Specific Safety Regulations for the Division of Nuclear Physics

Introduction

This document contains specific safety regulations for the Division of Nuclear Physics, including rules and advice relating to the working environment. Special emphasis is placed on matters concerning personal safety.

All employees shall have read and understood the information in this document. This is to be certified by signing the form "Declaration". This Declaration is to be repeated every year, at an annual information meeting organized by the Executive Committee.

This document will be updated at least annually and when otherwise necessary (employees will be notified via email). You are invited to make suggestions for the improvement of this document.

The Department of Physics is engaged in systematic efforts in the areas of occupational health and safety, and the working environment (see the Department's intranet, under the tab "HMS" http://intranet.fysik.lu.se/intranet/arkivet/arkiv15/hms.pdf (in Swedish). All employees are required to follow the General Rules for the Department of Physics and the Occupational Health and Safety Act in both teaching and research laboratories.

Mattias Olsson can help you when you need to use the chemistry labs at the Division of Nuclear Physics. Before being given access to the chemistry labs, you must have gone through the Division's Specific Safety Regulations with Mattias (this document) and have signed the corresponding declaration. Note that all use of chemicals and gas requires that a risk assessment be completed (see below).

When working in the aerosol lab at IKDC, separate safety regulations must be followed. The superintendent of the aerosol lab, **Anders Gudmundsson**, is responsible for occupational health and safety. Risk assessments should be reported to him. Before being allowed to work individually in the aerosol lab, the safety course organized by the superintendent must be completed. Work at Vavihill also falls under the regulations that apply to the aerosol lab. See also http://www.cast.lu.se/.

When working in the AstroGeoBiology lab at Medicon Village, separate safety regulations must be followed. **Fredrik Terfelt** is responsible for occupational health and safety. Risk assessments should be reported to him. Before being allowed to work individually in the aerosol lab, the safety course organized by Fredrik Terfelt must be completed.

When working in the LIBAF facility, separate safety regulations must be followed, in particular regarding radiation safety. **Charlotta Nilsson** is responsible for occupational health and safety, including risk assessments for work at the LIBAF facility as well access to the lab (by the LU access card). Before being allowed to work individually at the LIBAF facility, radiation safety instructions must be gone through with **Mikael Elfman**, who is the Division's radiation safety officer.

When working at external research establishments or other departments within the University, the local safety regulations must be followed.

Procedures and rules for all laboratory work at the Division of Nuclear Physics

General rules

- A risk assessment must be carried out before commencing new experiments or any new activity (see below).
- Use fume hoods and protective equipment, such as hearing protection, safety glasses, lab coat (cotton), respiratory protection and protective gloves, if not obviously unnecessary. Make sure the exhaust fan in the fume hood is working. When handling chemicals it is good practice to assume that they are all dangerous and harmful to health. The product data sheet provides more information on the material.
- The power sockets at fume hoods at the Nuclear Physics Division are not equipped with a switch turning the power off in case of malfunctioning ventilation. Due to the increased risk of explosion it is prohibited to use electric equipment together with flammable chemicals in the fume hoods (except t EX-classified equipment).
- If the ventilation in the fume hoods is stopped or limited (alarm will be triggered) the laboratory must be evacuated immediately if the fume hoods contain hazardous chemicals that can present a risk at limited ventilation.
- It is forbidden to eat, drink, smoke or use snuff (*snus*) in the laboratory, and to apply cosmetics (including lip balm and hand cream or moisturiser).
- Clean lab coats are available for loan in the chemistry laboratory. Lab coats must not be worn outside the laboratory to prevent contamination of the workplace. Wash your hands after working in the lab.
- Contaminated protective clothing must be discarded or sent to the laundry. Contact Mattias Olsson if pollution involves health risks or risks to the environment.
- Eyewashes and full body showers are available in chemistry lab. Use them immediately if an accident occurs. The eye washes and emergency showers are checked once a year by Mattias Olsson.
- You must not work alone if dangerous operations are involved.
- If especially dangerous procedures or dangerous equipment are being used (see risk assessment), other staff (e.g. cleaners) must be informed by a notice in the lab.
- Master’s students may only perform laboratory work during normal working hours.
- If an experiment continues overnight or at weekends, the name and telephone number of the person responsible must be provided, together with the length of the experiment, on a notice in the lab.
- All incidents and occupational injuries must be reported to the Head of Division.
- All experiments must be clearly labelled with the name of the contact person.
- The labs must be kept clean. Equipment no longer in use must be put away. Keep the floor as clear as possible. Make sure cables etc. do not present a tripping hazard.
- Return equipment to its proper place after use.

- Always ask permission before borrowing equipment from any of the labs. The name of the person responsible for the lab is written on the lab door. Write a list of what you have borrowed (name, date, what has been borrowed).
- Equipment that is broken or behaves abnormally must be labelled, and the head of the research group informed.
- Electric hotplates and water baths must always be fitted with a timer. Electric hotplates must always be placed on a non-combustible surface. Ensure that there is a free space of at least 50 cm above any hotplate. Water baths must be made of metal and be equipped with overheating protection.
- Corridors are escape routes and must not cluttered with equipment, cupboards or appliances, etc.
- Make sure that you are acquainted with fire safety in the lab before you start any work.

Chemicals

- Information on newly purchased chemicals (including gases) must be reported to Mattias Olsson (including the name of the purchaser, and the name, quantity, and storage location of the chemical, etc.).
- If a chemical is permanently moved from one storage location to another, this must be communicated to Mattias Olsson.
- When transporting dangerous chemicals inside or outside the laboratory use a suitable container, such as a bucket containing vermiculite intended for this purpose.
- The transport of personnel in the lift (elevator) together with dangerous/flammable substances is prohibited.
- Chemicals should be stored in ventilated chemical cabinets, not in the fume hood.
- All solutions/samples must be labelled with the contents, any necessary hazard symbol, the name of the owner and the date.
- A list of all the chemicals stored in a cupboard must be affixed to the cupboard.
- Only chemicals in use may be left standing on the laboratory bench. Chemicals/containers must not be stored on the floor.
- Chemicals/waste in fume hoods must be kept on trays so they cannot run down the drain. Waste is to be dealt with or sent for destruction/decontamination regularly so that large amounts of waste are not stored at the lab. Consult Mattias Olsson on storage until waste is collected or dealt with.
- Doors close to fume hoods or drawbenches must remain closed to ensure proper ventilation.
- On completion of the project, samples/waste must be dealt with by the person who carried out the experimental work. Chemicals that are no longer in use are to be returned to the respective stores. If samples etc. are to be saved, they must be labelled with the name of the supervisor or project manager.

Spills and waste

- Waste must be handled according to specific regulations (contact Mattias Olsson). All waste sent for destruction/decontamination should be documented at the Division.
- If specific measures or protective equipment are needed to clean up spills, this must be noted in the risk assessment.
- Spills should normally be wiped up immediately. If you are unsure of what to do, contact Mattias Olsson. In the event of a major spillage call the emergency services (tel. 112, NB: dial '0' first for an outside line if you are using an internal phone).
  - Liquid chemicals: the chemical lab has buckets of vermiculite for the absorption of all types of liquid chemical waste: acids, bases, organic solvents, etc. After absorption sweep up the vermiculite, place it in the appropriate container with the correct labelling, and treat it as hazardous waste. Use masks as vermiculite tends to form dust. Small spills are to be wiped up with paper towels that should be dried in a fume hood before being disposed of in hazardous waste containers.
  - Solid chemicals: harmless chemicals are to be swept up or collected with paper and sorted.
  - Chemicals that are poisonous, corrosive, oxidizing, etc. are to be collected with paper towels and placed in the appropriate containers with correct labelling, and handled as hazardous waste (collection by SYSAV Kemi).
  - In the event of a major spillage: block off the area and inform those in the vicinity. Evacuate if necessary. If flammable solvents have been spilled check whether there is any electrical equipment running nearby which may cause sparking and, if possible, turn off the equipment, or the main switch to the lab. Call the emergency services tel. 112 (NB: dial '0' first for an outside line if you are using an internal phone).

Gases

- Gather as much information as possible about the gas you are going to work with. Study the safety data sheet carefully. If you have any questions, contact the gas supplier.
- Gas cylinders must be anchored in approved stands during both transport and storage. Gas cylinders are to be transported on carts intended for this purpose. The reducing valve must be removed prior to transport. Valves should be handled with care, and must not be exposed to shock or impact. Gas cylinders are extremely dangerous if the neck/reducing valve is broken off, for example, if the cylinder falls. They must not be placed so that they are exposed to heat, or so that they can be knocked over. They should therefore always be chained (but not around the valve) – in such a way that they can be quickly removed – or on wheeled stands for gas cylinders.
- Check that you have the correct gas cylinder and valve or reducing valve. Gas cylinders may only be connected to a reducing valve with the same gas name as indicated on the bottle. Note that only hoses approved for connection to gas cylinders may be used.
- Gas hoses must not be left on the floor (tripping hazard).

- Pipelines to gas cylinders must be leak-tested, and these tests documented annually, after long breaks in work, and when changing a gas cylinder.
- Doors to rooms in which gas cylinders are stored are to be marked with the appropriate hazard sign for gas cylinders. This information is important for fire fighters in the event of fire.
- Flammable gases must be kept in ventilated spaces intended for the purpose.

See also the National Board of Occupational Safety and Health regulations on the handling of gases: https://www.av.se/arbetsmiljoarbete-och-inspektioner/publikationer/foreskrifter/gaser-afs-19977-foreskrifter/ (in Swedish).

The General Safety Regulations for Laboratories are always to be followed: http://www.nuclear.lu.se/fileadmin/nuclear/HMS/Generella_saekerhetsfoereskrifter.pdf (in Swedish).

Radiation Safety

The University's **general safety instructions regarding ionizing radiation** can be found at: (in Swedish).

http://www.stralsakerhetsmyndigheten.se/Lagar-forfattningar/Lagar--forordningar/

Hanna Holstein has the overall responsibility for radiation safety at the University. The person responsible for radiation safety at the Division of Nuclear Physics is **Mikael Elfman**. Risk assessments must be made for new kinds of experiments, and the experiments must be authorized by a senior researcher and the Head of Division (see above).

For general radiation safety regulations at Lund University, see the following file (in Swedish):

http://www.medarbetarwebben.lu.se/sites/medarbetarwebben.lu.se/files/beslut-lunds-universitets-stralskyddsforeskrifter.pdf.

This document e.g. describes the required content in the mandatory radiation safety folder which must be placed just inside the door in rooms where radioactive sources/X-ray equipment/lasers are handled and used. The folder is pointed out at the mandatory tour taking place before obtaining access to the microbeam accelerator laboratory. English versions are expected within a near future.

When working with radioactive samples or materials in the aerosol lab the regulations that apply to the aerosol lab must be followed (consult **Göran Frank**).

Radioactive materials

All radioactive materials are to be stored in designated areas, accompanied by a list of the materials.

Radiation dose

The radiation dose to humans is always to be minimized using all reasonable measures.

Accelerators

All those working at the **microbeam accelerator** or the **SSAMS facility** must have a film badge dosimeter, which is to be worn when in the vicinity of the accelerator. **Gunnar Hyltén** is responsible for film dosimeters at the Division of Nuclear Physics. When working at other accelerators, in Sweden or abroad, you must follow the local radiation protection regulations.

When experiments are being carried out at the microbeam accelerator, **an operator responsible for the running of the accelerator** must be present. The task of this person is, among other things, to ensure compliance with the radiation protection regulations. This person also determines who has access to the accelerator hall.

An **operating log** is to be kept, including information on the kind of particles accelerated, the terminal voltage, the beam current, the target material and the name of the operator responsible, so that it is always clear when the accelerator is running who is responsible for radiation protection. Observations relevant to radiation protection should also be recorded.

When working alone with the microbeam accelerator a fall alarm must be used.

Rotating machines/tools

If a workpiece is not properly secured, it may rotate due to the force of the machine bit, and can lead to serious injury. Machines may only be used after appropriate instruction and permission has been granted for their use.

Heavy lifts/ladders

Be careful when lifting heavy objects or climbing, e.g., a ladder. Ask a colleague for help rather than run the risk of injury.

Electric shock

Be extremely careful with custom-built equipment, such as electric ovens, pumps and variable voltage transformers, where faults can easily arise. Check that all equipment is earthed. If the plastic jacket on a high-voltage coaxial cable is defective or incorrectly fitted in SHV, MHV or BNC connectors, the voltage can be such that it appears that the equipment is earthed. Reduce the voltage before removing such contacts. According to new regulations, a circuit breaker must always be used in sockets on lab benches.

Custom-built equipment intended for use in the aerosol lab must first be approved by **Anders Gudmundsson** before use.

For instructions on what to do when someone has suffered an electric shock, see http://www.nuclear.lu.se/fileadmin/nuclear/HMS/Livraeddning_vid_elskada.pdf (in Swedish) under the HMS tab on the Nuclear Physics intranet.

Liquid nitrogen

- Contact with liquid nitrogen can cause frostbite on the skin and eyes. Splashing liquid nitrogen in the eyes can lead to permanent damage. Therefore, always wear protective gloves and safety glasses when handling liquid nitrogen. The gloves should have collars (not elasticated tops), they should sit loosely, and be sufficiently rough to give a good grip. The material of the outer surface of the gloves should not become brittle at low temperatures, and the surface must be sufficiently watertight to prevent liquids from penetrating the gloves. Wear proper shoes not sandals.
- Liquid nitrogen may only be fetched from the Kryolab after instruction from an experienced person at the Division of Nuclear Physics or by the Kryolab superintendent, **Leif Magnusson**.
- The Kryolab is equipped with an alarm system indicating low oxygen levels.
    - If the alarm goes off (flashing light and sounding horn) during filling, turn off the flow of liquid nitrogen and leave the lab immediately through the main doors. Leave the main doors open until the alarm stops.
    - If the alarm has been triggered when you arrive at the lab, call the emergency services (tel. 112, remember to dial ‘0’ first for an outside line if you are using an internal phone). Do not enter the lab.
- Liquid nitrogen must not be stored in sealed containers as there is a risk of explosion due to excess pressure.
- Vessels containing liquid nitrogen must be labelled.
- Ensure there is adequate ventilation when storing and handling liquid nitrogen as evaporation can cause suffocation.
- The transport of personnel in the lift (elevator) together with liquid nitrogen is prohibited because of risks resulting, for example, from a power failure. Two people should transport liquid nitrogen when using a lift: one on each floor.
- Ensure that vessels containing liquid nitrogen can not tip or be overturned during transport or storage.
- Oxygen from the air can condense on the exterior of uninsulated equipment for liquefied gas that has a temperature below the boiling point of oxygen (about -183 °C), for example, liquid nitrogen at low pressure. This leads to the enrichment of oxygen on the equipment, which can lead to an increased risk of fire. There is also a risk of ice forming on the outside of the equipment used for liquefied gas at temperatures below 0 °C.

Power outages

The following measures must be taken to reduce the consequences of a power failure.

- Only experienced personnel may start up the accelerator after a power failure.
- Machines that may be dangerous when restarted and equipment that can be damaged by an intermittent power supply must be equipped with no-volt protection.
- Information on the expected duration of power cuts during normal working hours, 08.00-16.30, can be obtained from the University switchboard by dialling 99 or +46 46 222 00 00. Outside normal working hours, contact Securitas, extension, 20700, or + 46 46 22 20700.

Risk assessment

Risk assessment should be carried out in all cases where there is a risk of occupational injury, but also in other cases, for example, the risk of theft and computer hacking. Risk assessment must be carried out for each doctoral project and for laboratory practicals in undergraduate teaching. The Head of Division is responsible for ensuring risk assessments are carried out, and he or she should be able to be present them to the Head of Department.

Risk assessments are to be carried out for all laboratory activities, as described below.

1. When starting a new project that may be associated with significant new risks, a written risk assessment of the project must *always* be made. This risk assessment is only valid for 1 year, and must then be updated. Material data sheets must not be older than 3 years when the risk assessment is made.
2. Risk assessment of laboratory operations should normally be made by the person who is to perform the work. If there is a change in personnel, a new risk assessment should normally be made. Contact **Mattias Olsson** regarding the risk assessment of chemical hazards. Risk assessments are to be reviewed by Mattias Olsson and approved by the Head of Division before work commences.
3. When the risk assessment is made by someone other than the person who is going to perform the work, the person making the risk assessment is responsible for ensuring that the person who will carry out the work has read and understood the risk assessment, signs a declaration to this effect, and agrees to comply with the measures set out in the risk assessment.
4. *The original* is to be kept by the Head of Division.
5. A *copy* is to be kept so that it is readily accessible in the area in which the work is being carried out.

For further information, see the Department's intranet under the tab HMS: http://intranet.fysik.lu.se/intranet/arkivet/arkiv15/hms.pdf (in Swedish).

Help in performing and documenting risk assessments

Help in performing and documenting risk assessments can be found on the Division's intranet: (http://www.nuclear.lu.se/hms/). The template that is to be used to document risk assessments is also available there.

For more information on how to formulate risk assessments, see The Swedish Work Environment Authority's checklist:

https://www.av.se/globalassets/filer/checklistor/hantering-av-kemiskt-amne-riskbedomning-checklista-2011-03-15.pdf (in Swedish).

Reporting incidents

All accidents and incidents, and events that could have become incidents, are to be reported to the Head of Division. In this way, we can prevent incidents and accidents from being repeated.

Dirk Rudolph
Head of Division

Jan Pallon
Deputy Head of Division

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