

# RADIATION PROTECTION TRAINING IN HEALTH CARE

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APPENDIX A CONTENT OF RADIATION PROTECTION TRAINING FOR HEALTH CARE PERSONNEL

APPENDIX B MINIMUM AMOUNT OF RADIATION PROTECTION TRAINING AND THE TARGET COMPETENCE REQUIRED FOR HEALTH CARE PERSONEL

This Guide is valid as of 1 February 2013 until further notice.

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# Authorization

The Radiation Act stipulates that the party running a radiation practice is responsible for the safety of the operations. The responsible party is obliged to ensure that the level of safety specified in the ST Guides is attained and maintained.

Under section 70, paragraph 2, of the Radiation Act (592/1991), STUK – Radiation and Nuclear Safety Authority (Finland) issues general instructions, known as Radiation Safety Guides (ST Guides), concerning the use of radiation and operations involving radiation.

Translation. In the event of any differences in interpretation of this guide, the Finnish and Swedish versions shall take precedence over this translation.

# 1 General

The party running a radiation practice (hereafter the responsible party) shall be liable for the safe use of radiation. In health care, radiation safety includes the radiation safety of workers engaged in radiation work, patients and other persons. The radiation safety of patients is a part of patient safety.

In medical uses of radiation, all staff employed by the responsible party or otherwise engaged in the use of radiation shall be qualified as required for the particular duties and be appropriately trained in radiation protection. The responsible party shall be responsible for the competence of the staff and the sufficiency of their radiation protection training.

This Guide presents, with respect to the use of ionising radiation, the objectives relating to the contents and minimum amounts of radiation protection training to be given to health care staff during their basic and further training (specialization studies) as well as during training offered to them as supplementary training. The purpose of this Guide is to ensure that all health care staff engaged in the use of ionising radiation is given sufficient radiation protection training so that their own safety as well as the safety of their patients and all other persons is ensured in all phases of the medical use of radiation.

The term basic training in this Guide shall mean education leading to a vocational qualification or degree, and further training shall mean the studies thereafter that lead to a subsequent vocational qualification or degree, or a special qualification. The term supplementary training shall refer to the training that is on the duty of the responsible party to organize in order to ensure that all staff engaged in the use of radiation have current knowledge appropriate to their duties concerning ionising radiation and its effects, radiation protection, current radiation legislation, and other provisions and guidelines governing the use of radiation.

This Guide shall not apply to training in non-ionising radiation or its use.

*Provisions concerning the responsible party's general duty of care and the expertise required of the*

*responsible party in matters related to the safety of operations are laid down in section 14 of the Radiation Act (592/1991).*

*The requirements for the training and qualifications of health care professionals in duties involving the use of radiation are prescribed in chapter 5 of the Decree of the Ministry of Social Affairs and Health on the medical use of radiation (423/2000, hereafter referred to as the MSAH Decree).*

*Section 8 of the Health Care Act (1326/2010) and the related Decree (341/2011) of Decree of the Ministry of Social Affairs and Health lay down provisions for the quality of health care and patient safety as well as for the quality management and patient safety implementation plans required of health care units in the health care system that is organized under the responsibility of local authorities.*

*In addition, section 3 of the Private Health Care Act (152/1990) lays down provisions concerning operational conditions such as facilities, equipment, appropriate training of staff and due attention to patient safety.*

## 2 Radiation protection training is given during basic and further training and as supplementary training

Health care professionals engaged in the use of radiation are required to be given radiation protection training in the following circumstances:

- in the context of their basic and further training
- in the form of supplementary training on a regular basis throughout their careers
- when new radiation appliances are introduced for use (user training)
- when new examination and treatment procedures are introduced.

### 2.1 Radiation protection in basic and further training

Physicians who refer patients for procedures involving exposure to ionising radiation,

physicians who take responsibility for these procedures, workers who perform these procedures and all other staff involved in the use of radiation shall have adequate knowledge of such radiation protection as is required for their duties. Radiation protection training shall include the following sectors: fundamentals of radiation physics, fundamentals of radiation biology, radiation protection provisions, radiation safety at the workplace, and the medical use of radiation.

The target is that before professionals in health care start work, the contents and minimum amounts of their radiation protection training as well as the competence they have acquired through the training meet the objectives presented in Appendices A and B of this Guide. Each training organization shall specify the training they offer and the related learning outcome targets in more detail. At least one half of the radiation protection training included in basic training should be given in the form of guided instruction (contact teaching). The rest of the training may consist of independent study as specified in the respective curriculum.

It is recommended that radiation protection training be arranged as specific courses. If, however, radiation protection training is integrated into other courses or training modules due to considerations of expediency, the course descriptions and module descriptions shall clearly itemize the contents and amount of this training, and the completion of the training shall be documented. These descriptions shall establish clearly which parts of the courses constitute radiation protection training such as is referred to in this Guide. However, this requirement shall not apply to basic education that cannot be considered vocational training in health care. The standard procedure in educational institutions is that students may apply for formal accreditation of their studies if they have previously acquired learning that may fulfil the objectives of the curriculum.

If radiation protection training as presented in this Guide was not included in the basic training of a worker engaged in radiation work, the responsible party is required to see to it that this worker is given the necessary radiation

protection training before starting work. In such a case, the responsible party shall assess the worker's competence and make a plan which shows what radiation protection training is needed (see Item 2.2, first paragraph); the training shall be documented.

Instruction in the fundamentals of radiation protection shall be included in the basic training curriculum in the relevant fields of study in a manner suitable for each professional group. The further training subsequent to the basic training of persons involved in the use of radiation should include, depending on the field of specialization, advanced studies of the aspects set out in Appendix A. Further training should emphasize the special features of radiation safety inasmuch as they are required for the duties in each field of specialization.

Educational institutions shall monitor the quality of the radiation protection training they provide so that their trainees can acquire adequate, up-to-date competences.

*Sections 23 and 24 of the MSAH Decree lay down provisions concerning STUK's authority to prescribe content requirements for radiation protection training to be given to physicians that refer patients for examinations and treatments (procedures) involving exposure to radiation, and to physicians responsible for these procedures, unless the basic training of these physicians has included a demonstration of such knowledge.*

*The provisions concerning STUK's authorization to confirm the qualifications for persons working in radiation users' organizations and to investigate compliance with the said qualifications are laid down in section 18 of the Radiation Act. Qualification and radiation protection training requirements for radiation safety officers and persons working in radiation users' organizations are given in Guide ST 1.8.*

*Section 13 of the Radiation Decree (1512/1991) lays down provisions concerning the conversance of the medical practitioner responsible for the medical surveillance of occupationally exposed workers in category A with occupational health care and with the health effects of radiation. More detailed requirements concerning the medical practitioner's conversance with health effects are presented in Guide ST 7.5.*

## **2.2 Maintenance of radiation protection knowledge and skills through supplementary training**

The responsible party shall ensure that employees have the competences and radiation protection training required for the conduct of their duties under the relevant statutes. If the demonstration of the required knowledge was not a part of an employee's basic studies (as, for example, in the case of a degree earned abroad), then the knowledge may be acquired through separate radiation protection training, which shall meet the content requirements presented in this Guide. The responsible party shall arrange any radiation protection training that an employee may lack, and the completion of the training shall be documented.

The responsible party shall ensure that all employees receive the supplementary training referred to in this Guide to keep their radiation protection knowledge and skills current. Supplementary training shall be organized, in particular, concerning new examination and treatment methods. In addition, employees returning to work after long absences (e.g. three years or longer) shall receive the necessary supplementary training in radiation protection as well as an introduction to their tasks.

If any employees engaged in radiation work are not employed by the responsible party but the work is to be performed under a commission agreement, a good practice of ensuring the meeting of the supplementary training requirements is to state the requirement in the contract document.

It is also good practice to ensure that physicians issuing referrals for examinations involving exposure to radiation have appropriate training in radiation protection even when they are not employed by the responsible party. X-ray units, nuclear medicine units and radiotherapy units often have the best conditions for offering supplementary training also for referring physicians.

The responsible party must maintain records of the details of the supplementary training (content and amount of training) of all staff engaged in the use of radiation so that this supplementary training can be verified for each

worker for a period of no fewer than five years. It is a recommended practice that the responsible party prepares a supplementary training programme for workers and also monitors the implementation of the programme.

The supplementary training of staff engaged in the use of radiation shall, over five year periods, include at least the minimum amount of radiation protection training presented in the table in Appendix B. In addition to this, health care professionals functioning as radiation safety officers and medical physics experts shall receive no less than 20 hours of supplementary training over a period of five years.

The supplementary training may be guided instruction (group work, demonstrations, guided practical exercises), independent study, or participation in training events. If a supplementary training programme contains independent study, the proportion of independent work shall be specified in advance, and that independent work shall be documented.

Supplementary training shall include revision of the essential aspects of radiation protection that were already covered in basic and further training. Supplementary radiation protection training for referring physicians shall include, in particular, assessing the justification of examinations and procedures involving exposure to radiation and the risks involved in a particular examination or procedure, and informing patients of them. Supplementary training shall emphasize the special features of radiation safety that are necessary in the particular duties; the training shall include the following matters:

- the changes that have occurred in the use of radiation in that particular field
- assessment of justification and optimization in the case of new examination and treatment procedures and new radiological devices
- the changes in radiation legislation and recommendations
- an update of information concerning radiation safety and radiation exposures arising from examinations and procedures involving exposure to radiation
- the latest information on the effects of radiation.

Supplementary training of physicians performing medical surveillance shall pay particular attention to the health effects of radiation.

It is the recommended practice to award certificates of supplementary training to trainees, detailing the amount and content of the training and indicating that the training constitutes supplementary training as referred to in section 27 of the MSAH Decree. The responsible party shall determine for the respective workers how great a part of the supplementary training referred to in this Guide is covered by the training received by these employees.

*Section 27 of the MSAH Decree lays down the provisions concerning STUK's authority to confirm the requirements for the contents of professional supplementary training in radiation protection for persons participating in the medical use of radiation.*

*The contents and documentation of supplementary training for employees of radiation users' organizations and for other individuals involved in the use of radiation are discussed also in Guide ST 1.8.*

*Guide ST 1.4 proposes that the fulfilling of the relevant competence and supplementary training requirements be stated in the contract documents in the cases in which the medical practitioners or experts are not employed by the responsible party.*

### **2.3 Familiarization training and user training when new radiation appliances and examination and treatment procedures are introduced**

In addition to radiation protection training included in basic and further training and regular supplementary training, users of radiation shall be introduced to radiation-safe working methods and to the optimal use, in the view of safety, of each radiation appliance and radiation source. This shall apply, in particular, to workers participating in any of the following:

- uses of radiation causing high exposure such as in radiotherapy, interventional radiology and computer tomography
- uses of radiation involving groups whose additional risks due to exposure to radiation are significant; these uses include e.g. examinations and procedures that expose children to radiation
- screening examinations

- uses of unsealed sources and combined computed tomography imaging in nuclear medicine.

The user training provided by the device supplier, guiding users in the optimal, radiation-safe use of the device, shall form an essential part of this familiarization training. In addition, when new examination and treatment procedures are introduced, software is changed or other significant changes occur, workers shall receive the necessary supplementary training in radiation protection.

It is recommended that the user training and guidance in the use of the appliances provided by their suppliers, as well as any supplementary training in special examinations such as screening mammography or dental cone beam computed tomography (CBCT), be entered in the training records of the respective employees.

## **3 Training organizations are responsible for the quality of the training they provide**

The radiation protection training received by health care personnel shall be such that trainees obtain the radiation protection competence required of them in their duties in medical uses of radiation.

It is good practice for training organizations to assign a person to be in charge of radiation protection training; this person shall ensure that the requirements set forth in radiation legislation concerning such training are fulfilled, and that the appropriate course descriptions are written and course objectives set. Persons in charge shall be experts in radiation protection in the fields for which they are responsible. These individuals shall be knowledgeable about radiation protection, possess practical radiation protection skills, and understand the use of radiation in clinical work. If such expertise is not available within an organization, this organization shall use the services of external experts.

Training organizations shall ensure that

their trainers are qualified to provide radiation protection training. It is good practice that individuals giving radiation protection training are experts in the specialized field in which they teach radiation protection. This means that trainers, in addition to having a comprehensive understanding of radiation protection, are aware of the clinical practices in the use of radiation in that special field and know the most recent examination and treatment procedures in practice. Such competence can be best demonstrated with vocational diplomas, certifications and employment certificates.

Trainers shall possess current information and their competence levels must be appropriate for the topics they teach as well as for the competence levels of their trainees. In the course of five years in addition to independent study, trainers should have no fewer than 20 hours of supplementary training in radiation protection in line with what is presented in Item 2.2.

Supplementary training for trainers can be acquired from various educational events and conferences, or through independent study. It is important that training organizations prepares plans for their trainers regarding the required supplementary training, and then monitor the implementation of the plans.

The best way for user training for radiation appliances to take place is as teamwork in places of use of radiation.

Basic and further training for health care staff as well as the related radiation protection training are provided by universities, universities of applied sciences, polytechnics, and vocational education institutions. Supplementary training in radiation protection may be arranged by educational institutions that arrange respective basic and further training, by professional associations and organizations, and by other training organizations. If a party responsible for the use of radiation arranges its own supplementary training courses or uses private specialists as trainers, then the responsible

party shall ascertain that these specialists are qualified to provide supplementary training in radiation protection.

STUK's opinion or statement may be requested when necessary concerning a radiation protection training programme in order to verify in advance that the training will comply with this Guide. No separate approval is required from STUK if the radiation protection training is implemented with the content and amount as is set out in this Guide.

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## APPENDIX A

### Content of radiation protection training for health care personnel

Radiation protection training shall include the following matters in a manner that is suitable for each professional group:

#### 1 Fundamentals of radiation physics

- the structure of atoms and atomic nuclei, radioactivity
- types and sources of radiation
- interactions between radiation and matter
- quantities and units of radiation
- detection and measurement of radiation

#### 2 Fundamentals of radiation biology

- effects of radiation and their recognition
- risk of cancer due to radiation and the risk of inheritable and deterministic effects
- assessment of radiation risk

#### 3 Radiation protection provisions

- legislation and guidelines concerning radiation, their international foundations (EU statutes and guidelines, recommendations of ICRP, IAEA and WHO)
- other provisions governing radiation (health care legislation, the parts of nuclear energy legislation and emergency powers legislation applicable to health care, etc.)
- regulatory control of the use of radiation and the regulatory authorities

#### 4 Radiation safety at the workplace

- safety licence and reporting obligation
- radiation user's organization, radiation safety of equipment and facilities, radiation safety arrangements at the workplace and the safety culture
- monitoring of radiation exposure and medical surveillance of workers
- dose limits and dose constraints
- warning and alarm equipment, warning signs and safety arrangements
- abnormal events and measures in the case that any should take place

#### 5 Medical use of radiation

##### 5.1 X-ray examinations, dental X-ray examinations and procedures involving exposure to X-radiation

- X-ray equipment, examination and treatment methods, and alternative methods
- general principles of radiation protection (justification, optimization), reference levels for X-ray examinations and procedures
- indications for examination, referral criteria and the related practices
- factors affecting exposure to radiation and image quality
- special examinations (e.g. procedures exposing children and pregnant women to radiation, screening examinations, scientific research, medico-legal examinations)
- radiation protection of the patient and staff
- quality assurance, self-assessment and clinical audits

- patient doses, determination of patient doses, the related quantities and units
- assessing radiation risk and explaining it understandably to the patient

## **5.2 Nuclear Medicine**

- fundamentals of nuclear medicine
- equipment used in nuclear medicine, radiopharmaceuticals, methods of examination and treatment, alternative examination methods, scientific research
- general principles of radiation protection (justification, optimization), reference levels in nuclear medicine
- indications for examination and referral criteria
- factors affecting exposure to radiation and image quality
- work with unsealed sources
- storage of radioactive substances, radioactive wastes
- radiation protection of the patient and staff
- quality assurance, self-assessment and clinical audits
- patient doses, determination of patient doses
- assessing radiation risk and explaining it understandably to the patient
- instructions concerning children, pregnant women and breastfeeding mothers
- release of patients after radionuclide therapy

## **5.3 Radiotherapy**

- equipment and methods used in radiotherapy, treatment indications, alternative treatment methods, scientific research
- general principles of radiation protection (justification, optimization) in radiotherapy
- biological principles of radiotherapy, phenomena at the cellular and molecular level in tumours and normal tissue
- factors modifying the effects of radiation (fractionation, time, dose rate, oxygen concentration, etc.)
- direct effects of radiation, late reactions in normal tissue, risks involved in radiotherapy
- assessing radiation risk and explaining it understandably to the patient
- radiotherapy dosimetry
- dose planning and confirming of treatment
- symptoms and treatment of acute radiation syndrome
- quality assurance, self-assessment and clinical audits
- radiation protection of the patient and staff.



## APPENDIX B

### Minimum amount of radiation protection training and the target competence required for health care personnel

The table shows the necessary competences in radiation protection and the minimum amount of radiation protection training per professional group as required for the duties in each field. The target competences are not directly comparable across the professional groups.

**Table.** Minimum amount of radiation protection training and target competences required for professional groups engaged in the medical use of radiation.

One ECTS credit (cr) corresponds to approximately 27 hours of studying, and one study week (sw) corresponds to about 40 hours of studying. At least one half of the radiation protection training included in basic training should be given in the form of guided instruction (contact teaching). The rest of the training may consist of independent study as specified in the respective curriculum. Supplementary training may be guided instruction, independent study or participation in training events.

Professional group	Minimum amount of radiation protection training during basic or further training	Amount of supplementary training in radiation protection over a period of five years	Target competences <sup>8)</sup> grouped per subject area (see Appendix A)			
			Fundamentals of radiation physics	Fundamentals of radiation biology	Radiation protection provisions	Radiation safety measures at the workplace
<b>Professional groups involved in the use of radiation</b>						
Radiologist and interventional radiologist	3 cr (80 h)	40 h	III	III	III	III
Physician using a great deal of radiation, e.g. interventional cardiologist	3 cr (80 h)	40 h	III	III	III	III
Radiation oncologist	3 cr (80 h)	40 h	III	III	III	III
Specialist in clinical physiology and nuclear medicine	3 cr (80 h)	40 h	III	III	III	III
Orthopaedist, cardiologist, other physician using radiation	2 cr (54 h)	20 <sup>1)</sup> h	II	II	III	II
Dentist specialized in radiology <sup>2)</sup>	2,5 cr (68 h)	20 h	II	III	III	III
Other dentist	2 cr (54 h) <sup>3)</sup>	20 h	II	II	II	II
Radiographer	4,5 cr (120 h)	40 h	II	II	II	III
Nurse or practical nurse working in a cardiology laboratory, gastroenterology, or in an operating room, or otherwise participating in procedures involving high exposure to radiation	2,0 cr/1,4 sw (54 h) <sup>4)</sup>	20 h	I	I	I	I
Staff in an isotope laboratory <ul style="list-style-type: none"> <li>• chemist</li> <li>• bioanalyst, nurse or laboratory technologist</li> </ul>	3 cr (80 h) <sup>4)</sup> 2,0 cr (54 h) <sup>4)</sup>	40 h 40 h	III I	III I	III II	III I
Dental hygienist, practical nurse graduated from a degree programme in oral health care, or other health care professional who may perform dental imaging as instructed by a physician	1,5 cr/1,0 sw (40 h) <sup>3) 4)</sup>	20 h	I	I	I	I
Nurse or practical nurse graduated from a degree programme in emergency care, and other health care staff that may assist in performing procedures involving exposure to radiation under the supervision of the physician responsible for the procedure	1 cr/0,7 sw (27 h) <sup>3) 4)</sup>	20 h	I	I	I	I
Technical staff <sup>5)</sup>	1,5 cr/1 sw (40 h) <sup>4)</sup>	20 h	II	II	II	II
Hospital engineer <sup>6)</sup>	2 cr (54 h) <sup>4)</sup>	20 h	II	II	II	III
Hospital physicist	6 cr (160 h)	40 h	III	III	III	III
<b>Other professional groups</b>						
Referring physician	1,5 cr (40 h)	8 h	II	II	II	I
Physician performing medical surveillance <sup>7)</sup>	2 cr (54 h)	20 h	II	III	II	II

- 1) Orthopaedist, cardiologist or other physician using a great deal of radiation 40 h.
- 2) Dentist specialised in clinical dentistry with bias on radiology.
- 3) In addition, when starting operation, dentists responsible for CBCT examinations and nurses performing dental X-ray imaging are required to complete the supplementary training specified in Guide ST 3.1, if such training was not included in their basic or further training.
- 4) Minimum amount of radiation protection training when starting work.
- 5) "Technical staff" here refers to technical professionals engaged in radiation work, such as engineers, polytechnics engineers, technicians, service technologists and other vocationally trained mechanics, fitters and experts.
- 6) "Hospital engineer" here refers to a technical professional engaged in radiation work, such as a university or polytechnics engineer with a master's or bachelor's degree and who functions as a hospital engineer.
- 7) Medical practitioner responsible for the medical surveillance of occupationally exposed workers in category A as referred to in section 33 of the Radiation Act.
- 8) Target competences:
  - I: The trainee understands, in general terms, the radiation protection concepts and principles pertaining to his or her duties, and in conducting his or her duties, is able to answer ordinary questions on the basis of his or her learning. The objective is that, on the basis of the training, the trainee is able to take care of radiation protection in his or her duties and adopts safe work practice.
  - II: The trainee understands the radiation protection concepts and principles pertaining to his or her duties applying them to practical situations and is able to explain them to others. The objective is that on the basis of the training, the trainee is able to minimize risks involved in the use of radiation, knows the statutes and provisions related to the use of radiation, is able to take care of radiation protection in his or her duties, adopts safe work practices, also instructing others to work safely.
  - III: The trainee understands, in depth, the radiation protection concepts and principles pertaining to his or her duties, is able to apply the knowledge in new types of practical situations, and is able to train and instruct others in the maintenance and improvement of radiation safety. The objective is that on the basis of the training, the trainee is able to recognize, assess and minimize risks involved in the use of radiation and optimize the use of radiation, has an extensive knowledge of the statutes and provisions related to the use of radiation, and is able to apply them in practice, and adopts safe work practices, also instructing and training others to work safely.