

## TA2 - RADIOLOGICAL PROTECTION SYSTEMS AND REGULATION.

### EVOLUTION OF RADIATION PROTECTION TRAINING PROGRAMMES IN SPAIN

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**ABSTRACT:**

*Education and training are an important tool to promote safety culture and to upgrade competence. In this sense, Radiation Protection (RP) training programmes are a major challenge in order to achieve occupational, public and environmental radiation protection in all applied fields of ionising radiation.*

*The Spanish RP Education and Training system provides a solid and integrated educational model. The needs for a specialised training on RP for exposed workers appears into the Spanish regulation in 1964. Since then, a wide variety of RP initial, continuous and on the job training courses has been carried out, taking into account the diverse applied fields, the different levels of responsibilities, the technological and methodological advances, as well as the international trends.*

*CIEMAT, through the RP training Unit, has been organising and developing most of the RP training in Spain since 1964, becoming a reference centre. The educational programmes are being continuously updating and improving in order to complete and adapt all RP training levels. Initial training, long-life training, updating or upgrading training, as well as other innovative courses related with RP are being offered by CIEMAT each year. Another important aspect of RP is the information and training to stakeholders. CIEMAT is also working in this sense.*

*The purpose of this paper is to analyse the evolution of RP training processes since 1964 in Spain, in order to conclude which are the future trends and the changes required to adapt the Spanish RP Education and Training system to the current needs and upcoming scene.*

## 1. INTRODUCTION:

Practices involving ionising radiation, either from an artificial source or from a natural source, are widespread. There is also an increase of their use in all sectors (industry, medicine, research, etc.). Technology and methodology as well as new knowledge in the ionising radiation field are continuously improving and advancing. In this sense, a great effort in order to maintain exposures as low as reasonable achievable is necessary, taking into account new practices, new technology and the new international framework.

Education is widely recognised as an essential instrument to encourage safety culture and to improve efficiency in the work. Training in general and specific training in Radiation Protection (RP) are one of the basic components of optimisation programmes for vocational and public exposures. All the international bodies, along with several guidelines published by the European Commission (EC), recognise the importance of education and training in reducing doses while maintaining the desired level of quality in whatever practice involved with ionising radiation. It is, then, a requirement for government to encourage and to promote education and training in order to ensure the qualification of workers.

In Spain practices involving ionising radiation represent an important sector, concerning a great number of workers. In table 1, the number of the different practices, workers and individual medium doses per year in 2004 are shown.

### NUCLEAR AND RADIOACTIVE INSTALATIONS IN SPAIN IN 2004

	Nº INSTAL.	Nº WORKERS	Individual dosis in average (mSv/year)
<i>Nuclear power plants</i>		6077	1,31
<i>Nuclear fuel cycle and CIEMAT</i>		1109	0,71
<i>Industrial Irradiator</i>	1		
<i>Commercial activities</i>	71		
<i>Industry</i>	748	6006	1,53
<i>Research and Training centers</i>	170	4641	0,56
<i>Medicine (except X R)</i>	340		
<i>X Ray Diagnostic</i>	24069	71344	1,34
<i>Transport</i>		65	3,08
<i>Decommising</i>		5	0,14
<b>TOTAL</b>	<b>25399</b>	<b>89247</b>	

Figure 1: Practices, workers and individual doses in average per year in 2004

The Spanish RP Education and Training system provides a solid and integrated educational model. The needs for a specialised training on RP for exposed workers appears into the Spanish regulation in 1964. Since

*then, a wide variety of RP initial, continuous and on the job training courses has been carried out, taking into account the diverse applied fields, the different levels of responsibilities, the technological and methodological advances, as well as the international tendencies.*

*A description of the Education and training system in Spain is detailed in short next:*

## **2. EDUCATION AND TRAINING SYSTEM IN SPAIN**

### **REGULATED TRAINING:**

#### **1) EXPOSED WORKERS: initial and continuous training**

##### **1.1 Radioactive or nuclear facility: (Radiation sources used in: Nuclear Medicine, Radiotherapy, Non-sealed sources Laboratories, Industrial Radiology, Nuclear Gauges and Well Logging).**

*✓ Supervisors, professionals who supervises the operation of a radioactive installation and guarantees the application of technical specifications, regulations, emergency plans and other official document approved. A license, conceded by the Regulatory Body, CSN, is required. (1, 2, 3).*

*✓ Operators, professionals who operates in a radioactive facility under the supervision of the supervisor. A license conceded by the Regulatory Body, CSN, is required.(1, 2, 3)*

*Specific training requirements are established for workers of X Ray facilities devoted to medical diagnostic. Special accreditation to operate and supervise the facility is required (4, 5).*

*Specific courses are desinged for National Security Guards, who use an X ray equipment to screen for weapons, bombs, and explosive devices.*

*✓ Exposed workers without license: initial and continuous training is required (6). The continuous training has to be shown in the radiological card of exposed workers (7). The training for exposed workers can be grouped in: 1) Staff workers and 2) External workers: non staff workers who developed its labour activity in a Radioactive or nuclear facility: A biennial basic training is required, under the responsibility of the contracted company. An annual specific training is also required, under responsibility of the radioactive or nuclear facility (8, 9).*

##### **1.2 Radiation Protection Unit or Service: qualified experts on radiation protection**

*Radiation Protection Unit or Service is an institution authorised by the Regulatory Body and its role is to advise radioactive and nuclear facilities in RP aspects and to carry out the tasks in this matter established in the regulation. Spanish regulation establishes training requisites and specific accreditation for qualified experts on radiation protection at different levels:*

- ✓ *Radiation Protection Officer: a high level postgraduate course, in industrial, nuclear, environmental or medical applications, to achieve the accreditation conceded by the Regulatory Body, is required to become a Radiation Protection Officer, responsible of a RP Technical Unit or Service. This specialised training is established in 1986 (5) and it has been updated and improved in 2002 (10).*
- ✓ *Technical qualified expert: in 2001, the technical qualified expert in RP appears in the national Regulations (6) to carried out the tasks of a RP Technical Unit or Service under the supervision of the RP officer. In 2002, specialised training, initial (40 hours course) and continuous, and prerequisite are established (10)*

### **1.3 Hospitals: Experts on Medical Physics (Radiophysics):**

*In the medical sector, special educational programme, practical training and specific accreditation are established for experts on medical physics (11). This training includes a previous exam and a three-year practical training in a hospital. An Expert on Medical Physics is the professional who has the knowledge to apply the techniques used in the radiation physics in the medical procedures involved with ionising radiation.*

*The continuous training is specially designed to promote and to profit the benefit of the new emerging technologies, being one of the bases in the RP optimisation programmes (9).*

### **2) NON EXPOSED WORKERS: information and training to non-radiological sector and stakeholders**

*Spanish RP Education and Training Programmes provide, as well, training and information devoted to non-radiological or nuclear sectors, which are likely to be involved with ionising radiation. An example is the RP training plan to iron and steel industry, carried out by CIEMAT together with ENRESA and the Regulatory Body, CSN, since 1998.*

*Information and training about NUCLEAR EMERGENCY PLANS to population and actors is also well defined (13).*

### **3) ACADEMIC PROGRAMMES OF UNIVERSITIES AND TECHNICAL SCHOOLS**

*RP training is also considered in the national academic programmes of Universities and technical schools, specially in the training of sanitary staff, following the requirements of 97/43/EURATOM directive (7).*

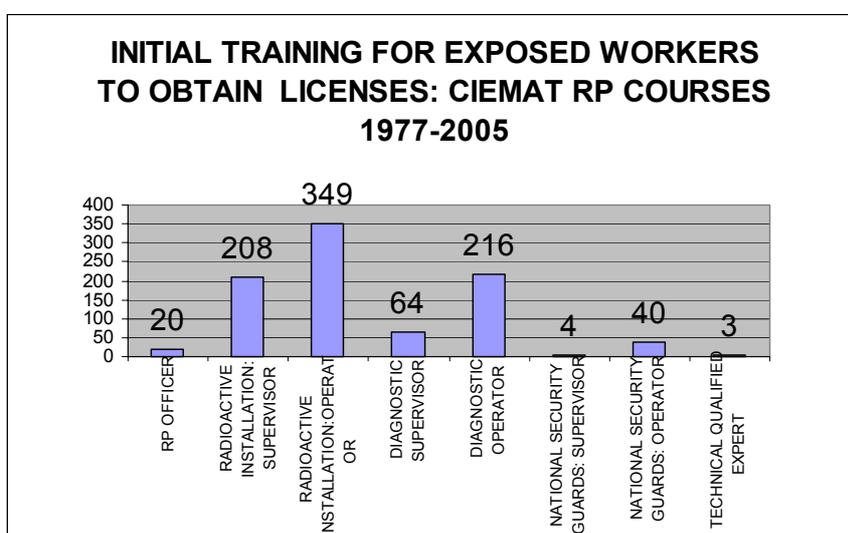
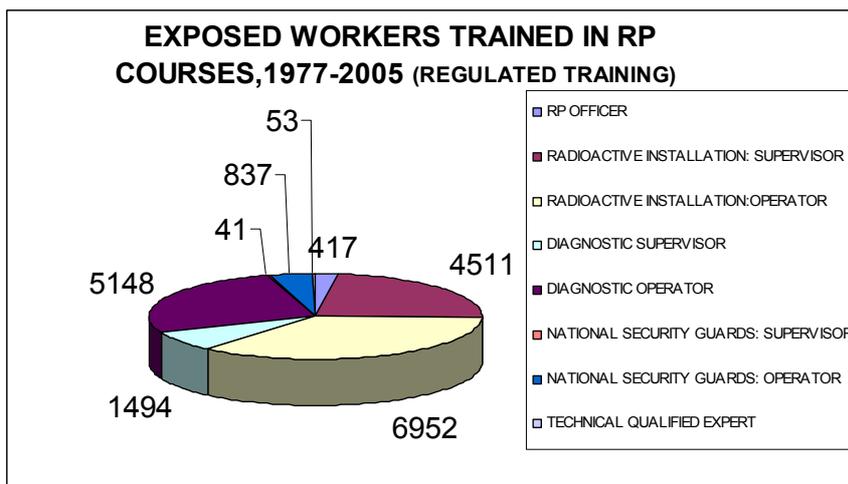
*In table 1, a summary of the Spanish regulated training in RP is detailed.*

### **3. RESULTS:**

*CIEMAT, through the RP training Unit, has been organising and developing most of the RP training in Spain, becoming a reference centre. Initial training, long-life training, on the job training, updating or upgrading training, as well as other innovative courses related with RP are being offered by CIEMAT each year. CIEMAT is also involved in the information and training to non-radiological or nuclear sectors, as the iron and steel industry, and stakeholders. In addition, specialised training has been offering since its foundation in topics like Ionising Radiation Measurement, Dosimetry, Radioactive Material transport, Radioactive Wastes, Nuclear Security, etc.*

*The RP educational programmes are being continuously updating and improving in order to complete and adapt all RP training levels. In this sense, new advances of technologies, methodologies and knowledge are taken into account. New educational tools are also being included in the offered training. Nevertheless, Open and Distance learning focussed on e-learning is one of the goals to be implemented in RP training. CIEMAT is also working in this sense.*

*In relation to the regulated training, in most cases, the RP specific training was offering by CIEMAT previous to its regulation. Contents, programmes, educational material and schedule were and are being constantly adapted to the national regulations as well as the international background. Concerning this training, 19.437 workers has been trained by CIEMAT, since 1977. Table 2 and figures 1 and 2 show the courses carried out by CIEMAT related with regulated training in RP during 1977 until 2005. Trained people in the different level of the regulated training described in table 1 are also shown.*



**Figure 1 and 2**

*RP training programmes have evolved in this 28 years to a more specialised training. In general, number of lecture hours have decreased, increasing essentially the number of practical sessions. A great effort in order to focussed the training in the concerning practice has been made. Nevertheless, the vast number of practices involving ionising radiation with its particularities has not always allow to reached this objective. The level of responsibility is another aspect which has been carefully included in RP training. New advances of sciences, technology and international normative and recommendations make necessary the continuous updating of content.*

*The future trends and the changes required to adapt the Spanish RP Education and Training system to the current needs and upcoming scene makes indispensable the inclusion of the new educational tools as well as the revision of all the different practices involving ionising radiation.*

		NORMATIVE	PREVIOUS TRAINING	INITIAL TRAINING		EXPERIENCE	ACREDITATION	CONTINUOUS TRAINING
				N° HOURS	EXAM			
Radiation Protection Officer (RP Qualified expert)	Radioactive or nuclear facility	I.CSN IS-06, 2002 (Derogates GS CSN 7.2, 1986) RD 783/2001	High Univ. Degree on Sciences	300 H	YES	3 YEARS	DIPLOMA (CSN)	-
	XR facility					6 MONTHS		
Supervisor	Nuclear facility	RD 1846/1999 GS CSN 5.12, 1988	Medium or high University degree	18 months	YES	3 YEARS	LICENSE (CSN)	
	Radioactive facility	I.CSN IS-07, 2005		35-54 H	YES	-		
	XR facility	RD 1891/1991 Resol. CSN, 1992	Physician/Dentist/Veterinarian/Podologist	25 H GENERAL 17 H DENTAL (*)	YES	-	ACCREDITATION (CSN)	
	National Security guards	RD 1846/1999 GS CSN 5.12, 1988 I.CSN IS-07, 2005	Medium or high University degree	19 H (no normative)	YES	-	LICENSE (CSN)	
Operator	Nuclear facility	RD 1846/1999 GS CSN 5.12, 1988	Medium University degree or equivalent with RP knowledge	1 year	YES	2 YEARS	LICENSE (CSN)	
	Radioactive facility	I.CSN IS-07, 2005	Secondary education or equivalent	30-46 H	YES	-		
	XR facility	RD 1891/1991 Resol. CSN, 1992	Health professionals and technicians	24 H GENERAL 16 H DENTAL (*)	YES	-	ACCREDITATION (CSN)	
	National Security guards	RD 1846/1999 GS CSN 5.12, 1988 I.CSN IS-07, 2005	Secondary education or equivalent	17 H (no normative)	YES	-	LICENSE (CSN)	
Technical qualified expert	Radioactive or nuclear facility	I. CSN IS-06, 2002 RD 783/2001	Technical or vocational high school	40 H (30 T , 10 P)	YES	3 MONTHS	RECOGNITION (RP OFFICER OF THE RP UNIT OR SERVICE)	YES
	XR facility							
Medical Physic Expert / Radiophysics	Medical sector	RD 220/1997	High Univ. Degree on Sciences	NATIONAL EVALUATION TO ACCESS TO PROFESSIONAL EXPERIENCE IN A NATIONAL HOSPITAL		3 YEARS	DEGREE	YES

*(\*) A PORPOSAL FOR DECREASING THE NUMBER OF LECTURE HOURS IS BEING STUDING (OP RX: 19H, dental: 12 H; SP RX:22H, dental: 15 H)  
Table 1: Summary of the regulated training in RP in Spain.*

		INITIAL TRAINING		YEARS (first year - modified date- last year )	N° OF COURSES		N° OF TRAINERS PER COURSE Aprox.	N° OF LEARNERS	
		N° HOURS	EXAM						
<i>Radiation Protection Officer (RP Qualified expert)</i>	<i>Radioactive or nuclear facility</i>	331 H	YES	1977-2004	20	100	401		
	<i>XR facility</i>								
<i>Supervisor</i>	<i>Radioactive facility</i>	55 H	YES	1977-2005	208	45	4511		
	<i>XR facility</i>	25 H	YES	1985-2005	64	12	1494		
	<i>National Security guards</i>	19 H	YES	2000-2004	4	12	41		
<i>Operator</i>	<i>Radioactive facility</i>	41-45 H	YES	1977-2005	349	35	6952		
	<i>XR facility</i>	24 H	YES	1985-2005	216	10	5148		
	<i>National Security guards</i>	17 H	YES	1991-2005	40	10	837		
<i>Technical qualified expert</i>	<i>Radioactive or nuclear facility</i>	75 H (1 <sup>st</sup> course)	55 H	YES	2002-2005	1	3	30	53
	<i>XR facility</i>								

*Table 2: Summary of CIEMAT courses held concerning regulated training in RP, during 1977 until 2005*

#### 4. CONCLUSIONS

- *Education is widely recognised as an essential instrument to encourage safety culture and to improve efficiency in the work. Radiation Protection (RP) training is one of the basic components for reducing exposures in any practice involving ionising radiation. A solid and integrated RP educational model is, then, necessary to ensure the protection and qualification of workers.*
- *Spanish regulation provides a good RP Education and Training system. Since 1964, a wide variety of RP initial, continuous and on the job training was established into the Spanish regulation.*
- *The diverse practices, the different levels of responsibilities, the technological and methodological advances, as well as the international tendencies are included in the RP training programmes.*
- *CIEMAT has been organising and developing most of the RP training in Spain, becoming a reference centre. In most cases, the RP specific training was offering by CIEMAT previous to its regulation. The design of RP programmes has been always developed together with the Regulatory Body.*
- *Since 1977 until 2005, 904 courses concerning only regulated training were carried out by CIEMAT. As a result, 19.437 people were trained. The more demanded training has been the operator training for a radioactive installation.*
- *In addition, CIEMAT offers, each year, specialised training in topics like Ionising Radiation Measurement, Dosimetry, Radioactive Material transport, Radioactive Wastes, Nuclear Security, etc, as well as training to non-radiological sectors and stakeholders*
- *RP regulated training programmes have evolved in this 28 years to a more specialised training, decreasing the general number of lecture hours and increasing essentially the number of practical sessions.*
- *A great effort to focus the training on the concerning practice has been made. The level of responsibility is another aspect which has been carefully included. New advances of sciences, technology and international normative and recommendations has also been considered.*
- *RP training programmes have to be permanently adapted in the above mentioned aspects, taking into account the real scenery which includes all the different practices involving ionising radiation, the future needs and the international background.*

- *The future trends makes indispensable the inclusion of the new educational tools. In this sense, Open and Distance learning focussed on e-learning is one of the goals to be implemented in RP training. CIEMAT is also working in this direction.*

## **5. REFERENCES:**

- 1.** *RD 1846/1999 por el que se aprueba el reglamento de Instalaciones Nucleares y Radiactivas.*
- 2.** *Guía de seguridad del CSN 5.12: Homologación de cursos de formación de supervisores y operadores de instalaciones radiactivas, CSN, 1988.*
- 3.** *INSTRUCCIÓN IS-07, de 22 de junio de 2005, del Consejo de Seguridad Nuclear, sobre campos de aplicación de licencias de personal de instalaciones radiactivas.*
- 4.** *RD 1891/1991 sobre instalación y utilización de aparatos de rayos X con fines de diagnóstico médico.*
- 5.** *Resolución del 5 de noviembre de 1992, del CSN, por la que se establece las normas de homologación de cursos o programas que habiliten para la dirección y operación de las instalaciones de rayos X con fines diagnósticos.*
- 6.** *RD 783/2001, por el que se aprueba el Reglamento sobre Protección Sanitaria contra las radiaciones ionizantes.*
- 7.** *RD 815/2001, sobre justificación del uso de las radiaciones ionizantes para la protección radiológica de las personas con ocasión de exposiciones médicas.*
- 8.** *RD 413/1997, sobre protección operacional de los trabajadores externos con riesgo de exposición a radiaciones ionizantes por intervención en zona controlada.*
- 9.** *INSTRUCCIÓN número IS-06, de 9 de abril de 2003, del Consejo de Seguridad Nuclear, por la que se definen los programas de formación en materia de protección radiológica básico y específico regulados en el Real Decreto 413/1997, de 21 de marzo, en el ámbito de las instalaciones nucleares e instalaciones radiactivas del ciclo del combustible.*
- 10.** *INSTRUCCIÓN de 6 de noviembre de 2002, del Consejo de Seguridad Nuclear, número IS-03, sobre cualificaciones para obtener el reconocimiento de experto en protección contra las radiaciones ionizantes.*
- 11.** *RD 220/1997, por el que se crea y regula la obtención del título oficial de Especialista en Radiofísica Hospitalaria.*
- 12.** *96/29/Euratom Directive. BSS protection of the health of workers and the general public against the dangers arising from ionizing radiation. E.C. L-159 vol.39; Comunicación 98/C 133/03.*
- 13.** *RESOLUCIÓN de 7 de junio de 2005, por la que se aprueban las directrices por las que se han de regir los programas de información previa a la población y capacitación de actuantes y los ejercicios y simulacros de los planes de emergencia nuclear, exteriores a las centrales nucleares.*

