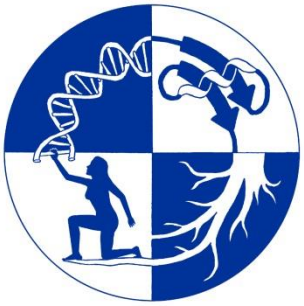
Safety Regulations

for work in the laboratories
at the Department of Molecular Biology and Genetics

Department of Molecular Biology and Genetics
Aarhus University



2023

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1) Introduction

Everybody working in the laboratories at the department must familiarise themselves with the contents of this booklet with safety regulations. They are intended to help staff, students and guests by giving some general or special guidelines for safe work in the laboratory.

It is impossible for this booklet to cover everything, since many different techniques are being used. It is therefore the duty of every group leader (lecturer/professor) and supervisor to provide instructions for the safe use of special techniques. Furthermore, it is the duty of everybody working in the laboratory to seek the information required to work in a safe manner.

The safety instructions are useless unless they are respected by everybody. In this context, it must be stressed as a general principle that

- ***a lab coat must be worn for all laboratory work - this is an absolute demand from the Danish Working Environment Authority ("Arbejdstilsynet").***

- ***everybody finding a room or a piece of equipment that does not meet the safety requirements must take action immediately so that the situation can be remedied.***

In some situations, it may be something simple so that you can do it yourself, e.g. wiping up a spill. In more complicated situations, help should be sought from one of the persons responsible for the room or the apparatus or one of the Work Environment Representatives.

Please note that if you call from a landline phone at Aarhus University, you need to press 0 before the number to get a line out of the house.

All information in this booklet can also be found on the department's website
https://mbg.medarbejdere.au.dk/en/working-environment

This edition of the safety regulations is a thoroughly revised version of that from 2008, 2014 and 2020. The regulations are updated to new practices and rules and regulations at the department.
The revision work has been carried out by the members of the Occupational Health and Safety Committee and the radiation responsible persons.
All comments to the revisions are welcome.

2) First aid

The four main steps of first aid:

1. stop the source of the accident
2. give life-saving first aid
3. call for any help needed
4. give general first aid

Call for help:

Dial 112
When you are connected, state clearly:

- where the accident has happened
- what has happened
- how many persons are injured
- who is calling
- from where the call is being made

Make sure that the Emergency Service is met at the entrance to the building and is informed about all the details.
Inform an Occupational Health and Safety (OHS) representative/supervisor

Burns:

- Immediately wash the burned area with cold water
- Remove loose clothing from the burned area
- Continue washing while someone else fetches a bowl of tepid water (22- 23oC)
- Dip the burned part into the tepid water and keep it there until the pain disappears for at least half an hour
- Cover the affected area with a cold wet compress and take the victim to the hospital's casualty ward.

Frostbite:

Frostbite falls into three categories:

First degree burns:	Produces white numb areas on the skin
Second degree burns:	Produces white and harder tissue in a large area, often blistering while thawing.
Third degree burns:	Produces white and hard tissue that when tapped sounds like tapping a piece of wood, in the worst case scenario. The tissue is dead and becomes spongy while thawing.

In all categories, first aid involves immersion in 38 degrees warm water. Be aware that this can be very painful. When the skin becomes red, a sterile bandage should be applied, carefully avoiding any pressure or cooling. For second and third degree burns, seek a doctor.

Corrosive substances

Internal:

- Do not try to induce vomiting
- Give plenty to drink (milk or water)
- Call an ambulance or take the victim to the hospital's casualty ward. Bring information about the corrosive substance (name, chemical formula, and container).

External:

- rinse immediately with plenty of water
- remove clothing - continue washing for 10 min.
- if pain continues, continue washing for a further 10 min.
- if there is no improvement, take the victim to the hospital's casualty ward, by ambulance if necessary. Bring information about the corrosive substance, (name, chemical formula, and container).

Corrosive substances in the eye:

- rinse immediately with plenty of gently running water
- rinse from the base of the nose outwards
- continue for 5 min.
- always consult a doctor afterwards.
- bring information about the corrosive substance (name, chemical formula, and container).

See also the section on the use of the eye wash bottle.

Poisoning

Call "giftlinjen" (advice about poisoning) 82121212.

When the victim is conscious:

- if the substance involved is neither an organic solvent nor a corrosive then vomiting can be induced by sticking a finger down the victim's throat, possibly after giving a drink of water.
- place the victim in a recovery position.
- call own doctor or the emergency ward at 70113131.
  https://www.sundhed.rm.dk/akuthjalp/emergency-contact/
  If necessary, then take the victim to the casualty ward Aarhus Universitetshospital, Skejby, Palle Juul-Jensens Blvd. 161, Indgang J3, 8200 Aarhus N, by ambulance if necessary. Bring the vomit to the casualty ward.

When the victim is unconscious:

- place the victim in a recovery position.
- call 112 for an ambulance. Provide information about the poison (name, CAS number and/or chemical formula, and container).

First Aid Supplies, gas mask and heart defibrillator

A First Aid box is to be found on each floor of building 1870, in the teaching laboratories in building 1875, Make a note where they are to be found *before* you need. Inform your Occupational Health and Safety representative if something is missing from the box.

Remember: *all accidents, both big and small, must be reported to an Occupational Health and Safety representative.*

Heart defibrillators are found at the main entrance and on 5th floor in building 1870. Gas masks against toxic organic fumes and particles are located on the 2nd and 5th floor of

building 1870. Suction mats to soak up liquid chemicals can be found at the same places.

Use of eye rinsing bottles

These are found in all laboratories.

- First make sure that the solution is clear and the bottle is sealed.
- Unseal by turning the eye cup.

Alone:

- bend yourself over the bottle
- open the eye wide with the thumb and index fingers
- press the cup carefully against the eye while the eye is still open
- rinse with plenty of eye rinse by pressing the bottle repeatedly

With a helper:
Some serious injuries result in a reflex eye closure so that the victim is unable to rinse the eye effectively. Assistance will be necessary.

With a standing or sitting patient:

- the helper opens the injured eye with the thumb and index fingers
- the eye cup is held a hand's width from the eye
- tinse liberally by pressing on the bottle

With patient lying down:

- the eye cup is held a hand's width from the eye
- rinse with plenty of eye rinse by pressing the bottle repeatedly

The solution in the eye bottle must always be sterile (see instruction on the bottle).

Efficient eye washing can also be carried out by attaching a piece of tubing directly to a tap. There must always be a piece of tubing attached to at least one tap in a laboratory.

Please note: Make sure that the eyelid is washed thoroughly, too!!!

3) Alarms and evacuation

Universitetsbyen has several different alarms. It is important to know about these.

Fire alarm and evacuation

Universitetsbyen has an internal alarm system that checked regularly. It is activated when there is fire or gas leakage. The evacuation alarm is divided by zones which means that evacuation is done on the floor of the relevant building where the fire or gas leakage occurred. If the fire is spread to more zones, a complete evacuation is started.
If the system is not working the following can initiated when there is a fire or gas leakage.

1) Activate the internal fire alarm located in the corridors (tilt safety lid and press the button).

2) Call the fire department by dialling 112 and give them the following addresses:

   Fire at Aarhus University
   Universitetsbyen 83, building 1870-1875

   Be ready to give information about **any victims, what is burning, and the telephone number** from which you are ringing**.**

   Extinguishing fires is the job of the Fire Dept., but it is important that certain precautions are taken before the Fire Dept. arrives, in order to minimise the risk to personnel and to limit the burning area.

3) Start an evacuation if relevant:
   Take the evacuation package hanging on all floors in building 1870-1875 and follow the instructions.
   https://medarbejdere.au.dk/en/administration/au-planning/emergency-response/emergencies/evacuation

   Please note. It is extremely dangerous to enter into rooms filled with smoke and burning buildings. Leave this job to the Fire Department's specially trained persons.

4) Call AU's alarm number 87151617

   An emergency shower is found above the door in all laboratory hallways
   A fire blanket is found at the door inside the laboratories
   CO_2-extinguishers are found on all floors and marked on the ceiling.

   Make a note of where these things are located and how to use them, before it is too late!

Ventilation alarm

To ensure good ventilation at work all laboratories are equipped with ventilation. If the ventilation is out of order a acoustic alarm will sound. All work in the laboratories has to stop immediately you leave the laboratory and door to the laboratory is closed. NT-byg is contacted to tell about the problem. It is not necessary to leave the building. Therefore you are allowed to stay at the offices.

When the ventilation is working again, you have to wait for 30 minutes before you can enter the laboratory again so that the pollution is removed.
The ventilation systems of the buildings are independent.

CO_2-alarm

Certain rooms like cell laboratories and cold rooms are equipped with a CO_2-alarm.
It is activated by CO2 emissions and warns by an acoustic alarm. If the alarm sound, the room is evacuated immediately andNat-Tech Byg is contact to solve the problem.
Remember to close the door to the relevant laboratory. Tell your colleagues about the CO_2 emission and wait for further instructions from Nat-Tech Byg.

It is not allowed to store dry ice in the cold rooms as it will activate the CO_2 alarm.

Confinement alarm

The cold rooms in the department are equipped with a confinement alarm that can be activated manually if a person cannot get out of the room. To activate the alarm you pull the chain located at the entrance of the room. Immediately after that, an acoustic alarm will sound in the hallway and a red lamp located outside the cold room will light up. The alarm is only activated in the hallway of the cold room.
The alarm is turned off by pulling the chain for 5 seconds.

Alarms on fumehoods and chemistry cabinets

All fume hoods and chemistry cabinets are equipped with an acoustic alarm and a light emitting diode that will change from green to red when the ventilation level is too low. It is further described in the chapter “Personal safety equipment”.
If there is an alarm on fume hoods or chemistry cabinets, the laboratory is evacuated and the door to the room is closed. Contact Nat-Tech Byg and tell them about the problem. Tell your colleagues about the ventilation failure.

4) Good laboratory practice

Students and employees should consider the following before they start their work to create a safe and healthy working environment:

Long hair – Long hair should away from your face in relationship to open fire and work where there is a risk of contamination and spread of infection.

Footwear – There ae no rules about footwear, but consider if it is an advantage with a closed shoe or one that can be cleaned. In Class 2 laboratories special shoes will be available.

Clothing – Lab coat is required in all laboratories. Consider if your own clothes is a safety risk in relation to laboratory work. If the clothes touch the floor there might be a risk of falling and it can be contaminated. You should consider if loose and fluttering clothes is hindering your safe movement in the laboratory. Your personal clothes must never hinder effective use of the lab coat.

Headgear – You should be able to move your head freely and use safety equipment like mask or safety goggles in a correct way.

Gloves – You are not allowed to wear personal gloves when working in the laboratory and private gloves are not allowed below the safety gloves. If you have eczema, allergy or sensitive skin you can find cotton gloves to wear under the safety gloves in the laboratory.

In case of accidents – In case of accidents it can be necessary to remove contaminated clothes. If that is the case, you can get a disposable suit. They can be found in room 1870-215.

General rules for work and tidiness

- It is compulsory to wear a lab coat in all experimental laboratories.
- Do not begin an experiment until you have collected everything you need (substances and apparatus).
- All smelly and dusty work and cleaning of the used equipment must be carried out in the fume hood.
- Follow all instructions closely. Any deviation should only be made after consulting the supervisor or instructor.
- Keep continuously updated logbooks on all lab work.
- Water pumps must NOT be used for suction filtration. Instead use membrane pumps or vacuum pumps with a trap.
- Instructions for use and function should be found on each fume hood.
- It is forbidden to eat, drink or smoke in the laboratories.
- Keep the laboratory clean and tidy.
- Put small apparatus back in its place when not in use. Keep the floor free of apparatus, boxes, waste, etc.
- Put containers of chemicals and bottles of reagents back in place after use.
- Keep the fume hood clean and tidy.
- Cans and bottles with inflammable liquids (solvents) must not be placed on the bench or on the floor. They must be stored in a special cupboard or cupboards with ventilation.
- Water spills must be wiped up immediately to avoid the risk of slipping.

- Spilled chemicals must be cleared up immediately and disposed of according to the instructions given.
- Glassware must be cleaned as quickly as possible after use before being sent for dishwashing.
- The laboratories must be left clean and tidy after work.

Preparation for laboratory work

It is important that lab work is carefully prepared, with regard to both safety and the end result. A continuously updated lab logbook is an invaluable and indispensable tool in this respect.

An evaluation of the risk and safety precautions is an important part of the preparation for your work. For example, it can be necessary seek information on the properties of a substance: State, reaction with water, combustibility (kindling temperature, explosion limit), caustic and corrosive properties, odour, toxic properties and especially long-term effects, penetration of rubber and plastic (gloves) its possible hygienic threshold.

For many known chemical reactions and products, much of this information is unavailable. Only typical physical and chemical properties are registered. However, various types of literature have articles describing substances that are hazardous to health and the environment.

When preparing for lab work (whether experimental or routine) each person must consider the risk involved.

- As a result of the physical, chemical and toxic properties of the chemicals, substances and compounds that are to be used or that can be formed. Search the KIROS database for description of the risk of the chemicals https://kiros.chem.au.dk/Web/
- As a result of special characteristics (e.g. heat production) for the reaction or procedure that is being followed.
- As a result of the apparatus construction to be used.
- Search the literature for any missing information.
- Note down any relevant information in the laboratory logbook with regard to risks and precautions.
- Whenever alternative procedures are possible, then the least risky must be used.
- When a huge risk cannot be eliminated, consider dropping the experiment. If this is not possible, the project leader should carry it out or should watch over the procedure.
- The scientific staff member who starts up a project (project leader) must be acquainted with the health and environmental risks involved. Furthermore, the project leader is responsible for informing all persons (staff and students) involved of these risks so that they can take the necessary precautions before the project is started.
- Be prepared to give first aid to yourself and to others in the event of an accident or incident.

Working outside normal working hours

- No one who is alone in the building is allowed to carry out experimental or work that carry a risk factor. When working alone with non-risk procedures, you should ensure

that at least one other person knows where you are.
- When laboratories or other rooms are left for the night, weekend etc., all windows must be closed and lights turned off.
- Any alarm system must be activated. Electrical apparatus that are not in use should be unplugged and all gas and water taps turned off (also permanent cooling devices).
- If it is necessary to have an apparatus running overnight, then cooling connections and all tubing must be fastened securely. Electrical systems must be secured against any unforeseen temperature rise that could cause a fire.
- The responsibility for ensuring that all the safety rules are followed lies with the person who set up the experiment.

Personal

Fume hoods and how to use them

All work with substances and reactions that give rise to hazardous or malodorous gases or vapours must be carried out in a fume hood. As a general rule, the fume hood should be used for all forms of chemical work whenever possible.

The degree of safety provided by the fume hood depends partly on its technical and construction conditions and partly on personal and actual conditions, namely:

- The type and amount of the substance being used.
- How the user handles the substance and how the fume hood is being used.
- The set-up of apparatus or other kinds of hindrances to the flow of air inside the fume hood.
- The temperature inside the fume hood.

The following rules apply when using a fume hood:

- After opening the fume hood check that air is being extracted and that the alarm works. Be wary of a possible failure.
- Always have the least possible opening. It is not always possible to keep the fume hood completely closed when working in it.
- Respect the alarm. When it sounds, make sure to find out what is wrong.
- Keep your face (respiratory zone) over the lower edge of the fume hood window.
- Apparatus should be placed at the back of the fume hood and as far as possible from the side walls. Large apparatus that can interfere with the flow of air should be raised ca. 5 cm.
- Avoid rapid movements when working and when opening the fume hood. Make sure to button your lab coat. Do not have windows open and avoid moving quickly past these as this increases the risk of contamination.
- Keep to the general safety rules for working with inflammable material when working in the fume hood. An open flame must not be used.

- Keep the fume hood clean and tidy. Clear up and wipe the floor of the fume cupboard. It must not be used for storage of for example chemicals.
- In the event of any failure that is likely to be a safety risk, all work must be stopped immediately. Inform the management, the Occupational Health and Safety representative/supervisor or the departmental safety organisation about the incident.
- Equipment with heating must always be placed on a lift table so that heating can be turned off safely.

- Every three months, and own-check must be conducted of each fume hood and entered into the logbook or on form kept by the fume hood. The own-check includes control of the suction of the fume cupbard by putting a piece of paper on the edge of the fume hood, control of alarm with light and sound and clean-up.

Fume hood alarm:

The Danish Working Environment Authority (”Arbejdstilsynet”) demands that fume hoods be fitted alarms that are activated when the airflow is inadequate.

Each fume hood has its own alarm, which sounds and shows a red light when the airflow falls below a certain level.

When a fume hood is closed there is still a slight suction. When the window is opened, the airflow is increased, but when the height of ca. 40 cm is reached, the alarm is activated. Even before this height is reached, air movement around the opening can reduce the effectiveness of the air flow, especially if more than one fume hood in a laboratory is open at the same time, as there is a limit to the total capacity for suction.

Working outside normal working hours

- No one who is alone in the building is allowed to carry out experimental or work that carry a risk factor. When working alone with non-risk procedures, you should ensure that at least one other person knows where you are.
- When laboratories or other rooms are left for the night, weekend etc., all windows must be closed and lights turned off.
- Any alarm system must be activated. Electrical apparatus that are not in use should be unplugged and all gas and water taps turned off (also permanent cooling devices).
- If it is necessary to have an apparatus running overnight, then cooling connections and all tubing must be fastened securely. Electrical systems must be secured against any unforeseen temperature rise that could cause a fire.
- The responsibility for ensuring that all the safety rules are followed lies with the person who sets up the experiment.

5) Personal safety equipment

This section mostly deals with the protection of eyes, skin and respiratory organs.

Safety goggles and face mask

It is mandatory to wear safety goggles or a face mask when working with liquid nitrogen. It is also required to wear safety goggles or a face mask when working with anything that can splash when boiling, or can splinter, when working with strong acids, bases or radioactive materials.

When wearing contact lenses: be extremely careful when working with strong acids, bases or poisonous solutions. If any of these substances come into contact with the eye they may come underneath the contact lens and damage the eye. Therefore, always work in the fume hood and wear safety goggles. In the event of an accident, it is extremely important to remove the contact lens so the eye can be thoroughly washed.

Safety goggles are found in various qualities and sizes. They must have side protection so that there is less likelihood of particles coming into the eye from the side. Some have adjustable side lengths, some are adjustable up or down so that they fit the individual. Usually they are made from strong plastic material (e.g. polycarbonate) - their weakness being that some organic solvents can dissolve the surface so they become opaque.

Gloves

Safety gloves are used when needed to protect the hands from substances that can damage the skin, either directly or by penetrating the skin and cause damage elsewhere.

When should gloves be used?

- Wearing gloves is absolutely necessary whenever there is a danger for skin contact with hazardous substances (e.g. when cleaning up a spill, when the hands are dipped into a substance, when hands are in contact with skin-penetrating vapours, when there is a risk of spillage etc.).
- Wearing gloves is also necessary when skin contact with experimental solutions can be harmful for the experiment itself (transfer of microorganisms, proteases, nucleases or other skin-borne enzymes).
- In other situations one should consider whether it is at all necessary to wear gloves, since they retain moisture so that the skin becomes overheated and its pores open up. Cotton gloves can be used as under gloves to absorb the moisture. Some glove material can give rise to eczema or allergy (especially latex).
- When working with solids, the cheapest disposable gloves can be used as solids do not penetrate. However, this is assuming that the gloves are not wet and that one is not working with solvents at the same time.

Penetration times

- Not all gloves are equally resistant to all substances and materials.
- Penetration times provide data showing how much time can elapse from the first contact until the first traces of the substance getting through the glove.
- Penetration times are provided by the glove producer. Notice that penetration times often refer to pure substances and not blends.
- It is always necessary to know penetration times when working with liquids. When working regularly with a special blend, it is possible to test the penetration time by using a special glove tester. Several authorised advisory bodies offer this service.
- See Aarhus University's purchase agreement for penetration times. Look at Product

range and prices at
https://medarbejdere.au.dk/en/administration/finance/procurement/purchasing-agreements/template-new-agreement-1-1
See Aarhus University's (SvF AU) "Glove database" ("Handskedatabase").
- See also "Quick selection guide to chemical protective clothing", Krister Forsberg, S. Z. Mansdorf, Fourth edition.

Provisions and precautions

- Use only gloves approved by DS/EN 374-3. Approval means that the gloves have been tested for one or more chemical with regard to penetration and that it is possible to obtain test data from the producer.
- Preferably use disposable gloves that can be thrown away if they come into contact with a chemical or when the penetration limit has been reached.
- Use gloves that are not powdered (allergy risk). The powder (cornstarch) does not itself cause allergies, but can be an irritant and carry possible allergy-causing molecules from the glove material.
  N.B. There may be a risk of allergy even from powder-free gloves.

General advice on using gloves

Before putting on gloves:

- hands should be clean and dry.
- avoid wearing rings inside gloves.
- the gloves should be intact
- when working with liquid chemicals make sure you know the penetration time for the gloves you are using. This is calculated from the first contact with the substance.
- if the gloves are to be worn for more than 15 min, inner cotton gloves will help to absorb moisture from the hands.

Gloves must be changed:

- if they break, are torn, etc.
- before the penetration time has been reached, even if the gloves are intact
- if gloves become dirty on the inside (often with short cuffs)
- when inner gloves become wet
- after work and before breaks, etc.

Always wash hands when changing gloves.

Good hand hygiene

- Good hand hygiene is extremely important as dry and cracked hands increase the risk of picking up substances and materials that can cause eczema and allergic reactions.
- Wash hands thoroughly and often.
- Dry hands carefully and rub in a nourishing hand cream.
- If one type of glove gives problems, change to another type or to another size.

See local policies on the website:
https://mbg.medarbejdere.au.dk/en/working-environment/leaflets-rules-databases-etc/policy-for-gloves-and-lab-coats

Breathing

Only under very special circumstances, e.g. in the event of accident, will it be necessary to use respiratory aids (gas or dust masks). Respiratory organs are primarily protected by avoiding situations likely to give rise to hazardous gases, vapours or dust, such as working in a fume hood.

The masks are located on the landing in building 1870 on the 2nd and 5th floor.

Fume hoods and the use of them

Work with chemicals and reactions where dangerous and smelling gasses or vapous are developed should be done in fume hoods. In principle all kinds of chemical work should be done in a fume hood, if possible.

The safety at work in a fume hood depends on the technical circumstances and the building and personal circumstances. Of these the following can be emphasized:

Which chemicals are used and in which amounts

How the user is handling the chemicals and how he/she is behaving in front of the fume hood

The experimental set-up and other obstacles for the free movement of air in the fume hood.

The temperature in the fume hood.

The following rules applies for the use of fume hoods

Check that the fume hood is turned on (green light)

Check after opening the fume hood that flow is ok and that the alarm is working. Be aware of eventual problems.

Work with the smalles fume hood opening. It is not always possible to keep the fume hood closed when you work there.

Respect the fume hood alarm when it sounds. Make sure you fix what is wrong.

Keep your head (the breathing zone) above the border of the fume hood door.

Place the experimental set-up close to the rear wall and as far away from side walls as possible. You might elevate larger experimental set-ups that are a problem for the air movement approximately 5 cm.

Do not make sudden movements during the work and when opening the fume hood door. Do not open the windows and no fast passage near the fume hood. That gives a risk of emission from the fume hood.

Obey elementary safety rules for work with flammable materials in the fume hood. It is not allowed to use open fire in the fume hood.

Keep the fume hood clean and ordered. Remove any unnecessary apparatus/material from

the fume hood. Clean the fume hood. Do not use the fume hood for storage of for example chemicals.

If any problems, causing safety problems, are found, the work is stopped immediately. Nat-Tech Byg, the working environment manager and the Occupational Health and Safety representative is informed.

Equipment with heating should be placed on a elevator table so that the heating can be stopped without safety risk.

Every third month each fume hood is checked by a group member and the result is written in the logbook or on a scheme stored at the fume hood. This check involves check of the flow with anemometer and check of the alarm (light and sound) and cleaning. The flow should be at least 0,5 m/sec.

The alarm system of the fume hood

The Danish working environment authority demands that the fume hood is equipped with an alarm that is activated if the flow is too low.

Every fume hood has its own alarm system, that immediately signals by sound and red light, when the flow is below a certain level.

When the fume hood is closed, a weak flow is maintained. When the fume hood door is opened, the flow increases. At an opening of approximately 40 cm an alarm is activated. Already before the fume hood is opened that much air vortices might reduce the efficiency of the exhaust. Expecially if many fume hoods in the laboratory are opened at the same time as there are limits to the total exhaust capacity.

Point extraction/process ventilation

Several laboratories are equipped with process ventilation that removes the pollution at the site of development. It is required the Danish working environment authority that process ventilation is on places where dust, bad smell or other types of problematic air pollution is developed. Before use the process ventilation is turned on manually and the damper is opened by the handle. For optimal flow the process ventilation is placed maximally 15 cm from the pollution source. If nothing else is known, the process ventilation is active for two hours. After that it turns off automatically.

A few laboratories have places with closed process ventilation. They can be used for weighing chemicals in the weighing rooms. It should not be confused with fume hoods s the power of ventilation islower than in the fume hood, but they can be used for weighing less dangerous substances.
On the weighing tables alarm panel you can see the if the flow is on. If it is closed the display shows “OFF” with red light diodes. If it is on the display changes to “100” with a green diode.
The weighing tables turn off automatically after two hours. It is therefore important always to check if it is on.
Even if the light is on in the weighing table it is NOT meaning that the ventilation is on.If you work with

If you work with chemicals that are hazardous to health or dangerous in other ways you

have to move the experiment to the fume hood.

Chemistry cabinets

Chemistry cabinets are present in several laboratories to store for example poisonous and carcinogenic chemicals and chemicals that are harmful to health in other ways. All cabinets are according to law equipped with a lock.
An alarm panel is present above the cabinet. It shows the flow from 0 to 100%.
With a normal flow the diode is green in the OK field.
When the flow is too low you will get an alarm in the following way:

1. The display is flashing
2. The green diode turns off
3. The red diode is flashing
4. You will get an acoustic alarm

In case of an acoustic alarm you have to leave the laboratory and contact Nat-Tech Byg

6) Gas cylinders, liquid nitrogen, dry ice

Gas cylinders with pressurised gas are frequently used in all types of laboratory work and carry many risk factors. Damage to a gas cylinder can cause it to explode because the gas is under high pressure. A broken valve can result in such a violent rush of gas that the cylinder becomes a projectile. The escaping gas from a damaged cylinder or a badly conducted experiment can cause an explosion and fire, poisoning, corrosion or choking, depending on the type of gas. A list over the most commonly used pressurised gases is found below:

The pressure at 20°C in the cylinders we use:

150 – 200 atm	**10 – 60 atm**
Hydrogen	Carbon Dioxide (56 atm)
Oxygen	
Nitrogen	
Helium	

Working with and storing liquid nitrogen and dry ice presents the risk of frostbite (N_2, -196 °C; CO_2, -78°C) and choking (1 L liquid nitrogen at 20°C and 1 atm will fill ca. ¾ m^3). Carbon Dioxide has also a physiological effect and in concentrations of 10–20% lead to instant death. Liquid nitrogen is often used in cooling traps and can result in condensation of atmospheric oxygen inside the trap as well in the liquid nitrogen tank. This oxygen can cause violent explosion in contact with oxidising substances, e.g. organic compounds.

- Gas cylinders must be transported on a trolley and must be locked with a chain.
- Gas cylinders must not be moved when the reduction valve is in place. The protective cover must be in place when moved.
- Both empty and full gas cylinders must be secured against falling whenever they are used or stored.
- Gas cylinders must not be subjected to knocks or strong, especially exposed heating (sun, radiators, etc.)
- Gas cylinders must not be opened with heavier tools than those recommended.
- Gas cylinders must be protected against backward suction from wash bottles and reaction containers by inserting a safety trap.
- A triangular warning sign with the text “Gas cylinders to be moved in the event of fire”, must be found wherever gas cylinders are used or stored.
- Safety goggles or a face mask must be worn when drawing off or pouring liquid nitrogen.
- Liquid nitrogen and dry ice must not be transported in a manned elevator. Danger of choking! Neither should these substances be transported in a closed car. It is not allowed to pour liquid nitrogen in the sink as it can damage the drainpipe. Excess dry ice should be stored in Styrofoam container in the dry ice freezer.
- First Aid for frostbite and choking: See section on First Aid.

7) Inflammable liquids

Liquid: Substance that is fluid at normal temperatures and pressure.

Kindling temperature: The lowest temperature at which a liquid gives off flammable vapours.

Inflammable liquid: Liquid with a kindling temperature below 100°C.

Class I: Inflammable liquid with a kindling temperature below 21°C.

Class II: Inflammable liquid with a kindling temperature of 21-55°C

Class 3: Inflammable liquid with a kindling temperature above 55-100°C

All three classes are divided up into *sub-Class I* for liquids that are *not* water miscible under all conditions, and a *sub-Class II* for liquids that are water miscible under all conditions.

Class	Storage amounts	Max. storage in	
		glass	approved plastic or metal container
I	1 *L*	2,5 *L*	no limits up to 25 *L*
II	5 *L*	5 *L*	no limits up to 125 *L*
III	50 *L*	10 *L*	no limits up to 1250 *L*

Plastic containers over 125 *ml* ***must always*** be approved by the Danish Emergency Management Agency (”Beredskabsstyrelsen”).

The given amounts refer to the ***total*** **amount of stock, usage and waste.**

Altogether, there should be no more than 50 storage units per laboratory

Containers with inflammable liquids of Class I-1, I-2, II-1 and III-1 ***must not*** be placed in any of the escape routes (corridors, stairways, etc.).

Further information in Danish:
https://www.brs.dk/globalassets/brs---beredskabsstyrelsen/dokumenter/forebyggelse/2020/-vejledning_om_brandfarlige_og_brandbare_vasker_november2020-.pdf

8) Inflammable and explosive chemicals

Do not work close to an open flame or where there is a risk of sparks.

Please note: Explosive substances, e.g. diethyl ether and petroleum ether ***must not*** be stored in a normal refrigerator.

Name	Kindling point (^{o}C)	Group	Source
Acetylaldehyde	-38	I-2	c
Acetone	-19	I-2	a
Acetonitril (= methylcyanide)	2	I-2	c
iso-Amylalcohol (= iso-entylalcohol)	18	I-1	b
Benzene	-11	I-1	a
n-Butanol	29	II-1C	c
2-Butanol (= sec.butanol)	24	II-1	c
tert-Butanol	11	I-2	c
iso-Butanol	27	II-1	c
Butylacetate	22	II-1	a
n-Butylchloride	-7	I-1	b
Carbon disulphide	<-20	I-1	c
Cellosolve (=2-ethoxyethanol - ethyleneglycol mono-ethylether)	40	II-2	c
Cyanbrinte (= Prussic acid)	-18	I-2	a
Cyclohexane	-18	I-1	b
Cyclohexanone	43	II-2	b
Diethylamine	<-20	I-2	c
Diethylether	-45	I-1	a
N,N-Dimethylformamide	58	III-2	b
Dimethylsulfoxide (DMSO)	95	III-2	b
Dioxane	12	I-1	c
Acetic acid, conc.	40	II-2	c
Acetic anhydride	49	II-2	c
Ethanol	13	I-2	*
Ethylacetate	-4	I-1	c
Ethylalcohol	12	I-2	a
Ethylenechlorohydrine	55	III-2	c
Ethylenediamine	34	II-2	c

Continued

Name	Kindling point (°C)	Group	Source
iso-Hexane	<-20	I-1	c
n-Hexane	-22	I-1	c
n-Heptylalcohol (= 1-heptanol)	< 21	I-1	a
Methanol	11	I-2	a
2-Methoxyethanol (= ethylenglycol-monomethylester = methylcellosolve)	37	II-2	c
Methylisobutylketon (= MBIK)	14	I-1	c
Mineral turpentine	< 60	III-1	a
Nitrobenzene	88	III-1	c
iso-Octane	-12	I-1	a
Pentane	<-20	II-1	a
1-Pentanol	38	II-1	a
Propanol (= 1-propanol)	22	II-2	b
iso-Propanol	12	I-2	a
iso-Propylether (= di-iso-propylether)	22	I-1	b
Pyridine	17	I-2	c
Styrene (= vinylbenzene)	32	II-1	a
Tetrahydrofuran	-17	I-2	a
Toluene	6	I-1	a
Trichlorethen (= trichlorethylen = "Tri")	32	II-1	a
Triethylamine	-7	I-2	c
Trimethylamine 30% in water)	<-30	I-2	a
Xylene (*o-, m- and p-*)	25-30	II-1	a

The information given above comes from the following sources:

a: Kemikalier og Sikkerhed, Teknisk Forlag, 1976.
b: Merck Index, 11th edition, 1989
c: Hommel's Handbuch der gefährlichen Güter, 1973/74.

See also the KIROS database (http://www.kiros.dk/W/)

9) Chemicals

Before starting to work with chemicals, you must seek information about their hazardous characteristics, e.g. whether they are inflammable, poisonous, caustic or have long-term effects. For labels and instructions for use and guidelines from work place and distributors, see the KIROS database.

Working with chemicals

Avoid contact with chemicals in all situations where chemicals are handled: Weighing out, pouring, routine lab work, transporting, cleaning up and disposal of waste.

- Avoid any contact of chemicals and solvents with the skin or eyes.
- Wear lab coat, gloves and safety goggles.
- Avoid breathing in chemicals and vapours. Always work in the fume hood.
- Weighing out of chemicals must always be carried out in a fume hood or point suction.
- Wipe up any spills immediately.

Storing chemicals

- Chemicals must be stored in closed, clearly labelled containers: Name, formula, melting point/boiling point.
- Possible hazardous characteristics: Explosive, inflammable, self-igniting, water or air sensitive, caustic, poisonous, allergenic or carcinogenic.
- Solutions in ether and other volatile solvents can only be stored in the refrigerator when explosion-safe. Beakers must not be used. Use only closed flasks and bottles.
- Only small amounts of inflammable chemicals/solvents can be stored in the laboratory.

Transporting chemicals

- Chemicals transported out of the laboratory must be in closed containers. Glass containers must be carried in a carrying basket or on a trolley.
- Specially volatile, fuming, caustic, inflammable and explosive chemicals must not be transported in a manned elevator. This applies for example to volatile solvents, liquid nitrogen, dry ice and fuming acids.

Chemical spillage

- Spilled chemicals must be wiped up immediately. Liquids are absorbed by a kemi-sorb mat (alternatively porous material such as cat litter, sand, vermiculite, etc.), possibly after neutralising and /or diluting with water. Spilled powder can be dusty to wipe up, therefore suitable personal protection must be used.
- For disposal, see under the section Waste Disposal.
- Kemi-sorb mats can be found on the landing in building 1870 on the 2nd and 5th floor.
- Vermiculite can be found in the chemical waste room in building 1870, room K11C.
- Contaminated clothing should be changed as quickly as possible. Shoes, watch straps, etc. that have absorbed liquids should be removed immediately.

Contact your local Occupational Health and Safety representative for guidance.

10) Peroxides and other unstable substances

For substances or containers with possible explosive qualities, age, storage temperature, light and air can be crucial for stability, so it is of utmost importance that these substances are not bought and stored in large quantities.

The Danish Emergency Management Agency (”Beredskabsstyrelsen”) has complete information on peroxides and formic acid.
If in doubt about high peroxide contents then be very careful about carrying and opening the container. A simple method of checking whether there are peroxides in e.g. ether is to mix a couple of mls with a potassium-iodide solution, add a couple of drops of diluted HCl and shake. The brown colour of iodine is a sure sign of peroxide.

The peroxide content can be checked with Peroxide Strips (Merck 1.10081.0001, level 1-100 mg/L H_2O_2). Most peroxide-forming chemicals carry a stabiliser when delivered and chemical companies usually guarantee the shelf-life in unopened containers for three to five years from the production date. For chemicals not containing added stabilisers, there is a shorter shelf life.

Some peroxide-forming substances can reach explosive peroxide levels without a concentration of the solvent, and the general rule for substitution means that there should be a special reason for using diisopropylether.

According to the Danish “ADR” rules for transporting dangerous material, many of the ethers used routinely are classified as class 3 inflammable liquids. These rules (article 2.2.3.2.1) state that Class 3 liquids that easily form peroxides can only be transported by road when the peroxide content is no more than 0.3%, i.e. 3000mg/L. Such a high peroxide content will seldom be found in a laboratory, and unused peroxide-forming substances will normally be disposed of via the waste disposal system.

If in doubt – or it is known – that a substance has a high peroxide content (limit 100ppm), contact an Occupational Health and Safety representative/supervisor for further information, e.g. it could mean destroying the peroxides with an acid solution of ferrous-sulfate.

Containers with unstable chemicals should be labelled with date of purchase, date of opening, stability control, location, etc.

11) List of incompatible substances

Unless the mixing process is under control **do not** mix:

- oxidising agents and reducing agents
- acids and bases
- water-reacting substances and water.

Oxidising agents and reducing agents

*Examples of the most commonly used **oxidising agents** (easily reduced substances)*	
Free halogens (Chlorine, Bromine and Iodine)	Chromic sulphuric acid
Perchloric acid and perchlorates	Fuming & concentrated nitric acid
Periodic acid and periodates	Chromium trioxide
Chlorates	Fuming &concentrated sulphuric acid
Hypochlorites – bromites	Chlor sulphonic acid
Peroxides – organic: Di-benzoylperoxide m-chlorperbenzoic acid	Peroxides – inorganic: Hydrogen Peroxide Sodium- & barium oxide Sodium sulphate
Bleach	Sulphurylchloride
Permanganates	Ozone
Manganese oxide	Nitrates
Di-chromates	Nitrites

These must not be mixed with:

*Examples of the most commonly used **reducing agents** (easily oxidized substances)*	
Hydrogen chloride, chlorides	Hydrazine (-hydrate, sulphite)
Hydrogen iodide, iodides	Metallic salts (ferro-, chromo-, stamno-)
Sulphur dioxide	Metals (lithium, natrium, kalium, zinc
Sulphites	Phenols (hydroquinine, pyrogallol)
Sodium dithionite (sodium dydrisulphite)	Aromatic amines
Organic compounds in general, especially: Methanol Ethanol Formaldehyde Acetaldehyde Formic acid	Metallic hydrides: Sodium- Lithium- Sodiumboron- Lithium aluminium

Please note: Concentrated or fuming nitric acid + ethanol must **not** be used for cleaning glassware because of the danger of explosion.

Acids and bases

The warning is specially meant for concentrated acids and bases

*The most common **concentrated acids** are:*	
Fluoric acid and liquid hydrogenfluoride	Chlorsulphoric acid
Hydrochloric acid conc.	Nitric acid, conc. and fuming
Perchloric acid	Phosphoricacid, conc. Polyphosphoric acid
Hydrogenbromic acid, conc.	Phosphoruspentoxide
Sulphuric acid, conc	Acetic acid, conc.
Sulphuric acid, fuming	Acetic acid anhydride
Sulphur trioxide	Formic acid, conc.

These must not be mixed with:

*The most common **concentrated bases** are:*	
Sodium hydroxide, solid form (caustic soda)	Barium hydroxide, solid form
Sodium hydroxide, 33% aqueous (lye)	Amines (e.g. triethylamine, 40% aniline
Potassium hydroxide, solid	Ammonia (water free)
Calcium oxide	Conc. Aqueous ammonia
Calcium hydroxide	Hydrazine, hydrazinehydrate
	Salts of weak volatile acids such as: fluorides, suphides, sulphites, nitrites, cyanides and carbonates

Water-reacting substances and water

Water-reacting substances react radically with water, often producing a lot of heat and in many cases producing gases. When mixing, pour the substance carefully into the water – **never the other way round.**

Examples of such substances are:

*Produce hydrogen or hydrogen carbons (*e.g. *methane and butane with water) Risk of explosion and fire!*
Alkaline metals (Li, Na, K, Rb, Cs)
Alkaline earth metals (Ca)
Metalhydrides (LiH, NaH, CaH_2, $LiAlH_4$, $NaBH_4$, $NaAl(OR)_2H_2$)
Metalalkyles (CH_3, Li, C_4, H_9, Li, CH_3, MgX)

Produce self-igniting, inflammable or poisonous gases with water or diluted acids Risk of explosion, fire and poisoning
Carbides
Silicides
Phosphides
Sulphides
Tellurides
Selenides
Arsenides
Nitrides
Acid chlorides

Mix or react with water, producing a lot of heat
Concentrated acids (sulphuric acid)
Acid anhydrides (sulphur trioxide, phosphorous pentoxide, acetic acid anhydride)
Acid chlorides (thioyl chloride, sulphuryl chloride, phosphor-oxy-chloride, phosphor trichloride, phosphor-pentachloride, Stannichloride, acetyl chloride, benozyl chloride
Water-free salts (aluminium chloride, ferric chloride, calcium chloride.
Concentrated bases (solid alkaline hydroxides, lime

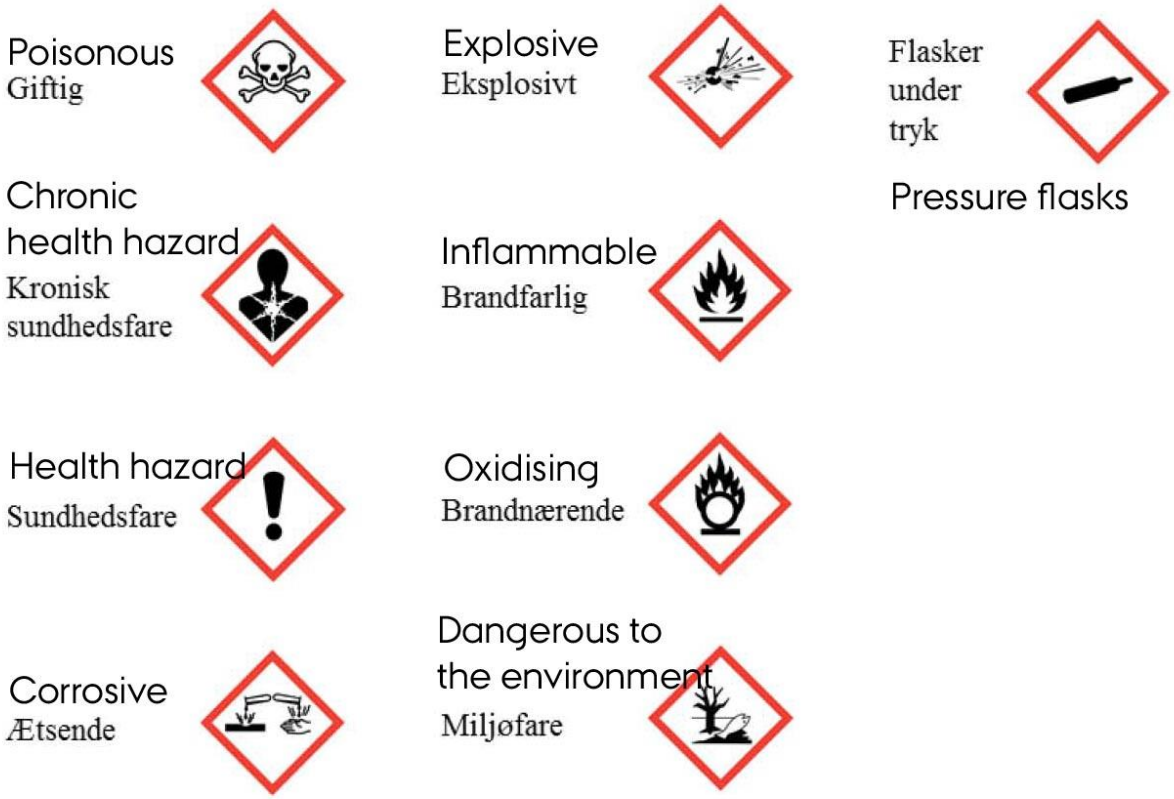
When mixing, pour the chemical carefully into the water.

12) Instructions for working with hazardous substances

Hazardous substances are defined as those substances that are dangerous for health and the environment.

Information on classification and limits can be found in Danish on website of the Danish Environmental Protection Agency ("Miljøstyrelsen") under the Chemicals (http://mst.dk/virksomhed-myndighed/kemikalier/).
Details can be found in Kiros and in the "EU list of harmonised classifications" (se Literature).

Danger is indicated by signal words and hazard pictograms. The signal word is either "Danger" or "Warning" and may use one of the following pictograms:



It is your duty to seek all the necessary information about the chemicals to be used before starting an experiment. These can be found in Kiros and the guidelines from the distributors.

Chemicals marked with a danger symbol, such as media in powder form, can cause allergies and should always be prepared in the fume hood.

Moreover, those following substances marked with an H are covered by the Danish Environmental Protection Agency's rules for storage of dangerous agents and must be placed in a locked place after use: H300, H301, H310, H311, H3, H331, H340, H350, H360 and H370.

The seriousness of an injury caused by a chemical - acid, base, or poisonous - is naturally dependent upon the type of chemical, but also on how its concentration in the tissue and the length of time it has been allowed to remain there. Therefore:

- avoid contact with the skin, i.e., wear *protective gloves and a lab coat.*
- avoid inhalation of vapours, i.e., work in a *fume hood.*

Remember that gloves provide only limited protection. Some substances penetrate some types of gloves very quickly. There are many different types of gloves. See section on personal safety equipment or ask an Occupational Health and Safety representative or a lab technician.

Spills on the working surface or floor must *immediately be wiped up.* Used glassware must be rinsed with plenty of water before being sent for washing.

All scientific staff members who order or in any other way bring chemicals into the lab must check and take the responsibility for the correct safety procedures. This includes labelling, and instruction of all laboratory personnel regarding storage and use.

13) Safety procedures when working with phenol

Injury to the skin: If phenol comes into contact with the skin, wash immediately with plenty of water, after which the skin must be wiped for at least 15 min with gauze or a cloth soaked in a mixture of polyethylene glycol (PEG 400) and ethanol in the ratio 7:3. This should continue until every trace of solidified phenol is removed. Wash again with plenty of water. Clothes spotted with phenol must be removed immediately. The person giving aid must wear gloves.

Wherever phenol is used there must always be found a clearly labelled bottle of polyethylene glycol 400/ethanol in the ratio 7:3.

If this mixture is not to be found, wash with plenty of water for at least 15 min. If the injury is of a serious nature, take the victim to a hospital and give a detailed description of the type of accident and the procedures taken.

Injury to the eyes: If phenol splashes into the eyes, the phenol must be thoroughly washed away with a mixture of polyethylene glycol 400 and water in the ratio 1:1. Thereafter, wash with water for 5-10 min.

Wherever phenol is used there must always be found a clearly labelled bottle of polyethylene glycol 400/water in the ratio 1:1.

If this mixture is not to be found, wash with plenty of water for at least 15 min. Take the victim to a hospital, possibly to the eye department. Washing must be continued during transportation with the aid of an eye bottle, until a doctor has taken over.

Injury to the mouth, throat, etc.: Phenol in the mouth should be washed out with water, and followed by a couple of spoonfuls of edible oil. Do **not** try to induce vomiting.

A clearly labelled bottle of edible oil should always be found wherever phenol is used.

If the victim is unconscious and is not breathing, artificial respiration should be administered. If the victim is unconscious but breathing normally, then treat according to general first aid for shock: Turn the person on one side with head lower than the rest of the body and keep warm with a blanket or coat. Unconscious persons must never be given anything to drink.
After necessary first aid, the victim should be taken to a hospital and the staff be informed about the type of accident and the procedures taken.

See also workplace guidelines for Phenol.

14) Safety procedures when working with acrylamide

Acrylamide is a white crystalline powder that is easily taken up through the skin, the lungs, and the wall of the intestine. Acrylamide is carcinogenic and can affect the nervous system even when only small amounts are ingested.

Acrylamide must therefore be handled with extreme caution, both in crystalline form and when in solution so that there is minimal risk for skin contact or ingestion by nose or mouth.

Therefore:

- all procedures involving acrylamide must be carried out in the fume hood, also when making gels.

We suggest that all groups buy acrylamide-bisacrylamide as ready-made solutions.

Thorough cleaning is essential so that others are not subjected to contact with acrylamide.

All glassware must be carefully rinsed.

Always use DS/EN 374-3 nitrile-disposable gloves (see section on personal safety equipment), also after polymerisation.

See also workplace guidelines for Acrylamide.

15) Safety procedures when working with ethidium bromide

From 1st of January 2009, SYBR Safe, GelRed or similar is to be used instead of Ethidium Bromide – see website for further details. In special cases, if it is not possible to replace ethidium bromide, you need to get the permission from the Head of Department to use this.

Ethidium bromide is a powerful mutagen, possibly also carcinogenic, and must be handled with extreme caution. The following guidelines are suggested in order to minimise the risk involved in working with this substance.

- As a general rule, all work with this substance should be carried out in a fume hood or in another well-ventilated place. When transporting gels and solutions containing ethidium bromide, always use a closed container.
- Wear gloves whenever handling gels. Dispose of the gloves immediately afterwards so that door handles and suchlike are not contaminated with ethidium bromide.
- Solutions for disposal must be kept in a closed container or destroyed according to the procedure below. The methods suggested do not eliminate other methods of destruction.

See also workplace guidelines for ethidium bromide.

Destruction of ethidium bromide in solution:

1) Destaining Bags for example VWR (E732-25)

- Buffer with ethidium bromide should be collected in a suitable container with the "tea bag". Incubate overnight with stirring or on a rocking table.
- The effectivity is controlled by measuring the absorbance at 343 nm.
- The liquid can then be disposed of into the sink.
- The gel is disposed of in a closed bag as solid H2-waste.
- One Destaining Bag can decontaminate 1 l buffer with an ethidium bromide concentration of 0.5 mg/ml.

2) Active carbon filter, Carbon Cap 75 (Frisenette APS, 67047500)

- Buffer solutions with less than $\leq$ 2 mg ethidium bromide/l can be cleansed by passing through the filter after which it can be thrown directly into the sink.
- It is a good idea to filter the buffer solution through a normal paper filter before passing it through the carbon filter, because gel pieces can clog the filter.
- Carbon Cap has a capacity of about 200 mg ethidium bromide. Measure the absorbance at 343 nm regularly to make sure the capacity is not overloaded.
- Gels are disposed of in a closed plastic bag as solid hazardous waste.

Disposal of both Destaining Bags and Carbon Cap 75 is treated as B5-waste, i.e. in closed plastic bags.

In the event of large spills of ethidium bromide solutions, use absorbing material as described on page 20.

16) Safety when working with radioactive isotopes

A Powerpoint presentation for instruction of employees of MBG that are going to work with radioactive isotopes can be downloaded from:
https://mbg.medarbejdere.au.dk/arbejdsmiljoe/sikkerhedskursus
In addition to personal instruction of new isotope users and buyers there will be a common instruction where the Powerpoint presentation will be presented.

Instructions for working with radioactivity

Reference: Act ("Bekendtgørelse") No. 670 of 5th of July 2019 on the Use of Radioactive Substances, Act No. 669 of 5th of July 2019 on ionizing radiation and radiation protection, and use of open radioactive sources, guidelines 2020. The Danish Health Authority's Radiation Protection.

Below some general and practical advice is given concerning the handling of isotopes which are used in our laboratories at present. Whenever a new isotope is introduced, it will be included in the collection.

It is taken for granted that when working with isotopes, the safety rules which apply for working with hazardous chemicals also apply here, i.e., **wear lab coat, gloves, safety goggles** (when required), etc.

According to Act No. 669, individual employees are categorized as radiation exposed employees in category A, B or C based on a safety assessment by describing the amounts of isotope used in the different working steps to assess how many mSv /year the. individual employee is exposed to. This determines how to monitor the dosis:

Section 38. A radiation exposed employee must be categorized according to the rules in section 39, section 40 or section 41 before the employee starts using radiation sources or becomes exposed to radiation. The categorization needs to be continually reassessed.

Section 39. A radiation-exposed employee who, under normal conditions or in the event of accidents, may receive an effective dose of more than 6 mSv/year or an equivalent dose to the eye lens of more than 15 mSv/year or an equivalent dose to skin or extremities of more than 150 mSv/year must be categorized as a Category A radiation- exposed employee. *Subsection. 2*. Only persons over the age of 18 may be classified as Category A-exposed employees.

Section 40. A radiation-exposed employee who, under normal conditions or in the event of accidents, may receive an effective dose of more than 1 mSv/year, but not more than 6 mSv/year, or an equivalent dose to skin or extremities of more than 50 mSv/year, but not exceeding 150 mSv/year, shall be categorized as a Category B radiation exposed employee.

Section 41. A radiation-exposed employee who, under normal conditions or in the event of accidents, may receive an effective dose of not more than 1 mSv/year or an equivalent dose to skin or extremities not exceeding 50 mSv/year, shall be categorized as a radiation exposed employee in category C.

Based on the safety assessment of the planned work on isotopes, the exposed employee at MBG will usually be placed in category B or C. Thereafter, a decision is made on how to monitor the dose:

Monitoring of dosis with a personal dosimeter

Section 78. Exposed employees in category A and exposed employees in category B shall be subject to individual dose monitoring in accordance with subsection (1). 2-7.
Subsection 2. If, under normal conditions or in the event of an accident, an employee will be able to receive an effective dose greater than 6 mSv/year from external radiation (category A), the effective dose shall be determined using a personal dosimeter with a measurement period not exceeding **1 month**.
Subsection 3. If, under normal conditions or in the event of an accident, an employee will be able to receive an effective dose larger than 1 mSv/year, but less than or equal to 6 mSv/year (category B), from external radiation, the effective dose shall be determined using a personal dosimeter with a measuring period not exceeding **3 months**.
Act No. 669 of 5 July 2019 is the basis for the rules. In relation to previous regulations, the limit for the maximum permissible annual personal dose has been lowered to 20 mSv, and special rules apply for pregnant women's work with radioactive substances - see page 36

Activity units	1 mCi = 37 MBq 1 μCi = 2,2 x 10^6 dpm (decay per min.) 1 MBq = 27 μCi, 1 Bq = 1 dps (decay per second)

The following isotopes are being used at the department

Isotope	Maximum energy	Halflife
β-radiation		
^{3}H	0,018 MeV	12,3 year
^{14}C	0,159 MeV	5760 year
^{32}P	1,71 MeV	14,3 days
^{86}Rb	1,8 MeV	18,6 days

γ-radiation		
^{125}I	0,035 MeV	60,1 days
^{57}Co	0,137 MeV	271,8 days

Radiation protection

For β-particles, a maximum range, which depends on the energy of the particle, is calculated. The particle is slowed down, and the heavier the braking substance, the faster

the particles are slowed down. Also, be aware that absorption of particle radiation in a heavy absorber gives rise to stronger brake radiation than absorption in a light absorber. Plexiglass therefore offers better protection against ^{32}P than ordinary glass.

Range and necessary shielding for selected isotopes:

Isotope	water	air	Shielding thickness
^{3}H	0,006 mm	6 mm	Not necessary
^{14}C	0,28 mm	24 cm	1 cm plexiglass
^{32}P	0,8 cm	720 cm	1 cm plexiglass
^{35}S	0,28 mm	24 cm	1 cm plexiglass
^{57}Co			3mm lead or lead glass
^{125}I			3mm lead or lead glass

The γ radiation from ^{125}I will be halved after penetrating e.g. 0.2 mm lead, 5 mm aluminum or 3 mm H^2O.
Lead is a toxic substance, so it must be sealed inside plastic or painted.

Classified areas: Monitored and controlled areas

Sign boards for classified areas. Monitored area (left sign board) typically corresponds to type C isotope laboratories, whereas controlled area (right sign board) is typically type B isotope laboratory, where the largest amount of radioactive material can be used.

Type B and C isotope laboratories:

All approved premises must have a freely available protocol for recording the measurement results, as the measurement must be carried out by the employee working with isotopes after each handling, and entered into the protocol and in addition by the person responsible for the room at least monthly if isotope work is currently been carried out. The protocol with documentation must be stored for at least 5 years. In addition, each isotope laboratory must have calibrated beta (Geiger-Müller counts) and/or gamma

monitors if relevant to the isotopes being worked on.

Type B isotope laboratory:
Classified laboratory: 1874-148

For the isotope laboratory, class B, room 1874-148, the following maximum limits apply: (Source: Act no. 670, Appendix 3 and The Danish Health Authority's Radiation Protection: "Use of open radioactive sources 2020"). The term "in use at a time" means the maximum activity that may be used in the laboratory at a time. If several experiments are carried out simultaneously in one and the same laboratory, it must be assessed whether the amount per trials must be reduced in view of the increased risk of personal contamination during work and accidents.

Isotope laboratory Class B	^{125}I	^{32}P	^{14}C	^{3}H
MBq / mCi in use at a time at				
Low risk operation	100.000 / 2.700	10.000 / 270	1.000.000 / 27.000	10.000.000 / 270.000
Moderate risk operation	10.000 / 270	1.000 / 27	100.000 / 2.700	1.000.000 / 27.000
Significant risk operation	1.000 / 27	100 / 2,7	10.000 / 270	100.000 / 2.700

This means that the maximum limits for work with ^{32}P in a type B isotope laboratory is:
Low risk = 10^{10} Bq = 10 GBq
Moderate risk = 1 GBq
Significant risk = 100 MBq

Examples of **low risk operation**: Pipetting from stock solution that is not associated with the risk of inhalation of radioactive material or significant external radiation exposure, dilution, administration to the patient.
Examples of **moderate risk operation**: Chemical analysis, synthesis, labeling, animal administration.
Examples of **significant risk operation**: Handling of radioactive material in gas, aerosol or powder form.

Type C isotope laboratories
Classified laboratories:
1872-467, 1873-216, 1873-217, 1873-220, 1873-228, 1873-322, 1873-323, 1873-334, 1873-519, 1873-614, 1874-212, 1874-326/328, 1874-356, 1874-539, 1874-626, 1874-632, 1874-652.

For laboratories without fume hoods, the handling of dry or volatile radioactive material must be carried out in a fume hood or in a LAF bench with exhaust.

Waste room: 1875-K49

For the isotope laboratories, class C, the following maximum limits apply: (Source: Act no.

670, Appendix 3 and The Danish Health Authority's Radiation Protection: "Use of open radioactive sources 2020"). The term "in use at a time" means the maximum activity that may be used in the laboratory at a time. If several experiments are carried out simultaneously in one and the same laboratory, it must be assessed whether the amount per trials must be reduced in view of the increased risk of personal contamination during work and accidents.

Isotope laboratory Class C	$^{125}I+^{57}Co$	^{32}P	^{14}C	^{35}S	^{3}H
MBq / **mCi** in use at a time at					
Low risk operation	100 / 2,7	10 / 0,27	1000 / 27	10000/270	100000 / 2700
Moderate risk operation	10 / 0,27	1 / 0,027	100 / 2,7	1000/27	10000 / 270
Significant risk operation	1 / 0,027	0,1 / 0,0027	10 / 0,27	100/2,7	1000 / 27

This means that the maximum limits for work with ^{32}P in a type C isotope laboratory is:
Low risk = 10^7 Bq = 10 MBq
Moderate risk = 1 MBq
Significant risk = 0.1 MBq

Examples of **low risk operation**: Pipetting from stock solution not associated with risk of inhalation of radioactive material or significant external radiation exposure, dilution.
Examples of **moderate risk operation**: Chemical analysis, synthesis, labeling, animal administration.
Examples of **significant risk operation**: Handling of radioactive material in gas, aerosol or powder form.

Stocks in isotope laboratories must be justified and agreed with the Danish Health Authority's Radiation Protection for each isotope laboratory.

Storage facilities and facilities that are not simultaneously classified areas

All places where open radioactive sources are stored, where the total activity is larger than the exception value (value below which you do not need to report to the Danish authorities), and at all entrances to plants or areas where they are stored or handled, etc. open radioactive sources where total activity is larger than 100 times the exception value, there must be a warning sign for ionizing radiation to the applicable standard supplemented with the text "Radioactive material". The figure shows the sign board to be used at storage places and plants that are not simultaneously classified areas.

Isotope	Exception values: Activity concentration	Exception values: Activity
^{125}I	10^5 Bq/g	10^6 Bq
^{57}Co	10^2 Bq/g	10^6 Bq
^{35}S	10^5 Bq/g	10^8 Bq
^{32}P	10^3 Bq/g	10^5 Bq
^{14}C	10^4 Bq/g	10^7 Bq
^{3}H	10^6 Bq/g	10^9 Bq

If an open radioactive source is stored in a locked cabinet, refrigerator or the like, the sign board is placed on the cabinet door. Otherwise, place the sign board on the front door of the repository.

Stocks of radioactive material must be stored in a refrigerator or freezer with radioactivity label in one of the isotope laboratories, and must be included in the isotope storage database.

When planning the purchase of radioactive material, it is the purchaser's responsibility to ensure that the total permitted inventory for each isotope permit is respected. The database on the department's intranet can help with current information on this. Furthermore, it is incumbent on the buyer to introduce new purchases into this database immediately after receipt, and it is incumbent on each user of stored isotope material to register their amount used as soon as possible.

Lists of instructed staff can be found on the department's website: https://mbg.medarbejdere.au.dk/en/working-environment/authorisations-and-instructions/persons-instructed-in-how-to-work-with-radioactive-substances

17) General guidelines for working with isotopes

Of course, general care must be taken. Thus, always use plastic trays, gloves, lab coat and goggles when working. Have decontamination equipment and suitable monitor such as Geiger-Müller counter for ^{32}P work and gamma monitor for ^{125}I work in place. Measure for control the laboratory, gloves and lab coat after work and enter the result in the log (logbook). Measure also hands and lab coat after work to prevent spread. Wash hands thoroughly after work.

Labeling of containers for isotopes

The individual storage containers must be clearly and durably marked with:

- Symbol for ionizing radiation following standard supplemented with the text "Radioactivity".
- Radionuclide, amount of activity and, where relevant, activity concentration on a given date
- Physical state and chemical form
- Relevant contact person

Contamination check

Each time the work is completed, the isotope laboratory must be examined for radioactive contamination and the result entered in the protocol (logbook) in the relevant isotope laboratory:

Geiger-Müller counts when working with ^{32}P
Gamma monitor when working with ^{125}I and ^{57}Co
Swab test when working with ^{3}H, ^{35}S and ^{14}C.

Waste and cleaning after work with ^{3}H, ^{14}C

Radioactive material must not be diluted to obtain:

- exemption from the Radiation Protection Act's radiation protection requirements.
- Liquid waste with activity concentration below the exception and release values can be poured into the sink.
- ^{3}H and ^{35}S has an exception value according to Act no. 670/2019, appendix 4 of 100 Bq/g. Therefore, a company can, for example, dispose of an unlimited number of waste units of 1 l by pouring it into the sink as long as they do not contain more than 100 kBq ^{3}H.
- ^{14}C has an exception value according to Act no. 670 of 1 Bq/g. Therefore, a company can, for example, dispose of an unlimited number of waste units of 1 l by pouring it into the sink as long as they do not contain more than 1 kBq ^{14}C.
- Always rinse thoroughly with water and let the water run in the sink for 5 min. after the discharge.
- All **solid waste** is collected in the laboratory in the intended containers of 2 cm plexiglass with a plastic bag and is transported to the radioactive waste room 1875-K49 after the work has been completed. The bag is placed in a specific drum, which is labeled with the name of the isotope. Information about the waste such as date, isotope, MBq, weight and contact person.
- ^{3}H and ^{35}S have an exception value according to Act no. 670 of 100 Bq/g. Therefore, a company can, for example, dispose of an unlimited number of waste units of 1 kg as ordinary H solid waste as long as they do not contain more than 100 kBq ^{3}H.
- ^{14}C has an exception value according to Act no. 670 of 1 Bq/g. Therefore, a company can, for example, dispose of an unlimited number of waste units of 1 kg as ordinary H solid waste as long as they do not contain more than 1 kBq ^{14}C.
- Glassware and the like that have been used for preparation are soaked overnight in soapy water (e.g. Decon 90) and rinsed thoroughly before being sent for washing.
- ^{3}H, ^{35}S and ^{14}C emit weak beta radiation, so it is not possible to detect contamination with ^{3}H and ^{14}C with a contamination monitor or dose rate meter. Instead, contamination is detected by measuring on wipe samples (swab test). A wipe test is

performed by wiping an area with a glass filter paper moistened with solvent, for example water. It is advisable to choose the same area size when wiping areas, for example 10 cm x 10 cm. The glass filter paper is then transferred to a counting glass which is added to scintillation liquid and measured in a liquid scintillation counter. A background count must always be made for reference. If pollution is detected, it is washed off at the site and new swab tests must be carried out to ensure that the pollution is gone.

- Each isotope laboratory must have a protocol (logbook) listing the results of all control measurements. The record must be kept for at least 5 years. Accidents are also noted in this protocol.

Scintillation counting

OptiPhase 'HiSafe' 3 or Ultima Gold from PerkinElmer is used as scintillation fluid.
It is then disposed of in accordance with current waste management at the department.
Scintillation fluid is added in a fumehood.

The use of scintillation fluids containing toluene and xylene is no longer permitted.

When counting ^{32}P, the Cerenkov method should be used as far as possible, i.e. counting ^{32}P without scintillation fluid in the ^{3}H window.

Guidelines for working with the isotope ^{32}P

- Always store the ^{32}P ampoule in a lead container.
- All work with isotope quantities larger than 10 MBq must be done in the class B isotope laboratory in 1874-148 . In class C isotope laboratories less than 10 MBq ^{32}P must be handled in low risk operations and less than 1 MBq in operations of moderate risk. Extraction from stock solutions is made in a fume hood. The isotope must be handled behind plexiglass screens or behind equivalent shielding.
- Always work in plastic trays and use nitrile gloves, a lab coat and goggles while working. Use a plexiglass screen.
- When working with ^{32}P, glass should be avoided as this will create brake radiation.
- Always have a monitor (Geiger-Müller counter) standing at the workplace.
- Regularly check yourself and the workplace with the monitor. It is important to check hands and lab coat every time you leave the space.
- The laboratory must be checked with a monitor after work is completed and also once a month, where the results are entered in a special protocol (log book) stored in the laboratory.
- Use plexiglass or lead containers for transport between laboratories.

Waste and cleaning after working with ^{32}P

Liquid ^{32}P can be discharged when the activity concentration is below 1 kBq/g = 1MBq / l aqueous solution.
The liquid waste stored in bottles is marked with group name and date. Use plastic bottles instead of glass bottles as glass bottles lead to break radioation. After six months, the ^{32}P isotope has decayed and the groups must take care of the cleaning up themselves.

- Liquid waste containing organic solvents (e.g. phenol) in addition to ^{32}P should either be collected in a fume hood (e.g. in a special plastic bottle together with other phenolic waste) until the isotope has decayed. It is then disposed of in accordance with current waste management at the department. In "Biokæden" (campus), liquid waste can be decayed behind shield in room 503, building 1130.

- *All solid waste* contaminated with ^{32}P *must* be collected. Use the plexiglass containers located in the isotope laboratory. The container is transported to the radioactive waste room 1875-K49. The bag is placed in a specific drum, which is labeled with the isotope name. Information about the waste such as date, isotope, MBq, weight and contact person is written on the waste list. When the ^{32}P activity concentration is below 1 MBq/kg, the drum can be disposed of as ordinary H-solid waste. In practice, you should leave the solid ^{32}P waste in the drum for six months after which it has decayed and can be thrown out as ordinary H-waste.

- Wash contaminated *objects* with Decon (use only the sink in the isotope laboratory). If, after washing, it is not possible to detect contamination, the items are sent for washing. If things are still contaminated, they are immersed in decontamination baths overnight. If this is still not sufficient, the objects are stored for 10 half-lives.

- *Cleaning the workplace*. Check the workplace with the Geiger-Müller counter and clean if necessary if there are contaminated sites. Insert the result of the measurements into the protocol. Remember that the isotope laboratory does not necessarily have to be contaminated !!

Guidelines for working with isotope ^{125}I and ^{57}Co

Before starting to work with this isotope you must contact one of the persons responsible for work with radioactive isotopes: Hans Henrik Gad or Niels Sandal.

- All work with isotope ^{125}I in its free form must take place in the fume hood of the type B isotope room 1874-148 behind lead glass. After iodination a urine sample is sent to Sundhedsstyrelsen, Strålehygiejne.
- One must be especially careful about personal contamination with ^{125}I. Free iodine is particularly dangerous.
- Work involving use of iodinated molecules (proteins, etc.) must take place in a type B 1874-148 or in one of the type C laboratories.
- ^{125}I-ampoules must be stored in a lead container.
- Always have a gamma monitor standing beside you and check frequently during and after the work for contamination.

Waste and cleaning after work with ^{125}I

- *Liquid ^{125}I waste* is collected in bottles in a lead container labeled "liquid ^{125}I waste" in the fume hood in the isotope laboratory (room 3131-0.10 in the Science Park). The bottle should contain 1 M NaOH. Radioactive waste must be stored for a maximum of one year. For example, a company must maximum disposal 1 MBq ^{125}I per month per

permit where the number of waste units is determined by the activity concentration not to exceed 1 MBq/kg.

- *Solid waste* containing ^{125}I from iodination is placed in special lead-lined, airtight metal tubes marked "solid ^{125}I waste" in the fume hood in the isotope waste room 1875-K49. Name, group, date, amount in MBq and activity concentration in MBq/g are written on the sticker that is placed on the tube.

- The solid ^{125}I waste can be stored for **up to one year** in the isotope waste room 1875-K49 in a blue waste drum with an inner plastic bag. A company must maximum dispose 1 MBq ^{125}I per month per permit where the number of waste units is determined by the activity concentration not to exceed 1 MBq/kg. In this case, the company can dispose of e.g. 10 waste units of 1 kg each with an activity concentration of 0.1 MBq/kg via normal renovation. Similarly, the company can dispose of 100 waste units of every 1 kg each month per permit if the activity concentration is 0.01 MBq/kg.

- If it is not possible to dispose the waste from the above (when stored for decay for a maximum of 1 year), then the radioactive waste must be transferred to another company that can process and discharge the waste or store it for disposal. This can be done, for example, by a transfer to Dansk Dekommissionering.

Waste and cleaning after work with ^{57}Co

Liquid ^{57}Co waste is placed in lead containers marked “liquid ^{57}Co waste” plus date and contact person in isotope waste room 1875-K49. Solid ^{57}Co waste is placed in a marked ^{57}Co waste container with an inner plastic bag in isotope waste room 1875-K49. Liquid and solid ^{57}Co waste can be stored up to one year in the isotope waste room.

Rules for working with radioactivity during pregnancy and breastfeeding

According to Act no. 669: Section 45 (6), the exposed person must be instructed on the necessity of early notification of pregnancy and breastfeeding in order to take the necessary measures to ensure that the dose to the unborn or to the nursing child becomes so low as reasonably possible.

Act no. 669: Section 79. A pregnant radiation-exposed employee must be individually dose-monitored if it cannot be ruled out that the effective dose to the fetus after notification to the employer of the pregnancy could exceed 1 mSv.

Subsection 2. In case of external irradiation, dose monitoring should, if possible, be carried out using a personal dosimeter and, if necessary, with a measurement period of 1 month.

Subsection 3. If there is a risk of internal radiation, individual dose monitoring must be carried out in accordance with a dose monitoring program approved by the The Danish Health Authority.

Act no 669, Section 24: Equivalent dose to a fetus from maternal exposure to occupational radiation must be kept as low as reasonably possible and must not exceed 1 mSv after notification to the employer of pregnancy.
Pregnant women must **not** iodize with ^{125}I.

If the pregnant woman works in a laboratory where others work with open radioactive sources, the dose and risks thereof must be included in the overall assessment of the load. The Occupational Medical Clinic ("Arbejdsmedicinsk Klinik") may be included in the risk assessment.

If a woman is breastfeeding during a period when she is working with radioactive substances, this must be taken into account, as in case of accident, radioactivity can be transferred to the child through the breast milk. However, the risk is very small.

Reference is also made to the "Congratulations" - information booklet for pregnant women at the Department of Molecular Biology and Genetics.
https://mbg.medarbejdere.au.dk/fileadmin/site_files/mb/internt/arbejdsmiljoe/pjecer__regler/Graviditetspjece_2022-UK.pdf

Accidents with radioactive material

Waste or loss of radioactive material

It is the responsibility of the person who caused the spill to provide immediate and careful cleaning. In the event of major spills and areas, contact the occupational health and safety representative immediately and the isotope-responsible group leader. For small amounts of liquid radioactive waste, wipe up to the center so that the spread is minimized with absorbent paper (paper towel). Wear gloves and forceps if necessary. Wipe away any powder or other dry material with wet absorbent paper. Then wash with a carrier solution, i.e. a non-radioactive solution of the labeled substance which is spilled. For ^{32}P waste a potassium phosphate solution is used, for ^{125}I waste a sodium iodide solution.

All paper and other items used for cleaning are treated as solid radioactive waste.

After cleaning, the area of radioactive contamination is measured. ^{125}I and ^{57}Co is measured with a gamma counter and ^{32}P and ^{14}C are measured directly with a Geiger-Müller counter. Furthermore, due to the low sensitivity of the monitor to ^{14}C β-radiation, it is measured by drying with moist filter paper and counting in scintillation counter as the paper is dried and 5 ml of scintillation liquid is added. The same method is used for ^{3}H and ^{35}S.

Radioactive pollution of persons

Persons who work with or regularly come close to ^{125}I and ^{32}P must wear a Thermoluminescence dosimeter (TLD/TL dosimeter). Every month, the dosimetry results (as well as an annual statement) is sent to the department from The Danish Health Authority's Radiation Protection. The dose limit is 20 mSv / year. However, the dose limit

for fetuses is set at 1 mSv/year (see section Rules for working with radioactivity during pregnancy and breastfeeding on page 35). At our department we usually get the results 0 mSv and occasionally 0,1 mSv as dosimetry results.

Gloves should always be worn while working with radioactive isotopes and hands should be thoroughly washed after work. Should skin contamination still occur, it should be rinsed several times with carrier solution and washed several times with soap and water. If, after this, there is still sign of skin contamination, the hospital`s emergency department (tel. 70113131) should be consulted.

In case of damage to the skin with simultaneous radioactive contamination (corrosion or ulceration), rinse with plenty of water and possibly, any wound edges are pulled apart to increase bleeding and flushing. Thereafter, the emergency department should be consulted immediately.

Clothes that are heavily radioactively contaminated are treated as radioactive waste. In case of spills on the body, in addition to rinsing at the sink, it is also possible to flush with emergency shower at the entrance to the laboratory.

Intake of radioactivity

If you accidentally drink radioactive solutions, The Danish Health Authority's Radiation Protection and the person responsible for radiation must immediately be consulted. See below. The radiation officer must immediately notify the The Danish Health Authority's Radiation Protection (tel. 44943773) - a 24-hour watch for accidents that may have resulted in unintended radiation exposure of personnel or other persons, about radioactive sources lost and major pollution of persons, premises, equipment or the environment.

Useful phone numbers

Radiation responsible persons:
Hans Henrik Gad, tel. 41430377
Niels Sandal, tel. 20760042

Radiation Protection: 24-hour security 44943773, should be contacted in the event of major accidents with radioactive isotopes.
When dialing at the 24-hour number, an automatic answering machine will ask you to enter a name, describe what the call is about and give the telephone number where you can be called. The person on duty will then call back within 15 minutes.

The officer in charge will be able to assist with:

- assessing the situation
- taking/directing measurements
- providing medical care
- requesting measurement teams from the state emergency centers
- contacting other relevant institutions/persons

18) Rules for working with gene technology Class 1

The rules are based on the Ministry of Employment, Act no. 910 of 11 September 2008" The Act of Genetic Engineering and Healthy and Safety" ("Bekendtgørelse om genteknologi og arbejdsmiljø", and correction of Acts no. 88 of 22 January 2010 and no. 1707 of 15 December 2010.
https://at.dk/en/regulations/executive-orders/genetic-engineering-910/
Reference is made to the Danish Working Environment Authority's guidelines C.0.4, December 2009 - updated in October 2014: "Classification of laboratories, plants for the production, etc." ("Klassifikation af laboratorier til genteknologisk arbejde") and C.0.5, April 2001 "Risk Assessment of genetic engineering research, etc." "Risikovurdering af genteknologiske forskningsprojekter m.v."

Biologically active material refers to living organisms, cells or viruses that contain genetically engineered DNA or RNA. Isolated DNA, RNA or protein, prepared from genetically engineered material is *not* biologically active.

Work with biologically active material *must* be carried out in areas that have been classified by the the Danish Working Environment Authority ("Arbejdstilsynet") (Class 1).

- Bags, outdoor clothing and other unnecessary items must not be taken into classified laboratories.
- It is forbidden to use private mobile telephones in Class 1 laboratories.
- Access to classified laboratories by unauthorized persons must be kept to a minimum.
- A buttoned-up lab coat must be worn in classified laboratories. This lab coat may be yellow, green, or white with the yellow gene technology symbol on the breast pocket. This also applies for visitors or craftsmen.
- The yellow, green and white (with gene tech symbol) lab coats are collected for laundering in polyvinylacetate bags in a plastic container with a lid marked "Biohazard".
- All standard laboratory hygiene must be adhered to: It is forbidden to eat, drink, or in the laboratory. Remember to wash your hands before leaving the lab.
- Pipetting by mouth is not allowed.
- All glassware, petri dishes, test tubes, etc., containing biologically active material must be labelled with a yellow marker.
- Biologically active material that must be transported outside the classified laboratories or areas must be in containers labelled with a gene technology warning sign. All GMO laboratories should have transport boxes that are correctly labelled. Autoclave buckets are considered closed containers and can therefore be transported to the autoclave on rolling tables. When transporting GMO organisms 70% EtOH and paper must be present for disinfection in case of waste.
- All waste containing biologically active material, i.e., living organisms, cells, or viruses that contain genetically engineered DNA or RNA, must be collected in suitable containers and disinfected. Solid material must be collected in the buckets marked for autoclaving. After disinfecting and autoclaving, solid waste can be disposed of in the usual way. Liquid waste must be disinfected with 1% Diversol or 1% Virkon overnight, after which it can be poured down the sink. Liquid waste can also be disinfected by autoclaving. The liquid waste must be autoclaved before disposal. Liquid GMO waste containing small quantities of chemicals or cytostatic agents must be desinfected with 1% Virkon or 70% EtOH. After that, the waste is treated as hazardous waste (see information on the fume hoods).
- Replacement of filters in the LAF benches and in the ventilation system is carried

out the assistant engineers from the department. Replacement of filters in the ventilation systems it taken care of by the building management technicians. The staff are required to wear respiratory aids, special clothing and gloves. Used filters must be placed in autoclave bags and closed tightly. Laboratory personnel can then autoclave the bags and dispose of them as for inflammable waste.

- Exchange of filters in the LAF benches is done by MBG´s technical staff. The linen bag used in the ventilation system must be taken down every six months by the faculty's workshop technicians. The technicians must wear respiratory protection, working clothes and gloves. The used filters are placed in an autoclave bag that is closed. After autoclaving the filteres are disposed as normal waste.
- Glassware, etc., contaminated with biologically active material must be autoclaved or disinfected with 70% EtOH for at least an hour before they are sent to be washed.
- Virkon and 70% EtOH can be used for cleaning and disinfection of all types of surfaces, although Virkon can be corrosive in contact with some metals, especially aluminium.
- Waste for autoclaving must be collected and transported in closed, labelled stainless steel buckets.
- Injection needles, scalpel blades and other sharp objects that have been in contact with GMO must be put in a special waste container for sharp objects before autoclaving and disposing as clinical hazardous waste.
- When working with biologically active material, procedures should be limited as much as possible. Any procedure likely to result in aerosols must be carried out in the fume hood or at a vertical laminar flow bench.
- A workplace must be cleared, cleaned, and disinfected daily. Spilled material that is biologically active must be immediately wiped up and the area washed with 70% ethanol. In the event of large spills, the safety officer must be notified.
- Disposable gloves used when working with biologically active material in classified laboratories must be autoclaved.
- Wash hands frequently after contamination with biologically active material, as well as when taking a break, and at the end of the day.
- Paper must not be left lying about or hung up freely in the laboratory. Protocols, etc. should be covered with plastic. Cardboard boxes must not be kept in classified areas - use plastic boxes instead.
- Note-taking should be restricted to an especially taped-off area, a pull-out shelf or the window sill.
- Remember that pull-out shelves must be pushed in when not in use.
- Remember that paper, protocols, books etc., must be kept separate from apparatus.
- In the event of an accident, measures to be taken must be discussed with the project leader or the occupational and health safety representative. An occupational health and safety representative/supervisor must be notified as soon as possible.
- All accidents or near-miss incidents must be reported to the responsible occupational and health safety representative/supervisor and the injured person has to fill out an online report about the accident at : http://medarbejdere.au.dk/en/administration/hr/workingenvironment/reportinginjuries/
- Please note! Although students are self-insured, they must still report the accident at the department.
- At the entrance to a classified laboratory there must be a sign on the door reading: "Gene technology laboratory Class 1".
- The project leader responsible for a laboratory has a duty to instruct all staff and

students in carrying out the project in a safe and responsible manner and in in accordance with the current safety regulation for working in classified laboratories. It should always be possible to call on a professionally competent person. A list with phone numbers should be hung at the entrance to the classified laboratories.

Gene technology Class 2 laboratories

The above rules relate only to work in Class 1 laboratories. For Class 2, please see the rules for Safety regulations for Class 2 laboratories at the Department of Molecular Biology and Genetics.

Procedure for upgrading from Class 0 to Class 1

- The Danish Working Environment Authority (”Arbejdstilsynet”) must be notified when a laboratory is upgraded. This contact is made via the department’s OHS organisation. Upgrading of a laboratory can only take place after permission has been given.

- A person is selected to have the overall responsibility in cooperation with the HSO representative and they apply to the Danish Working Environment Authority for a Class I approval. The person’s name is given to the Danish Working Environment and written in the log book for the laboratory.

- At the entrance to each classified room is a notice with the telephone number of the person responsible for that room.

- For cleaning purposes, classified laboratories/areas should contain only the most items. All items standing on the floor must be removable (on wheels).

- All persons working in a classified laboratory /area **must** wear **buttoned-up lab coats**.

- Use of the log book is a requirement from the **Act relating to gene technology**. The date of the upgrading is to be entered into the log book.

- A **warning sign** stating: “**Genteknologisk laboratorieområde - Klasse 1**” (Class I laboratory for Gene Technology) must be found at the entrance to the laboratory.

- Round plastic containers for solid hazardous waste, labelled autoclave buckets, and containers for sharp objects must be found in classified laboratories

- Bottles with 70% ethanol must be found in classified laboratories.

- Lab coats must be hung on hooks just inside the classified laboratories.

- Cleaning personnel must wear lab coats when working in Class I laboratories. The person responsible for a laboratory must inform the OHS Committee (Secretariat) whenever an upgrading occurs. Laboratory personnel must carry out the daily cleaning and disinfection of the working area and the items used.

- Students working with biologically active material must be supervised by

competent persons.

Stainless steel buckets for autoclaving must be placed in upgraded laboratories. These buckets are to be used for the collection and decontamination of items used while working with biologically active material (disposable pipettes, centrifuge tubes, etc.), fluids containing GMO must be autoclaved separately.

Procedure for downgrading from gene technology Class 1 to Class 0

Permanent/shorter periods

- Permanent downgradings must be reported to The Danish Working Environment Authority (”Arbejdstilsynet”) This contact must be made by the OHS Committee. A downgrading can only take place after permission has been given. The date for downgrading must be reported in the log book.

- Short-term downgrading can be done by the local OHS representative. Downgrading must be recorded in the room logbook, and the GMO door plate must be covered.

- All **lab coats** from classified laboratories must be put in the polyvinyl acetate bags which must then be closed and sent to be laundered following the department’s normal procedure.

- Containers with disinfected needles or other sharp objects must be closed tightly and disposed of as clinical risk waste.

- All round plastic containers must be emptied for solid H waste and sent for incineration.

- All **autoclave buckets** must be sent for autoclaving.

- Possible **contaminated instruments** (gyro shaker, tabletop centrifuges, mixers, micro-pipettes, etc.), must be washed with a disinfectant before they are removed from the room.

- All other utensils must be removed from the room.

- All **work surfaces** (lab benches, sinks and their surrounds, fume hoods, etc.), must be disinfected with 70% ethanol and then washed with a neutral soap solution.

- The person responsible for the project must notify the cleaning staff that a laboratory has been downgraded, after which the cleaning personnel will be required to clean it thoroughly according to the regulations for Class I.

- The warning sign must be taken down.

- Further use and cleaning of the downgraded laboratory follow class 0 regulations until a new upgrading has been accepted.

Cleaning instructions for classified laboratories

The cleaning staff **must** wear a buttoned up yellow or special white lab coats with a yellow

gene technology mark on the chest pocket when cleaning classified laboratories bearing a notice “Gene technology laboratory Class 1”. The lab coats are found inside the door to the classified room.

The cleaning staff’s daily cleaning routine consists of mopping the floor and removing ordinary trash. Note that the trash is removed together with the waste bag, and that waste must not be poured from one bag to another. The waste bags must be closed before they are removed from the laboratory.
In addition to the daily cleaning, the floor must be washed 2 times a week. Trolleys and hazardous waste boxes must be moved out when the floor is being washed.

Floor cloth, soapy water and bucket are only to be used in the classified laboratories and the water is to be poured in the sink. The bucket and floor cloth may thus not be used anywhere else. When the floor cloth is to be washed, it must be autoclaved first. This is done by putting the cloth in an autoclave bag, closing it with autoclave tape and labelling it with yellow tape. After autoclaving, the cloth is washed in the usual way.

The project leaders and the technical staff at “Nat-Tech Byg” are responsible for overseeing that the rules are obeyed.
In addition, the staff from Nat-Tech Byg is responsible for taking care of the following tasks:

- dusting and vacuuming elevated ventilation channels and electrical fixtures every six months
- cleaning the cooling systems in the laboratories every six months
- cleaning under refrigerators and freezers twice a year (laboratory personnel must pull them out and put them back)
- cleaning all stationary furniture /equipment below table/bench height.

The dates for the thorough cleaning must be entered into the log book.

The laboratory personnel are responsible for the daily cleaning of laboratory sinks, window sills, tables/benches, fume hoods, sterile benches and other work places, as well as a monthly cleaning of shelves, cupboards, bottles, electric supplies, free-standing apparatus and furniture.

In connection with the up- or downgrading of a laboratory, all the above cleaning procedures must be carried out.

In the event of an accident, a notice must be placed on the door to the laboratory and the person responsible for the laboratory must be informed. The name of the person responsible for the project is to be found at the entrance to the laboratory. The cleaning must be discontinued.

Rules for gene technology Class 2 work at MBG:
Gene technology Class 2 work requires instruction and training. Contact the person responsible for the gene technology Class 2 laboratory before starting work.

Rules for cleaning gene technology Class 2 lab at “Biokæden” (Campus)
Contact the person responsible for the gene technology Class 2 laboratory before starting work.

19) Rules for biological work Class 2

Three laboratories in “Biokæden” are classified as biological Class 2. The safety level for Class 2 is equivalent to a GMO Class 1. Therefore, work must be carried out in the same way and follow the same rules and regulations as for GMO Class 1.
If you are going to work with biological material such as bacteria and viruses in risk class 2 you have to send a risk analysis to the Danish Working Environment Authority and MBG.

When doing biological Class 2 work, the following conditions are respected:

- A biological Class 2 warning sign is placed on the door to laboratories and equipment used for biological Class 2 work.
- The biological material is stored in a closed vessel in and on the equipment.
- The biological material transported to and from the classified areas must always be transported in a sealed container and on a trolley. During transportation, 70% ethanol and paper must always be present to be able to wipe up spills and wash with spirits immediately, should an accident happen.

Persons working with Class 2 biological material should be told what can happen at an accident. How you can get infected and which symptoms you can get.
In case vaccines against the relevant bacteria or viruses are available, the persons working with them should be offered vaccination.

20) Rules for gene technology work involving plants and animals

Rules for gene technology work involving plants

The work with genetically modified plants (GMO-Class Plants) should be done in rooms that are classified for the work. In the application the company should describe the cleaning procedures for rooms such as greenhouse and how release of pollen and seeds to the surroundings is prevented. At the end of an experiment the plants should be autoclaved. If they are in the greenhouse, they can be placed in closed plastic bags in a separate container that will be brought to an incinerator.

Rules for gene technology work involving animals

Handling of animals

Before starting animal research, you must study the rules applicable. Rules, permits and courses are available on the website of the Danish Animal Research Authority under the Ministry of Environment and Food (in Danish only): https://dyreforsoegstilsynet.dk/

You need to get an authorisation to carry out animal research.

Handling of animals. Contact Ernst-Martin Füchtbauer before starting.
Room 1131-512 is divided into two sections. To the left of the door is the animal section, where there is a fume hood, a ventilated animal hood and a laminar flow bench. The other section is an S1 cell culture section which includes the entire right side of the laboratory together with a table on the left side closest to the window.

Work in the two sections must be kept separate. You are not allowed to move S1 GMOs to the animal section. In the S1 section, all the rules for working in S1 laboratories apply, including waste disposal.

In the animal section, the rules described below apply. In the event of an accident, where the animal section becomes contaminated with S1 GMOs, all waste from this section must also be autoclaved.

The animals are transported in transport boxes, either from the commercial breeder or from the central faculty animal room of Aarhus University. When the animals arrive they must be put in cages with a top filter in the fume hood, after which they are moved to the ventilated animal cabinet (Scantainer isolater).

The animals are handled or killed either in the fume hood or in the laminar flow bench alongside the animal cabinet.

Dead animals must be put into a sealed plastic bag and stored in the freezer room in the central faculty animal room in the Skou building of Aarhus University.

Bedding from the animal cages must be transferred to a plastic bag in the fume hood. The plastic bag must be tied tightly.

The contents of cages are placed into autoclave bags in the fume hood. The bag is closed tightly and removed from the room and disposed of as ordinary waste. The cages are cleaned with a wet cloth or paper before it is autoclaved.

Responsible persons Class Animals:

Mice, Ernst-Martin Fürchtbauer (emf@mbg.au.dk)

Flies, Peter Ebert Andersen (pra@mbg.au.dk)

Zebrafish, Kasper-Kjær Sørensen (kks@mbg.au.dk)

Before handling animals, you must have received training in internal procedures.

21) Instructions for work with human biological material

See the department's website for further information:
http://mbg.medarbejdere.au.dk/en/working-environment/authorisations-and-instructions/human-biological-material/

According to Danish law, all research projects in Denmark involving human beings or any kind of human tissue, cells, blood, etc. must have permission from a regional ethics committee to carry out the experiments. In the case of multi-centre trials, the investigator shall only apply for permission from the regional committee where the principal investigator carries out the research project. However, in the case of multi-national trial projects, permission from a Danish committee is always required. Guidelines about notification, etc. of a biomedical research project to the committee system on biomedical research ethics.

If material or information from a biobank (i.e. 'a structured collection of human biological material which is accessible under certain criteria, and where information contained in the biological material can be traced back to individuals') is used in a research project, the additional approval of the Danish Data Protection Agency is required.

Standards for the collection, storage, handling and disposal of human biological material at MBG

The principal investigator is responsible for ensuring confidential, secure and appropriate storage of the tissue, ethical use of the tissue, respect for donor confidentiality and appropriate disposal of the tissue. It is recommended that you do not work with your own biological material due to the risk of transformation and lack of antigenicity.

Collection of samples from living individuals: Only registered physicians, nurses or certified technicians who are trained to take out human biological material for scientific or medical purposes, and who obtain samples while working under protocols and procedures approved by the relevant regional ethics committee, are authorised to extract human biological material. This regulation does not apply for the non-invasive collection of biological fluids such as semen, saliva, milk, etc.

Storage: All human samples must be stored in a secure location, which is clearly labelled on the outside with the universal biohazard symbol. You must place samples in secure, leak-proof containers and store them in a manner that will prevent decomposition or deterioration during storage. Each container must also be labelled with the name of the biological material, the user's name and contact information. Containers used for sample storage must be discarded as biohazardous waste after removal of the sample.

Handling: All human samples should be handled as potentially hazardous in terms of contamination and infection. Adequate personal protective equipment for handling potentially contaminating agents should therefore be chosen according to the risk of exposure. Personal protective equipment includes gloves, protective eyewear, masks, aprons, shoe covers and cap/hair covers, etc.
All work with human samples MUST be carried out in areas that have been classified as GMO Class 1 or biological Class 2.

Disposal: Human samples should be disposed of in closed, non-leaking containers and put in the yellow bags or autoclaved. Blood sampling equipment, scalpels and other equipment that can damage the skin should be disposed of in specified yellow needle boxes.

Transport: To avoid spill, human specimens/samples should be transported in unbreakable closed containers marked as biohazardous material.

Accidents

Biological spills on non-working areas such as the floor should be removed immediately and cleaned normally. You should also remove large spills immediately and disinfect the affected area with an appropriate agent (1% Diversol or 70% ethanol in water, possibly supplemented with UV light for 30 minutes).
If you injure yourself or others with equipment that has been contaminated with either blood or tissue fluids:

- let the wound bleed
- wash carefully with water and soap
- brush the wound with 70% ethanol or 2.5% iodine ethanol

If you become contaminated with biological material in your mouth or a wound, you should carefully rinse the area with saline or normal tap water.

If you get biological material in your eyes, rinse them carefully using the eye rinsing bottles available in all laboratories.

You should contact by phone (70113131) the emergency room at the local hospital (Aarhus University Hospital, Skejby, Palle Juul-Jensens Blvd. 161, 8200 Aarhus N) immediately or within two hours of the accident for a risk assessment of infection with HIV, hepatitis B or hepatitis C. There is normally no treatment 24 hours after the accident.

Contact your local safety officer at MBG to make a claim report of the accident. It is important that you contact the safety officer no matter how minor the accident.

22) Instructions for cleaning staff, workmen and other unauthorised personnel

When you enter a laboratory you should behave as though everything is hazardous.

Therefore:

- **do not move anything**
- **do not touch anything**
- **do not attempt to smell the contents of bottles**

If you accidentally knock something over, leave it as it is but inform one of the laboratory personnel.

The incident may appear to be harmless, but it can be dangerous, or the results of several days' work. A knowledgeable person may be able to salvage the pieces, whereas everything will be lost if you attempt to put things right.

If you break a glass bottle and the contents run out, you must leave the laboratory at once. Do not attempt to wipe it up because the substance may be corrosive or poisonous. If you spill some on yourself, leave the room, and quickly wash with lots of water. Inform someone who can evaluate the situation.

If you come across something which makes you feel uncertain, e.g. a strange smell, sound, or smoke, go out of the room immediately and inform someone who can decide whether it is hazardous or not. Remember that the Occupational Health and Safety representative/supervisors are here to be helpful.

It is better to ask too often than too seldom

Do not work alone. If you must work in a room where nobody can see you, inform someone about what you are doing and tell them when you are finished.

In case of an accident, remember

- **do not touch anything, but leave the room**
- **wash with lots of water if you spill something on yourself**
- **fetch laboratory personnel**

When you enter a laboratory which has a sign **"Genteknologisk laboratorieområde - Klasse 1"** you must wear a **buttoned up yellow lab coat or a white one with the special yellow gene technology symbol on the chest pocket**. Cleaning utensils that you use in these laboratories must not be used in other areas.

Persons you can contact, please check the department's website: http://mbg.medarbejdere.au.dk/en/working-environment/health-and-safety-organisation/.

23) Waste disposal

At the department there are several sorts of waste. Ordinary waste like cardboard etc. is taken care of by the cleaning personel. More specific types of waste is taken care of by the department and selected persons.

Chemical waste

Special rules apply for collection, packing and disposal of chemical waste. Therefore you have to think of how to dispose of the chemical waste before you start your experiment. Both because of the continued process, but also to also avoid reactions between existing fractions,

In all fume hoods a list about chemical waste at MBG is found. The list is not exhaustive. If you are in doubt or have other types of waste please ask your Occupational Health and Safety representative.

All chemical waste is transported to the chemical waste room in building 1870, room K11C. Bags with solid H2 waste is disposed of in 660L containers while laboratory glass is disposed of in a 660L container marked **Fast H2 – Laboratorieglas.**
All other types of packing is done by waste team. It is therefore not allowed to pack other types of chemical waste than solid H2. There are trolleys in the room upon which you can place plastic containers with waste. On the plastic container you write group initials, room number, waste fraction and contents.

New containers for waste can be found in building 1870 room K11D.

Remember that the plastic canister should be marked with ”UN 3H1/X” to be legal.

All information about sorting of chemical waste at MBG can be found on the homepage, including waste fractions, sorting, packing etc.
https://mbg.medarbejdere.au.dk/en/working-environment/waste-management

Yellow hazardous waste boxes

Must only be used for waste from medical treatment of persons, animals or biological experiments that pose a risk of infection.

Injection needles, ampoules and such like must be put into the container for needles and closed tightly. The container can then be put into the hazardous waste box. When these are ready to be collected they must be closed correctly so that they will not open again.

Write clearly on the outside: Aarhus University, Department, Building number and the contact person’s initials.

The yellow hazardous waste boxes can be obtained from your OHS representative.

24) Batteries

Used batteries should be delivered in the containers placed in the copy room at 5th floor in building

1872.

25) Working safely with electricity

These shortened guidelines are based on information from the department's website:
https://mbg.medarbejdere.au.dk/en/working-environment/safety-with-electricity
where there are illustrations of the correct plugs and sockets as well as wrong and dangerous plugs.

Safety when working with electricity must be taken very seriously.
Strict regulations were imposed in 1993 regarding:

- Equipment safety
- User familiarity with safety conditions

Discard any apparatus that fails to meet safety standards.
When in doubt, do not use it and ask MBG's staff from the workshop to have a look at it.

General information on the dangers posed by electrical equipment

- Electric shocks cause muscles to contract violently, resembling a cramp or seizure.
- The most serious electrical accidents lead to cardiac arrest, while a milder shock can cause significant discomfort. Never touch electrophoresis apparatus or the electric cables when the electricity is switched on. (Under proper conditions* this should not be possible).
- Most liquids in the laboratories conduct electricity. Many of them are even very good conductors and correspond to a direct connection with the connected core.
- Electrical apparatus and cables must always be clean and dry, without salt deposits. Never handle electrical equipment with wet hands or gloves (the thin rubber gloves do not protect against high voltage).
- The cold room increases the risk of electrical failure and accident because of condensing water.
- The two most dangerous currents are 230 volt mains electricity and that from high voltage electrophoresis apparatus.

If in doubt whether the apparatus is safely set up, think about this basis rule:
** The apparatus must be protected against accidental touching of live current in any situation!*

230 volts mains electricity

All electrical equipment must be earthed via the mains cable. This provides better protection from electric shock and accidents even when there may be some leakage in the apparatus.

Therefore:
All laboratory apparatus must have a Danish 3-pin mains plug that is earthed, 2 round pins and one flat "earth "pin below!

- Plugs and cables must be in perfect condition. Users must make sure that the mains connections, i.e., mains socket and apparatus socket are not damaged (the plug pins are intact and the cable insulation is not torn, etc.).

Note also that:

- cables must be of robust quality, without holes or burn marks from hot plates, etc.
- cables must be attached firmly to the mains and to the apparatus.

When in doubt about the quality of the mains cable, discard it and get a new one.

Please note: Leakage circuit breakers cannot handle everything. They can only ensure against leakage from 230 volts mains connection to earth, and before that you will anyway get an electric shock.

Contact with both “active” mains cables will give many kilowatts for hours.

Leakage circuit breakers do not protect at all against errors in the high voltage output.

The following applies to MBG in Universitetsbyen
All 230 volts power plugs are EU standard also called Schuko with side earth. This is also the type that is on new equipment. All old cables and extension cords with the Danish 3-pin earth should be changed to Schuko plugs. Apparatus cables and extension cords can be found at the electronics workshop in building 1874, room 160.

The following applies to MBG at iNANO:
All laboratory equipment should have Danish 3-pin plugs with earth pin, 2 round and a flat earth pin below!

Equipment cables with Schuko plugs do not have earth connection in Danish power plugs. They are NOT allowed. Change them in the electronics workshop (1874-160).

High voltage connection to electrophoresis apparatus

- Cables must be of high quality and always have approved “safety plugs”
- Cables and gel apparatus must have insulation against more than 1000 volts (even 1500 volts. In other words:
- Silicon rubber cables that give a continuous heat should be used
- Avoid rubber tubing (they crack) and thin plastic tubing that melts in contact with the edge of a hot plate.
- Never use transformers, adjoining cables or adaptors that can transform the approved safety sockets to those that are less safe. They are dangerous and must be discarded.
- Cables and gel apparatus must be capable of taking the same current as the attached safety plug.

Safety plugs and sockets of the correct type

At the Department of Molecular Biology, we use only two types of safety plugs. Other types are not allowed in the laboratories.
Note that both types have *solid insulation sleeves* so that the plug pins cannot be touched directly.

- Ordinary 4 mm safety plugs that are standard for most equipment. They are internationally approved and are suitable for about 1000 volts when they are dry.
- 2 mm safety plugs with a longer, stronger *covering,* suitable for up to 1500 volts.

Please note that plugs with resilient coverings are unsuitable as they are only for low voltage (to minimise short circuit). Under no circumstance must they be used or found!
The same applies for old-fashioned banana plugs (as well as sockets and extension cables). They must be discarded as they do not meet the regulations and are far too dangerous.

Safe power supplies

- Power supplies must of course have the correct sockets, corresponding to the correct safety plug.
- 4 mm safety sockets have mouldings suitable for the plug’s covering.

- 2 mm safety sockets are deeper, corresponding to the long plug's bigger covering.
- Equipment with old-fashioned sockets for banana plugs must be discarded.
- Power supplies with high voltage current must be insulated with respect to "earth" or have a safety circuit that breaks when earthed (this can be checked by MBG's staff at the workshop).

New equipment and MBG rules

All new equipment must be CE-marked (this has been obligatory since 1997). However, a CE mark is not an approval (as many think), but merely the factory's statement that the equipment is safe to use.
You must therefore be critical and evaluate the equipment before buying!

Note, that Bio-Rad, for example, uses a "longer, modified, banana plug" *without a solid covering*, with accompanying lowered sockets in their power supplies.
Maybe this looks reliable when their equipment is assembled, but it is especially dangerous when used together with other equipment having the correct safety sockets.

The Occupational Health and Safety Committee and the Head of Department therefore stress that:

- banana plugs with exposed electrical parts must be discarded immediately
- plugs with resilient coverings must not be used
- high voltage plugs and sockets must be the standard safely type with solid coverings
- all electric laboratory apparatus must be earthed, i.e., mains plugs must be EU standard also called Schuko with side earth
- you should contact the Department's staff at the workshop before buying new equipment to make sure that it is in agreement with departmental rules.

26) Instructions for the use of large apparatus and centrifuges

Contact persons are chosen by the Head of Department. Names of contact persons are to be found by each apparatus. Ask them for advice about the use of apparatus.

Students, trainee technicians, and all other users who do not have a thorough knowledge about the use of the apparatus, *must* - before attempting to use it - have clear instructions. It is the responsibility of each supervisor or project leader to ensure that each student or new person is well-instructed in the use of the apparatus. Instructions regarding use can be found in the "Instruction Manual" beside the machine or on the Departments homepage. If in doubt, ask one of the contact persons.

In the event of breakdown: Please notify the staff in MBG's workshop or one of the contact persons for the apparatus.

Cleaning: It is not a matter of doing a spring clean, but the obvious and necessary cleaning that must follow every time it has been used. ***Each and every user must make sure that the apparatus is cleaned.***

In the event of spillage of biologically active material, the spill must be wiped up and the area disinfected with 70% ethanol.

Rotors must not be washed with ordinary soap but with "Neutral Extran", MA 02 in a 1-2% solution. A bottle of this should be found by each centrifuge.

Remember that centrifuges must be closed in such a way that the lid cannot be lifted while a rotor is in action. Rotors must never be stopped by hand.

27) The Occupational Health and Safety organisation

You can find an updated overview of the Occupational Health and Safety organisation at the Department of Molecular Biology and Genetics on the department's website:

https://mbg.medarbejdere.au.dk/en/working-environment/health-and-safety-organisation

28) Literature

KIROS database **(**http://www.kiros.dk)

See also the selection of workplace guidelines for specific substances, to be found in the laboratories.

Relevant links can be found on the Department's website:
https://mbg.medarbejdere.au.dk/en/working-environment

The Danish Working Environment Authority's ("Arbejdstilsynet") guidelines and laws can be found on: http://engelsk.arbejdstilsynet.dk/en.

The EU list of harmonised classifications (the former list of hazardous substances):
http://mst.dk/virksomhed-myndighed/kemikalier/stoflister-og-databaser/listen-over-harmoniseret-klassificering/ (Danish version) or
http://eng.mst.dk/topics/biocides/application-in-accordance-with-the-danish-authorisation-scheme/requirements-subsequent-to-the-decision/authorisation-is-granted/classification-and-labelling/

Sundhedsstyrelsen, Strålebeskyttelse: Brug af åbne radioaktive kilder til ikke-medicinske formål. 2020 (in Danish).
https://www.sst.dk/-/media/Udgivelser/2020/Brug-af-aabne-radioaktive-kilder.ashx?sc_lang=da&hash=EB80BEACF4AE5C77941C5AD0FA58C83E

Useful books:

- The Merck Index, 14th edition, 2004.
- Hazards in the Chemical Laboratory.
- "Opbevaring af laboratoriekemikalier" (How to store laboratory chemicals) by Lene Hjerrild, Hanne Troen and Jørgen Stage Johansen, DL-F
- "Laboratoriesikkerhed" (Safety in the laboratory) 6th edition (Nyt Teknisk Forlag)
  ISBN: 978-87-571-2811-6
  ISBN: 978-87-571-3335-6 (e-book)