सीएसआईआर
CSIR
भारत का नवाचार इंजन
The Innovation Engine of India

सीएसआईआर

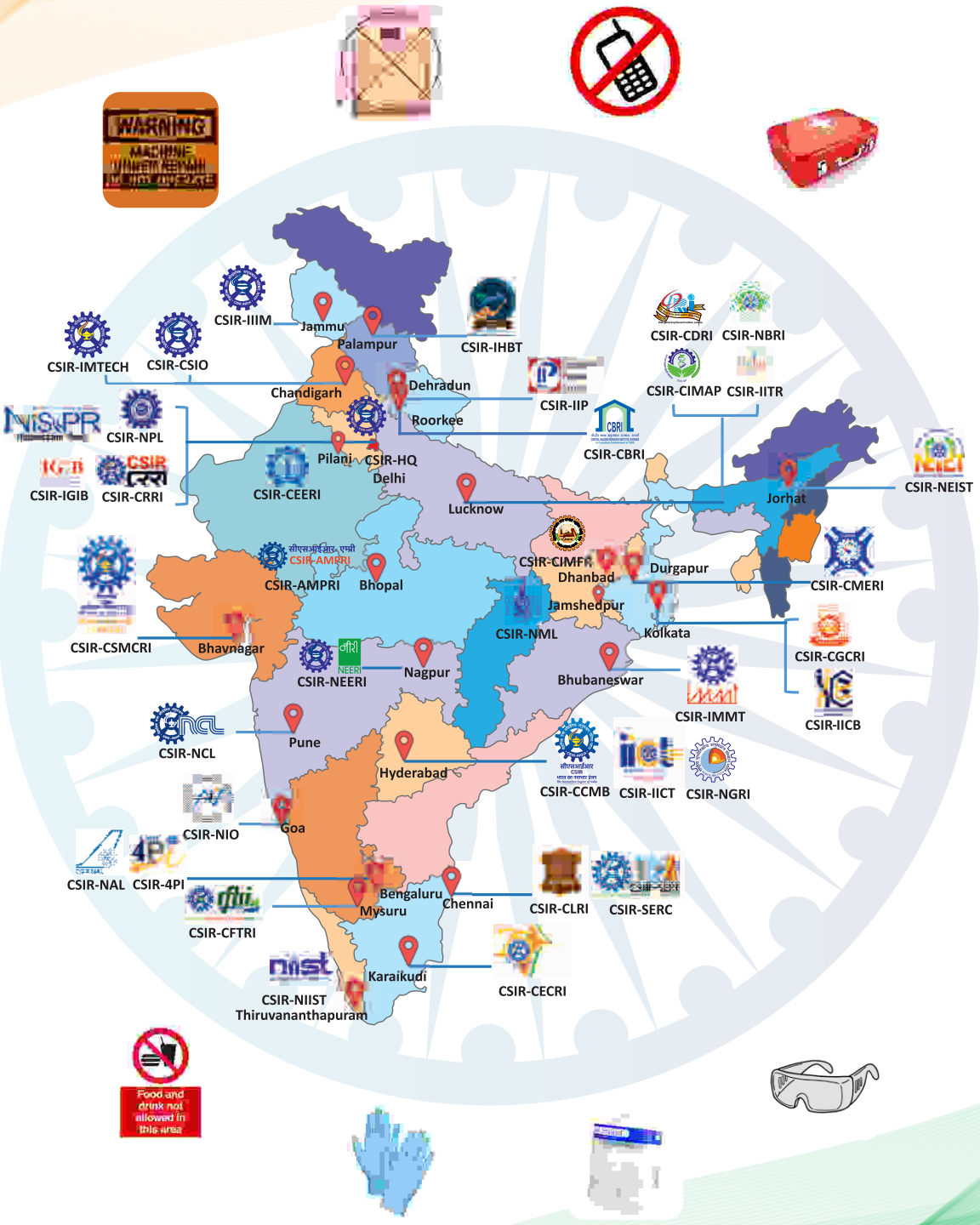
सुरक्षा पुस्तिका

कार्यस्थल पर सुरक्षा हमारी सामूहिक जिम्मेदारी है

CSIR SafetY MANUAL

SAFETY AT WORKPLACE IS OUR COLLECTIVE RESPONSIBILITY

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद, नई दिल्ली
Council of Scientific and Industrial Research, New Delhi


CSIR-IIIM
Jammu
Palampur
CSIR-IHBT
CSIR-IMTECH
CSIR-CSIO
CSIR-CDRI
CSIR-NBRI
CSIR-CIMAP
CSIR-IITR
Chandigarh
Dehradun
CSIR-IIP
Roorkee
CSIR-NPL
CSIR-CBRI
Pilani
CSIR-HQ
Delhi
CSIR-IGIB
CSIR-CRRI
CSIR-CEERI
Lucknow
Jorhat
CSIR-NEIST
CSIR-CIMFR
Dhanbad
Durgapur
CSIR-AMPRI
Bhopal
CSIR-CMERI
Jamshedpur
CSIR-CSMCRI
Bhavnagar
CSIR-NML
Kolkata
CSIR-CGCRI
CSIR-NEERI
Nagpur
Bhubaneswar
CSIR-IMMT
CSIR-IICB
CSIR-NCL
Pune
Hyderabad
CSIR-CCMB
CSIR-IICT
CSIR-NGRI
CSIR-NIO
Goa
CSIR-NAL
CSIR-4PI
Bengaluru
Chennai
CSIR-CLRI
CSIR-SERC
Mysuru
CSIR-CFTRI
Karaikudi
CSIR-CECRI
CSIR-NIIST
Thiruvananthapuram

संदेश

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद् (सीएसआईआर) वैज्ञानिक उत्कृष्टता, नवाचार और राष्ट्र सेवा का प्रतीक है। अग्रणी अनुसंधान के प्रति हमारी प्रतिबद्धता न केवल बौद्धिक जिज्ञासा और तकनीकी दक्षता, बल्कि सुरक्षा के प्रति हमारी गहरी और स्थायी प्रतिबद्धता पर भी आधारित है।

सीएसआईआर में, विज्ञान के साथ सुरक्षा का एकीकरण वैकल्पिक नहीं,बल्कि अनिवार्य है। इस दस्तावेज में प्रस्तुत दिशानिर्देश उस प्रतिबद्धता के ही प्रमाण हैं। ये दिशानिर्देश छात्रों और तकनीकी कर्मचारियों से लेकर वैज्ञानिकों और प्रशासकों तक, अनुसंधान पारिस्थितिकी तंत्र में एक साझा जिम्मेदारी को दर्शाते हैं, ताकि एक ऐसा कार्य वातावरण विकसित किया जा सके जहाँ वैज्ञानिक अनुसंधान व्यक्तिगत और सामूहिक सुरक्षा के साथ मिलकर आगे बढ़ सके।

सीएसआईआर में विज्ञान, प्रौद्योगिकी और नवाचारचालित अनुसंधान की प्रकृति के अनुसार संभावित खतरों का ध्यान रखना, उपकरणों और रसायनोंका सावधानीपूर्वक उपयोग करना और सावधानी की एक अंतर्निहित संस्कृति पर जोर देना आवश्यक है। इन दिशानिर्देशों का उद्देश्य न केवल जोखिमों को कम करने में मदद करना, बल्कि 'सुरक्षा–सर्वोपरि' के मानसिकता को भी बढ़ावा देना भी है। प्रत्येक वैज्ञानिक प्रयोग, प्रत्येक परियोजना और प्रत्येक गतिविधि– 'क्या यह सुरक्षित रूप से किया जा रहा है?'–प्रश्न से ही शुरू होनी चाहिए।

सीएसआईआर के महानिदेशक के रूप में, मैं सख्त सुरक्षा प्रोटोकॉल विकसित करने और उनके उपयोग को बढ़ावा देने में सीएसआईआर–सीजीसीआरआई और शामिल अन्य सभी प्रयोगशालाओं के प्रयासों का पूर्णतः समर्थन करती हूँ। मैं सीएसआईआर–सीजीसीआरआई के निदेशक और सीएसआईआर–स्तरीय सुरक्षा समिति के समन्वयक निदेशक, प्रो. बिक्रमजीत बसु के नेतृत्व की सराहना करती हूँ तथा सीएसआईआर प्रयोगशालाओं में सुरक्षा की संस्कृति को बढ़ावा देने में अपना सहयोगात्मक दृष्टिकोणप्रदान करने हेतु सीएसआईआर–एनपीएल, सीएसआईआर–आईआईआईएम, सीएसआईआर–सीबीआरआई और सीएसआईआर–सीडीआरआई के निदेशकों के प्रति भी आभार व्यक्त करती हूँ।

आइए, हम इस दृढ़ विश्वास के साथ आगे बढ़ें कि सुरक्षा और विज्ञान साथ–साथ चलते हैं और अपने लोगों को सुरक्षित रखते हुए हम अपने विज्ञान को भी सशक्त बना सकते हैं।

डॉ. एन कलैसेल्वी

महानिदेशक, सीएसआईआर एवं सचिव, डीएसआईआर

Foreword

The Council of Scientific and Industrial Research (CSIR) stands for scientific excellence, innovation, and service to the nation. Our pursuit of path breaking research is anchored not just in intellectual curiosity and technical competence, but also in a deep and abiding commitment to safety.

At CSIR, the integration of safety with science is not optional — it is essential. The guidelines presented in this document are a testament to that commitment. They reflect a shared responsibility across the research ecosystem, from students and technical staff to scientists and administrators, to cultivate a work environment where outreach scientific inquiry thrives in tandem with personal and collective safety.

The nature of Science, Technology and Innovation-driven research across CSIR demands meticulous attention to potential hazards, careful handling of equipment and chemicals, and an ingrained culture of precaution. These guidelines aim not only to help mitigate risks but also to foster a mindset of safety-first thinking. Each scientific experiment, each project, and each activity must begin with the question: Is this being done safely?

As the Director General of CSIR, I fully endorse the efforts of CSIR-CGCRI and all participating laboratories in developing and upholding rigorous safety protocols. I commend the leadership of Prof. Bikramjit Basu, Director, CSIR-CGCRI and Coordinating Director of the CSIR-level Safety Committee, i.e. the Directors of CSIR-NPL, CSIR-IIIM, CSIR-CBRI, and CSIR-CDRI, for their collaborative approach in promoting a culture of safety across CSIR laboratories.

Let us move forward with the conviction that safety and science go hand in hand and that in safeguarding our people, we strengthen our science.

Dr. N Kalaiselvi

DG, CSIR and Secretary, DSIR

प्रिय सहकर्मियों,

सीएसआईआर परिवार की ओर से हम आप सभी को सुरक्षा संबंधी इन दिशा–निर्देशों को पढ़ने और समझने के लिए आमंत्रित करते हैं।

पेशेवर रूप से,हम रचनात्मकता और वैज्ञानिक खोज के प्रति जुनून को बढ़ावा देने के लिए प्रतिबद्ध हैं। साथ ही साथ हमें हर समय सुरक्षा के उच्चतम मानकों का भी पालन करना है। सीएसआईआर में सुरक्षा भी अनुसंधान का एक अभिन्न अंग है और सभी शोधकर्ता –चाहे वे छात्र हों, तकनीकी अधिकारीहों, तकनीशियन हों या वैज्ञानिक हों –की यह जिम्मेदारी है कि वे सुरक्षा और आपातकालीन प्रोटोकॉल का सख्ती से पालन करें। एक सुरक्षित कार्य वातावरण सुनिश्चित करने की शुरुआत संभावित खतरों के बारे में जागरूकता और सुरक्षा संबंधी दिशानिर्देशों के निरंतर अनुपालन से होती है। हम सभी से आग्रह करते हैं कि वे कार्यस्थल को स्वच्छ रखें,असुरक्षित स्थितियों की तुरंत रिपोर्ट दें और व्यक्तिगत सुरक्षा उपकरणों (पीपीई) का उचित उपयोग करें।

प्रयोगशाला के भीतर किसी भी प्रयोग को सुरक्षित रूप से करने की अंतिम जिम्मेदारी मुख्य रूप से प्रयोगकर्ता की ही होती है। सुझाए गए दिशानिर्देश, दुर्घटनाओं को रोकने और कम करने तथा जोखिम को कम करने में मदद कर सकते हैं,जिससे कर्मचारियों की भलाई होगी और कार्यस्थल पर उनके प्रभावशीलता में सुधार होगा।

इस दस्तावेज की गंभीरता से समीक्षा करने और इसमें शामिल करने हेतु उपयोगी टिप्पणियाँ देने के लिए हम डॉ. राजन शंकरनारायणन, उत्कृष्ट वैज्ञानिक, सीएसआईआर–सीसीएमबी, हैदराबादय, डॉ. पी.के. बनर्जी, उत्कृष्ट वैज्ञानिक, सीएसआईआर–सीआईएमएफआर, धनबाद तथा डॉ. नेट्टम वी. चौधरी, विशिष्ट वैज्ञानिक, सीएसआईआर–आईआईसीटी, हैदराबाद का आभार व्यक्त करते हैं।

साइबर सुरक्षा से संबंधित भाग की समीक्षा 4पीआई के वैज्ञानिकों द्वारा की गई और इस सहयोग हेतु हम डॉ. जी.के. पात्रा, निदेशक, सीएसआईआर–4पीआई के आभारी हैं।

मुझे आशा है कि हम सीएसआईआर को सर्वोत्तम सुरक्षापद्धतियों वाला एक उत्कृष्ट राष्ट्रीय संस्थान बनाने के लिए मिलकर काम करेंगे। आप चाहे अनुसंधान, तकनीकी सेवाओं या प्रशासन में कहीं भी कार्यरत हों,आपका योगदान भारत और इसके बाहर उन्नत सामग्रियों के भविष्य को आकार देने में महत्वपूर्ण भूमिका निभाएगा।

शुभकामनाओं सहित,

- प्रो. वेणुगोपाल अचंता, निदेशक, सीएसआईआर–एनपीएल
- डॉ. जबीर अहमद, निदेशक, सीएसआईआर–आईआईआईएम
- प्रो. बिक्रमजीत बसु, निदेशक, सीएसआईआर–सीजीसीआरआई, समन्वयकनिदेशक, सीएसआईआर स्तरीय सुरक्षा समिति
- प्रो. प्रदीप कुमार रमनचारला, निदेशक, सीएसआईआर–सीबीआरआई
- डॉ. राधारंगराजन, निदेशक, सीएसआईआर–सीडीआरआई

Dear Colleague,

On behalf of the CSIR family, we welcome you to read and understand the safety related guidelines.

Professionally, we are committed to fostering creativity and a passion for scientific discovery, while maintaining the highest standards of safety at all times. At CSIR, safety is an integral part of research, and it is the responsibility of all researchers — whether Students, Technical Officers, Technicians, or Scientists — to strictly adhere to safety and emergency protocols. Ensuring a safe working environment starts with awareness of potential hazards and consistent compliance with safety guidelines. We urge everyone to maintain a clean workspace, report unsafe conditions promptly, and use personal protective equipment (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.

We gratefully acknowledge Dr. Rajan Sankaranarayanan, Outstanding Scientist, CSIR-CCMB, Hyderabad, Dr. P K Banerjee, Outstanding Scientist, CSIR-CIMFR, Dhanbad, Dr. Nettem V. Choudary, Distinguished Scientist, CSIR-IICT, Hyderabad for critically reviewing this document and also for providing insightful comments, which were duly incorporated.

The Cyber Security related part was reviewed by CSIR-4PI scientists and we thank Dr. G K Patra, Director, CSIR-4PI.

We hope that we will work together to make CSIR, 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 research in India and beyond.

With best wishes,

- Prof. Venu Gopal Achanta, Director, CSIR-NPL
- Dr. Zabeer Ahmed, Director, CSIR-IIIM
- Prof. Bikramjit Basu, Director, CSIR-CGCRI, Co-ordinating Director
- Prof. Pradeep Kumar Ramancharla, Director, CSIR-CBRI
- Dr. Radha Rangarajan, Director, CSIR-CDRI

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001
Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001

SAFETY MANUAL

Version 1.0

This document contains safety protocols and related guidelines to be followed in all institutions of CSIR.

December, 2025

SAFETY MANUAL DRAFTING SUB-COMMITTEE

DIRECTORS

- Prof. Venu Gopal Achanta, Director, CSIR-NPL
- Dr. Zabeer Ahmed, Director, CSIR-IIIM
- Prof. Bikramjit Basu, CSIR-CGCRI, Co-orditating Director, CSIR level Safety Manual Committee
- Prof. Pradeep Kumar Ramancharla, Director, CSIR-CBRI
- Dr. Radha Rangarajan, Director, CSIR-CDRI

MEMBERS

- Dr. Sidharth Chopra, Senior Principal Scientist, CSIR-CDRI
- Sh. Samir Kumar Kopai, Technician (2), CSIR-CGCRI
- Ms. Tanima Kundu, Technician (1), CSIR-CGCRI
- Sh. Swachchha Majumdar, Chief Scientist, CSIR-CGCRI
- Dr. Mousumi Majumder, Senior Principal Scientist, CSIR-CGCRI
- Dr. Ashis Kumar Mandal, Chief Scientist, CSIR-CGCRI
- Dr. Tuhin Kumar Mandal, Chief Scientist, CSIR-NPL
- Sh. Sukamal Mondal, Principal Technical Officer, CSIR-CGCRI
- Dr. Srikrishna Manna, Senior Technical Officer (3), CSIR-CGCRI
- Sh. Sk. Md. Mursalin, Technician (2), CSIR-CGCRI
- Dr. Vignesh M., Scientist, CSIR-CGCRI
- Dr. S.K. Panigrahi, Chief Scientist, CSIR-CBRI
- Dr. Venkatesh Pilli, Scientist, CSIR-CGCRI
- Dr. Ravi Shankar, Principal Scientist, CSIR-IIIM
- Sh. Ranvir Singh, Principal Scientist, CSIR-CDRI

ACKNOWLEDGEMENT

1. Office of Laboratory Safety and Environmental Health, Indian Institute of Science, Bangalore.
2. Environmental Health Safety. Princeton University.
3. Institute Laboratory and Biosafety Committee, IIT (ISM), Dhanbad.

REFERENCES

1. World Health Organization-Laboratory Safety Manual IIIrd Edition, 2004, ISBN 92 4 154650 6
2. Biosafety in Microbiological & Biomedical Laboratories (BMBL), 5th Edition, 2009, Centres for Disease Control and Prevention, National Institutes of Health, USA
3. Guidelines on Handling Chemical Carcinogens, Teratogens and Mutagens, Texas A&M University, 1995,

   www.chem.tamu.edu/rgroup/wooley/pag/Safety/15safehandlingofcarcinogenicteratoge nicandmutageniccompoundscctm.pdf
4. Ethidium Bromide: Safe handling and Proper Disposal, EH&S, Columbia University, New York, USA,

   http://ehs columbia.edu/etbr.html

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.

INSTITUTE'S LAYOUT PLAN

(All labs to insert their layout plan)

Safety Policy

CSIR strongly emphasizes a safe, healthy, and accident-free workplace. We believe that Safety is a collective responsibility.

Our commitments include:

1. Ensuring personnel safety and environmental protection during R&D activities.
2. Adopting preventive, protective, and mitigative measures.
3. Adhering to safe procedures and methods.
4. Complying with health, safety, and environmental regulations.
5. Fostering a safety-conscious culture through awareness and leadership participation.

This policy demonstrates CSIR's dedication to employee well-being and environmental responsibility.

December, 2025 Director General, CSIR

सुरक्षा नीति

सीएसआईआर एक सुरक्षित, स्वस्थ और दुर्घटना–मुक्त कार्यस्थल पर जोर देता है। हमारा मानना है कि सुरक्षा एक सामूहिक जिम्मेदारी है।

हमारी प्रतिबद्धताओं में निम्नलिखित शामिल हैं:

1. अनुसंधान एवं विकास गतिविधियों के दौरान कार्मिक सुरक्षा और पर्यावरण संरक्षण सुनिश्चित करना।
2. निवारक, रक्षात्मक और न्यूनकारी उपाय अपनाना।
3. सुरक्षित प्रक्रियाओं और विधियों का पालन करना।
4. स्वास्थ्य, सुरक्षा और पर्यावरण संबंधी नियमों का पालन करना।
5. जागरूकता और नेतृत्व की भागीदारी के माध्यम से सुरक्षा के प्रति सचेत रहने की संस्कृति को बढ़ावा देना।

यह नीति कर्मचारी कल्याण और पर्यावरणीय जिम्मेदारी के प्रति सीएसआईआर के समर्पण को दर्शाती है।

दिसंबर 2025

महानिदेशक, सीएसआईआर

CONTENTS

ADDITIONAL RECOMMENDATIONS

✪ Apart from the various safety guidelines outlined in this manual, CSIR laboratories/institutes can have additional guidelines.

1. **Biological Safety:** Details of biological safety are provided in Section 6. In addition, lab-specific posters may be designed and displayed at prominent locations inside the institute premise.

2. **Radiation Safety:** A separate section on Laser Safety is providedin Section 7 and lab-specific more information can be provided at the lab-level.

3. **Pilot Plant and Scale-up Safety:** CSIR labs/institutes engaged in Technology Development Programs can have the pilot plant-specific safety guidelines.

4. **Field Work and Site Operations:** For CSIR labs/institutes engaged in problem-solving at fields (for example, CSIR-CSMCRI, CSIR-NIO, CSIR-NGRI, etc.) or Technology demonstration/ Commercialization in an industry, appropriate safety guidelines may be formulated by the respective lab.

✪ A two-tier Safety Governance Structure may be considered for approval:

1. **Apex Safety Council** (to be constituted by DG, CSIR)

2. **Lab Safety Council** (to be constituted at the lab level by the Director, with Chairperson at the rank of Chief Scientist and Conveners at the rank of Chief Scientist/ Senior Principal Scientist, and Safety Champions from all Divisions of the Institute and a working group of Safety Security and Disaster Management officials). As an example, current administrative structure of the SSDM Committee at CSIR-CGCRI is provided in Appendix H.

All CSIR labs/institutes are advised to keep the annual records for their respective lab/institute and the same may be presented before the Research Council or Management Council:

1. Number of personnel trained on safety aspects in a year
2. Number of incidents/ near misses reported
3. Number of safe man-days achieved
4. Dates of internal safety audit
5. Dates of fire drills

Based on the above criteria and recommendations of the Apex Committee, CSIR labs/institutes can be recognized at the CSIR Foundation Day on September 26 each year at New Delhi.

✪ In order to encourage the CSIR labs/institutes to implement safety measures, the employees may be recognized suitably to follow/implement safety norms at the highest level in their labs/institutes.

CHAPTER 1
Background

The aim of this safety manual is to spread awareness among all staffs of CSIR 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 all CSIR institutions 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 needs to use several hazardous chemicals, high temperature furnaces, as well as precision equipment 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 equipment.

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 such incidence.

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.

CSIR, as an R&D organisation, is committed to implement all measures in an effective manner to establish safety goals, demanding accountability for safety performance and providing the resources necessary for safe workplace.

CHAPTER 2

Safety Principles

Different people think differently about safety, sometimes because of lack of awareness, and sometimes because of lack of sufficient forethought. Safety is defined as follows: “Safety is a freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property or damage to the environments”

Six basic principles of safe workplaces are:

(i) Safety is an ethical responsibility

Ethical responsibility of every employee of CSIR is the starting point on which true safety culture can be established in any workplaces. It is our moral and ethical responsibility to lay down standard operating procedures (SOP)/rules, and follow them to protect employees from death, injury, and illness at workplace.

(ii) Safety is a culture

Commitment with complete participation of the entire laboratory is required to create and maintain safe work culture. Every person in the lab is responsible and accountable for avoiding accidents.

(iii) Employees must be trained

All employees must be trained to work safely, since awareness of safety does not come just like that. Effective training programs at regular intervals should be mandatory for all employees to be a productive part of the safety culture.

(iv) All injuries are preventable

All accidents at the workplace are preceeded by a chain of events (Noncompliance of SOP's). The fundamental belief that injuries are by their nature preventable, is a catalyst that encourage us to prevent injuries.

(v) Safety program must be site-specific with the cyclic audits of the work places and prompt corrective action

The primary aim of workplace audit is to find cause and offer remedy for the potential hazards of the site before they cause injuries to employees. Cyclic hazard

analysis, detailed inspections, aggressive investigation of accidents or near misses, discover potential workplace hazards and identify shortfalls, if any. Safety plans, programs, policies and SOPs, safety regulations and generic safety programs are not sufficient to discover hazards because they are not specific to individual work places. Safety audit programs are site-specific. On finding any deficiency prompt action is required, both to overcome hazards and to strongly pass the message that Safety is Priority.

(vi) Safe workplace prevents economic loss and human casualty

Reducing workplace injuries and illness will give cost benefit to the organization in the long run. Efficient workplace safety is not an expense ; it is an asset. An effectively managed safety culture based on the above principles of work place safety will result in employees who actively participate in training, identify and the alert each other and manages to potential hazards, and feel a responsibility for their own safety as well as the safety of their co-workers. Accepting safety as a moral and ethical responsibility demonstrates a sincere concern for each employee which establishes the foundation of an effective safety culture. Newly recruituted employees (regular, contract staff, and project students) should undergo safety sessions/training as part of the orientation program. Visitors are also allowed to any workplaces where safety matters only after safety briefing.

CHAPTER 3

General Safety Protocols

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

3.1 Safe Laboratory Practices

1. The Divisional Chairperson 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. Equipments in safe operating condition should be used. All equipments that are malfunctioning, unsafe or undergoing maintenance should be clearly labelled as shown beside.

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. Necessary information to the concerned authority (Security, Divisional Scientist/HoD) are to be provided for work beyond working hr or on holidays including weekends. A guidelines for such intimation is provided in Annexure G.
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.
15. Ensure an uninterrupted water supply before you start your experiment.

16. Inspect all equipment for wear or deterioration at regular interval. Maintain all equipment as per the manufacturer's specified requirements. Retain records of calibration/ certification, maintenance and repairs for the life of the equipment.
17. 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.

3.2 FIRST AID

- **Chemicals in the Eyes:** Getting any kind of a chemical into the eyes is undesirable, but certain chemicals are especially harmful. They can destroy eyesight in a very short time. If it does happen, remove lenses and flush your eyes with copious quantities of cool running water, for at least 20 minutes. The eyelid of any affected eye should be lifted up and the area beneath the eyelid irrigated as well. Seek medical treatment immediately.
- **Chemical Spills on the Skin:** Wash thoroughly; bath the affected skin with cotton wool soaked in 5% aqueous sodium carbonate, if acid and 5% acetic acid or undiluted vinegar, if alkali. Remove contaminated clothing and footwear. Care should be taken not to affect unexposed areas of the casualty, or yourself. Wash the affected areas with running water. The length of time that affected areas should be washed will vary depending upon the chemical, its hazards and characteristics. If unsure, wash the affected area for at least 20 minutes. Do not attempt to pick off any solid chemical contaminants that are attached to the skin. Cover the affected area with a sterile, non-stick dressing. If necessary, seek emergency medical treatment.
- **Inhalation:** All experiments that give off smoke or noxious gases should be conducted in a well-ventilated fume hood. This will make an accident of this kind unlikely. If smoke or chemical fumes are present in the laboratory, all persons even those who do not feel ill should leave the laboratory immediately. Make sure that all doors to the laboratory are closed after the last person has left. Since smoke rises, stay low while evacuating a smoke-filled room. Thoroughly ventilate the room before going back to work.
- **Fire:** Fire in the laboratory may occur due to spirit lamps, electrical appliances or other inflammable reagents used in a laboratory. All laboratories should have a fire extinguisher and easy access to safety showers and fire blankets. If the victim is on fire, roll him/her in a blanket to smoothen the flames. Inform the physician. Lay the victim on the ground. Do not remove his clothing. Do not apply any treatment to the burns. This must be left to the physician.
- For minor burns, plunge the affected part into cold water or ice-water to soothe the pain. Apply Mercurochrome or Burnol ointment to the burn.
- A person whose clothing or hair catches on fire will often run around hysterically in an unsuccessful effort to get away from the fire. This only provides the fire with more oxygen and makes it burn faster. It is the responsibility of the closest person to bring the fire blanket to the victim as quickly as possible. Smother the fire by wrapping the victim in the blanket.
- **Injury:** Most cuts that occur in the laboratory are minor. For minor cuts, apply pressure to the wound with sterile gauze, wash with soap and water, and apply a

sterile bandage. If the victim is bleeding badly, raise the bleeding part, if possible, and apply pressure to the wound with a piece of sterile gauze.

- **Fainting:** If a person faints, lay the people down on the back. Position the head lower than the legs and provide fresh air. Loosen restrictive clothing.
- **Electric shock:** The symptoms are fainting and asphyxia. Before doing anything else, put off the main switch. Send for a physician. Begin giving mouth to mouth respiration immediately.

3.3 Spill Response Procedures

- Proper spill response is critical for preventing contamination and exposure. The following procedures apply based on the severity and nature of the spill:

3.3.1. Minor Spills (⩽50 mL, Low Concentration)

- Immediate Action: Notify other lab personnel of the spill.
- Disinfection: Wearing gloves, spray the affected area with a 10% bleach solution.
- Absorption: Cover the spill with absorbent paper and allow the disinfectant to act for 15 minutes.
- Clean-Up: Wipe the area with fresh absorbent paper and dispose of it in regular waste.
- Residue Removal: Use 70% ethanol wipes to remove bleach residue.
- Final Step: Dispose of gloves in a biohazardous waste container and wash your hands thoroughly.

3.3.2 Major Spills (> 50 mL, High Concentration, or Aerosol Risk)

- Initial Action: Immediately spray the spill area with a 10% bleach solution (full strength if necessary).
- Notification: Alert everyone present and exit the Lab
- Emergency Response: Contact CSIR safety personnel without delay. Emergency contact numbers are posted on lab doors.
- Ventilation Control: Air circulation systems may need to be shut down and full-room disinfection initiated by trained personnel.

3.3.3 Contaminated Instrument Decontamination

- Preferred Method: Autoclaving is the recommended method for sterilizing contaminated instruments.
- Alternative Method: Instruments may also be decontaminated using a 10% bleach solution with a minimum contact time of 10 minutes. Any remaining bleach residue should then be removed using 70% ethanol wipes.

CHAPTER 4

Building Safety

To maintain a safe building structure, regular maintenance, protective inspections and adherence to safety standards are crucial. This includes addressing potential issues like foundation problems, structural weakness and fire hazards. Implementing safety protocols, using quality materials and ensuring proper construction practices are also vital for long-term structural integrity. The following points to be noted for safety of a building structure

1. Information on date of construction, type of construction, building plan to be preserved
2. Implement a preventative maintenance program to address issues like roof leaks, plumbing problems
3. Conduct regular inspections of the building structures
4. Structural health assessment to be done periodically after 25 years of construction or as prescribed by the designer
5. Identification of damage and appropriate retrofitting

4.1 Regular Inspections:

- **Structural Integrity:** Conduct regular inspections of the foundation, walls, roof, and load-bearing elements to identify and address any signs of damage or deterioration.
- **Fire Safety Systems:** Ensure fire alarms, sprinkler systems, and fire exits are in good working order and regularly inspected.
- **Electrical and Plumbing:** Check electrical wiring, plumbing, and drainage systems for any potential hazards or leaks.
- **Environmental Hazards:** Inspect for asbestos, mold, or lead paint, which can compromise the building safety and health.

4.2 Proactive Maintenance:

- **Address Issues Promptly:** Repair any identified problems immediately to prevent them from worsening and impacting the building overall structural integrity.
- **Foundation:** Ensure proper drainage around the foundation to prevent water damage and maintain its stability.

- **Exterior:** Maintain the buildings exterior, including the roof, walls, and windows, to prevent water intrusion and structural damage.

4.3 Safety Protocols and Standards:

- **Follow Building Codes:** Adhere to all relevant building codes and standards for construction, fire safety, and accessibility.
- **Safety Training:** Provide safety training to all occupants and staff on fire safety procedures, emergency exits, and general safety practices.
- **Emergency Plans:** Develop and regularly update emergency plans for various scenarios, including fire, earthquakes, and other natural disasters.

4.4 Construction Practices:

- **Qualified Professionals:** Engage qualified engineers and contractors for construction and renovations to ensure proper design and execution.
- **Material Quality:** Use high-quality building materials that meet industry standards and are appropriate for the buildings location and intended use.
- **Foundation and Load-Bearing Elements:** Ensure the foundation is properly designed and constructed to support the buildings weight and withstand environmental conditions.
- **Underpinning:** If necessary, underpin adjacent buildings during construction to prevent settling or collapse.

4.5 Ongoing Monitoring and Assessment:

- **Regular Safety Audits:** Conduct regular safety audits to identify potential hazards and ensure compliance with safety regulations.
- **Risk Assessments:** Perform risk assessments for various activities and operations within the building to identify potential hazards and implement appropriate control measures.
- **Incident Reporting:** Establish a system for reporting and investigating safety incidents to learn from past events and prevent future occurrences.
- **Safety Culture:** Foster a strong safety culture among all occupants and staff, emphasizing the importance of safety and encouraging proactive reporting of hazards.

CHAPTER 5

Laboratory Chemicals

A wide variety of hazardous chemicals are used in the laboratories of CSIR. 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.

5.1 Basic Safety Rules

Whenever working in a laboratory, follow the basic laboratory safety rules. Some of the salient safety rules are listed below:

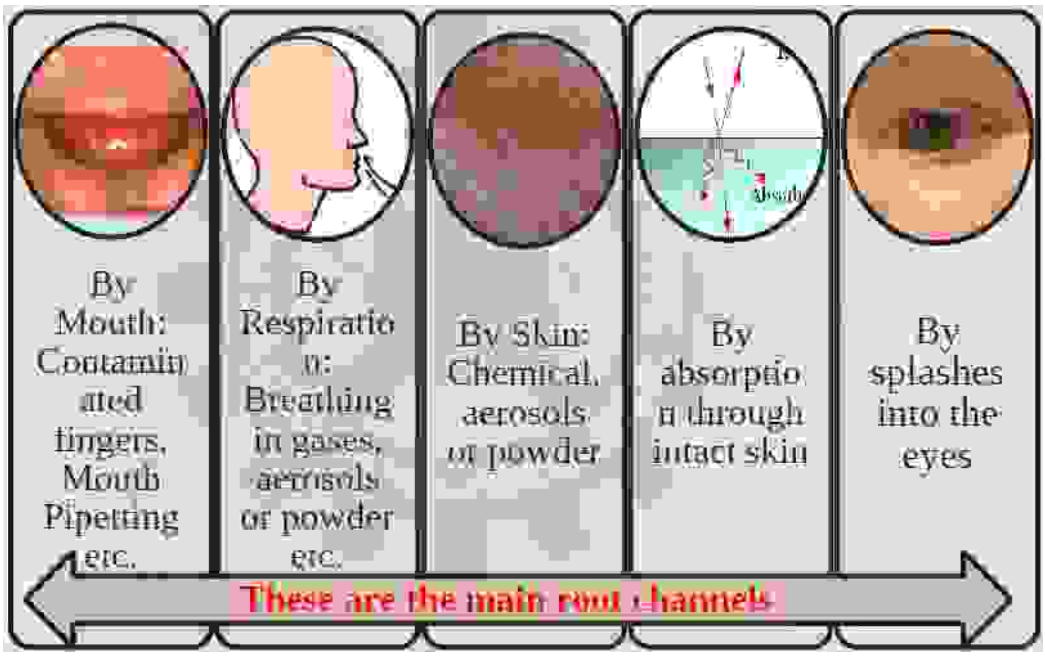
- Be aware of the locations of nearest laboratory safety shower, eye wash station, and fire extinguisher.
- Familiarize yourself with the emergency exit routes.
- Take precaution to protect your skin and eyes from all chemicals.
- Stay safe from all chemical exposures. Never taste or sniff any chemical.
- Maintain decorum inside the laboratory.
- Practice safety and chemical hygiene at all times. Wash exposed areas of the skin prior to leaving the laboratory.
- Strictly avoid eating and/or storing food or beverages in areas where hazardous chemicals are used or stored.
- No contact lenses should be worn around hazardous chemicals even when wearing safety glasses.
- Always wear laboratory safety goggles whenever working 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 eye protection. Always wear safety goggles over your prescription glasses while working with hazardous chemicals. Only closed toe shoes will be allowed within the laboratory. Sandals are inappropriate.
- Clothing made of synthetic yarns easily catch fire, melt and stick to human skin. These should not strictly be worn while working with flammable liquids.
- Laboratory coats should not be carelessly left in sitting areas or wash-rooms to stop spreading contaminates.
- 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)	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 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 chemical containers 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.
- Any unknown chemical produced in the laboratory 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 to minimize the formation and dispersion of aerosols.
- Do not pour chemicals down drains.
- All sink traps (including cup sink traps and floor drains) are to be kept filled with water by running water down the drain at least monthly.
- Fume hoods should not be used for evaporation and disposal of volatile solvents.

- Always work with hazardous chemicals in a properly working fume hood to minimize potential exposures. While 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 stores, or service areas, etc. should be limited to approved personnel only.
- Waste storage locations should be designated and well-marked.
- 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.



5.2 Chemical Storage and Handling

There are several effective strategies for working with chemicals that help minimize both the likelihood of accidents and the severity of their consequences. Risk reduction is achieved through the imlementation of safe work practices, appropriate engineering controls, correct use of Personal Protective Equipment (PPE), limiting the quantity of chemicals used, and substituting hazardous substances with safer alternatives whenever

possible. Chemical safety is closely connected with overall laboratory safety and can be significantly enhanced by following a few basic guidelines.

- Laboratory personnel should label all chemical containers with the date of receipt and the date of first opening, indicating the day, month, and year. This practice is essential for substances that may form organic peroxides over time and is strongly recommended for all other chemicals as well.
- Laboratories should store only the chemicals that are actively in use, minimizing
- Laboratory personnel should label all chemical containers with the date of receipt and the date of first opening, indicating the day, month, and year. This practice is essential for substances that may form organic peroxides over time and is strongly recommended for all other chemicals as well.
- Laboratories should store only the chemicals that are actively in use, minimizing excess storage. Laboratory doors must remain closed at all times to maintain safety and containment.
- Personnel must not handle chemicals or operate equipment unless they have received proper training.
- 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.

Follow these chemical storage guidelines to ensure safe handling and minimize risk:

Acids

- Store large acid containers on low shelves, in trays within acid storage cabinets, or in cabinets clearly labeled “Corrosives.”
- Keep oxidizing acids separate from organic acids, as well as from flammable orcombustible materials.
- Store acids away from bases, reactive metals viz. sodium, potassium, and magnesium, and other incompatible substances.
- Always use bottle carriers or carts when transporting acid containers.
- Ensure that spill control pillows or acid-neutralizing agents specifically designed for acids are readily available. Avoid using bases to neutralize acid spills, as this can cause a dangerous reaction.

Bases

- Store bases separately from acids and other incompatible substances to prevent hazardous reactions.
- Store large containers of liquid bases in trays within a cabinet labeled “Bases” or “Corrosives.”
- Solutions of inorganic hydroxides should be stored in plastic containers.
- Keep spill control pillows or caustic neutralizers readily available for spills involving bases, Do not use acids to neutralize these spills.

Flammables

- Keep flammable liquids only in approved flammable storage cabinets or flammable-safe refrigerators
- Keep all flammable materials away from ignition sources.
- Ensure fire oxtinguishing and spill control equipment is easily accessible.
- When working with flammable metals, keep a Class D'fire extinguisher nearby. Refer to fire extinguisher guidelines for proper usage.

Oxidizers

- Store oxidizing agents in a cool, dry location.
- Keep them away from flammable or combustible substances such as paper, wood, and solvents.

Peroxide-Forming Chemicals

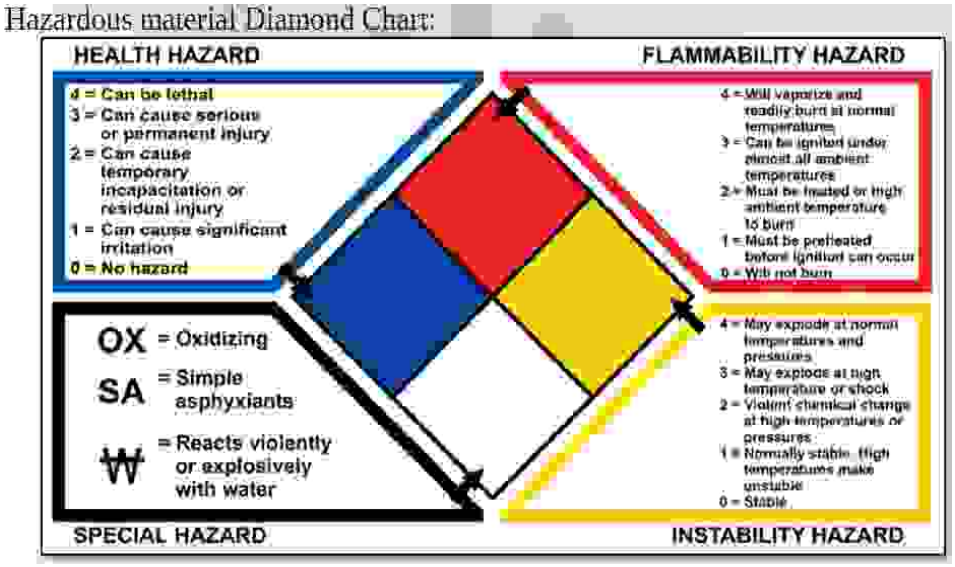
- Clearly label containers with the date of receipt and the date they were first opened.

- Store in tightly sealed containers in a cool, dry, and dark environment.
- Periodically check for peroxide formation using appropriate test strips.
- Dispose of peroxide-forming chemicals by the expiration date or within one year of opening-whichever comes first.

5.2.1 Chemical handling guidelines

When handling chemicals, follow these essential practices to ensure safety:

1. Use only the quantity of chemicals required for the task at hand avoid removing excess amounts.
2. Ensure all chemicals are properly sealed, clearly labeled, and stored in suitable containers immediately after use.
3. Regularly inspect stored chemicals for signs of deterioration, damage, or leaking ontainers.
4. Keep chemicals away from heat sources, direct sunlight, and reactive substances that could trigger dangerous reactions.
5. Never dispose of hazardous chemicals by pouring them down sink drains.
6. Promptly clean up any spills or leaks using approved spill response procedures.
7. Familiarize yourself with emergency protocols related to chemical exposures and spills.
8. Dispose of chemicals strictly in accordance with established disposal procedures.
9. Segregate chemicals by compatibility groups for storage.
10. Familiarise yourself with the appropriate protective measures when exposed to the following classes of hazardous materials like flammable, corrosive, toxic, carcinogen, compressed gases, poisonous



Mercury

Elemental mercury is a commonly used toxic material. When spilled, mercury often fragments into small beads that can bounce and roll away from the location of the initial spill. This, combined with the relatively high vapor pressure of elemental mercury makes it a difficult material to control once spilled. Due to the toxic properties of mercury, and the difficulty in cleaning it up, mercury is one of the most expensive materials to clean-up and dispose of after a spill Once vaporized, the lungs readily absorb elemental mercury from inhaled air. Much of the elemental mercury absorbed by the lungs reaches, and enters, the brain before it can be oxidized by the red blood cells. Oxidized mercury accumulates in the kidneys. At sufficient dose levels, mercury can cause salivation, coughing, chest pain, tremors, emotional instability, kidney damage and reproductive issues. High level acute doses and lower level chronic doses are both causes for concern. The following preventive measures and procedures have to be followed in case of handling mercury and its spills respectively.

Preventive Measures

- Always store mercury in unbreakable containers with closed lids located in well-ventilated areas.
- Do not store mercury with acetylene, fulminic acid, or ammonia. Mixing mercury with these materials can result in an explosive material.
- When breakage of an instrument containing mercury is a possibility, the instrument should be placed in an enameled or plastic pan that can be cleaned easily. Be sure that the pan is large enough to contain the mercury.
- Transfers of mercury from one container to another should be carried out in a hood, over a tray or pan to confine any spills. .

Do not handle mercury over sinks where it could spill down the drain.

- Always wear nitrile or latex gloves while handling mercury.
- Pregnant women and people with a history of kidney damage, should be kept away from the spill area.

Mercury spill clean-up

A typical spill kit will include treated sponges, mercury absorbing powder, water spray bottle, latex gloves, face mask, shoe coverings, flashlight, small dust pan, plastic scoop, and small plastic bags.

- Prior to clean-up, remove all gold or silver rings, watches and bracelets. If mercury comes in contact with gold or silver jewelry, it can bond to the metal.

- Latex, or other impermeable protective gloves shall be worn during the mercuryClean-up.
- Use caution and wear disposable shoe coverings so you do not contaminate your shoes with mercury during the clean-up.
- Begin your clean-up at the outer perimeter of the spill. Work carefully, it is easy to miss contamination, or spread the contamination when the clean-up work is rushed.
- Mercury should never be swept with a broom or vacuumed with an ordinary vacuum cleaner. These procedures will disperse mercury droplets, increase the airborne level of mercury vapor and contaminate the equipment used.
- The preferred way to collect mercury is to dust the area of the spill with mercury absorbing powder (Polyacrylate/Polyalcohol Copolymer water). When used according to instructions, this powder will form a solid mercury metal amalgam that is much safer and easier to handle than elemental mercury.
- Using a damp sponge, work the powder into a paste while scrubbing the contaminated surface. After the paste has dried, it can be collected with a squeegee or stiff card and placed into the plastic container for disposal.
- Place sponges, used powder, rags, shoe covers, and anything used for the clean-up into a plastic bag for disposal.
- Hand over the collected mercury to the stores for disposal.

5.3 Special Precautions for Hazardous Chemical Usage

5.3.1 Hydrofluoric acid (HF)

- Hydrofluoric acid, HF, presents a significant hazard for personal injury. It is available in 40% concentration, diluted, and as the active component of buffered HF, Buffered Oxide Etch. It is widely used in the semiconductor processing for etching oxide films.
- HF is a very hazardous chemical. It is colourless and odourless, so indistinguishable from water. At the concentrations used in the laboratory, HF "burn" is initially painless.
- A victim may not even notice a splatter. When exposed to skin on hands, arms, or face, the acid diffuses in and starts to silently eat away the flesh. The fluoride ion is not consumed in this process. Due to solubility, the ions keep penetrating deeper and deeper, until they reach the bone. At this time the victim feels excruciating pain.

- Unfortunately, by this time it is too late to reverse the considerable tissue damage. At some point, it enters the blood stream, and scavenges Ca ions all over the body. This severely affects the ionic chemistry of the nervous system. If left untreated, exposure is fatal. Be very careful with HF.

1. HF must only be used in the designated extracted wet benches (chemistry laboratory and staff clean room).
2. Apron, gloves, and a face shield should always be worn when handling these chemicals.
3. If there is inorganic fluorides in lab, there should be a 2.5% calcium gluconate ointment nearby to treat burns.
4. Contact trauma centre immediately, if you think you have been exposed

5.3.2 Volatile Solvents

- Highly volatile solvents, like acetone, are flammable with a low flash point. So, they can be ignited even at low-temperatures. They present a significant fire hazard, so must be managed.

1. Flammable solvents must only be transported in chemical buckets. A spill of a gallon bottle of acetone could cause a catastrophic fire or explosion.
2. Highly volatile solvents should only be used inside hoods.
3. Never use volatile solvents near a hot plate. Spilled solvent can be ignited by the hot plates. The resulting fire could easily be drawn up into the exhaust ducts, again with catastrophic consequences.
4. Spilled solvents can react explosively with oxidising agents, e.g., peroxides, nitric acid. Spilled solvents should be contained immediately with chemical spill kits. Seek help as required.

5.3.3 Chlorinated Solvents

- Chlorinated solvents (chlorobenzene, trichloroethylene, and methylene chloride) are used in various resist processes. Their exposure is particularly hazardous, causing cancer, organ damage, etc. They should not be mixed with normal solvents in waste bottles. There are separate waste bottles for chlorinated solvents. As with most solvents, they can be readily absorbed through the skin.

5.3.4 Peroxides

- All peroxides are oxidizers. Considerable energy is released when they react with common materials. Peroxide can also be unstable and explode. Extreme care

should be used in mixing solutions containing peroxides. Peroxides are incompatible with all forms of organic solvents. The class of organic peroxides is even more dangerous. Please read MSDS before handling peroxides.

5.3.5 Inhalation hazards

- Inhalation hazards are often not obvious and hence, overlooked, even though the consequences of inhalation can be quite serious.

1. Some specialized equipment is capable of producing airborne hazards fumes, dust, or mist, for e.g. physical vapour deposition systems (sputtering, evaporation, etc.); sandblasters; grinders, low-melting point metals; solids that sublime at low-temperature; etc. These hazards are compounded if the same equipment are used to handle materials that are toxic. Care must be taken to reduce exposure while using these equipment or toxic materials. Consider using gas masks, respirators, etc.
2. Gases are another common source of inhalation hazard. There are gasses, like H_2S, which occur naturally and can be tolerated in small amounts. Hence, there is a tendency to discount their severity. This is a mistake. Always refer to the MSDS to know the exact amount of allowed exposure; instantaneous and chronic. When such information is not available, err on the side of caution.

5.4 Chemical Storage Cabinets

CABINET TYPE	MATERIAL/CONSTRUCTION	DESCRIPTION
Flammable Liquid Cabinets	Steel, Powder Coated	Designed for storing flammable liquids. Features include self-closing doors and are ventilated with a flame arrestor.
Corrosive Chemical Cabinets	Polyethylene, Stainless Steel	Built to store corrosive chemicals. Corrosion-resistant materials prevent damage to the cabinet and the environment. Add secondary Containment also
Acid Storage Cabinets	Polyethylene, Steel with Acid-Resistant Lining	Cabinets are specifically designed to safely store acids with spill containment features and anti-corrosive linings.

CABINET TYPE	MATERIAL/CONSTRUCTION	DESCRIPTION
Explosive Chemical Cabinets	Heavy Duty Steel, Explosion-Proof	Explosion-proof design with reinforced steel for handling explosive chemicals and high security.
Refrigerated Chemical Cabinets	Insulated Steel, Cooling System	Used for storing temperature-sensitive chemicals with built-in refrigeration and insulation.
General Chemical Storage Cabinets	Steel, Powder Coated	Basic storage for various chemicals, offering features such as adjustable shelves and chemical-resistant coating.
Safety Storage Cabinets	Steel, Ventilated	Ventilated cabinets designed for general chemical storage, offering safety and airflow control for volatile substances.

5.5 Chemical Incompatibility Chart

Group 1	Do NOT mix/store with	Example of Dangerous Reaction
Acids	Bases, Cyanides, Sulfides, Organic Solvents	Release of toxic gases, fire
Bases	Acids, Ammonium salts, Metals	Violent reaction, toxic gas
Organic Solvents	Acids (especially strong oxidizers like nitric acid)	Fire, explosion
Oxidizers	Organic matter, Flammable liquids, Reducing agents	Fire, explosion
Flammable Liquids	Oxidizers, Acids	Fire, explosion
Cyanides	Acids	Release of hydrogen cyanide gas (toxic)
Sulfides	Acids	Release of hydrogen sulfide gas (toxic)
Peroxides	Organics, Metals, Heat	Violent decomposition, explosion
Ammonium compounds	Strong bases, Strong oxidizers	Release of toxic gas
Halogens (Cl2, Br2)	Ammonia, Organic materials	Toxic fumes, explosions
Nitrates	Acids, Reducing agents	Fire, explosion
Metals (e.g., Na, K)	Water, Acids	Fire, explosion, hydrogen gas release

Refrigerated Chemical Cabinets	Insulated Steel, Cooling System	Used for storing temperature-sensitive chemicals with built-in refrigeration and insulation.
General Chemical Storage Cabinets	Steel, Powder Coated	Basic storage for various chemicals, offering features such as adjustable shelves and chemical-resistant coating.
Safety Storage Cabinets	Steel, Ventilated	Ventilated cabinets designed for general chemical storage, offering safety and airflow control for volatile substances.

Chemical A	Chemical B	Hazard
Hcl (acid)	NaOH (base)	Violent heat and splashing
Acetone (organic solvent)	Nitric Acid	Fire, explosion
Sodium metal	Water	Fire, explosion (hydrogen gas)
Hydrogen peroxide	Acetone	Fire, explosion
Ammonia	Bleach (sodium)	Toxic chloramine gas

5.6 Guidelines in case of laboratory emergencies

While regular inspections and proper maintenance of laboratory equipment help prevent accidents, it is equally important to know how to respond if an emergeney oceurs. Your fust priority should always be your own safety. If necessary, contact local emergency services immediately. Notify others in the area about the emergency and inform them of any potential hazards. Take appropriate measures to minimize injury or property damage, based on the nature and severity of the incident. Your response should align with documented laboratory emergency protocols Stay calm, assess the situation carefully, and act accordingly to ensure an effective and safe response. 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.

Chemicals in the Eyes: Getting any kind of a chemical into the eyes is undesirable, but certain chemicals are especially harmful. They can destroy eyesight in a very short time. If it does happen, remove lenses and flush your eyes with copious quantities of cool running water, for at least 20 minutes. The eyelid of any affected eye should be lifted up and the area beneath the eyelid irrigated as well. Seek medical treatment immediately.

Chemical Spills on the Skin: Wash thoroughly, bath the affected skin with cotton wool soaked in 5% aqueous sodium carbonate, if acid and 5% acetic acid or undiluted vinegar, if alkali. Remove contaminated clothing and footwear. Care should be taken not to affect unexposed areas of the casualty, or yourself. Wash the affected areas with running water.

The length of time that affected areas should be washed will vary depending upon the chemical, its hazards and characteristics. If unsure, wash the affected area for at least 20 minutes. Do not attempt to pick off any solid chemical contaminants that are attached to the skin. Cover the affected area with a sterile, non-stick dressing. If necessary, seek emergency medical treatment.

Inhalation: All experiments that give off smoke or noxious gases should be conducted in a well-ventilated fume hood. This will make an accident of this kind unlikely. If smoke or chemical fumes are present in the laboratory, all persons even those who do not feel ill should leave the laboratory immediately. Make sure that all doors to the laboratory are closed after the last person has left. Since smoke rises, stay low while evacuating a smoke-filled room. Thoroughly ventilate the room before going back to work.

Chemical Spills

Chemical spills are among the most frequent accidents in laboratories that handle chemicals. Such spills can occur due to improper or careless opening, handling, or storage of chemical substances. Even a minor spill of a hazardous chemical or a large spill of a non-hazardous one can no serious risks to laboratory personnel. Therefore, it is crucial to exercise caution at all times and to wear appropriate Personal Protective Equipment (PPE) to prevent exposure.

In the event of a chemical spill, follow these steps:

1. First, wear appropriate PPE to protect against potential exposure—never attempt to handle a spill without proper protection.
2. If possible, stop or modify the source of the spill to prevent it from spreading further.
3. Shut down any nearby heat or ignition sources immediately if the chemical is flammable.
4. Avoid inhaling chemical vapors, particularly from volatile or toxic substances. Work in a well-ventilated area or use a fume hood if available.
5. Locate the spill kit and use its tools to cordon off and contain the affected area.
6. Apply an appropriate absorbent material to the spill. If the chemical is acidic or basic, use a neutralizing agent suitable for the substance.
7. Collect the absorbed material and any residues, then place them into a compatible, labeled waste container for proper disposal.
8. Restock or refill the spill kit after use so it is ready for future incidents.

Taking swift, informed, and cautious action can significantly reduce the risks associated with chemical spills.

6.1 Scope

The following guidelines are applicable for all the biological research activities carried out in CSIR laboratories.

"Laboratory bio-safety" is the term used to describe the containment principles, technologies and practices that are implemented to prevent unintentional exposure to pathogens and toxins, or their accidental release.

The advancement in the field of biological research has increased the risks to personnel involved in research activities. The bio samples handled may be infected with pathogens and the manipulation of host cells may produce toxic effects. This calls for adoption of good microbiological techniques and appropriate facilities while carrying out bio research activities. Apart from this, other hazards involved in microbiological laboratories, involves handling of hazardous chemicals, radioactive chemicals, liquid nitrogen, etc.

"Laboratory Biosecurity" refers to institutional and personal security measures designed to prevent the loss, theft, misuse, diversion or intentional release of pathogens and toxins. Biosafety protection is to protect laboratory workers, clinical specimens and the environment.

The basic objective of a biosafety program is the containment of potentially harmful biological agents. The purpose of containment is to reduce or eliminate exposure of laboratory workers, other persons, and the outside environment to potentially hazardous agents. The use of vaccines may provide an increased level of personal protection.

"Containment" is used in describing safe methods, facilities and equipment for managing infectious materials in the laboratory environment where they are being handled or maintained.

The appropriate combination of the elements of containment required in a laboratory is determined on the basis of the risk assessment of the work to be done with a specific agent.

6.2 Institutional Biosafety Committee (IBSC)

IBSC decided that the following general guidelines would apply to all projects and activities approved by the IBSC.

General Guidelines

1. These guidelines would be in addition to the specific SOP's already in place for the BSL2 and BSL3 laboratories that are already in place.

2. All personnel handling infectious agents shall be informed the risk involved and trained by PI and arrangements be made to offer them periodic health check up by PI. Usage of all samples should be maintained in proper laboratory record book available for inspection at anytime.

3. It is expected that all project leaders to keep themselves and their staff/students informed about the regulatory guidelines, rules, regulations, risk assessments, etc applicable for work with various categories of bio-hazardous material. Special attention should be given to the literature disseminated by international agencies (WHO, CDC, ATCC, etc.).

4. The PI is ultimately responsible for safe storage and handling of the organisms by his/her group members, as per SOPs of BSL2 and BSL3 laboratory.

5. In case of any Principal Investigator (PI) has an ongoing project and plans to leave the institute (including superannuation) it is the PI's responsibility to provide the information in advance to the IBSC regarding either closure or handing over of project responsibility. Failure to do so in time may result in the project having to be suspended/closed.

6. These guidelines will be periodically reviewed and modified if necessary, based on newer scientific advances and feedback from experimenters.

Biological agent	Zoonotic Disease
Viruses	Hanta virus, Herpes B, Herpes simplex, Measles, Pox viruses, Rabies
Bacteria	Mycobacterium tuberculosis; Coxiella burnetti (Q fever): Streptobacillus moniliformis (rat bite fever); Rochalimaea henselae (cat scratch disease); Clostridium tetani (tetanus); Mycobacterium marimum (an aquatic infection); Erysipelothrix rhusiopathice (a marine animal infection), L. interrogans (leptospirosis), Yersinia enterocolitica (yersiniosis).
Fungi	Dermatophytes (ringworm)
Protozoans	Giardia, Cryptosporidium, Entamoeba (gastrointestinal diseases); Toxoplasma gondii (toxoplasmosis).
Worms	Hymenolepis spp (tape worm)

6.3 Risk Assessment

Biosafety risk groups classify microorganisms based on their potential hazard to human, animal, or plant health.

Risk Group 1

A pathogen that is unlikely to cause any disease in humans or animals.

Risk Group 2

A pathogen that can cause disease in humans or animals but is unlikely to be a serious hazard. Effective treatment and preventive measures are available and the risk of spread of infection is limited.

Risk Group 3

A pathogen that can cause serious human or animal disease, but does not ordinarily spread from one infected person to another. Effective treatment and preventive measures are available.

Risk Group 4

A pathogen that usually causes serious human or animal disease and that can be readily transmitted from one individual to another, directly or indirectly. Effective treatment and preventive measures are not usually available.

Risk Groups	Risk Assessment	Description
Risk Group 1 (RG1)	No or low individual and community risk	A microorganism that is unlikely to cause human or animal disease. E.g. S. cerevisiae (yeast), Lactobacillus, B. subtilis
Risk Group 2 (Rg2)	Moderate individual risk, low community risk	A pathogen that can cause human or animal disease but is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Laboratory exposures may cause serious infection, but effective treatment and preventive measures are available and the risk of spread of infection is limited. E.g. Streptococcus, Herpes virus, most mammalian cell lines
Risk Group 3 (RG3)	High individual risk, low community risk	A pathogen that usually causes serious human or animal disease but does not ordinarily spread from one infected individual to another. Effective treatment and preventive measures are available. E.g. Yersinia pestis, HIV, SARS virus
Risk Group 4 (RG4)	High individual risk and community risk	A pathogen that usually causes serious human or animal disease and that can

6.4 Biosafety Levels

Bio-safety protection is to protect laboratory workers, clinical specimens and the environment. Diagnostic and health-care laboratories (public health, clinical or hospital-based) must all be designed for at least Bio-safety Level 2 or above if required. As no laboratory has complete control over the specimens it receives, standard precautions should always be adopted and practiced.

Laboratory facilities are designated as

1. Basic- Biosafety Level 1 (BSL 1)
2. Basic- Biosafety Level 2 (BSL 2)
3. Containment-Biosafety Level 3 (BSL 3)
4. Maximum Containment-Biosafety Level 4. (BSL 4)

The four biosafety levels correspond to four risk groups of pathogens.

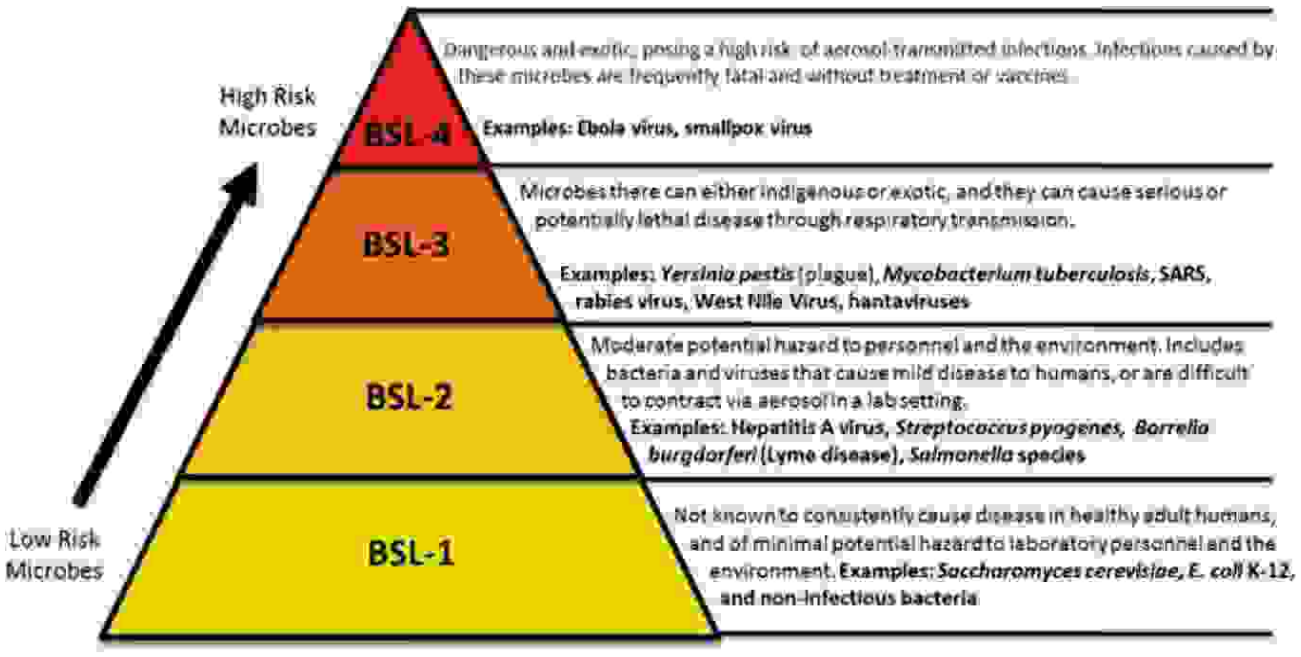
The assignment of a biosafety level takes into consideration the pathogenic agent handled, the facilities and equipment available, the practices and procedures required to conduct work safely in the laboratory.

Biosafety is the result of the following sum of factors:

Microbiological risk assessment + Good working practices + Primary safety barrier + Secondary safety barrier +Medical survey

Each biosafety level has its own specific containment controls that are required for the following:

- Laboratory practices
- Safety equipment
- Facility construction



CDC Classification of Biosafety

The biosafety levels range from BSL-1 –BSL 4, each biosafety level builds on the controls of the level before it. Every microbiology laboratory, regardless of biosafety level, follows standards microbiological practices.

Symbol or Labels for different Biosafety Levels

6.4.1 Biosafety Level-1

The microbes there are not known to consistently cause disease in healthy adults and present minimal potential hazard to laboratorians and the environment. An example of a microbe that is typically worked with at a BSL-1 is a non-pathogenic strain of E-coli.

Specific considerations for a BSL-1 laboratory include the following:

Laboratory practices

- Standard microbiological practices are followed.
- Work can be performed on an open lab bench or table.

Safety equipment

Personal Protective Equipment (lab coats, gloves, eye protection) are worn as needed.

Facility construction

- A sink must be available for hand washing.
- The lab should have doors to separate the working space with the rest of the facility.

BSL-1 Laboratory

6.4.2 Biosafety Level-2

The microbes there pose moderate hazards to laboratorians and the environment. The microbes are typically indigenous and associated with diseases of varying severity.

An example of a microbe that is typically worked with at a BSL-2 laboratory is Staphylococcus aureus.

In addition to BSL-1 considerations, BSL-2 laboratories have the following containment requirements:

Laboratory practices

- Access to the laboratory is restricted when work is being conducted.

Safety equipment

- Appropriate personal protective equipment (PPE) is worn, including lab coats and gloves. Eye protection and face shields can also be worn, as needed.
- All procedures that can cause infection from aerosols or splashes are performed within a Biological Safety Cabinet (BSC)
- An autoclave or an alternative method of decontamination should be available for proper disposals.

Microbiologist working in a biosafety laboratory –Biosafety Cabinet

Standard Operating Protocol For BSL- 2 Lab

- Street footwear to be left outside the lab
- SOP Instructions at Ante Room
- Manual Entry In the Main Log book
- Personal accessories to be kept in the drop box
- As per SOP wearing PPE - Gloves, Individual Shoes, Lab coat, optional 3 ply mask

Laboratory Clothing Requirements

To maintain biosafety and prevent contamination in BSL-2 laboratories, the following clothing and personal protective equipment (PPE) protocols must be followed:

1. Lab Coats and Gloves

Laboratory coats and disposable gloves are mandatory within the BSL-2 laboratory. These items must remain within the laboratory and are not to be worn in non- laboratory areas such as hallways, break rooms, or galleys.

2. Minimum PPE Standards

At a minimum, all personnel must wear a lab coat, disposable gloves, safety goggles, and a protective mask while conducting work in the laboratory.

3. Hair Restraint

Long hair must be securely tied back or covered with a hairnet to prevent visual obstruction and to avoid contamination of the work area.

Material Handling

To prevent contamination and ensure safe material transfer within and outside the BSL-2 laboratory, the following protocols must be observed:

1. All contaminated materials intended for removal from the laboratory must be securely bagged and kept outside the lab area.

2. The transport of all materials into and out of the laboratory must occur via the designated transfer chamber provided within the BSL-2 facility.

3. Prior to being placed in a biological safety cabinet or removed from the lab, all containers and equipment must be disinfected using a 70% ethanol solution or an approved alternative disinfectant.

Special Practices

The following specialized practices are mandatory for maintaining biosafety and regulatory compliance in BSL-2 laboratories:

1. Biohazardous waste must be placed in sealed, leak-proof containers before being transported to other areas for decontamination.

2. Laboratory access is restricted while experiments are in progress. Children, pregnant individuals, and those who are immune-compromised are not permitted entry. Final authority over access rests with the lead laboratory personnel.

3. Only individuals who have been informed of the associated risks and who meet the specified entry criteria are permitted access to BSL-2 laboratories, as determined by supervisory staff.

4. Laboratory doors, equipment, containers, and materials must display appropriate biohazard signage. The main entrance must include the name of the responsible supervisor and clearly state any special entry requirements (e.g., PPE, respiratory protection).

5. All laboratory-generated waste must undergo appropriate decontamination procedures prior to final disposal.

1. Gloves must be worn for all procedures conducted in biological safety cabinets and when handling reagents or chemicals in the BSL-2 lab. Used gloves must be discarded as biohazardous waste.

2. Any spills, accidents, or suspected exposures to biohazardous materials must be reported immediately to the lab supervisor or designated safety officer.

3. The use or transport of human-derived materials—such as blood, tissues, or primary cells— must be pre-approved by the laboratory supervisor. A special set of rules apply for these types of work.

4. A safety and operations manual detailing known and potential hazards, along with mitigation procedures, is posted on the inner side of laboratory doors. Personnel are required to review this document and follow all outlined safety protocols.

Containment Equipment

To ensure safe handling of biohazardous materials and to minimize exposure risks, the following equipment-related practices must be followed in BSL-2 laboratories:

1. All high-risk procedures—including centrifugation, blending, vigorous mixing or shaking, opening containers containing biohazards, and handling human or animal-derived tissues or fluids—must be conducted inside a certified Class II Biological Safety Cabinet or using appropriate personal protective equipment (PPE).

2. All sharp items such as needles, glass slides, coverslips, and microchips must be disposed of in designated biohazardous sharps containers to prevent injury and contamination.

6.4.3 Biosafety Level-3

BSL-3 builds upon the containment requirements of BSL-2. The microbes there can be either indigenous or exotic, and they can cause serious or potentially lethal disease through respiratory transmission. Respiratory transmission is the inhalation route of exposure. One example of a microbe that is typically worked with in a BSL-3 laboratory is Mycobacterium tuberculosis, the bacteria that causes tuberculosis.

Microbiologist working in a biosafety laboratory –Biosafety Cabinet

In addition to BSL-2 considerations, BSL-3 laboratories have the following containment requirements:

Laboratory practices

➢ Laboratorians are under medical surveillance and might receive immunizations for microbes they work with.

➢ Access to the laboratory is restricted and controlled at all times.

➢ Safety equipment

➢ Appropriate PPE must be worn, and respirators might be required.

➢ All work with microbes must be performed within an appropriate BSC.

Facility construction

➢ A hands-free sink and eyewash are available near the exit.

➢ Exhaust air cannot be recirculated, and the laboratory must have sustained directional airflow by drawing air into the laboratory from clean areas towards potentially contaminated areas.

➢ Entrance to the lab is through two sets of self-closing and locking doors.

Standard Operating Protocol For BSL- 3 LAB

➢ SOP Instructions at Ante Room

➢ Manual Entry In the Main Log book

➢ Keep Personal accessories in the drop box

➢ As per SOP wearing PPE – Individual shoes

While moving between BSL2 and BSL3

If you are going from BSL2 to BSL3, please ensure these

➢ Carry your cultures in a closed box to avoid any mishaps

➢ Throw your old pair of gloves and wear a new one. Rinse with spirit before holding the handle of the door of BSL2

➢ Open the door to BSL3 and ensure all the latches are locked after entering

➢ After using BSL3, follow the processes mentioned in Step 2.

While leaving the facility

➢ Compete your decontamination process on the areas of work

➢ Place used glasswares after rinsing, in pass-box

➢ Remove your gloves before opening the door

➢ Once in the lobby of the facility, leave your lab-coat in the UV chamber

➢ Leave your lab shoes in the rack provided

➢ Sign out

➢ Leave the facility

Protocol for bringing materials in and out

➢ Any infectious pathogen (either in the form of purified/culture/blood/serum) should be cultured in the facility only after proper IBSC approval is obtained.

➢ No live pathogen is supposed to come out of the facility in the form of cultures. Culture pellets should be processed inside the facility and no infected cultures/pellets to be stored in freezers of main lab in New R&D Block. Once the cells are lysed inside BSL, lysates could be brought outside the facility.

➢ Any material brought outside the facility should be decontaminated on the surface. Samples should be placed in a closed box and the surface of the box should be wiped with spirit.

Protocol for washing the lab coat

Your lab-coat needs periodic disinfection. Contact maintenance-in-charge for the autoclave and washing of your lab-coat. Everyone involved with experiments should have two lab-coats; one in use and the other back-up. In case of spillage of cultures onto your lab-coat, please drop it into a fresh red bag, leave on your work-bench or in closed cabinet beneath it and inform your PI.

Any concerns should be brought into the notice of maintenance-in-charge and the facility in-charge.

The onus of following biosafety guidelines is on the user, not facility

6.4.4 Biosafety Level-4

BSL-4 builds upon the containment requirements of BSL-3 and is the highest level of biological safety. The microbes in a BSL-4 lab are dangerous and exotic, posing a high risk of aerosol-transmitted infections. Infections caused by these microbes are frequently fatal and without treatment or vaccines. Two examples of microbes worked with in a BSL-4 laboratory include Ebola and Marburg viruses.

In addition to BSL-3 considerations, BSL-4 laboratories have the following containment requirements:

Laboratory practices

➢ Change clothing before entering.

➢ Shower upon exiting.

➢ Decontaminate all materials before exiting.

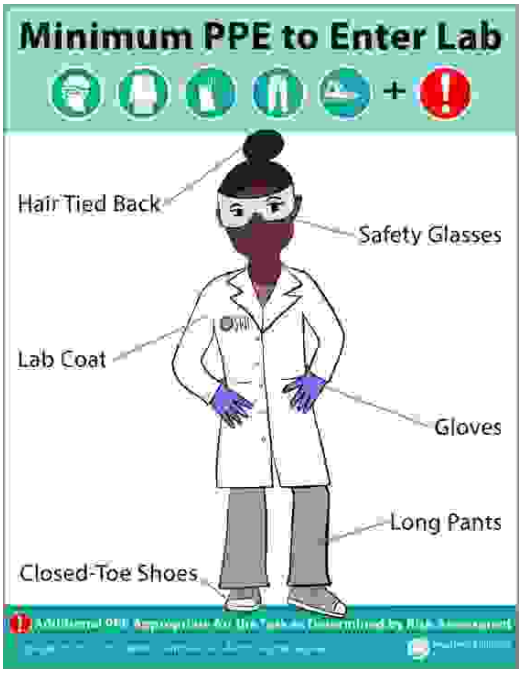
Safety equipment

All work with the microbe must be performed within an appropriate Class III Basfet cabinet , or by wearing a full body, air-supplied, positive pressure suit.

Microbiologist working in a biosafety laboratory Highly Risk Pathogen

Relation of risk groups (RG) to biosafety levels, practices, and equipment (WHO Laboratory Biosafety Manual 2004)

Risk Group	Biosafety Level	Example	Laboratory Type	Laboratory Practices	Safety Equipment
RG-1	BSL-1	Non-pathogenic strains of *E. coli*	Basic teaching, research	Good Microbiological Techniques (GMT)	None, open benchwork
RG-2	BSL-2	HIV, *Salmonella*, *Staphylococcus aureus*	Primary health services, diagnostic services, research	GMT plus protective clothing, biohazard sign	Open bench plus BSC for potential aerosols
RG-3	BSL-3	*West Nile virus*, Tuberculosis, Yellow Fever	Special diagnostic services, research	As Level 2 plus special clothing, controlled access, directional airflow	BSC and/or other primary devices for all activities
RG-4	BSL-4	Ebola, Marburg, Lassa virus	Dangerous pathogen units	As Level 3 plus airlock entry, shower exit, special waste disposal	Class III BSC, or positive pressure suits in conjunction



6.5 Cell Culture Facility

Every user is responsible for safely disposing of all biological waste.

➢ Clean and safe working environments are critical to maintaining good primary cultures. Routine cleaning involves cleaning all work surfaces inside and outside the biosafety cabinets and the floors.

➢ Humidified incubators are of particular concern as they have the potential for fungal and bacterial growth in the water trays. Biosafety cabinets are checked weekly to ensure they are safe to use.

➢ Dry waste containers near the hood are emptied daily, and water with hypo solution is provided at every hood to dispose of contaminated pipettes. They are kept overnight in HYPO solution before autoclaving and sent for incineration every day.

➢ All the incubators and water baths are cleaned every week, and the water is changed in the incubator trays and replaced with sterile water after moping with 70% alcohol.

➢ A 5 L beaker containing 5% Hypo solution is provided at the wash area. All the users are advised to dispose of the used culture media into that beaker, whereas the used culture flasks and dishes are sent daily for incineration. When any bacterial or fungal growth is observed in any of the cultures, it is sterilized by autoclaving and incinerated.

➢ Any biological waste or radioactive materials will be handed over to the institutional collection centre for disposal by a third party.

➢ The dry and wet waste collecting buckets are appropriately labelled and must be used accordingly.

➢ All the students and users are requested to clear unused cells and make space before leaving the institute.

➢ Personal hygiene is highly expected at the facility, and wearing lab coats and gloves is necessary. Do not enter the facility with open hair and barefoot. Use slippers.

➢ Do not use mobile phones in the facility.

➢ Consuming food and drinks in the facility is strictly prohibited.

➢Do not store media and other materials in the cold room for prolonged periods. Contaminated stuff should be discarded immediately in consultation with the facility's help.

➢ Unlabelled, unidentified, contaminated stuff will be discarded periodically by the tissue culture staff. The staff reserves the right to inspect and discard materials if found contaminated.

➢ Appropriate approvals from IBSC and IEC (including IC-SCR) should be shared.

➢ Users are requested to follow the guidelines for all purposes, and the respective SOPs are available at the facility.

6.6 Standard Safe Microbiological Practices

To ensure safety and prevent exposure to biological hazards in BSL-2 laboratories, the following foundational microbiological practices must be strictly observed:

1. Controlled Access

2. Access to the laboratory is restricted while work is being conducted. Doors must remain closed during experiments and must not be propped open under any circumstances. Work in biosafety cabinets (BSCs) when handling infectious or potentially infectious materials. Surface Decontamination

Laboratory work surfaces must be disinfected at least once daily and immediately following any spills involving biohazardous materials.

3. Waste Decontamination

➢ All waste materials—both liquid and solid—that have been contaminated must be properly decontaminated using chemical treatment and /or autoclaving prior to disposal in accordance with institutional and regulatory guidelines.

4. Use of Mechanical Pipetting Devices

Only mechanical pipettes are permitted. Mouth pipetting is strictly forbidden.

5. Prohibited Activities

Eating, drinking, smoking, chewing gum or tobacco, and the application of cosmetics or contact lenses are strictly prohibited within the laboratory environment.

6. Hand Hygiene

Personnel must wash their hands thoroughly before and after handling biohazardous materials, and upon entering or exiting the laboratory.

7. Aerosol Minimization

8. All procedures must be executed with care to reduce the generation of aerosols and splashes that could lead to contamination or exposure.Innoculation

Provide recommended vaccinations to workers handling specific biological agents (e.g., Hepatitis B in case of handling blood samples).

9. Seek Prior Approval

➢ Research work should be conducted with appropriate ethical clearances such as Bio-safety clearance from the Institutional Biosafety Committee, Human Ethics or Animal Ethics, as applicable. For any clarification, please contact the Chairman/ Convener of the respective Committees. No work involving recombinant DNA technology or microbes (protozoa, bacteria, fungi, viruses etc) should be undertaken without obtaining clearance certificate from the CSIR Lab's Certification Authority.

➢ All biohazard wastes must be double-bagged and autoclaved prior to disposal to Institutional Biohazard Waste Management. Each biohazard bag must not be disposed of prior to autoclaving.

➢ All deposits/withdrawal into/from -70° C deep freezer must be documented.This is to allow an accurate inventory of all microbial cultures used in the facility

➢ All potential infectious materials must be placed in durable, leak-proof container during collection, handling, processing, storage or transport.

➢ Segregate and dispose of biological waste (e.g., sharps, cultures)

➢ Evaluate the hazards associated with biological agents and materials before starting work. Proper handwashing after handling biological materials and before leaving the lab.

➢ Routine checks to ensure compliance with biosafety standards. Maintain logs for biological agent use, incidents, training records, and waste disposal.

➢ Over the last several years a number of organic compounds have been confirmed as carcinogens and the list is steadily growing. It is best to assume that all chemicals are toxic, and possibly carcinogenic.

6.7 Safety Guidelines related to handling Pathogenic Fungi Facility

➢ Safety comes before your work. All the biosafety protocols are derived with safety as the primary concern. Your work comes next.

➢ Any procedure in the facility should be seen through the angle of safety of you and your colleagues with who you share the facility.

➢ Your acts should be in agreement with the principles of biosafety. Therefore, any breach of safety should be reported immediately and remedial measure taken quickly.

➢ Biosafety lab is not a regular place for conversations. You are responsible for not only your own safety, but that of your colleague as well.

➢ Please read the following instructions very carefully. You are accountable for any violation and hence make sure that you clarify any of your concerns/doubts your PI/ Scientist in-charge of the facility.

1. Anyone who is working in Pathogenic Fungi Facility must have proper authorization from the respective PI and the scientist in- charge. The approval must be submitted to the scientist in-charge.
2. Shoe-rack: Place your shoes in the shoe-rack kept outside the. Do not leave on the floor. Wear the shoe cover placed on the shoe-rack before entering into the facility.
3. You should have your own laboratory shoe placed in the shoe-rack kept in the lobby of the facility.
4. Entry into the facility must be only via the biometric access. Access for this will be provided by the scientist in-charge.
5. Hang your lab-coats properly in the hangar which is located on the door.
6. When you enter BSL-2, wear your lab coat first (applicable to everyone including PIs /LTS staff)
7. Please keep the common working area clean.Clear the workbenches of any glass or plastic ware after use.

8. Incubator shaker-top is not a storage area. Do not store anything on it. Anything found there would be removed periodically.

9. Class 2 Biosafety cabinet is very important for your work as well as safety. Before use, open it, wipe with 70% ethanol and turn on the UV for 20 minutes prior to use. This will not only kill any left-over pathogen, but save your experiment from contamination. Any instrument or plastic ware taken inside the BSC should be wiped with spirit.

10. It is a good idea to keep a set of disposable plastic ware required for your experiment inside the BSC during the UV-exposure. Do not dump the BSC with plastic ware not needed for your immediate use. The larger the BSC surface exposed to UV, the better.

11. While using BSC, make sure the air flow is not obstructed.

12. After the use of BSC, remove unwanted materials, clean the surface of the cabinet and turn on UV for 20 minutes.

13. Media-trap placed under the BSC is kept to collect used media from your culture that is potentially infectious. This needs to be decontaminated using bleach/hypochlorite. Please make sure that the trap bottle has enough bleach. You could decide it by seeing the color of the liquid in it. If it is turning pink,add more bleach. If the trap is half- filled, please replace with fresh trap with enough bleach in it.

14. Dispose any glass or sharp items in the sharp container placed under the BSC. At no point in time, materials should be projecting outside.

15. In no case, lab-coats should be found hanging anywhere in the biosafety lab. If you are stepping out of the facility, even if it is for a minute, you are required to hang it in the designated hanger.

16. Red bags are for disposing solid waste only. Semi-solid materials can be disposed into a conical flask containing bleach that is placed inside BSC. Red bags would be autoclaved after sealing and any leakage of liquid material could be disastrous.

17. Always wear lab-coat and gloves while working in the facility. Please do not save your used gloves for later use in biosafety lab. This is absolutely against biosafety principles. Wear a fresh one when you resume work.

18. If your gloves are contaminated, please dispose them into the red-bag and wear a new one. Please do not move around with a pair of gloves that have come into contact with a pathogen culture.

19. Dispose your solid waste into red bags either near the BSC or under the adjacent table in the facility. Please take a moment to make sure that the waste is in fact dumped right into the red-bag avoiding spillage outside.

20. Lysis of your live cultures should be performed inside the BSL.

21. Use of cell phone is not allowed inside the facility. Please leave all your personal belongings in the lobby.

22. Spillage of your culture and culture media should be avoided. Make sure you do not hurry into your experiments. The best disinfectant is bleach. If there is any spillage of culture/media, please spray bleach first and then wipe after two minutes. Wipe with spirit at the end. This is true for your incubator, BSC, work area and floor.

23. In case of any major spillage, inform the scientist in-charge and your PI.

24. Music and other forms of digital entertainment are absolutely not allowed inside the facility.

25. No wastes (micro-slides, cover-slide, cotton, tips, tubes etc.) should be left on the work-bench or the floor. If you find any, please discard them appropriately.

26. BSL is not a gossiping place: Limit your conversation to experimental purpose.

27. BSL facility is not a place to rest or sleep. BSL benches are not places to rest your hands or head.

28. While you are working in the facility, you are supposed to conform with the guidelines. For example, if you came to work in BSC and found that the glass trap is full, please report it or get it replaced. If you are found working with such breaches, you are responsible for it. You cannot claim that it was done by the previous user. If you are found using BSC with overfilled red-bag or sharp container, you are held responsible for the violation. Working in BSL is not an automatic right, but a privilege.

While leaving the facility:

1. Complete your decontamination process on the areas of work
2. Remove the lab coat and place it in the hangar and discard first pair of gloves before opening the door
3. After you exit, remove the shoe covers and the 2nd pair of gloves and discard them into the bin kept on the shoe rack.
4. Leave your lab shoes in the rack provided
5. Leave the facility

Protocol for bringing materials in and out

1. Any infectious pathogen should be cultured in the facility only after proper IBSC approval is obtained.
2. No live pathogen is supposed to come out of the facility in the form of cultures. Culture pellets should be processed inside the facility. Once the cells are lysed inside BSL, lysates can be brought outside the facility.

Protocol for washing the lab coat

Your lab-coat needs periodic disinfection by autoclaving and washing of your lab- coat. Everyone involved with experiments should have two lab-coats; one in use and the other back-up. In case of spillage of cultures onto your lab-coat, please drop it into a fresh red bag, and inform Scientist in-charge/PI.

6.8 Plant Biology Lab

- Exposure to several hazardous and toxic chemicals and other agents in a laboratory poses danger to the researcher so it is essential to adopt safety measures for their protection.
- Prior to use equipment or a chemical, the information and instructions should be read vividly.
- It is essential to read the warning signs or labels on equipment and chemicals before using them. It is important to make sure that the location of the safety equipment like the eye washes, first aid kits, clean up kits and fire extinguishers is known along with the knowledge about their usage.
- It is mandatory to wear lab coats, gloves, eye protection and inhalation protection masks when working with chemicals, UV light etc.
- The volatile or potentially hazardous chemicals in a laboratory should be used in a fume hood only.
- In case of an injury, medical aid should be sought immediately.
- A bottle should never be held by its neck, but instead firmly around its body, with one or both hands, depending on the size of the bottle to avoid spills.
- Label the container before adding the reagent, and dispose of when proper expiry date is reached.
- No eating, drinking or smoking in the lab.
- Application of cosmetics is prohibited.
- Wash hands frequently and hydrate with a good lotion.
- Keep finger nails short.
- At the end of the day clean all working benches with a disinfectant.
- Tie back long hair.
- Do not wear jewelry, loose or baggy clothing.
- Since you will use common facilities, all solutions and everything stored in an incubator, refrigerator, etc., must be labeled. In order to limit confusion, each person should use her/his initials or another unique designation for labeling plates, etc. Unlabeled material found in the refrigerators, incubators or freezers may be discarded. Always mark the culture/reagent bottles with your initials, the date, and relevant experimental data.

Always power off / unplug the equipment if not in use. Electrical equipment should not be handled with wet hands, nor should electrical equipment be used after liquid has been spilled on it. The equipment must be turned off immediately and dried thoroughly.

6.9 Fly Lab Facility

- Keep the work space clean.
- Cleanliness is the outcome of civilization.

Don't take anything from other's table without informing them.

Taking anything without permission is stealing

Use the central table for stock transfer and setting up cages Leave the table clean and tidy for the next user.

If you are transferring old bottles, spread blotting paper on the table, sprinkle benzyl benzoate on the sheets, do the transfer and discard the paper promptly.

Take maximum care when you are transferring flies.

Take extra care when you are transferring flies from bottles.

Make sure that you are closing the vials and bottles properly when you discard those in buckets.

Swirl the morgue after discarding flies.

Cages/ plates/ cotton/ ether/ glass wares are kept at the cupboards. Tips/tubes/gloves/plates/slide boxes are kept on the shelf behind the door. Slides/cover slips/HC oil are kept on the shelf inside the injection room.

Stationeries/tissues are kept at the shelf in the stock room.

Pipette /cavity blocks/MQ water/distill water/alcohol squeeze bottle are kept near the sink.

Don't leave the empty trays on the central table, it has to go near the sink. We have separate buckets for vials discard and bottles discard, don't mix up. Don't through tissues in buckets, there are trash bins for that purpose.

Used Coffee, tea cups and banana or any fruit peel will invite stray flies so better avoid those to keep on your table.

Flies need day and night cycle, the last user leaving the lab should switch off the lights.

1. **Incubators are set at**
   - 18°
   - 25°
   - 29°
   - 37°

- Spaces have been allotted to the individuals.
- Whoever comes in the morning check the lights on /switch on the lights.
- Don't occupy others space.
- Don't replace or shuffle.
- Don't meddle with knobs.
- Check the trays regularly. 18° once in 25 days.

  25° once in 20 days

  29° every 15 days.

  Label all your trays kept inside the incubator.

2. CO_2 cylinders

Two are kept near Nectar lab as reserve

There are two CO_2 cylinders kept all the time in the lab.- Working

- Reserve

Before opening the cylinder knob check for CO2 from the gun, for the gun no need of power supply required, for the peddle it needs power supply, check power on.

It's a good practice to close the CO2 knob when it is not in use.

The ringe that is used to open the CO2 cylinder should be kept in its place. Open and close the CO2 knob very gently.

3. Microscopes Individuals

------- Common Trinocular

- Fluorescent
- Microinjection

Enter the user name in the register Check the power supply of the computer.

Keep the slide in the microscope, when the lens is kept at low magnification Reduce the intensity of the lamp of the microscope when switched on and off. Working benches are cleaned every week and microscopes are cleaned in alternate weeks.

4. Stock Room

Stock room is maintained at 20° It is only for general stocks. Stock room is not for storing fly food vials You can keep just for overnight. Don't store old vials in the stock room.

6.10 Animal House Facility

The main aim of animal house is to produce and supply good quality laboratory animals (mice, rats, rabbit, hamster and g.pig). The adherence of the standard operating procedures for regular activities of animal house enables to supply improved quality of lab animals. (Animals free from infectious diseases and genetically defined type of animals). Our major objectives are to supply of good quality animals to our investigators to perform various kind of experiments related to basic and applied research.

Objectives

1. Housing, care, breeding and maintenance of all the species of laboratory animals (mice, rats & rabbits) to provide physical comfort and health.
2. Use of healthy, nulliparous and non-pregnant animals to various experiments related to basic and applied research.
3. Practice of standard hygiene and sanitation in animal facilities
4. Feeding of laboratory animals on balanced diet in which the feed consisting ofv a r i o u s proportions of proteins, carbohydrates, fat, minerals, vitamins and water depending on the species and status of animals. (as per NIN and NRC standard)
5. Medical care, treatment and disease control.

6. Adoptation of procedure to reduce pain and distress in animals by anesthesia and euthanasia.

Introduction

Name of the Unit: Animal House, CSIR-Center for Cellular and Molecular Biology, Hyderabad (example)

Purpose: To utilize laboratory animals in biomedical research related to human health and family welfare

Monitoring, care and use of animals: Institutional animal care and ethics committee to monitors the animal care procedure and use. Full time veterinarian is given responsibility to conduct health monitoring activities. Handling of animals is done by well-trained technical personnel.

Purpose

Standard operating procedure is required to be followed in Animal House, for the following activities

1. Animal Husbandry
2. Breeding
3. Feeding
4. Veterinary Medical care
5. Personal Hygiene of staff
6. Record keeping
7. Other Activities

Responsibility: Every animal house staff

All the husbandry parameters are recorded. Noise Levels: Animal house maintained free from noise pollution.

Entry and Exit

- Use lab coat and chappal/ shoe cover, face mask for every animal house users. First floor lab coat and chappals does not mix with ground floor
- All Staff enter through cabin type air shower in first floor animal house
- Materials enter through the material doors
- All animal house inputs (auto calved cages, paddy husk, feed etc) comes through dump lift
- Dead /discarded animals, dirty cages/materials comes through dump lift

Housing Plan (example: CSIR-CCMB, Hyderabad)

Our animal facility has two floors. Ground floor consists of animal rooms, health monitoring room, autoclave room, cage washing room, feed room, storeroom, and operation room. In animal room, different kinds of species of animals are kept in separate rooms and experimental animal rooms are separately accommodated with different species. Rabbit and mice have separate experimental room. All the animals in ground floor maintained in

conventional system. Each room has been assigned specific number. Any problem related to electrical, mechanical and civil, complaint has to be marked to Head, Lab services with respective formats and they rectify the complaints.

N119 – Mice Breeding Room N117 – Mice experimental room

N118 – Experimental room for Rats & Hamster N115 – Rat breeding room

N113 - Rat experimental Room N111 – Rabbit breeding groom N 109 - Autoclave room N 112 - Operation Room

N 114 - Health monitoring/ microbiology lab room N 116 - NMR LAB N110 C – Rat behavior room

N 110 B - Mice experimental room N118 B – In charge, Room N 105 - Staff Room

N 106 - Cage washing room

First floor consists of animal rooms, washing room, genetic monitoring, feed room and staff room. The first two rooms are experimental rooms and next two rooms are mice breeding rooms. Three rooms are allocated for foundation stock in which we maintain the foundation stock of each strain of mice received from Jackson laboratory and several human disease model transgenic and knockout mice in the isolators. Another two rooms accommodate immuno deficient rodents (SCID and nude mice) maintained in barrier environmental condition.

N220 –Transgenic mice expansion / exp room 1 N205 – Transgenic mice expansion / exp room 2 N218 – Mice breeding room

N216 – Transgenic Mice generation experiment room N214 – Foundation colony stock animal's room

N 212 - Foundation colony mice room -1 N 211 A - Foundation colony mice room -2 N 210 B - Mice breeding room

N215 – Scid & Nude mice experiment roomN213 – Scid and nude mice breedingroom

Floor diagram and animal house floor plan are enclosed. R & D 3rd Floor Animal House

N412 : Experimental room for transgenic /knock out mice N415 : experimental mice room

Floor Cleaning (example: CSIR-CCMB, Hyderabad)

From 9.30am to 6.00pm, all the animal house rooms are cleaned and mopped thrice using floor disinfectant by contract staff.

Ground floor mopping by using Aseptic – from Novartis Company

First floor scid mice and barrier animals – Cidex from Johnson & Johnson Inbred mice colony – Taski spiral from Qualigen

Hand disinfectant - Lever med – from GSK Company Concentration of disinfectant is as per manufacturer protocol

Once in a month, all the corridors and rooms are cleaned with automated floor cleaner machine using vim powder.

Veterinary Medical Care

A full time two veterinarian appointed for daily observation of animal for illness or abnormal behaviors, health monitoring and veterinary care of animals. The following health monitoring work is carried once in every six months for the entire animal colony including sick animals.

1. Physical examination
2. Laboratory Investigation
3. Routine treatment

Physical examination includes external observation like feed intake, active, alert, discharge from eye, nostrils, natural orifices, ectoparasites and physical deformities. Laboratory investigation includes examination of blood, faces, skin scrapping of diseased animals and newly acquired animals. Observations are recorded in the respective formats. Routine treatment includes deworming and antibiotics to all animals through feeds. If any kind of infection is noticed in the colony, we give them suitable broad-spectrum antibiotics with supplements. All the newly acquired animals are kept Quarantine room IVC for 7 days of screening procedures. During this time animals are thoroughly checked with various microbiological and pathological tests and the health status of animals are screened.

Personnel Hygiene:

All the staff at animal house are allowed to enter the animal room with proper clothing, laboratory coat, mask and foot wear. SCID mice facility staff are allowed after taking bath and also their clothes are required to be autoclaved.

Health care of staff

Once in two year, health checkups are performed for animal house staffs at dispensary. In addition complete blood analysis, X ray and intra dermal test (tuberculin) to be evaluated for tuberculosis infection. Addition to this, tetanus toxoid and anti rabies vaccinated once in three years. All the animal house staff health records are filed and maintained individually .

6.11 R & S Phrases

The so called R-Phrases give hints to special risks which may arise by the handling of hazardous substances or formulations. The letter “R” is the abbreviation for “Risk”. After the “Ordinance on Hazardous Substances”, the R-Phrases have to be selected due to the classification of a substance and used for its labelling. Selection of R-Phrases follows the same criteria of the guidelines as for the assignment of hazard symbols and hazard descriptions. R-Phrases and the combination of R-Phrases are listed in the “Ordinance on Hazardous Substances”. (See also “Legal Conditions for the Handling of Hazardous Substances” and “Technical Guidelines on Safety in Chemical Laboratory Courses”). The R-Phrases consist of one or several code letters and the related descriptions (e.g., R41: Risk of serious damage to eyes). A particular attention is given to R10 (flammable), since this category does neither have a hazard symbol nor a code letter.

The so called S-Phrases give hints to safety informations of a hazardous substance. They should enable the user to avoid risks during the handling of hazardous substances and

formulations, and to take measures against the release of these substances, to control the consequences of accidents, and recommend to give first aid. The letter "S" is the abbreviation for "Safety". After the "Ordinance on Hazardous Substances", the S-Phrases have to be selected due the classification of a substance and used for its labelling. S-Phrases and the combination of S-Phrases are listed in the "Ordinance on Hazardous Substances". Analogous to the R-Phrases, they consist of one or several code letters and the related descriptions (e.g., S22: Do not breathe dust).

While labelling a substance with several R&S Phrases these can be separated from each other by a hyphen (- : individual phrases) or a slash (/ : combination of phrases). Certain R-Phrases are always combined with certain S-Phrases, e.g., R45 with S53. The R&S Phrases are important parts of an operating instruction and they must be strictly followed.

In practice chemists will often be faced with the problem that different R&S Phrases are assigned to the same substances depending on their origin (producer). The reason for this is following: The EU assigns obligatory classification and labelling for a series of substances (i.e., R&S Phrases). But for all other substances not listed by the EU, the producer has the obligation to assign the hazard symbols and R&S Phrases by himself (Council Directive 67/548/EEC of 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances). Classification is done by the EU guidelines on the basis of physical-chemical and toxicological data of the substances. In these cases, there are no standards and each producer classify his product after own test data leading to non-uniform labelling. The data base for these classifications are usually not available and the classification is, therefore, not comprehensible. It is, therefore, recommended that in case of different labelling of the manufacturers one should follow the strongest R&S Phrases given.

R-Phrases – Hints to special risks

The separation of two R-Phrases by a hyphen (- , e.g., R12-20) means that the R-Phrases R12 and R20 have to be considered (and not R12 to R20). If R-Phrases are separated by a slash (/ , e.g., R26/27/28) then all three R-Phrases are indicated: R26 and R27 and R28 (combination of R-Phrases).

List of R-Phrases

R1 : Explosive when dry

R2 : Risk of explosion by shock, friction, fire or other source of ignition

R3 : Extreme risk of explosion by shock, friction, fire or other source of ignition R4 :Forms very sensitive explosive metallic compounds

R5 : Heating may cause an explosion

R6 : Explosive with or without contact with air R7 : May cause fire

R8 : Contact with combustible material may cause fire R9 : Explosive when mixed with combustible material R10: Flammable

R11: Highly flammable R12: Extremely flammable

R13: Extremely flammable liquefied gas R14: Reacts violently with water

R15: Contact with water liberates highly flammable gases

R16: Explosive when mixed with oxidizing substances R17: Spontaneously flammable in air

R18: In use, may form flammable/explosive vapor-air mixture R19:May form explosive peroxides

R20: Harmful by inhalation

R21: Harmful in contact with skin R22: Harmful if swallowed

R23: Toxic by inhalation

R24: Toxic in contact with skin R25: Toxic if swallowed

R26: Very toxic by inhalation

R27: Very toxic in contact with skin R28: Very toxic if swallowed

R29: Contact with water liberates toxic gas R30: Can become highly flammable in use R31: Contact with acids liberates toxic gas R32: Contact with acids liberates very toxic gas R33: Danger of cumulative effects

R34: Causes burns

R35: Causes severe burns R36: Irritating to eyes

R37: Irritating to respiratory system R38: Irritating to skin

R39: Danger of very serious irreversible effects R40: Possible risk of irreversible effects

R41: Risk of serious damage to eyes

R42: May cause sensitization by inhalation R43: May cause sensitization by skin contact

R44: Risk of explosion if heated under confinement

R45: May cause cancer

R46: May cause heritable genetic damage

R47: May cause birth defects

R48: Danger of serious damage to health by prolonged exposure R49: May cause cancer by inhalation

R50: Very toxic to aquatic organisms R51: Toxic to aquatic organisms R52: Harmful to aquatic organisms

R53: May cause long-term adverse effects in the aquatic environment R54: Toxic to flora

R55: Toxic to fauna

R56: Toxic to soil organisms R57: ` Toxic to bees

R58: May cause long-term adverse effects in the environment R59: Dangerous to the ozone layer

R60: May impair fertility

R61: May cause harm to the unborn child R62: Possible risk of impaired fertility

R63: Possible risk of harm to the unborn child R64: May cause harm to breast-fed babies

R65 Harmful: may cause lung damage if swallowed

R66 Repeated exposure may cause skin dryness or cracking R67 Vapors may cause drowsiness and dizziness

R68 May cause irreversible effects

Combinations of R-Phrases

R14/15:Reacts violently with water liberating highly flammable gases R15/29: Contact with water liberates toxic, highly flammable gas R20/21:Harmful by inhalation and in contact with the skin

R20/21/22:Harmful by inhalation, in contact with the skin and if swallowed R20/22:Harmful by inhalation and if swallowed

R21/22: Harmful in contact with the skin and if swallowed R23/24:Toxic by inhalation and in contact with the skinR23/24/25: Toxic by inhalation, in contact with the skin and if swallowed R23/25: Toxic by inhalation and if swallowed

R24/25: Toxic in contact with the skin and if swallowed R26/27:Very toxic by inhalation and in contact with the skin

R26/27/28: Very toxic by inhalation, in contact with the skin and if swallowed R26/28:Very toxic by inhalation and if swallowed

R27/28: Very toxic in contact with the skin and if swallowed R36/37: Irritating to eyes and respiratory system R36/37/38: Irritating to eyes, respiratory system and skin R36/38: Irritating to eyes and skin

R37/38: Irritating to respiratory system and skin

R42/43: May cause sensitization by inhalation and skin contact

R48/20: Harmful: danger of serious damage to health by prolonged exposure through inhalation

R48/20/21: Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with the skin

R48/20/21/22:Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with the skin and if swallowed

R48/20/22: Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed

R48/21: Harmful: danger of serious damage to health by prolonged exposure in contact with skin

R48/21/22: Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed

R48/22: Harmful: danger of serious damage to health by prolonged exposure if swallowed

R48/23: Toxic: danger of serious damage to health by prolonged exposure through inhalation

R48/23/24: Toxic: danger of serious damage to health by prolonged exposure through

inhalation and in contact with the skin

R48/23/24/25:Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with the skin and if swallowed

R48/23/25: Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed

R48/24: Toxic: danger of serious damage to health by prolonged exposure in contact with skin

R48/24/25: Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed

R48/25: Toxic: danger of serious damage to health by prolonged exposure if swallowed

R50/53: Very toxic to aquatic organisms, may cause long term adverse effects in the aquatic environment

R51/53: Toxic to aquatic organisms, may cause long term adverse effects in the aquatic environment

R52/53: Harmful to aquatic organisms, may cause long term adverse effects in the aquatic environment

R68/20: May cause irreversible effects by inhalation R68/21:May cause irreversible effects in contact with skin R68/22: May cause irreversible effects if swallowed

R68/20/21: May cause irreversible effects by inhalation and in contact with skin R68/20/22 May cause irreversible effects by inhalation and if swallowed R68/21/22M a y cause irreversible effects in contact with skin and if swallowed

R68/20/21/22 May cause irreversible effects by inhalation, in contact with skin and if swallowed

S-Phrases – Safety Recommendations

The separation of two S-Phrases by a hyphen (- , e.g., S10-23) means that the S-Phrases S10 and S20 have to be considered (and not S10 to S23). If S-Phrases are separated by a slash (/ , e.g., S36/37/38) then all three S-Phrases are indicated: S26 and S27 and S28 (combination of S-Phrases).

List of S-Phrases

S1 : Keep locked up

S2 :Keep out of reach of children S3 : Keep in a cool place

S4. Keep away from living quarters

S5 : Keep contents under. (appropriate liquid to be specified by the manufacturer)

1 ... water

2 ... kerosene

3 ... paraffin oil

S6 :Keep under. (inert gas to be specified by the manufacturer)

1 ... nitrogen

2 ... argon

3 ... carbon dioxide

S7 : Keep container tightly closed S8 : Keep container dry

S9 : Keep container in a well-ventilated place S12: Do not keep the container sealed

S13: Keep away from food, drink and animal feedstuffs

S14: Keep away from (incompatible material to be indicated by the manufacturer)

1 ... reducing agents, heavy metal compounds, acids, alkaline

2 ... oxidizing and acidic substances and heavy metal compounds

3 ... iron

4 ... water and alkaline

5 ... acids

6 ... alkaline

7 ... metals

8 ... oxidizing and acidic substances

9 ... flammable organic substances

10 .. acids, reducing agents and flammable materials

11 .. flammable substances S15: Keep away from heat

S16: Keep away from sources of ignition - No Smoking! S17: Keep away from combustible material

S18: Handle and open container with care S20: When using do not eat or drink

S21: When using do not smoke

S22: Do not breathe dust

S23: Do not breathe gas/fumes/vapor/spray (appropriate wording to be specified by the manufacturer)

1 ... gas

2 ... vapor

3 ... spray

4 ... fumes

5 ... vapor/spray

S24: Avoid contact with the skin S25: Avoid contact with eyes

S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice

S27: Take off immediately all contaminated clothing

S28: After contact with skin, wash immediately with plenty of. (to be specified by the manufacturer)

1 ... water

2 ... water and soap

3 ... water, soap, and polyethylene glycol 400, if available

4 ... polyethylene glycol 300 and ethanol (2:1), then water and soap

5 ... polyethylene glycol 400

6 ... polyethylene glycol 400, then cleaning with water

7 ... water and acidic soap S29: Do not empty into drains

S30: Never add water to this product

S33: Take precautionary measures against static discharges S34: Avoid shock and friction

S35: This material and its container must be disposed of in a safe way 1 ... through treatment with 2% sodium hydroxide

S36: Wear suitable protective clothing S37: Wear suitable gloves

S38: In case of insufficient ventilation, wear suitable respiratory equipment

S39: Wear eye/face protection

S40: To clean the floor and all objects contaminated by this material use (to be specified by the manufacturer)

S41: In case of fire and/or explosion do not breath fumes

S42: During fumigation /spraying wear suitable respiratory equipment (appropriate wording to be specified by the manufacturer)

S43: In case of fire, use. (indicate in this space the precise type of fire fighting equipment. If water increases the risk, add "never use water")

1 ... water

2 ... water and powder extinguishing agent

3 ... powder extinguishing agent, do not use water

4 ... carbon dioxide, do not use water

6 ... sand, do not use water

7 ... metal extinguishing agent, do not use water

]8 ... sand, carbon dioxide, or powder extinguishing agent, do not use water S44:If you feel unwell, seek medical advice (show the label where possible)

S45: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)

S46: If swallowed, seek medical advice immediately and show the container or label S47: Keep at temperature not exceeding °C (to be specified by the manufacturer) S48:K e e p wetted with (appropriate material to be specified by the manufacturer) S49: Keep only in the original container

S50: Do not mix with. (to be specified by the manufacturer)

1 ... acids

2 ... alkaline

3 ... strong acids, strong alkaline, heavy metals and their salts S51: Use only in well ventilated areas

S52: Not recommended for interior use on large surface areas S53: Avoid exposure - obtain special instructions before use

S54: Obtain the consent of pollution control authorities before discharging to waste-water treatment plants

S55: Treat using the best available techniques before discharge into drains or the aquatic environment

S56: Do not discharge into drains or the environment, dispose to an authorised waste collection point

S57: Use appropriate containment to avoid environmental contamination S58:To be disposed of as hazardous waste

S59: Refer to manufacturer/supplier for information on recovery/recycling S60:This material and/or its container must be disposed of as hazardous waste

S61: Avoid release to the environment. Refer to special instructions/ material safety data sheet

S62: If swallowed, do not induce vomiting: seek medical advice immediately and show the container or label

S63: In case of accident by inhalation: remove casualty to fresh air and keep at rest

S64: If swallowed, rinse mouth with water (only if the person is conscious)Combinations of S-Phrases

S1/2: Keep locked up and out of reach of children S3/9: Keep in a cool, well ventilated place

S3/7/9:Keep container tightly closed in a cool, well ventilated place

S3/14: Keep in a cool place away from (incompatible materials to be indicated by the manufacturer)

1 ... reducing agents, heavy metal compounds, acids, alkaline

2 ... oxidizing and acidic substances and heavy metal compounds

3 ... iron

4 ... water and alkaline

5 ... acids

6 ... alkaline

7 ... metals

8 ... oxidizing and acidic substances

S3/9/14: Keep in a cool, well ventilated place away from (incompatible materials to be indicated by the manufacturer)

1 ... reducing agents, heavy metal compounds, acids, alkaline
2 ... oxidizing and acidic substances and heavy metal compounds
3 ... iron
4 ... water and alkaline
5 ... acids
6 ... alkaline
7 ... metals
8 ... oxidizing and acidic substances

S3/9/49: Keep only in the original container in a cool, well ventilated place

S3/9/14/49: Keep only in the original container in a cool, well ventilated place away from. (incompatible materials to be indicated by the manufacturer)

1 ... reducing agents, heavy metal compounds, acids, alkaline
2 ... oxidizing and acidic substances and heavy metal compounds
3 ... iron
4 ... water and alkaline
5 ... acids
6 ... alkaline
7 ... metals
8 ...oxidizing and acidic substances

S3/14: Keep in a cool place away from (incompatible materials to be indicated by the manufacturer)

S7/8: Keep container tightly closed and dry

S7/9: Keep container tightly closed and in a well ventilated place

S7/47: Keep container tightly closed and at a temperature not exceeding °C(tobe specified by the manufacturer)

S20/21: When using do not eat, drink or smoke

S24/25: Avoid contact with skin and eyes

S27/28: Take off immediately all contaminated clothing. After contact with skin, wash immediately with plenty of (to be specified by the manufacturer)

S29/35: Do not empty into drains. This material and its container must be disposed of in a safe way.

S29/56: Do not empty into drains: dispose of this material and its container to hazardous or special waste collection point

S36/37: Wear suitable protective clothing and gloves

S36/37/39: Wear suitable protective clothing, gloves and eye/face protection

S36/39: Wear suitable protective clothing and eye/face protection

S37/39: Wear suitable gloves and eye/face protection

S47/49: Keep only in the original container at a temperature not exceeding°C (to be specified by the manufacturer)

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 jewellery, 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

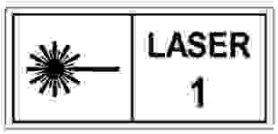
- Repairing and maintenance of Class 3B and Class 4 lasers should be performed only by trained and authorized personnel.
- Spectators are permitted in the laser-controlled area only with the explicit approval of the laser supervisor.

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.

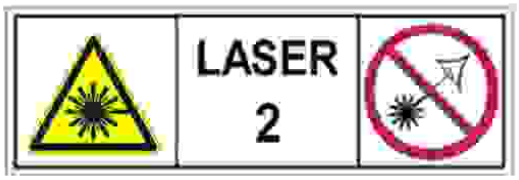
However, they can become hazardous if their beams are viewed through collimating optical instruments, such as binoculars or telescopes, which can concentrate the beam and significantly increase its intensity. Appropriate safety measures should be implemented to mitigate this risk.

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 poter



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), radio frequency (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.

GAMMA RADIATION

Emergency Preparedness and Response Plan for Gamma Irradiation Chamber (GIC)

(Requirements as per Atomic Energy Radiation Protection Rules, 2004)

a. List of Emergency Handling Equipment at site

Fire Extinguishers

Radiation Survey Monitors

Remote handling tongs

b. Emergency Situations

The occurrence of any one or more of the following situations may be deemed to constitute an emergency:

i. Loss/ theft of radiography sources from storage/radiography sites.

ii. Malevolent actions by the anti-social elements leading to damage to the GIC.

iii. Fire incident, explosion, or natural disaster such as earthquake, etc., at the GIC installation location.

i. Radiation levels in excess of the baseline/ normal values on the GIC unit during routine operation.

ii. Over-Exposure due to unsafe radiography work practices. (The institution should list out the likely scenario that may lead to an emergency) Anyone noticing any of the above instances should immediately bring the matter to the notice of the RSO/ Site-in-charge available at the site. The site-in-charge is the only person responsible for handling any emergency taking place at the site. Radiographers should cordon off the area and act as per the instructions and guidance of the Site-in-charge/RSO.

c. Action Plans for handling the above emergency scenarios

The following action plans are for each of the above emergency scenarios.

i. Loss/ theft of radiography sources from storage/ radiography sites:

- Gather information regarding the radioactive source Collect handling & monitoring equipment
- Inform the security.
- If the area is known, determine with a survey meter the presence of the source.
- Cordon off the area.
- Switch on the survey meter & move in a direction where the radiation level increases.
- Radiation level in R/ h indicates source is nearby (RL < 1 R/ hr).
- Bring the lead pot and transfer the source with a 2 m CV tong to the container.
- Search for the source in suspected areas. Deploy more search teams.
- Intimate AERB, the Regulatory Body.
- Lodge Police Complaint.
- Public Announcement after getting permission from AERB.
- Intimation to Government & Municipal Hospitals.

ii. Malevolent actions by the anti-social elements leading to damage to the GIC:

➢ To close down the GIC facility to prevent access, deploy the response force (Security personnel) to prevent unauthorized access. Inform the nearest police, i.e., Law Enforcement Authority. In case of damage, assess the situation and provide temporary additional shielding to reduce the radiation levels to the permissible limit. In case of fire/ explosion, contact the fire department for help and follow the procedures as given in the fire incident.

➢ Inform Crisis Management Group (CMG), DoAE, Govt. of India, Competent Authority and manufacturer/ supplier, i.e., Board of Radiation & Isotope Technolow (BRIT)/ BARC, Mumbai.

➢ Investigate any personal exposure to radiation by workers involved in the remedial action.

iii. Fire incident, explosion or natural disaster such as earthquake, etc. at GIC installation location:-

➢ In case of fire or explosion, contact the fire department for help.

➢ RSO will guide firefighters in the safe handling of fire incidents. As GIC is housed with radioactive material, there is a possibility of loss of shielding integrity during fire, which may cause higher radiation levels around.

➢ After controlling the fire, measure the radiation levels to check the shielding loss, if any, Additional shielding should be provided if required to reduce the radiation levels to the permissible limit. Check the radiation if any.

➢ Inform the manufacturer/ supplier and Competent Authority of the further course of action.

➢ Investigate personnel exposure, if any, to the radiation workers involved in the remedial action.

➢ For an Action plan on the part of the manufacturer (supplier i.e., BRIT/BARC,

➢ On receipt of information, a responsible officer from the manufacturer should be deputed to the institution to assess the extent of damage in terms of physical and radiation leakage that occurred due to the fire accident.

➢ Repair of GIC repair for reuse or decommissioning is to be undertaken by the manufacturer based on the damage assessment.

iv. Radiation levels in excess of the baseline (normal values on the GIC unit during routine operation:

➢ Counter-check the radiation levels with a calibrated and functional radiation survey meter.

➢ Provide temporary additional shielding to reduce the radiation levels to the permissible limit.

➢ Inform the manufacturer/ supplier (BRIT/BARC) and the Competent Authority for further course of action.

➢ Investigate personnel exposure, if any, to the radiation workers involved in the remedial action.

d. Emergency:

i. Loss/ theft of radiography sources from storage/ radiography sites.

ii. Malevolent actions by the anti-social elements leading to damage to the GIC. iii. Fire incident, explosion, or natural disaster such as earthquake, etc., at the GIC installation location.

iv. Radiation levels in excess of the baseline/normal values on the GIC unit during routine operation.

v. Over-Exposure due to unsafe radiography work practices.

(The institution should list out the likely scenario that may lead to an emergency)

Anyone noticing any of the above instances should immediately bring the matter to the notice of the RSO/Site-in-charge available at the site. The site-in-charge is the only person responsible for handling any emergency taking place at the site. Radiographers should cordon off the area and act as per the instructions and guidance of the Site-in-charge/ RSO.

e. Action Plans for handling the above emergency scenarios

The following action plans are for each of the above emergency scenarios.

I. Loss/_theft of radiography sources from storage/ radiography sites:

- Gather information regarding the radioactive source
- Collect handling & monitoring equipment
- Inform the security.
- If the area is known, determine with a survey meter the presence of the source.
- Cordon off the area.
- Switch on the survey meter & move in a direction where the radiation level increases.
- Radiation level in R/ h indicates source is nearby (RL < I R/ hr).
- Bring the lead pot and transfer the source with a 2 m CV tong to the container.
- Search for the source in suspected areas. Deploy more search teams.
- Intimate AERB, the Regulatory Body.
- Lodge Police Complaint.
- Public Announcement after getting permission from AERB.
- Intimation to Government & Municipal Hospitals.

ii. Malevolent actions b the anti-social elements leading to damage to the GIC:

- To close down the GIC facility to prevent access, deploy the response force (Security personnel) to prevent unauthorized access. Inform the nearest police, i.e., Law Enforcement Authority. In case of damage, assess the situation and provide temporary additional shielding to reduce the radiation levels to the permissible limit.
- In case of fire/ explosion, contact the fire department for help and follow the procedures as given in the fire incident.
- Inform Crisis Management Group (CMG), DoAE, Govt. of India, Competent Authority and manufacturer/ supplier, i.e., Board of Radiation & Isotope Technology (BRIT)/ BARC, Mumbai.
- Investigate any personal exposure to radiation by workers involved in the remedial action.

iii. Fire incident, explosion or natural disaster such as earthquake, etc. at GIC installation location:

- In case of fire or explosion, contact the fire department for help.

➢ RSO will guide firefighters in the safe handling of fire incidents. As GIC is housed with radioactive material, there is a possibility of loss of shielding integrity during fire, which may cause higher radiation levels around.

➢ After controlling the fire, measure the radiation levels to check the shielding loss, if any. Additional shielding should be provided if required to reduce the radiation levels to the permissible limit. Check the radiation contamination, if any.

➢ Inform the manufacturer/ supplier and Competent Authority of the further course of action.

➢ Investigate personnel exposure, if any, to the radiation workers involved in the remedial action.

f. For an Action plan on the part of the manufacturer/ supplier i.e., BRIT/BARC,

➢ On receipt of information, a responsible officer from the manufacturer should be deputed to the institution to assess the extent of damage in terms of physical and radiation leakage that occurred due to the fire accident.

➢ Repair of GIC repair for reuse or decommissioning is to be undertaken by the manufacturer based on the damage assessment.

g. Radiation levels in excess of the baseline / normal values on the GIC unit during routine operation:

➢ Counter-check the radiation levels with a calibrated and functional radiation survey meter.

➢ Provide temporary additional shielding to reduce the radiation levels to the permissible limit.

➢ Inform the manufacturer/ supplier (BRIT/BARC) and the Competent Authority for further course of action.

➢ Investigate personnel exposure, if any, to the radiation workers involved in the remedial action.

PROCEDURES FOR CLEAN-UP OF RADIATION SPILLS

Low-Level Spills

➢ A low-level spill is one that is confined to a limited area and does not increase the radiation levels in the area beyond the acceptable limits of 2 mR/hr.

➢ The spill is confined to absorbent paper or an impervious tray.

➢ Radiation levels 1 meter from the centre of the spill do not exceed 2 mR/hr.

➢ The total quantity of material spilled is greater than 1 uCi but less than 1 mCi.

➢ The licensed principal investigator supervising the activities in the laboratory where the spill occurred must be notified immediately. The investigator is responsible for ensuring the spilled material is collected and disposed of properly. Decontamination procedures should include the following steps:

1. If the spill was absorbed by the bench paper, collect the paper and place it into a plastic bag. Label the bag and place it into the appropriate radioactive waste drum,

2. If the spill was confined to an impervious tray, wash the tray with decontamination solution. The rinse water may be disposed of in the sink if levels of radiation are within permissible limits (see Disposal). Otherwise, it must be disposed of as radioactive liquid waste and placed into the appropriate container.

3. Clean the surrounding area with decontamination solution.

4. Following decontamination procedures, the area should be monitored with a survey meter and surface wipes. Decontamination procedures must be repeated if contamination persists until detectable radiation levels are as low as reasonably achievable (Al-ARA)

5. The principal investigator is responsible for submitting a Radioactive Contamination Report to the Radiation Safety Officer within 7 days. The report will be retained in the Radiation Safety Office.

Remember:

1. NOTIFY: Notify persons in the area that a spill has occurred.
2. PREVENT THE SPREAD: Cover the spill with absorbent paper.
3. MARK OFF THE AREA: Do not allow anyone to leave the area without being monitored.
4. NOTIFY THE RADIATION SAFETY OFFICER.
5. CLEAN UP: Use disposable gloves and remote handling tongs. Normal cleaning agents should be adequate, or use "Count-Offt . Keep cleaning supplies to a minimum. Proceed from the outermost edges of the contaminated area inward. Place cleaning materials into a plastic bag and dispose them in the radioactive waste container. Also, all other contaminated materials, such as disposable gloves, should be put into the plastic bag.
6. SURVEY: With a GM survey meter, check the area around the spill, hands, and clothing for contamination

Major Hazard Spill

A major hazardous spill is any spill more significant than a low-level spill. A spill is a major hazardous spill if it meets lay of the following criteria:

- The quantity spilled is greater than 1 mCi.
- The quantity spilled is greater than 1 uCi and is not confined to absorbent paper or an impervious tray.
- Radiation levels 1 meter from the centre of the spill exceed 2 mR/hr.

THE RADIATION SAFETY OFFICER MUST BE NOTIFIED IMMEDIATELY WHEN A MAJOR HAZARDOUS SPILL OCCURS.

- The Radiation Safety Officer and the Department RSO will determine the extent of the spill by survey meter and wipes of the surrounding area. The contaminated area will be

labelled with tape and cordoned off to prevent inadvertent entry. Only radiation safety personnel and the principal investigator may enter the area until the decontamination procedures are completed.

➢ The Radiation Safety Office is responsible for directing the decontamination and assuring that the area is as free of contamination as reasonably achievable when decontamination procedures are completed. The principal investigator is responsible for promptly executing the decontamination procedures deemed necessary by the Radiation Safety Officer.

➢ The Radiation Safety Officer and the principal investigator will complete a Radioactive Contamination Report. A meeting of the Radiation Safety Committee will be convened to determine corrective measures to prevent, if possible, future hazardous spills of a similar nature.

Remember:

➢ CLEAR THE AREA: Notify all persons not involved in the spill to vacate the room

➢ PREVENT THE SPREAD: Cover the spill with absorbent pads, but do not attempt to clean it up. Confine the movement of all personnel potentially contaminated to prevent the spread.

➢ SHIELD THE SOURCE: If possible, the spill should be shielded, but only if it can be done without further contamination or without significantly increasing your radiation exposure.

➢ CLOSE THE ROOM: Leave the room and lock the door(s) to prevent entry.

➢ CALL FOR HELP: Immediately notify the Radiation Safety Officer.

➢ PERSONNEL CONTAMINATION: Contaminated clothing should be removed and stored for further evaluation by the Radiation Safety Officer. If the spill is on the skin, flush thoroughly and then wash with mild soap and lukewarm water.

➢ External Bodily Contamination

➢ Radioactive materials in contact with body surfaces (e.g., hands) should be removed promptly using approved decontamination products. The area should be scrubbed gently and rinsed with lukewarm water.

➢ DO NOT USE HARD OR CAUSTIC SOAPS.

➢ DO NOT SCRUB THE AREA WITH AN ABRASIVE TOOL (e.g., SCRUB BRUSH).

➢ AVOID PROCEDURES THAT MAY BREAK THE SKIN, CAUSING POTENTIAL TRANSFER OF MATERIAL INTERNALLY.

➢ The Radiation Safety Officer should be notified if the material comes into contact with the skin:

➢ Exceeds 10,000 dpm.

➢ Is in a chemical form that may readily be absorbed.

➢ Gives a dose greater than 500 mR/hr.

➢ If these conditions exist, the Radiation Safety Officer will determine whether

decontamination can proceed on-site or in the Emergency Room.

➢ Guidance Note:

This plan section will focus on identifying various vulnerable/ susceptible areas within and around the Laboratory building (s) and the probable risks arising from structural and non structural assessment. Vulnerable areas in the laboratory buildings may include non-structurally and structurally weak areas of the buildings, improper electricity panels/ wirings (location and condition both), chemistry labs with improper placement/ storage of chemicals, improper placement of office cupboards and furniture (which can be affected due to electric shot-circuit fire hazard or can fall during earthquake), obstructions in the escape route in case of a hazard (inside the room as well as in corridors etc.), etc. Vulnerable areas in the campus and outskirts of the Laboratory campus may include improper drainage network, choking of existing drains, unstable slopes around the campus (in case of Laboratory placed in hill States), etc.

CHAPTER 8

Laboratory Waste Disposal

We should dispose 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- 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.

8.1 Chemical waste disposals guidelines

1. Acids + solvents mixture can spontaneously ignite. Never store/leave a solvent + acid mixture in the lab unattended. If you do happen to make such a solution, segregate it and take it outside of the building to the waster shed.
2. Acidic waste with fluoride ions must be collected separately in plastic containers, e.g. dilute hydrofluoric acid, ammonium fluoride and buffered-oxide etch.
3. Acidic wastes which contain toxic metal salts (Cr, Pb, etc.) cannot be buried in a chemical l and fill, so must be collected separately.
4. Acid waste that does not contain metallic toxins or fluoride and have a pH>4 can be disposed into the drain with copious amounts of water
5. Acid waste that does not contain metallic toxins or fluoride and have a pH<4 must be separately collected in plastic containers.
6. Acids + oxidizers react and evolve gas. So, unattended acids+oxidizer mixtures present an explosion hazard -- in extreme cases plastic bottle can burst spraying acid everywhere. Fresh acids+oxidizer mixtures must be collected separately and kept inside the fume hood for 1 day. This allows time for the reaction to complete and gasses to escape. Nitric acid is both a strong acid and an oxidizer so solutions containing HNO_3 should be treated as an acid+oxidizer.
7. Solvents + oxidizer mixture can also spontaneously ignite. Never store/leave a solvents + oxidizer mixture in the lab unattended. If you do happen to make such a solution, segregate it and take it outside of the building to the waste shed.
8. Base + solvent mixtures also evolve gasses. So unattended base+oxidizer mixtures present an explosion hazard -- in extreme cases plastic bottle can burst spraying base everywhere. Fresh base+oxidizer mixtures must be collected separately and kept inside the fume hood for 1 day. This allows time for the reaction to complete and gasses to escape.

9. Solvents must be separately collected in plastic or metal containers, e.g. benzene, ether, ethyl acetate, acetone, alcohols, hydrocarbons, etc.
10. Non-toxic basic waste with a pH<10 can be disposed into the drain with copious amounts of water
11. Basic waste with pH>10, must be separately collected in plastic container.
12. Never return unused chemicals to stock bottles, but dispose of them properly.

8.2 Biohazardous Waste Disposal

Waste that contains any type of infectious (or potentially infectious) substance/biomedical waste are divided into the following color codes for disposal.

Proper disposal of biohazardous materials is essential for maintaining laboratory safety and environmental compliance (Bio-Medical Waste Management Rules, 2018).. The following procedures must be observed:

1. All personnel must review and follow the waste management procedures outlined in the divisional "Biosafety Manual", which is available within the laboratory.
2. Biohazardous waste bags or containers must be replaced when they reach two-thirds (⅔) of their capacity. Securely tie the top of the filled bag, replace it with a new one, and transport the full bag to the designated autoclave room.

➢ Leakage Prevention: If there is a possibility of leakage, double-bag the waste to prevent contamination during transport.

- Post-Autoclaving: Once autoclaving is complete and the materials have cooled, the treated waste may be disposed of with regular trash, in accordance with local regulations.

3. Full sharps containers designated for biohazardous waste must also be autoclaved prior to final disposal.
4. All bio-hazardous wastes should be treated chemically or by autoclaving in order to minimize their hazardous nature prior to disposal.

   Users should bear in mind, however, that although chemical treatment and autoclaving are very effective methods of destroying pathogens, there is a possibility although slight, that chemical-, or heat- and high-pressure-resistant pathogens might survive these processes and still pose a threat.
5. Treat all liquid biohazards overnight with 10% (v/v) bleach before disposal into a labeled collector bottle. Do not discard into the sink (Bleaching solution, chlorine water, etc. may be used).
6. All solid bio-hazardous wastes must be disposed of into the “biohazard bins” only. Do not discard into the regular waste bins.
7. All biohazard bins must be lined with “biohazard bags” when in use. All the biohazard bags containing solid waste must be closed and sealed before giving to autoclave.
8. All biohazard bags should be enclosed in an additional biohazard bag before being autoclaved.
9. Discard all autoclaved waste into the collector bins provided for final disposal.

CHAPTER 9

Gases and Cryogenics

9.1.1 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.

9.1.2 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.

9.1.3 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.
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.

Colour-coded gas cylinders in use

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.
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.

Gas regulator

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.

- Always use two-stage regulators on the gas cylinders, ie, with two gauges on the regulator, one showing cylinder pressure and the other outlet regulated pressure. Regulators should be used for gases for which they are intended and marked. Keep regulators in good shape and maintain order.
- When connecting a regulator to a evlinder. it is important that the regulator's connecting threads are aligned accurately. If threads are misaligned and forced to thread in, it is possible to damage the regulator or cylinder head, or both, seriously.

12. Pilot plants in chemical laboratories using gases such as hydrogen, methane, carbon monoxide, syn gas etc, at high temperature and pressure should have gas sensors installed at appropriate locations to minimize accidents due to leakage.

9.1.4 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. In case pressure is lesser 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.

9.2 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.

9.2.1 Hazards

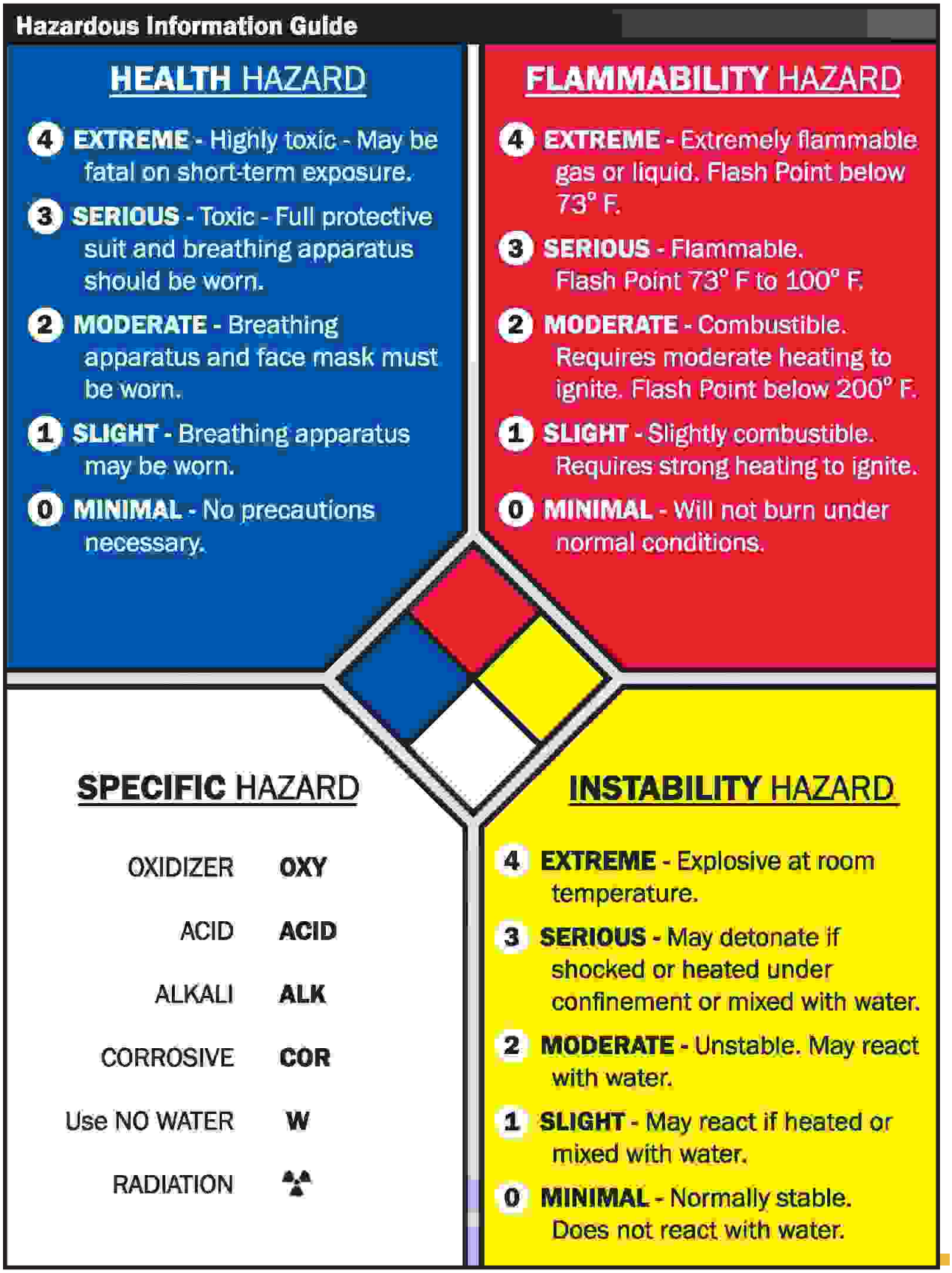
1. Extreme cold: Cryogenic liquids and their cold vapours can cause frostbite to human skin (cold burn). The skin appears waxy yellow. After initial contact, there is no pain, but extreme pain occurs when the frozen tissue thaws. Bare skin may stick to the metal cooled by these cryogenic liquids and 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.

9.2.3 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.
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.

Liquid dewars of different capacities


Hazardous Information Guide
HEALTH HAZARD
4 EXTREME - Highly toxic - May be fatal on short-term exposure.
3 SERIOUS - Toxic - Full protective suit and breathing apparatus should be worn.
2 MODERATE - Breathing apparatus and face mask must be worn.
1 SLIGHT - Breathing apparatus may be worn.
0 MINIMAL - No precautions necessary.
FLAMMABILITY HAZARD
4 EXTREME - Extremely flammable gas or liquid. Flash Point below 73° F.
3 SERIOUS - Flammable. Flash Point 73° F to 100° F.
2 MODERATE - Combustible. Requires moderate heating to ignite. Flash Point below 200° F.
1 SLIGHT - Slightly combustible. Requires strong heating to ignite.
0 MINIMAL - Will not burn under normal conditions.
SPECIFIC HAZARD
OXIDIZER OXY
ACID ACID
ALKALI ALK
CORROSIVE COR
Use NO WATER W
RADIATION
INSTABILITY HAZARD
4 EXTREME - Explosive at room temperature.
3 SERIOUS - May detonate if shocked or heated under confinement or mixed with water.
2 MODERATE - Unstable. May react with water.
1 SLIGHT - May react if heated or mixed with water.
0 MINIMAL - Normally stable. Does not react with water.

Name of the Gas	Oxygen (O_2)	Nitrogen (N_2)	Carbon Dioxide (CO_2)	Ammonia (NH_3)	Freon 12 (CCL_2F_2)
Visual Identification					
Distinctive Colour: Body	Black	Grey	Black	Black	Bottom Grey, Neck end Violet
Band	None	Black	White	Red & Yellow	None
Pressure when fully charged at 30 deg C (approx.) Kg/sq.cm	139	139	18	11	8
Lbs/sq.cm	1980	1980	260	155	115

Name of the Gas	Argon (A)	Chlorine (CL_2)	Hydrogen (H_2)	Acetylene (C_2H_2)	LPG. Commercial Butane (C_4H_{10}) (80%)	Air
Visual Identificationt						
Distinctive Colour: Body	Blue	Yellow	Red	Maroon	Red	Grey
Band	None	None	None	None	None	None
Pressure when fully charged at 30 deg C (approx.) Kg/sq.cm	139	8	139	18	3	139
Lbs/sq.cm	1980	114	1980	250	45	1980

CHAPTER 10

Fire and Electrical Safety

10.1 Fire Safety:

The best fire defense is proactive prevention. Everyone, including students, staff and contractual employees at CSIR are expected to know how to operate a basic fire extinguisher. Fire-fighting trainings are required to be organized at regular intervals in all CSIR Institutes and all members should participate and learn these basic skills. In case of fire, follow the evacuation plan as displayed in the building.

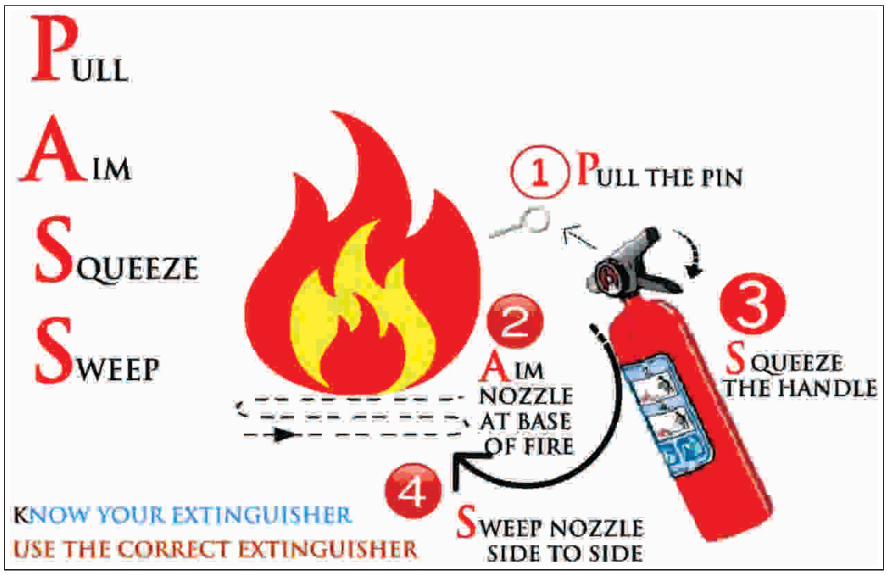
Fire extinguishers for Fire due to Electrical short circuit:

Fire extinguishers labeled 'suitable for use on electrical fires' are designed for circuits with voltages lower than those found in traction, signaling, and industrial power supply systems. Fire extinguishers and fire hoses must never be used on live electrical equipment in traction, signaling, or industrial power supply systems.

FOR EXTINGUISHING THE FIRE, there are mainly four types of fire extinguishers namely **a) water, b) foam, c) CO2 and d) powder. They are used for different application based on the type of fire source.**

Instructions for using fire extinguishers

- Sweep the extinguisher from side to side at the base of the fire — where the fuel source is — until the flames are fully extinguished.
- Never use a fire extinguisher on flames caused by escaping gas. Only attempt to tackle a fire in its very early stages.
- Do not approach the fire unless it is safe to do so, and always maintain minimum distance of one metre.



Fire blankets, hoses and buckets

These fire extinction methods serve as valuable supplements to fire extinguishers:

Fire Buckets:

- These can be filled with water for use on Class A fires (involving ordinary combustibles), or with sand to absorb Class B fires (involving spilled flammable liquids). Never use water from fire buckets on burning fat or oil, or on electrical fires.

Fire Hoses:

- Designed to deliver water at high pressure, fire hoses can be effective against Class A fires. However, they are heavy and may be difficult to handle without proper training.

Fire Blankets:

- Ideal for smothering small fires, fire blankets work best when a complete seal is achieved. They are also suitable for wrapping around a person whose clothing is on fire. Made from fibreglass, these blankets can withstand temperatures up to 500°C, are compact, portable, and require no maintenance. However, they are single-use items.

10.2 Electrical Safety:

Lockout-Tagout (LOTO) for Electrical Work

Before servicing any electrical system, Lockout-Tagout (LOTO) procedures must be followed:

- Power must be switched off and isolated.
- A lock and warning tag must be placed on the power switch.
- Only the authorized technician should remove the lock after work completion.

Do's

1. Inspect electrical equipment thoroughly before each use.
2. Report any electrical issues or malfunctions immediately.
3. Always follow warnings and keep clear of live electrical circuits and locked-out equipment.
4. Read and adhere to the manufacturer's instructions for the safe operation of electrical equipment.
5. Use extension cords only when authorized, and ensure they are of the correct type and capacity for the task.

6. Inspect cords and wires regularly to ensure their insulation is intact and in good condition.
7. Keep Electrical equipment's 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. Never insert anything other than a proper plug into an electrical outlet.
4. Never leave electrical equipment or machinery running unattended beyond working hours.
5. Avoid allowing cords to become twisted, tangled, or damaged.
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 equipments.

Precautionary measure during working within electric and magnetic fields:

Personnel working in areas with electric and magnetic fields must be adequately protected from potential hazards.

This includes protection from the nuisance of electric discharges caused by strong electric fields, as well as the potential biological effects linked to exposure to extremely strong electric and magnetic fields.

Individuals with implantable medical devices—such as cardiac pacemakers—should consult their physician and the designated organizational safety officer before entering areas where strong electric or magnetic fields are present, to assess any risk of electromagnetic interference with their devices.

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

Exposure Guidelines for Electric Fields:

- No time limits apply for exposure levels below 10 kV/m.
- Short-term exposure to electric fields between 10 kV/m and 30 kV/m is allowed, provided the product of field strength (in kV/m) and exposure time (in hours) does not exceed 80 over a full day.
  - For example, exposure to a 20 kV/m field is permissible for up to 4 hours.
- For field strengths exceeding 30 kV/m, alternative protective measuresm u s t b e implemented. These may include:
  - Wearing earthed or bonded conductive suitscreening and earthing of vehicles
  - Screening of work platforms and access pathways
  - De-energising nearby electrical equipment

a. 50 Hz

Magnetic fields Whole working day	0.5 milliTesla (5000 milliGauss)
Short-term (Two hours per day)	3 milliTesla (50,000 milliGauss)
Limit for limbs (eg. ostended 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 ab and e of occupational exposure to static or DC magnetie-fields are as follows:

Head and trunk	2000 milliTesla
Limbs	8000 milliTesla

Special Notes:

1. Caution: Due to potential indirect adverse effects, ICNIRP (International Commission on Non-Ionizing Radiation Protection) emphasizes the need for practical policies to prevent unintentional exposure of individuals with implanted electronic medical devices or implants containing ferromagnetic materials. To ensure safety, this may require setting much lower exposure limits, potentially as low as 0.5 milliTesla.
2. In specific occupational settings, exposure levels of up to 8000 milliTesla may be acceptable, provided the environment is strictly controlled and appropriate safety protocols are followed to manage movement-induced effects.
3. Sufficient room for work must be present in the area of breaker boxes. All the circuit breakers and the fuses shall be labeled to indicate whether they are in the "on" or "off" position, and what appliance or room area is served. Fuses must be properly rated.

4. Electrical cords or other lines shall not be suspended unsupported across rooms or passageways. Do not route cords over metal objects such as emergency showers, overhead pipes or frames, metal racks, etc. Do not run cords through holes in walls, ceilings, doorways or windows. Do not place under carpet, rugs, or heavy objects. Do not place cords on pathways or other areas where repeated abuse can cause deterioration of insulation.

Victim rescue:

Personnel must receive training in victim rescue techniques relevant to their specific job functions. Prior to attempting a rescue near or involving live exposed conductors, the rescuer must carefully assess all potential hazards and implement appropriate control measures to ensure the rescue can be conducted safely.

These control measures may include:

- De-energising the circuit,
- Using insulated rescue sticks, and
- Maintaining the Safe Approach Distance (SAD) during the rescue.

Rescuers must immediately contact the Engineering Services Division (ESD) to arrange for isolation or de-energisation of the equipment, and must wait for official confirmation that the equipment has been de-energised before attempting to shift the victim from the particular place.

Victim rescue training and assessment must be conducted by qualified personnel in accordance with relevant National Competency Standard Units.

Fire, smoke from high voltage apparatus:

Electrical equipment failure can cause fires and release large amounts of smoke. Additionally, burning or damage to certain types of electrical insulation may emit toxic fumes.

Fire extinguishers and hoses must not be used on live high-voltage equipment.

Immediately contact the ESD to arrange for the de-energisation and/or isolation of the affected equipment.

Negative and electrolysis return circuits:

When working on negative return or electrolysis circuits, extra caution is required because hazardous voltages may occur under abnormal conditions. Consequently, certain tasks on these circuits must be carried out in accordance with the specific access authorities outlined in these regulations.

All work on such circuits should strictly follow the organisational procedures established to ensure safety.

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 refers to any illegal activity that involves the use of a computer, a 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. Cybersecurity is the protection of computer systems and networks from these cyber crimes.It is true that modern technology eases our lives but it is also the responsibility of a user to update themselves with these technologies from time to time and take preventive measures. Some safety tips are listed below:

Dos

1. Create strong passwords that are at least eight characters long using uppercase letters, lowercase letters, numbers, and special characters.
2. Avoid creating common passwords such as your name, DOB, family member's names, address etc.
3. Use unique passwords for each of your accounts to ensure that, in the event one password is compromised, your other accounts remain secure.
4. Change passwords every 45 days.
5. Ensure that your passwords or passphrases remain confidential. Refrain from sharing them with others or recording them in written form. You are responsible for all activities associated with your credentials.
6. Perform regular backups of important data and maintain an offline backup of your critical data.
7. Download and install open-source software only from online sources you trust. Further, use authorized and licensed software only.
8. Close windows displaying pop-up advertisements or unexpected warnings by selecting the 'X' button located at the top-right corner of the window, rather than clicking anywhere within the window itself. To minimize future interruptions, enable pop-up blocker settings in the web browsers on both your computer and mobile devices.
9. Install enterprise antivirus client offered by the Institute on your official desktops/laptops. Ensure it is regularly updated with the latest virus definitions, signatures, and security patches.

10. Ensure that your operating system and BIOS firmware are consistently updated with the latest patches and security updates.
11. All portable media such as USB drives and DVDs must be scanned for malware.
12. Educate yourself about phishing scams and remain highly vigilant toward emails, phone calls, and flyers. Attackers often impersonate trusted individuals or organizations to deceive recipients into revealing credentials, clicking malicious links, or opening attachments that may infect systems with malware, trojans, or zero-day exploits—potentially resulting in ransomware attacks.
13. 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.
15. Ensure your internet connection is secure by utilising a trusted VPN service.
16. Use a standard (non-administrator) user account when performing routine tasks on your computers or laptops to minimize security risks.
17. While performingonline purchases, bankingor 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.
18. Make online purchases only through secure websites that provide encrypted connections, as you will be required to enter sensitive information such as credit card or bank account details—data highly targeted by cybercriminals.
19. Avoid storing your credit or debit card information on websites or within web browsers to reduce the risk of unauthorized access.
20. Exercise caution when clicking on shortened URLs (e.g., tinyurl.com/ab534), as they may obscure the destination and potentially lead to malicious sites.
21. Be vigilant when opening links received via SMS or social media, especially those accompanied by enticing offers, discounts, or news claims, as they may redirect to phishing or malware-infected websites that could compromise your device.
22. Maintain awareness of your surroundings when handling sensitive information byprinting, copying, faxing, or discussing it. Collect printed or faxed documents promptly to prevent unauthorized access.
23. Enable two-factor or multi-factor authentication wherever possible to add an extra layer of security beyond standard password protection.

24. Store your data and files on a secondary drive (e.g., D:) to ensure better organization and protection.
25. Before leaving the office, ensure that your computer and printers are properly shut down to safeguard information and equipment.
26. Setup unique passcodes for shared printers.
27. Download applications only from official app stores such as Google Play Store (for Android) and Apple App Store (for iOS). Prior to downloading, verify the app's popularity and review user feedback. Exercise caution when installing apps with poor reputations or a limited user base.
28. Follow the security advisories issued by NIC-CERT and CERT-In to stay informed about current threats and best practices.
29. Always log out of your online accounts after use, particularly when accessing them from public or shared computers, to protect your information.
30. 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.
31. Immediately report any suspicious emails or security incidents to the IT Department.
32. Classify documents properly (e.g. Public, internal, Confidential, restricted)
33. Use password to lock sensitive files while sharing outside the organization and share password via different channel.

Don'ts

1. Never select the "Remember My Password", 'Keep me logged in' or 'Remember me' option on a shared or an unlocked computer.
2. Do not record passwords, IP addresses, or any other sensitive information on unsecured materials such as sticky notes.
3. Avoid posting private or sensitive information—including credit card numbers andpasswords—on public websites or social media platforms. Additionally, do not send such information via email unless you have proper authorization. Utilize privacy settings on social media to restrict access to your personal data.
4. Do not leave your device unattended without a screen lock or logging out.
5. Never reply to e-mails requesting financial or personal information. Avoid making financial transactions in an unsecure network and public WiFi.

6. Do not connect personal and unsecured devices to Institute's LAN.
7. Do not install peer-to-peer (P2P) file-sharing programs, such as µTorrent, which may facilitate the illegal download of copyrighted content.
8. Do not install and/or use pirated copies of software and Operating Systems.
9. Do not upload or store any internal, restricted, or confidential government data on non- government cloud services (e.g., Google Drive, Dropbox).
10. Avoid using third-party anonymization services such as NordVPN, ExpressVPN, Tor, proxies, or similar tools.
11. Refrain from installing third-party toolbars (e.g., download managers, weather toolbars, AskMe toolbar) in your web browser.
12. Don't use any unauthorized remote administration tools (ex: Teamviewer, Ammyy Admin etc.)
13. Do not use unauthorized third-party video conferencing or collaboration tools for conducting sensitive internal meetings and discussions.
14. Avoid using external email services for official communications.
15. Refrain from using external mobile app-based scanning services (e.g., CamScanner) to scan internal government documents.
16. Do not utilize external websites or cloud-based services for converting or compressing government documents (e.g., Word to PDF conversion or file size reduction).
17. Avoid accessing inappropriate websites or any sites whose security and content you are uncertain about.
18. Disable automatic file and media sharing and download as far as possible.
19. Don't jailbreak or root your mobile phone as it disables some of the built-in security features of the operating system.

CHAPTER 12
Safety Management System

At CSIR, the integration of safety with science is not optional — it is essential. The guidelines presented in this document are a testament to that commitment. They reflect a shared responsibility across the research ecosystem, from students and technical staff to scientists and administrators, to cultivate a work environment where outreach scientific inquiry thrives in tandem with personal and collective safety.

12.1 Safety Goal and objectives:

CSIR as an organization, strongly emphasizes a safe, healthy, and accident-free workplace. We believe that Safety is a collective responsibility.

Our commitments include:

1. Ensuring personnel safety and environmental protection during R&D activities.
2. Adopting preventive, protective, and mitigative measures.
3. Adhering to safe procedures and methods.
4. Complying with health, safety, and environmental regulations.
5. Fostering a safety-conscious culture through awareness and leadership participation.

12.2 Committee Organisation for Safety

It is recommended that each CSIR Laboratory/Institute constitutes a Core Committee on Safety, Security and Disaster Management (SSDM) with the following strength:

Position	Designation
Chairperson	Chief Scientist
Convener	Senior Principal Scientist
Joint Convener	Senior Principal Scientist
Member	Controller of Administration and or Administrative Officer
Member	Secuirity Officier
Member	Engingeering Service Division (Civil)
Member	Engingeering Service Division (Electrical)

In addition to the core committee, each institute is suggested to establish the Safety Security and Disaster Management Working Committee (SSDM WC) to be the primary body responsible for effective implementation of workplace, environmental, laboratory safety across the institute. SSDM WC shall report to the Institute SSDM Committee. SSDM WC shall:

a. comprise various sub-committees, namely: Disaster Assessment and Management Plan (Pre-disaster preparedness), Awareness generation, Warning and Information

Dissemination (Pre-disaster preparedness), Evacuation team (during disaster), Search and Rescue Team (during disaster), Fire Safety Team (during disaster), First aid team (during disaster), Damage Assessment and Repair & Retrofitting (Post disaster management) and General Laboratory Safety and Security.

b. be responsible for ensuring Awareness generation, Preparedness and Management of various hazards within the Institute premises.

12.3 Role and responsibility of Leader, executor and staff

12.3.1 Chairperson and Convenors of SSDM shall

a. review this policy from time to time and suggest modifications required, if any.

b. oversee activities with respect to effective implementation of safety policies and ensure awareness generation and preparedness against management of various hazards in the institute premises.

12.3.2 Executor (Safety Champion)

Each CSIR laboratory/Institute will have designated safety champions from different R&D Divisions, who must be employees from the cadre of scientific or technical staff. The Safety Champion shall:

c. be responsible for identifying and informing the core committee of any unrecognized hazards in the division.

d. compile the annual internal safety-audits into a consolidated report and communicate to the core committee.

e. display a list of emergency contacts.

f. conduct investigation into any safety complaint received from users. If appropriate, the issue can be escalated to the core committee.

g. generate and maintain records 'Incident Reports'. A copy of these must be sent to the core committee and shared with the divisional members.

h. establish an 'Emergency Response Plan' for the division as per the norms established by the core committee. This may include fire prevention, fire alarms, emergency evacuation, assembly points, and emergency response.

i. raise awareness of the employees about the 'Emergency Plan' in a mandatory safety session and a surprise emergency drill, to be organized at least once every year.

j. Be the point of contact for emergency response team (ERT).

12.3.3 SSDM Staff:

The staff of SSDM office will be responsible for,

- Internal Inspection in the institute, including residential complexes
- Follow up the incident reporting in common places
- Preparation of Investigation report
- Day-to-day work related to safety
- Safety Poster preparation

➢ Procurement of items related with safety like PPE, Safety signage, Safety shower, eye shower and other items as required

12.4 Rule Procedure and safety Standard Adopted

Safety policy of institute should be included in the safety Manual in tri-lingual (Hindi, English and in local language for example Bengali, Tamil, Telegu, Gujarati) One such example is provided bellow (CSIR-CGCRI):

12.4.1 নিরাপত্তামূলক নীতি

সিএসআইআর-সিজিসিআরআই একটি নিরাপদ এবং দুর্ঘটনামুক্ত কর্মক্ষেত্রের উপর জোর দেয়। আমরা বিশ্বাস করি যে নিরাপত্তা একটি সম্মিলিত দায়িত্ব।

আমরা অঙ্গীকারবদ্ধ থাকবো:

১. গবেষণা ও উন্নয়নমূলক কার্যক্রমের সময় কর্মীদের নিরাপত্তা এবং পরিবেশগত সুরক্ষা নিশ্চিত করবো ।
২. প্রতিরোধমূলক, প্রতিরক্ষামূলক এবং প্রশমনমূলক ব্যবস্থা গ্রহণ করবো ।
৩. নিরাপদ পদ্ধতি এবং নির্দেশিকা মেনে চলবো।
৪. স্বাস্থ্য, নিরাপত্তা এবং পরিবেশগত নির্দেশিকা মেনে চলবো ।
৫. সচেতনতা এবং নেতৃত্বের অংশগ্রহণের মাধ্যমে একটি নিরাপত্তা-সচেতন সংস্কৃতি গড়ে তুলবো।

12.4.2 सुरक्षा नीति

सीएसआईआर–सीजीसीआरआई एक सुरक्षित, स्वस्थ और दुर्घटना–मुक्त कार्यस्थल पर जोर देता है। हमारा मानना है कि सुरक्षा एक सामूहिक जिम्मेदारी है।

हमारी प्रतिबद्धताओं में निम्नलिखित शामिल हैं:

1. अनुसंधान एवं विकास गतिविधियों के दौरान कार्मिक सुरक्षा और पर्यावरण संरक्षण सुनिश्चित करना।
2. निवारक, रक्षात्मक और न्यूनकारी उपाय अपनाना।
3. सुरक्षित प्रक्रियाओं और विधियों का पालन करना।
4. स्वास्थ्य, सुरक्षा और पर्यावरण संबंधी नियमों का पालन करना।
5. जागरूकता और नेतृत्व की भागीदारी के माध्यम से सुरक्षा के प्रति सचेत रहने की संस्कृति को बढ़ावा देना।

12.4.3 Safety policy

CSIR-CGCRI strongly emphasizes a safe, healthy, and accident-free workplace. We believe that Safety is a collective responsibility.

Our commitments include:

1. Ensuring personnel safety and environmental protection during R&D activities.
2. Adopting preventive, protective and mitigative measures.
3. Adhering to safe procedures and methods.
4. Complying with health, safety, and environmental regulations.
5. Fostering a safety-conscious culture through awareness and leadership participation.

12.5 Safety Observation and Incident Reporting System

A template representative for Incident reporting is as follows

INCIDENT REPORT

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		Gasleakage	
		Accident		Explosion	
		Chemical/ acidspillage		Other	
7.	*Was anybody injured*	Yes ☐		No ☐	
8.	*If yes,was first aid/medical Treatment provided*	Yes ☐	No ☐	Notrequired ☐	
9.	*Any Damage In brief, If Yes:-*	Yes ☐		No ☐	
10.	Current Status (Is the *event resolved oris still active?)*				

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

Note:

i. It is mandatory to use the 'incident report' (like the above or similar such form) form, while reporting any accidents or incident at work place as soon as possible, but not later than 24 hours.

ii. Examples of accidents/incidents include but not restricted to: safety alarm triggers (true and false alarms); chemical spills; accidents involving humans or equipment; explosions; fires; gas-leaks; arcing; unauthorized access.; major damage in civil and electrical infrastructure

iii. 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.

iv. Incident reports will be kept confidential, unless mandated otherwise by law or Institute administration.

v. On receipt of incident report, investigation will be performed to implement corrective actions.

12.6 Safety Related Investigation Process

Template for preliminary Investigation is included in the manual as follows

ACCIDENT-FIRST REPORT

1	Name of the division	
2	Date and time of the incident	
3	Date of Investigation	
4	Location	
5	Nature of incident *(check what is applicable)*	a) Violation b) Alarm c) Accident d) Other
6	Investigation performed by	
7	Was anyone injured	Yes ☐ No ☐
8	Was Medical treatment provided	Yes ☐ No ☐ Not required ☐
9	*Any Damage* *In brief, If yes:-*	Yes ☐ No ☐
10	Current Status *(Event is still active or resolved?)*	
11	Observations of Safety staff incident site during investigation	
12	Recommendations	

- Brief description of the event (with a reasonably detailed event timeline):

- Action taken by the division:

- Persons responsible for action against recommendations:

- What caused the event?

- Investigation performed by

Note:

1. Use this form for investigation against accidents/incidents/near misses.
2. Divisional Safety champions/ PIs, victims and eye witnesses should be present with safety officers on the incident site during investigation.
3. All Investigation reports must be sent to dept. safety champion /Concerned PIs either by email /hard copy
4. Investigation reports will be kept confidential, unless mandated otherwise by law or Institute administration.

12.7 Safety Audit including Contract Job

- Each CSIR Laboratory/Institute must take initiative to conduct internal safety inspection to identify the lapses and rectify those lapses.
- It is recommended to conduct safety audit by an external agency.

12.8 Safety Communication

Periodic public lectures, safety drills and safety related training e.g. fire extinguishers are to be organised at each CSIR Lab/ institute at workplace and residential complexes.

12.9 Safety training

Periodical training on fire extinguisher amongst staff has to be organised. SSDM staff and safety champion to undergo safety training from reputed institute.

12.10 EMERGENCY RESPONSE PLAN (ERP)

EMERGENCY RESPONSE PLAN (ERP)

This document serves as the official emergency response plan for CSIR, outlining step-by-step procedures for each actor to follow during a laboratory emergency.

List of Emergency Contact numbers

Police: 100

Fire Brigade: 101

Ambulance: 102

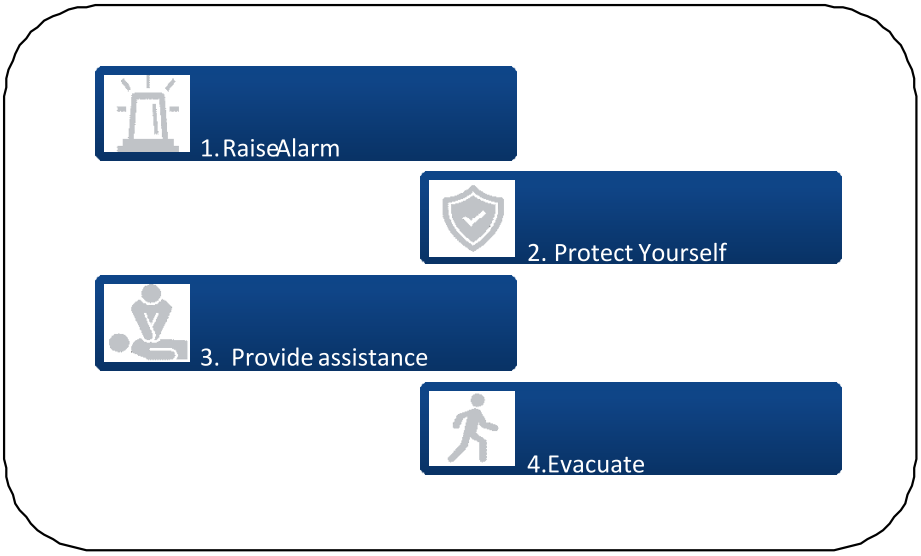
Women Helpline:1091

Centralized Emergency Helpline: 112

In India, the 112 number serves as a unified emergency helpline, providing a single point of contact for all emergency services, including police, fire, and medical assistance.

In emergencies, every second counts. Delays can lead to loss of life and property. Please memorize and save the important numbers mentioned earlier for quick access.

An Emergency Response Plan (ERP) is a structured, step-by-step guide to managing emergencies, clearly defining roles and responsibilities for all participants. It addresses key questions: who, what, when, how, and where.



Scientist or PI: Scientists and Principal Investigators (PIs) are responsible for Implementing safety protocols in their labs, including

1. Personal Protective equipment (PPE)
2. Proper storage and house-keeping

1. Clear safety signage
2. Functional fire extinguishers
3. Operational fire alarm systems
4. Stocking lab-specific safety items (spill kits, masks, gloves, gas detectors)
5. Developing a documented lab-specific emergency plan

This plan should be included orientations of new employees, PhD students, with regular refreshers recommended for existing users.

Safety Champion (SC) or convener, Scientist, member or HoD: First responders may not be aware of specific hazards. During an emergency, they can contact divisional safety champions or the designated convener, member, or HoD for critical information.

Safety, Security & Disaster Management (SSDM) or Safety and Security Staff must ensure division-level fire infrastructure is properly maintained, including:

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.

Good Practices

a) Familiarize yourself with your surroundings by knowing:

i. The nearest exit

ii. The location of the nearest fire extinguisher

iii. The nearest safety shower and eyewash stations"

b) Display critical information to ensure preparedness:

i. Poster displaying emergency numbers in the lab

ii. Complete and display a hazard information sheet outside the lab

a) Know the Emergency Response Plan (ERP) and take personal responsibility to educate yourself:

i. Know the emergency contact sequence (who to call first, second)

ii. Understand procedures for self-injury response

iii. Be aware of protocols for responding to others' injuries

b) Remain vigilant and report any hazards or suspicious situations to ensure a safe environment

Note:

➢ Share pertinent information with the Emergency Response Team (ERT) or security guard.

➢ Stay in the designated assembly area and avoid wandering off until the "all-clear" is given.

➢ Only the ERT can declare an "all-clear," and re-entry is strictly prohibited until then

Action in case of fire (Victim)

Did you know?

Anyone can call ambulance. There is no need to take permission from PI, Health Centre, Safety Champion, or Safety officer

Chemical exposure response:

- Skin exposure: Immediately remove contaminated clothing and flush the area with running water for at least 20 minutes, prioritizing thorough decontamination.
- Eye exposure: Use the eyewash station to flush eyes with water for 20 minutes, ensuring thorough rinsing.
- Action items for witness
- Raise the alarm, inform the security control room or SSDM office, and trigger the department-wide alarm if needed.
- Assess your own safety:

a) Evacuate if you're in danger.

b) If safe, attend to the victim.

- Evaluate the injury's severity, erring on the side of caution:

a) For serious injuries, call an ambulance directly or through the control room (see Section 3.2 for examples).

b) Provide first-aid if possible.

- Meet the ambulance at the main gate and guide them to the victim.
- Keep the safety control room or main gate security room informed while waiting.

Once the victim is stable or transported, notify the Principal Investigator (PI) and Divisional Chair/HoD.

On-site Security Guard Action Items:

- Assist victims and witnesses.
- Use fire extinguishers if necessary.
- Trigger the department-wide alarm if needed.
- Notify the SSDM/safety office or Main gate security control room.
- Meet and guide emergency responders (ambulance/patrol vehicle) to the site.

During Department-Wide Alarm:

a) Evacuate the building via designated routes to assembly areas.

b) Direct occupants to safe exits and stairs, away from the fire.

c) Ensure no one uses 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.

Action items for Security Control Room

1.	Note contact information of the witness		
2.	Dispatch emergency vehicle		
3.	Meet on-site security guard		
4.	Get information about the nature of the emergency		
	Fire or Gas leak	Minor Injury	Major Injury
5.	If the fire is large, contact the fire brigade	Provid e First aid	Call ambulance via the security control room
6.	Call SSDM Chair or Convener or safety offiicer		
7.	Coordinate with ambulance or Institute vehicle for further actions		

Action items for SSDM or Safety Staff

1.	Immediately reach the place of accident or incident			
2.	Talk to the victim(if possible),witness, and the on-site safety champion to assess the situation			
	Fire	**Gas Leak**	**Minor Injury**	**Major Injury**
3.	Identify the source of fire	Trigger alarm or announce to evacuate the building	Remove the victim from the hazard	If possible, remov e the victim from the hazardous place
4.	Use appropriate extinguisher to control fire	If needed, wear Breathing set or mask to approach the site	Provide first-aid.	Call ambulance via the security control room
5.	For uncontrollable fire, call the fire brigade via the SSDM office or Security control room	Close the cylinder at the source.	If needed, call an Ambulance, the SSDM office or Security control room.	Stabilize the victim
6.	Deploy fire hydran ts, if possible	Ventilate the area	Coordinate with medical cell to transport the victim to medical cell.	Resolve the underlying fault/ issue
7.	Cordon off the area			
8.	Debrief the witnesses. Ensure that all victims are accounted for.			
9.	Evaluate next steps after conferring with the Chair, SSDM Chair or safety & Security			
10.	Once it is safe to do so, declare all-clear so that users can go back into the lab.			

Note:

SSDM/Safety committee and Security to organize regular training and mockdrills to train the team

Action items for on-call SSDM Chair/convenor or Safety officer

- Respond promptly to the incident site.

- Provide technical support to first responders.
- Conduct a thorough follow-up investigation.

Action items for Divisional Chair/Head

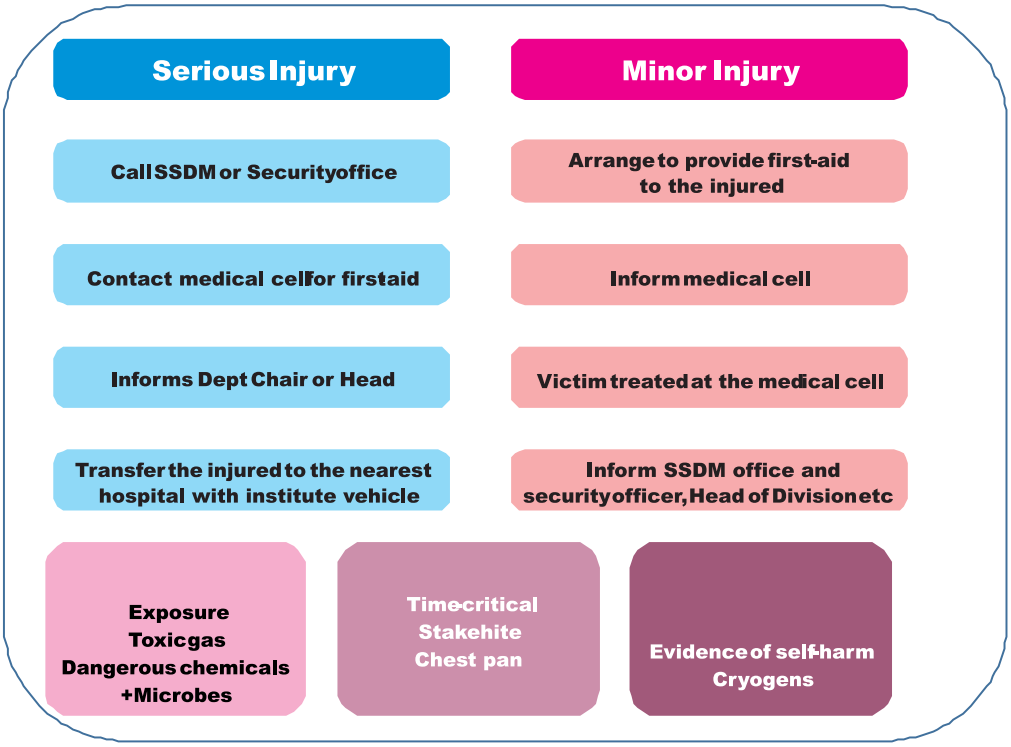
- Respond to the incident site if necessary.
- Provide technical support to first responders.
- Keep PI or Department Safety Champion informed.

Action items for concerned scientist or Lab In-charge

- Respond to the incident site.
- Provide technical support to first responders.
- Offer lab-specific expertise and inputs.

Response in Case of Injury

The following flowchart is a general guideline to the overall sequence of events.



Examples of Serious Injuries

Directly Call Ambulance or Institute vehicle (Via informing SSDM / secuirity office)

First aid Physical injury

1. Blunt Trauma:

a) Immobilize the affected area to prevent further injury.

b) Apply ice packs to reduce swelling.

2. Penetrating/ Cut Injury:

a) Apply consistent pressure to control bleeding.

b) Elevate the affected area above heart level if bleeding persists.

c) Dress or support the wound to protect it from further injury."

3. Splash in Eyes

1. Rinse the affected eye with low-pressure running water for at least 10 minutes.
2. Position your face with the injured eye down and to the side
3. Keep the eyes open as wide as possible during rinsing.
4. Flush out contact lenses if present; gently remove them after flushing if they don't come out.
5. Avoid rubbing the eyes.

4. Splash Over Skin

1. Flush the affected area with running water for at least 20 minutes.
2. Exceptions:

a) Dry lime: Brush off before irrigation.

b) Phenols: Wipe off with glycerin.

c) Elemental metal fragments: Remove with dry forceps and cover with mineral oil.

d) Hydrofluoric acid exposure: After irrigation, apply 2.5% Calcium Gluconate gel and consider ice packs to slow ion diffusion.

Additional Step:

Remove contaminated jewellery, clothing, or articles."

5. Exposure to Toxic Gases:

1. Immediately move the victim to clean air.
2. Loosen tight clothing.
3. If the victim is not breathing, perform CPR until emergency help arrives, taking precautions to avoid chemical exposure yourself.

6. Burns

1. Move the person away from the heat source immediately.
2. Cool the burn with lukewarm running water for 20 minutes.
3. Avoid using ice, iced water, or grease on the burn.
4. Don't use fire extinguishers directly on the victim to prevent cold burns.

5. Remove jewelry or clothing near the affected area."

7. Needle poke or cut with contaminated sharp item:

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

Emergency Training

Regular Training Needed:

Due to the institute's rolling population, regular training sessions are crucial. These sessions should cover:

8. Basic Life Support: CPR, first aid, etc.
9. Fire Safety: Fire extinguisher usage and alarm protocols.

Voluntary Participation:

Contact SSDM/safety office to schedule workshops, ensuring lab users are equipped to respond during the time of emergencies.

Infrastructure to be maintained for Emergency Response

Medical cell

- Ready to transfer mechanism to the emergency of nearest listed hospital
- CSIR Ambulance or designated vehicle

Emergency Phone Numbers should be available

- Safety shower with enough privacy.
- Eye wash station.
- Stock disposable gowns so victims can quickly discard clothes
- Fire Extinguishers.
- Availability of suitable PPE

Security and SSDM/safety Control room

- A Security control roem that can efficiently and effectively work during an emergency.
- Normal working hours:

a) Manned by at least two people.

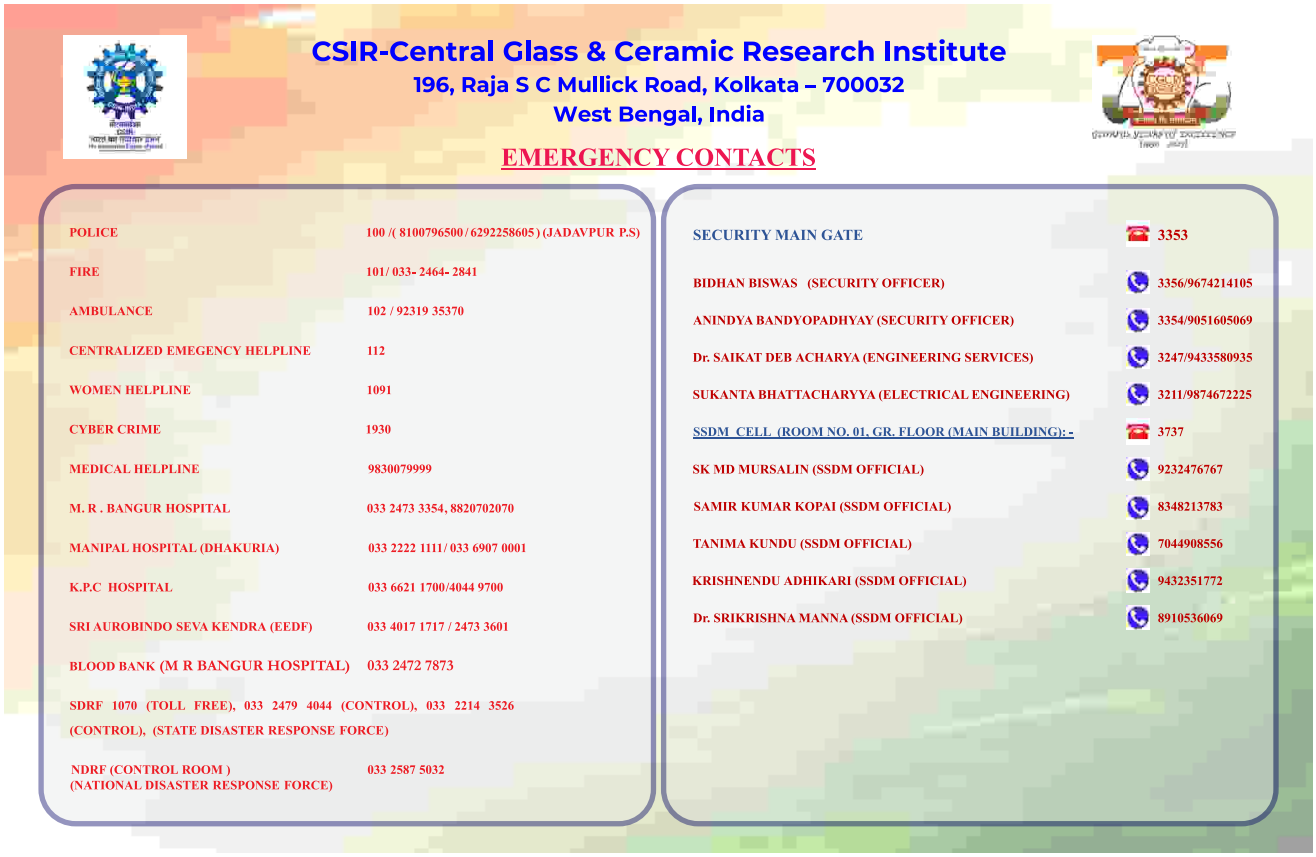
b) Non-office hours: On-call availability for emergencies

c) One person must be fluent in Bengali because the fire department is not comfortable with any other language.

- The SSDM control room/safety & security control room must be in constant contact with all security guards posted on campus.
- The SSDM control room/security control room should be able to call the Fire brigade ambulances.
- The SSDM control room/ safety & security control room will maintain contact information for Chairs of all departments and SSDM/safety officer.

Manpower

- Security guards or SSDM/safety team should be empowered to quickly respond to an emergency, especially in case of fire and injury, where the first few minutes are crucial.
- All security guards should be trained on fire extinguishers and basic life support (BLS).
- A notice Board with the following information must be displayed at important location at the workplace as well as residential complexes of a CSIR Lab/ Institute. A representative example is provided bellow



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

EMERGENCY CONTACTS

POLICE	100 /(8100796500/ 6292258605) (JADAVPUR P.S)
FIRE	101/ 033- 2464- 2841
AMBULANCE	102 / 92319 35370
CENTRALIZED EMEGENCY HELPLINE	112
WOMEN HELPLINE	1091
CYBER CRIME	1930
MEDICAL HELPLINE	9830079999
M. R . BANGUR HOSPITAL	033 2473 3354, 8820702070
MANIPAL HOSPITAL (DHAKURIA)	033 2222 1111/ 033 6907 0001
K.P.C HOSPITAL	033 6621 1700/4044 9700
SRI AUROBINDO SEVA KENDRA (EEDF)	033 4017 1717 / 2473 3601
BLOOD BANK (M R BANGUR HOSPITAL)	033 2472 7873
SDRF 1070 (TOLL FREE), 033 2479 4044 (CONTROL), 033 2214 3526 (CONTROL), (STATE DISASTER RESPONSE FORCE)	
NDRF (CONTROL ROOM) (NATIONAL DISASTER RESPONSE FORCE)	033 2587 5032

SECURITY MAIN GATE	3353
BIDHAN BISWAS (SECURITY OFFICER)	3356/9674214105
ANINDYA BANDYOPADHYAY (SECURITY OFFICER)	3354/9051605069
Dr. SAIKAT DEB ACHARYA (ENGINEERING SERVICES)	3247/9433580935
SUKANTA BHATTACHARYYA (ELECTRICAL ENGINEERING)	3211/9874672225
SSDM CELL (ROOM NO. 01, GR. FLOOR (MAIN BUILDING): -	3737
SK MD MURSALIN (SSDM OFFICIAL)	9232476767
SAMIR KUMAR KOPAI (SSDM OFFICIAL)	8348213783
TANIMA KUNDU (SSDM OFFICIAL)	7044908556
KRISHNENDU ADHIKARI (SSDM OFFICIAL)	9432351772
Dr. SRIKRISHNA MANNA (SSDM OFFICIAL)	8910536069

Specialized Emergency Response Team:

- Security personnel subset to be trained in:
- Fire-hydrant operations
- Chemical spill response
- Self-Contained Breathing Apparatus (SCBA) usage
- Gas safety protocols

Emergency vehicle

- An emergency vehicle that is available to respond to an emergency.
- Safety team will ensure minimum fire safety infrastructure across departments.
- Departments should report any gaps to SSDM/safety. Key requirements:
- Adequate fire extinguishers (type and quantity) at accessible locations.
- Compliance with Indian Building Code for fire hydrant loops and sprinkler systems.
- Centralized fire alarm systems with hooters and strobe lamps in hazardous departments.
- Clearly marked emergency exits and assembly points in all buildings.
- Annual mock drills to ensure preparedness.

Divisions/Labs

Basic Safety Infrastructure Requirements:

All divisions must maintain the following basic safety infrastructure, with the Divisional Chair/Head ensuring compliance:

- First-aid boxes in each lab, stocked according to lab-specific hazards.
- Working service lift in departments with: 2 or more floors with compressed gas cylinders or hazardous chemicals
- Emergency lights in each lab that automatically turn on during power failure.
- Hazard sheets (safety signage) displayed outside each lab.
- Designated Lab-in-charge knowledgeable about lab-specific hazards.
- Access system for locked labs (e.g., key collection or biometric system).
- Clear and suitable safety signage.
- Mains power disconnect switches at the lab or floor level.

Circuit breakers with suitable ratings to automatically disconnect power during faults

Special infrastructure for Hazardous Chemicals

Departments handling hazardous chemicals require:

- Safety shower and eyewash station (ANSI Z358,1 compliant).
- Chemical storage in segregated, safety cabinets.
- Calcium gluconate storage for labs using or storing hydrofluoric acid

Gases or Cryogens:

- Hazardous gases (NFPA > 2) must be stored in gas cabinets.
- Labs with hazardous gases (NFPA > 2) require gas alarms.
- Departments with hazardous gases (NFPA > 2) must have a Self-Contained Breathing Apparatus (SCBA).

Other Hazards:

- Labs with high electrical loads require an external mains switch to cutoff power without entering the lab.
- BSL3 labs must store hazard suits outside the lab for quick access by first responders in emergencies
- Emergency Fire Response:

Fire Station Details (All labs to put local details) in the SSDM or Safety & Security office.

Emergency Plan in case of fire, should be displayed mentioning following:

- **ResponseTime:**
- **AccessandEscort:**
- **Fire tender entering through main gate or as designated gate**
- **Security will escort to the location**

Coordination: Safety, Secuirity and Respective division need to provide specific input to the fire team

12.11 Personal Protective Equipment (PPE)

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 CSIR laboratory/Institute 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

PPE for specialized laboratories and/or situations are listed out with respect to certain common tasks expected in laboratories. 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 exposes users to pressures >2 bar or vacuum <400 mmHg requires caution. Examples include: - Pressurized gas nozzles - High-pressure systems - Vacuum chambers	1. Skin damage 2. Eye damage 3. Implosion	**Face Protection** When working with equipment that poses implosion or explosion risks, wear a face shield if no other protective barrier is present. For additional guidelines on compressed gas safety, refer to Section 9.
2.	When working with high-temperature equipment or objects, take necessary precautions to prevent burns and injuries.	1. Burns 2. Fire 3. Splash	Personal Protective Equipment (PPE) for High-Temperature Work When working with high temperatures, wear: Gloves: Suitable for the working temperature Handling Hot Objects (>50°C): Use an extra set of thermal gloves for direct handling Body Protection: Lab coat or apron suitable for the working temperature
3.	Working with inert cryogens (He, Ar, N_2, etc.)	Frostbite Eye damage Hypoxia in confined spaces	Cryogenic Safety Precautions **For ⩽ 10 Liters:** 1. Body: Lab coat or apron 2. Eyes: Safety goggles 3. Hands: Inner disposable nitrile gloves + outer insulated cryogenic gloves (when handling objects exposed to cryogens) **For ⩾10 Liters:** 1. Eyes: Safety goggles 2. Face: Face shield 3. Hands: Inner disposable nitrile gloves + outer insulated cryogenic gloves 4. Body: Lab coat or cryogenic apron **Additional Precaution:** - Use only in well-ventilated areas to prevent gas buildup. Proper PPE and ventilation help prevent cryogenic- related injuries.

	Task	Potential Consequence	Additional PPE
4.	Working at Elevated Locations	1. Fall and subsequen t injury	**When working at heights: 3m** - Use ladders with a stable base - Avoid using ad-hoc platforms, stools, or chairs as substitutes for ladders - Ensure proper ladder safety protocols are followed to prevent falls and injuries. **When working at heights : > 3m** 1. Safety harness 2. Hard-toed safety shoes 3. Hard safety hat/ safety helmet.
5.	**Falling Object Hazards**	1. Serious or fatal injuries to head and other body parts.	1. Safety helmet/ Safety-hat. 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	Additional PPE
1.	Working with solids of low hazard	1. Skin damage 2. Eye damage	Minimum PPE as described in section 2
2.	Working with moderate hazard chemicals, small volumes (<100 ml.).	1. Skin damage 2. Eye damage	Minimum PPE as described in section 2

3.	Working with moderate hazard chemicals (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, 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 layer of protection 4. Body: Chemical -resistant apron or lab coat
5.	Working with high hazard chemicals 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. Fa ce: Face shield (if quantity > 4 liters or splash hazard) 3. Hands: Disposable chemical - resistant gloves (thick) as a second layer 4. Body: Chemical - resistant apron 5. Inhalation: Suitable face mask (if quantity > 4 liters or material is noxious)
6	Working with volatile solvents. E.g. • Ethanol, Isopropanol • Propylene • Oxide Xylene • Methanol • Chloroform • Phenol • Etc.	1. Skin damage 2. Eye damage 3. Fire	• Eyes: Safety goggles • Hands: Suitable chemical - resistant gloves (thin) • Nitrile for alcohols • Butyl for propylene oxide and xylene • Face: Face shield (if quantity > 4 liters or splash hazard) • Body: Lab coat or apron • Inhalation: Suitable face mask (if quantity > 4 liters or material is noxious)
7	Working with chemicals of acute toxicity e.g., hydrogen fluoride, hydrogen cyanide.	1. Inhala tion 2. Skin damage 3. Eye damage 4. Toxic by skin contact	1. Eyes: Safety goggles 2. Face: Face shield (if quantity > 4 liters or splash hazard) 3. Hands: Chemical - resistant gloves (thick) as a second layer; use special gloves designed for specific hazards

			4. Body: Chemical - resistant apron 5. Inhalation: Suitable face mask (if quantity > 1 liter/kg or material is noxious)
8	Handling Long -Term Toxins like carcinogens, mutagens, nanoparticles, or other long -term toxins:	1. Inhalation 2. Skin damage 3. Eye damage 4. Toxic by skin co ntact	• Eyes: Safety goggles • Hands: Chemical - resistant gloves (appropriate for the chemical) • Body: Chemical - resistant apron • Face: Face shield (if quantity > 1 liter/kg or splash hazard) • Inhalation: Suitable face mask (if quantity > 1 liter/kg)
9	Handling Ai r or Water - Reactive Chemicals.	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 Conseq uence	Additional PPE
1	**Handling Biologica l Hazards**	Exposure to infectious material	Face: Face mask or shield Body: Lab coat or disposable gown/apron
2	**Working with Fixatives** like formalin or paraformaldehy de:	Exposure to fixative used to preserve the sp ecimen. If tissue is fixed, there is no longer exposure to infectious material.	Eye: Safety goggles Hand: Impermeable glove suitable for preserved specimens Face: Face mask Body: Lab coat or Disposable gown
3.	**BSL -2 Precautions** When working	Risk Group 2 Agents Biological agents posing moderate	1. Eye: Safety googles 2. Hand: Nitrile gloves 3. Face: Face mask 4. Body: Lab coat or

	with Risk Group 2 agents (recombinant DNA, cell lines, viruses, bacteria) requiring Biosafety Level 2 (BSL -2)	infection risks through: - Injection - Skin exposure - Ingestion - Inhalation Examples include certain bacteria, viruses, and fungi. Handling these agents requires Biosafety Level 2 (BSL -2) precautions to minimize exposure risks.	Disposable gown
4.	BSL -2+ Precautions When working with Risk Group 3 agents in a BSL -2 facility with BSL -3 prac tices	Risk Group 3 Agents Biological agents posing moderate to serious infection risks through: - Injection - Skin exposure - Ingestion - Inhalation Examples include certain bacteria, viruses, and fung i that can cause severe diseases. Handling these agents requires Biosafety Level 3 (BSL -3) precautions to minimize exposure risks.	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.	**BSL -3 Precautions**	Risk Group 4 Agents Biological agents posing serious or lethal infection risks through: - Injection - Skin exposure - Ingestion - Inhalation	• Eye: Safety goggles • Hands: Nitrile gloves (double) • Body: Full disposable coverall suit + head cover • Foot: Shoe cover • Face: N95or other triple - layered mask + Face shield.

		Examples include highly pathogenic viruses. Handling these agents requires Biosafety Level 4 (BSL -4) precautions and maximum containment to p revent exposure and transmission.	
6	**Working with Live Animals** (e.g., mice, 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 man dated 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 sources, infrared-emitting equipment, UV sources (<400 nm)	1. Eye damage 2. Skin-burn	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.

9. PPE for Compressed Gas Cylinders& Cryogens

	Task	Potential Consequences	Additional PPE
1.	Transport or handling of inert gas cylinders	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	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	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. Work: Only trained electrical technicians should perform electrical work
2.	High Voltage (> 400V)	1. Electrocution 2. Arc flash	1. Body: Arc flash clothing (flame- resistant materials) 2. Hands and Feet: Electrical-rated gloves and steel-toe cap boots with rubber insulation 3. Head: Electrical-rated safety helmet 4. Tools and Procedures: Use specified electrical standard tools and switch off mains/incoming supply during maintenance/repair work

CHAPTER 13

Closure : Safety as a Shared Responsibility

13.1 Commitment of Safety

The CSIR Safety Framework Manual has been compiled by the CSIR Safety Committee members to serve as a comprehensive guide for ensuring safe work practices, emergency preparedness, and risk mitigation across all technical and administrative divisions of CSIR.

This manual provides detailed safety guidelines and emergency response strategies that must be strictly followed by all personnel, including scientists, engineers, technicians, and students. The objective is to create a zero-incident workplace by fostering a strong safety culture within the organization.

The CSIR Safety Framework Manual is a comprehensive document designed to promote a strong safety culture across all divisions of the organization. This manual outlines safety protocols, hazard management strategies, and emergency response procedures, ensuring that all personnel operate in a secure and controlled environment.

Through this manual, CSIR has established a systematic approach to safety, focusing on:

- Workplace hazard identification and risk mitigation
- Safe handling of chemicals, gases, and electrical systems
- Implementation of fire safety, personal protective equipment (PPE), and emergency preparedness measures
- Regular safety audits, inspections, and training programs
- Compliance with national and international safety standards

13.2 Safety as a Shared Responsibility

Ensuring safety at CSIR is not just a regulatory requirement but a shared responsibility of every employee, researcher, student, and visitor. A proactive approach to safety, rather than a reactive one, will help reduce workplace hazards, improve operational efficiency, and protect human life and assets. To achieve a zero-incident workplace, all personnel are encouraged to:

- Follow the safety guidelines, protocols, emergency procedures and protocols outlined in this manual.
- Report any unsafe conditions, hazards, or near-miss incidents immediately.

- Actively participate in safety training, emergency drills and awareness programs.
- Use the appropriate Personal Protective Equipment (PPE) and adhere to workplace safety measures.
- Maintain a culture of continuous safety improvement and awareness.

Ensuring safety is not the responsibility of just a few individuals—it is everyone's collective duty at CSIR

13.3 Continuous Improvement & Compliance

TheCSIR Safety Committee will periodically review, update, and enhance this manual to ensure compliance with national and international safety standards and incorporate technological advancements in safety management and best industry practices. The institution continuously aims to enhance its safety culture and operational safety framework through ongoing audits, risk assessments, and safety training.

All employees must take personal accountability for safety and work collaboratively to strengthen CSIR's reputation as a leader in research and workplace safety.

13.4 Final Statement

At CSIR, safety is not just a policy—it is a way of life. By embracing the principles outlined in this manual, we can create a safer, more productive, and innovative work environment for all. The CSIR Safety Committee urges all employees to adhere to the guidelines and safety strategies outlined in this manual to ensure a secure, compliant, and hazard-free work environment. This manual serves as a living document and will be periodically updated to reflect the latest safety practices.

Let us build a culture where safety is the foundation of excellence. Together, we can uphold a safety-first culture and achieve operational excellence at CSIR.

List of Emergency Contact Numbers

- Police: 112
- Fire Brigade: 101
- Medical Helpline: 108
- Senior Citizen Helpline: 14567
- Child Helpline: 1098
- Women Helpline: 1090
- Traffic Helpline: 103
- Electricity Helpline: 1912
- Centralized Emergency Helpline: 112

APPENDIX A: LIST OF EMERGENCY CONTACT NUMBERS

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001

Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001

List of Emergency Contact numbers

Police:	100
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 B: INCIDENT REPORT FORM

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001
Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001

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. Examples of accidents/incidents include but not restricted to: safety alarm triggers (true and false alarms); chemical spills; accidents involving humans or equipment; explosions; fires; gas-leaks; arcing; unauthorized access.; major damage in civil and electrical infrastructure
3. All incident reports must be sent to Conveners / Chairman of Safety, Security and Disaster Management Committee (SSDM) or Safety and Security Committee 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. On receipt of incident report, investigation will be performed to implement 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 In Brief, If Yes :-*	Yes ☐	No ☐		
10.	Current Status (Is the event resolved or is still activd?)				

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	

Signature

APPENDIX C: ACCIDENT-FIRST REPORT FORM

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001
Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001

ACCIDENT FIRST REPORT

Instructions:

1. Use this form for investigation against accidents/incidents/near misses.
2. Divisional Safety champions/ PIs, victims and eye witnesses should be present with concerned safety officers on the incident site during investigation.
3. All Investigation reports must be sent to dept. safety champion /Concerned PIs either by email /hard copy
4. Investigation reports will be kept confidential, unless mandated otherwise by law or Institute administration.

Details:

1	Name of the division	
2	Date and time of the incident	
3	Date of Investigation	
4	Location	
5	Nature of incident *(check what is applicable)*	a) Violation b) Alarm c) Accident d) Other
6	Investigation performed by	
7	Was anyone injured	Yes ☐ No ☐
8	Was Medical treatment provided	Yes ☐ No ☐ Not required ☐
9	*Any Damage* *In Brief, If Yes :-*	Yes ☐ No ☐
10	Current Status *(Event is still active or resolved?)*	
11	Observations of incident site during investigation	
12	Recommendations	

Brief Description of the Event

With a reasonably detailed event timeline

Action Taken by the division

Persons responsible for action against recommendations

Root Cause

- What caused the event?

Investigation performed by

APPENDIX D: SAFETY DECLARATION(English)

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001
Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001

Council of Scientific and Industrial Research (CSIR) is committed to the health and safety of all the employees working in its Laboratory/Institute premises. The purpose of this policy is to establish responsibilities of various stakeholders towards this goal. This policy applies to all employees, students and visitors.

The policy is based on the following guiding principles:

I. **Safety is paramount:** Safety for all on CSIR Institutes' premises is the primary concern. All activities, including research, operation and maintenance of equipment, development, production, demonstration and teaching, must be conducted without compromising safety.

II. **Accountability:** Any person having access to any equipment or material housed in the Institute campus(es) must take personal responsibility for his/her actions/omissions and ensure adherence to highest standards of safety at all times.

III. **Trust but also Verify:** The CSIR recognizes that for diverse activities in various Institutes with several R&D and R&D support divisions, there are varieties of research being conducted, and there exists a diversity of hazards and attendant risks. The persons responsible for setting up the facilities and guiding the experiments are expected to be aware of the associated hazards and risks, and are entrusted with taking the necessary safety precautions. The role of the Safety Committee of the respective institute is primarily to set the safety policies, while the role of the Working Committee for Safety or Safety Cell is to implement these policies and monitor compliance. The Institute requires divisions to implement the policies in letter and spirit and reserves the right to verify compliance.

1 **"Safety Rules** refer to the rules laid down by the Safety Committee of individual laboratory/Institute that must be followed by all "Users". These rules will be listed on the Safety Manual and are subject to revision from time to time. All users must abide by the 'Safety Policy' and 'Safety Rules' and will be responsible for their actions/omissions.

2 Core Committee on Safety

The Safety Committee will consist of scientific, technical and administrative staff, and other personnel as per the relevant norms. The primary role of this Committee is to:

a. review this policy from time to time and suggest modifications required, if any.

b. oversee activities with respect to effective implementation of safety policies and ensure awareness generation and preparedness against management of various hazards in the institute premises.

3 Safety Champions

Each CSIR laboratory/Institute will have designated safety champions, who must be employees from the cadre of scientific or technical staff with sufficient authority and constitute the core safety committee.

The Safety Champion shall:

a. be responsible for identifying and informing the core committee of any unrecognized hazards in the division.

b. compile the annual internal safety audits into a consolidated report and communicate to the core committee.

c. display a list of emergency contacts.

d. conduct investigation into any safety complaint received from users. If appropriate, the issue can be escalated to the core committee.

e. generate and maintain records of 'Incident Reports'. A copy of these must be sent to the core committee and shared with the divisional members.

f. establish an 'Emergency Response Plan' for the division as per the norms established by the core committee. This may include fire prevention, fire alarms, emergency evacuation, assembly points, and emergency response.

g. raise awareness of the employees about the 'Emergency Plan' in a mandatory safety session and a surprise emergency drill, to be organized at least once every year.

h. be the point of contact for emergency response team (ERT).

4 Users

All permanent employees and students/project staff/ visitors shall:

a. be personally responsible for their own safety.

b. strictly follow the 'Safety Rules' as written in the safety manual.

c. understand potential hazards in their respective laboratories and follow safe practices to minimize the risk associated with those hazards.

d. inform the divisional safety champion/safety cell of any coercion to violate safety norms, these reports will be kept confidential.

e. undergo training in laboratory safety protocols and emergency responses.

f. report the occurrence of any accident using the prescribed 'Incident Report'.

5 Acknowledgement

Lack of attention to sound safety practices can lead to loss of property, compromising years of painstaking research, serious injuries and loss of lives. The Institute, therefore, considers it the duty of all individuals to adhere to this Safety Policy and the 'Safety Rules' published in the CSIR Safety Manual or Safety Manual on the Institute's website.

All employees, project staff, and registered students of the institute are expected to have read and understood this 'Safety Policy', and to agree to work towards adopting a strong culture of safety.

Visitors, short-term and long-term users, such as foreign exchange students, visiting faculty, collaborators, interns, employees of companies and individuals who temporarily access facilities at the Institute under any arrangement need to acknowledge the safety policy as below.

I hereby acknowledge that I have read the above- described 'Policy on Laboratory Safety' and understand my responsibilities under this Policy, as well as these described in CSIR's safety manual.

Signature: _____

Name: _____

Division/Section: _____

Purpose of Visit (for visitors): _____

Date: _____

APPENDIX E: SAFETY DECLARATION (Hindi)

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001
Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001

सुरक्षा घोषणा

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद (सीएसआईआर) इसके प्रयोगशालाध्संस्थान परिसरों में कार्य करने वाले सभी कर्मचारीयों के स्वास्थ्य और सुरक्षा हेतु प्रतिबद्ध है। इस नीति का उद्देश्य इस लक्ष्य की प्राप्ति हेतु विभिन्न हितधारकों की जिम्मेदारी निर्धारित करना है। यह नीति सभी कर्मचारियों, छात्रों और आगंतुकों पर लागू होती है।

यह नीति निम्नलिखित मार्गदर्शक सिद्धांतों पर आधारित है:

I- सुरक्षा सर्वोपरि है: सुरक्षा सभी सीएसआईआर संस्थान परिसरों हेतु प्राथमिक सरोकार है। अनुसंधान, उपकरणों का संचालन और अनुरक्षण, विकास, उत्पादन, प्रदर्शन और शिक्षण सहित सभी गतिविधियां सुरक्षा से समझौता किए बिना संचालित की जानी चाहिए।

II- जवाबदेही: संस्थान परिसर में रखे गए किसी भी उपकरण या सामग्री तक पहुंच रखने वाले किसी भी व्यक्ति को अपने कार्यों‍ध्चूक के लिए व्यक्तिगत रूप से जिम्मेदारी लेनी होगी तथा हर समय सुरक्षा के उच्चतम मानकों का पालन सुनिश्चित करना होगा।

III- विश्वास करें लेकिन जांच भी करें: सीएसआईआर में हम यह मानते हैं कि विभिन्न संस्थानों के अनुसंधान एवं विकास तथा अनुसंधान एवं विकास हेतु सहायक विभागों में अनेक प्रकार की अनुसंधान गतिविधियाँ की जा रही हैं, और साथ–ही–साथ उनसे जुड़े जोखिमों में भी विविधता है। सुविधाओं की स्थापना और प्रयोगों का मार्गदर्शन करने हेतु जिम्मेदार व्यक्तियों से अपेक्षा की जाती है कि वे संबंधित खतरों और जोखिमों से अवगत हों, और उन्हें सुरक्षा सावधानियों संबंधी दायित्व सौंपे गए हों। संबंधित संस्थान के सुरक्षा समिति की प्राथमिक जिम्मेदारी सुरक्षा संबंधी नीति निर्धारण है, जबकि सुरक्षा हेतु कार्यकारी समिति या सुरक्षा प्रकोष्ठ की जिम्मेदारी इन नीतियों को लागू करना और इनके अनुपालन की निगरानी करना है। संस्थान की यह अपेक्षा रहेगी की सभी विभाग इन नीतियों को अक्षरशः लागू करें संस्थान को अनुपालन की जांच का अधिकार भी है।

1. ''सुरक्षा नियम'' से तात्पर्य प्रत्येक प्रयोगशालाध्संस्थान की सुरक्षा समिति द्वारा निर्धारित नियमों से है जिनका सभी ''उपयोगकर्ताओं'' द्वारा पालन किया जाना अनिवार्य है। ये नियम सुरक्षा नियमावली में सूचीबद्ध होंगे और समय–समय पर संशोधन के अधीन होंगे। सभी उपयोगकर्ताओं को 'सुरक्षा नीति' और 'सुरक्षा नियमों' का पालन करना होगा और अपने कार्यों‍ध्चूक के लिए स्वयं उत्तरदायी होना होगा।

2. सुरक्षा संबंधी कोर कमेटी

सुरक्षा समिति में वैज्ञानिक, तकनीकी और प्रशासनिक कर्मचारी, तथा प्रासंगिक मानदंडों के अनुसार अन्य कार्मिक शामिल होंगे। इस समिति की प्राथमिक भूमिका निम्नलिखित है:

क) समय–समय पर इस नीति की समीक्षा करना और आवश्यक संशोधनों, यदि कोई हों, का सुझाव देना।

ख) सुरक्षा नीतियों के प्रभावी कार्यान्वयन से संबंधित गतिविधियों की देखरेख करना और संस्थान परिसर में विभिन्न खतरों के प्रबंधन हेतु जागरूकता फैलाना और तैयारी सुनिश्चित करना।

3. सुरक्षा चौंपियंस

प्रत्येक सीएसआईआर प्रयोगशालाध्संस्थान में निर्दिष्ट सुरक्षा चौंपियन होंगे जिनमें पर्याप्त प्राधिकार वाले वैज्ञानिक या तकनीकी स्टाफ कैडर से कर्मचारी शामिल होंगे तथा जो कोर सुरक्षा कमेटी में भी शामिल होंगे।

सुरक्षा चौंपियन:

क) विभाग में किसी भी अज्ञात खतरे की पहचान करने और कोर कमेटी को सूचित करने के लिए जिम्मेदार होंगे।

ख) वार्षिक आंतरिक सुरक्षा–ऑडिट को एक रिपोर्ट में संकलित करेंगे और कोर कमेटी को सूचित करेंगे।

ग) प्रयोगशाला में आपातकालीन संपर्क की एक सूची प्रदर्शित करेंगे।

घ) उपयोगकर्ताओं से प्राप्त किसी भी सुरक्षा शिकायत की जाँच करेंगे। यदि उपयुक्त हो तो मामले को कोर कमेटी के समक्ष प्रस्तुत किया जा सकता है।

ङ) 'घटना रिपोर्ट' का रिकॉर्ड तैयार करेंगे और उसका अनुरक्षण करेंगे। इसकी एक प्रति कोर कमेटी को भेजनी होगी और सदस्यों के साथ साझा करनी होगी।

च) कोर कमेटी द्वारा स्थापित मानदंडों के अनुसार विभाग के लिए एक 'आपातकालीन प्रतिक्रिया योजना' तैयार करेंगे। इसमें आग की रोकथाम, आग अलार्म, आपातकालीन निकासी, असेंबली पॉइंट और आपातकालीन प्रतिक्रिया शामिल हो सकते हैं।

छ) अनिवार्य सुरक्षा सत्र और अकस्मात आपातकालीन अभ्यास के माध्यम से 'आपातकालीन योजना' के बारे में कर्मचारियों की जागरूकता बढ़ाएंगे, जिसका आयोजन प्रतिवर्ष कम से कम एक बार किया जाएगा।

ज) आपातकालीन प्रतिक्रिया दल (ईआरटी) के लिए संपर्क बिंदु के रूप में कार्य करेंगे।

4. उपयोगकर्ता

सभी स्थायी कर्मचारी और छात्रध्परियोजना कर्मचारीध्आगंतुक :

क) अपनी सुरक्षा के लिए व्यक्तिगत रूप से जिम्मेदार होंगे।

ख) सुरक्षा नियमावली में लिखे अनुसार 'सुरक्षा नियमों' का सख्ती से पालन करेंगे।

ग) अपनी–अपनी प्रयोगशालाओं में संभावित खतरों को समझेंगे और उन खतरों से जुड़े जोखिम को कम करने के लिए सुरक्षित पद्धति का पालन करेंगे।

घ) सुरक्षा मानदंडों का उल्लंघन करने के लिए किसी भी दबाव की सूचना विभागीय सुरक्षा चौंपियनध्सुरक्षा प्रकोष्ठ को देंगे। ये रिपोर्टें गोपनीय रखी जाएँगी।

ङ) प्रयोगशाला सुरक्षा प्रोटोकॉल और आपातकालीन प्रतिक्रियाओं का प्रशिक्षण लेंगे।

च) निर्धारित 'घटना रिपोर्ट' का उपयोग करके किसी भी दुर्घटना की सूचना देंगे।

5. आभारोक्ति

ठोस सुरक्षा पद्धतियों पर ध्यान न देने से संपत्ति की हानि, वर्षों के श्रमसाध्य अनुसंधान पर असर, गंभीर चोट और जानमाल का नुकसान हो सकता है। इसलिए, संस्थान सभी व्यक्तियों का यह कर्तव्य मानता है कि वे इस सुरक्षा नीति और सीएसआईआर सुरक्षा नियमावली या संस्थान की वेबसाइट पर सुरक्षा नियमावली में प्रकाशित 'सुरक्षा नियमों' का पालन करें।

संस्थान के सभी कर्मचारियों, परियोजना कर्मचारियों और पंजीकृत छात्रों से अपेक्षा की जाती है कि वे इस 'सुरक्षा नीति' को पढ़ें और समझें, और सुरक्षा की एक मजबूत संस्कृति को अपनाने की दिशा में कार्य करने के लिए सहमत हों।

आगंतुक, अल्पकालिक और दीर्घकालिक उपयोगकर्ता, जैसे विदेशी विनिमय छात्र, अतिथि संकाय, सहयोगी, प्रशिक्षु, कंपनियों के कर्मचारी और व्यक्ति जो किसी भी व्यवस्था के तहत संस्थान में अस्थायी रूप से सुविधाओं का उपयोग करते हैं, उन्हें नीचे दी गई सुरक्षा नीति को स्वीकार करना होगा।

मैं यह स्वीकार करता हुँ की मैंने ऊपर वर्णित 'प्रयोगशाला सुरक्षा नीति ' को पढ़ लिया है और इस नीति के अंतर्गत अपनी जिम्मेदारियों को समझताध्समझती हूँ और साथ ही सीएसआईआर की सुरक्षा पुस्तिका में वर्णित जिम्मेदारियों को भी समझताध्समझती हूँ।

हस्ताक्षरः

नामः

विभाग/अनुभागः

आगमन का उद्देश्य (आगंतुकों के लिए):

तिथि :

APPENDIX F: EMERGENCY RESPONSE PLAN (ERP)

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001
Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001

This document serves as the official emergency response plan for CSIR, outlining step-by-step procedures for each actor to follow during a laboratory emergency.

List of Emergency Contact numbers

Police:	100
Fire Brigade:	101
Ambulance:	102
Women Helpline:	1091
Centralized Emergency Helpline:	112

In India, the 112 number serves as a unified emergency helpline, providing a single point of contact for all emergency services, including police, fire, and medical assistance.

In emergencies, every second counts. Delays can lead to loss of life and property. Please memorize and save the important numbers mentioned earlier for quick access.

What is an emergency response plan (ERP)?

An Emergency Response Plan (ERP) is a structured, step-by-step guide for managing emergencies, clearly defining roles and responsibilities for all participants. It addresses key questions: who, what, when, how, and where.

What is the scope of this document?

The Emergency Response Plan is designed to address lab emergencies and includes:

1. Standard operating procedures for emergency response
2. List of personnel responsible during emergencies
3. Sequence of actions for medical emergencies or injuries
4. List of infrastructure to be maintained by divisions and security

How should I prepare?

Response actions vary by role.

For lab users, who may be both victims and witnesses, it is crucial to understand these roles and, at a minimum, memorize emergency contact numbers. In summary:

Scientist or PI: Scientists and Principal Investigators (PIs) are responsible for implementing safety protocols in their labs, including:

1. Personal Protective Equipment (PPE)
2. Proper storage and housekeeping
3. Clear signage

4. Stocking lab-specific safety items (spill kits, masks, gloves, gas detectors)
5. Developing a documented lab-specific emergency plan

This plan should be included in new user orientations, with regular refreshers recommended for existing users.

Safety Champion (SC) or convener, Scientist, member or HoD: First responders may not be aware of specific hazards. During an emergency, they can contact divisional safety champions or the designated convener, member, or HoD for critical information.

Safety, Security & Disaster Management (SSDM) or Safety and Security Staff must ensure division-level fire infrastructure is properly maintained, including:

i. Clear safety signage
ii. Functional fire extinguishers
iii. Operational fire alarm systems

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.

Good Practices

a) Familiarize yourself with your surroundings by knowing:
   i. The nearest exit
   ii. The location of the nearest fire extinguisher
   iii. The nearest safety shower and eyewash stations
b) Display critical information to ensure preparedness:
   i. Poster displaying emergency numbers in the lab
   ii. Complete and display a hazard information sheet outside the lab
c) Know the Emergency Response Plan (ERP) and take personal responsibility to educate yourself:
   i. Know the emergency contact sequence (who to call first, second)
   ii. Understand procedures for self-injury response
   iii. Be aware of protocols for responding to others' injuries
d) Stay vigilant and report any hazards or suspicious situations to ensure a safe environment

1. Emergency Response Plan

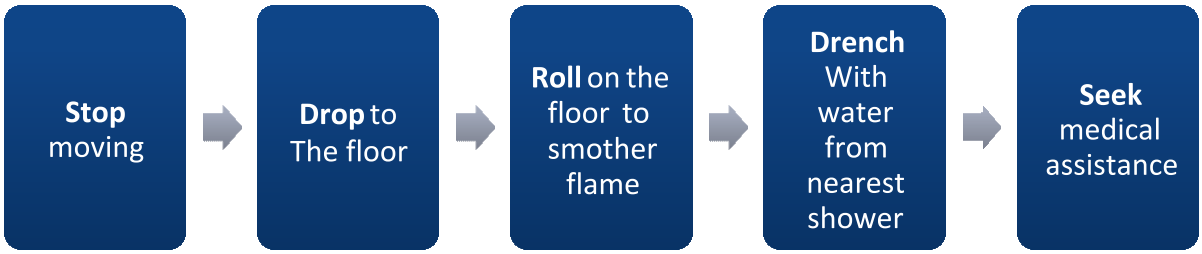
	Who	Informed By?	When informed?	Immediately	Follow-up action(s)
1.	Victim	--	--	Call for help or Security	1. Try to remove yourself from the hazard 2. Use safety shower if needed. 3. Use eyewash station.
2.	Witness	--	--	Call Security OR Ambulance	1. If you can do so safely, help the victim/Onsite security 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 In-charge	1. Trigger alarm. 2. Help victim. 3. Use fire extinguisher 4. Escort first responders
4.	Main gate (Security)	Witness or victim or on-site guard	Right after the incident.	[Critical injury]Call ambulance. [Non-critical injury] Call Security In-charge [Fire] Call fire brigade	5. Inform on site guard. 6 Call SSDM/Safety and Security Chair 7. Call Divisional Head.
7.	SSDM Officer/ Safety Officer	Security	As per follow-up actions	Reach location	1. Assist first responders 2. Conduct follow-up investigation
8.	HoD	Security	As per follow-up actions	If needed, reach the location	1. Assist first responders 2. Inform PI/lab in-charge
9.	PI or Lab-in-charge	HoD	As per follow-up actions	If needed, reach the location	1. Assist first responders 2. Help with information on lab-specific hazards

Note:

- Share pertinent information with the Emergency Response Team (ERT) or security guard.
- Stay in the designated assembly area and avoid wandering off until the "all-clear" is given.
- Only the ERT can declare an "all-clear," and re-entry is strictly prohibited until then.

Action items for victim

- Alert others (lab buddy, security guards, etc.) to raise the alarm.
- Remove yourself from the hazard if possible.
- Call the Security room or ambulance if able.
- If you're on fire, follow proper protocols (e.g., Stop, Drop, and Roll).



Did you know?

Anyone can call ambulance. There is no need to take permission from PI, Health Centre, Safety Champion or Safety Officer

Chemical exposure response:

- Skin exposure: Immediately remove contaminated clothing and flush the area with running water for at least 20 minutes, prioritizing thorough decontamination.
- Eye exposure: Use the eyewash station to flush eyes with water for 20 minutes, ensuring thorough rinsing.

Action items for witness

- Raise the alarm, inform the security control room or SSDM office, and trigger the department-wide alarm if needed.
- Assess your own safety:
  a) Evacuate if you're in danger.
  b) If safe, attend to the victim.
- Evaluate the injury's severity, erring on the side of caution:
  a) For serious injuries, call an ambulance directly or through the control room (see Section 3.2 for examples).
  b) Provide first-aid if possible.
- Meet the ambulance at the main gate and guide them to the victim.

Keep the safety control room or main gate security room informed while waiting.

- **Once the victim is stable or transported, notify the Principal Investigator (PI) and Divisional Chair/HoD.**

On-site Security Guard Action Items:

- Assist victims and witnesses.
- Use fire extinguishers if necessary.
- Trigger the department-wide alarm if needed.
- Notify the SSDM / Safety office or Main gate security control room.
- Meet and guide emergency responders (ambulance/patrol vehicle) to the site.

During Department-Wide Alarm:

a) Evacuate the building via designated routes to assembly areas.

b) Direct occupants to safe exits and stairs, away from the fire.

c) Ensure no one uses 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.

Action items for Security ControlRoom

1.	Note contact information of the witness		
2.	Dispatch emergency vehicle		
3.	Meet on-site security guard		
4.	Get information about the natureof the emergency		
	Fire or Gas leak	***Minor Injury***	***Major Injury***
5.	If the fire is large, contact the fire brigade	Provid e First aid	Call ambulance via the security control room
6.	Call SSDM Chair or Convener or Safety Officer		
7.	Coordinate with ambulance or Institute vehicle for further actions		

Action items for SSDM or Safety and Security Staff

1.	Immediately reach the place of accident or incident			
2.	Talk to the victim (if possible), witness, and the on-site safety champion to assess the situation			
	Fire	***Gas Leak***	***Minor Injury***	***Major Injury***
3.	Identify the source of fire	Trigger alarm or announce to evacuate the building	Remove the victim from the hazard	If possible, remove the victim from the hazardous place
4.	Use appropriate extinguisher to control fire	If needed, wear Breathing set or mask to approach the site	Provide first-aid.	Call ambulance via the security control room
5.	For uncontrollable fire, call the fire brigade via the SSDM office or Security control room	Close the cylinder at the source.	If needed, call an Ambulance, the SSDM office or Security control room.	Stabilize the victim
6.	Deploy fire hydrants, if possible	Ventilate the area	Coordinate with medical cell to transport the victim to medical cell.	Resolve the underlying fault/ issue
7.	Cordon off the area			
8.	De brief the witnesses. Ensure that all victims are accounted for.			
9.	Evaluate next steps after conferring with the SSDM Chair or safety & Secuirity			
10.	Once it is safe to do so, declare all-clear so that users can go back into the lab.			

Note:

- SSDM/ Safety and Security committee to organize regular training and mockdrills to train the team

Action items for on-call SSDM Officer

- Respond promptly to the incident site.
- Provide technical support to first responders.
- Conduct a thorough follow-up investigation.

Action items for Divisional Chair/Head

- Respond to the incident site if necessary.
- Provide technical support to first responders.
- Keep PI or Department Safety Champion informed.

Action items for concerned scientist or Lab In-charge

- Respond to the incident site.
- Provide technical support to first responders.
- Offer lab-specific expertise and inputs.

Response in Case of Injury

- The following flowchart is a general guideline to the overall sequence of events.

Serious Injury	Minor Injury
Call SSDM or Security office	Arrange to provide first-aid to the injured
Contact medical cell for first-aid	Inform medical cell
Informs Dept Chair or Head	Victim treated at the medical cell
Transfer the injured to the nearest hospital with institute vehicle	Inform SSDM office and security officer, Head of Division etc

Exposure
Toxic gas
Dangerous chemicals
+Microbes

Time-critical
Stakehite
Chest pan

Evidence of self-harm
Cryogens

Examples of Serious Injuries

Directly Call Ambulance or Institute vechile (Via informing SSDM /Security Office)

Unconscious
No pulse
Convulsions
Stroke

Not Breathing
Trouble breathing
Wheezing
Blue extremities

Trauma
Eye
Head
Fire or chemical burns
Major blood loss

First aid

Physical Injury

1. Blunt Trauma:
    a) Immobilize the affected areas to prevent further injury.
    b) Apply ice packs to reduce swelling.
2. Penetrating/Cut Injury:
    a) Apply consistent pressure to control bleeding.
    b) Elevate the affected area above heart level if bleeding persists.
    c) Dress or support the wound to protect it from further injury.

Splash in Eyes

1. Rinse the affected eye with low-pressure running water for at least 10 minutes.
2. Position your face with the injured eye down and to the side.
3. Keep the eyes open as wide as possible during rinsing.
4. Flush out contact lenses if present; gently remove them after flushing if they don't come out.
5. Avoid rubbing the eyes.

Splash Over Skin

1. Flush the affected area with running water for at least 20 minutes.
2. Exceptions:
    a) Dry lime: Brush off before irrigation.
    b) Phenols: Wipe off with glycerin.
    c) Elemental metal fragments: Remove with dry forceps and cover with mineral oil.
    d) Hydrofluoric acid exposure: After irrigation, apply 2.5% Calcium Gluconate gel and consider ice packs to slow ion diffusion.

Additional Step:

Remove contaminated jewellery, clothing, or articles.

Exposure to Toxic Gases:

1. Immediately move the victim to clean air.
2. Loosen tight clothing.
3. If the victim is not breathing, perform cardiopulmonary resuscitation (CPR) until emergency help arrives, taking precautions to avoid chemical exposure yourself.

Burns

1. Move the person away from the heat source immediately.
2. Cool the burn with lukewarm running water for 20 minutes.
3. Avoid using ice, iced water, or grease on the burn.
4. Don't use fire extinguishers directly on the victim to prevent cold burns.
5. Remove jewelry or clothing near the affected area.

Needle poke or cut with contaminated sharp item:

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

Emergency Training

Regular Training Needed:

Due to the institute's rolling population, regular training sessions are crucial. These sessions should cover:

3. Basic Life Support: CPR, first aid, etc.
4. Fire Safety: Fire extinguisher usage and alarm protocols.

Voluntary Participation:

Contact SSDM/safety office to schedule workshops, ensuring lab users are equipped to respond in emergencies.

Infrastructure to be maintained for Emergency Response

Medical cell

- Ready to transfer mechanism to the emergency of nearest listed hospital
- CSIR Ambulance or designated vehicle

Simple Emergency Phone Number:

Adopt an easy-to-remember number

- Safety shower with enough privacy.
- Eye wash station.
- Stock disposable gowns so victims can quickly discard clothes
- Fire Extinguishers.
- Availability of suitable PPE

Security and SSDM / safety Control room

- A Security control room that can efficiently and effectively work during an emergency.
- Normal working hours:
  a) Manned by at least two people.
  b) Non-office hours: On-call availability for emergencies
  c) One person must be fluent in local language because the fire department is not comfortable with any other language.
- The SSDM control room/safety & security control room must be in constant contact with all security guards posted on campus.
- The SSDM control room/security control room should be able to call the Firebrigade and ambulances.
- The SSDM control room/safety & security control room will maintain contact information for Chairs /Heads of all departments and SSDM / safety officers.

Manpower

- Security guards or SSDM/ safety team team should be empowered to quickly respond to an emergency, especially in case of fire and injury, where the first few minutes are crucial.
- All security guards should be trained on fire extinguishers and basic life support (BLS)

Specialized Emergency Response Team:

- Security personnel subset to be trained in:
- Fire-hydrant operations
- Chemical spill response
- Self-Contained Breathing Apparatus (SCBA) usage
- Gas safety protocols

Emergency vehicle

- An emergency vehicle that is available to respond to an emergency.

Safety team will ensure minimum fire safety infrastructure across departments. Departments should report any gaps to SSDM/Safety and Security. Key requirements:

- Adequate fire extinguishers (type and quantity) at accessible locations.
- Compliance with Indian Building Code for fire hydrant loops and sprinkler systems.

- Centralized fire alarm systems with hooters and strobe lamps in hazardous departments.
- Clearly marked emergency exits and assembly points in all buildings.
- Annual mock drills to ensure preparedness.

Divisions/Labs

Basic Safety Infrastructure Requirements:

All divisions must maintain the following basic safety infrastructure, with the Divisional Chair/Head ensuring compliance:

- First-aid boxes in each lab, stocked according to lab-specific hazards.
- Working service lift in departments with:

  2 or more floors with compressed gas cylinders or hazardous chemicals
- Emergency lights in each lab that automatically turn on during power failure.
- Hazard sheets (safety signage) displayed outside each lab.
- Designated Lab-in-charge knowledgeable about lab-specific hazards.
- Access system for locked labs (e.g., key collection or biometric system).
- Clear and suitable safety signage.
- Mains power disconnect switches at the lab or floor level.
- Circuit breakers with suitable ratings to automatically disconnect power during faults

Special infrastructure for Hazardous Chemicals

Departments handling hazardous chemicals require:

- Safety shower and eyewash station (ANSI Z358,1 compliant).
- Chemical storage in segregated, safety cabinets.
- Calcium gluconate storage for labs using or storing hydrofluoric acid

Gases or Cryogens:

- Hazardous gases (NFPA > 2) must be stored in gas cabinets.
- Labs with hazardous gases (NFPA > 2) require gas alarms.
- Departments with hazardous gases (NFPA > 2) must have a Self-Contained Breathing Apparatus (SCBA).

Other Hazards:

- Labs with high electrical loads require an external mains switch to cutoff power without entering the lab.
- BSL3 labs must store hazard suits outside the lab for quick access by first responders in emergencies
- Emergency Fire Respons:e:

Fire Station Details (All labs to put local details) in the SSDM or Safety & Secuirity office.

Emergency Plan in case of fire, should be displayed mentioning following:

- **Response Time:**
- **Access and Escort:**
- **Fire tender entering through main gate or as designated gate**
- **Security will escort to the location**

Coordination: Safety, Secuirity and Respective division need to provide specific input to the fire team

APPENDIX G : PRIOR PERMISSION TO WORK BEYOND OFFICE HOURS

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001
Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001

Prior permission to work beyond office hours
(Required for working beyond 8.30 PM (or any other time as decided by the laboratory/institute) or during weekend/closed holidays for students/Researcher)

<table>
<tr><td rowspan="2">Student/Research Scholar details</td><td>Name, Designation and computer code</td><td colspan="3">Contact/mobile no</td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td rowspan="4">Accompanying Students/staff

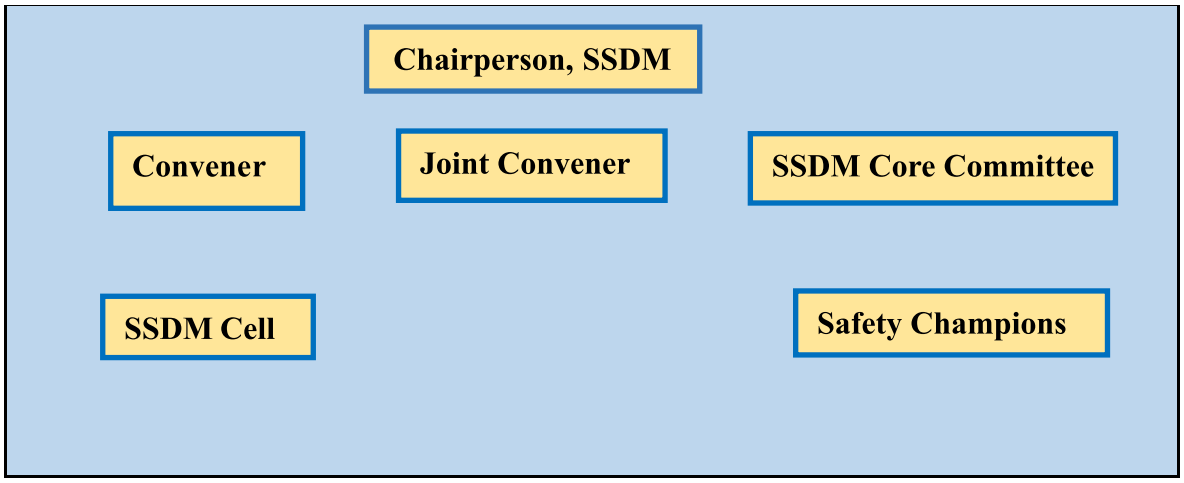
(Minimum one additional person required to work in the lab considering safety)</td><td>1.</td><td colspan="3"></td></tr>
<tr><td>2.</td><td colspan="3"></td></tr>
<tr><td>3.</td><td colspan="3"></td></tr>
<tr><td>4.</td><td colspan="3"></td></tr>
<tr><td>Purpose</td><td colspan="4"></td></tr>
<tr><td>Name of the Division/Section</td><td colspan="4"></td></tr>
<tr><td>Name of PI/Supervisor</td><td colspan="4"></td></tr>
<tr><td>Working permission required: (Room No/Lab to be mentioned)</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Permission required for</td><td colspan="4">Date:</td></tr>
<tr><td>From (Time)</td><td></td><td>to (Time)</td><td></td></tr>
<tr><td>Signature of PI/Supervisor/HOD</td><td colspan="4"></td></tr>
<tr><td>Signature of Security Officer</td><td colspan="4"></td></tr>
</table>

** This form may be completed in all respect and need to be deposited at Main Gate Security Kiosk well in advance(preferably within 05.00 PM).

APPENDIX H : COMPOSITION OF SSDM COMMITTEE AT CSIR-CGCRI

(A REPRESENTATIVE EXAMPLE)

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001
Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001



सीएसआईआर
CSIR
भारत का नवाचार इंजन
The Innovation Engine of India

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली – 110001

Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg, New Delhi - 110001