

COURSE ON “RADIATION PROTECTION EXPERT. CONVERGENCE TOWARDS THE EUROPEAN STANDARD

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ABSTRACT

The revision of the basic safety standards of EURATOM has tried to homogenize the figure of the Radiation Protection Expert (RPE) all around Europe. Although the Directive transposition is scheduled for 2018, measures are being taken in favor of the implementation of new education and training requirements for RP experts, with the funding of projects such as ENETRAP.

CIEMAT has participated in these projects from the beginning (2005) up to now; and since the eighties is the Spanish organization that traditionally delivers this training course as part of the main education and training programs. In this context, the Course of “Radiation Protection Expert” is updated, following the ENETRAP RPE scheme, ensuring compliance with all the criteria established by the Spanish Nuclear Regulatory Body (CSN) and introducing the new educational trends demanded by society.

This paper presents the new course format and the results of the first editions. Now it is a blended learning course (on-line & face to face) structured into five modules, three of them correspond to a mandatory common part, and the other two are part of the speciality. One of them, Research Laboratories and Medical Facilities or Nuclear Facilities and of Nuclear Fuel Cycle is mandatory. It also includes the completion of an end-of-course project.

The educational tools kit for the first modules has been prepared in multimedia format, to be managed in an educational platform. This phase lasts three months. In this phase of learning, the contents are organized in didactic units of one or two weeks and all the multimedia material has been developed by experts in these subjects and includes interactive theoretical content, exercises, animations, videos, etc.

The face-to-face classroom part lasts one month and a half and includes the practical sessions and discussion and calculation seminars belonging to the first two modules, as well as part of module III, and all modules IV & V. This phase is developed on daily sessions, which are taught in CIEMAT and other facilities by collaborating entities.

Finally, we have been working on improving the teaching methodology, developing methodological guides to harmonize and support the tasks of the teachers involved with the objective to achieve greater dynamism improving learning efficiency.

This new version of the Course “Radiation Protection Expert” is the result of the natural evolution of any training action driven by the current educational, social and technological situation: adaptation and modernization.

It aims to further evolve into the Common European Training Space without forgetting compliance with the requirements and conditions established and enforced of the CSN.

1. Introduction.

The revision of the basic safety standards of EURATOM has tried to homogenize the figure of the Radiation Protection Expert (RPE) all around Europe. Although the Directive transposition is scheduled for 2018, measures are being taken in favor of the implementation of new education and training requirements for RP experts, with the funding of projects such as ENETRAP (European Network on Education and Training in Radiological Protection) (6PM and 7PM).

CIEMAT has participated in these projects since the beginning (2005) up to now; and since the eighties is the Spanish organization that traditionally delivers this training course as part of the main education and training programs.

In Spain, the figure of the Radiation Protection Expert (EPR) is defined in the technical instruction IS-03 of the CSN. This document establishes the requirements to be able to obtain the qualification and to be recognized as EPR; To do this, the applicant must have a university degree, pass a 300-hour training course, 3 years of experience in the field of radiation protection (six months in the case of RX facilities for diagnostic purposes) and certified medical fitness.

In this context, the Course of “**Radiation Protection Expert**” is updated, following the ENETRAP RPE scheme, ensuring compliance with all the criteria established by the Spanish Nuclear Regulatory Body (CSN) and introducing the new educational trends demanded by society.

This paper presents the new course format and the results of the first editions.

2. Innovations performed.

Taking into account that educational and training needs are changing and that the society demands a different structure, from the beginning CIEMAT Training Unit proposed a type of course completely renovated but maintaining the technical contents that characterize it. The first part of the renovation took place in the first edition of the course during 2014-2015 and the second part in the 2016 edition, where some improvements were introduced that were planned as secondary but also necessary and important. These are:

2.1. - Modulation of the program.

The course has been modulated according to the ENETRAPII scheme for RPE (Radiation Protection Expert), common practice in the new training plans of masters. It has been structured into five modules: three of them correspond to a mandatory common part (Basic Concepts, Fundamentals of Radiation Protection and Operational Radiation Protection), and the other two are part of the speciality. One of them, Research Laboratories and Medical Facilities or Nuclear Facilities and of Nuclear Fuel Cycle is mandatory. It also include the completion of an end-of-course project.

This design of modular system would allow to including, in future editions, up to three more optional modules. This, together with the completion of an end-of-course project to be developed in a job, would make it possible, in the future, to turn the course into a master's degree if this were of interest.

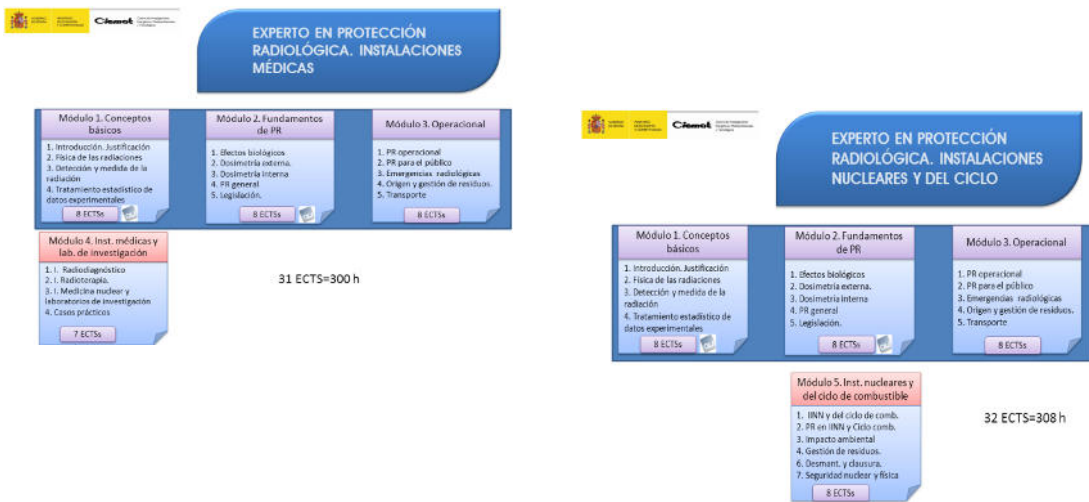


Fig. 1. Modules of the course

2.2. - Methodological changes

Perhaps the most relevant change in Education and Training in this century has been the incorporation of new teaching methodologies, not only consolidation of information and communication technologies (ICTs) but also the way of student-teacher relationship. The introduction of these tools mainly affects (although we try to spread them to the whole course) to the phase of online study that has had a great importance in this phase and is in which more changes and improvements have been introduced.

Since its first edition, the course has been developed by implementing a "blended learning" methodology, that is, the combination of face-to-face and on line learning. The chosen learning methodology efficiently combines different teaching methods, teaching models and learning styles, based on a transparent communication of all the areas involved in the course. The didactic resources used are alternated in a balanced way, using tools based on technology - appropriate for a more individualized learning - combined, in the same format with the more traditional version, the master class. This basic format of presentation of the information is powered by face-to-face, theoretical and practical sessions and group work dynamics (round tables, seminars, group work in the resolution of practical cases or in the elaboration of end of course projects), that help to the understanding, recovering gaps and misconceptions, and finally, to a deeper consolidation and fixation of learning. Thus, a methodology that uses all the available tools to achieve a dynamic, participative and effective teaching, reaching the proposed objectives.

The implementation of this blended learning modality has allowed us to save time moving from a three-month stay in Madrid, expensive in time and money for students and also for companies and institutions, to a five weeks face-to-face, plus three months online, of course with all available resources made available to the participants through our internet platform "Virtual Classroom".

The improvements have been:

- Development of methodological guides to unify and support the tasks of the teachers involved (authors, online tutors and face-to-face teachers) with the aim of achieving greater dynamism that results in the efficiency of learning.



Fig. 2. Different teaching guides

- Incorporation of tutors. Each module is structured in different teaching units coinciding with specific themes. Each unit has a virtual tutor to support students. Among its activities have been: attention to students and resolution of doubts concerning the content of that unit; the proposal of exercises to be solved and their monitoring and evaluation; the proposal of innovative actions that help the understanding of the contents by other non-standard ways, different from the traditional exercises.
- Change in the evaluation system, introducing online exams, practical cases, exercises, etc.

3. - Results

The new format of the Radiation Protection Expert course is based on a blended learning methodology (on-line & face to face course) and it has a teaching load equivalent to 465 hours summarized:

- ✓ 365h general part (258h online and 107h face-to-face) and
- ✓ 100h per specialty (70h face-to-face and 30h End-of-Course Project)

Structuring the course modularly has allowed us to identify those modules that can be carried out at a distance, due to its more general or easier to study theme through this system, and to bet on the face-to-face methodology for those modules in which the subject is more experimental, operational or must be updated annually.

- **On line part**

Educational tools kit for the first modules has been prepared in multimedia format, to be managed in an educational platform. This phase lasts three months. In this phase of learning, the contents are organized in didactic units of one or two weeks and all the multimedia material have been developed by experts in these subjects and include interactive theoretical content, exercises, animations, videos, etc.

Each module consists of:

- Program of the module. Document in html in which the teaching team (teachers and coordinators) makes a recommendation on the study of the corresponding module and that includes the start and end dates of all the activities of the module.
- Online content multimedia interactive, self-learning, including theoretical explanations, flash animations of the most and less complex physical phenomena, self-evaluation exercises, graphics, drawings, videos...
- Complementary material, formed in all cases by a manual in pdf (practical cases, examples, videos, legislation....)
- Mandatory exercises. In all modules there is at least one compulsory exercise proposed by the corresponding teaching staff, which must be delivered and evaluated within the duration of the module.
- Forums of contents where students can ask any questions related which must be answered within a maximum of 24 hours by the teacher or can even be answered by other students. This forum can also be used for discussions on topics proposed by the teacher or open debates to resolve the proposed exercises.
- Evaluation. The evaluations consist of 10 test questions to answer in 30 minutes. Students are allowed to make a maximum of two evaluations being assigned the best note of the two trials.

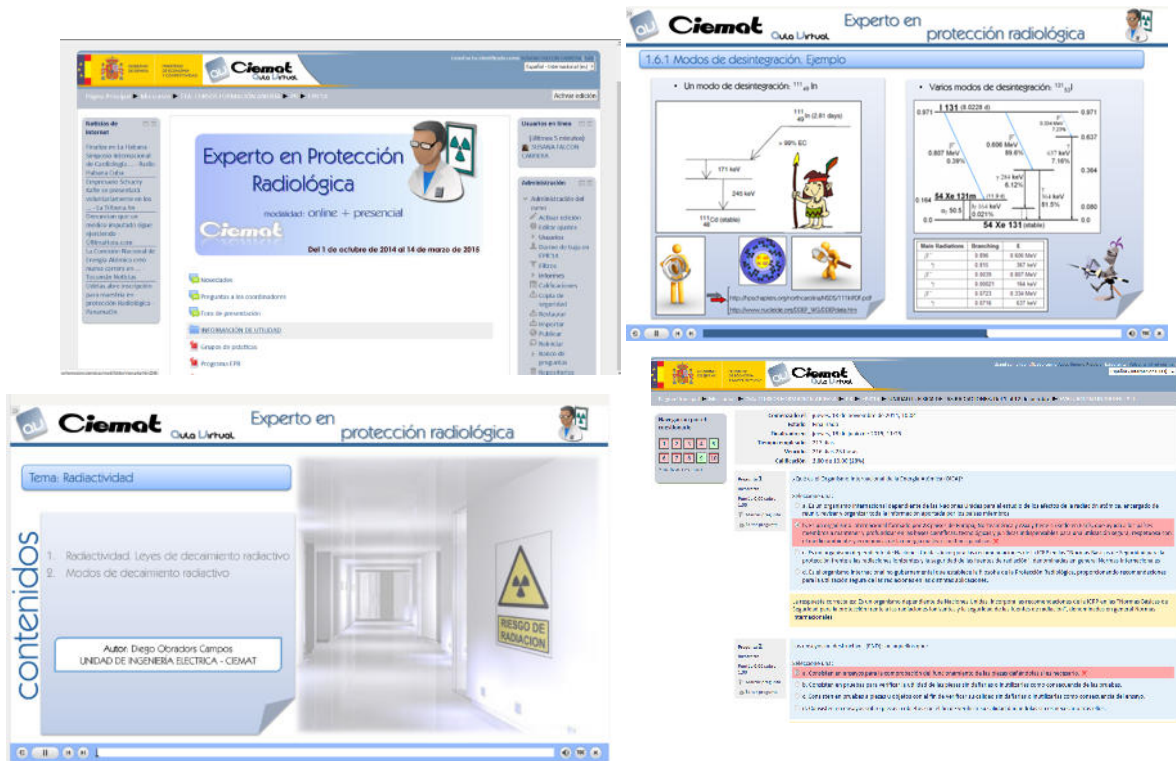


Fig. 3. Multimedia material through the Virtual Classroom

- **The face-to-face classroom part** lasts one month and a half and includes the practical sessions and discussion and calculation seminars belonging to the first two modules, as well as part of module III, and all modules IV & V. This phase is developed on daily sessions, which are taught in CIEMAT and other facilities by collaborating entities.

The material provided to the students follows the online material and consists of written documentation of each of the topics and practices as well as the presentations of the teachers. The virtual space in which the online part is developed, also serves as support for the face-to-face part, providing support for didactic materials in digital format, use of forums for questions, debates, news, and valuation surveys.

- **Evaluation system**

The evaluation of the course is carried out through elements on both parts:

- **On line part:**

1. Online content and records on the platform. The platform records all the actions, as well as the time dedicated to each of them. It produces complete reports of dedication. It is mandatory to visualize all multimedia content (SCORM) to pass the modules
2. Activities proposed by teachers, personal or group, compulsory or optional, in order to assist in the learning process. These activities are an integral part of the assessment of learning, accounting for 40% of the module score.
3. Student-tutor communication. The student-tutor communication, through forum, mail, etc., provides an indicator of the progress of the learning process. Participation in the forums is a very positive element in the final assessment.
4. Questionnaires. The student must pass the assessments of all the modules. The minimum mark is five on all questionnaires. There are two attempts for each questionnaire. The higher of the two attempts is maintained. This represents 60% of the final mark.

The students must surpass 90% of the online content in order to attend the face-to-face part of the course.

- **Face to face part:**

5. Face-to-face classes and practices. They are surpassed attending them and they are registered by means of signature control, being necessary a minimum attendance of 90%.
6. Face-to-face assessments. There are two face-to-face evaluations for the common modules and one more evaluation for each of the specialty modules. The specific weight of each evaluation in the final grade is 35% each one of the common modules and 30% the evaluation of the specialty.
7. End of course project. A project must be completed at the end of each specialty.

4. - Conclusions

This new version of the Course "Radiation Protection Expert" is the result of the natural evolution of any training action driven by the current educational, social and technological situation: adaptation and modernization.

It aims to further evolve into the Common European Training Space without forgetting compliance with the requirements and conditions established and enforced of the CSN.

The choice of a blended learning format for this course (on line & face to face) it has been successfully proven with a good reception by the students and their results comparable to those of previous editions.

This course is constantly updated so that, without losing sight of the high quality standards achieved, it adapts to current national and international requirements.

In this two editions, CIEMAT has continued the efforts begun in previous years to improve the initial project, following the ENETRAP RPE scheme, changing the learning format, reviewing the contents, both offered on-line and in face-to-face mode, consolidating both parts in a more inclusive course format, avoiding redundancies and investing in improving the pedagogical and methodological skills of our teachers, with special emphasis on the most complex subjects. In order to achieve this, reinforcement materials have been developed in a digital format that is more accessible to the participants, familiar with new technologies, and guides have been edited for classroom teachers and on-line tutors to help them to stimulate the learning of the student. The system for assessing students' knowledge has also been revised and updated.

Finally, it has been tried to guarantee a friendlier environment of the course in which its own development, relation with the tutors and other participants as well as the resolution of exercises and problems act in themselves as catalysts of the motivation to obtain a calmer learning, being more efficient at the same time.

5. - References.

- 1.- Falcón S, Fernández J, Llorente C, Marco M. Aplicación del esquema europeo de Formación al EPR. 1^{er} curso de Experto en Protección Radiológica. SNE, 2015
2. - Llorente C, Falcón S, Fernández J, Marco M. Spanish course for the radiation protection expert. A new approach in the methodology. EUTERP, Grecia, 2015.
- 3.- Falcón S, Fernández J, Llorente C, Marco M. Curso de Experto en Protección Radiológica. Esquema europeo de Formación del EPR. SEPR, Valencia 2015.