



UMEÅ UNIVERSITET

RULE FOR RADIATION PROTECTION

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1. Description

This rule describes Umeå University's radiation protection organisation and how the University's local operations are to work with unsealed and sealed radiation sources. The rule constitutes the University's management system for radiation protection and is aimed at both managers and employees.

2. Background

The purpose and aim of the Swedish Radiation Protection Act (*Strålskyddslagen 2018:396*) is to protect the environment and human health from the harmful effects of radiation. Umeå University's work with radiation is considered to be an operation subject to a licence obligation, which means that the University must apply for and be granted a licence to carry out work involving ionising radiation. The Vice-Chancellor is the licence holder and is ultimately responsible for the University's radiation protection work, but in accordance with the Vice-Chancellor's decision and delegation order¹ (*rektors besluts- och delegationsordning*), the head of department or equivalent is responsible for the implementation of and compliance with the radiation protection regulations within their local operation.

According to the Swedish Radiation Safety Authority's regulations on basic rules for licensable practices with ionising radiation² (*Strålsäkerhetsmyndighetens föreskrifter om grundläggande bestämmelser för tillståndspliktig verksamhet med joniserande strålning SSMFS 2018:1*), the operation must be supported by a management system and a documented organisation and decision structure that clearly shows responsibilities and authorities within the operation, and how these work together, as well as how the operation is managed, evaluated and developed.

The purpose of this rule is to fulfil the requirements in the legislation, to function as a management system, and to provide information to the local operations within Umeå University that handle radiation sources or devices that generate ionising radiation. This is to ensure that the handling and the protective measures provide satisfactory protection for employees.

The following legislation is relevant to the handling of radiation sources and devices that generate ionising radiation at Umeå University:

- Strålskyddslagen (2018:396)
(Radiation Protection Act)
- Strålskyddsförordningen (2018:506)
(Radiation Protection Ordinance)
- Strålsäkerhetsmyndighetens föreskrifter om grundläggande bestämmelser för tillståndspliktig verksamhet med joniserande strålning (SSMFS 2018:1)

¹ No official English title is available

² No official English title is available



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(the Swedish Radiation Safety Authority's regulations on basic rules for licensable practices with ionising radiation³)

- Strålsäkerhetsmyndighetens föreskrifter om anmälningspliktiga verksamheter (SSMFS 2018:2)
(The Swedish Radiation Safety Authority's regulations on notifiable operations⁴)
- Strålsäkerhetsmyndighetens föreskrifter om undantag från strålskyddslagen om friklassning av material, byggnadsstrukturer och områden (SSMFS 2018:3)
(The Swedish Radiation Safety Authority's regulations on exemptions from the Radiation Protection Act for free-release of materials, building structures and areas⁵).

3. Definitions

The Swedish Radiation Safety Authority

The Swedish Radiation Safety Authority is both a supervisory and licensing authority. The Authority produces rules and issues licences for operations that handle radiation and supervises operations to ensure compliance with the regulations.

Licensed operation and local operations

In the licence issued by the Swedish Radiation Safety Authority, Umeå University is considered to be a licensed operation. In this rule, faculties, departments and units are referred to as local operations and are subordinate to and included under the umbrella of the licensed operation.

Radiation Protection Coordinator

The Radiation Protection Coordinator at the Property Management Office coordinates the University's radiation protection work. The Radiation Protection Coordinator is the University's contact for the Swedish Radiation Safety Authority.

Radiation Protection Expert

The Radiation Protection Expert is the University's advisory function on radiation protection matters. Local operations engaged in work with ionising radiation can consult the Radiation Protection Expert on matters related to radiation protection.

Contact Person

Each department working with ionising radiation must have a designated contact person who acts as the local operation's contact with the radiation protection coordinator and radiation protection expert. The Contact Person's duties include submitting an inventory of radiation sources used in the local operation each year.

Radiation Protection web page

The radiation protection web page is the place where all information about radiation protection is published. The exception is local governing documents that must be made available to the relevant employees.

³ No official English title is available

⁴ No official English title is available

⁵ No official English title is available



Sealed source

A sealed source is a radioactive substance permanently sealed inside a vessel or contained within a solid material that prevents the spread of the radioactive substance during normal use.

Unsealed source

A radioactive substance that is not a sealed source.

4. Organisation

This section describes the roles and responsibilities of the radiation protection organisation.

4.1 Roles and responsibilities

4.1.1 Vice-Chancellor

The Vice-Chancellor is the license holder and ultimately responsible for radiation safety at Umeå University. The Vice-Chancellor is responsible for:

- the operation complying with current Swedish legislation on radiation protection and that the local operations using ionising radiation comply with the conditions laid down in the licence
- the individuals assigned tasks under the organisational structure have sufficient radiation protection competence for their duties and are provided with the necessary authorities and resources to carry out radiation protection work
- making decisions on disciplinary measures for local operations in cases where serious deviations from radiation protection rules and regulations have been identified, following proposals from the Radiation Protection Coordinator.

Through the University's delegation procedure, the Vice-Chancellor can delegate to a dean the task of overseeing radiation protection and the work with radiation sources within the dean's faculty. The Vice-Chancellor assigns the Radiation Protection Expert to serve as the University's consultant in radiation protection matters.

4.1.2 Dean

Following delegation from the Vice-Chancellor, a dean may delegate to a head of department or equivalent the responsibility for ensuring that work with ionising radiation within the local operation complies with the requirements in the Swedish legislation, the Swedish Radiation Safety Authority's Regulations and Umeå University's rules.

4.1.3 Head of Department or equivalent

Subject to delegation from the dean, the head of department or equivalent is responsible for ensuring that work with ionising radiation within the local operation complies with the requirements of the Swedish legislation, the Swedish Radiation Safety Authority's Regulations and Umeå University's rules. The Head of Department or equivalent is responsible for:



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- appointing and formally delegating tasks, documented in writing, to a Contact Person for radiation protection work within the local operations
- ensuring that the Contact Person has sufficient knowledge about radiation protection for the local operation
- ensuring that all employees at the local operation working with ionising radiation are familiar with Umeå University's governing document, Rule for Radiation Protection
- ensuring that an annual inventory of current and the next year's planned sources of radiation for the local operation is carried out in the University's survey system during quarter 3, starting from quarter 2
- ensuring that all employees working with ionising radiation in the local operation are given basic training in radiation protection, with refresher courses every five years and documenting locally which employees have completed the training
- ensuring that the correct measuring equipment is available for calibration and contamination measurement
- ensuring that documentation and procedures for working with radiation sources are accessible and stored locally
- investigating, addressing, following up on and reporting accidents, incidents, or significant deviations from the rules regarding radiation protection in the University's incident reporting system
- ensuring that employees are categorised and informed about which category they belong to and that their categorisations are documented locally
- ensuring that premises used for working with ionising radiation in the local operation are correctly signposted as a Protected or a Controlled area
- ensuring that only authorised staff have access to premises where radiation sources are handled and that this is documented locally
- ensuring that employees working with ionising radiation in the local operation are informed about the importance of reporting pregnancy or breastfeeding to the employer without delay
- carrying out risk assessments for pregnant and breastfeeding employees, implementing measures and, if necessary, adapting duties following the risk assessment
- notifying the University's Radiation Protection Coordinator of relevant changes in the local operation, for example when the contact person is changed
- on request, providing the University's Radiation Protection Coordinator and Radiation Protection Expert with information and documentation regarding radiation protection and providing access to premises where work involving ionising radiation is carried out
- ensuring there is an up-to-date decommissioning plan for the local operation.

4.1.4 Radiation Protection Coordinator

The Radiation Protection Coordinator at the Property Management Office coordinates the University's radiation protection work at the University level and is the University's contact person for the Swedish Radiation Safety Authority. The Radiation Protection Coordinator is responsible for:

- applying for a licence for the operation
- designing and updating the governing documents for radiation protection
- ensuring that basic radiation protection training is offered annually in Swedish and English



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- ensuring that an annual report is prepared and presented in the work environment and equal opportunities committee
- proposing disciplinary measures to the Vice-Chancellor for a local operation where serious breaches have been discovered
- a compilation of the total amount of radioactive waste from the local operations is carried out in order to ensure that, collectively, they do not exceed the permitted limits for the licensed operation.

4.1.5 Radiation Protection Expert

According to the Swedish Radiation Safety Authority's regulations on basic rules for licensable practices with ionising radiation (SSMFS 2018:1), Umeå University must have a Radiation Protection Expert who meets the requirements set out in the Regulations. The University Director delegates to the head of department or equivalent at the appropriate department or unit the task of appointing a Radiation Protection Expert and this assignment is not time-limited. The Radiation Protection Expert has an advisory role and supports the University management, the Radiation Protection Coordinator and the head of department or equivalent and employees at the local operation in matters related to radiation protection.

The Radiation Protection Expert is responsible for:

- notifying the Radiation Protection Coordinator if irregularities are detected in a local operation and advise on what course of action to take
- assisting the Radiation Protection Coordinator in designing and updating governing documents
- annually conducting basic radiation protection courses and refresher courses in Swedish and English as well as local courses if necessary
- providing input to the Radiation Protection Coordinator in cases where the Swedish Radiation Safety Authority or other bodies have posed questions that apply to the University as a whole
- visiting local operations to provide advice and support on their work with radiation protection
- assisting the Radiation Protection Coordinator in their assessment of the annual inventory and, if necessary, other documents from local operations
- assisting local operations in the disposal of equipment that is no longer being used
- providing advice and support when establishing or making changes to an operation that handles ionising radiation.

The Radiation Protection Expert is assigned to:

- function as a medical physicist in all operations that involve human irradiation
- prepare the annual inventory and sending it to the Radiation Protection Coordinator
- prepare an annual report together with the Radiation Protection Coordinator
- participate in the work environment and equal opportunities committee on request
- assign a category to employees who work with ionising radiation.

4.1.6 Contact Person

Each department working with ionising radiation must appoint a Contact Person who acts as the local operation's contact with the Radiation Protection Coordinator and Radiation



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Protection Expert. When a Contact Person is appointed, a written delegation from the Head of Department or equivalent must be provided to the Contact Person. The form for this is available on the Radiation Protection web page (*Kontaktperson för strålskyddsarbete*). A copy is sent to the Radiation Protection Coordinator.

The Contact Person is assigned to submit the local operation's inventory of radiation sources annually and, upon request, providing requested information to the Radiation Protection Coordinator. If the Contact Person does not have sufficient authority or knowledge to act within their area of responsibility, this must be communicated to the head of department/equivalent without delay. The form for return of delegation (*Returning av arbetsuppgift*) must be filled out by the Contact Person. It can be found on the Radiation Protection web pages.

4.1.7 Employees in local operations that handle ionising radiation

Employees in local operations who work or come into contact with ionising radiation are required to:

- comply with university-wide and local rules and procedures for radiation protection
- use safety equipment and take the necessary measures to ensure that radiation protection functions as it should
- participate in relevant courses offered regarding radiation protection
- in the event of an accident, incident or significant deviation concerning radiation protection, report the matter as soon as possible in the University's incident reporting system.

4.2 Organisation chart

Below is Umeå University's organisation chart for radiation protection.

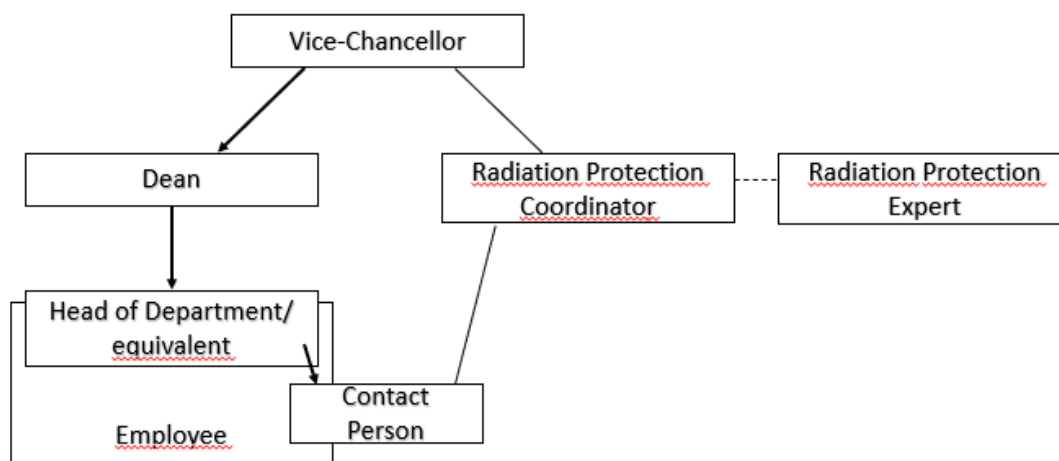


Figure 1. The figure shows the organisation chart for the radiation protection organisation at Umeå University.



5. Licence

The Vice-Chancellor holds Umeå University's licence for operations involving ionising radiation. The University holds two licences: an umbrella licence for conducting operations that involve ionising radiation for research purposes and teaching, and a licence for human exposure.

The umbrella licence covers unsealed and sealed sources of radiation as well as technical equipment that can generate ionising radiation that is registered with the Swedish Radiation Safety Authority. The licence also covers discarded sources of radiation and radioactive waste. The licence for human exposure applies to the transfer, leasing, acquisition, possession and use of X-ray equipment intended for medical X-ray diagnostics and is limited to one of the University's departments.

Both licences with their conditions and register extracts are available from the Radiation Protection Coordinator at the Property Management Office. If the conditions in the licences are not complied with, the University risks losing its right to work with radiation sources.

6. Annual inventory

Every year, Umeå University is required to take an inventory of the radiation sources and devices intended to generate ionising radiation that are used in its operations. Each local operation takes an inventory of their radiation sources annually and estimates the amount for the coming year. The inventory is then reported in the University's survey system during quarter 3, starting from quarter 2.

7. Annual report

At the beginning of each year, the Radiation Protection Expert and Radiation Protection Coordinator meet to write an annual report on radiation protection work for the past calendar year. Problems and deviations brought to light must be addressed and an action plan drawn up if necessary. The Radiation Protection Coordinator then presents the annual report to the work environment and equal opportunities committee.

8. Systematic follow-up

The Radiation Protection Expert regularly visits the local operations to follow up on how radiation protection work is carried out in practice and to provide advice and support.

9. Accidents, incidents and deviations

Accidents, incidents and other significant deviations concerning radiation protection must be reported as soon as possible in the University's deviations system. The local operations must have local procedures for managing accidents. If necessary, contact the Radiation Protection Expert and Radiation Protection Coordinator for assistance in assessing the severity of the event.



10. Pregnancy and breastfeeding

It is important that employees report pregnancy or breastfeeding to the employer as soon as possible. In the case of pregnancy, a risk assessment must be carried out, and the employee has the right to request that the employer offer them tasks that do not involve ionising radiation. While the employee is breastfeeding, their tasks must be planned so that the employee does not risk ingesting or being contaminated by radioactive substances that may cause their child to be exposed to ionising radiation.

11. Training

Everyone working with radiation sources must undergo basic radiation protection training at the beginning of their employment and then complete a refresher course every five years. The courses are provided annually in Swedish and English and taught by the Radiation Protection Expert. Each employee's participation in the course must be documented locally. On request, the Radiation Protection Expert can provide advanced training that is specific to the operation.

Basic radiation protection courses cover:

- radioactivity
- ionising radiation
- X-ray
- detection and measurement
- radiation doses
- effects of radiation
- laws, regulations and local rules.

12. Categorisation of employees

Employees working with ionising radiation must be categorised according to the assessed radiation dose that they risk being exposed to. Their categorisation must be documented locally, and employees must be informed of their categorisation. Categorisation is not required if the annual radiation dose that an employee risks being exposed to is less than the levels set out below for Category B. Contact the Radiation Protection Expert to carry out the categorisation.

An employee belongs to **Category A** if they could be exposed to an annual radiation dose where:

- the effective dose exceeds 6 millisievert (mSv)
- the equivalent dose to the lens of the eye exceeds 15 mSv
- the equivalent dose to extremities exceeds 150 mSv
- the equivalent dose to the skin as an average value over one square centimetre exceeds 150 mSv, regardless of the size of the area exposed.

An employee belongs to **Category B** if they could be exposed to an annual radiation dose where:



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- the effective dose is more than 1 mSv, but less than 6 mSv
- the equivalent dose to extremities is more than 50 mSv, but less than 150 mSv
- the equivalent dose to the skin, as an average value over one square centimetre, is more than 50 mSv, but less than 150 mSv, regardless of the size of the area exposed.

Random sampling measurements of Category B employees must be carried out every two years or when there is a change in the operation. Employees in Category B have a right to wear a personal dosimeter, but this is not a requirement. Category A employees must wear a personal dosimeter.

13. Classification of premises

Premises where work involving ionising radiation is conducted must be classified as either a Protected or a Controlled area. In a Controlled area, there **must** be written instructions based on the provisions governing the room/area, and no unauthorised persons may enter the room/area. In the case of a Protected area, written instructions **should** be provided.

A **Controlled area** means a room/area where employees could be exposed to annual dose levels exceeding 6 mSv, or where significant radioactive contamination could occur and be spread to other premises or workplaces.

A **Protected area** means a room/area where employees could be exposed to the following annual dose levels:

- the effective dose exceeds 1 mSv
- the equivalent dose to the lens of the eye exceeds 15 mSv
- the equivalent dose to extremities exceeds 50 mSv
- the equivalent dose to the skin as an average value over one square centimetre exceeds 50 mSv, regardless of the size of the area exposed.

14. Decommissioning plan

Local operations that work with radiation sources must have a decommissioning plan. The decommissioning plan must describe the management and disposal of radioactive materials and waste, which must follow Umeå University's procedures for waste management. The plan must contain detailed information on the materials and premises that could be cleared for free-release, and the requirements applicable from the Swedish Radiation Safety Authority's regulations on exemptions from the Radiation Protection Act for free-release of materials, building structures and areas (SSMFS 2018:3).

14.1 Clearance for free-release

Materials, buildings and areas that have, or may have, been contaminated by radioactive substances in an operation involving ionising radiation must be treated as either radioactive waste or cleared for free-release. Clearance for free-release means that the rules under the Radiation Protection Act (2018:396) need not be applied, as the risks of radioactive contamination are so small that they can be considered negligible.



Diluting radioactive material is prohibited if the purpose of this act is to obtain clearance for free-release for the material.

14.1.1 Decision on clearance for free-release

Clearance of materials by decision of the head of department/equivalent

The head of department/equivalent may decide on clearance for free-release for materials, provided that the radioactive contamination is below the free-release levels specified in Sections 12–15 of SSMFS 2018:3.

Clearance by decision of the Swedish Radiation Safety Authority

Following an application by the head of department/equivalent, the Swedish Radiation Safety Authority may test whether premises, areas and materials where the contamination is not below the free-release levels specified in Sections 12–15 of SSMFS 2018:3 may be granted clearance.

Use of premises without a clearance decision

Premises that have been decontaminated and inspected may, if the presence of radioactive substances is below the clearance levels specified in SSMFS 2018:3, Annex 4, be used by the local operation for other purposes without a prior specific decision from the Swedish Radiation Safety Authority. If the local operation ceases to use the premises, an application for clearance for free-release must be submitted to the Swedish Radiation Safety Authority.

14.1.2 Materials and premises that may be considered for free-release

Materials

Fume cupboards, work benches, refrigerators and freezers are examples of materials that may be considered for free-release. The local decommissioning plan must specify which materials may be subject to clearance for free-release.

Premises

All premises used for operations that involve unsealed sources of radiation at Umeå University may be considered for free-release. The local decommissioning plan must specify which premises may be subject to clearance for free-release.

14.1.3 Prior to free-release

Prior to clearance for free-release being granted, decontamination and an inspection of materials and premises must be carried out.

Inspections of materials and premises are conducted by taking measurements, or estimates that have been verified by measurements. Measurement is carried out using the same instrument as used for checking for contamination. Prior to the inspection, an inspection programme must be drawn up. The programme must describe:

- what is to be inspected and what contamination is thought to be present
- the methodology to be used for the inspection
- how the material will likely be managed and used following free-release
- how the inspection will be quality-assured and documented.



14.1.4 Documentation of free-release

Inspections and their results, as well as the decisions made and measures in the case of free-release, must be documented. The documentation must be kept until free-release has occurred and thereafter for ten years or for the period specified by the Swedish Radiation Safety Authority. The documentation must describe:

- what was inspected
- the inspection methodology and who carried out the inspection
- presence of radioactive contamination
- how the inspection methodology, the inspection itself and the results have been quality-assured
- who has authorised the free-release of other hazardous waste sent for incineration or landfill and who the recipient is.

15. Purchase of radiation sources

15.1 Purchase of technical equipment

Prior to the purchase of technical equipment capable of and intended to emit ionising radiation (X-ray equipment, electron capture detectors, liquid scintillation counters, etc.), the Radiation Protection Expert must be contacted for advice. Once the order is complete, a report must be sent immediately to the University's Radiation Protection Coordinator. The report to the Radiation Protection Coordinator must include a copy of the order, the responsible department and section, the make, type designation and serial number.

For electron capture (EC) detectors and liquid scintillation counters the following must also be specified:

- the type of radiation source
- activity in Becquerel (Bq) and reference date.

For X-ray equipment, the following must also be specified:

- maximum kilovolt (kV)
- maximum milliampere (mA).

15.2 Purchase of unsealed and sealed radiation sources

The Radiation Protection Expert does not need to be contacted when purchasing unsealed radiation sources containing an isotope that is already part of the local operation, provided that it is included in the previous year's inventory of radiation sources and is included in the local operation's waste management plan. This does not apply to the purchase of fissile materials (uranium, thorium and plutonium). In these cases, the Radiation Protection Expert and the Radiation Protection Coordinator must be contacted before each order is made. The Radiation Protection Coordinator must also be contacted before ordering if the purchase will lead to deviations from the waste management plan for the local operation.



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When purchasing sealed sources or purchasing unsealed sources containing an isotope not included in the previous year's inventory for the local operation, the Radiation Protection Expert must be contacted for advice.

When ordering a sealed source, a report must be sent immediately to the Radiation Protection Coordinator. The report to the Radiation Protection Coordinator must always include a copy of the order, the responsible department and section, and:

- activity in Bq (or Bq/ml) and reference date
- decay type (alpha, beta or gamma).

16. Unsealed radiation sources

16.1 Work with unsealed radiation sources

Work with unsealed radiation sources must be planned so that employees receive the smallest radiation dose possible. Employees have an obligation to comply with this planning. This means, but is not limited to, the following:

- Work with unsealed radiation sources may only take place in a designated and enclosed area with adequate signage.
- Protective gloves must always be worn. Laboratory coats and other protective clothing such as a visor or hair protection must be used if splashing is a risk.
- The laboratory bench must always be protected with absorbent paper with a plastic backing that is changed after each laboratory session, or an equivalent solution. Contaminated protective paper is to be treated as radioactive waste.
- When working with high-energy beta emitters, radiation shields must be used.
- If there is a high risk of splashing or a risk of radioactive gas/aerosols leaking out, the work must be carried out in a fume cupboard/fume bench.
- Eating, drinking, using Swedish snuff or storing food in a workplace where unsealed radiation sources are stored or used is strictly prohibited.
- After completion of the work, the work surface must be wiped down and a contamination inspection carried out. This is not required when using alpha emitters and low-energy beta emitters.
- After completion of the work, employees must wash their hands before leaving the laboratory.

16.2 Design of premises and signage

The premises must be adequate for work with unsealed radiation sources, and the signage must be accurate. Contact the Radiation Protection Expert for advice. Work surfaces intended for handling unsealed radiation sources must be framed with warning tape. Specially marked bins must be provided for radioactive waste and residual radioactive material.

The following signs must be placed directly adjacent to the premises so that no one can enter the premises without having been made aware of the information:



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- The layout of the premises (Controlled/Protected area)
- Warning for ionising radiation
- Type of radiation source (unsealed/sealed, alpha/beta/gamma).

The following sign must be placed in the premises so that everyone working there can access the following information:

- Contact details of the local contact person and the Radiation Protection Expert.

The following information must be readily accessible in the premises, so that everyone working there can access the information:

- Procedure for individual work steps
- Procedure in the case of an accident, incident or deviation
- Procedure for contamination measurement.

16.3 Access to premises

Only authorised employees with relevant training and knowledge of local procedures may enter a laboratory where unsealed radiation sources are handled. Relevant training includes the basic radiation protection course provided annually by the Radiation Protection Expert. If an employee has received training elsewhere, the Radiation Protection Expert may be contacted for validation of that training. Access may be restricted by means of locked doors, signage or another solution depending on the characteristics of the radiation sources and how they are handled. Contact the Radiation Protection Expert for assistance with this assessment.

16.4 Contamination control

Contamination control instruments must be available at the workplace. The instrument must be calibrated annually, either via the supplier or with the assistance of the Radiation Protection Expert. Contamination control must be carried out after each work step when handling high-energy beta emitters and gamma emitters. When working with low-energy beta emitters, smear test measurements must be carried out at least once every six months and always after a spillage.

16.5 Spillage

There must be procedures in place for spillage at the local operation. If a spillage occurs, thorough cleaning must be done as soon as possible. It is best to wipe up spills with an absorbent material, while being careful not to spread the activity further. After cleaning, a contamination control must be carried out. Spills on the skin must always be washed off promptly, as low-energy beta emitters in particular can emit locally high radiation doses. Accidents, incidents and deviations must always be reported.

16.6 Storage and labelling

Unsealed radiation sources must be kept locked away and labelled with the ionising radiation warning symbol. The storage container must also be labelled with the radionuclide, the



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amount of activity and the reference date for the stated activity. The storage site must be marked with the warning sign 'Storage site for radioactive material' (*Förvaring av radioaktivt material*) and the storage site for the waste must be labelled with the sign 'Storage site for radioactive waste' (*Förvaringsplats för radioaktivt avfall*).

16.7 Documentation

The following documents must be available and stored locally:

- List of employees working with ionising radiation in the local operation
- Procedure for granting access and the list of those granted access to the laboratory where ionising radiation activities are conducted
- Descriptions of the work steps related to ionising radiation
- Waste management plan and procedures for managing waste, such as transport and storage
- Procedure for contamination measurement
- Procedure for calibrating instruments that measure ionising radiation
- Procedures for basic radiation protection training for new employees and refresher courses
- List of those who have completed the initial or refresher course in basic radiation protection
- Procedures regarding pregnancy and breastfeeding
- Procedures for spills and similar incidents
- Procedures for ordering, receiving, internal transport and disposal of radioactive substances
- Decommissioning plan for the operation.

17. Sealed radiation sources

17.1 Work with sealed radiation sources

Work with sealed radiation sources must be planned so that employees receive the smallest radiation dose possible. Employees have an obligation to comply with this planning. This means, but is not limited to, the following:

- Work with sealed radiation sources may only take place in a designated and enclosed area with adequate signage
- Employees must have a sound knowledge of how to use the source/device in a way that ensures protection from the radiation
- Any required protective equipment must always be worn during exposure.

17.2 Design of premises and signage

The premises must be adequate for work with sealed radiation sources, and the signage must be accurate. It must be clearly apparent when exposure is in progress. Contact the Radiation Protection Expert for advice. The radiation source must be stored in such a way that no unauthorised person can gain access to it. The radiation source must be labelled with:



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- warning symbol for ionising radiation
- substance
- activity
- reference date.

The following signs must be placed directly adjacent to the premises so that no one can enter the premises without having been made aware of the information:

- The classification of the premises (Controlled/Protected area)
- Warning for ionising radiation
- Type of radiation source (unsealed/sealed, alpha/beta/gamma).

The following sign must be placed in the premises so that everyone working there can access the following information:

- Contact details of the local contact person and the Radiation Protection Expert.

The following information must be readily accessible in the premises, so that everyone working there can access the information:

- Procedure for individual work steps
- Procedure in the case of accident, incident or deviation.

17.3 Access to premises

Only authorised employees with relevant training and knowledge of local procedures may enter a laboratory where sealed radiation sources are handled. Relevant training includes the basic radiation protection course provided annually by the Radiation Protection Expert. If an employee has received training elsewhere, the Radiation Protection Expert may be contacted for validation of that training. Access may be restricted by means of locked doors, signage or another solution depending on the characteristics of the radiation sources and how they are handled. Contact the Radiation Protection Expert for assistance with this assessment.

If no radiation is generated while the device is switched off, employees may be present in the premises when no exposure is in progress.

17.4 Documentation

The following documents must be available and stored locally:

- List of employees working with ionising radiation in the local operation
- Procedure for granting access and the list of those granted access to the laboratory where ionising radiation operations are conducted
- Descriptions of the work steps related to ionising radiation
- Procedure for calibrating instruments that measure ionising radiation where calibration is applicable
- Procedures for basic radiation protection training for new employees and refresher courses

- List of those who have completed the initial or refresher course in basic radiation protection
- Procedures regarding pregnancy and breastfeeding
- Servicing plan/servicing agreement for sealed radiation sources
- Instructions for use of the equipment used
- Decommissioning plan for the operation.

18. Waste

18.1 Equipment containing a radiation source

Before discarding the equipment, remove any radiation source and store it in a way that ensures protection from its radiation. The Radiation Protection Expert can help with the removal of the radiation source.

If the equipment has one of the symbols in Figure 1 on any side, it contains radioactivity that needs to be removed before discarding it. However, the absence of a warning symbol does not necessarily mean that the equipment is definitely free of radioactivity. Refer to the equipment's manual for information on any possible source of radiation.

Unused X-ray equipment must be rendered unusable before discarding. In cases of uncertainty, contact the Radiation Protection Expert for advice.



Figure 1. Radioactivity warning symbols.

Examples of equipment that may contain radioactive substances include:

- liquid scintillation counters
- eliminators
- X-ray fluorescence analysers
- grammage meters
- level gauges
- thickness meters
- densometers.

There may be additional equipment not mentioned here. Note that the equipment may have a different name, for example, liquid scintillation counters are often called beta counters or alpha counters.



18.2 Management of radioactive waste

An operation that produces radioactive waste must have a waste management plan and procedures that describe how the waste is to be managed. There are statutory limits (Swedish Radiation Safety Authority's Regulations SSMFS 2018:3, Annex 1) on the amount of waste the operation in total may dispose of per calendar month and these limits determine whether or not waste can be cleared for free-release or not. As it is the cumulative waste from the operation in total that is counted, the waste management plan and procedures for the local operation must be coordinated annually with the Radiation Protection Coordinator. This is carried out in connection with the annual inventory to be taken by the local activity during quarter 3.

18.2.1 Free-release waste

Radioactive waste with such a low level of radioactivity that the waste does not exceed the activity limit specified in the Swedish Radiation Safety Authority's Regulations SSMFS 2018:3, Annex 1, may be exempted from certain provisions of the Swedish Radiation Act and therefore does not require any special measures. It is then regarded as free-release waste and can therefore be sent for incineration or poured down the drain according to the instructions below. At present, only unsealed radiation sources can be cleared for free-release.

Remember to sort different isotopes into different containers.

Solid waste

Examples of solid waste are single-use materials such as gloves, underlay paper, syringes, hoses and vessels used when working with solutions of radioactive isotopes. Free-release solid waste is collected in a special bin with a lid and a plastic liner. The plastic liner is sealed once it is filled and disposed of without further action along with other waste sent for incineration.

Liquid water-soluble waste

Free-release liquid water-soluble waste may be poured down a drain, provided that in each instance its activity does not exceed the radioactivity limit specified in the Swedish Radiation Safety Authority's Regulations SSMFS 2018:3, Annex 1. Flush with plenty of water in each instance of discharge down a drain. Discharge of radioactive waste should be limited to one discharge point/drain per laboratory. At the discharge point, there must be clearly visible signage indicating that liquid radioactive waste may be discharged into the wastewater system/down the drain.

Liquid non-water-soluble waste

Free-released liquid non-water-soluble waste must be delivered to the Hazardous Waste Building.

18.2.2 Storage pending clearance for free-release or transfer

Waste can be stored locally if it is adequately managed (locked premises intended for radiation sources) pending clearance for free-release or transfer to Region Västerbotten. This applies primarily to substances with a short half-life. For further information or clarification, contact the Radiation Protection Expert. Examples of radiation sources that can be stored



pending clearance for free-release are the bodies of animals and other waste that requires freezing. These must not be mixed with other waste.

Remember to sort different isotopes into different containers.

18.2.3 Transfer of waste to Region Västerbotten

Waste that cannot be free-released

Radioactive waste with levels of activity too high for the waste to be cleared for free-release is considered a radiation hazard and therefore requires special procedures for its treatment and final deposition. Umeå University has an agreement with Region Västerbotten, which takes care of the radioactive waste that the University produces, and which cannot be free-released and sent for incineration, or free-released into the wastewater system.

Procedures must be in place to ensure that transport and delivery is carried out in a way that ensures radiation safety. For further information or clarification, contact the Radiation Protection Expert.

When an operation needs to dispose of radioactive waste, Region Västerbotten must be notified, and the time of the handover must be booked via e-mail. You can find the e-mail address on the Radiation Protection web pages. Employees at Region Västerbotten's waste storage room may refuse to accept radioactive waste that is incorrectly sorted or inadequately packaged. Waste with unknown activity may need to be sent to specialised companies that handle radioactive waste for final disposal, which in such cases is paid for by the submitting local operation.

Remember to sort different isotopes into different containers.

Solid waste

Examples of solid waste include containers containing stock solutions, underlay paper and materials that have been used in connection with stock solutions with high specific activity and are suspected of being highly contaminated, as well as the bodies of animals, organs and wood shavings used as bedding for laboratory animals treated with radioactive substances. Radioactive solid waste may only be placed in special containers intended for hazardous waste. Once the container is full, the lid must be properly sealed and labelled and delivered to Region Västerbotten's waste storage room.

Ensure that the lid of the container is securely attached. If the contents fall out when the container is lifted, it can pose a significant risk to the employee.

Bottles and ampoules

Bottles and ampoules that contain or have contained, for example, a stock solution, sealed radiation sources or calibration preparations must not be mixed with other radioactive waste. These must be handed over separately together with the radiation shielding in which they were originally delivered, such as lead containers.

Liquid water-soluble waste

Radioactive liquid waste must be delivered to Region Västerbotten's waste storage room in a tightly sealed container and must be labelled.



Liquid non-water-soluble waste

Non-water-soluble liquid waste must be delivered to Region Västerbotten's waste storage room.

The exception is liquid scintillation solutions that generally have low levels of activity and thus do not need to be treated as radioactive waste. Because they are not water-soluble, they must not be poured down a drain, but must be deposited with the University's Chem Store. Liquid scintillation solutions containing alpha-emitting radionuclides or having an activity concentration greater than that specified in SSMFS 2018:3, Annex 1, are special cases. These are considered to be radioactive liquid waste and must be delivered to Region Västerbotten's waste storage room.

Documentation

The local operation must document how much waste (in terms of its activity) is sent to Region Västerbotten's waste storage room. Local procedures must be in place to ensure that the documentation is properly maintained and stored locally.

Radioactive waste transfer form

The 'Transfer of radioactive waste' form (*Överlämning av radioaktivt avfall*) must be used prior to delivery of radioactive waste to Region Västerbotten. The form is available on the Radiation Protection web pages. Two copies of the form must be completed. The department keeps one copy as documentation that the transfer has been carried out in accordance with the regulations, and the other is submitted to the recipient at Region Västerbotten.

Liquid waste label

Before you can deliver liquid waste, the vessel containing the liquid must have a label showing the following details:

- Type of isotope it contains
- Start Date – the date the vessel started being filled
- End Date – the date when the vessel was sealed
- Calculated activity in Bq
- Contact details
- Type of solvent.

Chem Store

The visiting address of the Chem Store is Kemi A, Level 2, Linneaus väg 8.

Region Västerbotten's waste storage room

Region Västerbotten's waste storage room is provided by the Region's Centrum för informationsteknik och medicinsk teknik (CIMT) (*Centre for Information Technology and Medical Technology*⁶). The waste storage room can be found at the University Hospital of Umeå (*Norrlands universitetssjukhus*) in building 27, target point QA, level -1 (culvert) in rooms 27–1020. The room is signposted Radioaktivt avfall (*Radioactive waste*).

⁶ No official English title is available