

# Spanish educational website on radiation protection nuclear medicine course

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## **Abstract**

The Spanish Regulatory Body (CSN) and the Research Centre for Energy, Environment and Technology, CIEMAT, are developing a Radiation Protection Training Project based on an educational web site to achieve and maintain a high level of safety and best practice in Nuclear Medicine procedures.

The project includes the specialized training material needed to qualify Operators and Supervisors working in Nuclear Medicine facilities. It also provides a minimum common level of training in order to prevent accidents with radiological consequences and to mitigate them. The specific training is based on national and international regulations.

The main goals of the project are to optimise educative programmes to the above mentioned exposed workers in order to achieve the required level of expertise and competencies and to supply clear guidance as required for Operators and Supervisors.

This paper describes the prerequisite educational level, the training requirements, including competences and the training packages for Nuclear Medicine workers.

## **1. Introduction**

At the present time, Nuclear Medicine (NM) is one of the most common technique for diagnostic and in some cases for therapy, which are becoming increasingly popular in the advanced society. In the last years the specialized workers, physicians, nurses and nuclear medicine technologist, have been increasing. Actually, in Spain there are approximately 2.000 specialized workers in NM. The RP training for these workers exposed to an ionising radiation has supposed a great effort in the European countries and in Spain in particular.

Spanish Normative in radiation protection (RP) field establishes the necessity to guarantee an adequate initial training to those workers who are involved in Nuclear Medicine practices. Individual certifications, granted by the Spanish Regulatory Body, Consejo de Seguridad Nuclear (CSN), based on personal licences and accreditation are required for workers who operate and supervise Nuclear Medicine facilities (1,4).

The CSN grants and renews these certifications or licenses each 5 years. Regarding the training, it also establishes the requirements and procedures of the courses needed to obtain licenses for operators and supervisors. In fact, syllabus and objectives for training courses are described in the Spanish Normative (2) compatible with the European regulations(3,5).

Training courses imparted to the workers from the NM facilities should be accredited by the regulatory body and should have similar syllabus, practical exercises and imparted hours. Moreover all the courses should have an examination at the end of the training. In general, those certificates programs are offered in hospitals, universities or specialized and recognized training centres when needed. There are two different levels of accredited programs in nuclear medicine technology, regulated for the nuclear medicine workers depending of the level of responsibilities of the workers:

TC for Supervisors on Nuclear Medicine addressed to NM physicians or medical practitioner  
TC for Operators on NM addressed to nuclear medicine technologist and nurses

To improve the level of education and training on RP of those workers and to take advantage of the level of expertise acquired in the educational system in the past years, the CSN and CIEMAT have developed a didactical project for providing standardized RP training material of those courses designed in order to facilitate the training required to obtain licences, through an educational web site.

Objectives, syllabus, lectures, practical sessions and complementary material of the courses are available in the web site and, in special cases, in another support, as CD-ROM.

## 2. Project methodologies

This paper presents the educational web site that will be accessible through the CSN web. The web site is being developed to provide educational material based on a modular design to facilitate the management, organization and development of the courses to obtain licenses on nuclear medicine, which have to be supervised by the CSN, to organisers, trainers and professionals. We present the nuclear medicine training programme developed last year as the initial results of this useful tool for practitioners. The user can choose to obtain the information included in the web site by downloading the complete course or by obtaining the individual modules stepwise. This training project attempts to propose the use of a web site as standardisation of radiation protection training material, in order to contribute to the optimisation of radiation protection through a high quality education.

The expected results are described as follows:

1. To facilitate the management, organization and development of the courses designed to obtain licenses and accreditation, which have to be supervised by the CSN, to organisers, trainers and professionals.
2. To standardise the RP training material of those courses.
3. To guarantee the quality of the training material and, therefore, the adequate training in each applied fields and level of responsibility.
4. To contribute to the harmonization of RP training material.

As it has been mentioned before, the project supplies a comprehensive standardized material for training courses aimed at training professionals to acquire the RP basis needed to operate and supervise Nuclear Medicine facilities. According to local regulations (6,7,8), the NM training programmes should include the following topics:

PROGRAMME; TRAINING TOPICS	operator	supervisor
<b>Module 1: BASIC AREA</b>		
Nuclear physics and Interaction of radiations with the matter	2	3
Radiological units	1	1
Detection and Measurement Methods. Dosimetry	2	2
Biological effects of radiation	1.5	1.5
Radiation Protection. General criteria	1	1.5
Radiological protection. Occupational exposures. Wastes	2.5	3
National and European regulations	1	1.5
Practical works and seminars	6	8
Evaluation	Y	Y
<b>TOTAL (Basic area):</b>	<b>17</b>	<b>21</b>
	<b>/16CSN</b>	<b>/18CSN</b>
<b>PROGRAMME; TRAINING TOPICS</b>	<b>operator</b>	<b>supervisor</b>
<b>MOD.2 NUCLEAR MEDICINE</b>		
Nuclear medicine procedures and objectives. Instrumentation in NM	2	3
Diagnostic and therapeutic procedures	1	1
Associated risks. Training and information.	1	1.5
Radiation protection: workers and patients. System of radiological protection for medical exposures.	4	4.5
Quality assurance in NM services and legal aspects.	2	3
Specific practical works, seminars and Technical visit	10 h.	12 h.
Evaluation	Y	Y
<b>TOTAL N. Medicine:</b>	<b>20 h</b>	<b>25 h</b>

Fig 1: RP Courses for Nuclear Medicine staff

Taking into account the requirements above mentioned, a specific working group was created to develop all the tasks included in the project. The group was integrated by experts from the regulatory body, radiophysics and radiation protection experts involved in nuclear medicine practices and radiation protection experts from CIEMAT.

We use a modular approach including one basic or general module covering the basic learning objectives, which includes matters shown in Fig.1. The core learning objectives are then supplemented with specific material covering different applications. For each of the modules the following material has been developed and included in the web site: Learning objectives, syllabus, training schedule, theoretical lessons and practical sessions guidance (demo and lab exercises), visual aids for trainers, examples of questions to be used for oral and written assessment.

The implementation of the project is being carried out in different tasks, described as follows:

- Implementation of the web server.
  - Elaboration of objectives, syllabus and practical and theoretical lessons of:
    - Basic module of courses for both levels: operator/supervisor.
    - Specific module: Nuclear Medicine field, for both levels: operator/supervisor.
- Elaboration of the complementary material for the courses.



Fig 2: Material for the Basic Module

### 3. Results

The project develops comprehensive training packages aimed to train professionals to acquire the RP basis needed to operate or supervise the Nuclear Medicine facilities. The two modules of the nuclear Medicine training program for operators and supervisors have been structured in a common core curriculum corresponding to the basic area and other specific in nuclear medicine for both levels. The syllabus of the courses takes into account the different tasks and responsibilities that those workers are developing in the NM services to ensure necessary competence.

The basic module covers the basic learning objectives which includes the topics detailed in Fig.1.; The specific module in Nuclear Medicine covers the most common applications and techniques in nuclear medicine ( gamma cameras; SPECT; PET; activity calibrators; common procedures; radiation safety precautions; patient dosimetry and QA requirements, etc.

The user is able to download PDF files with lessons, practical sessions, objectives and complementary material through the web site. Next figures show some of the screens available at the web site. Fig 2, Fig 3, Fig 4.

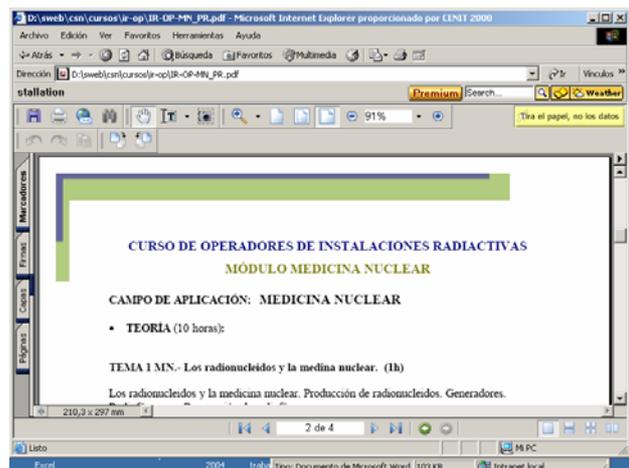
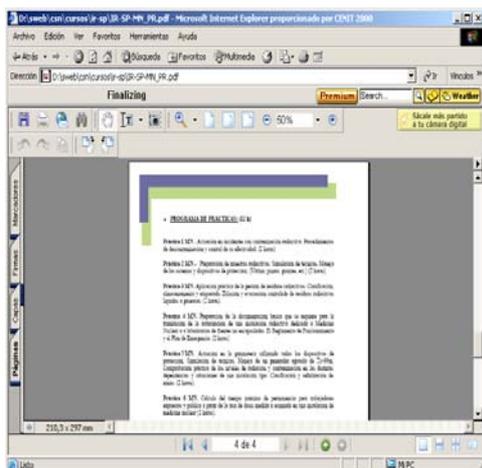


Fig 3: Theory and practical works syllabuses

**OPERADORES DE INSTALACIONES RADIATIVAS.**

**CAMPO DE APLICACIÓN: MEDICINA NUCLEAR**

**OBJETIVOS DIDÁCTICOS**

**TEMA 1: LOS RADIONUCLEIDOS Y LA MEDICINA NUCLEAR.**

**La medicina nuclear**

- Conocer el alcance de la especialidad de la Medicina Nuclear
- Conocer la definición de Radiofármaco
- Conocer las características ideales de un Radionucleido para:
  - Imagen SPECT
  - Imagen PLANAR
  - Imagen PET

**Producción de radionucleidos**

- Conocer los procedimientos de obtención de Radionucleidos
- Conocer los Radionucleidos de aplicación en la Medicina Nuclear que se obtienen en el Reactor Nuclear
- Identificar los radionucleidos de uso médico obtenidos en Ciclotrón

**OPERADORES DE INSTALACIONES RADIATIVAS. MEDICINA NUCLEAR**

**OBJETIVOS DIDÁCTICOS**

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- Conocer los Radionucleidos de aplicación en la Medicina Nuclear que se obtienen en el Reactor Nuclear
- Identificar los radionucleidos de uso médico obtenidos en Ciclotrón
- Conocer los aspectos teóricos de un Generador
- Entender el concepto de Equilibrio Radiactivo
- Conocer las técnicas de separación de un radionucleido hijo procedente de Generador
- Conocer las características ideales de un Generador
- Conocer antecedentes históricos del Generador  $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$
- Conocer los diferentes controles de calidad del eluido de un Generador

**Preparación de radiofármacos**

- Conocer los procesos fundamentales en la preparación de un Radiofármaco
- Conocer las características fundamentales de los Radiofármacos de  $^{99\text{m}}\text{Tc}$
- Analizar los aspectos relacionados con el control de calidad de Radiofármacos

Fig 4: Syllabus and objectives of the NM course

The course includes practical works to provide the participants hands-on and individual practical training. The practical works should be developed in the NM services. This course on NM lasts in general, two weeks depending on the target audience.

#### 4. Conclusions

- The training packages on NM developed in this project cover the minimum standards of radiation protection training required by the Spanish regulatory Body. They also provide a common level of training in order to prevent accidents with radiological consequences or mitigate them.
- The training program is based on the use of a web site.
- The project includes training tools developed in a modular approach. The basic module covers the general aspects related to radiation exposures and the specific module covers the most common nuclear medicine techniques.
- Task in each of the training modules has been designed to develop specific competence taking into account different target groups. It is expected that the training packages will assist the participants to establish and maintain an effective programme in nuclear medicine.
- Complete materials for trainers and trainees will be available in the web site to ease courses performance.

This paper is the result of accumulated experience in radiation protection training of CIEMAT, CSN and Hospital Ramon y Cajal. The authors wish to acknowledge to all the authors for his support.

### References

- [1] Real Decreto RD1846/1999 por el que se aprueba el reglamento de Instalaciones Nucleares y Radiactivas.1999
- [2] Safety Guide CSN 5.12: Homologación de cursos de formación de supervisores y operadores de instalaciones radiactivas; CSN, 1988.
- [3] Directive 96/29/ BSS for the protection of health of workers and the general protection of health of workers and the public against the dangers arising from ionisation radiation. 1996
- [4] RD 783/2001, de 6 de julio, por el que se aprueba el reglamento sobre protección sanitaria contra radiaciones ionizantes.
- [5] Directive 97/43; Health Protection of Individuals against the dangers of ionizing radiation in relation to medical exposure. Official Journal of the European Communities, L 180: 1997.
- [6] Real Decreto RD815/2001, sobre justificación del uso de las radiaciones ionizantes para la protección radiológica de las personas con ocasión de exposiciones médicas; 2001.
- [7] Protocolo Nacional del Control de Calidad en la Instrumentación en Medicina Nuclear SEFM, SEMN, SEPR 1999.
- [8] RD 479/1993, de 2 de abril, por el que se regula los radiofármacos de uso humano.

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