

RADIATION PROTECTION TRAINING IN HEALTH CARE

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This Guide is valid as of 1 March 2003 until further notice. The provisions governing requirements for radiation protection training shall be met by no later than the end of 2004 (Ministry of Social Affairs and Health Decree 423/2000, section 29).

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Authorization

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.

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.

Translation. Original text in Finnish.

1 General

The responsible party shall be liable for the safe use of radiation. The responsible party refers to the holder of a safety licence, any business or sole trader, enterprise, corporation, foundation or institution which uses radiation sources in its operations, or any other employer or self-employed person engaged in radiation practices (Radiation Act 592/1991, section 13).

In matters concerning the safety of operations, responsible parties must possess the expertise required with respect to the nature and extent of the operations (Radiation Act, section 14). All persons in the service of the responsible party and involved in the use of radiation shall possess the training and qualifications required for their duties. It shall be the duty of the responsible party to ensure that all personnel have current knowledge that is appropriate to their duties concerning ionizing radiation and its effects, radiation protection, current radiation legislation, and other regulations and instructions governing the use of radiation.

The Radiation and Nuclear Safety Authority (STUK) shall stipulate the qualifications required of a radiation safety officer and of other persons working in the radiation user's organization, and shall investigate compliance with the said stipulations (Radiation Act, section 18).

The requirements for training and qualifications of health care professionals engaged 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, hereinafter referred to as the MSAH Decree).

STUK shall prescribe content requirements for radiation protection training given to physicians referring patients for examinations and treatments (procedures) involving exposure to radiation, and to physicians responsible for the said procedures, unless the basic training of these physicians has included a demonstration of this knowledge (MSAH Decree, sections 23 and 24). STUK shall also confirm the requirements for the content of professional supplementary training with respect to

radiation protection of persons participating in the medical use of radiation (MSAH Decree, section 27).

According to section 13 of the Radiation Decree (1512/1991, Amendment 1143/1998), the medical practitioner responsible for medical surveillance of category A workers, i.e. the physician performing medical surveillance, shall be familiar with occupational health care and the health effects of radiation. Further requirements on familiarity with health effects are set out in Guide ST 7.5.

This Guide presents the content and minimum amount of radiation protection training for health care staff with respect to the use of ionizing radiation. This Guide does not apply to training with respect to non-ionizing radiation and its use.

2 Requirements Concerning Radiation Protection Training

2.1 Basic Training and Further Training

A physician who refers a patient for procedures involving exposure to ionizing radiation, the physician who performs and takes responsibility for the said procedures, and all other staff involved in the use of radiation shall have adequate knowledge of radiation protection required for the said work. Radiation protection training shall include the following subject areas: fundamentals of radiation physics, fundamentals of radiation biology, radiation protection provisions, radiation safety at the workplace and medical use of radiation. The content and minimum amount of training, and the target level of knowledge for the said training divided by subject area in basic and further training (specialization training) for various professional groups are set out in Appendices A and B.

Instruction in the fundamentals of radiation protection shall be included in the basic training syllabus for the study subject concerned in a manner that is suitable for each professional

group. The further training that follows basic training of persons involved in the use of radiation should include advanced studies of the aspects set out in Appendix A depending on the field of specialization. Further training should emphasize the necessary special features of radiation safety in duties pertaining to each field of specialization.

If demonstration of such knowledge was not part of the basic studies of the physician (for example, in the case of a degree earned abroad), then the knowledge may be demonstrated through separate radiation protection training, which must meet the content requirements imposed in this Guide (see section 23 of the MSAH Decree). No retroactive requirement with respect to a radiation protection training of basic studies shall be imposed for persons who are already working in Finland before the entry into force of this Guide.

Even after the entry into force of this Guide, certain duties may be performed by persons whose basic training did not include the minimum amount of radiation protection training set out in the table (Appendix B). Such persons may include, for example, nurses working in cardio-angio laboratories, nurses or laboratory technologists/bioanalysts working in nuclear medicine departments, technical maintenance staff and hospital engineers. Radiation protection training must be provided in such cases as on-the-job training and must be documented.

2.2 Supplementary Training

Responsible parties shall ensure that the staff in their service receive supplementary training enabling their radiation protection knowledge and skills to be kept up to date.

A responsible party shall maintain records of the details of the supplementary training (content and amount of training) of its staff engaged in the use of radiation so that the said supplementary training can be verified for each employee over a period of not less than five years. It is a recommended practice to prepare a programme of supplementary training and also to monitor implementation of the said programme.

The supplementary training of staff involved in the use of radiation must, over five year periods, include at least the minimum amounts of radiation protection training presented in the table in Appendix B. The said training may be guided training (group work, demonstrations, guided practical exercises) or participation in training events. Part of supplementary training may also consist of private study performed according to the supplementary training programme referred to above, the completion of which has been notified to the responsible party by the employee in writing.

Supplementary training should emphasize special features of radiation safety that are necessary in each duty, and the training shall include at least the following matters:

- revision of essential aspects of radiation protection included in basic and further training
- the changes that have occurred in the field of radiation use in question
- the radiation protection aspects required by the development of new examination and treatment practices and radiological equipment
- changes in radiation legislation and recommendations
- an update on knowledge of radiation exposures arising from examinations and procedures involving exposure to radiation and of radiation safety
- the latest knowledge on the effects of radiation.

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

In addition to the radiation protection training involved in basic training and to regular supplementary training, anyone using a radiation appliance and radiation source shall be familiarized with radiation safe working methods for each procedure, and with the optimal use of the radiation appliance and radiation source. This shall apply in particular to staff working in radiotherapy, screening examinations, interventional radiology, computerized tomography, procedures exposing children

to radiation and nuclear medicine. Operator training provided by the supplier to guide the user in the optimal and radiation safe use of an appliance shall form an essential part of this familiarization. Necessary training must also be arranged for the staff following software upgrades or other significant changes. It is recommended that operator training and guidance in the use of appliances provided by the supplier be entered in the training records of the employee.

It is a recommended practice to award a certificate of supplementary training to the employee specifying the amount and content of the training and indicating that the training provided constitutes the supplementary training referred to in section 27 of the MSAH Decree.

The opinion of STUK may be requested where necessary concerning a radiation protection training programme in order to verify that the training complies with this Guide.

3 Provision of Training

The training given by an educational institution or organization providing radiation protection training (a training organization) shall furnish the trainee with the ability to understand the knowledge necessary in radiation protection and to demonstrate radiation safety in practical duties at work. The training organization shall be responsible for ensuring that its trainers are qualified to provide radiation protection training.

Basic and further training of health care staff is provided by such organizations as universities, higher education institutes, polytechnics and institutes of vocational education. It is recommended that the content, minimum amount and target level of knowledge for the radiation protection training included in basic and further training should correspond to this Guide.

The educational institutions that provide basic and further training may also arrange the supplementary training referred to in section 27 of the MSAH Decree. Supplementary training may also be arranged, for example, by professional associations or organizations, or by

other training organizations. If a responsible party arranges its own supplementary training or uses private specialists as trainers, then the responsible party shall ascertain that the said specialists are qualified to provide the supplementary training referred to in the MSAH Decree. No separate approval of STUK shall be required when the content and scope of radiation protection training have been implemented in the manner set out in this Guide.

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APPENDIX A**CONTENT OF RADIATION PROTECTION TRAINING FOR STAFF INVOLVED IN THE USE OF RADIATION IN HEALTH CARE**

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
- quantities and units of radiation
- gamma radiation and particle radiation
- X-radiation
- non-ionizing radiation and ultrasound
- radiation sources (natural radiation, artificial sources)
- internal and external radiation
- interactions between radiation and matter
- attenuation of radiation in matter
- detection and measurement of radiation

2 Fundamentals of Radiation Biology

- effects of radiation at the molecular, cellular and tissue levels
- deterministic and stochastic effects of radiation and their identification
- the threshold value and its significance
- the response curve of radiation and its effects
- radiation burns
- radiation sickness
- effects of radiation on the developing foetus
- observations of radiation-induced cancer in human beings
- assessment of radiation risk

3 Radiation Protection Provisions

- general principles of radiation protection (justification, optimization and dose limits)
- international foundation of radiation protection legislation and regulations (EU, ICRP, IAEA, WHO)
- radiation protection legislation and guides
- other provisions governing radiation (nuclear energy legislation, health care legislation etc.)
- regulatory authorities

4 Radiation Safety Measures at the Workplace

- safety licence and reporting obligation
- radiation user's organization
- operational radiation protection
- regulatory control of radiation use at the workplace
- justification and optimization of radiation use in practice
- categories A and B
- controlled and supervised areas

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- monitoring of radiation exposure of workers (individual monitoring and monitoring of working conditions)
- medical surveillance of workers
- use of protective equipment (patient, staff and person assisting the patient)
- radiation shielding materials
- radiation safety of equipment and facilities
- warning and alarm equipment, warning signs
- documentation
- radiation accidents and associated response measures

5 Medical Use of Radiation

5.1 X-ray Examinations, Dental X-ray Examinations and Procedures Involving Exposure to X-radiation

- generation of X-radiation, X-ray tube and generator
- attenuation of X-radiation, contrast media
- recording of radiation and image formation, images, fluoroscopy, digital imaging
- examination indicators
- use of earlier examination results
- alternative examination methods
- image projections and typical imaging faults
- factors influencing the interpretation of X-ray images
- procedures exposing children and pregnant women to radiation
- examinations of sexually mature individuals
- screening examinations
- scientific research
- medico-legal examinations
- familiarization with use of equipment
- radiation protection of the patient and staff
- factors affecting exposure to radiation
- factors affecting image quality
- optimization of radiation exposure and image quality
- patient doses and their determination (measurements, calculation and reference levels) and corrective actions
- assessment of radiation risks and intelligible explanation to the patient
- quality assurance
- self-assessment and clinical audits
- abnormal occurrences pertaining to X-ray examinations

5.2 Nuclear Medicine

- fundamentals of nuclear medicine
- radiopharmaceuticals
- the radionuclide generator
- imaging and measuring devices
- radionuclide examinations and treatment
- alternative examination methods

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- scientific research
- work with unsealed sources (internal and external radiation, risk of contamination)
- storage of radioactive substances
- radioactive waste
- quality assurance
- patient doses and their assessment, reference levels
- assessment of radiation risk and intelligible explanation to the patient
- instructions concerning children, pregnant women and breast-feeding mothers
- patient discharge following radionuclide therapy
- self-assessment and clinical audits
- abnormal occurrences in nuclear medicine

5.3 Radiotherapy

- radiotherapy methods, radiotherapy practises and radiotherapy implementation (e.g. positioning of patient, dose to surrounding healthy tissue)
- treatment indicators
- alternative treatment methods
- scientific research
- biological principles of radiotherapy, phenomena at the cellular and molecular level in tumours and normal tissue
- factors modifying the effect of radiation (fractionation, time, dose rate, oxygen concentration etc.)
- direct effects of radiation, late reactions in normal tissue, risks of radiotherapy
- intelligible explanation of radiotherapy risks to the patient
- appliances used in radiotherapy
- radiotherapy dosimetry
- radiotherapy dose planning
- radiation safety of radiotherapy appliances and facilities
- quality assurance in radiotherapy
- self-assessment and clinical audits
- abnormal occurrences in radiotherapy

APPENDIX B

MINIMUM AMOUNT OF RADIATION PROTECTION TRAINING AND TARGET LEVEL OF KNOWLEDGE FOR STAFF INVOLVED IN THE USE OF RADIATION IN HEALTH CARE

The table shows the necessary level of knowledge in radiation protection and the minimum amount of radiation protection training by professional group in duties involving exposure to radiation in each field of work. The levels of knowledge are not directly comparable across professional groups.

Table. *Minimum amount of radiation protection training and extent of target level of knowledge for various professional groups.*

Professional group	Minimum amount of radiation protection training (study credits ¹⁾) at various training stages			Extent of target level of knowledge for radiation protection training divided by subject of study (see Appendix A)					
	Basic training ²⁾	Further training	Supplementary training ²⁾ over a five-year period	Fundamentals of radiation physics	Fundamentals of radiation biology	Radiation protection provisions	Radiation safety measures at the workplace	Medical use of radiation	
Specialist in radiology, physician using radiation a great deal, e.g. interventional cardiologist	1.0	1.0	1.0	III	III	III	III	III	
Radiation therapy physician	1.0	1.0	1.0	III	III	III	III	III	
Nuclear medicine physician	1.0	1.0	1.0	III	III	III	III	III	
Orthopaedist, cardiologist, other physician using radiation	1.0	0.5	0.5 ³⁾	II	II	II	III	II	
Dentist	1.0	0.5	0.5	II	II	II	II	II	
Referring physician	1.0		0.2	II	II	II	I	II	
Physician performing medical surveillance ⁴⁾	1.0	0.5	0.5	II	III	II	II	II	
Radiographer	3.0		1.0	II	II	III	III	III	
Other nurse participating in procedures involving exposure to radiation ⁵⁾	1.0		1.0	II	II	III	III	III	
Other health care professional using radiation ⁶⁾	1.0		0.5	I	I	I	II	I	
Technical staff ⁷⁾	1.0		0.5	II	II	II	II	II	
Hospital engineer	1.0	0.5	0.5	III	II	III	III	III	
Hospital physicist	2.0	0.5	1.0	III	III	III	III	III	

APPENDIX B

Level of knowledge:

- I basic knowledge (person understands matters pertaining to his or her field of work in general terms and is able to answer ordinary questions pertaining thereto or to refer the questioner to a suitable expert)
- II good knowledge (person understands matters pertaining to his or her field of work in practice and is able to explain them to others)
- III knowledge in depth (person understands matters pertaining to his or her field of work in practice and in theory, and is also able to apply these matters and to make decisions in practical working situations on the basis of them)
- 1) One study credit corresponds to 40 hours of studying.
 - 2) At least one half of the radiation protection training involved in basic training should be guided instruction (contact teaching). The rest may be private study. Supplementary training may be guided instruction, private study or participation in training events.
 - 3) One study credit for an orthopaedist, cardiologist and other physician using radiation a great deal.
 - 4) Medical practitioner responsible for medical surveillance of category A workers referred to in section 33 of the Radiation Act (Amendment 1142/1998).
 - 5) "Other nurses" here refers to nurses participating in procedures involving high exposure to radiation, for example, nurses working in a cardio-angio laboratory or in gastroenterology, or nurses and laboratory technologists/bioanalysts working in isotope laboratories.
 - 6) "Other health care professionals" here refers to the persons referred to in section 25 of the MSAH Decree, who may perform dental X-ray examinations under the supervision of a physician (e.g. a dental hygienist, specialist dental hygienist, oral hygienist, dental assistant and a practical nurse serving in dental care) or who may assist in performing procedures involving exposure to radiation under the supervision of a physician responsible for the said procedures (e.g. nursing staff in an operating theatre).
 - 7) "Technical staff" here refers to a technical professional engaged in radiation work, such as an engineer, polytechnic engineer, technician or a service technologist or other vocationally trained fitter or expert.

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General Guides

- ST 1.1 Radiation Practices and Regulatory Control, 20 June 1996
- ST 1.3 Warning Signs for Radiation Sources, 10 November 1999
- ST 1.4 Organization for the Use of Radiation, 24 October 1991
- ST 1.5 Exemption of the Use of Radiation from the Safety Licence and Reporting Obligation, 1 July 1999
- ST 1.6 Operational Radiation Protection, 29 December 1999
- ST 1.7 Radiation Protection Training in Health Care, 17 February 2003

Radiation Therapy

- ST 2.1 Quality Assurance for Radiotherapy, 22 May 2003 (in Finnish)
- ST 2.2 Radiation Safety of Radiotherapy Equipment and Treatment Rooms, 2 February 2001.

Diagnostic Radiology

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- ST 3.2 Mammography equipment and their Use, 13 August 2001
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- ST 3.4 Quality Control of Image Intensifier - Television Chains, 24 October 1991
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Industry, Research, Education and Commerce

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- ST 5.4 Trade in Radiation Sources, 2 October 2000
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Unsealed Sources and Radioactive Wastes

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Radiation Doses and Health Surveillance

- ST 7.1 Monitoring of Radiation Exposure, 25 February 2000
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Natural Radiation

- ST 12.1 Radiation Safety in Practices Causing Exposure to Natural Radiation, 6 April 2000 (in Finnish)
- ST 12.2 Radioactivity of Construction Materials and Ash, 8 October 2003 (in Finnish)
- ST 12.3 Radioactivity of Household Water, 9 August 1993