Specialised training module 4:
Nuclear power plants & research reactors

1. Background of the ENETRAP training modules

The ENETRAP project series (FP7 grant agreement n° 605159) developed a European radiation protection training scheme (ERPTS) for RPEs, consisting of three common basis modules, several optional modules and some add-on modules. This specialised training module (N°4: Nuclear power plants & research reactors) is optional and advances on the knowledge, skills and competences acquired in the three basic modules. The module consists of a number of training courses which are linked to specific competences and activities that a Radiation Protection Expert (RPE) requires in compliance with Council Directive 2013/59/Euratom (BSS).

2. Training module objective

The course participant will gain the knowledge, skills and attitudes to provide expert radiation protection advice to employers, staff and contractors in nuclear power plants and research reactors that will allow him or her to seek the status of Radiation Protection Expert (RPE) from an authorised body.

3. Module overview

The Module on nuclear power plants and research reactors consists of six training courses.

Course 4.1	Layout of a nuclear power plant
22	**Describe the principles of nuclear power plant operation**
22.1	Describe the layout of a NPP in the context of RP
Course 4.2	Measuring devices/installations and quality control for RP in nuclear power plants
23	**Apply RP in routine operation**
23.1	Manage monitoring of radiation in routine operation
23.2	Apply quality control in RP
Course 4.3	Organisation and RP roles and duties
23.3	Organise RP in nuclear power plants
23.4	Manage personal dosimetry
Course 4.4	Radiation accidents, incidents, alarm, emergency, preparedness and response
23.5	Set up emergency and alarm plans in an organisational context
Course 4.5	Organisation of RP during shutdown both routine and incidental
24	**Apply RP during shutdown**
24.1	Organise RP during shutdown
Course 4.6	Interaction with stakeholders and the public
25	**Manage interactions with the hierarchy, regulatory bodies and the public**
25.1	Manage interactions with internal and external units
25.2	Manage interactions with the hierarchy
25.3	Manage interactions with regulatory bodies
25.4	Manage interactions with the public and media

4. Marking and assessment criteria

Each of the 6 courses requires self-studying previous to the course.

There will be a one hour written examination on the last day of the face to face module that will consists of a multiple choice examination to assess knowledge (K) (70% pass-mark) showing a detailed understanding of the subject. Skills (S) and attitude (A) will be assessed in daily oral and/or written and/or practical examinations during the face to face phase.

The candidate must pass all three components (K, S, A) to pass each course. The candidate must also pass all 6 courses to pass the Module.

Evaluation Procedure		
Evaluation Question	**Judgement Criteria**	**Indicators and Descriptors**
To what extent has the course module participant achieved the required RPE KSAs?	The participant's level of achievement of the course module KSAs will be judged by their grade (marks) from the written examinations.	An overall grade (mark) of: <50% indicate a need for further development. 50 – 70% the course module participant has average knowledge and some experience, however, they should upgrade their KSAs to increase their level of qualification. >70% the course module participant has sufficient knowledge and experience.

5. Pre-requisites

The applicant will be expected to have achieved:
(i) An education to level 6 of the European Qualification Framework (EQF) (e.g. Bachelor degree level either specifically in radiation protection, or in a physical/engineering/mathematical discipline or equivalent through life long learning)

AND
(ii) A minimum of 3 years' experience working in radiation protection environment.

The applicant will be expected to have completed the following 3 generic ENETRAP III modules as pre-requisites for the Nuclear Power Plant Module (see below for alternative pre-requisites):

Basic training module 1: Basics
1.1 Radioactivity and Nuclear Physics
1.2 Interaction of radiations with matter
1.3 Dosimetry: quantities and units
1.4 Biological effects of radiations
1.5 Physical principles of detection

Basic training module 2: Foundation
2.1 Application of ionising radiation
2.2 Radiation protection
2.3 Radiation protection internal dosimetry
2.4 Protection against external exposure
2.5 Dose monitoring
2.6 Regulatory context
2.7 Natural sources of ionising radiation
2.8 Public and environmental radiation protection
2.9 Ethical considerations

Basic training module 3: Occupational
3.1 Transport
3.2 Design issues
3.3 Accidents and emergency issues
3.4 Safety culture
3.5 Waste management
3.6 ALARA culture

Accreditation of Prior Certificated Learning (APCL), which covers learning that has been assessed and certificated by an education or training system, will be considered where appropriate, e.g. the applicant has been awarded a Bachelor or Master's degree whose contents demonstrates the above components had been covered and examined. Alternatively, applicants who can demonstrate equivalent achievement through Life Long Learning (LLL) will also be considered. APCL or LLL applications should be made to the Module co-ordinator before starting the module.

6. Learning outcomes and indicators from EQF per training course

Legend:

Competence	**22**	**Describe the principles of NPP operation**
Training course	4.1	Layout of a nuclear power plant
Activity	22.1	Describe the layout of a NPP in the context of RP
Learning outcome in terms of knowledge (K), skills (S) or attitude (A)	LO K 22.1.1	List the various types of reactors and their principles

22	**Describe the principles of NPP operation**
Course 4.1	Layout of a nuclear power plant
22.1	Describe the layout of a NPP in the context of RP
Knowledge	
LO K 22.1.1	List the various types of reactors and their principles
LO K 22.1.2	Describe the relevant components of a NPP
LO K 22.1.3	Identify the hazards resulting from the operation of a NPP
LO K 22.1.4	Illustrate interactions and reactions of neutrons with matter
Skills	
LO S 22.1.1	Comprehend the situation and apply appropriate RP

LO S 22.1.2	Set up efficient shielding for neutron radiation

Indicators from EQF	
Knowledge	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles
Skill	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study
EQF Level	6
ECVET Credit Points	1.5
Proposed Duration	35 hours pre-course 5 hours face to face Total 40 hours
	The pre-course phase will consist of self-studying. The face to face phase of the course will consist of lectures and optionally practical units about the principles of nuclear power generation; the layout of a nuclear power plant; and the hazards resulting from its operation for staff, contractors and the public.

23	**Apply RP in routine operation**
Course 4.2	Measuring devices/installations and quality control for RP in nuclear power plants
23.1	Manage monitoring of radiation in routine operation
Knowledge	
LO K 23.1.1	Name the various measuring devices in RP and describe their proper handling
LO K 23.1.2	Describe the handling and maintenance of relevant RP installations
LO K 23.1.3	Illustrate the relevant radioanalytical methods
Skills	
LO S 23.1.1	Define critical parameters
LO S 23.1.2	Analyse the data from RP measurements
LO S 23.1.3	Define an appropriate scheme for routine measurements
LO S 23.1.4	Collect representative samples appropriately for further analysis
Attitude	
LO A 23.1.1	Apply adequate RP
23.2	Apply quality control in RP
Knowledge	
LO K 23.2.1	List the methods of quality control in RP and calibration of relevant equipment
LO K 23.2.2	Characterise interfering factors in radiation measurements
Skills	
LO S 23.2.1	Set up a routine protocol for quality control/quality assessment
LO S 23.2.2	Train the staff in quality control
Attitude	
LO A 23.2.1	Train on the importance of quality control/quality assessment
Course 4.3	Organisation and RP roles and duties
23.3	Organise RP in nuclear power plants
Knowledge	
LO K 23.3.1	Describe the RP procedures of the operator
LO K 23.3.2	Describe the pertinent regulations, rules and guidelines

LO K 23.3.3	Define the concepts of work place zoning
Skills	
LO S 23.3.1	Apply and enforce the RP procedures of the operator
LO S 23.3.2	Identify and supervise the demands for operational RP and act accordingly
LO S 23.3.3	Create a training sequence and deliver appropriate training to the staff
Attitude	
LO A 23.3.1	Propose improvements within the organisation
23.4	Manage personal dosimetry
Knowledge	
LO K 23.4.1	Describe the national regulations for dosimetry
LO K 23.4.2	Categorise function and applications of the various dosimeters
LO K 23.4.3	Name the dosimetric quantities and concepts
Skills	
LO S 23.4.1	Supply appropriate dosimetry to staff
LO S 23.4.2	Set up a protocol for the dosimetry of contractors and visitors
LO S 23.4.3	Calculate provisional dosimetry
LO S 23.4.4	Define suitable documentation
Attitude	
LO A 23.4.1	Promote appropriate personal dosimetry
Course 4.4	Radiation accidents, incidents, alarm, emergency, preparedness and response
23.5	Set up emergency and alarm plans in an organisational context
Knowledge	
LO K 23.5.1	Identify the national and local stakeholders for nuclear emergency
LO K 23.5.2	Name the pertaining legislations
LO K 23.5.3	List accidents, incidents and technical actions
LO K 23.5.4	Define the roles and function of the channel response
LO K 23.5.5	Describe the relevant forms of internal and external aggression
Skills	
LO S 23.5.1	Elaborate a protocol for medical emergencies in RP areas
LO S 23.5.2	Set up an emergency protocol for RP in case of fire
LO S 23.5.3	Set up an emergency protocol for RP in case of technical failures and incidents
LO S 23.5.4	Set up an alarm plan for internal and external aggression
LO S 23.5.5	Elaborate an alarm plan for major technical failures
Attitude	
LO A 23.5.1	Inform on emergency issues
LO A 23.5.2	Conduct alarm, emergency, preparedness and response trainings

Indicators from EQF	
Knowledge	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles
Skill	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study
EQF Level	6
ECVET Credit Points	1.5
Proposed Duration	30 hours pre-course 15 hours face to face Total 45 hours
	The pre-course phase will consist of self-studying.

	The face to face phase will consist of lectures and practical units on operational RP; alarm and emergency planning in RP; RP in nuclear power plants.

24	**RP during shutdown of the power plant**
Course 4.5	Organisation of RP during shutdown both routine and incidental
24.1	Organise RP during shutdown
Knowledge	
LO K 24.1.1	Identify the predominant radiation hazards for each step of the fuel cycle
LO K 24.1.2	List the activities during a routine shutdown
LO K 24.1.3	Illustrate the transport techniques for fuel elements
LO K 24.1.4	Describe the gammagraphy techniques
Skills	
LO S 24.1.1	Set up a RP scheme for a routine shutdown
LO S 24.1.2	Organise RP during shutdown
LO S 24.1.3	Inform and train staff and contractors on RP issues during shutdown
Attitude	
LO A 24.1.1	Promote a positive safety culture during shutdown

Indicators from EQF	
Knowledge	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles
Skill	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study
EQF Level	6
ECVET Credit Points	1.5
Proposed Duration	20 hours pre-course 5 hours face to face Total 25 hours
	The pre-course phase will consist of self-studying. The face to face phase of the course will consist of lectures and optionally practical units on the organisation of RP during shutdown.

25	**Manage interactions with the hierarchy, regulatory bodies and the public**
Course 4.6	Interaction with stakeholders and the public
25.1	Manage interactions with internal and external units
Knowledge	
LO K 25.1.1	Identify the RP actors at national level
LO K 25.1.2	Describe the organisational structure of your power plant
Skills	
LO S 25.1.1	Harmonise RP with relevant units of your organisation
LO S 25.1.2	Harmonise your unit with external RP bodies
Attitude	
LO A 25.1.1	Engage staff to promote a positive safety culture
LO A 25.1.2	Inform on RP issues
LO A 25.1.3	Discuss the distinct roles among staff members
LO A 25.1.4	Adopt a positive attitude towards organisational harmonisation

25.2	Manage interactions with the hierarchy
Knowledge	
LO K 25.2.1	List the duties of documentation and storage thereof
LO K 25.2.2	Illustrate how to retrieve and compile relevant data
LO K 25.2.3	Describe the hierarchical structure of the organisation
LO K 25.2.4	Identify all relevant staff and whom to report
Skills	
LO S 25.2.1	Organise appropriate documentation of all RP actions
LO S 25.2.2	Compile and store all relevant documentation in compliance with regulations and guidelines
LO S 25.2.3	Compile relevant data and write reports according to the duties
Attitude	
LO A 25.2.1	Discuss documentation issues
LO A 25.2.2	Discuss relevant RP aspects with appropriate actors
LO A 25.2.3	Participate in the representative bodies
25.3	Manage interactions with regulatory bodies
Knowledge	
LO K 25.3.1	List the relevant regulatory bodies
LO K 25.3.2	Identify relevant contact persons
LO K 25.3.3	List duties of report
LO K 25.3.4	Describe how to communicate an emergency appropriately with authorities and relevant bodies
Skills	
LO S 25.3.1	Interact professionally and efficiently with all regulating bodies
LO S 25.3.2	Provide the required reports and forward them
LO S 25.3.3	Anticipate and plan for regulatory controls and the control programme (internal and external)
Attitude	
LO A 25.3.1	Discuss relevant RP issues with appropriate actors
25.4	Manage interactions with the public and media
Knowledge	
LO K 25.4.1	Describe the guidelines for interaction with the public and media
LO K 25.4.2	Describe relevant confidentiality policies
Skills	
LO S 25.4.1	Interact appropriately with the public and media
LO S 25.4.2	Train the staff accordingly
Attitude	
LO A 25.4.1	Interact adequately with the public and media

Indicators from EQF	
Knowledge	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles
Skill	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study
EQF Level	6
ECVET Credit Points	1.5
Proposed Duration	15 hours pre-course 5 hours face to face Total 20 hours
	The pre-course phase will consist of self-studying.

	The face to face phase of the course will consist of lectures on the interaction with stakeholders and the public.