RADIATION SAFETY DIRECTORATE

Pursuant to Article 26-e, paragraph 1, item 2 of the Law on Ionising Radiation Protection and Radiation Safety (Official Gazette of the Republic of Macedonia No. 48/02 and 135/07), the Director of the Radiation Safety Directorate hereby adopts a

RULEBOOK ON THE TYPES OF TRAINING AND THE CONTENT OF THE PROGRAMME FOR TRAINING PERSONS RESPONSIBLE FOR RADIATION PROTECTION AND PERSONS WORKING WITH SOURCES OF IONISING RADIATION

Article 1

This Rulebook shall prescribe the types of training and the content of the programme for training persons responsible for radiation protection and persons working with sources of ionising radiation.

Article 2

Basic and additional training shall be organised for persons responsible for radiation protection and persons working with sources of ionising radiation.

Article 3

All persons responsible for radiation protection and persons working with sources of ionising radiation shall complete basic training in radiation protection.

The content of the programme for the basic training referred to in paragraph 1 of this Article shall be given in Appendix 1, which is a constituent part of this Rulebook.

The content of the training programme referred to in paragraph 2 of this Article shall establish the subject matter and the number of hours per each subject matter, depending on the activity with sources of ionising radiation and the eventual dangers arising from the application of sources of ionising radiation.

Article 4

Persons responsible for radiation protection, in accordance with the Law on Ionising Radiation Protection and Radiation Safety shall perform basic training for persons working with sources of ionising radiation, as well as training and/or instructions for ancillary staff that is temporarily present in the controlled and supervised radiation areas, in accordance with the training programme referred to in Article 4 of this Rulebook.

Article 5

In addition to basic training, persons responsible for radiation protection and persons working with sources of ionising radiation shall undergo additional training, depending on the activity with sources of ionising radiation.

The content of the programme for the additional training referred to in paragraph 1 of this Article shall be given in Appendix 2, which is a constituent part of this Rulebook.

Article 6

The provisions of this Rulebook shall apply after the establishment of a training system intended for persons responsible for radiation protection, starting from 1 January 2011 at the latest.

Article 7

This Rulebook shall enter into force on the eighth day from the date of its publication in the Official Gazette of the Republic of Macedonia.

No. 01-1668/1 Director,

2 December 2009 PhD **Rumen Stamenov**

Skopje

APPENDIX 1

Basic training programme for persons responsible for radiation protection and persons working with sources of ionising radiation

1. **Basic radiological physics**
   - Structure of atoms and atomic cores
   - Radioactive transformations
   - Interaction of ionising radiation with matter
   - Radiological instruments
   - Sources of ionising radiation (natural radiation, artificially obtained radiation sources, radiation generators)
   - Radiological quantities and units
   - Dosimetric calculations and measurements
   - Principles for detection of radiation and measurements

2. **Biological effects of exposure to ionising radiation**
   - Radiation effects at the molecular and cellular level
   - Deterministic effects
   - Stochastic effects
   - Radiation effects on the embryo and fetus
   - Radiation damage concept

3. **Principles of radiation protection and a regulatory framework**
   - Basic principles of radiation protection (justifiability, optimisation and dose limits)
   - International radiation protection institutions and organizations (EURATOM, IAEA, ICRP, ICRU, UNSCEAR, ILO, WHO, FAO, OECD/NEA, PAHO)
   - Regulatory system in the Republic of Macedonia
     - Structure and organization of the radiation protection system (regulatory body, authorised expert technical services, etc.)
     - Regulations on radiation protection, requirements and guidelines
   - Strengthening awareness of radiation (radiation protection programme)

4. **Protection of occupationally exposed persons**
   - Methods of protection and safety of radiation sources: optimisation
   - Individual and work environment monitoring
   - Medical examinations
   - Potential exposure

5. **Exposure of the general public to radiation**
   - Causes for exposure of the general public
   - Responsibilities of legal entities and competent institutions

APPENDIX 2

Additional training programme for persons responsible for radiation protection and persons working with sources of ionising radiation

1. Diagnostic and intervention radiology

- Generating X-ray radiation, X-ray tube and generator
- Attenuation of X-ray radiation, contrast environment
- Diagnostic image, fluoroscopy, digital image
- Diagnostic examination indicators
- Usage of previous examination results
- Design of the room housing X-ray machines and radiation safety
- Alternative examination methods / techniques
- Screening projections and typical error in computer screening
- Factors affecting the interpretation of X-ray images
- Procedures for the exposure of children and pregnant women to ionising radiation
- Examination of sexually mature individuals
- Systematic screenings/examinations by means of exposure to ionising radiation
- Scientific research
- Diagnostic examination due to medical procedures prescribed by general regulations
- Introduction to the manner of use of the equipment
- Radiation protection of patients and occupationally exposed persons
- Factors affecting the exposure to ionising radiation
- Factors affecting image quality
- Optimisation of the exposure to radiation and of image quality
- Patient doses and the determination thereof (measurements, calculations and diagnostic reference levels) and corrective measures
- Radiation risk assessment and clear explanation of risks to patients
- Radiation protection programme
- Self-assessment and clinical examinations
- Abnormal phenomena relating to X-ray screening
- Practical work

2. Stomatological X-ray machines

- Stomatological X-ray machines and usage thereof
- Usage of previous examination results
- Alternative examination methods / techniques
- Screening projections and typical error in computer screening
- Factors affecting the interpretation of X-ray images
- Procedures for the exposure of children and pregnant women to radiation
- Scientific research
- Diagnostic examination due to medical and legal obligations (Medico-legal examination)
- Design of the room housing X-ray machines and radiation safety
- Radiation protection of patients and staff
- Patient doses and the determination thereof
- Radiation risk assessment and clear explanation of risks to patients

- Factors affecting the exposure to ionising radiation
- Factors affecting image quality
- Radiation protection programme
- Practical work

3. Application of X-ray machines in veterinary medicine

- X-ray machines in veterinary medicine and the usage thereof
- Usage of previous examination results
- Design of the room housing X-ray machines and radiation safety
- Radiation protection of staff
- Alternative examination methods / techniques
- Factors affecting the interpretation of X-ray images
- Factors affecting the exposure to ionising radiation
- Factors affecting image quality
- Scientific research
- Radiation protection programme
- Practical work

4. Radiotherapy

- Radiotherapy methods, operators in radiotherapy and application of radiotherapy (e.g. positioning of patients, dose for the adjoining healthy tissues, etc.)
- Alternative examination methods / techniques
- Scientific research
- Biological principles of radiotherapy, phenomena at the molecular and cellular level of tumours and normal (healthy) tissues
- Factors of modification of ionising radiation effects (fractionation, time, dose rate, oxygen concentration, etc.)
- Direct radiation effects, belated responses in normal tissues, radiotherapy risks
- Clear explanation of radiotherapy risks to patients
- Devices used in radiotherapy
- Radiotherapy dosimetry
- Planning of doses in radiotherapy
- Radiation safety of radiotherapy devices and premises
- Design of the room housing sources of ionising radiation in radiotherapy and radiation safety
- Radiation protection programme
- Abnormal phenomena in radiotherapy
- Practical work

5. Nuclear medicine

- Basics of nuclear medicine
- Radiopharmaceuticals
- Radioactive components in radiopharmaceuticals
- Characteristics and selection of radionuclides
- Radionuclide generators
- Screening and measurement instruments
- Examination and treatment with radionuclides
- Alternative examination methods

- Scientific research
- Work with unsealed sources (internal and external exposure, contamination risk, decontamination)
- Control of the release of radioactive substances
- Storage of radioactive substances
- Managing radioactive waste
- Design of nuclear medicine premises
- Radiation protection programme
- Patient doses and the assessment thereof, diagnostic reference levels
- Radiation risk assessment and clear explanation of risks to patients
- Guidelines regarding children, pregnant women and breast feeding women
- Discharge of patients following a radionuclide therapy
- Abnormal phenomena in nuclear medicine
- Practical work

6. Industrial radiography

- Basics of industrial radiography
- Devices used in industrial radiography
- Specific legal regulations
- Design of the premises and radiation safety
- Radiation protection programme: radiation protection of staff and the general public, radiation protection during fieldwork, emergency plans, etc.
- Transport and storage of radioactive sources in industrial radiography
- Practical work with devices in industrial radiography

7. Industrial meters

- Devices used
- Specific legal regulations
- Design of the premises and radiation safety
- Radiation protection programme: radiation protection of staff and the general public, emergency plans, etc.
- Practical work

8. Geological surveys with ionising radiation sources

- Devices used
- Specific legal regulations
- Radiation protection programme: radiation protection of staff and the general public, radiation protection during fieldwork, emergency plans, etc.
- Transport and storage of radioactive sources
- Practical work

9. Industrial irradiators and accelerators

- Devices used
- Specific legal regulations
- Design of the premises and radiation safety
- Radiation protection programme: radiation protection of staff and the general public, emergency plans, etc.
- Practical work

10. Production of radionuclides and radiopharmaceuticals

- Production of radionuclides
- Production and preparation of radiopharmaceuticals
- Specific legal regulations
- Packaging of radionuclides, preparation for transportation thereof
- Plant and control of the release of radioactive substances
- Design of the premises and radiation safety
- Work with unsealed sources (internal and external exposure, contamination risk, decontamination)
- Radiation protection programme
- Abnormal phenomena in the production of radionuclides and radiopharmaceuticals
- Storage of radioactive substances
- Managing radioactive waste
- Practical work

Recommended number of hours for basic and additional training of persons responsible for radiation protection and of persons working with sources of ionising radiation, as well as recommended number of hours for instructing persons who occasionally work with and/or are occasionally present in the controlled and supervised radiation areas.

	Type of training	Persons responsible for radiation protection	Persons working with sources of ionising radiation	Persons who occasionally work with and/or are occasionally present in the controlled and supervised radiation areas
1	Basic training	30-50	20-30	/
2	Additional training	40-60	30-40	/
3	Instructions			20-40