Translation from Finnish

Legally binding only in Finnish and Swedish
Ministry of Social Affairs and Health, Finland

Decree of the Ministry of Social Affairs and Health on ionizing radiation (1044/2018)

By decision of the Ministry of Social Affairs and Health, the following is enacted under the Radiation Act (859/2018):

Chapter 1
General provisions

Section 1
Limitation of scope of application

This Decree does not apply to non-ionizing radiation.

Chapter 2
Qualifications, radiation protection knowledge and work experience

Section 2
Knowledge and work experience of radiation safety expert

Provisions on the knowledge requirements and sufficient work experience required in terms of a radiation safety expert's field of expertise are laid down in Annex 1.

Section 3
Knowledge and work experience of radiation safety officer

Provisions on the practice type-specific fields of expertise of a radiation safety officer are laid down in Annex 2.

Provisions on the knowledge requirements and sufficient work experience required in a radiation safety officer's practice-type specific field of expertise are laid down in Annex 3.

Section 4

Certificate provided on the training of a radiation safety expert and radiation safety officer

The certificate provided to a person who has successfully completed the training of a radiation safety expert or radiation safety officer must indicate:

1) the organization which provides the certificate;
2) the name and date of birth of the person who has completed the training;
3) that the certificate concerns radiation protection training as referred to in section 37, subsection 1 or section 41, subsection 4 of the Radiation Act (859/2018);
4) the radiation safety expert's field of expertise or the radiation safety officer's practice type-specific field of expertise;
5) the content and scope of the provided radiation protection training in such a way that the certificate proves the fulfilment of the knowledge requirements referred to in section 2 and section 3, itemized in accordance with the knowledge requirements applicable to a radiation safety expert's field of expertise or a radiation safety officer's practice-type specific field of expertise as laid down in Annex 1 and Annex 3.

The certificate shall be signed by a person authorized to sign on behalf of the training organization or another person authorized by the training organization to sign the certificates in question.

If the radiation protection training of a radiation safety expert or radiation safety officer is included in their university degree, the completion of the training must be indicated in the diploma or a separate certificate must be provided on the completion of the training.

Section 5

Qualifications and competence of workers engaged in medical use of radiation

Workers engaged in the medical use of radiation must possess the knowledge, skills and competence in radiation physics, radiobiology and radiation protection required by their tasks.

The qualifications and radiation protection competence criteria of a worker engaged in the medical use of radiation are laid down in Annex 4.

Section 6

Practical prerequisites for carrying out of the tasks of experts and radiation safety officers

Radiation safety expert, medical physics expert and radiation safety officer must be fit for their jobs. The person must have a real possibility to carry out the tasks assigned to them by the undertaking.

A radiation safety officer's place of work and other conditions must be organized in such a way that they are able to carry out their tasks as a radiation safety officer as required by the demands and extent of the use of radiation.

Chapter 3

Supplementary training

Section 7

Supplementary training maintaining professional skills

Supplementary radiation protection training ensures that workers engaged in radiation practices possess up-to-date knowledge on ionizing radiation and its impacts as well as on radiation protection and the provisions and instructions pertaining to radiation practices in line with their duties.

Section 8

Requirements concerning supplementary training

Workers engaged in radiation practices must be provided with supplementary radiation protection training in periods of at least five years. The supplementary training must focus on the special characteristics related to radiation safety in the task in question and on the latest knowledge and changes impacting radiation safety in the radiation practice in question.

Requirements applicable to supplementary training are laid down in Annex 5.

In addition to what is provided in subsection 1, a radiation safety expert or medical physics expert must be provided with a minimum of 20 hours of supplementary radiation protection training over a five-year period. In addition to what is provided in Annex 5, a radiation safety office must be provided with a minimum of ten hours of supplementary radiation protection training over a five-year period.

Chapter 4
Medical exposure

Section 9
Qualifications of a physician or dentist responsible for medical exposure

The qualification requirements of a physician or dentist responsible for medical exposure are:

1) in radiotherapy, a specialist in oncology or other specialist qualified for radiotherapy in their specialty;
2) in nuclear medicine, a specialist in clinical physiology and nuclear medicine or other specialist qualified in nuclear medicine;
3) in X-ray examinations and interventional radiology: a specialist in radiology; other specialist responsible for medical exposure arising from the use of X-ray equipment shall possess the knowledge of radiation protection necessary for the examinations, procedures or treatments performed in their specialty;
4) in dental X-ray examinations: a dentist or other physician with the necessary knowledge of radiation protection.

The qualification requirements specified above in subsection 1, paragraph 3 shall also apply to a physician performing an X-ray examination or procedure.

In examinations, procedures, or treatments other than those specified in subsection 1, the physician responsible for medical exposure must possess the necessary knowledge of radiation protection.

If the necessary knowledge on radiation protection has not been included in the medical studies of a physician referred to in subsection 1, paragraph 3, the knowledge can be acquired by completing the supplementary training referred to in section 8.

Section 10
Carrying out and reporting of self-assessment

In the medical use of radiation, self-assessment of practices shall be carried out at least once a year.

The content and reporting of the self-assessment is subject to what is provided in section 13 and section 14 on the matters to be accounted for and reported on when carrying out clinical audits.

Section 11

Performance of internal clinical audits

An internal clinical audit supplementing the self-assessments of practices must be carried out at least every four years in practices where the category of medical exposure is 1 or 2.

The audit must rely on up-to-date knowledge and experiences of good medical practices.

Section 12

Performance of external clinical audits

An external clinical audit, which supplements internal clinical audits and the self-assessments of practices, must be organized at least:

1) every six years in practices where the category of medical exposure is 1;
2) every eight years in practices where the category of medical exposure is 2.

External clinical audits shall be carried out by a group of qualified and experienced experts independent of the undertaking.

Section 13

Matters to be accounted for in the performance of clinical audits

At least the following must be paid attention to in a clinical audit:

1) the practical implementation of the defined power and responsibilities;
2) the practice and information flow observed in justification assessments;
3) the practices of optimizing radiation protection, including:
    a) instructions and practices pertaining to the performance of examinations, treatment, and procedures involving exposure to radiation as well as ensuring the implementation of the planned treatment;
    b) the optimal and appropriate use equipment for examinations and treatment;
    c) optimizing the dose arising from the medical exposure and the quality of the image;
    d) the quality of the radiological report to be provided on the examinations;
4) the examination and treatment results achieved and their communication;
5) staff training;

6) quality assurance, the results of the self-assessment of the practices, and the use of the results.

Section 14
Report on clinical audit

The report to be prepared on the clinical audit shall present the course of the audit as well as the essential observations made in the audit, the assessments and conclusions drawn on their basis, and the recommendations of the party performing the audit for development measures.

The audit report is addressed to the undertaking.

Chapter 5
Existing exposure situations

Section 15
Limitation of chapter's scope of application

The provisions of this chapter do not apply to situations pertaining to natural radiation which are provided for in chapter 6.

Section 16
Reference level of occupational exposure in protective actions

In an existing exposure situation, the reference level of occupational exposure in protective actions, as an effective dose, is one millisievert a year.

Section 17
Setting a reference level for public exposure

In an existing exposure situation, the reference level of public exposure, as an effective dose, may be at maximum 10 millisieverts a year. The reference level may be set to below the level of 1 millisievert a year if it concerns a particular area or object or a specific exposure pathway related to it. However, the reference level may not be set below the level of 0.1 millisieverts a year if the achievement of this would require unreasonably extensive or expensive measures.

When the radiation exposure decreases, the reference level for public exposure must be decreased, provided that further decrease of the radiation exposure is possible within reason.

Section 18
Use of reference levels

The effective dose caused by occupational or public exposure is compared against the reference level. The determination of the effective dose must account for all exposure pathways other than exposure caused by radon.

The protective actions should be carried out in such a way that the effective dose caused by the radiation exposure remains below the reference level. However, a dose greater than the reference level can be accepted if the achievement of a dose below the reference level requires actions which would result in unreasonable harm in relation to the benefit gained.

Chapter 6
Natural radiation

Section 19
Reference level for the radon concentration in a workplace and reference level for occupational exposure to radon

The reference level for the radon concentration in a workplace is 300 becquerels per cubic meter in a space where working time is 600 hours or more per year. The radon concentration is calculated as the annual average of radon concentration during working hours.

The reference level for occupational exposure to radon is 500,000 becquerel hours per cubic meter a year. Exposure is calculated as the sum of the exposures accumulated in all work spaces during a year.

The reference level for occupational exposure to radon is not applied if the worker works only in a space where the radon concentration is lower than the reference level for the radon concentration in the workplace's indoor air.

Section 20
Reference levels for and measurement of the radon concentration in a dwelling or other occupied space

The reference level for the indoor air radon concentration in a dwelling or other occupied space is 300 becquerels per cubic meter.

The radon concentration in a dwelling is determined as the annual average radon concentration, which is either measured or estimated on the basis of a measurement during a continuous period of twelve months. The radon concentration of other occupied space is calculated as the annual average radon concentration during the space's use.

The measurement of the radon concentration must be continuous and last for at least two months. The measuring must be conducted between the beginning of September and the end of May. Supplementary measurements may also be carried out in other occupied spaces for more accurate determination of the radon concentration.

Section 21
Reference level for the radon concentration in a new building

The reference level for the radon concentration in indoor air when designing and implementing new buildings is 200 becquerels per cubic meter.

The annual average radon concentration in a dwelling or other occupied space and the annual average radon concentration during working hours in a workplace is compared against the reference level specified in subsection 1.

Section 22
Reference level for exposure caused by cosmic radiation

The reference level for the exposure of aircraft crew caused by cosmic radiation is, as an effective dose, one millisievert a year.

Section 23
Reference level for occupational exposure caused by other natural radiation

The reference level for occupational exposure arising from natural radiation other than radon or cosmic radiation from radiation practices is one millisievert a year. The exposure is determined as an addition of the effective dose to the effective dose caused by natural background radiation.

Section 24

Reference levels for public exposure from construction products

The reference level for public exposure arising from construction products meant for housing construction is 1 millisievert a year, although in such a way that the radiation dose from the cesium-137 in the construction products is at maximum 0.1 millisieverts a year.

The reference level for public exposure arising from materials used in the construction of roads, streets, and yards as well as in soil filling and landscaping is 0.1 millisieverts a year.

The public exposure is determined as an addition to the effective dose arising from the gamma radiation originating from natural radioactive substances and artificial radioactive substances present in nature on a permanent basis to the effective dose arising from natural background radiation.

Section 25

Reference levels for the radon concentration of household water and the public exposure arising from radioactive substances in household water

The reference levels for the radon concentration of household water and the public exposure arising from radioactive substances in household water shall be subject to what is provided on the quality requirements for radioactivity in section 17 of the Health Protection Act (763/1994).

Section 26

Reference level for public exposure arising from other natural radiation

The reference level for public exposure arising from natural radiation other than radon or cosmic radiation from radiation practices is 0.1 millisieverts a year. The exposure is determined as an addition of the effective dose to the effective dose caused by natural background radiation.

Radiation exposure caused by radioactive substances in construction products is not subject to subsection 1.

Chapter 7
Entry into force

Section 27
Entry into force

This Decree enters into force on 15 December 2018.

Council Directive 2013/59/Euratom (32013L0059); OJEU L 13, 17.1.2014, p. 1, Reported to the Commission in accordance with Article 33 of the Treaty establishing the European Atomic Energy Community.

ANNEX 1

Knowledge requirements and work experience of radiation safety experts

Table 1. Knowledge requirements and work experience of radiation safety experts.

LEVEL OF KNOWLEDGE	
A radiation safety expert's fields of expertise: • radiation practices in health care and veterinary medicine • radiation practices in industry and research • the use of nuclear energy	
Level of knowledge	• NQF *) 7
KNOWLEDGE REQUIREMENTS	
1 Scientific basis, general knowledge of radiation 1.1 Nuclear physics 1.2 Radiation physics 1.3 Radiochemistry	
• Has a deep understanding of the properties of different types of radiation, the physical mechanisms which give rise to them, interactive phenomena and the other properties of radioactive substances as well as the principles of applications and research methods based on the use of radiation. • Capable of acting as an expert in the adoption of new applications and methods and when initiating a new type of practice.	
2 Measurement technique and calculation methods 2.1 Radiation measuring and methods of measurement 2.2 Radiation dosimetry 2.3 Design of radiation shielding	
• Understands the methods of radiation measurement and determination methods based on the measurement of radiation exposure and calculations. • Knows how to define the characteristics of radiation meters suitable for the practice. • Knows how to design the radiation shields of the facility or place where the radiation is used.	
3 Radiation protection 3.1 Radiobiology 3.2 Quantities and units 3.3 Basic principles 3.4 Protection of members of the public, including contamination and the environment as an exposure pathway 3.5 Legislation and international recommendations 3.6 Radiation safety and security arrangements at the facilities and places where radiation practices are carried out 3.7 Risk identification and preparing for radiation safety deviations 3.8 Action in radiation safety deviations 3.9 Management system as well as the tasks and cooperation of a radiation safety expert, radiation safety officer and medical physics expert 3.10 Safety culture, supplementary radiation protection training and quality assurance	
• Understands the key principles of radiation protection and legislation as well as the radiation protection and security arrangements needed at the facilities and places where radiation practices are carried out. • Capable of acting as an expert in their own field of expertise, communicating radiation protection matters and guiding the undertaking in complying with statutory requirements. • Capable of guiding the undertaking in assessing the exposure arising from the practice, optimizing protection and in preventive planning and risk mapping. • Capable of advising the undertaking in organizing training and guidance on safe working for personnel engaged in radiation practices as well as planning the necessary supplementary radiation protection training.	

<table>
<tr><td colspan="3">4 Radiation practices
4.1 Practice, ways in which radiation is used, the properties and handling of radiation sources
4.2 The procurement process, installation, maintenance, and remediation of radiation sources
4.3 Trade in as well as importation, exportation, transfers, and transport of radiation sources
4.4 Keeping records, storage and decommissioning of radiation sources
4.5 The management, discharges, and decontamination of radioactive waste</td></tr>
<tr><td>Health care and veterinary medicine
(radiology, dentistry, veterinary medicine, radiotherapy, nuclear medicine)
Knows practices related to use of radiation in health care and veterinary medicine.
Knows the requirements pertaining to radiation practices.
Capable of drawing up a safety assessment of the radiation practices as well as statements, reports, recommendations, and instructions on radiation safety.
Capable of preparing quality assurance programmes in cooperation with the MPE.
Capable of advising how to organize training on safe working.</td><td>Industry and research
(unsealed sources, sealed sources, NORM sources, radon, X-ray equipment, industrial radiography, accelerators)
Knows the radiation sources used in industry and research and the related practices, the sources causing exposure to natural radiation and their behaviour.
Knows the requirements pertaining to radiation practices.
Capable of drawing up a safety assessment of the radiation practices as well as statements, reports, recommendations, and instructions on radiation safety.
Capable of preparing quality assurance programmes concerning the practices.
Capable of advising how to organize training on safe working.</td><td>Use of nuclear energy, in addition to the research and industry field of expertise
Knows the operating principles, special characteristics, and principal radiation sources of nuclear facilities.
Knows the radiation safety requirements and provisions applicable to nuclear facilities.
Knows the radioactive discharges, nuclear fuel handling, waste management, and decontamination procedures of nuclear facilities.</td></tr>
<tr><td colspan="3">WORK EXPERIENCE</td></tr>
<tr><td colspan="3">A minimum of two years of work experience in the field of expertise or in equivalent tasks.</td></tr>
<tr><td colspan="3">*) NQF = The framework for degrees and other skillsets referred to in section 2, subsection 1 of the Act on the Framework for Degrees and other Skillsets (93/2017), which is divided into eight difficulty levels.</td></tr>
</table>

In the use of particle accelerators in the production of radionuclides for the purpose of manufacturing radiopharmaceuticals and in the use of blood irradiators, the fields of expertise “radiation practices in health care and veterinary medicine” and “radiation practices in industry and research” are suitable for the radiation safety expert’s field of expertise.

ANNEX 2

A radiation safety officer's practice-type specific fields of expertise

A radiation safety officer's practice-type specific fields of expertise in the radiation practices of health care and veterinary medicine are as follows:

1. X-ray practices in health care
2. dental X-ray practice
3. in other native X-ray practices than computed tomography practices of a primary health care service provider as referred to in the Health Care Act (1326/2010) or a service provider referred to in the Private Health Care Act (152/1990), hereinafter *native X-ray practices*
4. veterinary X-ray practices
5. nuclear medicine
6. the installation, maintenance and remediation of radiation equipment and sources
7. general use of radiation in health care and veterinary medicine

A radiation safety officer's practice-type specific fields of expertise in the radiation practices of industry and research as well as in the use of nuclear energy are as follows:

1. sealed source and X-ray practices (other than the use particle accelerators in research and the production of radionuclides) as well as the use of unsealed sources in a laboratory in category 3 of radiation sources
2. the use of unsealed sources in a laboratory in categories 1 and 2 of radiation sources
3. industrial radiography
4. the use of particle accelerators in research and the production of radionuclides
5. practices that cause exposure to natural radiation
6. the use of nuclear energy

The practice-type specific field of expertise applicable to a radiation safety officer responsible for trade in radiation sources and the road and rail transport of radioactive substances is the practice-type specific field of expertise 1–13 in the use of the radiation sources in question.

ANNEX 3

Knowledge requirements and work experience of radiation safety officers

Table 1.1 Knowledge requirements and work experience of radiation safety officers in the radiation practices of health care and veterinary medicine.

PRACTICE-TYPE SPECIFIC FIELD OF EXPERTISE	**X-ray practices in health care; Dental X-ray practice; Native X-ray practice; Veterinary X-ray practices**	**Nuclear medicine**	**The installation, maintenance and remediation of radiation equipment and sources**	**General use of radiation in health care and veterinary medicine**
BASIC EDUCATION AND TRAINING	• For X-ray practices in health care, a specialist in radiology, other specialist using radiation or a medical physicist • For dental X-ray practice, a dentist *), physician, radiographer, or medical physicist • For native X-ray practice, a radiographer, physician, or medical physicist • For veterinary X-ray practices, a veterinarian, radiographer, or medical physicist	• A specialist in clinical physiology and nuclear medicine • Medical physicist	• Suitable university degree	• The qualifications of a radiation safety expert, field of expertise radiation safety in health care and veterinary medicine
LEVEL OF KNOWLEDGE	• For X-ray practices in health care NQF 7 • For dental X-ray practice, native X-ray practice and veterinary X-ray practices NQF 6	NQF 7	NQF 6	
KNOWLEDGE REQUIREMENTS 1. Scientific basis, general knowledge of radiation 1.1 Nuclear physics 1.2 Radiation physics 1.3 Radiochemistry	• Knows the principles of the essential applications and examination methods in their own field of expertise.			

PRACTICE-TYPE SPECIFIC FIELD OF EXPERTISE	**X-ray practices in health care; Dental X-ray practice; Native X-ray practice; Veterinary X-ray practices**	**Nuclear medicine**	**The installation, maintenance and remediation of radiation equipment and sources**	**General use of radiation in health care and veterinary medicine**
2. Measurement technique and calculation methods 2.1 Radiation measuring and methods of measurement 2.2 Radiation dosimetry 2.3 Design of radiation shielding	• Knows the methods for determining radiation exposure in their own field of expertise. • Knows how to use radiation meters according to instructions and draw conclusions on the necessary actions based on the results of the measurements.			
3. For radiation protection practices, as applicable 3.1 Radiobiology 3.2 Quantities and units 3.3 Basic principles and ethical perspectives 3.4 Protection of members of the public, including contamination and the environment as an exposure pathway 3.5 Legislation and international recommendations 3.6 Radiation safety and security arrangements at the facilities and places where radiation is used 3.7 Risk identification and preparing for radiation safety deviations 3.8 Action in radiation safety deviations 3.9 Management systems and cooperation 3.10 Safety culture, supplementary radiation protection training and quality assurance	• Knows the key principles of radiation protection and legislation as well as the radiation protection and security arrangements needed at workplaces within their own field of expertise. • Capable of implementing and supervising radiation protection arrangements, including the protection of a worker, related to the practice of their own field of expertise. • Knows how to guide their own unit's personnel in the safe use of radiation, the adoption of new methods and in optimization. • Capable of identifying risks in practical operations and preparing for radiation safety deviations and taking action during them. • Knows the management system and is capable of working in cooperation with experts. • Promotes radiation safety culture with their own actions. • Capable of ensuring the implementation of supplementary training and quality assurance.			

PRACTICE-TYPE SPECIFIC FIELD OF EXPERTISE	**X-ray practices in health care; Dental X-ray practice; Native X-ray practice; Veterinary X-ray practices**	**Nuclear medicine**	**The installation, maintenance and remediation of radiation equipment and sources**	**General use of radiation in health care and veterinary medicine**
4. Radiation practices in field of expertise 4.1 Practice, ways in which radiation is used, the properties and handling of radiation sources 4.2 The procurement process, installation, maintenance, and remediation of radiation sources 4.3 Trade in as well as transport and transfer of radiation sources 4.4 Keeping records, storage and decommissioning of radiation sources 4.5 The management, discharges, and decontamination of radioactive waste	• Knows the radiation sources in their field of expertise. • Knows the requirements pertaining to radiation practices and the workplace's radiation safety instructions in their field of expertise.			
EXTENT OF STUDIES	A total of at least 2 study credits (a minimum of 16 hours of contact instruction: 8 h theory + 8 h practical training)			
WORK EXPERIENCE	4 months in each of their fields of expertise			
*) Dentists prove their qualifications for acting as a radiation safety officer with a Licentiate of Dentistry diploma.				

Table 1.2a Knowledge requirements and work experience of radiation safety officers in the radiation practices of industry and research.

FIELD OF EXPERTISE	**Sealed sources and X-ray equipment (other than the use particle accelerators in research and the production of radionuclides) as well as the use of unsealed sources in laboratories in category 3 of radiation sources**	**The use of unsealed sources in laboratories in categories 1 and 2 of radiation sources**	**Industrial radiography**	**The use of accelerators in research and the production of radionuclides**
BASIC EDUCATION AND TRAINING	• Suitable training	• A master's degree in a suitable field	• Suitable training	• The qualifications of a radiation safety expert, field of expertise radiation practices in industry and research
LEVEL OF KNOWLEDGE	• NQF 4	NQF 7	NQF 4	
KNOWLEDGE REQUIREMENTS 1. Scientific basis, general knowledge of radiation 1.1 Nuclear physics 1.2 Radiation physics 1.3 Radiochemistry	• Knows the principles of the essential applications and research methods in their own field of expertise.			
2. Measurement technique and calculation methods 2.1 Radiation measuring and methods of measurement 2.2 Radiation dosimetry 2.3 Design of radiation shielding	• Knows the methods for determining radiation exposure in their field of expertise. • Knows how to use radiation meters according to instructions and draw conclusions on the necessary actions based on the results of the measurements.			

FIELD OF EXPERTISE	**Sealed sources and X-ray equipment (other than the use particle accelerators in research and the production of radionuclides) as well as the use of unsealed sources in laboratories in category 3 of radiation sources**	**The use of unsealed sources in laboratories in categories 1 and 2 of radiation sources**	**Industrial radiography**	**The use of accelerators in research and the production of radionuclides**
3. For radiation protection practices, as applicable 3.1 Radiobiology 3.2 Quantities and units 3.3 Basic principles and ethical perspectives 3.4 Protection of members of the public, including contamination and the environment as an exposure pathway 3.5 Legislation and international recommendations 3.6 Radiation safety and security arrangements at the facilities and places where radiation is used 3.7 Risk identification and preparing for radiation safety deviations 3.8 Action in radiation safety deviations 3.9 Management systems and cooperation with radiation safety expert 3.10 Safety culture, supplementary radiation protection training and quality assurance	• Knows the key principles of radiation protection and legislation as well as the radiation protection and security arrangements needed at workplaces within their own field of expertise. • Capable of implementing and supervising radiation protection arrangements, including the protection of a worker, related to the practice of their own field of expertise. • Knows how to guide their own unit's personnel in the safe use of radiation, the adoption of new methods and in optimization. • Capable of identifying risks in practical operations and preparing for radiation safety deviations and taking action during them. • Knows the management system and is capable of working in cooperation with experts. • Promotes radiation safety culture with their own actions. • Capable of ensuring the implementation of supplementary training and quality assurance.			

FIELD OF EXPERTISE	**Sealed sources and X-ray equipment (other than the use particle accelerators in research and the production of radionuclides) as well as the use of unsealed sources in laboratories in category 3 of radiation sources**	**The use of unsealed sources in laboratories in categories 1 and 2 of radiation sources**	**Industrial radiography**	**The use of accelerators in research and the production of radionuclides**
4 Radiation practices in field of expertise 4.1 Practice, ways in which radiation is used, the properties and handling of radiation sources 4.2 Procurement process, installation, maintenance, and remediation 4.3 Trade in as well as transport and transfer 4.4 Keeping of records, storage, and decommissioning 4.5 The management, discharges, and decontamination of radioactive waste	• Knows the radiation sources in their field of expertise. • Knows the requirements pertaining to radiation practices and the workplace's radiation safety instructions in their field of expertise.			
EXTENT OF STUDIES	Sections 1–4a total of at least 1 credit (a minimum of 16 hours of contact instruction: 8 h theory + 8 h practical training)	Sections 1–4a total of at least 2 credits (a minimum of 16 hours of contact instruction: 8 h theory + 8 h practical training)		
WORK EXPERIENCE	4 months	6 months	6 months	

Table 1.2b Knowledge requirements and work experience of radiation safety officers in the radiation practices of industry and research.

FIELD OF EXPERTISE	**Practices causing exposure to natural radiation**	**Use of nuclear energy**
BASIC EDUCATION AND TRAINING	• Suitable training • The qualifications of a radiation safety officer in practice-type specific field of expertise: o Sealed sources and X-ray equipment (other than the use of particle accelerators in research and the production of radionuclides) as well as the use of unsealed sources in laboratories in category 3 of radiation sources; or o The use of unsealed sources in laboratories in categories 1 and 2 of radiation sources	• A master's degree in a suitable field
LEVEL OF KNOWLEDGE	NQF 4	NQF 7
KNOWLEDGE REQUIREMENTS 1. Scientific basis, general knowledge of radiation 1.1 Nuclear physics 1.2 Radiation physics 1.3 Radiochemistry	• Knows the principles of the essential applications and research methods in their field of expertise.	
2. Measurement technique and calculation methods 2.1 Radiation measuring and methods of measurement 2.2 Radiation dosimetry 2.3 Design of radiation shielding	• Knows the methods for determining radiation exposure in their field of expertise. • Knows how to use radiation meters according to instructions and draw conclusions on the necessary actions based on the results of the measurements.	

FIELD OF EXPERTISE	**Practices causing exposure to natural radiation**	**Use of nuclear energy**
3. For radiation protection practices, as applicable 3.1 Radiobiology 3.2 Quantities and units 3.3 Basic principles and ethical perspectives 3.4 Protection of members of the public, including contamination and the environment as an exposure pathway 3.5 Legislation and international recommendations 3.6 Radiation safety and security arrangements at the facilities and places where radiation is used 3.7 Risk identification and preparing for radiation safety deviations 3.8 Action in radiation safety deviations 3.9 Management systems and cooperation with radiation safety expert 3.10 Safety culture, supplementary radiation protection training and quality assurance	• Knows the key principles of radiation protection and legislation as well as the radiation protection and security arrangements needed at workplaces within their field of expertise. • Capable of implementing and supervising radiation protection arrangements, including the protection of a worker, related to the practice of their field of expertise. • Knows how to guide their own unit's personnel in the safe use of radiation, the adoption of new methods and in optimization. • Capable of identifying risks in practical operations and preparing for radiation safety deviations and taking action during them. • Knows the management system and is capable of working in cooperation with experts. • Promotes radiation safety culture with their own actions. • Capable of ensuring the implementation of supplementary training and quality assurance.	
4. Use of radiation in field of expertise 4.1 Practice, ways in which radiation is used, the properties and handling of radiation sources 4.2 Procurement process, installation, maintenance, and remediation 4.3 Trade in as well as transport and transfer 4.4 Keeping of records, storage, and decommissioning 4.5 The management, discharges, and decontamination of radioactive waste	• Knows the radiation sources in their field of expertise. • Knows the requirements pertaining to radiation practices and the workplace's radiation safety instructions in their field of expertise.	
EXTENT OF STUDIES	Sections 1–4a total of at least 2 study credits (a minimum of 16 hours of contact instruction: 8 h theory + 8 h practical training)	
WORK EXPERIENCE	6 months	Three years, of which at least one year in radiation protection tasks in nuclear facilities.

ANNEX 4

The qualifications and radiation protection competence criteria of a worker engaged in the medical use of radiation

Table 1.1 The radiation protection competence criteria of a licentiate of medicine, other referrer, radiologist and other specialist carrying out interventional radiology, dental radiologist, a specialist of clinical physiology and nuclear medicine as well as a specialist in oncology and radiotherapy [1)].

OCCUPATIONAL TITLE	**Licentiate of medicine and other referrer** [2)]	**Radiologist and other specialist carrying out interventional radiology, dental radiologist** [3)]	**Specialist in clinical physiology and nuclear medicine** [4)]	**Specialist in oncology** [5)]
LEVEL OF KNOWLEDGE	NQF 6	NQF 7	NQF 7	NQF 7
COMPETENCE CRITERIA A. Radiation physics and radiobiology	Masters medical physics and radiobiology and knows how to apply data to be able to communicate, on a general level, about medical exposure, occupational exposure, and public exposure, and knows how to interpret radiation risks.	Masters medical physics and radiobiology and knows how to apply data in their field of work to be able to communicate the quality and quantity of radiation exposure within their own field; knows how to interpret radiation risks. Capable of justifying the radiation risk arising from medical exposure to the referrer and the patient. Capable of accounting for factors related to image quality and radiation exposure in equipment selection and the optimization of imaging protocols and in the selection of an imaging technique for an individual patient.	Masters medical physics and radiobiology and knows how to apply data in their field of work to be able to communicate the quality and quantity of radiation exposure within their own field; knows how to interpret radiation risks. Capable of justifying the radiation risk arising from medical exposure to the referrer and the patient. Capable of accounting for factors related to image quality and radiation exposure in the selection of a radiopharmaceutical and the equipment and in the optimization of imaging protocols and the selection of an imaging technique for an individual patient.	Masters medical physics and radiobiology and knows how to apply data in their field of work to be able to communicate the quality and quantity of radiation exposure within their own field; knows how to interpret radiation risks. Capable of justifying the radiation risk arising from medical exposure to the referrer and the patient. Capable of accounting for factors related to image quality and radiation exposure in the selection of radiotherapy and imaging equipment as well as the selection of a radiopharmaceutical used in radionuclide therapy and in the selection of a treatment for an individual patient.

OCCUPATIONAL TITLE	**Licentiate of medicine and other referrer** [2)]	**Radiologist and other specialist carrying out interventional radiology, dental radiologist** [3)]	**Specialist in clinical physiology and nuclear medicine** [4)]	**Specialist in oncology** [5)]
B. Radiation protection in medical exposure	Understands general radiation protection principles and is capable of applying them in practice to ensure patient safety in different exposure situations, accounting for, in particular, special characteristics in the radiation protection of a child, youth, foetus, and asymptomatic individual.	Understands general radiation protection principles and is capable of applying them in practice to ensure patient safety in different exposure situations, accounting for, in particular, special characteristics in the radiation protection of a child, youth, foetus, and asymptomatic individual. Capable of giving instructions for the monitoring of a patient in terms of any harm caused by an extremely high level of radiation exposure.	Understands general radiation protection principles and is capable of applying them in practice to ensure patient safety in different exposure situations, accounting for, in particular, special characteristics in the radiation protection of a child, youth, foetus, and asymptomatic individual. Capable of giving instructions to a patient who has received a radiopharmaceutical and any members of the public who are in close contact with the patient to optimize the radiation protection of members of the public.	Understands general radiation protection principles and is capable of applying them in practice to ensure patient safety in different exposure situations, accounting for, in particular, special characteristics in the radiation protection of a child, youth, foetus, and asymptomatic individual. Capable of providing instructions to a patient on the possible side effects of radiation. Capable of giving instructions to a patient who has received a radiopharmaceutical and any members of the public who are in close contact with the patient to optimize the radiation protection of members of the public.
C. The radiation protection of workers	Knows how to protect herself/himself from radiation in the work according to the instructions provided.	Knows how to use procedures aiming to optimize the protection of workers.	Knows how to use procedures aiming to optimize the protection of workers.	Knows how to use procedures aiming to optimize the protection of workers.

Table 1.2 The radiation protection competence criteria of a licentiate of dentistry, other physician using radiation, medical physicist, and radiographer[1)].

OCCUPATIONAL TITLE	**Licentiate of dentistry [6)]**	**Other physician using radiation [7)]**	**Medical physicist [8)]**	**Radiographer [9)]**
LEVEL OF KNOWLEDGE	NQF 7	NQF 7	NQF 8	NQF 6
COMPETENCE CRITERIA A. Radiation physics and radiobiology	Masters medical physics and radiobiology and knows how to apply data in their field of work to be able to communicate the quality and quantity of radiation exposure within their own field; knows how to interpret radiation risks. Capable of justifying the radiation risk arising from medical exposure to the referrer and the patient. Capable of accounting for factors related to image quality and radiation exposure in equipment selection and the optimization of imaging protocols and in the selection of an imaging technique for an individual patient.	Masters medical physics and radiobiology and knows how to apply data in their field of work to be able to communicate the quality and quantity of radiation exposure within their own field; knows how to interpret radiation risks. Capable of justifying the radiation risk arising from medical exposure to the referrer and the patient. Capable of accounting for factors related to image quality and radiation exposure in equipment selection and the optimization of imaging protocols and in the selection of an imaging technique for an individual patient.	Masters medical physics and radiobiology and knows how to apply data in their field of work to be able to guide others on the quality and quantity of radiation exposure in daily work. Capable of assessing and interpreting radiation risks. Capable of providing guidance in the selection of equipment and programs, accounting for factors related to image quality and radiation exposure.	Masters medical physics and radiobiology and knows how to apply the data in their field of work; able to communicate the key factors impacting medical exposure, the exposure of workers, and public exposure. Capable of communicating the quality and quantity of radiation exposure in daily work and interpreting radiation risks. Capable of accounting for factors related to image quality and radiation exposure in the imaging and treatment of an individual patient.
B. Radiation protection in medical exposure	Understands general radiation protection principles and is capable of applying them in practice to ensure patient safety in different exposure situations, accounting for, in particular, special characteristics in the radiation protection of a child, youth, foetus, and asymptomatic individual.	Understands general radiation protection principles and is capable of applying them in practice to ensure patient safety in different exposure situations, accounting for, in particular, special characteristics in the radiation protection of a child, youth, foetus, and asymptomatic individual.	Capable of assessing and developing radiation protection procedures suitable for the field of work to optimize medical exposure as well as the public and occupational exposure arising from the medical use of radiation.	Understands general radiation protection principles and is capable of applying them in practice to ensure patient safety in different exposure situations, accounting for, in particular, special characteristics in the radiation protection of a child, youth, foetus, and asymptomatic individual.

OCCUPATIONAL TITLE	**Licentiate of dentistry** [6)]	**Other physician using radiation** [7)]	**Medical physicist** [8)]	**Radiographer** [9)]
C. The radiation protection of workers	Knows how to use procedures aiming to optimize the protection of workers.	Knows how to use procedures aiming to optimize the protection of workers.	Knows how to optimize occupational exposure arising from the medical use of radiation in cooperation with a radiation safety expert.	Knows how to use procedures aiming to optimize the protection of workers.

Table 1.3. Radiation protection competence criteria of other health care professional using radiation, occupational physician familiar with radiation, other health care professional performing work exposing them to radiation, and licentiate of veterinary medicine *).

OCCUPATIONAL TITLE	**Other health care professional using radiation** 10)	**Occupational physician familiar with radiation**	**Other health care professional performing work exposing them to radiation and animal attendant** 11)	**Licentiate of veterinary medicine**
LEVEL OF KNOWLEDGE	NQF 6	NQF 7	NQF 6	NQF 7
COMPETENCE CRITERIA A. Radiation physics and radiobiology	Masters medical physics and radiobiology and knows how to apply the data in their field of work; able to communicate the key factors impacting medical exposure, the exposure of workers, and public exposure; capable of interpreting radiation risks. Capable of communicating the quality and quantity of radiation exposure in daily work and interpreting radiation risks. Capable of accounting for factors related to image quality and radiation exposure in the imaging and treatment of an individual patient.	Capable of communicating the quality and quantity of radiation exposure and interpreting radiation risks. Capable of selecting procedures for investigating the biological effects of radiation if necessary and interpreting the effects and deciding on further action.	Capable of communicating, on a general level, about medical exposure, occupational exposure, and public exposure, and interpreting radiation risks. Capable of communicating the quality and quantity of radiation exposure in daily work and interpreting radiation risks.	Capable of communicating the quality and quantity of radiation exposure in their own field and interpreting radiation risks. Capable of accounting for factors related to image quality and radiation exposure in the imaging and treatment of an individual animal. Understands general radiation protection principles and is capable of applying them in practice.
B. Radiation protection in medical exposure and veterinary medicine	Understands general radiation protection principles and is capable of applying them in practice to ensure patient safety in different exposure situations, accounting for, in particular, special characteristics in the radiation protection of a child, youth, foetus, and asymptomatic individual.		Understands general radiation protection principles and is capable of applying them in practice.	Understands general radiation protection principles and is capable of applying them in practice. Capable of ensuring the radiation protection of animal attendants and individuals restraining animals.

OCCUPATIONAL TITLE	**Other health care professional using radiation** [10)]	**Occupational physician familiar with radiation**	**Other health care professional performing work exposing them to radiation and animal attendant** [11)]	**Licentiate of veterinary medicine**
C. The radiation protection of workers	Knows how to use procedures aiming to optimize the protection of workers.	Understands the possible exposure pathways in different types of radiation practices. Capable of assessing a worker's qualification for a category A radiation worker. Capable of optimizing the protection of a worker, if necessary, in cooperation with a radiation safety expert and radiation safety officer.	Knows how to use procedures aiming to optimize the protection of workers.	Knows how to use procedures aiming to optimize the protection of workers.

*) The learning outcomes are described in "Radiation Protection No 175. Guidelines on Radiation Protection Education and Training of Medical Professionals in the European Union", published by the European Commission.

1) in Table 2.2.

2) in Table 3.1.

3) in Tables 4.1.1, 4.2.1 and 4.3.1.

4) in Table 4.4.1.

5) in Table 4.5.1.

6) in Table 5.1.

7) in Table 4.3.2.

8) in Table 7.1.

9) in Tables 6.1, 6.1.1, 6.1.2 and 6.1.3.

10) in Tables 4.3.2, 5.1, 6.1, 6.1.1 and 6.1.2.

11) in Table 8.1.

ANNEX 5

Supplementary training of worker engaged in radiation practices

Table 1.1 Supplementary training for radiation protection in medical use of radiation and veterinary medicine over a five-year period.

FIELD OF EXPERTISE	**X-ray practices in health care; dental X-ray practice; veterinary X-ray practices**	**Nuclear medicine; radiotherapy**	**The installation, maintenance and remediation of radiation equipment or sources**	**General use of radiation in health care and veterinary medicine**
OCCUPATIONAL GROUP	• A radiologist or other physician who uses radiation a great deal • Other physician using radiation, dentist, veterinarian • Referring medical practitioner or other referrer • Occupational physician familiar with radiation	• A specialist in clinical physiology and nuclear medicine • A specialist in oncology	• A person installing, maintaining, or remediating health care equipment	• Medical physicist
LEVEL OF KNOWLEDGE	• Radiologist, dental radiologist or other physician using radiation: • NQF 7 • Dentist, veterinarian, referring medical practitioner, other referrer, occupational physician familiar with radiation: • NQF 6	• NQF 7	• NQF 6	• NQF 8
A. Radiation physics and radiobiology	• Knows the principles of the essential applications and examination methods in their field. • Capable of communicating various exposures in their task in accordance with the latest data. • Capable of interpreting radiation risks. • *Occupational physician familiar with radiation*: also capable of applying the latest data of the health effects of radiation in their work. • *Medical physicist*: also capable of assessing radiation risks based on the latest data and guiding other professionals of health care and veterinary medicine to communicate the quality and quantity of the radiation exposure.			

FIELD OF EXPERTISE	**X-ray practices in health care; dental X-ray practice; veterinary X-ray practices**	**Nuclear medicine; radiotherapy**	**The installation, maintenance and remediation of radiation equipment or sources**	**General use of radiation in health care and veterinary medicine**
B. Radiation protection in medical exposure	• Capable of applying radiation protection principles in accordance with their tasks. • Capable of using procedures aiming to optimize medical exposure according to their tasks. • *Medical physicist**:*** also capable of assessing and developing applicable radiation protection procedures.			
C. The radiation protection of a worker and members of the public	• Capable of applying radiation protection principles in accordance with their tasks. • Knows how to use procedures aiming to optimize the protection of workers in accordance with their tasks. • *Occupational physician familiar with radiation*: capable of optimizing the protection of a worker in cooperation with a radiation safety expert and radiation safety officer. • *Specialist in clinical physiology and nuclear medicine and specialist in oncology*: Knows how to protect members of the public by providing instructions to a patient who has received radionuclide therapy or has radiation sources implanted in their body.			
EXTENT OF STUDIES	• *Radiotherapist or other physician who uses radiation a great deal or dental radiologistt*: sections A–C at least 40 hours in total • *Referring medical practitioner and other referrer*: sections A–C at least 8 hours in total • *Other physician who uses radiation, occupational physician familiar with radiation, dentist*: sections A–C at least 20 hours in total • *Veterinarian*: sections A–C at least 5 hours in total	Sections A–C at least 40 hours in total	Sections A–C at least 20 hours in total	Sections A–C at least 40 hours in total

FIELD OF EXPERTISE	**X-ray practices in health care; dental X-ray practice; veterinary X-ray practices**	**Nuclear medicine; radiotherapy**	**The installation, maintenance and remediation of radiation equipment or sources**	**General use of radiation in health care and veterinary medicine**
TASK	• Radiographer • A bioanalyst or nurse working in nuclear medicine • Dental hygienist, dental nurse • Health care professional assisting in the use of radiation • Other health care professional performing work exposing them to radiation • Animal attendant			
LEVEL OF KNOWLEDGE	• As defined for a radiographer in Table 1.2 and other health care professional using radiation, other health care professional performing work exposing them to radiation, and animal attendant in Table 1.3 of Annex 4.			
A. Radiation physics and radiobiology	• Knows the principles of the essential applications and examination methods in their field. • Capable of communicating various exposures in their task in accordance with the latest data. • Capable of interpreting radiation risks related to their task.			
B. Radiation protection in medical exposure and veterinary medicine	• Capable of applying radiation protection principles in accordance with their tasks. • Capable of using procedures aiming to optimize medical exposure according to their tasks.			
C. The radiation protection of a worker and members of the public	• Capable of applying radiation protection principles in accordance with their tasks. • Knows how to use procedures aiming to optimize the protection of workers and members of the public in accordance with their tasks.			
EXTENT OF STUDIES	*A radiographer and bioanalyst or nurse working in an isotope unit*: Sections A–C at least 40 hours in total *Health care professional assisting in the use of radiation:* Sections A–C at least 20 hours in total *Other health care professional performing work exposing them to radiation:* 20 hours *Animal attendant:* Sections A–C at least 5 hours in total			

Table 1.2 Supplementary training for radiation protection in the radiation practices of industry and research and in the use of nuclear energy.

	Use of radiation	**Practices causing exposure to natural radiation**	**Use of nuclear energy**
	• worker engaged in the use of radiation	• worker engaged in radiation practices	• radiation worker and person whose work has significant impact on the results of radiation protection
LEVEL OF KNOWLEDGE	NQF 4		
A. Radiation physics and radiobiology	• In the use of radiation, knows the principles of the essential applications in their field. • Capable of communicating various exposures in their task in accordance with the latest data. • Capable of interpreting radiation risks related to their task.		
B. The radiation protection of a worker and members of the public	• Capable of applying radiation protection principles in accordance with their tasks. • Knows how to use procedures aiming to optimize the protection of workers and members of the public in accordance with their tasks.		
EXTENT OF STUDIES	**Category 1–2 of occupational radiation exposure:** Sections A and B at least 10 hours in total over five-year periods. Other workers: Sections A and B at least 5 hours in total over five-year periods.	**Category 1–2 of occupational radiation exposure:** Sections A and B at least 10 hours in total over five-year periods. Other workers: Sections A and B at least 5 hours in total over five-year periods.	Sections A and B at least 10 hours in total over five-year periods. **Radiation worker:** Section B at least 2 hours over three-year periods **Person whose work has significant impact on radiation protection:** Sections A and B at least 10 hours in total over a five-year period