

Risk assessment-student laboratory work, part I

General safety aspects

Everyone working in a laboratory is responsible to plan and perform the work in a safe way, without causing danger to people or the environment, within or outside the laboratory.

Some general aspects of safety and protection:

- It is not allowed to eat, drink or bring in food or drinks into the lab.
- Maintain good order in the working areas.
- Handle equipment in a correct way.
- Follow the safety rules and routines.
- The need for personal protection should be considered in every situation.
- Never enter an elevator with hazardous chemicals, liquid nitrogen, gas or hazardous waste.
- First-aid equipment and fire extinguishers are available in labs and/or corridors. Be sure you know where to find them.
- Learn about the exit routes and meeting point in case of evacuation.

Chemicals

Read the safety data sheet (SDS) for the chemical you are going to use. The SDS includes information about chemical and physical properties, risk and safety aspects etc. All chemicals handled at Fysikum, are registered in the KLARA-system (Stockholm University's system for managing chemicals). Log in with your university account:

(<https://www.su.se/english/staff/it/it-support-systems/klara>)

Chemicals (including gases) are classified and labeled according to their potential effects on human health and environment. The classification is used e.g. to determine the safety precautions needed. The lack of classification and labeling does not necessarily mean that a specific product is harmless. It might implicate that existing toxicological data are not sufficient to meet the current criteria for classification and labeling, used by the authorities.

Some aspects of safety and protection:

- All bottles, tubes, beakers etc containing chemicals or preparations must be clearly labeled with content, date, and name of user.
- Never return a chemical into its original container.
- Keep your hands away from mouth and face when working in the lab.
- Hazardous substances must be handled in a fume hood.
- In order to assure good ventilation and function of the fume hoods, windows in the lab should be kept closed and objects not needed, should be kept away from the hood.
- Before starting an experiment, be sure that you know how to take care of waste and unexpected spill.
- To avoid contamination outside the room, never use gloves on door handles etc.
- Wash your hands when you leave the lab.

Gas handling

Gases are delivered in metal containers, either as highly pressurized gases or liquids in equilibrium with their gas phase. A regulator is connected to the container, to enable the adjustment of the pressure under which the gas is distributed into the gas handling system (tubes, valves, flow controllers etc). Before handling a gas, you must read the safety data sheet for the product, which includes information about toxicity, odor, reactivity, personal protection, in case of accident etc.

Some of the toxic gases have a strong characteristic odor that makes them detectable for the human nose also in small doses (for example ammonia (NH_3) and hydrochloric acid (HCl)). Some toxic gases are colorless and free of odor (for example carbon monoxide (CO)). Remember that also harmless gases can be dangerous because they can take the space of air (oxygen) in the room. Also consider that some gases are lighter than air and some are heavier than air.

Electrical safety

Knowledge and carefulness are crucial for safety during electrical work.

Some aspects of safety and protection:

- Keep the work area clean and in good order. The risk of short circuit will increase with unnecessary tools and material around. Also, parts falling into the wrong spot can cause accidents and destroy equipment.
- Check that the equipment (e.g. cable connectors) is intact. This can otherwise cause malfunction and accidents, harmful for both you and the equipment.
- Assume that everything is electrical energized until the opposite has been confirmed.
- Metal constructions must always be grounded. An electrical failure/mistake in a grounded object will immediately trigger a fuse or a residual current device (RCD) and thereby break the current.
- Contact protection (and warning signs) must be used to protect against contact with live parts.
- Touch the equipment first with the back of your hand. If the equipment is energized, the reflex will remove the hand rather than hold it attached.
- If possible, work only with one hand. This will protect you from dangerous current through your body, if something goes wrong and trigger a fuse or an RCD.
- In case of electrical accident: break the power and/or pull the injured person from live objects. Do not touch bare skin, instead use the clothes or some isolating material/objects when you touch the injured person.

It is normally not the voltage, but the current that will affect the body. Some guidelines: the threshold value for feeling a current in the body is about 0.5 mA. If the current is above 10 mA, you are not able to let go from an object you are holding (muscular spasm). For currents above 50 mA, there is risk for heart fibrillation, which can be fatal.

Laser safety

Different kinds of lasers are available. They can e.g. be pulsed or continuous, emit beams in the UV, IR or visible spectrum of light, have fixed frequency or be tunable. The lasers are classified (Class 1, 2, 3R, 3B and 4) according to their wave length, power and potential risk for health. The light they generate is potentially a serious hazard and even a very short exposure to a reflected laser beam may be dangerous and cause permanent loss of vision. In an optimal designed system, no hazardous laser beam should be present. The risk of accidental exposure is greatest during set-up and alignment of the system.

Some aspects of safety and protection:

- A warning light must always be turned on, in and/or outside the room, before the lasers are started.
- Personal belongings like watches, rings, jewelry, belt buckles etc must be removed before you start to work, so that no reflections can occur from these objects.
- Always use safety glasses. You must not start the laser before all persons in the lab are equipped with the appropriate safety glasses designed for the laser in use.
- If you leave the room while the experiment is running, the door must be looked and the warning light left on. Do not forget to shut off the warning light when the laser is turned off.

Radiation safety

There are different sources of radiation, for example radioactive decay, accelerators and X-ray devices. Furthermore, there are different types of radiation. The main types of radiation are alfa-, beta-, gamma-radiation, X-rays and neutrons. It is important to know what type of radiation you are going to work with. It will decide the protection precautions e.g. the shielding methodology you chose. The different types of radiation have different biological effects and health risks.

Radiation sources are classified either as sealed or open sources. In a sealed source, the radioactive substance is sealed within a capsule of non-radioactive material, to prevent spreading of the substance and minimizing the risk of contamination to the environment (clothes, other equipment etc), if handling the source in a correct way. During lab work at the department, sealed sources are used in almost all cases. In the points below, the ones mainly valid for open sources are indicated by (O).

Some aspects of safety and protection:

- The use of radioactive material should be restricted to specific locations, and the area should be labeled with warning signs for radioactivity.
- Label all the material used for radioactive work with radiation stickers.
- Keep the work space clean and free from unnecessary equipment.
- Exercise the practical procedures without the radioactive sources before you perform the real experiment.
- Whenever possible, use shielding between the radioactive source and yourself, and if available, use remote tools.
- Maximize the distance to the radioactive source.

- Minimize time of exposure to the radioactive source.
- Use liquid absorbent paper with plastic underside, for bench cover, if there is a risk for unexpected spill (O).
- If there is a risk of airborne radioactivity, the work should be performed in a fume hood (O).
- Personal protection, including gloves of appropriate material should always be worn (O). The gloves should be changed regularly and be treated as radioactive waste.
- If you are assigned a dosimeter, wear the dosimeter throughout the work process.
- Learn how to take care of waste and unexpected spill before you start the experiment.
- Always wash your hands after work.
- After finished work, check for contamination of yourself (hands, clothes and shoes), the working space and equipment, by using appropriate instruments.

Personal protective equipment (PPE)

The need for PPE should be considered before starting the lab work.

Examples of PPE:

- Safety glasses and face shield for eye/face protection.

Note: There are different types of safety glasses designed for different kinds of lasers. Use the appropriate safety glasses designed for the laser in use.

- Protective gloves for skin protection.

There are different types of gloves that will protect against different types of risks, e.g. mechanical, electrical, thermal, chemical risks. For a chemical substance, it is specified in the safety data sheet, which glove material and thickness you need for protection.

- Respiratory protective equipment.

A respiratory mask should be worn when there is a risk of airways exposure. Choose appropriate equipment (filter type) which protects against the specific product handled.

- Ear protection.

If there is a risk of high noise environment e.g. high frequency sounds, use appropriate hearing protection.

- Protective clothing for body protection.

The type of lab coat, lead apron etc. needs to be selected depending on the properties, concentration and quantity of the hazardous substance handled.

Examples of potential hazards/risk factors to consider

Exposure to hazardous substances, chemical spill, leakage of gas, fire, explosion, cryogenic condition, heat, radioactive sources, X-ray sources, laser equipment, strong magnetic fields, electricity, heights, heavy lifting, broken equipment, inaccurate equipment, non-functional/insufficient PPE, stress condition (e.g. time pressure, mental exhaustion).

All personnel, including students, are obliged to notify if errors and deficiencies are discovered with regard to safety, work environment and environment.

Medical contacts

In emergency situations: health care, ambulance, phone **112**.

The address to the building: Roslagstullsbacken 21, 114 21 Stockholm.

Medical advice: Vårdguiden phone **1177** (<https://www.1177.se>).

Hospital: Danderyd Hospital, switchboard phone **08-123 550 00** (<https://www.ds.se>).

Eye Hospital: St Erik Eye Hospital, switchboard phone **08-672 30 00**,
emergency department phone **08-672 31 00**

(<https://www.sankterik.se>)

Poison information: Swedish Poisons Information Center phone **010-456 6700** or **112**
(<https://giftinformation.se>).

Reporting to SAMIR

The SAMIR (Safety-, Work environment-, Environment-, Reporting) system, is Stockholm University's reporting system for security notifications, crimes, near accidents/incidents, accidents, work-related injuries or illness, and non-compliance with the rules governing the work environment. You can also report suggestions for improvements to the working environment.

All accidents and incidents must be reported to the SAMIR system (SAMIR-Tillbud/arbetsskada). Log in with your university account to file a report:

<https://www.su.se/medarbetare/it/stoedsystem>

Links

Information about rules and regulations, and about safety and protection for people and environment, are provided for example by:

Arbetsmiljöverket/Swedish Work Environment Authority (<https://www.av.se>)

Kemikalieinspektionen/Swedish Chemicals Agency (<https://www.kemi.se>)

Elsäkerhetsverket/National Electrical Safety Board (<https://www.elsakerhetsverket.se>)

Myndigheten för samhällsskydd och beredskap/Swedish Civil Contingencies Agency
(<https://www.msb.se>)

Strålsäkerhetsmyndigheten/Swedish Radiation Safety Authority
(<https://www.stralsakerhetsmyndigheten.se>)

Vid brand

Om möjligt, stäng av apparater, gaskranar etc som kan förvärra situationen.

1 Rädda

Kontrollera om det finns nödställda och rädda dem.

2 Larma/Varna

Ring räddningstjänsten, tel nr **112**.

Varna personer som hotas av faran.

3 Släck

Om möjligt, släck med hjälp av släckutrustning.

4 Utrym

Följ skyltar och utrymningsplanen. Undvik rökfyllda utrymmen. Använd ej hissar.

5 Återsamlas

Efter utrymning, bege dig till återsamlingsplatsen.

In case of fire

If safe, shut down equipment, close gas taps etc that can worsen the situation.

1 Rescue

Check for people in distress and rescue them.

2 Alarm/Warn

Call the fire brigade, phone **112**.

Warn people who might be in danger.

3 Extinguish

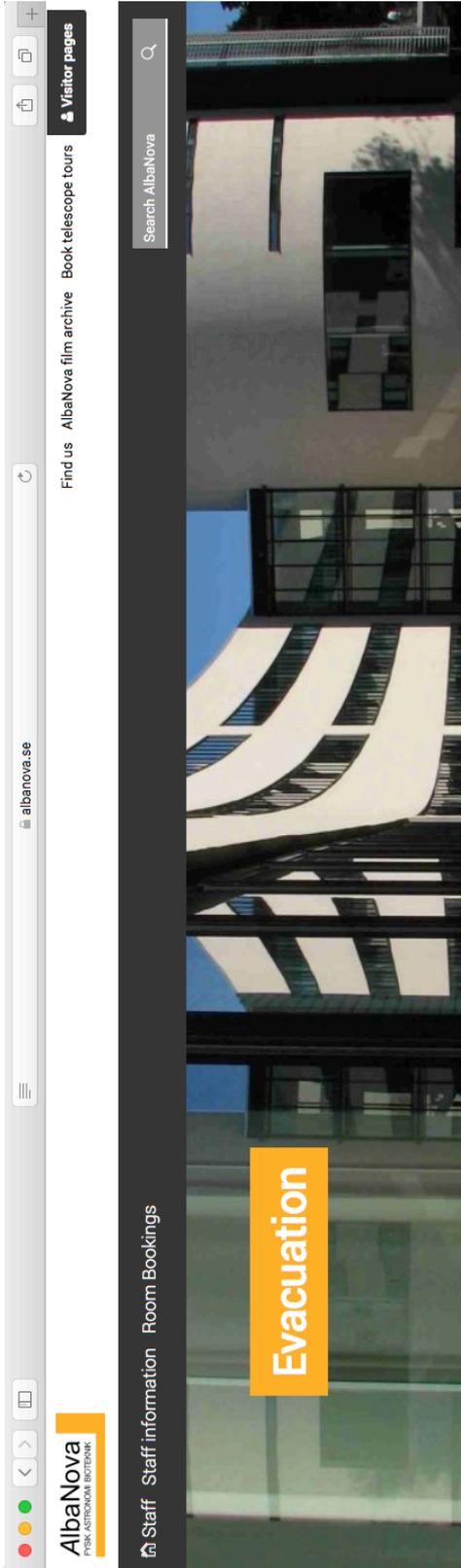
If safe, use the fire fighting equipment.

4 Evacuate

Follow signs and the evacuation plan. Avoid areas with smoke. Do not use elevators.

5 Reassemble

After evacuation, proceed to the assembly point.



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Evacuation

In case of a fire an alarm will sound throughout the building. If you hear the alarm swiftly make your way out of the building and move to the assembly point by the roundabout outside Roslagstullsbacken 33.

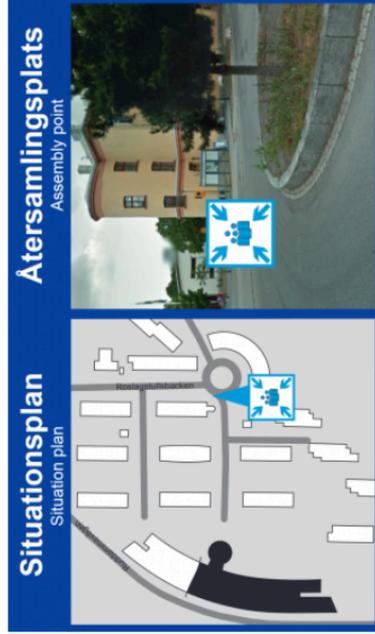
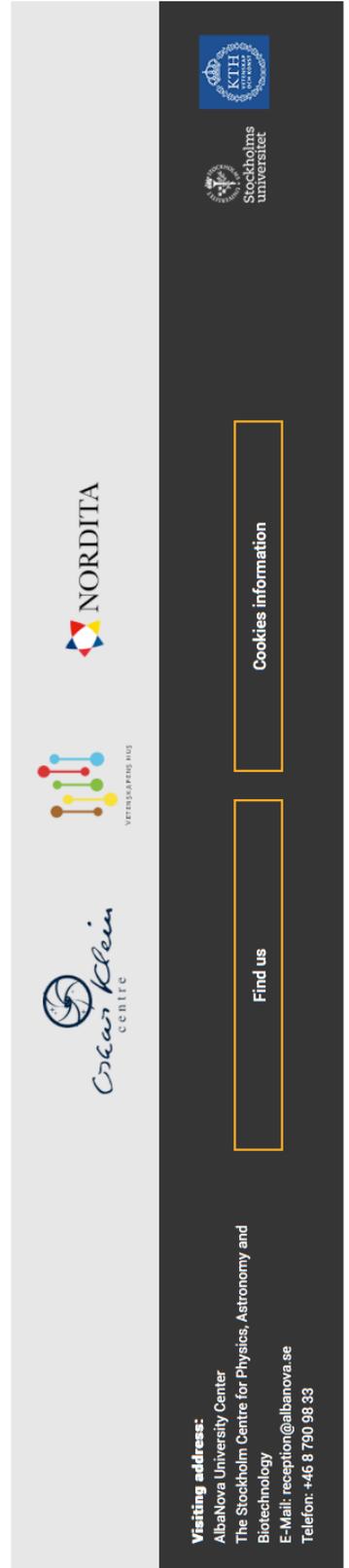
Evacuation plans

For the best evacuation route, see evacuation plans which are available on every floor near the building entrances and in or by the entrances to the office and lab corridors.

Evacuation

Appointed evacuation officers wear bright vests marked "utrymningsledare". The evacuation officer has the task of helping out with evacuation in case he/she is present in the premises.

In the event of a fire, the Rescue Services' primary task is to save human lives. The emergency services need to be informed as soon as possible if there are people left in a burning building, for example, a person with a disability who has difficulty getting out if elevators are not to be used. Then it is of the utmost importance that a routine exists so that this information is immediately provided to the Rescue Services' rescue leader. The evacuation officers who have a person with a disability within their area of responsibility must prepare a routine that ensures that the person can get help with evacuation if the situation arises.







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