Synchrotron-light for Experimental Science & Applications in the Middle East (SESAME)

Safety Instructions for Users

Updated September 2024

Prepared by the Safety Office

Training valid for one year

Information about this safety training

All Users must review this safety information, and pass the associated safety quiz before carrying out any activities at SESAME.

Safety training is valid for one year, and must therefore be repeated annually.

This safety training includes information about emergency response, specific safety practices in the experiment hall, and your responsibilities.

Contents of this safety training

- What is safety, and whose responsibility is it?
- General safety instructions
- Radiation safety
- Information about bringing samples to SESAME
- Chemical safety
- Biological safety
- Other aspects of safety

What is safety in the workplace?

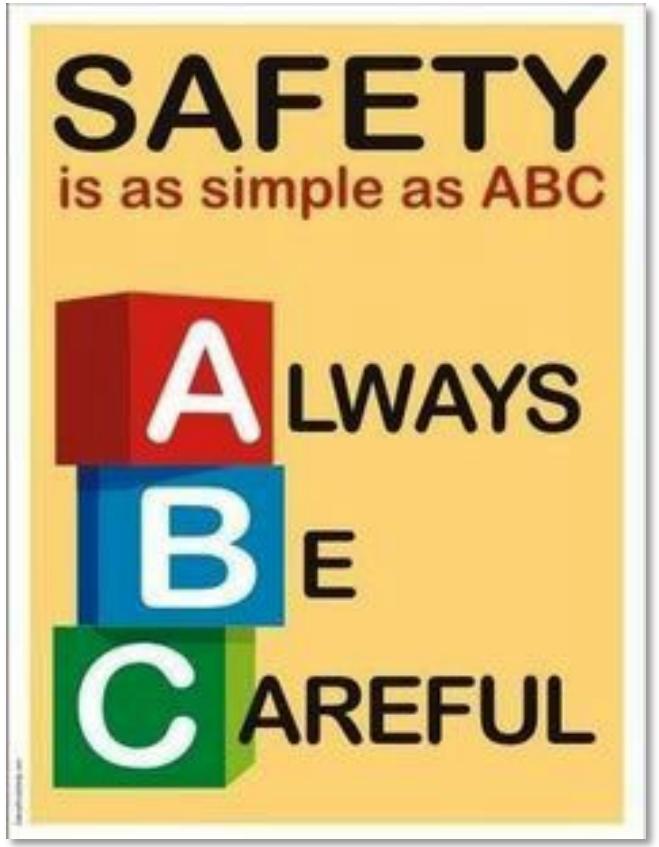
- Freedom from danger, risks, and injury - NOW and LATER
- In the context of SESAME, workplace safety includes chemical safety, radiation safety, electrical safety, physical safety (including vibration, light, noise), safety of structures and during construction, ergonomic considerations, mental health

Why is safety important?

- According to the SESAME safety policy, SESAME is committed to providing and maintaining a safe and healthy workplace for all workers, visitors, researchers, contractors, surrounding environment and members of the public as well as protecting its property.
- Every worker has a duty of care to protect those around them from harm
- Incidents at a scientific facility like SESAME can have a range of consequences including injury and illness, damage to laboratory infrastructure, waste of manpower and resources

What is your responsibility?

- To work in a safe manner at all times
- To keep the laboratory environment clean, safe, and free from hazards
- To report any incidents, hazards or concerns regarding safety
- To comply fully with all instructions



What is the responsibility of SESAME?

- To provide a safe work environment
- To provide everything needed to operate safely (including personal protective equipment, safety equipment)
- To provide all required training and advice regarding safety
- To support you to report incidents, hazards or concerns regarding safety

Safety structures at SESAME

Safety policy committee

Administrative Director
Chair

Technical Director

Scientific Director

Gihan Kamel
IR

Anas Abbadi
PSS

Thaer Abu Hanieh
Building

Adli Hamad
Rapporteur

Sofian Jafar
PS

Basheer Amayreh
Liaison

Safety office

Director General

Safety Office

Iyad Zahran
0777915246/214

Adli Hamad
0798290024/ 212

You can contact any member of the committee or the safety about any safety incidents or concerns

Five general hazard sources

e.g. chemical and biological materials, gases

e.g. noise, radiation (non-ionizing and ionizing), humidity, temperature, workstation design

e.g. machinery, tools, devices

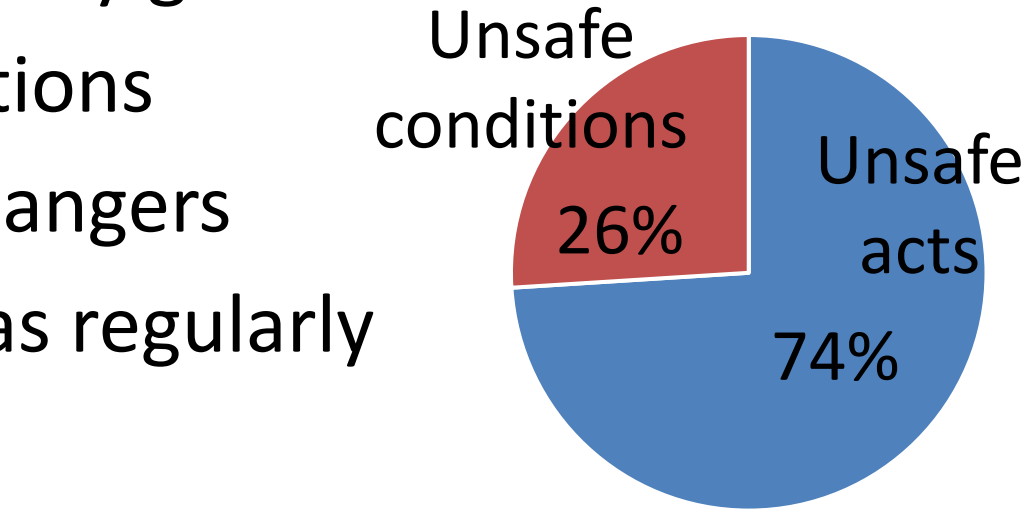
e.g. unsafe behaviors, employee fatigue, stress, rushing, drugs

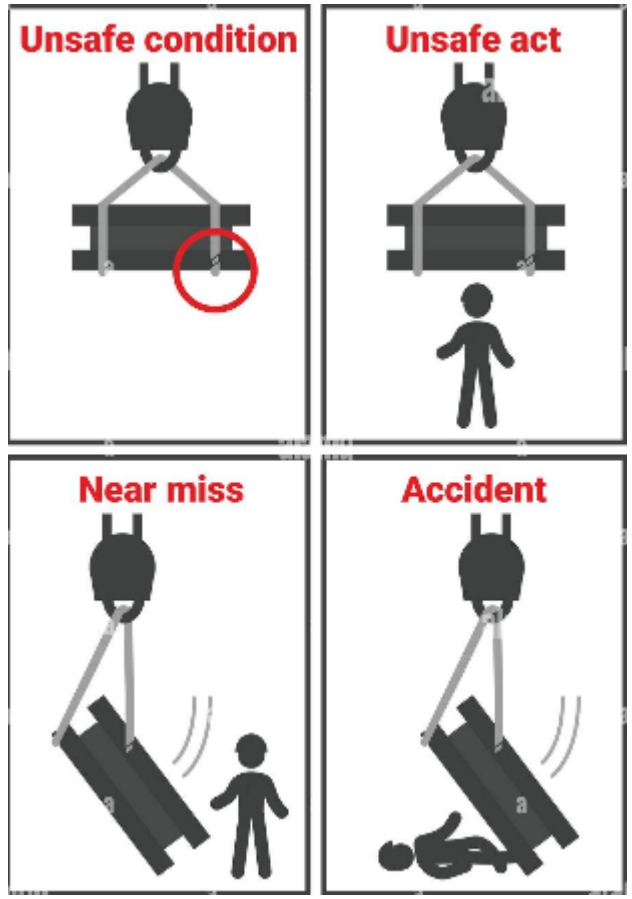
e.g. flawed policies, programs, plans, processes, procedures, and practices

Preventing accidents

- Always be alert
- Don't rush your work
- Keep the work area clean
- Wear required safety gear
- Follow all instructions
- Report possible dangers
- Inspect work areas regularly

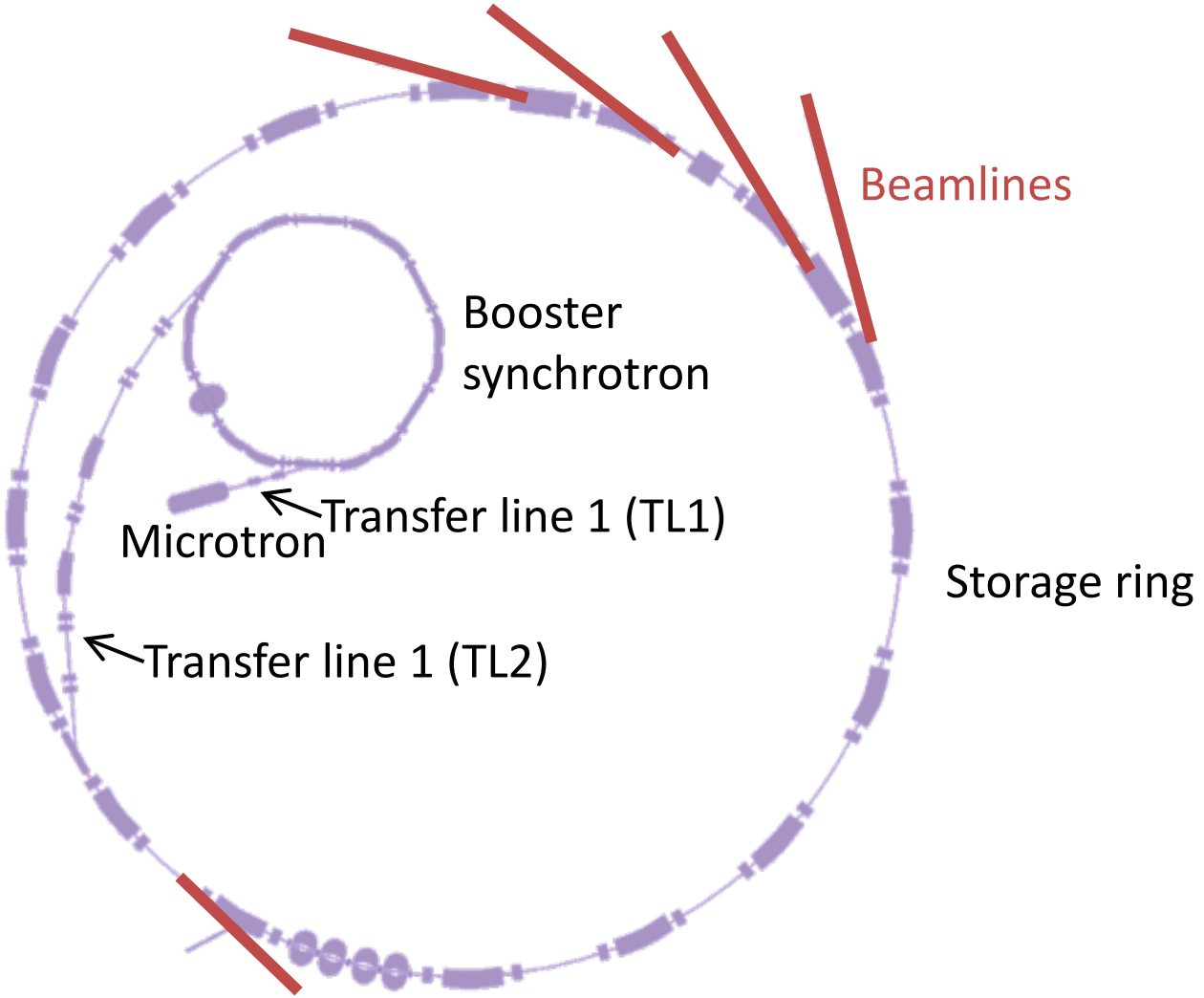
Contribution to accidents





General information about SESAME

- 20 MeV microtron.
- 800 MeV booster synchrotron.
- 2.5 GeV storage ring
- 5 beamlines: XRF/ IR/ MS/ HESEB/ BEATS
- 133.2 m circumference

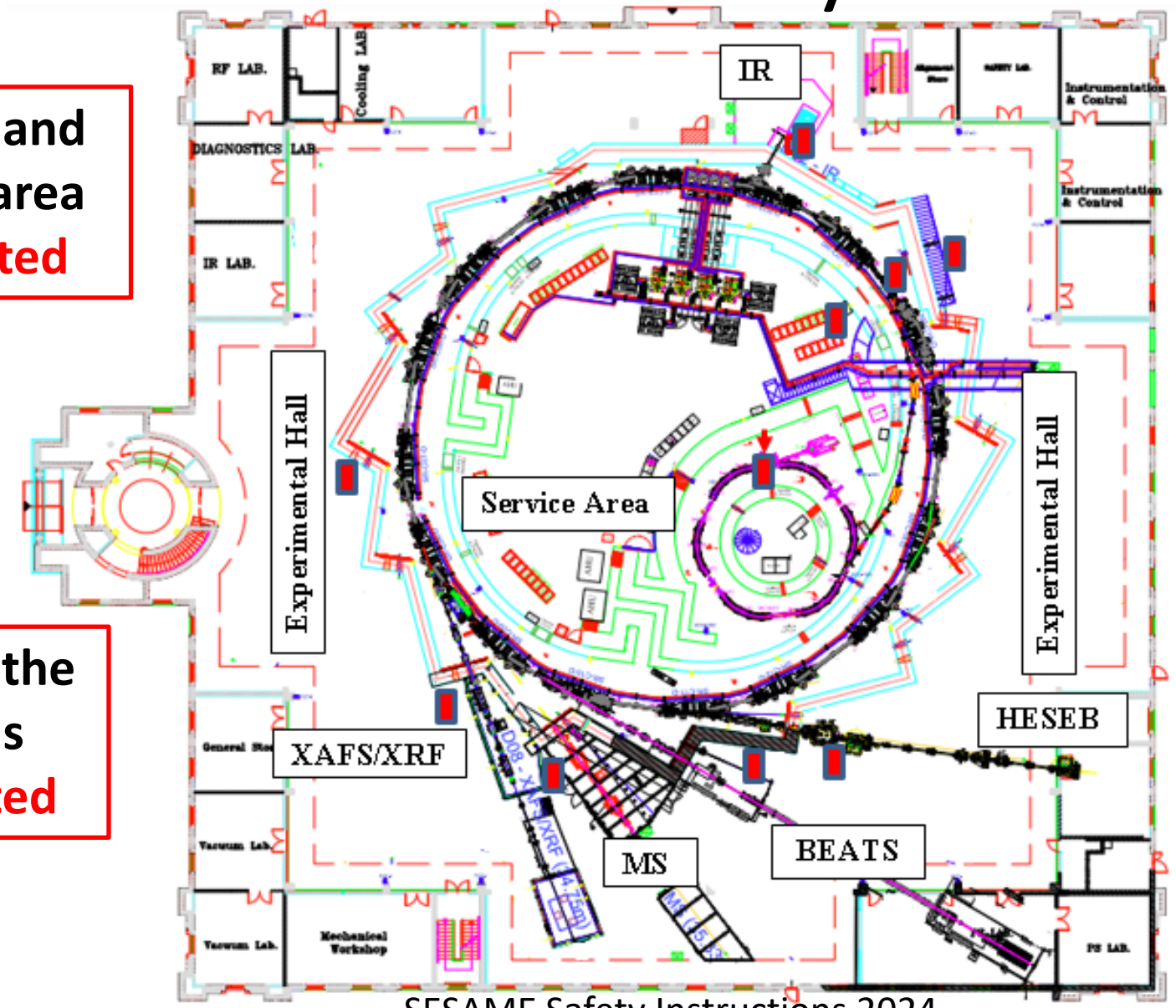


SESAME site map

Main hall layout

Tunnels and service area
Prohibited

Roofs of the tunnels
Prohibited



Experimental Hall
Accessible
after receiving valid training and wearing personal dosimeter

If an alarm rings when you're in the main hall

- Do not panic
- Leave the working area – leave the beamline as it is
- Follow exit signs
- Stay at assembly point
- Wait for instructions

Assembly point is the same for everyone at SESAME

<u>If the source of the hazard is part of the beam line itself:</u>

- Close shutters.
- Stop work.
- Leave working area.
- Triger the alarm bell.
- Call and report to your supervisor or Safety Office.
- Follow exit signs,
- Stay at assembly point.
- Wait for instructions

If an alarm rings when you're elsewhere

- Do not panic
- Leave in a calm manner
- Follow exit signs
- Report anything suspicious or improper that you observe
- Stay at assembly point
- Wait for instructions

Assembly point is the same for everyone at SESAME

There are no false alarms, so all alarms should be taken seriously

In case of an earthquake

<u>DROP down</u> onto your hands and knees. This position protects you from falling but allows you to still move if necessary.

<u>COVER</u> your head and neck (and your entire body if possible) underneath a sturdy table or desk. If there is no shelter nearby, get down near an interior wall or next to low-lying furniture that won't fall on you, and cover your head and neck with your arms and hands.

<u>HOLD ON</u> to your shelter until the shaking stops.

Be ready to leave using the safest and closest exit path or ask for help.

If you are in the Main Hall in an earthquake

If you are inside the tunnels: go and stay under the iron girders if possible or very close, based on where you are

If you are outside the tunnels: come close and take cover in the shielding walls of the tunnels.

Be careful to be away from any object that can fall on you from the side or above and keep in touch and communicate with friends or colleagues.

In case of a fire

1. Initiate fire alarm.
2. Move to the evacuation point
3. Immediately inform your supervisor or the safety office

General safety instructions

Make sure that you are familiar with:

- How to contact your host
- How to find the closest first aid box
- The locations of the emergency exits
- The location of the assembly point
- The specific policies for out of hours work in your location

Good laboratory practice

- It is strictly prohibited to eat, drink, smoke, chew gum, apply cosmetics, or take medicine in any laboratory where hazardous materials are used.
- Alcohol is strictly prohibited anywhere on SESAME premises
- You must not store food, beverages, cups, and other drinking and eating utensils in areas where hazardous materials are handled or stored.
- Glassware use for laboratory operations should never be used to prepare or consume food or beverages.
- Laboratory refrigerators, ice chests, cold rooms, ovens, and so forth should not be used for food storage or preparation.
- Laboratory water sources should not be used as drinking water.
- Laboratory chemicals should never be tasted.
- You must never pipette by mouth: a pipette bulb or aspirator must be used

More good laboratory practice

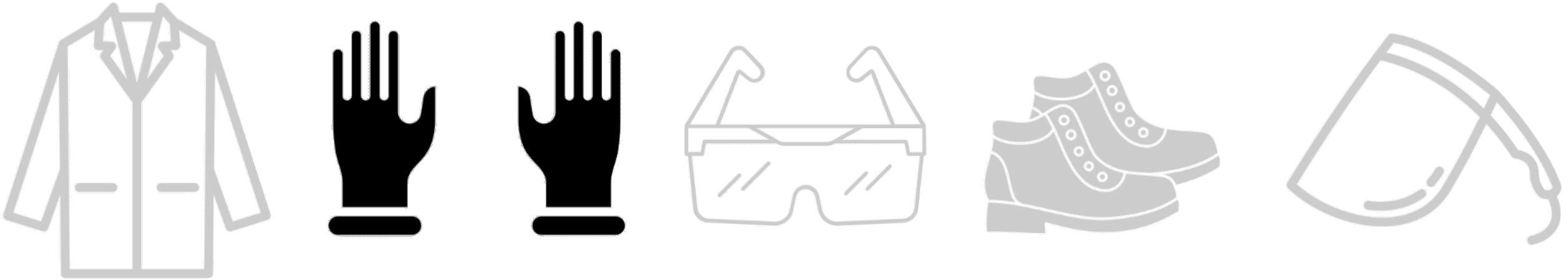
- Hands should be washed with soap and water immediately after working with any laboratory material, even if gloves have been worn.
- Inform the Safety Office if you suffering from a chronic or infectious disease or have implanted metals
- Wear a face mask in case of respiratory difficulties.
- Open toed shoes, high-heeled shoes and jewelry are not allowed. Long hair must be tied back.
- You must be familiar with the risks of all procedures that you are carrying out, and how to deal with any emergencies

Personal protective equipment

Lab coats

- Should be chemically-resistant
- Must be worn buttoned-up
- Should only be worn in the lab, not in other areas of the building
- Should be regularly cleaned

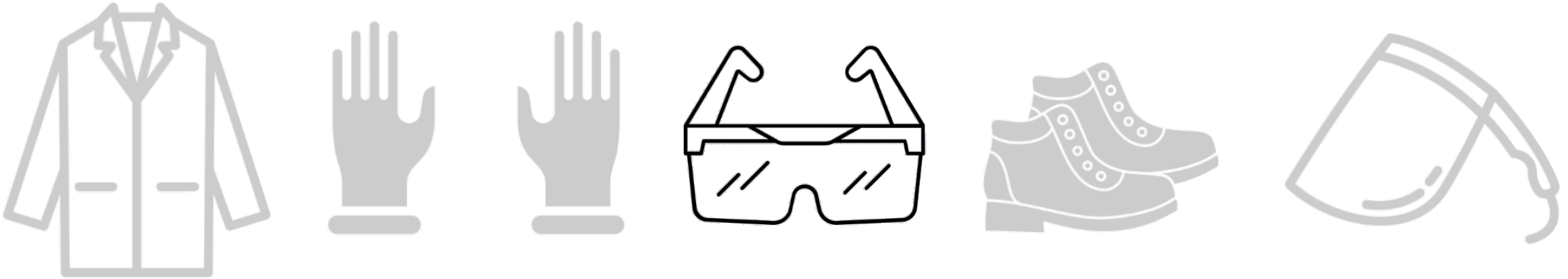
Personal protective equipment



Gloves

- Appropriate gloves should be selected for the chemical substance
- Should only be worn for chemical manipulations, and then be removed and disposed of immediately
- Do not touch anything that may be touched by others without gloves (*e.g.* door handles, computers)

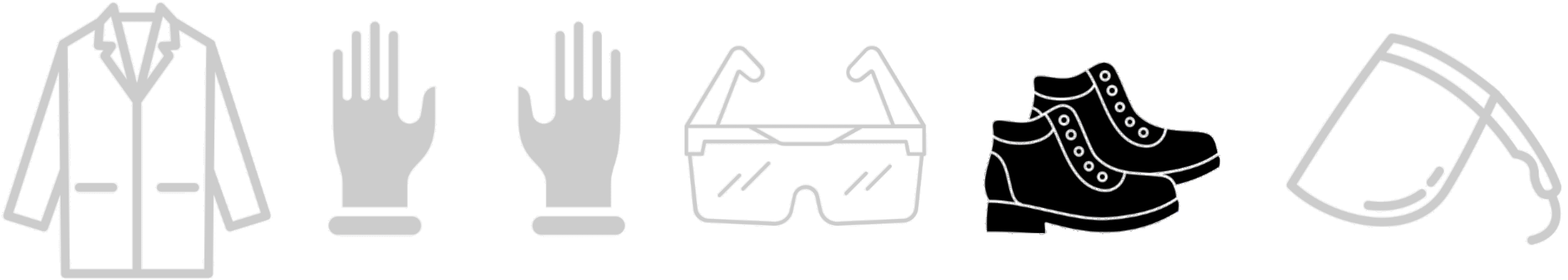
Personal protective equipment



Safety glasses

- Must be worn **at all times** in laboratories where chemicals are handled
- Must be available at the doors of all labs for visitors
- Do not wear contact lenses with safety glasses
- For prescription glasses, it is possible to order prescription safety glasses or find safety glasses that fit on top

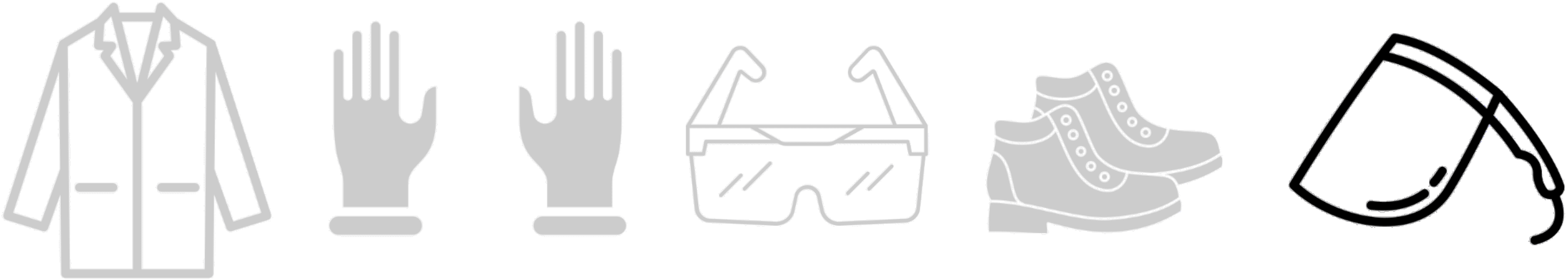
Personal protective equipment



Appropriate footwear

- Closed-toe shoes must be worn **at all times** in any laboratories or in the experimental hall
- Shoes that have large holes, mesh, or thin material should not be worn; leather or synthetic leather is best
- Shoe must cover the entire foot

Personal protective equipment



Face shield

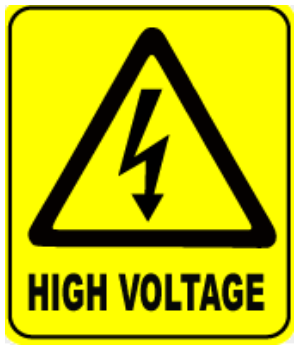
- A face shield may be required for handling certain chemicals or chemical procedures

Safety signs

YELLOW = WARNING SIGNS

RED = PROHIBITED SIGNS

BLUE = MANDATORY SIGNS



Precaution tapes

ENTER WITH CARE

In all case, call the Safety Office for assistance. Tapes should not be placed without advance coordination with the Safety Office.

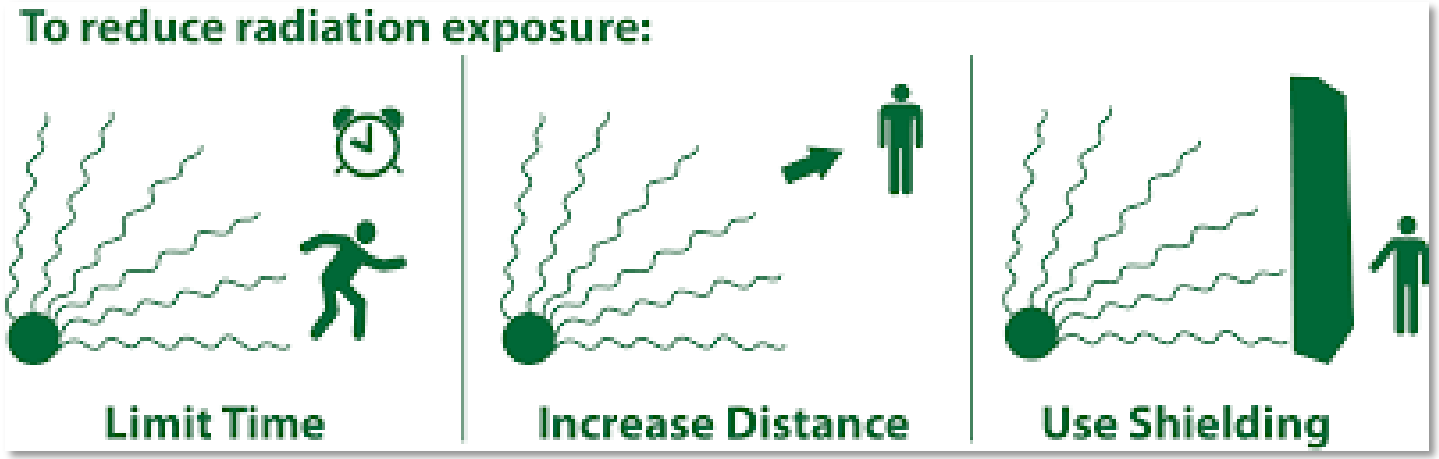
DO NOT ENTER

Radiation safety

There are two aspects to radiation safety:

- Radiation associated with the synchrotron itself
- Radioactive samples that you might bring

The general principles of radiation safety is that exposure to any person should be kept **A**s **L**ow **A**s **R**easonably **A**chievable (ALARA)



Levels of control against synchrotron radiation

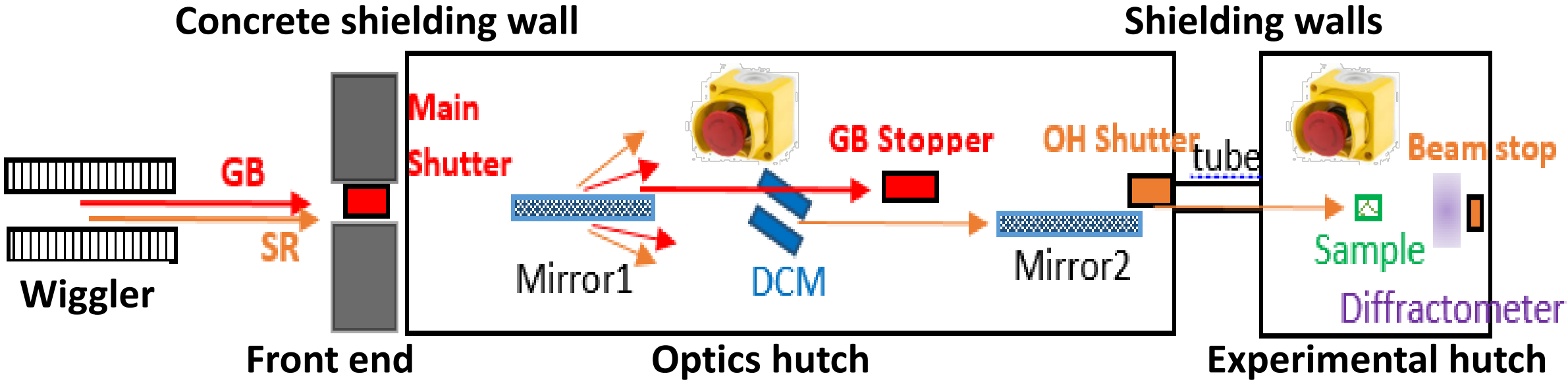
Physical controls
Shields and administrative controls

Radiation monitoring
All users are required to wear personal dosimeters

Throughout the years of operation, radiation levels have been found to be below radiation protection limits and guidelines.

The dose limits for non-radiation workers are 1 mSv/year.

Design of SESAME beamline shielding



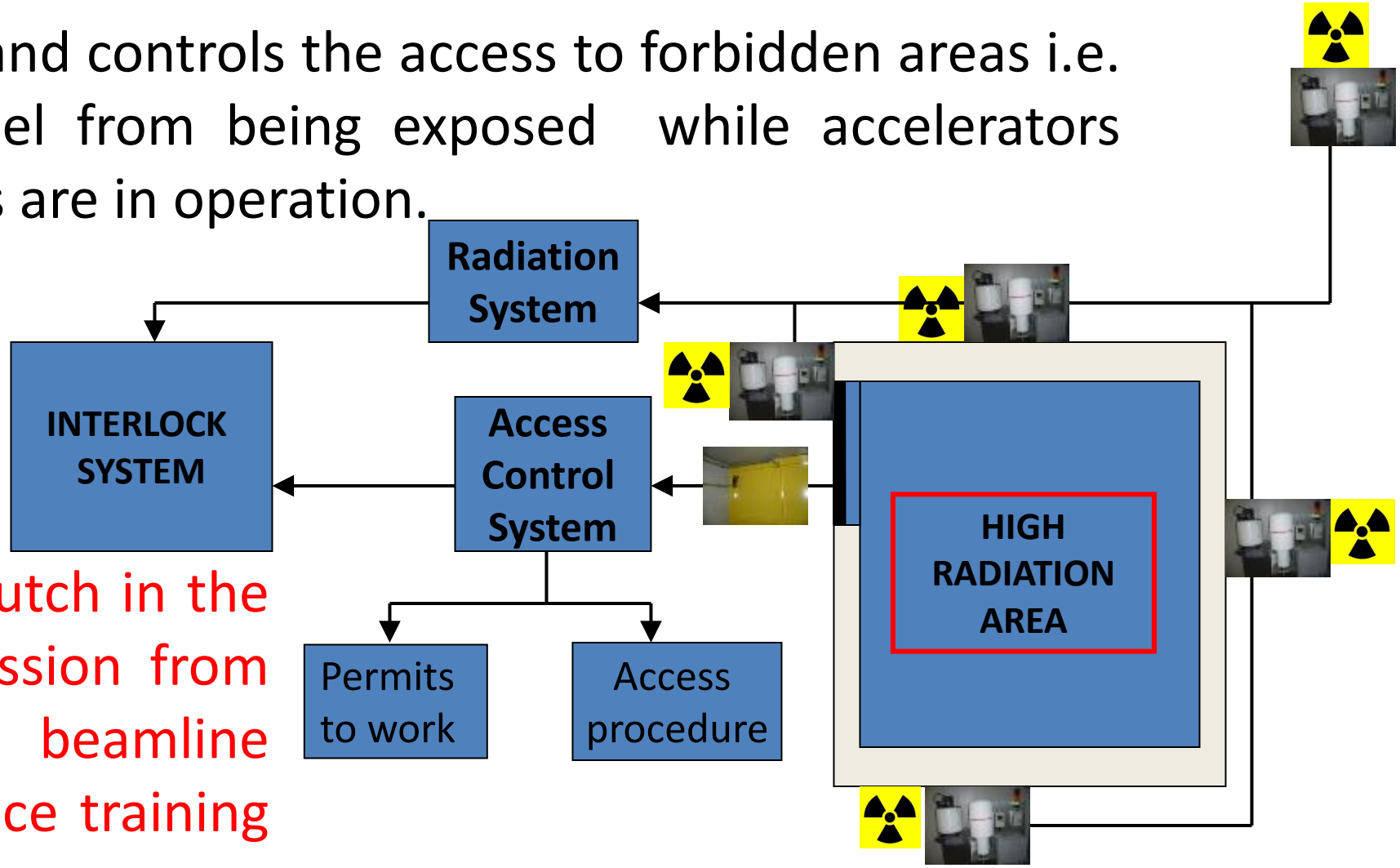
- Most Gas Bremsstrahlung (GB) & synchrotron radiation will be found inside the closed and interlocked hutches of the beamline.
- Radiation levels outside the hutches are below 0.5µSv/h in all directions.
- Before entering any hutch, pay attention to the status of the hutch and use the emergency push button to stop the beam.
- For soft X-ray beamlines no hutches are needed outside the accelerator shielding walls.

Physical radiation protection mechanisms

- At all times pay attention to the status of the hutches
- Inform the relevant beamline scientist or the safety office if you observe:
  - Missing lead panels.
  - Clear deformation in lead panels.
  - Any utilities chicanes are NOT properly closed from both sides.
  - Lead door not closed properly.
- You are not authorized to change the status of any shielding materials.

Personal safety system (PSS)

The PSS restricts and controls the access to forbidden areas i.e. prevents personnel from being exposed while accelerators or/and beam lines are in operation.



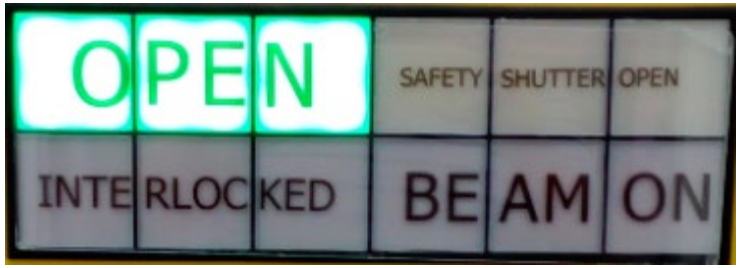
Do not close any hutch in the PSS without permission from the responsible beamline scientist and advance training from the control team.

Beamline hutches

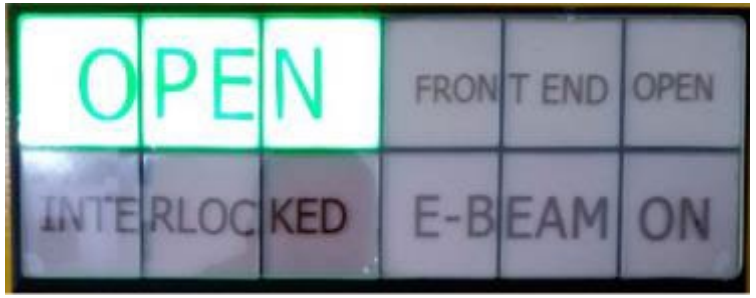
You can enter the hutches of the beamline if and only if:

1. You finished a special training on how to use PSS of the beamline and this training is still valid.
2. You are explicitly allowed to enter the hutches by the relevant Beamline Principal Scientist.
3. Under supervision of the relevant beamline scientists.
4. You are wearing a personal dosimeter if the machine is in operation
5. The hutch is in an **OPEN** state

Optical hutch (OH) indicators



Experimental hutch (EH) indicators



Area monitoring systems

- Must not be removed from their position
- Must not be disconnected from power or data

Passive radiation dosimeters

There are radiation monitors placed throughout the facility – **do not** remove these.





Personal dosimeters

Terms of use of Radiation Personal Dosimeters

- The dosimeter does not entitle you to enter restricted areas, and does not protect you from exposure to radiation
- Wear at **all times** at SESAME, especially when entering the main hall
- Wear on the chest, at the height level of electron beam
- Inform the safety office if the dosimeter is lost or broken
- Keep the dosimeter away from direct sunlight, water, spark sources
- Fill in the relevant form when you first collect the dosimeter
- Use only the dosimeter that has been assigned to you
- Do not take the dosimeter with you off the SESAME premises: store in the wooden mailbox each day when you leave
- If you have forgotten to return the dosimeter, kept it out of the reach of others and do not wear it when undergoing any medical radiography.
- In case of pregnancy, please inform the safety office

Bringing radioactive samples to SESAME

- If your experiment involves any radioactive samples, you will be required to fill in the radioactive risk assessment at least two weeks before your visit
- Users must quickly reply to any questions from the safety office
- Samples with dose rate (DR) > 0.5 µSv/h are not permitted
- Samples with DR of 0.25 – 0.5 µSv/h are considered high risk and must be handled accordingly
- Samples with radiation DR <0.25 µSv/h are considered medium risk
- Gaseous and liquid radioactive samples are not permitted

Bringing samples to SESAME

You must submit a risk assessment before bringing samples to SESAME:

- If you submitted a proposal through the SUP, you will have to provide sample and safety information at this time
- If you are carrying out an experiment by any other arrangement, you must submit the risk assessment form to the Safety Office at least two weeks before the experiment
- For any changes to risk rating of samples you are bringing, you must contact the Safety Office prior to your visit.

Samples prohibited at SESAME

Radioactive samples

Samples with dose rate (DR) > 0.5 µSv/h are not permitted

Chemical samples

Acutely toxic / dangerous chemicals, unless there is a rigorous sample handling procedure in place

Biological samples

Any samples categorized as posing a safety risk (Biosafety levels 1-4) without appropriate treatment

Sample and waste disposal

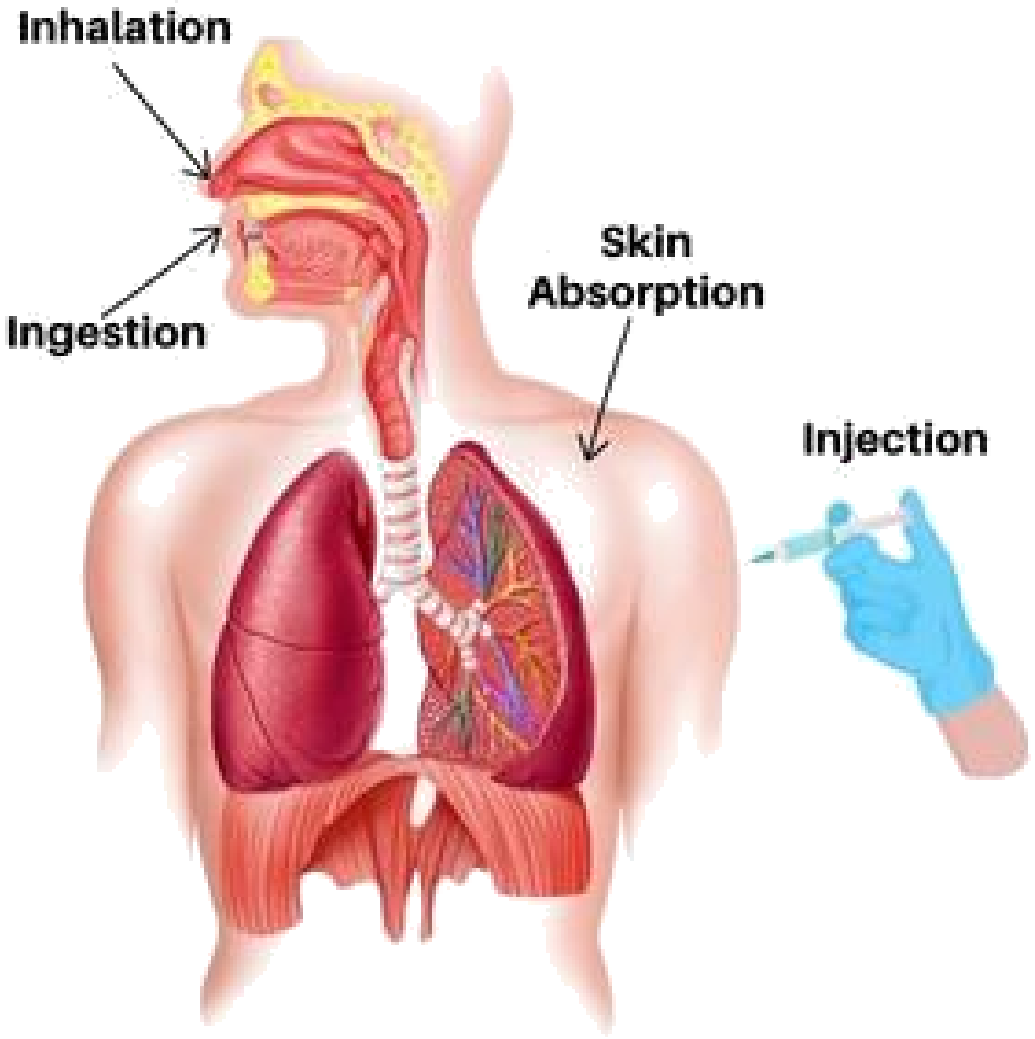
- It is expected that all samples that are brought into SESAME will be removed by the user except with the agreement of both the beamline scientist and the safety office.
- Any other waste generated by a user should be disposed of in the provided plastic waste bags, with the proposal number clearly indicated.

Chemical safety

- Hazardous chemicals are any **substances that can cause adverse health effects**
- Not all chemicals are hazardous
- Non-hazardous chemicals are also termed “non-dangerous goods”
- The impact of a hazardous chemical depends on a number of factors

Factors determining severity of health effects

- Duration of exposure
- Frequency of exposure
- Route of exposure
- Personal health
- Type of chemical



Determining the hazards of a chemical – the container

GHS pictograms

DG diamond

Globally Harmonized System (GHS) pictograms

Corrosive

Irritant / harmful

Explosive

Toxic material

Flammable

Gases under pressure

Toxic to aquatic organisms

Health hazard

Oxidizer

Dangerous Goods diamonds

CLASS 1
Explosives

CLASS 2.1
Flammable gases

CLASS 2.2
Non-flammable, non-toxic gases

CLASS 2.3
Toxic gases

CLASS 3
Flammable liquids

CLASS 4.1
Flammable solids

CLASS 4.2
Spontaneously combustible

CLASS 4.3
Dangerous when wet

CLASS 5.1
Oxidizers

CLASS 5.2
Organic peroxides

CLASS 6
Toxic substances

CLASS 7
Radioactive substances

CLASS 8
Corrosives

CLASS 9
Miscellaneous

Determining the hazards of a chemical – the SDS

- Safety data sheets (SDS) are internationally recognized and must be provided by the supplier for every chemical sold
- Users are obliged to hold a copy of an SDS that is less than 5 years old
- Each SDS generally has 16 sections: most significant are:

  1. Hazard Identification.

  3. First Aid Measures.

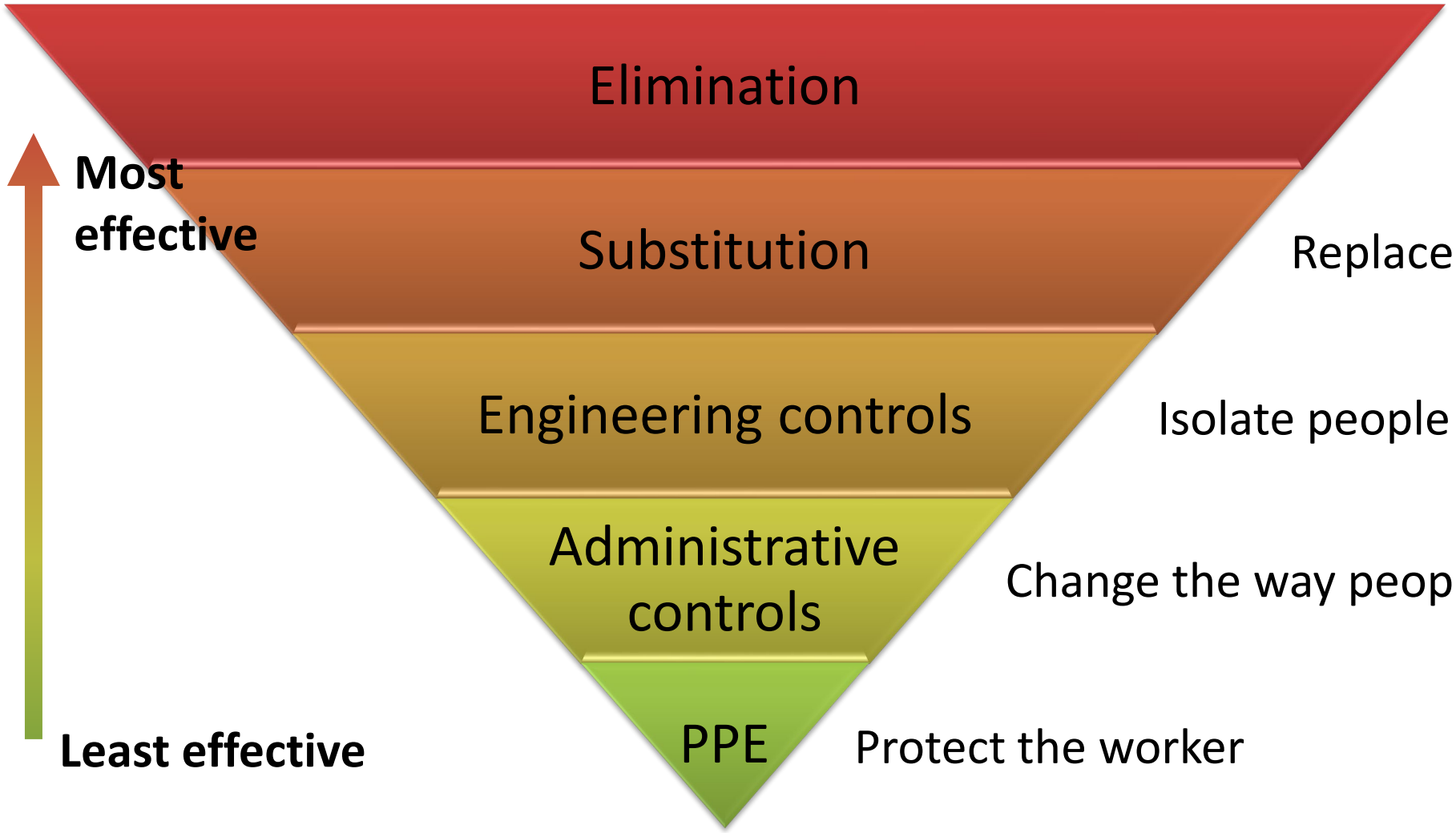
  5. Accidental Release Measures.

  6. Handling and Storage.

General actions in case of contact with chemicals

- The SDS will provide specific instructions for the exact chemical in question
- Remain calm and do not panic.
- In case of a cut or puncture, or chemical contact with the skin, immediately wash the wound under running water for at least 5 minutes.
- In case of eye contact, immediately rinse your eyes with running water for at least 20 minutes.
- In case of swallowing, seek medical attention immediately.
- Inform the safety officer of all incidents.

Hierarchy of controls



Physically remove the hazard

Replace the hazard

Isolate people from the hazard

Change the way people work

Protect the worker

Emergency response plan

All users must prepare a full spill response plan based on the type of hazardous material, taking into account:

- The level of risk.
- The personal protective equipment required.
- How the spill will be confined
- How clean-up and decontamination will be achieved

All incidents must be immediately reported to the safety office.

If a spill has occurred, the safety officer has the right to evaluate the case and give the permission to complete the work or wait for more safety actions.

Use of compressed gas cylinders

- Compressed gas cylinders must only be used under the supervision of or with the permission of the beamline scientists

Required PPE

Closed shoes

Cryogenic gloves

Safety glasses

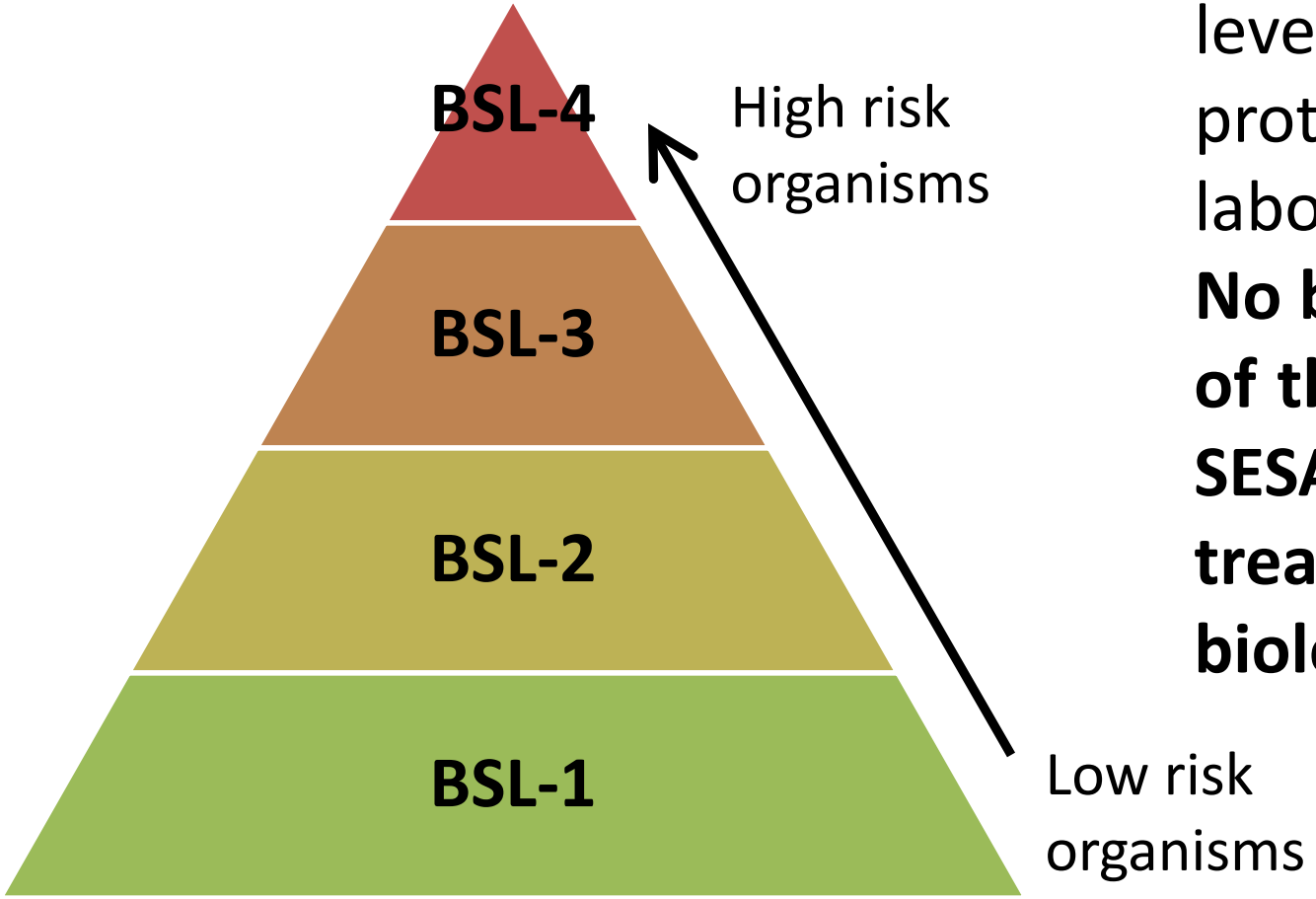
Biological safety

Biological hazards are organisms or substances produced by organisms that pose a threat to human health.

<u>Biological hazards include:</u>

- Viruses
- Toxins from biological sources
- Parasites
- Spores
- Fungi
- Pathogenic micro-organisms (*e.g.* bacteria)
- Bio-active substances

Biohazard safety levels



Biosafety levels describe the different levels of contamination, risk, and protective measures needed in laboratories for specific activities.

No biological sample that fits into any of these categories can be brought to SESAME, without appropriate treatment to ensure that the biological hazard is inactivated.

Permitted biological samples

All biological samples must be treated before they are brought to SESAME, to ensure that **no living organisms remain**.
This may involve the following processes:

- Chemical fixation *(e.g.* with methanol or paraformaldehyde)
- Resin-mounting of tissue
- Freeze-drying (lyophyilization)
- Heat-treatment of liquid samples

Manual handling and stair safety

When you intend to bring and use any equipment/ tools you must inform SESAME and take the approval before bringing it.

Use best practice for handling heavy items:

- Never lift an object that is too heavy for you: ask for assistance or for a mechanical aid.
- Use the muscles in your legs to lift, not the muscles in your back.
- Keep your back straight

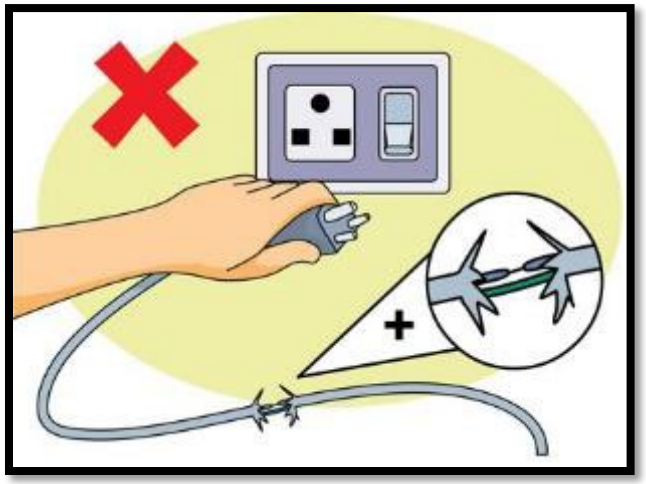
Pay attention to stair safety:

- Always hold the handrail
- Keep stairs clear
- Do not carry heavy objects, especially those that obstruct your view

Electrical safety

Main dangers of electricity

- Electrical shock: contact with live parts (direct and indirect contact).
- Arcing: Electricity can jump an air causing shock effects to person not in contact with conductor.
- Burns: The heat given off by current will cause direct burns at the point of contact.
- Fire and explosion: flow of electricity generates heat, which could lead to fire.



In case of electrocution

1. Alert others immediately
2. Do not touch the victim
3. Separate the victim from source of electricity as quickly as possible by:
   a) Turning off the source of electricity, or
   b) Move the source away from the victim.
4. If you have been first-aid trained, please start.
5. If you have no training, wait for help.

Next steps

Before you perform any experiments at SESAME, you must pass the safety induction quiz using the link that has been provided to you.
A mark of 100% is required – you can take the test as many times as necessary to achieve this mark.