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Vice-Chancellor

# Lund University Radiation Protection Regulations

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## Contents



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## 1. Introduction

The present radiation protection regulations cover general information, rules, laws and advice applicable to work with ionising radiation and work with lasers.

## 2. General contact information

If you have questions, or in a radiation-related emergency, please contact:

**Lund University radiation protection physicist**

Hanna Holstein 046-2220193
Hanna.holstein@med.lu.se

Radiation physics
Klinikgatan 5
3rd floor, internal mailing code 32
Lund

For emergencies involving radiation protection, you can also contact Sara Brockstedt at SUS (Skåne university hospital):

**Skåne university hospital radiation protection physicist**

Sara Brockstedt 046-176360
Sara.Brockstedt@skane.se

## 3. Applicable decisions

Pursuant to the radiation protection organisational plan BY 2012/309 approved on 14 June 2012, the radiation protection physicist is to:

1. be the University's radiation protection expert and consultant on radiation protection issues, provide advice and assistance to divisions and departments in the development and maintenance of their quality assurance work and their quality handbook,

2. draw up university-wide radiation protection regulations, assist in the drafting of local radiation protection regulations and participate in their approval or amendment,

3. issue local permits for divisions and departments within the framework of the University's collective permit and be responsible for the local

supervision and annual inventory of fixed and open sources of radiation,

4. be responsible for and coordinate the use of a central register (database) of documentation on local permits, employees who have undergone radiation protection training, fixed and open radiation sources and stored long-life radioactive waste,

5. be responsible for and coordinate information and training within the field of radiation protection, including online training and refresher courses,

6. coordinate personal dosimetry (the measurement and registration of individual radiation exposure) and contribute to its development,

7. regularly inform heads of department, contact persons and health and safety representatives as well as the central radiation protection committee (the latter is to be done through the environmental manager),

8. follow developments within radiation protection research and to a certain extent contribute to its development, and stay abreast of national and international radiation protection legislation, and

9. be of assistance as the University's representative and expert on the community's preparedness for radiation accidents.

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## 4. Local permits

For departments and their research teams to be allowed to work with ionising radiation, local permission is required from the radiation protection physicist. All radioactive substances and all apparatus which emit ionising radiation are to be registered in a central database by an appointed contact person. Every year, an inventory of apparatus and radioactive substances is to be made by the contact person. The radiation protection physicist will also visit the research teams once a year on a radiation protection inspection. The head of department or equivalent is responsible for the work environment and thereby also for radiation protection.

### a. Radiation protection folder

In premises where activities using ionising radiation take place there is to be a file labelled "*Radiation protection folder*"("*Strålskyddspärm*" in Swedish). This folder is to be kept in a locked room with no access for unauthorised persons, e.g. where the sources of radiation themselves are stored. The folder is to contain the following information:

- Contact person and manager.
- Telephone number of the contact person.
- Copy of local permit.
- List of the radioactive substances and apparatus emitting ionising radiation in the possession of the organisation (transcript from the central database) and date of the latest inventory.
- Copies of regulations affecting the activity and locally adapted radiation protection rules.
- Instructions for protective equipment and measuring instruments (description of method, quality control of detectors, etc.).
- Documented procedures and information on measures taken to prevent unauthorised persons from gaining access to the source of radiation, theft or other loss, damage through external effects or fire.
- Procedures for waste disposal.
- Procedures in case of accidents and incidents.

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### b. Contact person

For each organisation which has been granted a local permit, the head of department (or equivalent) is to appoint a contact person who takes practical responsibility for radiation sources and apparatus which emit ionising radiation. The contact person is to have good knowledge of radiation protection. For each organisation, the relevant contact person is responsible for:

- defining local working rules.
- supervising the work to ensure it is done safely from a radiation protection perspective.
- supervising purchases and ensuring that each one is registered in the central database.
- ensuring that an annual inventory of apparatus and radionuclides which emit ionising radiation takes place.
- keeping the radiation protection folder up to date.
- keeping the head of department or equivalent informed of any changes.
- maintaining a waste log book which is to be kept for at least 5 years.
- being the contact person for the radiation protection physicist at LU.

### c. Radiation protection inspection

At least once per year, the radiation protection physicist conducts an inspection round; see “radiation protection inspection” appendix. The radiation protection physicist visits the research teams which have been granted local permits and checks that all requirements in the local permit and in applicable regulations are met. The safety inspection includes checking that the local permit is current, that there is a radiation protection folder with the correct contents, that participating staff are trained and monitored through personal dosimetry, that all radiation sources and apparatus are registered in the central database, that contamination tests are carried out and documented, and a check of classification of staff, signage of premises and waste management.

### d. Applicable regulations

Legislation relevant to the activity is to be kept in the radiation protection folder (the statutes are available in Swedish on the website of the Swedish Radiation Safety Authority, www.ssm.se). The statutes relevant to Lund University’s activities with ionising radiation are the following:

- SSM FS 2008:51 The Swedish Radiation Safety Authority’s regulations on basic provisions for the protection of employees and the general public in work with ionising radiation

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- SSM FS 2010:2 The Swedish Radiation Safety Authority's regulations on the management of radioactive waste and emissions from work with open sources of radiation
- SSM FS 2008: 28 The Swedish Radiation Safety Authority's regulations on laboratory work with radioactive substances in the form of open sources of radiation
- SSM FS 2008:27 The Swedish Radiation Safety Authority's regulations on work with accelerators and sealed sources of radiation
- SSM FS 2008:9 The Swedish Radiation Safety Authority's regulations on the control of sealed radioactive sources with high activity
- SSM FS 2011:2 The Swedish Radiation Safety Authority's regulations on clearance of material, premises, buildings and land in work with ionising radiation
- SSM FS 2008:52 The Swedish Radiation Safety Authority's regulations on external persons in activities with ionising radiation
- SSM FS 2012:4 The Swedish Radiation Safety Authority's regulations on lasers and intense pulsed light

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## 5. Work rules

### a. General work rules

The departments or individual research teams working with ionising radiation are to have a local permit (issued by the radiation protection physicist). All radioactive sources and apparatus that emit ionising radiation are to be registered in a central database. The work is to be done in compliance with applicable regulations. Staff working with ionising radiation is to receive adequate training pursuant to the Swedish Radiation Safety Authority's regulations, see "Training".

### b. External exposure to radiation

The magnitude of the dose of radiation received in one work operation depends on several factors:

- Radiation type and activity
- Duration of stay in the radiation field
- Distance from the source of radiation
- Shielding

The dose of radiation from external exposure is directly dependent on the **time** spent in the radiation field; doubling the time spent entails doubling the dose of radiation.

The following work rules apply:

- Be well prepared.
- Work fast and methodically.
- Practise new and difficult work operations on non-radioactive material, such as water or a coloured solution.

Exploit the "Inverse square law", which means that the intensity of radiation decreases by the square of the **distance from the source**. Example: if the distance from the source is doubled, the intensity of the radiation is reduced to a quarter and thereby also the dose rate.

The following work rules apply:

- Work at the greatest possible distance from the source of radiation.
- Use tongs, forceps or other distance tools when handling radioactive substances without lead shielding.
- Avoid touching containers of radioactive material directly with your fingers.

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The intensity of radiation can be reduced through **shielding**. Suitable material depends on the type of radiation, and suitable thickness depends on the radiation's energy. Some examples:

- Beta radiation < 300 keV — No shielding needed
- Beta radiation 300 keV - 1 MeV — 5–10 mm plexiglass
- Beta radiation > 1 MeV — 10 mm plexiglass
- Gamma radiation < 200 keV — 2 mm lead
- Gamma radiation > 200 keV — Calculation of shield thickness required

### c. Work with open sources of radiation

- The areas (laboratory, part of a laboratory, fume cupboards, refrigerators, etc.), where work with radioactive substances is conducted or where the radioactive substance is stored are to be clearly delimited and clearly marked with warning symbols for ionising radiation (e.g. with radioactive tape).
- The work is to planned in such a way as to affect as few areas as possible.
- The work areas should be arranged in such a way that the "work flow" goes from high to low activity and with the shortest and simplest movement of slides possible. Do not place measuring equipment for low-level radioactive samples in high activity locations.
- The work surfaces and trays used are to be covered with protective paper with a plastified backing (with the absorbant surface upwards). Change the paper regularly and always in case of contamination. Contaminated paper is to be disposed of in the hazardous waste box, see "Waste management".
- In case of new work operations, first test all operations on inactive material in order to see where the weaknesses are.
- Develop procedures for decontamination before you start your work on a new radionuclide or a new method.
- Protective gloves and safety glasses must always be used. Do not use unwieldy gloves which worsen grip safety in handling test tubes and suchlike.
- Personal dosimeters are compulsory for category A work; in other cases their use is to be discussed with the radiation protection physicist.
- In case of planned work with radioactive solutions in which the concentration is > 5 MBq/ml and beta energy is > 1 Mev, the radiation protection physicist should be consulted for advice.
- In addition to shielding from radiation, face shields can also serve as splash protection and can therefore be appropriate in certain work operations even though the activity levels are not so high.
- A radiation detector meant for the relevant type of radiation (photons or beta) is to be available.

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- Radiation detectors which can be connected to a network and placed loose in a wall-mounted holder are practical as they enable hand contamination to be checked without touching the instrument.
- All work with volatile radioactive substances is to be conducted on a downflow bench or in a fume cupboard (depending on the nature of the work).
- All laboratory glass and other reusable equipment which has been in contact with radioactivity is to be decontaminated before it may be sent for routine washing or put away.
- If any radioactive substance is spilled on a floor or other surface, the area is to be marked immediately and prevented from spreading contamination.
- While considering how best to deal with a spill, one can cover it with a masonite sheet or similar.
- Contamination measurement of premises, work surfaces and equipment is to be done at least once per quarter and always if contamination is suspected.
- Work in the laboratory is to be documented in a log book to be kept in the laboratory. The log book entries are to include:
    - Nuclide and activity, purpose
    - Date of the work and who conducted it,
    - Unplanned events of significance from a radiation safety perspective
    - Results of contamination measurements and information on decontamination.

### d. Training

All staff working with ionising radiation at Lund University is to undergo training before starting such work. This training is to meet the applicable legal requirements. The radiation protection physicist regularly holds training courses (4 times per year) in Swedish or English, and the courses are advertised via email to employees. Regular refresher courses are also to be attended.

### e. Managing sources of radiation

Radiation sources are never to be left without supervision except when locked away according to regulations, so that unauthorised persons cannot access them. Radiation sources are not to be transported on public roads without an ADR driving license and no sources of radiation may be sent abroad without the knowledge and permission of the radiation protection physicist.

### f. Dosimeters

Staff in Category A, see “Division of staff into categories”, is to wear personal dosimeters and to undergo a medical examination before starting work with ionising radiation and subsequently every three years. In order to check the effective dose contributed by the work done with ionising radiation, an active dosimeter can be borrowed from the radiation protection physicist for up to one month.

### g. Pregnant or breastfeeding women

The person responsible for the activity (head of department/equivalent) is to inform female employees of child-bearing age of the risk entailed by exposure of a foetus to ionising radiation in the case of pregnancy.
A woman who is pregnant and has reported this fact has the right to be moved to work not involving ionising radiation for the remainder of her pregnancy.

If a pregnant woman is not moved, the work is to be planned in such a way as to ensure that the equivalent dose to the foetus is as small as is reasonably possible and that it is unlikely that the dose to the foetus will exceed 1 mSv during the remainder of the pregnancy, from the time this is observed.

A woman who is breastfeeding is to report this circumstance to the manager responsible for the activity. During the period she is breastfeeding, the woman is not to be placed in work which entails a risk of contamination with radioactive substances through which the infant could receive a dose of radiation significant from the point of view of radiation protection.

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## 6. Division of staff into categories and signage of premises

### a. Staff

Employees and workplaces are to be divided into categories where employees could be exposed to doses of radiation such that

1. the annual effective dose amounts to 1 millisievert (mSv) or more, or
2. the annual equivalent dose to the lens of the eye amounts to 15 mSv or more, or
3. the annual equivalent dose to extremities or skin amounts to 50 mSv or more.

**Division of staff into categories**

The person managing the organisation is to divide staff into categories A or B. An employee is to be included in category A if there is more than a negligible probability that
1. the annual effective dose will amount to 6 mSv or more or
2. the annual equivalent dose to the lens of the eye will amount to 45 mSv or more or
3. the annual equivalent dose to the extremities or skin amounts to 150 mSv or more.

The assessment of probability as set out in the first paragraph is to include the probability of errors or accidents which could entail doses of radiation even in activities which normally do not expose employees to high doses.

Employees who are not included in category A are to be included in category B. For employees in category B, the dose exposure is to be supervised to such an extent that it is possible to prove that placement in category B is correct. Staff in category A is to undergo a medical examination before starting work, to be repeated every third year, and to carry a personal dosimeter (not active).

### b. Controlled areas

A workplace in which the employees may be exposed to some of the annual doses of radiation stated for category A staff, or from which radioactive contamination of significance from a radiation protection point of view can be spread to the surrounding premises, is to constitute a controlled area. The person in charge of the activity is to set up local written regulations for each controlled area, stating how work is to be conducted and what protective measures are to be taken by those working within the area. The rules are to be designed with reference to the nature

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of the work and the sources of radiation and they must be accessible in the workplace.

A controlled area is to be delimited and access limited to **authorised persons**, which means people with the necessary training concerning

- the risks associated with work in a radiation environment,
- radiation protection measures which need to be taken, and
- the local rules which apply within the controlled area.

Temporary visitors may be granted access to a controlled area only if accompanied by an authorised person.

If there are radioactive substances within the controlled area which could contaminate the surroundings, the person responsible for the activity is to take appropriate measures to prevent the dissemination of radioactive substances beyond the controlled area.

A controlled area is to be marked with signs stating that it is a controlled area and what type of radiation sources are present within it.


### c. Supervised areas

Any premises in which the work may require staff to be divided into categories and which is not a controlled area is to be defined as a supervised area.

For each supervised area, the person responsible for the activity is to draw up written local working instructions, designed with reference to the nature of the work and the sources of radiation. The instructions are to be available in the relevant workplaces. A supervised area is to be marked with signs stating that it is a supervised area and the type of radiation source present. Signage in supervised areas which are marked according to older regulations need not be redone.

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Supervision of the work environment is to be done with methods appropriate to the type of radiation, energies and the physical and chemical properties of the radiation present at the site. The results of the supervision are to be documented and used, where necessary, to calculate personal exposure.

In cases where the work does not fall under the requirement to divide staff into categories, and does not constitute a supervised or controlled area, the area is still to be marked with the following sign in order to draw attention to the fact that work with ionising radiation takes place on the premises.


## 7. Purchasing

In connection with the purchase of new equipment/sources of radiation which emit ionising radiation (over the exemption levels) these purchases are to be registered in the central database by the contact person at/within the organisation and the research team must have obtained a local permit from the radiation protection physicist. The contact person at/within the department/research team is assigned a user name and password by the radiation protection physicist.

The radiation protection physicist is to be notified **immediately** of any changes such as moving sources of radiation, building work or organisational changes.

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## 8. Waste

For radioactive waste, Lund University’s rules are to be followed, see below, as well as the Swedish Radiation Safety Authority’s waste management regulations 2010:2.

Radioactive waste is divided into low-level radioactive waste, medium and high level radioactive waste and liquid scintillation solution.

NB! No waste can be transported from the site unless it is correctly packaged and labelled! Box labels must be attached in such a way that they cannot come unstuck during transportation.

### a. Low level radioactive waste

**Low level radioactive waste** means that the activity per package can be at most 1 limit value (L) each time (see exemption levels SSM FS 2010:2 rectification sheet) and 10 L limit values per month. The following applies to low level radioactive waste:

**Unmarked** (neutral), approved boxes are to be used. Seal the box with tape and a label for low level radioactive waste; this seal is to be resistant. You can find labels by going to lu.se and searching under hazardous waste.


The labels include information on **nuclide, activity and a signature** which is required to certify that the surface dose rate is **less than 5 µSv/h**, the activity is less than **1 limit value** (L) and whether it is a **point source** with activity of **less than 50 kBq.** The box is also to be marked with the name of the person who packed it (preferably the contact person), the department/division, telephone number and cost centre.

**A dangerous goods declaration** is to be attached to the box; you can find the appropriate form on lu.se by searching under hazardous waste.

**NB!** Liquid scintillation solutions are not classed as hazardous waste but rather as chemical waste, on condition that:

- The solution does not contain alfa-emitting nuclides
- Activity is at most 10 Bq/ml, or 100 Bq/ml if it only contains H-3 or C-14

Hazardous waste boxes with liquid scintillation waste are to be provided with a special label which you print out yourself on a colour printer (landscape A4, four labels per page), search on lu.se under hazardous waste. The label is to be firmly attached to the box.

There is to be a quality handbook (logbook) in which all waste is registered; the logbook must be kept for at least five years. Waste storage spaces are to be marked with the following sign.


**b. Medium and high level radioactive waste**

Medium and high level radioactive waste is to REMAIN (BE KEPT) at the department/division until agreement has been reached with the radiation protection physicist (hanna.holstein@med.lu.se) on the appropriate way to dispose of it.

A label with information on the radionuclide, the person responsible and the level of activity at the time of packaging is to be attached to the box.

**c. Liquid radioactive waste**

**The general rule at Lund University is that flushing anything down the drain is prohibited.**

If the research team wishes to rinse a nuclide down the sink, **the radiation protection physicist must be consulted beforehand!** The radiation protection physicist decides **whether this is permitted on a case to case basis** depending on the radionuclide, the half-life, etc.

## 9. Storage

All sources of radiation are to be stored in a **locked room** when not in use and no unauthorised persons are to have access to them. While the sources of radiation are in use, they must be under constant supervision. The storage space is to be marked with the following sign:


Radioactive substances are to be kept out of reach of unauthorised persons.

Radioactive substances are to be stored securely from a fire safety perspective. Containers and suchlike in which radioactive material is stored are always to be labelled with the radioactive symbol and a signature, relevant radionuclide, level of activity and date.

The dose rate around containers or small radiation protected storage rooms containing radioactive material where staff are not ordinarily present should not exceed 20 μSv/hour. In premises where staff is ordinarily present, the dose rate is to remain under 2 μSv/hour.

Work with open sources of radiation (3-H, C-14, 35-S etc) is to take place in one location (a work surface) and this work surface is to be labelled.

### a. Waste collection room and decay-in-storage room

There is to be a log book in the waste collection room and the decay-in-storage room in which all waste left for disposal and waste for decay on site is carefully documented; the log books are to be kept for five years.

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## 10. Transport of radioactive substances on public roads (ADR-S)

In case of transport of radioactive substances **on public roads, the ADR provisions are to be followed (transport of dangerous goods).** The person in charge of the activity (head of department or equivalent) has an obligation to ensure that these provisions are followed and that only drivers with ADR training transport dangerous goods. No sources of radiation may be transported/sent abroad without the knowledge of the radiation protection physicist.

More information on ADR-S provisions is available on:
https://www.msb.se/en/Prevention/Transport-of-dangerous-goods/

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## 11. Accidents and incidents

**In case of any incident/accident/mishap, contact the radiation protection physicist immediately!**

**Hanna Holstein Tel. 046-2220193**

In case of emergency/life-threatening situations, always call 112 first!

If you need to contact security or the University's emergency officer, call the **University's emergency number: 20 700**

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### a. Reporting accidents and incidents involving ionising radiation

Accidents and incidents involving ionising radiation are to be reported within one week to the Swedish Radiation Safety Authority, SSM. This is done by the radiation protection physicist.

Remember to conduct an internal investigation as soon as possible after the event, and make a record of the following:

- Where the incident took place.
- What happened.
- Cause of the incident, what working procedures were applied or deviated from.
- What equipment, machine or source of radiation was being used.
- Which people were involved.
- Any measured or estimated doses of radiation.
- What measures were taken or planned to prevent a recurrence of the incident.

Describe what happened and if possible how it could happen.

The following parameters are useful to report to the radiation physicist:

- Duration of stay in the radiation field
- Distance from the source of radiation
- Level of activity, radionuclide
- Surface contamination.

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## 12. Lasers

For the use of laser apparatus in work at Lund University, the Swedish Work Environment Authority's regulations apply:

Arbetsmiljöverkets föreskrifter om artificiell optisk strålning (AFS 2009:7) (in Swedish)
The purpose of these regulations is to protect the employee's eyes and skin from health risks and to prevent safety risks which can arise in case of exposure to artificial optical radiation during work.

As of 1 January 2014 the handling of strong laser pointers, including their use, possession, sale and import, is prohibited without permission from the Swedish Radiation Safety Authority.

Strong laser pointers are understood as battery-driven laser pointers intended for handheld use and belonging to laser class 3R, 3B or 4. This usually means laser pointers that are stronger than 1 milliwatt (mW). For more information, please consult ssm.se.

The use of lasers (class 3B and 4) is prohibited in a public place or in airspace, as well as for entertainment purposes, for art or advertising, without permission.

**The employer i.e. the head of department or equivalent is responsible for ensuring that these regulations are followed.**

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## Appendix 1
## Radiation protection inspection

Contact person:
Research team:
ID:
Room number:

**Permission**

☐ Does the research team have a local permit from the radiation protection physicist to conduct activities with ionising radiation?

☐ Date of annual inventory and registration in the central database of apparatus and substances emitting ionising radiation?

☐ Is there a local radiation protection folder? Does it contain all the information? Is it up to date?

**Training**

☐ Has all staff working with ionising radiation undergone radiation protection training (refresher course)?

**Personal dosimetry**

☐ Are personal dosimeters used where required?

**Radionuclides/apparatus**

☐ Are the nuclides and apparatus which are to be in the possession of the research team duly recorded in the central database?

☐ Are all deliveries recorded in a log book?

**Contamination**

☐ Are contamination tests regularly carried out?

☐ Are they recorded in a log book?

☐ Are there functioning radiation protection instruments which are suitable for the isotopes/apparatus in use?

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☐ Are incidents investigated and reported to the radiation protection physicist?

**Signage**

☐ Are the laboratories/premises marked with signs indicating “supervised/controlled area”?

☐ Is the location for waste marked “Storage space for radioactive waste”?

☐ Is the storage space marked “Storage space for radioactive substances”?

☐ Is the discharge location marked “Discharge location for liquid radioactive waste”? Is there a log book? Has the radiation protection physicist been contacted and permission granted?

**Dose rate**

☐ Is the dose rate in the laboratory/premises and in the storage of radionuclides and waste approved?

**Waste**

☐ Is radioactive waste recorded in a log book according to applicable procedure?

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**Comments:**

Measures to have been taken by:

(date)
---------------------------------------------------

Hanna Holstein
Radiation protection physicist

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Date

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