BSL 2+).	Biological agents that pose a moderate/ serious potential for infection by injection, skin exposure, ingestion, or inhalation.	1. Eye: Safety goggles 2. Hands: Nitrile gloves (double) 3. Body: Lab coat + disposable gown that ties in back 4. Inhalation: Respiratory protection like N95 mask
5.	Manipulation of infectious materials classified as Risk Group 3 and requiring Biosafety Level 3 (BLS-3) containment.	Biological agents that pose a serious or lethal potential for infection via injection, skin exposure, ingestion, or inhalation.	1. Eye: Safety goggles 2. Hands: Nitrile gloves (double) 3. Body: Full disposable coverall suit + headcover 4. Foot: Shoe cover 5. Face: N95 or other triple-layered mask + Face shield.

6	Working with live animals, e.g. mice and rats& chicken eggs:	1. Animal bites. 2. Exposure to animal allergens. 3. Potential Staph &Strep exposure.	1. Animal bites: Restraints or bite-resistant gloves 2. Animal allergen: N95 respirator. 3. Eye: Safety goggles 4. Body: Lab coat or apron, Hair bonnet + gown 5. Foot: Shoe covers

7 PPE for Radiation Hazards

Radiation safety is managed by AERB (Atomic Energy Regulatory Board-a governmental regulatory agency). AERB appoints safety officers. All radiation-related work must be done under rules of AERB and with permission from AERB safety officers.

	Task	Potential Consequence	Additional PPE
1.	Working with sealed sources.	1. Exposure	1. Minimum PPE unless the dosage is above safe limits 2. TLD badges, if mandated by AERB safety officer
2.	Working with solid radioactive material or solid radioactive waste.	1. Cell damage 2. The potential spread of radioactive	1. Hands: Disposable nitrile or other impermeable gloves (double) 2. Face: N95 mask 3. Body: Lab coat or apron 4. TLD badges, if mandated by AERB safety officer

8 PPE for Lasers and Intense Light Sources

	Task	Potential Consequence	Additional PPE
1.	Using an open-beam laser of Class 3 or above in a setup that is not fully contained or interlocked.	1. Eye damage 2. Skin damage	1. Eye: Appropriate laser safety goggles/glasses with optical density based on individual beam parameters. 2. Skin: Fully covered arms and feet. Flame-resistance clothing. Avoid synthetics. 3. Avoid reflective jewelry.
2.	Working with intense light	1. Eye damage	1. Eye: Appropriate laser safety goggles/glasses

	sources, infrared-emitting equipment, UV sources (<400 nm)	2. Skin-burn	with optical density based on individual beam parameters. 2. Skin: Fully covered arms and feet. Flame-resistance clothing. Avoid synthetics.

9 PPE for Compressed Gas Cylinders& Cryogens

	Task	Potential Consequences	Additional PPE
1.	Transport or handling of inert gas cylinders (NFPA 704 rating of <2 in all quadrants)	1. Cylinder falling over 2. Breaking off the valves	1. Hand: Wear mechanically resistant-gloves when handling cylinders. 2. Foot: Closed-toed shoes
2.	Transport of handling of flammable gases with NFPA 704 flammability rating of ≥3	1. Cylinder falling over 2. Breaking off the valves 3. Fire or explosion due to a sudden release	1. Skin: Flame resistant antistatic safety clothing. 2. Hand: Wear mechanically resistant-gloves when handling cylinders 3. Foot: Closed-toed shoes.
3.	Toxic gases with NFPA 704 health rating of ≥3	1. Cylinder falling over 2. Breaking off the valves 3. Poisoning	Respiratory protection-Toxic gas mask or self-contained breathing apparatus

10 PPE for Electrical Safety

	Tasks	Potential Hazards	Additional PPE
1.	Maintenance and repairing electrically powered equipment	1. Electrocution	1. Hands: Insulated electrical gloves. 2. Foot: Electrical safety shoes. 3. Electric works to be undertaken by trained electrical technicians ONLY.
2.	High Voltage (> 400 V)	1. Electrocution 2. Arc flash	1. Body: Arc flash clothing. Switching suits available from low level to high-level protection. Arc clothing is made from flame-resistant material such as a cotton and nylon blend. 2. Electrical rated gloves and steel toe cap boots with rubber, designed for protection against high voltage. 3. Electrical-rated safety helmet. 4. To use specified Electrical standard tools, switch OFF Mains/incoming supply during maintenance /repair work.

Safety, Security & Disaster Management (SSDM)

POLICY ON EMERGENCY RESPONSE PLAN (ERP)

This document is the official emergency response plan for CSIR-CGCRI. It lays out the step-by-step response for each actor during a laboratory emergency.

Table of Contents

Version information: This is the first version of the document

List of Emergency Contact numbers for CSIR-CGCRI, Kolkata

STD Code Kolkata: **033**

- **Police:** 100
- **Fire Brigade:** 101
- **Ambulance:** 102
- **Medical Helpline:** 9830079999
- **Senior Citizen Helpline:** 9830088884
- **Child Helpline:** 1098
- **Women Helpline:** 1091
- **Traffic Helpline:** 1073
- **Tourism Helpline:** 033-2243 6440
- **Water Supply Helpline:** 2440-2793 / 2418-0645
- **Electricity Helpline:** 19121
- **Centralized Emergency Helpline:** 112
- **Cyber Crime Helpline Number:** 1930

The **112** number is a unified emergency helpline introduced in India to provide a single point of contact for all emergency services, including police, fire, and medical assistance.

List of Emergency Contact numbers for CGCRI Naroda Centre, Ahmedabad

STD Code Ahmedabad: 079

- **Police:** 100
- **Fire Station:** 101
- **Ambulance:** 102
- **Blood Bank:** 1910
- **Child Helpline:** 1098
- **Health Helpline Number:** 104
- **Women Helpline:** 181, 1091
- **Citizen Call Centre:** 155303
- **Rescue And Relief Helpline:** 1070
- **District Helpline:** 1077
- **Railway Helpline (General):** 139
- **Centralized Emergency Helpline:** 112

The **112** number is a unified emergency helpline introduced in India to provide a single point of contact for all emergency services, including police, fire, and medical assistance.

List of Emergency Contact numbers for CGCRI Khurja Centre, Uttar Pradesh

STD Code Khurja, UP: 05738

- **CM helpline:** 1076
- **Police:** 112
- **Fire Brigade:** 101
- **Medical Helpline:** 108
- **Senior Citizen Helpline:** 14567
- **Child Helpline:** 1098
- **Women Helpline:** 1090
- **Traffic Helpline:** 103
- **Tourism Helpline:** 1363
- **Electricity Helpline:** 1912
- **Centralized Emergency Helpline:** 112

The **112** number is a unified emergency helpline introduced in India to provide a single point of contact for all emergency services, including police, fire, and medical assistance.

1.0 Introduction

The first few moments of an emergency are critical. Any delay or hesitance can cause loss of life and property. Please memorize and save the important numbers as mentioned in earlier.

1.1 What is an Emergency Response Plan (ERP)?

ERP is a step-by-step plan to deal with an emergency. The role and responsibility of every participant are clearly defined. The document tries to answer the 5 critical questions: who, what, when, how, and where.

1.2 What is the scope of this document?

The Emergency Plan is applicable for any lab emergency. The document contains:

a) The standard operating procedure for dealing with an emergency.
b) The list of personnel responsible during an emergency.
c) The sequence of actions (response) in case of medical emergency or injury
d) List of infrastructure that is supposed to be maintained by departments, security, and Health Centre.

1.3 How should I prepare?

The response changes with the role.

a) Lab users: Lab users can be both victims and witnesses, so understand those roles. At the very least memorize emergency numbers. In summary:

b) **Scientist or PI**: Scientists or PIs are ultimately responsible for establishing safety processes, especially concerning PPE, storage, housekeeping, and signage. Lab-specific items like spill kits, masks, gloves, and gas detectors must be stocked. Also, there must be a documented lab-specific emergency plan. The plan must be part of the orientation program for new users. Regular refreshers for existing users are strongly recommended.

c) **Safety Champion (SC) or Convener, member or Head**: First responders will not know specific dangers in a laboratory or department. First responders may contact the **department Safety Champions** or **Convener, member or Head** for that information during an emergency.

d) **SSDM** must ensure that department-level fire infrastructure is in order, e.g., signage, extinguishers, fire alarm system etc.

e) **Security**: On-site security personnel and their supervisors are the first responders. They are the primary response team of the Institute. Security will conduct regular training to ensure their preparedness.

1.4 Good practices

a) **Be familiar with your surroundings.**
   i. **Which is the nearest exit?**
   ii. **Where is the nearest fire extinguisher?**
   iii. **Which are the nearest safety shower and eyewash stations?**

b) **Display critical information. People tend to forget things and respond poorly in an emergency. Clear signage is important.**
   i. **Display emergency numbers in the lab.**
   ii. **Fill hazard sheet and display it outside lab.**

c) **Know the ERP. Take personal responsibility to educate yourself.**
   i. **Who do I call first? Who do I call second?**
   ii. **What to do if I am injured?**
   iii. **What to do if I see someone else get injured?**

d) **Be vigilant and report anything which seems dangerous or suspicious.**

2. Emergency Response Plan

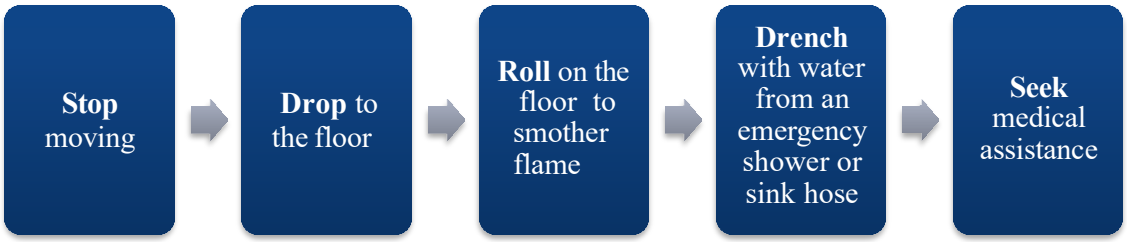
	Who	Informed By?	When informed?	Immediately	Follow-up action(s)
1.	Victim	--	--	Call for help or Security office	1. Try to remove yourself from the hazard 2. Call ambulance 3. Use safety shower if needed 4. Use eyewash station
2.	Witness	--	--	Call Ambulance	1. If you can do so safely, help the victim/On site security guard. 2. Trigger alarm. 3. Guide first responder. 4. Call PI/ Lab in charge.
3.	On-site security guard	Witness/ Victim	While waiting for first responders	Call Security Office	1. Trigger alarm 2. Help victim 3. Use fire extinguisher 4. Escort first responders
4.	Control Room (Security)	Witness or victim or on-site guard	Right after the incident.	[Critical injury] Call ambulance. [Non-critical injury] Call Health Centre [Fire] Call fire brigade	5. Dispatch patrol vehicle to the site. (First Responder) 6. Inform on-site guard. 7. Call Head of Division/ Section
5.	Health Centre	Control room or victim or witness	As per follow-up actions	Dispatch ambulance to the location	1. Inform duty doctor 2. Call control room.
6.	Division Head	Control room	As per follow-up actions	If needed, reach the location	1. Assist first responders 2. Inform PI/lab in-charge
7.	PI or Lab-in-charge	Head	As per follow-up actions	If needed, reach the location	1. Assist first responders 2. Help with information on lab-specific hazards

Note:

1. If you have pertinent information, inform the ERT or security guard.
2. Don't wander away during an emergency. Stay in the designated assembly area until "all-clear".
3. Only ERT can declare an "all-clear". No one is allowed back unless "all-clear" is declared.

2.1 Action items for victim

1. Raise the alarm by getting attention from lab buddy, security guards, etc.
2. Try to remove yourself from the hazard.
3. If you can, call the control room or ambulance.
4. If you are on fire:



5. If exposed to chemicals, remove clothing (don't worry about modesty) and flush the area with running water for at least 20 minutes.
6. If your eyes are exposed to chemicals, wash under the eyewash station for 20 mins.

Did you know?

Anyone can call ambulance. There is no need to take permission from PI, Medical Cell, Safety Champion, or SSDM.

2.2 Action items for witness

1. Raise the alarm and inform Security Office. If needed, trigger the department-wide alarm.
2. Decide if you are in danger.
   a) If you are, evacuate immediately. OR
   b) If you have the capacity to do so, attend to the victim.
3. Decide the seriousness of the injury. Err on the side of caution. Better to overreact.
   a) If the injury is serious, call ambulance directly. If you can't, call the control room. Section 3.2 list some examples of serious injuries.
   b) If you can, provide first-aid to the victim.
4. Go out to the main door. Wait for the ambulance. Guide them to the victim.
5. Inform the Control room or security guard while waiting for the ambulance.
6. Once the victim is stable or has left on the ambulance, inform PI, Scientists and Divisional Head

2.3 Action items for On-site Security Guard

1. Help the victim and witnesses
2. If needed, use fire extinguishers.
3. If needed, trigger the department-wide alarm.
4. Inform control room.
5. Wait for the ambulance or patrol vehicle. Guide them to the site.
6. If the department-wide alarm is triggered:
   a) Evacuate building along evacuation routes to primary assembly areas outside.
   b) Redirect building occupants to stairs and exits away from the fire.
   c) Prohibit the use of elevators.

How to extinguish a fire?

- Never turn your back to a fire.
- Always keep a clear exit path so you can retreat.
- Use the appropriate extinguisher for the fire (Type A, B, C, D).
- Remember P.A.S.S.

2.4 Action items for Security Office

1.	Note contact information of the witness		
2.	Call on-site security guard		
3.	Get information about the nature of the emergency		
	Fire or Gas leak	***Minor Injury***	***Major Injury***
4.	If the fire is large, call the fire brigade	Call Medical Officer	Call ambulance
5.	Call Divisional Head		

2.5 Action items for on-call SSDM Officer

1. If needed, reach on-site.
2. Provide technical support to first responders
3. Conduct follow-up investigation.

2.6 Action items for Divisional Head

1. If needed, reach on-site.
2. Provide technical support to first responders.
3. Inform PI or Department Safety Champion.

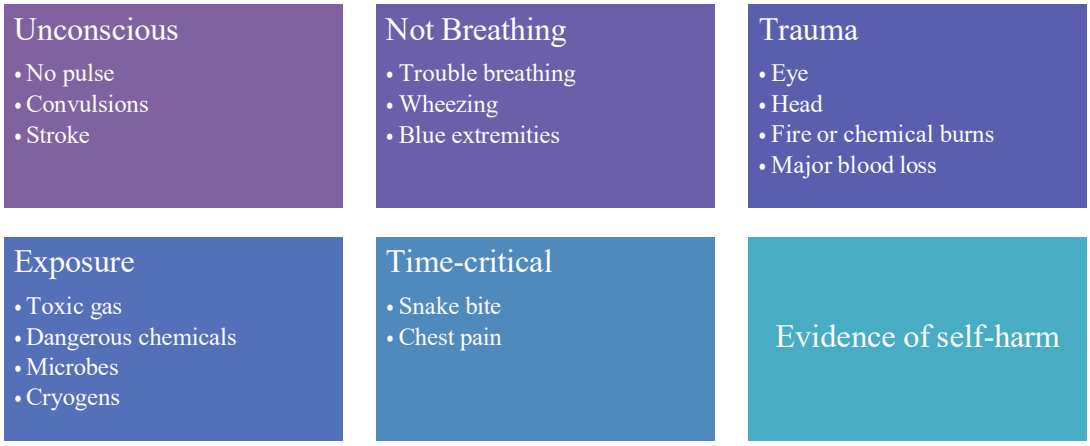
2.7 Action items for PI or Lab In-charge

1. Reach on-site.
2. Provide technical support to first responders.
3. Provide lab-specific inputs.

3. Response in Case of Injury

3.1 Examples of Serious Injuries

DIRECTLY CALL AMBULANCE FOR SIMILAR EMERGENCIES



3.2 First-aid

Physical Injury

1. Blunt trauma
   a) Immobilize the affected joint/part.
   b) Apply ice packs.
2. Penetrating/ cut injury
   a) Apply consistent pressure to arrest bleeding.
   b) Elevate the affected part above the heart if direct pressure is not stopping the bleeding.
   c) Dress or support the wound.

Splash in Eyes

1. Immediately rinse the affected eye with running water at low pressure for at least 10 minutes.
2. Position the face so that the injured eye is down and to the side.
3. Keep the eyes open as wide as possible.
4. Flush the eyes to remove contact lenses, if any. If they don't come out, try to gently

remove them after flushing.

5. Do not rub the eyes.

Splash Over Skin

1. Flush the area with running water for at least 20 minutes.
2. *Exceptions:*
   a) Dry lime: To be brushed off before irrigation.
   b) Phenols: Wipe off the skin using glycerin.
   c) Elemental metals fragments to be removed by dry forceps and affected area covered with mineral oil (or a comparable solution).
   d) Skin exposure with hydrofluoric acid, after thorough irrigation, should be applied with 2.5% Calcium Gluconate gel. Ice packs can be used to retard the diffusion of ions.
3. Remove jewellery or articles of clothing with chemicals on them.

Exposure to Toxic Gases:

1. Take the victim immediately away from the poisonous gas to clean air.
2. Remove any tight clothes.
3. If the victim is not breathing, perform CPR until the ambulance arrives.
   a) Be careful to avoid chemical poisoning during CPR.

Burns

1. Immediately remove the person away from the heat source to stop the burning.
2. Apply cool/lukewarm running water for 20 minutes.
3. Avoid using ice, iced water, or grease.
4. Avoid using extinguishers directly on the victim. This can cause cold burns.
5. Remove any jewellery or clothing near the burnt area of the skin.

Needle poke or cut with contaminated sharp item:

1. Immediately wash the area with soap and water for at least 15 minutes.
2. Immediately after rinsing, obtain medical attention.

Exposure to HF?

- HF is colorless, odourless gas. In solution, it looks like water
- Exposure is very dangerous, and initially painless
- Very important to get treatment immediately with calcium gluconate.
- Labs with HF must store calcium gluconate. It is also stocked by Health Centre. Calcium Gluconate should not be in expired condition for both labs and Health Centre.

3.3 Emergency Training

It is essential to train lab users in basic life support, first aid, and extinguishers. Given CSIR-CGCRI has a rolling population, any such training needs to be regular. By the very nature of the job, it must also be voluntary. Please contact SSDM to schedule workshops on:

1. Basic life support: CPR, first aid, etc.
2. Fire safety: Including use of fire-extinguisher and alarm.

4. Infrastructure to be maintained for Emergency Response

4.1 Security

1. A control room that can efficiently and effectively work during an emergency.
2. The control room must be manned by at least two people 24x7. One person must be fluent in Bengali because the fire department is not comfortable with any other language.
3. The control room must be in constant contact with all security guards posted on campus. Either through wireless or wired phones. Security should procure hardware

to enable the connectivity.

4. The control room should be able to call the Fire brigade ambulances.
5. The control room will maintain contact information for Heads of all departments and SSDM officers.

Manpower

6. Security guards should be empowered to quickly respond to an emergency, especially in case of fire and injury, where the first few minutes are crucial.
7. All security guards should be trained on fire extinguishers and basic life support (BLS).
8. A subset of security should be trained on specialized emergency response, including fire-hydrants, chemical spills, SCBA (Self-contained breathing apparatus), and gas safety. These form the cadre which will man the patrol vehicle.

4.3 SSDM

SSDM will maintain minimum fire safety infrastructure in all departments. Departments are requested to escalate any lacunae to SSDM.

1. Fire extinguishers of sufficient quantity and type, placed at an appropriate location.
2. All buildings must comply with the Indian Building Code in terms of fire hydrant loop and sprinkler systems.
3. All hazardous departments must have a centralized fire alarm system with hooters and strobe lamps.
4. All buildings need defined emergency exits, assembly points, etc. These need to be clearly marked.
5. Conduct mock drills at least once a year.

4.4 Department/ Labs

The infrastructure needed in a department or building is a function of the hazards. All buildings are expected to have basic safety infra. In addition, departments with "special" lab hazards need a special infrastructure.

Basic infrastructure

The following infrastructure must be maintained by all departments. It is the responsibility of the Head to ensure compliance.

1. First-aid boxes in each lab with contents suitable for hazards in the lab.
2. Working service lift:
   a) if departments have 4 or more floors; or
   b) if the department has 2 or more floors but uses compressed gas cylinders or hazardous chemicals.
3. Emergency lights. One in each lab will automatically turn on if power fails.
4. Hazard sheets outside each lab.
5. A designated Lab-in charge for each lab that is knowledgeable about hazards in the lab.
6. A system to access locked labs. The implementation can vary. For example, the department may maintain a collection of keys in the office; or a central biometric system that can be deactivated.
7. Clear and suitable safety signage.
8. All departments must have switches that can disconnect mains power. The disconnection must be at the level of the individual lab or floor.
9. All labs must have circuit breakers of suitable rating to automatically disconnect power during a fault.

Special infrastructure for Hazardous Chemicals

1. Departments with hazardous chemicals must have a safety shower & eyewash station (as per ANSI Z358.1).
2. Hazardous chemicals must be segregated and stored in chemical safety cabinets.
3. Calcium gluconate if lab stores or uses hydrofluoric acid.

Special infrastructure for Gases or cryogens

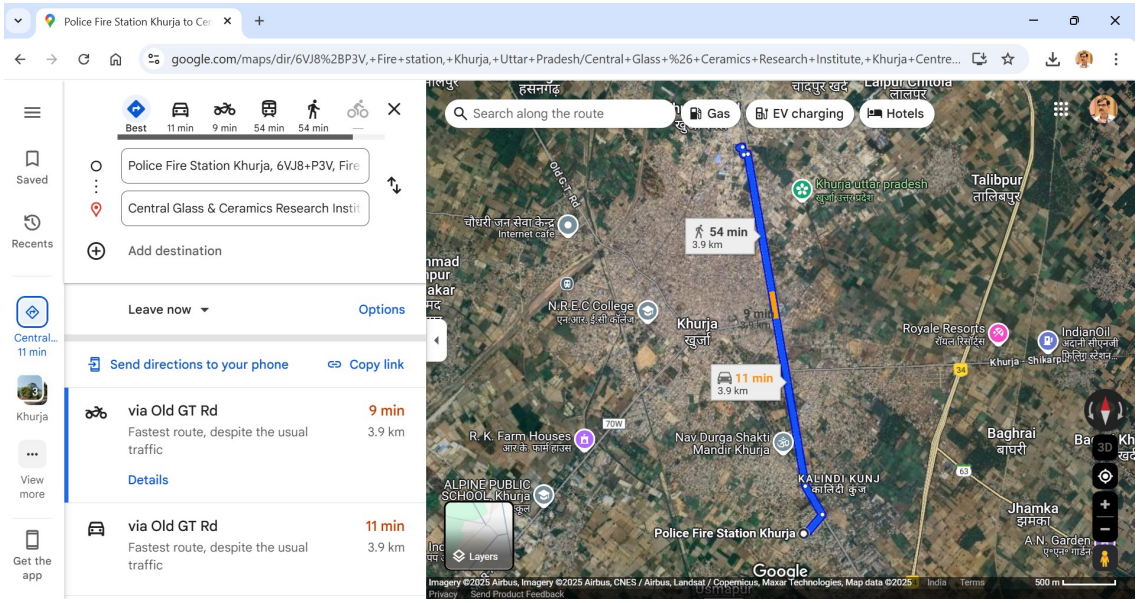
1. All hazardous gasses (NFPA > 2) must be inside gas cabinets.
2. Labs with hazardous gasses (NFPA > 2) must have gas alarms.
3. Departments with hazardous gasses (NFPA > 2) must have one SCBA.

Special infrastructure for Other Hazards

1. Labs with a high electrical load must have a mains switch mounted somewhere outside the lab so the electrical power can be turned off without entering the lab
2. BSL3 labs will store hazard suits outside the labs that can be quickly accessed by first responders in case of emergency.

5. Fire Tender Vehicle

- Fire station Gariahat Fire Station, 25, Golpark, Hindustan Park, Gariahat, Kolkata, West Bengal 700029 is 2.2 km from CSIR-CGCRI main gate. In case of a fire emergency, security will directly call the fire station (033 2464 2841). Users can also call **101** to contact the fire station directly.
- After confirming the location, the fire team gets ready within **30 seconds.** The fire tender reaches CSIR-CGCRI **in 10-12 minutes**. The team is available 24x7.
- The fire tender can enter the CSIR-CGCRI Khurja campus using main gate on old G T Road. The **security will escort the fire tender to the location.** The fire tender is stocked with **firefighting equipment** like extinguishers. The fire team may need specific input from SSDM, the department, or PI.



Note: The security will guide the vehicle to the nearest gate.

গুরুত্বপূর্ণ ল্যাব নিরাপত্তা নির্দেশাবলী

আপনার নিরাপত্তা আপনার দায়িত্ব। কর্মক্ষেত্রে নিরাপত্তা বজায় রাখুন ,যাতে দুর্ঘটনা এড়ানো যায়। যথাযথ প্রয়োজনীয় সুরক্ষামূলক সরঞ্জাম (যেমন - হেলমেট , হ্যান্ড গ্লাভস , সেফটি গগলস , ল্যাব কোট , সেফটি জুতো) পরে ল্যাব এ কাজ করতে হবে। কারোর প্রয়োজনীয় সরঞ্জাম ব্যবহার করতে যদি বুঝতে অসুবিধে হয় তাহলে আপনার বিভাগের বরিষ্ঠ বিজ্ঞানী ও কারিগরি কর্মকর্তাদের জানান ও তাদের সাহায্য নিন। অফিসের ল্যাবে যত্ন সহকারে রাসায়নিক ব্যবহার করা, কর্মক্ষেত্র পরিষ্কার রাখা আপনার কর্তব্য এবং আপনি এই বিষয়ে সতর্কতা অবলম্বন করবেন। আশা করি এই নির্দেশাবলী সম্বন্ধে আপনি অবগত হয়েছেন এবং নিয়মিত মেনে চলবেন। আপনার নিয়মিত স্বাক্ষর একান্তভাবে কাম্য।

স্বাক্ষর-

নাম -
বিভাগ-
ফোন নম্বর -

महत्वपूर्ण प्रयोगशाला सुरक्षा निर्देश

आपकी सुरक्षा आपकी जिम्मेदारी

किसी भी दुर्घटना को रोकने के लिए कार्यस्थल पर सुरक्षा बनाए रखें। कार्यस्थल पर काम करते समय हमेशा आवश्यक सुरक्षात्मक उपकरण (जैसे हेलमेट, हाथ के दस्ताने, सुरक्षा चश्मे, सुरक्षा जूते, लैब कोट आदि) पहनें रखे। किसी भी उपकरण के संचालन में किसी भी प्रकार की समस्या होने पर कृपया अपने वरिष्ठ वैज्ञानिक या तकनीकी अधिकारी को सूचित करें और उनकी सहायता लें। कार्यस्थल की साफ-सफाई बनाए रखना तथा प्रयोगशाला रसायनों के साथ काम करते समय सावधानी बरतना आपका कर्तव्य है एवं इसके लिए सदैव सतर्क रहें।

यह अपेक्षित है कि आपको प्रयोगशाला सुरक्षा दिशा-निर्देशों और मानकों के बारे में अवगत करा दिया गया है और आप उनका पालन करेंगे।

हस्ताक्षर

नाम

विभाग

फोन न: