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ENETRAP

European Network on Education and Training in Radiological Protection

Coordination Action

EURATOM Research and Training on Nuclear Energy

WD.04 Report on training needs and capabilities
(WP2 and WP3: Progress report on the status of the questionnaire results)

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SCK•CEN / Studiecentrum voor Kernenergie • Centre d'Etude de l'Energie Nucléaire

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	x
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

1. INTRODUCTION

Article 38.3 of the Euratom Treaty requires each Member State to recognise the capacity of the "Qualified Expert" and to ensure that arrangements for the training of such specialists are put in place. The overall aim of the work undertaken via work packages 2 and 3 of the ENETRAP project was to try and build a robust picture of the existing "qualification pathways" for the Qualified Expert in Member States, to look for areas of commonality and to consider the issue of mutual recognition.

As part of the study, the opportunity was also taken to consider education and training with respect to the RPO and to radiation workers.

The work was broken down as follows:

WP2: Assessment of training needs and capabilities

The specific objectives of this work package were:

- To obtain quantitative figures of RPEs working in each EU member, accessing and candidate state
- To examine the actual capabilities concerning the Education and Training in RP and the fields covered and
- To define more precisely the context of the needs and the capacities concerning RP training in the future.
-

WP3: Recognition of Competencies and Diplomas

Specific objectives of this work package were:

- To analyse the various levels and varieties of expert qualifications as published in the national legislation of various countries
- To compare the conditions for recognition of the RPEs in each country
- To compare the complementary conditions dealing with the recognition of the training provided by countries other than the one where the demand for agreement is introduced
- To recommend a possible common basis for criteria for the mutual recognition of competencies and diplomas

2. METHODOLOGY

A questionnaire was prepared, structured around the specific objectives outlined in section 1 and distributed to identified contacts in some 31 countries. The full list of countries, along with a copy of the questionnaire is given appendix 1.

Constructive responses were obtained from 28 of the 31 countries originally contacted; in itself this level of response points to the high level of interest in the ENETRAP project. Only two countries failed to respond (Romania and Slovakia); limited information was provided by Turkey. A significant amount of data and information was provided. A preliminary rationalisation of the initial returns indicated a need for a degree of follow-up either for the purposes of clarification of the detail provided, or to elicit some further or supplementary information.

A detailed breakdown of the final quantitative analysis of the returned questionnaires is presented in appendices II and III along with specific conclusions on each aspect examined. An executive summary of this analysis along with broader conclusions is presented in the following sections.

3. TRAINING NEEDS & CAPABILITIES

3.1 Definitions

For the purposes of the study it was important that there was a common understanding of the key terms used. The following definitions were applied:

"Radiation Protection Expert" (RPE)" - The term Qualified Expert (QE) refers explicitly to the definition given in the BSS[1,2]. It was considered more appropriate for the purposes of this study to uses the alternative term "Radiation Protection Expert (RPE)" to refer to the specific definition used in a country's national legislation, although it was recognised that this may be more or less equal to the definition of the QE.

"Radiation Protection Officer (RPO)" - Considered to be an individual appointed by the Registrant/Licensee/Employer to supervise or oversee the execution of the work (practices). Equivalent role as that defined in the IAEA International Basic Safety Standards[3], ie

"An individual technically competent in radiation protection matters relevant for a given type of practice who is designated by the registrant or licensee to oversee the application of the requirements of the standards".

"Workers" - Throughout, the term "worker" (or radiation worker) reflected the definition of the "exposed" worker in Council Directive 96/29/Euratom[1]:

"Persons either self-employed or working for an employer subject to exposures incurred at work … and liable to result in doses exceeding one or other of the dose levels equal to the dose limits for members of the public".

In addition to the above, definitions for terms associated with the education and training process were also provided :

"Education" - Within the context of this study, "education" was defined as the *provision of the initial knowledge base*, for example as might be obtained from a degree or diploma course, post-graduate study etc.

"Training" - Considered to be *the provision of specific expertise and competencies relevant to radiation protection*; often complimentary to, or further to, education.

"Training Schemes" - A series of linked training (or education + training) events.

"On-the-job-training" - A form of structured training where the trainee gains expertise and/or competence by working in an environment with the appropriate facilities or infrastructure, generally under the supervision of an experienced supervisor/expert.

"Work experience" - Time spent working within a specific practice gaining in-depth knowledge of that practice and experience in relevant radiation protection issues.

"E-Learning" - The use of electronic technology to support, enhance or deliver learning. E-learning can take a number of forms; CD-ROM, over the internet, intranet/extranet, audio and or videotape, interactive TV etc .

"Open and distance Learning" - For the purposes of the study this was taken to mean learning opportunities characterised by the separation of teacher and student in time and/or place. It is recognised that open learning can make use of a variety of media to facilitate the interaction between students and teachers.

3.2 Adequacy of RPEs

In the first two sections of the questionnaire (sections A and B) a series of questions were asked aimed at obtaining quantitative information on the numbers of RPEs, radiation workers and registrants/licensees along with the extent to which specific practices are undertaken in Member States.

3.2.1 Information relating to Practices.

Clearly, in order to arrive at any conclusion regarding "needs and capabilities" it was important to try and build up a picture of the degree of application of the various applications within Member and Candidate States. For this reason, respondents were asked to indicate (from a "pick" list) those practices/applications undertaken within their countries and to provide approximate numbers of RPEs, licensees and workers associated with these practices. It was felt that such information would facilitate the assessment of adequacy of numbers of RPEs, and

radiation support in general and help to identify where there might be a shortfall for the support of practices within a country.

Unfortunately, only 9 of the respondents were able to provide a distribution of values across all the indicated practices or fields of application and 6 were unable to provide any sort of breakdown at all (although 4 of these did provide an approximate total number). This apparent lack of information regarding the "distribution" of not only responsibility (licensee/employers) and workforce but also sources of expert advice is worthy of note and certainly relevant to any comment on needs and capabilities.

There could be a number of reasons for the apparent vagueness with respect to the distribution of RPEs. For example:

- A country may operate a system, such as in the UK, where RPEs are not strictly practice-specific. In effect, there are general RPEs capable of advising in a number of sectors.
- It does appear to be the case in many countries that structured controls only apply in one or two well-established sectors, such as the medical sector. Information is just not readily available with respect to less well controlled sectors.
- In some Member States, eg Croatia, there appears to have been retrospective fitting of existing suitably qualified personnel to the definition of the QE in the BSS, thus establishing a pool of expertise, rather than embarking on a process of educating and training "new" professionals.

As a consequence, given the unknowns with respect to this issue, the analysis of the data provided has been restricted to analysis of the total number of RPEs, workers and licensees in each country.

3.2.2 Statistical Analysis

From the analysis of the 28 countries, 11 countries judged the number of RPEs adequate for their national needs at the present time, although two of these countries foresee possible future shortage of RPEs. With regard to the latter, in one case the reason cited was further developments in the characterisation of NORM in industries and in the other, the national requirements for recognition of RPEs had been observed to be a deterrent in the medical sector (where other career paths are available).

Two countries (Czech Republic and France) didn't express any opinion on the matter. The remaining 15 countries (2 candidate states, 12 established states, 1 non-EU) consider their present number of RPEs to be inadequate. Of these 15, 9 specifically cited the medical sector as an area where it is felt that a shortfall exists. An observation of note is that a figure of at least 90 RPEs appears to represent the lower bound of adequacy in terms of total numbers of RPEs at the present time.

The perceived adequacy of a country's number of RPEs would be expected to depend on the extension and complexity of the national radiation protection issues (roughly quantified by the number of radiation workers and licensees). For this reason the ratio of the number of RPEs by either the number of workers or the number of licensees is examined. The preliminary analysis is perhaps surprising as some countries that consider the number of the RPEs inadequate (e.g. Malta, Latvia, Ireland), have a ratio of RPEs/Workers higher than other countries that claim an adequate number of RPEs (e.g. The Netherlands and UK). The analysis of the ratio of RPEs/Licensees seems to be even more random.

In a third approach, the number of RPEs is normalized to the mean number of workers for each licensee, i.e. number of workers divided by the number of licensees. This variable is successively named RWL. The underlying idea is that for each licensee a RPE should be generally appointed, and that, for each licensee, the higher the number of workers, the higher the probability of the presence of complex infrastructures, maybe with several sources of ionizing radiations. This variable RWL seems to be strictly correlated to the statement given by each country about the adequateness of the number of RPEs: all the countries with the highest values of this variable are systematically those ones considering adequate the number of RPEs.

The analysis carried out seems to point out an inner and surprising coherence between the simple qualitative judgement regarding adequacy of RPEs and the country's radiation protection issues (quantified by the number of radiation workers and licensees). The RWL could perhaps be used to support assessment of the adequacy of numbers of RPEs or to roughly estimate the future need of RPEs in the same country for which the numbers of workers and licensees are foreseen to change.

3.2.2 Overview

On the basis of the information provided there would appear to be somewhere in the region of 110k RPEs currently working across the EU. This figure should, however, be looked at in context as it is strongly influenced by variations in national definitions of RPEs. For example, of the 34.5k RPEs claimed by Spain, over 90% of these are working in the area of medical physics (and perhaps are medical physicists, rather than RPEs as defined above); in Germany the submitted value of 60k relates to numbers of RPO.

The blurring of the margins between RPO and RPE is of some note and it is a factor that has a strong influence on the management of radiation protection expertise within a country and on the consequent approach to education and training In practice there appears to be a sliding scale in approach to the RPO role. At one end of the scale (eg Ireland, the UK,) the role is restricted in effect to local supervision of working practices, requiring only a fairly basic understanding of radiation protection issues. In other countries (eg Germany, Finland, Croatia) the role is more substantial, requiring a more in-depth level of knowledge and ability in order to take a lead on radiation issues on behalf of the employer, which might include provision of training to the workforce, dose analsyis, complex measurements etc. In these situations, the RPO is often formally approved by the relevant Regulatory Body. At the top end of the scale (eg France, Czech Republic), the role of the RPO is the primary radiation protection position with the input

expected, and the degree of education and training required, being dependant on the complexity of the application.

The responses with regard to adequacy of RPEs are interesting. Of the 50% of the respondents who considered that current numbers are inadequate, the inadequacy in the majority of cases is felt to be in the predominant radiation sector in that country (generally medical or nuclear) and generally due to the introduction of new technologies or work programmes. In very few cases was an inadequacy expressed with respect to general industrial or miscellaneous applications (eg aircrew, radon, veterinary work etc) or research and teaching. Clearly this situation reflects specific national needs and priorities, but perhaps it should also be viewed with respect to the apparent lack of certainty with regard to the actual distribution of RPEs across the various applications.

3. 3 National capabilities for E&T

The specific objectives in the line of questioning pursued in sections C, D and E of the questionnaire are twofold. Firstly, to make an assessment of whether or not national capabilities for E&T in radiation protection fully support the national radiation protection needs (at both the RPE and RPO level) and, secondly, to consider whether or not the identified E&T resources could be of benefit in the support of radiation protection needs and requirements in other countries.

3.3.1 National E & T infrastructures

The analysis points to fairly robust national education and training infrastructures. The majority of Member States consider that the have either fully (68%) or partially (14%) self-sustainable programmes to support national needs with respect to RPEs, RPOs and workers.

The detail with respect to those (4) countries considering their infrastructure to be only partly self-sustainable is interesting. For 2 of these – Latvia and Malta – the deficiencies appear to lie primarily in the medical sector where there are a relatively small number of personnel employed. In these cases required specialist training (often abroad) is supported by the IAEA. Malta also does not consider that it can fully support E&T requirements with respect to NDT, this also being supported by the IAEA. In Slovenia the issue with regard to partial self-sustainability is rather different reflecting the "level" of required E&T rather than the application to which it relates; training for RPO and workers is fully supported within the country but specialist training at the RPE level is often sourced from IAEA. Similarly, in Switzerland the E&T capabilities are sound at the RPO and worker levels but there is a perceived lack of expertise to fully support E&T at the RPE level.

3.3.2 Availability of resources

In order to pursue the second objective it was necessary to try and make a quantitative assessment of the availability of both relevant academic educational courses and other relevant training events.

The situation is, as expected, variable. No academic level radiation protection courses are available in the new EU Member States Cyprus, Estonia, Hungary and Malta or in the Associated States Norway and Switzerland. General radiation protection courses on an academic level are provided in 16/28 responding countries with specialised courses (pre-requisites for other professions) also provided in 16/28 countries. Such specialized courses are mainly targeted at those intending to work in the medical sector but occasionally for other specialisms such as nuclear safety.

In a number of countries (Finland, Hungary, Latvia, Malta, Norway and Switzerland) academic level events do not appear to be available for any aspect of radiation protection. Nonetheless these countries consider themselves to have mainly self-sustainable infrastructures; it must be concluded that in these countries the training is managed by more vocational, rather than University, institutes.

Countries were asked to compare national training schemes with the EC basic syllabus for the RPE and/or the Post Graduate Education Course[4] (PGEC) of the IAEA. Only 10/28 countries claim that the schemes reflect the EC syllabus exactly with a further 13 claiming that the scheme reflects the syllabus in part, although in the majority of cases it is argued that this is a "good match" with the differences reflecting customisation to address national needs. Only 3 countries consider that training schemes reflect exactly the PGEC syllabus with the remainder indicating a range of variances or, in at least one case, not considering the comparison valid. A much more detailed analysis of the response to this line of questioning is given in section 1:4 of appendix III

A list of institutes providing RP training (including OJT) is provided in annex 1 of appendix III..

3.3.3 Overview

Overall, therefore the situation with regard to self-sustainability appears to be reasonably good with only a few countries (in general, the newer member states) relying on any significant level of external support. What is clear, is that in most countries, an academic level of basic education is a pre-requisite for progression to RPE, although not necessarily in a radiation protection discipline, this being particularly true for the medical and nuclear sectors. In some countries there is perhaps greater flexibility with respect to foundation education with a lesser educational level being satisfactory; however, this is generally dependant on the sector and perceived complexity. In these cases, additional requirements such as a prescribed level of experience and/or acknowledged competence are generally specified. In many countries, a prescribed educational level (in some cases to degree level) along with a demonstration of competence is also required for the RPO.

Some 80% of the countries have specified training schemes for the professional development of the RPE. While a great deal of information was referenced in support of this line of questioning it has been not been practicable to elicit detailed information about the contents of training course for different sectors of work and for expected levels of expertise. However, the tendency is for national training schemes to only partly reflect the EU basic syllabus; generally the range of

topics in the syllabus is addressed, but the treatment of the content, for example the depth to which it is covered is tailored to address national needs.

Where there are secure established E & T infrastructures, these have been developed to address national needs and are fit for purpose on a national basis. The degree to which these infrastructures, or components of them, could support the needs of other Member States is perhaps limited at this stage.

4. REGULATORY REQUIREMENTS & RECOGNITION

Establishment of a clear picture of the regulatory requirements for the training and qualification of RPEs, RPOs and workers across the EU is the essential first step in addressing the issue of mutual recognition. Such a picture should facilitate the identification of regulatory differences of significance.

4.1 Legal Requirements

Of the 28 countries that responded, just over half claim that the definition of the RPE in national legislation exactly reflects that of the QE as defined in Council Directive 96/29/Euratom. Seven countries are operating on a definition that reflects the Directive in part with the remaining 6 countries not reflecting the Directive at all (however, it should be noted that for 1 of these 6 the situation is under review and for the other the RPE is not defined).

That said, with the exception of only 3, all countries have legislation requiring that RPEs are suitably trained and qualified; there is, however, a considerable range in what constitutes "suitably trained and qualified". Comparing national legislative requirements in this area with the provisions for education, training and recognition specified in Communication 98/C 133/03 from the Commission indicates that only 9 countries claim an exact match with 13 countries considering that their national arrangements reflect Communication 98/c/ 133/03 in part. Within the context of the ENETRAP project the differences are pertinent, however, the lack of detailed information makes the qualifications of various persons difficult to compare. The remaining 6 countries have no formal provisions, as yet, for education, training or recognition of the QE (even though 4 of these do a have a legislative requirement for the RPE to suitably trained and qualified).

4.2 National Recognition

With few exceptions there is generally a requirement for the RPE to be formally recognised and in almost all cases such recognition is mandatory. It is clear that there is a wide range in approaches in the mechanism for recognition but to date a constructive comparison to identify similarities and differences has not been possible. However, as with the general approach to education and training the mechanisms in place have evolved to fit national needs. In most countries recognition is time limited and a demonstration of some form of continuous professional development (CPD) is required in order to maintain RPE status although, again what constitutes the required CPD varies across Member States. The most common period of validity

is 5 years, but it ranges from 3 to 10 years.

4.3 Mutual Recognition

At the present time only a minority of countries have a formal system for mutual recognition of RPEs (RPOs and workers) from abroad; 9/28 for RPE, 7/28 for RPO and 5/28 for workers. However, little evidence has been submitted as to how these systems work in practice or any detail on the success (or otherwise) of the schemes. Following the initial analysis of the data a follow-up question was asked as to why these countries felt it necessary to put such a system in - is there perhaps a perceived shortage of expertise either at the present time or foreseen? is there already a culture of workforce exchange ? etc. However, little was gained from this exercise and further investigation is needed.

4.4 Overview

The questionnaire concluded by canvassing opinion regarding the responder's view as to what could constitute minimal requirements for mutual recognition of RPEs, RPOs and workers (taking into account national recognition policies).

The majority of respondents (over 80%) took the opportunity to express views on this matter but, as might be expected, a consensus view did not materialise. For a significant number the de-minimus criteria would be compliance with national regulations which on the surface does not offer much scope for latitude. It is felt that further investigation is required to see whether or not establishing minimal requirements, acceptable for all countries is feasible. It is, however, recognised that such requirements should take into account the sector of work, complexity of practice along with specific national requirements.

5 SUMMARY CONCLUSIONS

i) Of the 28 countries that responded to the ENETRAP questionnaire more than half indicated that they felt that the number of RPEs is currently inadequate and does not satisfy national needs.

ii) Very few countries (<10) are able to provide any sort of detailed information, or comment on, the distribution of RPEs, licensee/employers or workforce across listed practices. This makes it difficult, at the present time, to comment in detail on "needs and capabilities".

iii) Despite the lack of detailed information referenced in (ii) above, statistical analysis undertaken on the data provided points to a general coherence between the simple qualitative judgement about the adequateness of the number of RPEs and a given country's radiation protection issues (as quantified by the number of radiation workers and licensees; RWL)

iv) There are significant differences in interpretation of the roles of the RPE and the

RPO across Member States. These differences have a strong influence on specified legislative requirements with respect to RPE and RPO as well as on the approaches taken with respect to Education and Training. There are wide ranging approaches to the latter.

v) On the basis of the information provided via the ENETRAP questionnaire and given the significant issues with the interpretation of key roles, it is difficult to conclude a workable "de-minimus" level of training for the RPE (or RPO). Further investigation of this issue is required.

vi) The majority of Member States have mechanisms in place for the recognition (and re-recognition) of the Radiation Protection Expert. However, the approaches taken vary significantly and are difficult to compare.

vii) Only a minority of countries have a formal system for mutual recognition or RPEs (RPOs and workers) and the study did not elicit a consensus view as to what could constitute minimal requirements for mutual recognition.

Issues v), vi) and vii) above all warrant investigation beyond the scope of the current ENETRAP project. It is suggested that the appropriate mechanism for pursuing these issues is via the EUTERP[5] Platform; the matters raised warrant discussion and opinion from the relevant Member States.

References

1. Council Directive 96/29/Euratom of 13 May 1996, laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation. Council of the European Union.

2. Communication 98/C 133/3 from the Commission concerning the implementation of Council Directive 96/29 Euratom laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation. Official Journal of the European Commission, 30 April 1998.

3. International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources. Safety Series No 115, International Atomic Energy Agency, Vienna 1996.

4. Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources, Standard Syllabus. Training Course Series 18, International Atomic Energy Agency, Vienna 2002

5. European Training and Education in Radiation Protection Platform. (www.euterp.eu)

ENETRAP

European Network on Education and Training in Radiological Protection

Project Questionnaire

Synopsis and Objectives

The European Commission is promoting better integration of education and training into occupational radiation protection infrastructures in the Member and Candidate States of the European Union. In addition to consolidating national radiation protection frameworks, it is hoped that such integration will also facilitate transnational access to vocational education and training infrastructures, promote harmonisation of the criteria and qualifications for and mutual recognition of Radiation Protection Experts, and remove obstacles for the mobility of these experts within the European Union.

BACKGROUND

In 2002, a survey was carried out on the situation of radiation protection experts (RPEs) in the Member and Candidate States of the European Union[1]. The survey covered all qualification aspects of RPEs, including:

- current definitions and other regulatory provisions and requirements;
- legal status;
- pre-educational requirements;
- duration of the education and training programme.

The results of the survey revealed significant differences in the legislative approach to the issue of Radiation Protection Experts within the European Union along with a wide variety of systems for the underpinning education and training. However, the survey also highlighted considerable interest among Member States for better harmonisation of education and training requirements in the different areas of radiation protection.

In a feasibility study[2], a number of recommendations were made during a workshop that was attended by most of the Member and Candidate States of the European Union. The feasibility study was intended to explore the possibilities of establishing a European Platform on Training and Education in Radiation

[1] *European Commission. The Status of the Radiation Protection Expert in the EU Member States and Applicant Countries: Study on Education and Training in Radiation Protection. Radiation Protection, Issue N° 133, 2003 (RP133).*

[2] *Initiation of the European Platform on Training and Education in Radiation Protection (EUTERP Platform); Final report, including the Proceedings of the workshop, 20-21 May 2004, CIEMAT, Madrid, NRG Report 21421/04.60160/P, October 2004, downloadable from www.nrg-nl.com.*

Protection (EUTERP Platform), which could pre-eminently play a role in reaching consensus about an internationally agreed system of recognition of radiation protection experts. It was also recognised that all countries have developed their own education system over a long period of time and it would be impossible to strive to uniformity in the educational approach. Instead of that, and despite the diversity of education and training systems, harmonisation should be reached by evolution of internationally agreed common minimum criteria for the qualifications of the radiation protection expert. Recognition should not only be based on the initial education and training, but also on competence. The feasibility study showed, again, a wide interest in the EU Member and Candidate States to participate in such a Platform. It is expected that this Platform will be established later this year.

CURRENT PROJECT

More detailed information on several of the issues identified in the feasibility study is required if the EUTERP Platform is to have a sound basis. Therefore, the ENETRAP project (European Network on Education and Training in Radiological Protection) has recently been launched in the 6th Framework Programme of the European Commission, specifically to address these issues.

The enclosed questionnaire represents the first phase of the ENETRAP project, the objective of this questionnaire being to elicit detailed information which will enable us to:

1. assess the actual training needs in the EU Member States and Candidate States;
2. understand the various regulatory aspects and consequently propose minimum requirements for mutual recognition of RPEs and RPOs;
3. collate details of the various training and education activities available in the EU Member and Candidate States, and
4. review the content, structure and methods of these training and education activities.

We recognise that the questionnaire is comprehensive and will require some time to complete. Nevertheless, we are sure that you acknowledge the importance of the subject and we are aware of your interest in these matters, since you might have been involved in one of the previous studies. Your opinion and comment is valued.

Ideally we would prefer one formal response from your country representing a collation of the data and information from all relevant sources. Of course you are free to circulate the questionnaire to colleagues, national bodies etc as you think necessary but please only return one completed questionnaire. If you think that you are not the most appropriate contact for us to correspond with on this matter please contact me (details below) so that we may establish an alternative contact.

Please send the completed questionnaire back to me by e-mail by October 31 at the latest. If you need more information about the questions or wish to discuss the issues in more detail, please do not hesitate to contact me. For more information on the ENETRAP project, please also visit http://www.sckcen.be/enetrap.

The ENETRAP consortium thanks you very much for your collaboration.

Yours sincerely,

Michèle Coeck
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Glossary of Terms

“Radiation Protection Expert (RPE)”
The term Radiation Protection Expert (RPE) refers to the specific definition used in a country's law and may be more or less equal to the definition of the "Qualified Expert" in Council Directive 96/29/Euratom, or in the International Basic Safety Standards (Safety Series No. 115, IAEA, Vienna, 1996). That is:
“*An individual who, by virtue of certification by appropriate boards or societies, professional licenses or academic qualifications and experience, is duly recognized as having expertise in a relevant field of specialization, e.g. medical physics, radiation protection, occupational health, fire safety, quality assurance or any relevant engineering or safety speciality”.*

“Radiation Protection Officer (RPO)”
An individual appointed by the registrant/licensee/employer to supervise or oversee the execution of practices. Defined in the IAEA international Basic Safety Standards as:
“*An individual technically competent in radiation protection matters relevant for a given type of practice who is designated by the registrant or licensee to oversee the application of the requirements of the standards*”.

“Workers”
The term worker (or radiation worker) reflects the definition of “exposed” worker in Council Directive 96/29/Euratom:
“Persons either self-employed or working for an employer subject to exposures incurred at work… and liable to result in doses exceeding one or other of the dose levels equal to the dose limits for members of the public”.

“Education”
Within the context of this project, “education” is defined as provision of the initial knowledge base, for example, as might be obtained from a degree or diploma course, post-graduate study etc.

“Training”
Within the context of this project, “training” is considered to be the provision of specific expertise and competencies relevant to radiation protection. Often complimentary and/or further to education.

“Training Schemes”
A series of linked training (or education + training) events.

“On-the-Job Training (OJT)”
On-the-Job Training (OJT) is a form of training in which the trainee works at a suitable environment where the facility or the infrastructure needed for the OJT is available, under the supervision of an experienced supervisor/expert (hands-on experience).

“Work Experience”
Time spent actively working within a specific practice gaining in-depth knowledge of the practice and experience in relevant radiation protection issues.

“E-Learning”
As defined by the Welsh Assembly Government as “*the use of electronic technology to support, enhance or deliver learning*". It can be presented on CD-ROM, over the Internet, intranet/extranet (LAN/WAN), audio and videotape, satellite broadcast, interactive TV, etc., or can be combined with traditional classroom instruction in a blended learning environment.

“Open and distance learning”

A means of providing learning opportunities that is characterised by the separation of teacher and learner in time and/or place. Open learning makes use of a variety of media (including printed and electronic material) to facilitate the interaction between learners and tutors.

Respondent details

Name:

Affiliation:

Address:

Country:

E-mail:

Telephone:

Fax:

Completion of the questionnaire:

☐ By yourself?

- ☐ Yes*
- ☐ Partly* (please specify below who else contributed an for which section A, B, C, D, E)
- ☐ No*

* Please tick appropriate box

☐ By other persons (please specify who and for which sections)

☐ We may wish to follow up on specific issues. It would be helpful if you could identify any additional contacts that you feel are relevant.

A. Numbers of Radiation Protection Experts (RPEs)

Objective:

To obtain quantitative numbers of RPEs currently working in each EU Member and Candidate State.

Questions:

A1. Please provide an indication of the number of RPEs currently working in your country. If you are unable to break the information down in to sectors of work, please just provide a "total" figure.

Sector of Work	Approximate Number of RPEs
1. Total Nuclear	**1. Total:**
a) Power production	☐ a)
b) Reprocessing	☐ b)
2. Total Medical	**2. Total:**
a) Diagnostic radiography	☐ a)
b) Radiotherapy	☐ b)
c) Nuclear Medicine	☐ c)
3. Total Industry	**3. Total:**
a) Industrial process gauges	☐ a)
b) Nuclear density gauges	☐ b)
c) Industrial irradiators	☐ c)
d) Industrial radiography	☐ d)
e) Recycling and scrap metal	☐ e)
f) Radioactive tracers	☐ f)
g) NORM/TENORM	☐ g)
4. Research/Teaching	**4. Total:**
a) Sealed sources	☐ a)
b) Unsealed radioactive materials	☐ b)
c) Radiation generators	☐ c)
5. Other	**5. Total:**
Total	

A2. The answer to A1 is (please tick appropriate box)

☐ Based on documented evidence.
Please indicate the source:

☐ Based on an estimated value.

A3. Is the total number of RPEs considered to be adequate at the present time?

☐ Yes
☐ No

Please comment on your response:

A4. Have all RPEs currently working within your country been trained and qualified within your country?

☐ Yes
☐ No
☐ Don't know

Please comment on your response:

B. Identification of practices

Objective:

To build up a picture of the degree of application of the various practices within EU Member and Candidate States. Such data should facilitate an assessment of "adequacy" of numbers of RPEs and radiation protection support in general, and identify where there may be a shortfall to support the practices within the country.

Questions:

B1. Please indicate which of the following practice/applications are undertaken within your country:

Nuclear
☐ Power production
☐ Fuel reprocessing

Medical
☐ Diagnostic radiography
☐ Radiotherapy
☐ Nuclear Medicine

Industry
☐ Industrial process gauges
☐ Nuclear density gauges
☐ Irradiators
☐ Radiography
☐ Recycling and scrap metal
☐ Radioactive tracers

Research/Teaching
☐ Sealed sources
☐ Unsealed radioactive materials
☐ Radiation generators

☐ NORM/TENORM

B2. Please identify anything you consider of relevance that is not in the above list.

B3. Are any changes/developments foreseen that could impact on radiation protection requirements? (e.g. impending change in legislation, introduction of new practices…)

B4. In the table below, please provide an indication of the total number of workers. If you are unable to break the data down into sectors of work, please provide an estimated total.

Sector of Work	Approximate Number of Radiation Workers
1. Total Nuclear	**1. Total:**
a) Power production	☐ a)
b) Reprocessing	☐ b)
2. Total Medical	**2. Total:**
a) Diagnostic radiography	☐ a)
b) Radiotherapy	☐ b)
c) Nuclear Medicine	☐ c)
3. Total Industry	**3. Total:**
a) Industrial process gauges	☐ a)
b) Nuclear density gauges	☐ b)
c) Industrial irradiators	☐ c)
d) Industrial radiography	☐ d)
e) Recycling and scrap metal	☐ e)
f) Radioactive tracers	☐ f)
g) NORM/TENORM	☐ g)
4. Research/Teaching	**4. Total:**
a) Sealed sources	☐ a)
b) Unsealed radioactive materials	☐ b)
c) Radiation generators	☐ c)
5. Other	**5. Total:**
Total	

B5. In the table below, please provide an indication of the number of registrants/licensees (employers) in your country.

Sector of Work	Number of Registrants/Licensees
1. Total Nuclear	**1. Total:**
a) Power production	☐ a)
b) Reprocessing	☐ b)
2. Total Medical	**2. Total:**
a) Diagnostic radiography	☐ a)
b) Radiotherapy	☐ b)
c) Nuclear Medicine	☐ c)
3. Total Industry	**3. Total:**
a) Industrial process gauges	☐ a)
b) Nuclear density gauges	☐ b)
c) Industrial irradiators	☐ c)
d) Industrial radiography	☐ d)
e) Recycling and scrap metal	☐ e)
f) Radioactive tracers	☐ f)
g) NORM/TENORM	☐ g)
4. Research/Teaching	**4. Total:**
a) Sealed sources	☐ a)
b) Unsealed radioactive materials	☐ b)
c) Radiation generators	☐ c)
5. Other	**5. Total:**
Total	

C. National Capabilities for Education and Training in Radiation Protection

Objective:

To make an assessment of whether or not the national capabilities for E&T in radiation protection
a) fully support the national radiation protection requirements (at the RPE and RPO level) and
b) are of any benefit in the support of radiation protection requirements in other countries.

Questions:

C1. Is the radiation protection education and training infrastructure in your country self-sustainable, or is it supported by other bodies (such as the IAEA) or other countries?

C2. Within your country are there any academic courses, i.e. degree, diplomas etc available where the focus of the qualification is “radiation protection” in general terms rather than in a supporting science? (For example, in the UK the University of Surrey offers an MSc in “Radiation and Environmental Protection “)

☐ Yes
Please provide details on the course:

☐ No

C3. Is successful completion of any of the academic courses identified in C2 a pre-requisite for the recognition of RPE?

☐ Yes
Please provide details:

☐ No

C4. Within your country are there any academic courses in radiation protection which are required basic education for certain professions (For example, for Medical Physicists, for Regulators...)?

☐ Yes
Please provide details:

☐ No

C5. Is successful completion of any of the courses identified in C2 sufficient for recognition as RPE or RPO?

☐ Yes
Please comment:

☐ No

C6. In general terms, is there a minimum level of basic education required for recognition of the RPE?

☐ Yes
Please provide details:

☐ No

C7. Please identify any training schemes specifically aimed at contributing to the initial professional development of the RPE. Include any detail that you think would be helpful.

C8. Do the schemes identified in C7 reflect the basic syllabus for Qualified Experts as specified in Communication 98/C 133/03 from the Commission, concerning the implementation of Council Directive 96/29/Euratom? Please tick the appropriate box.

☐ Yes, exactly

☐ Yes, in part

☐ No

Please comment on your response:

C9. Do the schemes identified in C7 reflect the Standard Syllabus of the Postgraduate Educational Course from the IAEA (IAEA Training Course Series No 18)? Please tick appropriate box.

☐ Yes, exactly

☐ Yes, in part

☐ No

Please comment on your response:

C10. Are there any training events that make use (either entirely or in part) of distant learning or e-learning tools?

☐ Yes

Please provide summary details; it would be helpful if you could identify contact persons for further discussions:

☐ No

☐ Not sure

C11. Are there any training events that make use (either entirely or in part) of On the Job Training (OJT)?

☐ Yes

Please provide summary details:

☐ No

☐ Not sure

C12. Specify which piece(s) of legislation provide the current legal basis for On the Job Training (OJT) and/or work experience. *Please provide a copy of the relevant text, preferably in English if available.*

C13. If the wording of the terms “on the job training” and “work experience” in the glossary does not reflect fully the definition in your national regulation, please comment.

C14. Are there different levels or classifications for OJT and/or work experience of radiation protection experts and/or RPO recognised in your country with regard to the complexity of the radiation applications in different areas, such as medicine, industry, research, nuclear fuel cycle etc?

☐ Yes

☐ No

C15. If the answer to C14 is “Yes”, please specify these different levels in terms of prior education, duration and content of the OJT and/or work experience, etc…. How is completion verified?

C16. Is there an assessment of the competency acquired during the OJT? Please tick the appropriate box.

☐ Yes – all cases:

☐ Yes – some cases:

☐ No

If “Yes” please comment on the assessment method(s). Is the objective of the assessment to test the knowledge or the job competency or to confirm if learning objectives have been achieved?

C17. Regarding OJT, do you have specific training providers such as research centres, power plants, hospitals, big industrial companies, and what are the capacities in terms of numbers of trainees and the possibility of providing OJT to trainees from other countries?

D. Regulatory Requirements

Objectives:

To build up a picture of the regulatory requirements for the training and qualification of RPEs, RPOs and exposed workers within the EU Member and Candidate States. Such a picture should facilitate the identification of any regulatory differences in the qualifications of such persons within the EU Member States and Candidate States.

Questions:

D1. Within your country is there legislation in place that requires certain persons to be suitably trained and qualified? If the answer to any of the specifications (RPE, RPO, Workers) is "Yes", please provide brief details, specifying any differences in requirements/qualifications (also per sector when appropriate). It would be helpful if you could provide the relevant regulatory text (English translation).

RPEs

☐ Yes:

☐ No

RPOs

☐ Yes:

☐ No

Radiation Workers

☐ Yes:

☐ No

D2. Does the definition of the Radiation Protection Expert in national legislation reflect the definition of the Qualified Expert, as defined in Council Directive 96/29/Euratom? Please tick appropriate box.

☐ Yes, exactly

☐ Yes, in part

☐ No

Please comment on your response:

D3. Do the provisions in the legislation relating to the RPE in your country reflect the provisions for education, training and recognition of the Qualified Expert, as specified in Communication 98/C 133/03 from the Commission, concerning the implementation of Council Directive 96/29/Euratom? Please tick appropriate box.

☐ Yes, exactly

☐ Yes, in part

☐ No

Please comment on your response; in particular specify conformities and differences:

D4. Is regulatory guidance available that specifies the minimum educational level, training (for example, syllabus, the duration and level of training, assessment of trainees), work experience and/or On-the-Job-Training (OJT) and personal attributes that should be demonstrated for the different categories as specified in question D1 and/or for the different sectors of work as specified in question B1?

☐ Yes
Please provide information on this guidance (in English):

☐ No

D5. If the recognition of RPE or RPO status is time limited in your country, is there legislation in place that specifies the duration and content of the education, training or OJT-activities necessary for keeping the recognition?

☐ Yes
Please provide details:

☐ No

D6. Is there a system(s) in place for the accreditation of
a) training providers?
b) training schemes?

☐ Yes

☐ No

If "Yes", are records maintained of such accreditation by the regulatory body?

☐ Yes
☐ No

Please describe the system for both a) and b)

a)

b)

E. Recognition

Objective:

To build up a picture of the criteria for recognition of RPEs, RPOs and other workers, with the objective of finding a common denominator for mutual recognition of these persons.

Questions:

E1. Are there formal systems in place for the recognition of RPEs, RPOs or other workers in your country by national authorities or professional bodies?

RPE

☐ Yes:

☐ No

RPO

☐ Yes:

☐ No

Workers

☐ Yes:

☐ No

If "Yes" to any of the above please provide details.

E2. Is participation in the scheme(s) mandatory or voluntary?

☐ Mandatory

☐ Voluntary

E3. Please provide a brief description of the method of operation of the scheme(s) (include reference to any web-site, publications etc.).

E4. Is there a formal system in place for the recognition of RPEs, RPOs or other workers who are qualified (and are recognised) in other countries?

RPE

☐ Yes:

☐ No

RPO

☐ Yes:

☐ No

Workers

☐ Yes:

☐ No

If you have indicated “Yes” to any of the above, please specify the system(s) and the requirements for recognition in your country. Are there any additional assessments necessary (knowledge of national regulations, fluency in the national language, etc.)?

E5. Is the recognition of the RPE status in your country time limited?

☐ Yes (if Yes, go to E6)

☐ No (if no, go to E14)

E6. What is the period of validity of RPE recognition?

E7. Briefly outline the mechanism for re-recognition.

E8. With respect to E7 it would be helpful if you could answer the following specific questions:

1. Is the RPE required to seek re-recognition under the original scheme?
   - ☐ Yes
   - ☐ No
2. Is evidence of practical experience required?
   - ☐ Yes
   - ☐ No
3. Is evidence of practical experience on its own sufficient?
   - ☐ Yes
   - ☐ No
4. Is evidence of further and/or refresher or update training required?
   - ☐ Yes
   - ☐ No
5. Is evidence on OJT required?
   - ☐ Yes

☐ No

6. Is evidence of training on its own sufficient?

   ☐ Yes

   ☐ No

7. Are there any differences in the mechanism for re-recognition between the sectors of work?

   ☐ Yes

   ☐ No

E9. Is the RPE required to take any action in order to maintain RPE status?

☐ Yes
Please provide details:

☐ No

E10. If the answer to Question E9 is “No”, or when ad-hoc decisions are taken, please specify the requirements that should be fulfilled for such persons to be recognised in your country.

E11. Taking into account your national policy on recognition of RPEs, RPOs and workers, what would be in your view the minimal requirements for mutual recognition of such persons within the European Union?

The ENETRAP consortium sincerely thanks you for all your interest and time to answer this questionnaire!

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Appendix II

Analysis of and conclusions drawn from the results of the questionnaire parts A and B

This analysis is based on the responses of 28 countries. In the parts 1 and 2 the responses to the Part A and B of the questionnaire are presented and discussed. In part 3 a general analysis of the quantitative data provided in the previous parts is attempted.

1 Part A: Number of Radiation Protection Experts (RPEs)

1.1 Number of RPEs currently working in a country (question A1)

26 countries provided the total number of RPEs or the number of RPEs working in each single sector from which the total number can be estimated (for the latter case the cells in the last column of Table 1 are red and have a total number of RPEs calculated as the sum of the number for each sector of work) . For few countries the figures refer to RPOs (Germany) or some similar professional profiles defined in the national legislation. 2 countries provided information only for a specific field of work (Finland: non-nuclear sector; Switzerland: nuclear sector). 2 countries didn't provide any figure (Croatia and France).
About 20% of the countries (5/26) have more than 1000 RPEs and slightly more than 20 % (6/26) has a number of RPEs between 100 and 1000. Half of the countries, (13/26), have a number of RPEs between 10 and 100. Only 2 countries (Estonia and Malta) have 10 or less than 10 RPEs.

The information about the distribution of the number of the RPEs vs. each sector of work is less complete. Several countries were not able to provide figures for all the proposed sectors.
For 19 countries (Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Slovenia, Spain, Sweden, United Kingdom) detailed information about the number of RPEs for each sector of work is given and, therefore, an analysis of the distribution is possible. Within this sub-group, for about 60% of the countries (11/19) the percentage of RPEs working in the medical sector is greater than 50%. For about 80% of the countries (15/19) the percentage of RPEs working in the nuclear sector is smaller than 10%: among these countries, nuclear applications are not undertaken within 8 countries (Croatia, Cyprus, Denmark, Estonia, Ireland, Luxembourg, Norway and Poland); in 2 other countries nuclear power plants have been stopped (Italy) or are intended as nuclear applications research reactors or waste facilities. For about 80% of the countries (15/19) the percentage of RPEs working in the industry sector is smaller than 30%.

Table 1 gives an overview of the responses on question A1.

Conclusion

The number of RPEs working in the European countries is generally of the order of hundreds or thousands. The distribution of the RPEs for specific sectors work points out the medical sector is the area were the greatest number of RPEs are engaged, even for those countries where significant nuclear applications (e.g. nuclear power production) are undertaken. The industry

sector is the second sector where a significant number of RPEs is engaged.

Table 1: Countries' responses on question A1[3]

Country	A1 Approximate number of RPEs					
	Nuclear Sector	**Medical Sector**	**Industry Sector**	**Reas. & Teach. Sector**	**Other sectors**	**Total**
Austria	10	200	10	20		250
Belgium	9	8	10	5	53	90
Bulgaria	20	30				50
Croatia						
Cyprus	0	24	1	4	0	29
Czech Republic						5500
Denmark	0	69	27	362	9	467
Estonia	0	0	2	0	0	2
Finland		45	0	0	0	Only non-nuclear field
France						
Germany						60000 (RPO)
Greece		434				434
Hungary	N/A	32	12	12		56
Ireland	N/A	25	<10	18	2	<55
Italy	30	800	400	200	20	1450
Latvia	8	4	2		1	15
Lithuania	2	10	8			20
Luxembourg	0	23	0	0	3	26
Malta	0					10
Netherlands	4	160	67	20		251
Norway		25	1	5	10	41
Poland	0	5250	1000	150	600	7000
Portugal						30
Slovenia	4	8	12	5	5	15 (a RPE for more facilities)
Spain	20	34660 (32100 diagn. radiography)				34680
Sweden	12	160	9	20		201
Switzerland	20					Only nuclear field
United Kingdom	75	137	160	70		500

1.2 Sources of information about RPEs, adequateness of their number and country of training/qualification (questions from A2 to A4)

31% of the countries (8/26) that replied to question A2 derived the number of RPEs and their distribution over the sector of work from documented evidence, while the majority (14/26. i.e. 54%) provided only estimated values. 4 countries derived the information about the RPEs from both documented evidence and estimation: in most of the cases the former one for the total number of RPEs, the latter one for the distribution though each sector of work

[3] Green means a positive answer on the question; colourless means a negative answer; red means no information.

More than half of the countries (15/26) claims the number of RPEs is not adequate at the present time (question A3). Among them, for 9 countries the medical sector is the main area where the inadequateness of the number of RPEs is more evident. Estonia attributed the lack of RPEs to the fact that this professional figure was only recently introduced into the national legislation. 3 didn't specify a particular reason for the lack of RPEs.
Among the countries that consider adequate the number of RPEs (11/26), two countries foresee possible future shortages, in the medical fields following the introduction of the formal recognition of RPEs (United Kingdom) or in practices with NORM (Italy).

In relation to question A4, in 17 countries (62%) RPEs qualified and trained within the country. For 2 countries (Latvia, Slovenia) the basic education is provided within the country and the specific training abroad. For Switzerland, that replied only for nuclear sector, the training courses are not available within the country and they are taken abroad (e.g. in Germany and UK). For Greece medical physicist training and qualification is carried out within the country, while a small number of RPEs are trained abroad. For Cyprus, even if the trainings are taken abroad, some training possibilities are available within the country as well.

Table 2 gives an overview of the responses on questions A2, A3 and A4.

Conclusion

More than half of the countries that responded to question A2 consider the number of RPEs available in the country as inadequate to the national needs. Among them, the shortage of RPEs seems to be less evident in the countries of the EU-15 (5 countries: Austria, Denmark, Greece, Ireland and Portugal) than in the other (10 countries: Bulgaria, Cyprus, Croatia, Estonia, Hungary, Latvia, Lithuania, Malta, Norway and Slovenia). For all these countries, the need is basically in the medical field.
The qualification and training of the RPEs is often carried out within the country. In few countries (3 countries: Greece, Latvia and Slovenia) education of RPEs is carried out within the country, while the training faciltites and courses are available abroad. For the nuclear sector this is valid also for Switzerland.

Table 2: Countries' responses on questions A2, A3 and A4.

Country	A2 Basis for Numbers of RPEs		A3 Adequateness of the Number of RPEs at the present time	A4 Qualification and training of RPEs within the country
	Documented evidence	Estimated value		
Austria			Needs in the medical field	
Belgium				
Bulgaria			Needs in the medical field	
Croatia			Needs in industry, resear.	
Cyprus			Needs in private sector	In Cyprus as well
Czech Republic				
Denmark			Needs in the medical field	
Estonia			RPE recently introduced	
Finland				
France				
Germany				
Greece			Needs in the medical field	Med Phys in GR, RPEs abroad
Hungary				
Ireland	Medical and Veter. sector	Industr. sector	Needs in new Radioth. Facilities	
Italy	Total n° RPEs	Sector Distrib.	Future needs with NORM	
Latvia			Needs in the medical field	Educat. in LV, training abroad
Lithuania			Needs in the medical field	
Luxembourg				
Malta				
Netherlands				
Norway			Needs in Diagnostic Radiog. and Nucl. Med.	
Poland				
Portugal				
Slovenia			Needs in the medical field	Educat. in SL, training abroad
Spain				
Sweden				
Switzerland				E&T courses abroad
United Kingdom	Total n° RPEs	Sector Distrib.	Formal recognition has reduced n° of RPE - Future needs medical field	

2 Part B: Identification of practices

2.1 Practices and applications with ionizing radiations (questions B1 to B3)

Question B1 was only partially responded by Switzerland, which provided information only about the nuclear sector. For the other countries (27), all the considered applications in the Medical and Research & Teaching sectors are undertaken, with the only exception of Cyprus and Estonia, where applications based on the use of radiation generators are not present.
50% of the countries (14/28) have applications concerning nuclear power and for about 20% (5/28) fuel reprocessing applications are present as well.
All the countries, that provided information about the Industrial sector (27), have applications using industrial processor gauges and radiography. Among the other industrial applications, nuclear density gauges are not present in 2 countries, irradiators in 6 countries, recycling and scrap metals in 4 countries, radioactive tracers in 8 countries and NORM/TENORM in 10 countries.

Other sectors of concern (question B2) are waste management (5 countries), veterinary practice (5 countries), decommissioning and dismantling research and nuclear power reactors (3 countries), transport, security screening devices, offshore logging companies, production of radiopharmaceuticals, exposure to radon, Regulatory bodies (police, inspectors, customs) and Services (Post), research rectors, accelerators, hot cells for fuel research (1 country for each field).

57% of the countries (16/28) foresee changes and developments that could impact on the radiation protection requirements (question B3). For Poland the nuclear power programme would be a reason.

Table 3 gives an overview of the responses on questions B1, B2 and B3.

Conclusion

Medical and Research & Teaching are the sectors of concern for all the countries. Applications in the Industrial sector are also largely undertaken within the countries, particularly industrial processor gauges and radiography. Therefore, they seem to be the sectors where any action concerning radiation protection issues would be of general interest.
The Nuclear sector is less significant concerning the number of countries (50%) with nuclear power applications or even less with fuel reprocessing activities. Other applications always concerning the nuclear sector such as the decommissioning/dismantling, the waste management and transport were identified as further applications undertaken in the countries.
The majority of the countries foresee changes that would impact in the radiation protection requirements. In most of the cases they foresee impending changes in the legislation or the probable introduction of new practices such as decommissioning/dismantling programmes or the enhancement of the medical applications.

Table 3: Countries' responses on questions from B1 to B3

Country	B1 Applications															B2 Other sectors of relevance pointed out by the country?	B3 Foreseen changes in radiation protection requirements?
	Nucl. Sector		Medical Sector			Industry Sector							Reas. & Teach. Sector				
	Power production	Fuel reprocessing	Diagnostic radiography	Radiotherapy	Nuclear medicine	Industrial processor gauges	Nuclear density gauges	Irradiators	Radiography	Recycling and scrap metal	Radioactive tracers	NORM/TENORM	Sealed sources	Unsealed radioactive materials	Radiation generators		
Austria																RR, NWf	
Belgium																NWm, Tr.	
Bulgaria																	
Croatia																	
Cyprus																	
Czech Rep.																	
Denmark																D, OW	
Estonia																	
Finland																	
France																	
Germany																	
Greece																	
Hungary																	
Ireland																V	
Italy																D	
Latvia																D	
Lithuania																sd	
Luxembourg																	
Malta																SSD	
Netherlands																V, PR	
Norway																RR OS.	
Poland																V, OW	
Portugal																	
Slovenia																sd	
Spain																	

Sweden																	
Switzerland																A, RR, NWm	
United Kingdom																V, NWm	

Legend: A: accelerators; D: decommissioning or dismantling actions; NWf and NWm: nuclear waste facilities and management; OS: offshore companies; OW: other waste processing, disposal or management; PR: production of radiopharmaceuticals; RR: research reactors; sd: see details; SSD: security screening devices; V: veterinary practices.

2.2 Number of radiation workers and registrants/licensees (questions B4 and B5)

The total number of radiation workers is available for 27 of the 28 countries that replied to the questionnaire. Few countries didn't provide the total number, therefore it was estimated by summing up the values given for each single sector (the relative cells in the last column but one of Table 4 are red). The number of radiation workers varies from few hundreds till more than 300,000. 3 countries have less than 1,000 radiation workers; 10 between 1,000 and 10,000 and 11 between 10,000 and 100,000. 4 countries have more than 100,000 radiation workers (France, Germany, Italy and United Kingdom).

The distribution of the radiation workers is peaked at high values in the Medical sector: in this sector only 15% of the countries (4/27) have less than 1,000 workers, while for 52% (14/27) and 26% (7/27) of the countries the workers are in the range 1,000 – 10,000 and 10,000 – 100,000, respectively. 2 countries (France and Germany) have more than 100,000 workers in the Medical sector. For the other main sectors (Nuclear, Industry, Research & Teaching) the distribution of the radiation workers is peaked at middle or low values. For each of these sectors, the percentage of countries with less than 1,000 radiation workers is more than 50% while the percentage of countries with more than 100,000 ranges from 0% to 15%.

The information about the number of registrants is less accurate. Also in this case, when the total number of registrants was not provided, it was estimated by summing up the values given for each single sector (the relative cells in the last column of Table 4 are red). Excluding Switzerland (information only about nuclear sector), the total number of registrants is equal or less than 1,000 for 33% of the countries (9/27), in the range 1,000 – 10,000 for about the half of the countries (48%, i.e. 13/27) and more than 10,000 for 19% of the countries (5/27). The distribution of the number of registrants in each sector is generally peaked to generally low values, particularly for non-medical sectors: the percentage of countries with less than 1,000 registrants varies from more than 50% for the Medical sector, up to the 80% or more for the other sectors (Nuclear, Industry, Research & Teaching).

Table 4 gives an overview of the responses on questions B4 and B5.

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Conclusion

The total number of radiation workers and registrants is generally high in the largest countries, as expected.

The analysis of the distribution of the radiation workers points out that the Medical sector is the

area were the greatest part of the workers are employed for most of the countries. The Medical sector is also the most significant for the number of the registrants.

Table 4: Countries' responses on questions B4 and B5

Country	B4 and B5 Sector of work											
	Nuclear Sector		**Medical Sector**		**Industry Sector**		**Reas. & Teach. Sector**		**Other sectors**		**Total**	
	Radiation workers	Registrants/Licensees	Radiation workers	Registrants/Licensees	Radiation workers	Registrants/Licensees	Radiation workers	Registrants/Licensees	Radiation workers	Registrants/Licensees	Radiation workers	Registrants/Licensees
Austria	100	5	25000	1000	3000	100	1500	10	300		~30000	~1000
Belgium	5000	4003	25000	3200	1000	200	1000	23	5000	2	37000	7428
Bulgaria	2000	1	5500	735	1500	125	550	39	250	246	9800	1146
Croatia			4150	367	640	104	200	13			4990	484
Cyprus	0	0	420	169	72	15	10	6			502	190
Czech Rep.	3083	4	12501	4488	706	400	1393	(in Ind. Sector)	1374	822	19663	5714
Denmark	0	0	7715	489	1039	568	2183	468	1375	336	12312	1861
Estonia	0	0	615	330	109	35	7	7	79	19	810	391
Finland	3000	2	6000	555	1000	1077	1000	(in Ind. Sector)		470	11000	2100
France	64400	59	103985	50494	36800	1463	14000	1198	36130	3248	255315	56462
Germany	15600	200	240000	20000	34000	3200	24000	1000		2200	313600	26600
Greece			7902	1324	307	244	247	205	1060		9516	1873
Hungary	4574	1	9948	4048	1428	624	370		19	497	16339	5170
Ireland	NA	NA	4295	136	1204	294	746	19	1755	1041	8000	1510
Italy		4	100000	5700							130000	7800
Latvia			1576	587	66	25	87	12	298	116	2027	740
Lithuania	4392	1	2543	792	106	74	79	20	180	189	7300	1076
Luxembourg	0	0	1262	82	20	52	16	13	373		1657	147
Malta	0	0	265	31	11	7	5	4	154	9	425	148
Netherlands	2048	5	20800	6650	3557	1320	2108	65	16198	1100	44711	9040
Norway			4650	25	580 (PI.)	115 (PI.)	650	20	400	11	6280	181
Poland	0	0	28000	240 (PL)	3500	915	2500	545	6000	1660	40000	3360
Portugal			9182	1951	1283	378	596	117	43		11102	2395
Slovenia	815	1	2315	161	513	80	250	34	889	393	4782	669
Spain	297	9	86102	24409	(incl. Med Sector)	172	(incl. Med Sector)	170	(incl. Med Sector)		86399	24760
Sweden	3600	4	3000	100	16110	812	2600	68		10250	19200	11234
Switzerland	4300	8										
United Kingdom	~ 33693	46 (NS) sd	~ 72500	1443 (H) + 9000 (D) sd	~ 10000	sd	~10000	100 (UNI) sd	~ 120000	sd	~ 246000	25000

Legend: D: dental practices; H: hospitals; NA: not applicable; NS: nuclear sites; sd: see details; PI: partial information; U: unknown; UNI: universities

3 Part A and B: Analysis of the adequateness of the number of RPEs vs. the number radiation workers and registrants

In the parts A and B of the questionnaire the total number of RPEs, radiation workers and registrants/licensees (questions A1 – Total, B4 – Total and B5 - Total, respectively) were provided by each country. A general judgement about the adequateness of the number of RPEs for the national needs was also asked in question A3.
It is worth trying to correlate the judgement about the adequateness of the number of the RPEs to the country's needs estimated on the base of the importance of the radiation protection issues, as quantified by the number of the radiation workers and the registrants.
In section 1 it was pointed out that, among 26 countries that have replied to question A3, 11 countries judged the number of RPEs adequate for their national needs at the present state. Among them, two countries foresee possible future shortage of RPEs (Italy and United Kingdom). Some countries didn't explicitly mention whether the number of RPEs is adequate or didn't provide at all any figure for the RPEs (Croatia, Czech Republic and France).

In Figure 1 the total number of RPEs, radiation workers and licensees are plotted for each country. If the number of RPEs is judged not adequate by a country a dashed fine border line is used. A dashed thick border line is used for countries that consider their number of RPEs adequate for the present but foresee a possible future shortage (Italy and United Kingodom). No border line is used for those countries that didn't explicitly mentioned whether the number of RPEs is adequate or didn't provide at all any figure for the RPEs (Croatia, Czech Republic and France). Switzerland provided information only for the nuclear sector. Finland provided information for all the sectors, except for nuclear one. The latter two countries are plotted with striped areas in the figures.
A very quick look at Figure 1 points out that, with the obvious exception of the Czech Republic, Croatia and France, the countries with the highest number of RPEs (greater than 90) are those that generally consider this number adequate too, at least for the present situation (9 countries: Belgium, Finland referring only to non-nuclear sector, Germany, Italy, Poland, Spain, Sweden, The Netherlands, United Kingdom*; note: almost all EU-15 countries*). Exceptions are Austria, Denmark, Greece (250, 467 and 434 RPEs, respectively, are not considered adequate for the national needs), Switzerland, only for nuclear sector, and Luxembourg and (20 and 26 RPEs, respectively, are considered an adequate number). All the other countries consider the number of RPEs inadequate (11 countries: Bulgaria, Cyprus, Estonia, Hungary, Ireland, Latvia, Lithuania, Malta, Norway, Portugal, Slovenia).

However, beyond this simple coherency in the judge about the adequateness of the number of RPEs (the higher the number, the more adequate), a quantitative correlation of this judge to the number of exposed workers and the number of licensees present was attempted. In fact, the judge of adequateness of the country's number of RPEs is expected to depend on the extension and

complexity of the national radiation protection issues (roughly quantified by the number of radiation workers and licensees). For this reason the ratio of the number of RPEs by either the number of workers or the number of licensees is plotted in Figure 2. This preliminary analysis results to be only partially useful as several countries, which consider the number of the RPEs inadequate (e.g. Cyprus, Greece, Denmark, Malta, etc.), have a ratio of RPEs/Workers higher than other countries that have an adequate number of RPEs (e.g. Luxembourg, Italy, Sweden, The Netherlands, UK, etc.). The analysis of the ratio of RPEs/Licensees seems to be even less predictive. Tables 5 and 6 can immediately show this situation: here the ratios are given in descending order and, if they were significantly descriptive, the whole group of the countries should be clearly segmented in two groups (adequate and inadequate number of RPEs).
The previous conclusions can be more quantitatively drawn using a simple non-parametric statistic test (Mann-Whitney U test). Excluding the countries with an incomplete information (5 countries), the two groups of countries that judge adequate (9 countries) or inadequate (14 countries) the number of RPEs have not significantly different values of the ratios RPEs/Workers or RPEs/Licensees (two-tailed test at 5% of level).

The last attempt of defining a general descriptive variable about the adequateness of the number of RPEs taking into account the real and legal dimension of the problem (number of radiation workers and licensees) is presented in Fig. 3 and Table 7. The number of RPEs is now normalized to the mean number of workers for each licensee, i.e. number of workers divided by the number of licensees. This variable is named RWL. The underlying idea is that for each licensee a RPE should be generally appointed, and that, for each licensee, the higher the number of worker, the higher the probability of the need of a RPE.
This variable RWL seems to be fairly correlated to the judge given by each country about the adequateness of the number of RPEs: all the countries with the highest values of this variable are systematically those ones considering adequate the number of RPEs. The only main exceptions are Greece, Denmark, Hungary and Luxembourg. A clear statement can not be made for countries such as Czech Republic, Croatia and France, that didn't clearly state the adequateness of the RPEs, and/or didn't provide the number of licensees and/or the number of RPEs and, therefore, the variable RWL can not be calculated. Finland and Switzerland provided information only for the non-nuclear and nuclear sectors, respectively (therefore, the RWL values should be more coherently compared with the RWL values for the analogous sectors in the other countries).
Table 7 now shows clearly the significance of the variable RWL: beyond the above mentioned exceptions, the countries are well spitted in two groups with a splitting value of RWL of about 10 – 20 RPEs/(Workers/Licensees).
The previous conclusion is more quantitatively drawn using the Mann-Whitney U test. The two groups of countries that judge adequate or inadequate the number of RPEs have now "very" significantly different values of the RWL variable (two-tailed test at 1% of level).

Conclusion

The analysis carried out seems to point out an inner and surprising coherence among the simple qualitative judgement about the adequateness of RPEs' number and the country's radiation protection issues (quantified by the number of radiation workers and licensees).
The RWL should be used to support the country's judgement about the adequateness of RPEs'

number or, in prospective way, to roughly estimate the future need of RPEs in the same country for which the numbers of workers and licensees are foreseen to change. Other application of RWL (e.g. to other countries for which the numbers of workers and licensees are available but no judgement is available about the adequanteness of the RPEs' number) should be carefully considered.

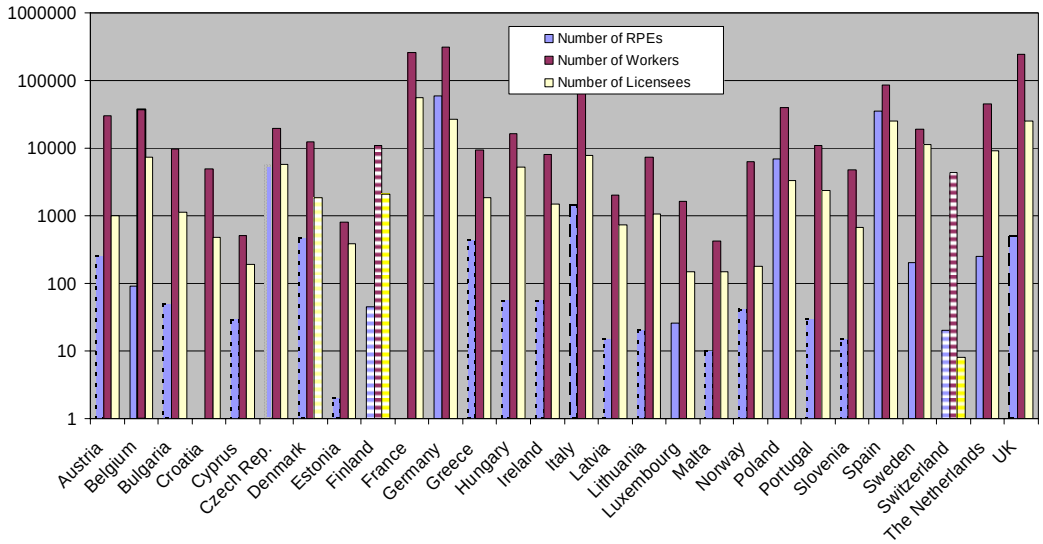

Fig. 1. Number of RPEs, workers and licensees, as provided by each single country. Dashed fine border: the number of RPEs is not adequate. Dashed thick border: the number of RPEs will be not adequate in prospective. No border line: didn't make any statement about adequateness of the number of RPEs or didn't provide any number. Striped area: partial information (non-nuclear or nuclear field).

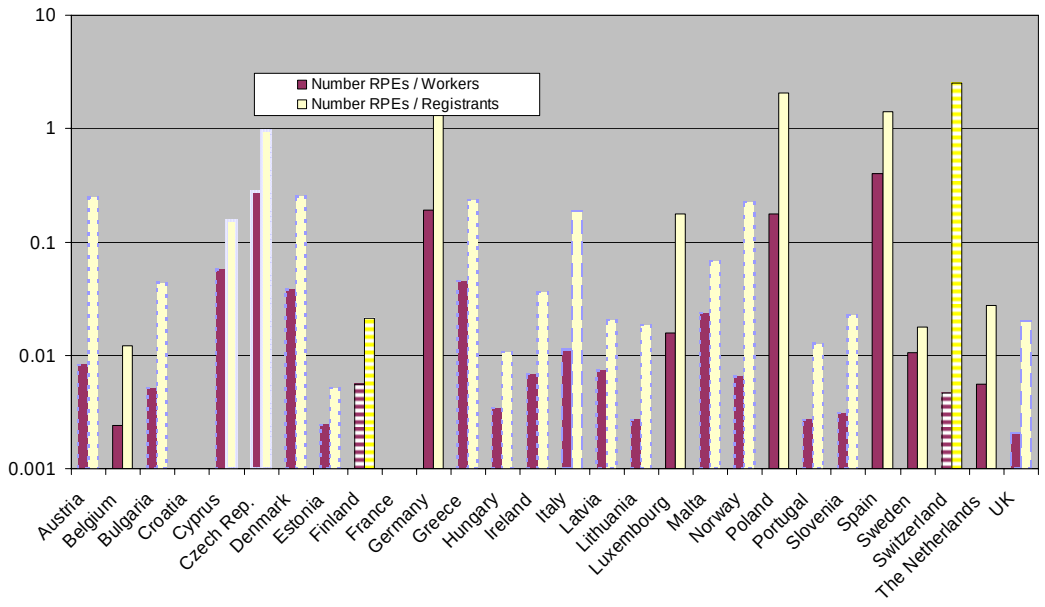

Fig. 2. Ratio of the number of RPEs by the number of workers and the number of licensees, as provided by each single country. Dashed fine border: the number of RPEs is not adequate. Dashed thick border: the number of RPEs will be not adequate in. No border line: didn't make any statement about adequateness of the number of RPEs. Striped area: partial information (non-nuclear or nuclear field).

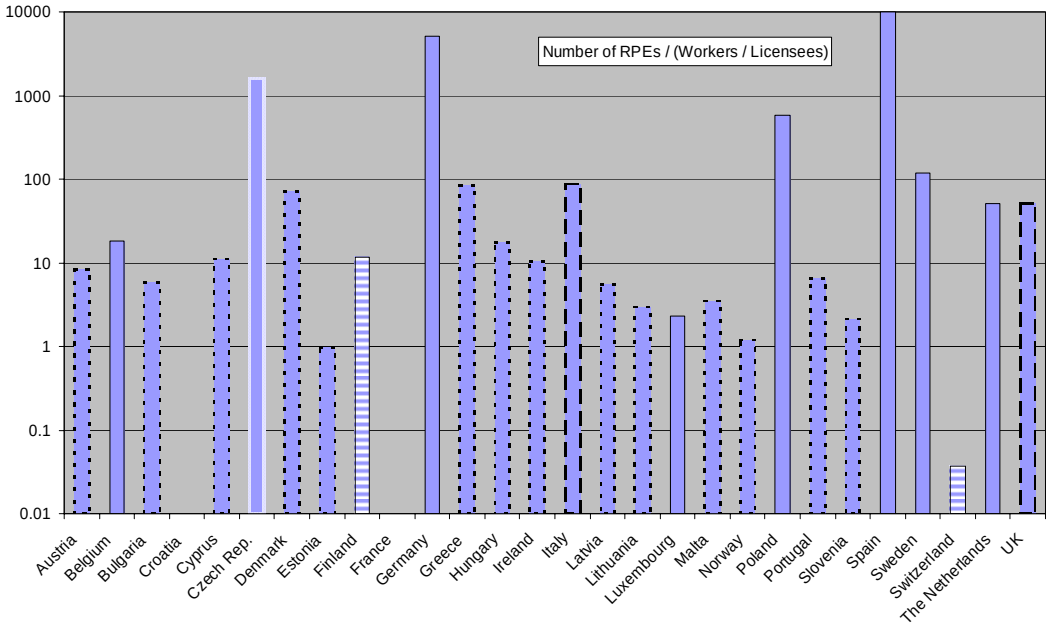

Fig. 3. Ratio of the number of RPEs by the mean number of workers per each licensee, as provided by each single country. Dashed fine border: the number of RPEs is not adequate. Dashed thick border: the number of RPEs will be not adequate in prospective. No border line: didn't make any statement about adequateness of the number of RPEs. Striped area: partial information (non-nuclear or nuclear field).

Table 5. Ratio of the number of RPEs by the number of Workers in descending order. The adequateness of the number of RPEs is given too.

	Adequate N° of RPEs		RPEs/Workers
	Yes	No	
Spain	X		0.401
Czech Rep.	---	---	0.280
Germany	X		0.191
Poland	X		0.175
Cyprus		X	0.058
Greece		X	0.046
Denmark		X	0.038
Malta		X	0.024
Luxembourg	X		0.016
Italy	X[(a)]		0.011
Sweden	X		0.010
Austria		X	0.008
Latvia		X	0.007
Ireland		X	0.007
Norway		X	0.007
Finland	X[(c)]		0.006
The Netherlands	X		0.006
Bulgaria		X	0.005
Switzerland	X[(b)]		0.005
Hungary		X	0.003
Slovenia		X	0.003
Lithuania		X	0.003
Portugal		X	0.003
Estonia		X	0.002
Belgium	X		0.002
UK	X[(a)]		0.002
Croatia		X	Not evaluable
France	---	---	Not evaluable

[(a)] Possible future shortage of RPEs. [(b)] Only nuclear sector. [(c)] Only non-nuclear sector

Table 6. Ratio of the number of RPEs by the number of Licensees in descending order. The adequateness of the number of RPEs is given too.

	Adequate N° of RPEs		RPEs/Licensees
	Yes	No	
Switzerland	X[(b)]		2.500
Germany	X		2.256
Poland	X		2.083
Spain	X		1.401
Czech Rep.	---	---	0.963
Denmark		X	0.251
Austria		X	0.250
Greece		X	0.232
Norway		X	0.227
Italy	X[(a)]		0.186
Luxembourg	X		0.177
Cyprus		X	0.153
Malta		X	0.068
Bulgaria		X	0.044
Ireland		X	0.036
The Netherlands	X		0.028
Slovenia		X	0.022
Finland	X[(c)]		0.021
Latvia		X	0.020
UK	X[(a)]		0.020
Lithuania		X	0.019
Sweden	X		0.018
Portugal		X	0.013
Belgium	X		0.012
Hungary		X	0.011
Estonia		X	0.005
Croatia		X	Not evaluable
France	---	---	Not evaluable

[(a)] Possible future shortage of RPEs. [(b)] Only nuclear sector. [(c)] Only non-nuclear sector

Table 7. Ratio of the number of RPEs by the mean number of Workers per each Licensee (RPEs/(Workers/Licensees)) in descending order. The adequateness of the number of RPEs is given too.

	Adequate N° of RPEs		RPEs/ (Workers/Licensees)
	Yes	No	
Spain	X		9938.50
Germany	X		5089.29
Czech Rep.	---	---	1598.28
Poland	X		588.00
Sweden	X		117.61
Italy	X[(a)]		87.00
Greece		X	85.42
Denmark		X	70.59
UK	X[(a)]		50.81
The Netherlands	X		50.75
Belgium	X		18.07
Hungary		X	17.72
Finland	X[(c)]		11.80
Cyprus		X	10.98
Ireland		X	10.38
Austria		X	8.33
Portugal		X	6.47
Bulgaria		X	5.85
Latvia		X	5.48
Malta		X	3.48
Lithuania		X	2.95
Luxembourg	X		2.31
Slovenia		X	2.10
Norway		X	1.18
Estonia		X	0.97
Switzerland	X[(b)]		0.04
Croatia		X	Not evaluable
France	---	---	Not evaluable

[(a)] Possible future shortage of RPEs. [(b)] Only nuclear sector. [(c)] Only non-nuclear sector

Appendix III

Analysis of and conclusions from the results of the questionnaire parts C, D and E

This analysis is based on the responses of 28 countries. Where possible, the results are compared with the results of an earlier survey, carried out in 2002 (RP 133; The status of the radiation protection expert in the EU Member States and applicant countries; Luxembourg, 2003).

1 Part C: National Capabilities for Education and Training in Radiation Protection

1.1 Sustainability of education and training infrastructure (question C1)

68 % of the countries (19/28) have a self-sustainable education and training infrastructure for building competence in radiation protection. Of these countries, the Candidate State Bulgaria considers itself as having a self-sustainable E&T infrastructure, albeit that it is methodologically supported by EC and IAEA. Also the Associated State Norway has a self-sustainable E&T infrastructure.

18 % of the countries (5/28; Croatia, Cyprus, Estonia, Luxembourg and Portugal) consider their E&T infrastructure not self-sustainable. Estonia has attempted to build up a sustainable E&T infrastructure, but considers this impossible to realize, due to the small size of the country. Other bodies, such as IAEA, support their training needs. Luxembourg has, for the same reason, no own E&T programme. It depends on RPEs that have been educated in other countries. Portugal has an incipient E&T infrastructure, but efforts are being made to improve the situation.

14 % of the countries (the new EU Member States Latvia, Malta and Slovenia, and the Associated State Switzerland) consider their E&T infrastructure as being partly self-sustainable. In Latvia, the infrastructure is self-sustainable in almost all sectors of work, except in the medical sector where only a small number of personnel is employed, such as in nuclear medicine and radiotherapy. These specialists are trained in other countries, supported by IAEA. The same situation applies for Malta. It is self-sustainable for many sectors of work, but not for nuclear medicine, radiotherapy as well as for non-destructive testing. It is supported by the IAEA in various training activities. Slovenia has a self-sustainable infrastructure for workers and RPOs, but special training of RPEs is often supported and organized by IAEA. Switzerland is mostly self-sustainable, except for RPEs in the nuclear power industry, also because of the small number of persons employed. These persons are mainly trained abroad.

Table 1 gives an overview of the responses on question C1.

Conclusion

The situation with respect to the radiation protection education and training infrastructure in the European Union is rather good. Most of the responding countries have a self-sustainable infrastructure and can educate their RPEs, RPOs and workers according to their national needs. Some countries consider themselves as being mainly self-sustainable, with exceptions in the medical sector, NDT and the nuclear sector. Some support may be needed for some of the new EU Member States and Candidate States, as well as for Portugal. The reason for not achieving complete self-sustainability in small countries may be that for certain sectors of work the number of employed persons is rather small. In such cases it may be more efficient to send persons to other training events, rather than setting up such events in the own country.

The results from this study are in good comparison with the results of the 2002 survey. The survey showed that from the EU-15 Member States only Luxembourg didn't have a self-sustainable E&T infrastructure, because of the size of the country. From the new EU Member States and Candidate States that responded to the survey (Czech Republic, Estonia, Hungary, Latvia, Malta, Poland and Romania) only Hungary and Poland were not supported by IAEA for their training programmes. From this, one can infer that in the meantime Czech Republic has become self-sustainable for their E&T infrastructure.

Table 1: Countries' responses on question C1[4]

Country	**Self-sustainable E&T RP infrastructure**
Austria	
Belgium	
Bulgaria	
Croatia	Supported by IAEA
Cyprus	Supported by IAEA
Czech Republic	
Denmark	
Estonia	Supported by IAEA
Finland	
France	
Germany	
Greece	
Hungary	
Ireland	
Italy	
Latvia	Not for Radiotherapy & Nuclear Medicine (supported by IAEA)
	Other applications
Lithuania	
Luxembourg	
Malta	Not for Radiotherapy, Nuclear Medicine & NDT (supported by IAEA)

[4] Green means a positive answer on the question; colourless means a negative answer; red means no information; blue means that the answer is unclear.

	Other applications
Netherlands	
Norway	
Poland	
Portugal	
Slovenia	For workers and RPO
	Supported by IAEA for RPE
Spain	
Sweden	
Switzerland	Nuclear power industry
	Other applications
United Kingdom	

1.2 Provision of general and specialized academic training courses (questions C2 and C4)

64 % of the countries (18/28) claim to provide academic courses in general radiation protection (question C2), and 61 % (17/28) claim to provide specialized academic RP courses that are required as basic education for certain professions (question C4). The responses to the two questions are, however, not without ambiguity. In several cases, the respondents identified courses in question C2, which should appear or have been repeated in question C4. For Denmark, it appears to be the other way around.

Cyprus, Estonia, Hungary, Malta, Norway and Switzerland (21 %; 6/28) have no academic RP courses, neither for general RP education, nor for special professions. Croatia, Finland and Luxembourg have no general academic RP course, but provide academic courses for health care professionals and regulators (only for Luxembourg). Denmark provides academic courses for RPEs working with unsealed sources in research. In Italy, Poland and Portugal it is just the other way around, providing general academic RP courses, but not for special professions. Ireland provides a MSc education in Medical Physics: the answer should therefore be “No” for question C2 and “Yes” for question C4. For Bulgaria (response C4) and Estonia (response C2 is inconsistent with response C10) the situation is unclear. The Netherlands and Spain provide RP courses at different universities (and other institutes), but these courses do not lead to an academic degree (only to a diploma after examination).

Table 2 gives an overview of the responses on the questions C2 and C4. Annex 1, Table A.1, gives a list of identified universities and institutes that provide the courses.

Conclusion

General radiation protection courses on an academic level are provided in Austria, Belgium, Bulgaria, Czech Republic, France, Germany, Greece, Italy, Lithuania, Netherlands, Poland, Portugal, Slovenia, Spain, Sweden and UK (57 %; 16/28). Of the rest of the countries, Finland, Hungary, Latvia, Malta, Norway and Switzerland (21 %; 6/28), consider themselves as having a mainly self-sustainable RP E&T infrastructure (see section 1.1). Therefore, the conclusion must be drawn that in these countries the training is conducted by non-university institutes.

Specialized courses that are required as basic education for other professions are given in Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Latvia, Lithuania, Luxembourg, Netherlands, Slovenia, Spain, Sweden and UK (68 %; 19/28). These courses are mainly for medical physicists and other medical professions, and occasionally also for other professions such as nuclear safety specialists, workers with unsealed sources in research, and regulators.

The new EU Member States Cyprus, Estonia, Hungary and Malta, and the Associated States Norway and Switzerland do not provide any academic radiation protection courses.

The results are comparable with the results from the 2002 survey, where it was concluded that in most countries a prior education on an academic level is needed for the RPE, certainly in the medical and nuclear sector. In the majority of the countries, these courses are given at universities, but other training centers do occur.

Table 2: Countries' responses on question C2 and C4

Country	**General academic RP courses**	**Academic RP courses required for certain professions**
Austria	RP courses at universities	Medical Physicists
Belgium	UCL (DEC+DES), ULg (DES) and ULB (DES) in RP and nuclear safety; XIOS/ISIB/SCK/IRE: RP	MSc in Engineering, Physics and Chemistry; Medical Physicists
Bulgaria	MSc Medical Physics & Radioecology; Medical Radiation Physics; Engineering Physics	For all IR professions?
Croatia		PG for Medical Physicists
Cyprus		
Czech Republic	BSc RP&Environm.; BSc Radiol. Assistant; MSc Dosim. & appl. of ioniz. rad.; MSc Medical Physics; MSc Crisis Radiobiology	Medical Physicists
Denmark		For RPEs working with unsealed sources in research
Estonia		
Finland		For health care professionals
France	MSc RP; RP for technicians	Medical Physicists; medical staff
Germany	Universities: MSc RP	Medical Physicists
Greece	Univ. + GAEC: MSc Medical Physics + PhD; PGEC (GAEC+IAEA)	MSc Medical Physics; RP courses for medical specialists
Hungary		
Ireland	MSc Medical Physics	
Italy	Several MSc's in RP at various universities and other institutes	
Latvia	BSc and MSc Medical Physics	BSc and MSc Medical Physics
Lithuania	MSc Environmental Engineering, with specialization RP	MSc Medical Physics
Luxembourg		Medical Physicists and regulators
Malta		
Netherlands	Level 2 course of Univ. Leiden / TU. Delft (diploma, no degree); Level 3 courses at universities and at NRG (diploma, no degree)	Medical Physicists
Norway		
Poland	Univ. Cracow: Dosimetry and Radiation Protection	
Portugal	TU Lisbon + ITN: MSc RP (started 2004)	

Slovenia	PG course Nuclear Technology; PG course Medical Physics (start 2006)	Medical Physics (start 2006)
Spain	Courses at several universities (no degree)	No details
Sweden	MSc Medical Physicist; MSc Radiation Physics	Medical Physicists + MSc Radiation Physics
Switzerland		
United Kingdom	MSc Radiation and Environmental Protection	Medical Physicists

1.3 Requirements with respect to education for recognition of RPE and RPO (questions C3, C5 and C6)

82 % of the countries (23/28) require an academic basic education level (or equal) for recognition of the RPE (question C6). In some of these countries (Bulgaria, Czech Republic, Latvia, Malta, Netherlands and the UK) the required education levels are diversified and they accept also lower education levels, depending on the sector of work and the complexity of the applications. In Sweden, generally an academic level is required, together with work experience, but as this is not always possible to realize in industrial radiography, work experience is in this sector more important than the academic education. In the UK, the minimum basic education has been specified by the HSE in the syllabus. Latvia has coupled the minimum basic education (from secondary level to PhD) to the years of experience (from 17 to 7 year). The answer of Greece refers to the PGEC and the Medical Physics course, i.e. not to basic education, but as these courses require an academic level it is assumed that also Greece requires an academic basis. Greece is therefore included in the above-mentioned 79 %. Luxembourg refers to a university degree for regulators, but for other professions, such as the medical physicist, there is no regulation. RPEs are accepted according to the acceptance criteria in the country where the RPE is educated. Croatia accepts an undergraduate degree or diploma. Poland gave no details on the minimum basic education level that is required.

The new Member State Lithuania and the EU-15 Nordic countries Finland and Sweden (11 %; 3/28) have not specified a minimum basic educational level for the RPE. France did not reply on question C6, presumably because the RPE does not exist in the French legislation. Instead of that, the “personne compétente” has been defined, for which only the required professional radiation protection training has been specified.

For 68 % of the countries (19/28), successful completion of the academic courses identified in question C2 is not a pre-requisite for recognition of the RPE (question C3). France didn’t respond on this question, presumably for the same reasons as identified above. Denmark and Luxembourg didn't respond either, presumably because no academic radiation protection courses are offered.

For Bulgaria, Greece, Latvia, the Netherlands, Spain and Sweden (21 %; 6/28) successful completion of the academic courses is claimed to be sufficient for recognition of the RPE. However, as already mentioned in section 1.2, some of the identified courses should not appear in the response on C2 but in the response on C4 (Bulgaria and Latvia: MSc for medical physicists;

Sweden: QE in the medical sector). The Netherlands is in a transition state, as the new recognition system (not yet in place) will also require experience as a prerequisite. With this in mind, the vast majority of countries require more than only the general academic courses for recognition of the RPE, such as experience or competence.

The response on question C5 is in good agreement with the response on question C3. For 61 % of the countries (17/28), successful completion of the academic courses identified in question C2 is not a pre-requisite for recognition of the RPE. From these countries, Austria and Bulgaria claim that completion of the courses is only sufficient for the RPO. This is also the case for France, who considers the “personne compétente” as being comparable to the RPO. Denmark and Luxembourg didn't respond on this question, presumably because no academic radiation protection courses are offered.

From the other countries who replied positive on question C5, Latvia and Sweden refer to the medical physicist, for whom successful completion of the courses is a pre-requisite for recognition as RPE in this sector. The Netherlands is, as explained above, in a transition state. Spain answered positive, but without any details. The answer of Malta refers to courses followed abroad. These seem to be sufficient for recognition as RPE or RPO.

Table 3 gives an overview of the responses on the questions C3, C5 and C6.

Conclusion

The majority of countries require an academic level of basic education for the RPE, although in some countries a lower background education is allowed, depending on the sector and the complexity of the application. For most of the countries successful completion of general professional radiation protection courses is as such not a pre-requisite for recognition of the RPE. In these cases, additional requirements apply such as experience and/or competence. To a somewhat lesser extent, this is also true for the RPO.

The results are comparable with the results of the 2002 survey, where it was concluded that in most countries a prior education on an academic level is needed for the training of the RPE, specifically for the medical and nuclear sector. Professional experience is another criterion for recognition in most countries, but not in all.

Table 3: Countries' responses on question C3, C5 and C6

Country	General academic course pre-requisite for recognition of RPE	General academic course sufficient for recognition as RPE or RPO		Minimum basic education for RPE
Austria		For RPO		Acad. (engineer, physicist...)
Belgium	Recognition based on complete file	Needs several requirements		Class 1: MSc Engin., Phys., Chem. Class 2: Technical Engin., MSc
Bulgaria	MSc for Med. Phys.	For RPE	For RPO. Courses are job-specific	Yes for Med. Phys. Other sectors job-specific
Croatia		RPE not defined (see D3)		Undergraduate degree or diploma
Cyprus				Degree in Science or Engineering + appropriate training in RP
Czech Republic				Academic or secondary education, depending on sector
Denmark				Academic for RPE in research, Med. Phys., DD and industrial radiography
Estonia				Academic or equivalent
Finland				
France		For RPO (personne compétente)		
Germany				Academic
Greece	Both PGEC and Med. Phys. course	Med. Phys.		PG for Rad. Phys. and Med. Phys. course
Hungary				BSc
Ireland				Physics degree
Italy				Degree in Engineering, Physics or Chemistry
Latvia	MSc Med. Phys.	Courses comply with 97/43 and EFOMP		From secondary level to PhD, with different years of expertise
Lithuania				
Luxembourg				
Malta		Courses followed overseas are sufficient, but experience is also required		Minimum practice specific levels have been specified
Netherlands		Yes, but in new system experience and training required		Level 3: High vocational education; Level 2: academic
Norway				MSc Physics or Nucl. Chem.
Poland		For RPE, but after additional exams		
Portugal				Physics course
Slovenia				Academic + 5-7 y experience
Spain		For RPE		Academic
Sweden	QE in medical sector	Only for Med. Phys.; not for MSc radiation physics. No recognition of RPO		Normally academic +experience, but in industrial radiography experience is more important than an academic education.
Switzerland				Acad., nature science + RP crse
United Kingdom		Suitability required		Specified in HSE syllabus

1.4 Identification of training schemes and comparison with EC basic syllabus and/or PGEC of IAEA (questions C7, C8 and C9)

In the majority of countries (79 %; 22/28) training schemes have been specified for the professional development of the RPE (question C7). This figure includes training schemes that are specific for RPEs in the medical sector (mainly medical physicists). France ("personne compétente") and Slovenia have specified training schemes only for the RPO. In Estonia and Portugal the specification of training schemes is under development (some training schemes have been identified in some hospitals in Portugal). There are no formal training schemes in Croatia and Norway. Luxemburg (no response) depends on RPEs that have been educated elsewhere.

36 % of the countries (10/28) claim that the training schemes reflect exactly the EC basic syllabus (question 8). Among these countries are the Applicant State Bulgaria and the Associated State Switzerland. Slovenia has no special syllabus for the RPE, but only for workers and the RPO, which are claimed to reflect the EC basic syllabus. The level of depth depends on the complexity of the practice for which the course applies, but the basic syllabus is used to compare the training of RPOs that have applied for recognition as an RPE.

46 % of the countries (13/28) claim that the training schemes reflect only partly the EC basic syllabus. Of those countries, Finland ("minor differences"), Ireland ("close") and Sweden ("course covers more"), may be considered as having training schemes that reflect the EC basic syllabus in a great deal. In Austria, the radiation protection legislation is under revision, which may shift the country into the list "Exactly" in the near future. Estonia follows the basic syllabus as much as possible and uses it for assessing the RPE. However, the country has to take into account the local needs and the possibilities. Also Malta has to take into account the local needs and possibilities, and combines courses for RPEs and RPOs, because of the small size of the country. Latvia has not enough practice capabilities to comply with the syllabus. Belgium uses a modular structure for their training schemes.

Three countries, Croatia and Norway (no formal training schemes), and Portugal (has an incipient E&T infrastructure, see section 1.1) declare that their training schemes are not comparable to the EC basic syllabus. Luxemburg (no response) depends on RPEs that have been educated elsewhere.

With respect to the basic syllabus of the PGEC set up by IAEA (question C9), the picture shifts from "exactly" to "partly". Only 11 % (3/28) of the countries, i.e. Bulgaria, Greece (which is organizing PGEC courses) and the Netherlands (for the Level 2 course) claim that their training schemes reflect exactly the PGEC syllabus.

57 % (16/28) of the countries consider their training schemes as only partly reflecting the PGEC syllabus. Austria uses the same argument (legislation under revision). In Czech Republic and in Switzerland the courses are considerably shorter than the length recommended in the IAEA standard syllabus, although the scope of the training schemes complies with this syllabus. In Ireland, the aspects pertaining to industries outside the medical sector, as well as higher-level management topics, are not covered comprehensively in their training schemes. In Lithuania,

only parts of the syllabus are reflected in the training. In the Netherlands, the Level 3 course is considered to reflect the IAEA standard syllabus only partially. This reflects the approach taken in the Netherlands to educate radiation protection personnel to different levels of complexity of the applications, with the highest level (Level 2) being exactly comparable to the standard syllabus and the highest-but-one level (Level 3) only in part. In Poland the scope of the training is more generally formulated than in the Standard Syllabus. In Slovenia the IAEA syllabus is not simply copied but it is rearranged. In Spain the regulatory systems included in the course are the national and European framework. The nuclear safety area is also not included. In Sweden, the parts concerning the philosophy of radiation protection are the same as IAEA and this also the basic in all education, but they also look at the practical experiences.

21 % (6/28) of the countries consider their training schemes as not reflecting the IAEA standard syllabus. Among those countries are, as above for question C8, Norway and Portugal. Croatia and Hungary give no details. Italy does not specify specific sub-topics, duration of the training and the type of practical exercise, as is done in the standard syllabus. The UK considers question C9 as being not applicable.

Finland and Malta have not checked compliance with the IAEA standard syllabus. France and Luxembourg didn't respond on questions C7, C8 and C9.

The results of the questions C7, C8 and C9 are given in table 4.

Conclusions

Some countries provided additional information by referring to specifications on internet websites, which show the requirements of the training schemes, and sometimes the content of the training courses, in more or less detail. Other countries did not provide any details. From the responses, it becomes clear that there has been a variety of reasons why countries consider their training schemes as not, or only partly reflecting the EU and/or the IAEA basic syllabus, although in some cases the length of the courses and the practice capabilities have been mentioned as being reasons for not complying with the IAEA syllabus. Without detailed information about the content of the training courses for the different sectors of work and for the different levels of expertise, it is difficult to compare the differences among the countries.

The results are comparable with the results of the 2002 survey, where it was concluded that in most countries the training programs address the topics of the EU basic syllabus. If a distinction in experts is made according to the sector of work, only those topics of the syllabus may be addressed that are relevant for the sector. If a distinction is made according to the complexity of the application, the time spent per topic may depend on the level of expertise that is deemed to be necessary for the expert.

Table 4: Countries' responses on question C7, C8 and C9

Country	Training for initial professional development of RPE	Training reflects EC basic syllabus			Training reflects PGEC basic syllabus of IAEA		
		Exact	Part	No	Exact	Part	No
Austria	RP courses at universities		Regulations under revision			Regulations under revision	
Belgium	Class 1: courses at universities Class 2: XIOS/etc.		Modular; 120 h				
Bulgaria	3 y after MSc MPE						
Croatia	Not for RPE						
Cyprus	Basic scheme in Medical Exposure Regulations						
Czech Republic	Initial and additional training					Shorter	
Denmark	RPE in research (unsealed sources) and for Med.Phys. (3 y program) and for Ind. Rad. (special training courses). DD has own training program.						
Estonia	Developing stage		Local needs				
Finland	RPE (=MPE) and RPO in medical area		Minor differences			Not checked	
France	RPE doesn't exist						
Germany	In various areas						
Greece	PGEC and Med. Phys. course				PGEC		
Hungary	Middle level and high level RP courses						
Ireland	Med. Phys.; IPEM syllabus		Close			Not outside medical	
Italy	Basic syllabus						
Latvia	Med. Phys.						
Lithuania	Various courses						
Luxemburg							
Malta	Some initial courses		Local needs		Not aware of IAEA PGEC		
Netherlands	Courses of level 2 & 3				Level 2	Level 3	
Norway	No formal training scheme						
Poland	See Regulation 18 January 2005						
Portugal	Some in hospitals						
Slovenia	Not for RPE	RPO				RPO	
Spain	Curriculum Reg. Body					Regulatory framework; no nuclear safety	
Sweden	Med. Phys.		Course covers more			Course covers more	
Switzerland	RP courses, experience, OJT					Shorter	
UK	RPTS; AURPO scheme						

1.5 The use of distant learning / e-learning and OJT in training events (questions C10 and C11)

The use of distant learning and/or e-learning (question C10) is not yet very common in the training programs. Only 21 % (6/28; Estonia, Germany, Greece, Latvia, Spain and UK) answered positive on question C10, mainly for the medical sector and for refresher courses or continuing professional development. In Estonia, at the university of Tartu, this has been developed only for radiation protection and dosimetry, as part of a broader course for environmental physicist. Spain has developed some useful tools, but these have not yet been accredited. In Finland a project is under development to provide supplementary training for medical professionals. 11 % (3/28; Italy, Netherlands and Sweden) of the respondents were not sure if this type of training is being provided in their country. France didn't respond on this question; the rest of the countries responded negative.

The picture regarding the use of OJT is much different. 71 % (20/28) of the countries use OJT (question C11) as part of the competence building. This is quite regular for the medical physicist (11 of the 20 responders refer to this professional group). It is also used in some cases for regulators, the nuclear sector (including decomissioning), as well as for industrial radiography. 21 % (6/28; Austria, Belgium, Cyprus, Luxembourg, Malta and Portugal) responded negative, although some OJT events have been identified in some hospitals in Portugal. The answer of Hungary was unclear.

The results of the questions C10 and C11 are given in table 5.

Conclusions

Distant learning techniques are yet not very common, but it appears to be a training technique that will be used more frequently, specifically in the medical sector and for refresher courses. OJT is a rather common part of competence building in the medical sector and nuclear sector.

Distant learning and OJT have not been addressed in the 2002 survey.

Table 5: Countries' responses on question C10 and C11

Country	Distant or e-learning			Training events with OJ
	Yes	No	Not sure	
Austria				
Belgium				
Bulgaria				Each postgraduate training includes OJT; Medical Physicist 3 y practical work
Croatia				Organised by State Office of Radiation Protection for professionals operating radiation sources
Cyprus				
Czech Republic				Selected personnel with IR sources
Denmark				For RPES as a regulator, at DD and for Med. Phys.
Estonia	Homepage Univ. Tartu			Training continues with OJT
Finland	Under development for medical sector			Medical Physicist
France				Medical Physicist 32 w
Germany	www.zfuw.de			Univ. Karlsruhe, Dept. of Safety Engineering; Medical Physicist and in NPP sector: 2y; Radiotherapy: 3 y
Greece	For PGEC			Medical Physicist (Inter university course; 4 m for diagnostics, therapy and nuclear medicin each). Regulators and inspectors
Hungary				Courses in 5-yearly professional workshop??
Ireland				Medical Physicist; Usually for industrial radiography, density gauge users and irradiation facilities
Italy				Lev 1: 120; Lev 2: 240; Lev 3 (NPP, accelerators): 360 d
Latvia	For med. sector			Employers are delivering OJT
Lithuania				For RPC staff
Luxembourg				
Malta				
Netherlands				Medical Physicist 3 y Industrial Radiography
Norway				RPE qualification based OJT on top of MSc Physics; 1-3 y clinical experience
Poland				Institute of Atomic Energy, which operates a research reactor
Portugal				Some OJT in hospitals available
Slovenia				Not sure (Krsko NPP uses OJT)
Spain	Not yet accredited			Yes (no details available)
Sweden				Medical Physicist 10 weeks
Switzerland				RPE for NPP: at least 4 weeks in other NPP
United Kingdom	AURPO			Yes, Med. Phys.

1.6 Specification of OJT and work experience in national legislations (question C12 and C13)

In a majority of countries (82 %; 23/28) there are legal provisions that specify the OJT or work experience required for performing certain professions (question C12). In most cases, details have been made available through internet addresses of authorities, many of them having English translations available. Ireland, Lithuania, Malta and Portugal have no legal provisions for OJT and work experience. Up to now, this is also the case in the Netherlands, but this will change in the near future when requirements for work experience will be specified for recognition of the RPE.

The main sectors of work where OJT and work experience are required are the medical sector and the nuclear sector, which is in line with answers on question C11. Since question C12 has a somewhat broader scope (OJT and work experience), the answers also reflect this broader scope: many regulations requiring work experience cover both the medical sector and other sectors where RPEs are needed. There are, however, some ambiguities in the answers, as is explained in section 1.7.

The wording of question C13 is such, that no reply implies that the terms "OJT" and "work experience" in the glossary of the questionnaire fully reflect the definition in the national regulations. With this in mind, and taking into account the responses on question C12, the responses on this question can be interpreted as follows.

61 % of the countries (17/28) have definitions for OJT and work experience in their regulations that fully reflect the definition given in the glossary of the questionnaire. In three other countries (Czech Republic, Germany and Italy) the definitions are only partly the same. The Czech definition for work experience is the same as in the glossary, but not the definition for OJT. In Italy, this is just the other way around. The German definitions do not always define if supervision is necessary (OJT) or not (work experience). The answers of Slovenia and the UK are unclear. Ireland, Lithuania, Malta and Portugal have no legal provisions for OJT and work experience, so these subjects are also not defined. Up to now, this is also the case in the Netherlands, but this will change in the near future when requirements for work experience will be specified for recognition of the RPE. Luxembourg claims to have legal provisions for OJT and/or work experience, but the terms are not defined.

The results of the questions C12 and C13 are given in table 6.

Conclusions

OJT and work experience are defined and specified in the regulations of a majority of the countries, although not always the same as defined in the glossary of the questionnaire. The main sectors of work where OJT and work experience are required are the medical sector and the nuclear sector.

OJT as such has not been mentioned in the 2002 survey, but professional experience has been

addressed. The results of this questionnaire are in agreement with those of the survey, where it was concluded that professional experience for recognition as RPE is required in many countries, but not all.

Table 6: Countries' responses on question C12 and C13

Country	Legal basis	Wording of OJT and work experience	
Austria	Work experience demanded by RP law		
Belgium	Royal Decree 2001, art 73.2. OJT required for renewal of recognition		
Bulgaria	Min. Health Ordinance No 31/28.06.2001 Art 11(3) on postgraduate training in health care; Ordinance for patient protection at medical exposure (not yet in force)	Fully reflect definitions	
Croatia	Official Gazette No 67/2000		
Cyprus	Legislation on the Protection from Ionizing Radiation		
Czech Republic	Atomic Law Section 9, para 1(n) Decree No 146/1997 (amended No 315/2002) Section 6 and 12	Not for OJT (no requirement for supervisor)	Yes for work experience
Denmark	Med. Phys.: VEJ nr 122 af 20/07/1995		
Estonia	Min. Environment Regulation Requirements for exposed workers radiation safety training	Fully reflect definitions	
Finland	Med. Phys.: Guide ST 1.7 (Annex B); RPO: Guide ST 1.8 (Annex B)		
France	Arrêté du 19 novembre 2004		
Germany	Guidelines (Technical Applications; RP in Medicine; Veterinary Med.; NPP personnel) See also paper A. S.-H.	German definitions do not always define if supervision is necessary (OJT) or not (work experience)	
Greece	RP Regulations para 1.1.7	Identical	
Hungary	Min Health Decrees 16/2000 and 31/2001 (not available)	(N/A)	
Ireland	None		
Italy	Legislative Decree 230/95, Appendix V	Yes for OJT	Not for work experience
Latvia	Cabinet regulation 290 describes minimum qualifications of RPO (!) incl. work experience and certificates in diagn. radiology or dentistry		
Lithuania	No special legislation	No definitions in legislation	
Luxembourg	Règlement grand-ducal du 16 mars 2001	No definition in legislation	
Malta	None	No definition in legislation	
Netherlands	No legal basis, but this will change for work experience	Not defined	
Norway	Radiation Protection Regulation no 1362 (2003) Section 33		
Poland	Regulation of 18 January 2005		
Portugal			
Slovenia	RP and Nucl. Safety Act requires 7 y work experience for RPE, 5 y for dosimetry exp., 5 y for MPE		

Spain	Regulations require OJT for the responsible of the RP service. (Only website in Spanish available)	
Sweden	SSI FS 2000:6 specifies that for extensive and complex practices (medical and nuclear area) the RPE should possess a wide and high competence and experience.	
Switzerland	Decree 814.501.261 for medical, nuclear and the rest. Guideline HSK-R-37/d for NPPs	
United Kingdom	IRR99 requires work experience for certification of RPA	Not applicable

1.7 Classification of OJT and/or work experience of RPE and/or RPO according to sector and/or complexity of applications (question C14 and C15)

64 % (18/28) of the countries have specified different levels or classifications for OJT and/or work experience of RPE and/or RPO with regard to the complexity of the radiation applications, or the different sectors of work (medicine, industry, research, nuclear fuel cycle, etc.) or both (question C14). The answers of Ireland and Malta are unclear, as they answered “None” on question C12, but “Yes” for question C14. For these two countries, there are different requirements associated with various sectors of work and complexity (question C15), and it remains unclear how this can be done without legislation providing a basis for work experience.

The ways of diversification varies (question C15), but most countries use different requirements for the various sectors of work and, to a lesser extent, for the level of complexity of the applications. Cyprus did not respond on the way of diversification.

Belgium, Czech Republic, Estonia, Finland, Greece, Poland and UK (25 %, 7/28) have a legal basis for work experience, but do not diversify this for levels of complexity or sectors of work. The answer of the UK (“Not applicable”) is unclear with regard to this subject. Croatia, Lithuania, Netherlands and Portugal (14 %, 4/28) do not have a legal basis at all, but this will change in the near future for the Netherlands.

Only Cyprus, Germany, Greece, Ireland, Italy, Latvia, Malta, Norway, Poland, Slovenia and Switzerland (39 %; 11/28) replied on the second part of question C15, referring to the verification of completion of OJT and work experience. In most cases, this is done by certification, after submission of the necessary documentation to the certifying authority. Cyprus makes a separate assessment for each case. In Luxembourg it is left to the Member State of origin of the medical physicist. Austria, Bulgaria, France, Spain and Sweden did not respond. The answer of the UK (“Not applicable”) is unclear.

There was no information from Hungary on question C15.
The results of the questions C14 and C15 are given in table 7.

Conclusions

Most of the countries use different levels for OJT and/or work experience as part of the education of the RPE and/or RPO with regard to the sector of work and, to a lesser extent, to the complexity of the applications. With respect to the verification of the OJT and/or work experience, most countries use a system of documentation that should be submitted to the certifying authority and showing that the requirements are fulfilled.

Table 7: Countries' responses on question C14 and C15.

Country	Different levels for OJT and/or work experience		Specify levels	Completion verified
	Yes	No		
Austria			RPO medical: univ. degree natural sc.	
Belgium				
Bulgaria			RPE Medical: 3 y experience; RPO: special course sufficient	
Croatia				
Cyprus				Assessment by Dept. of Labour Inspection
Czech Republic				
Denmark			**RPE:** Regulator: Academic + OJT + courses; Med. Phys.: 3 y program; DD: special program. **RPO:** depends on work aria	
Estonia				
Finland				
France			Requirements differ for various areas and sealed/unsealed	
Germany			Various levels (see paper)	Certificate
Greece				Hospitals, GAEC
Hungary				
Ireland			Requirements differ for various areas	Nomination signed by Sr. manager
Italy			Requirements differ for various areas	Certificate of completion of OJT
Latvia			Requirements differ for various areas	Attestation Committee
Lithuania				
Luxembourg			Requirements for medical physicists	Dependent on Member State of origin
Malta			Requirements differ for various areas and complexity	Documentation
Netherlands				
Norway			Requirements differ for various areas and complexity	Inspection by NRPA
Poland			See Regulation 18 January 2005	See Regulation 18 Jan. 2005
Portugal				
Slovenia			Requirements differ for various areas	Examination
Spain			Requirements differ for various areas	
Sweden			Requirements for medical and nuclear areas	
Switzerland			RPO Nuclear: 4 y exp +OJT; RPE: pre-education + 1 y exp. + 4 w OJT	Verification reports
United Kingdom			Not applicable	Not applicable

1.8 Assessment of competency during OJT (question C16)

Only 21 % of the countries (6/28; Bulgaria, Croatia, Czech Republic, Germany, Hungary and Poland) assess in all cases the competency of the expert acquired during the OJT. In Bulgaria, this is done by a state examination which assesses knowledge, competency and if the learning objectives have been achieved. Croatia assesses knowledge by a final examination. The Czech Republic requires an assessment of the competency for the various jobs. Germany uses a system of written training reports to confirm if learning objectives have been achieved, which will be checked by the competent authorities. Hungary and Poland did not specify the assessment.

Denmark, Estonia, France, Greece, Ireland, Latvia, Lithuania, Luxembourg, Spain and Switzerland (36 %; 10/28) assess the competency after OJT only in some cases. Denmark assesses competence of medical physicists by presenting documentation about the competences acquired to the National Board of Health. In Estonia competence assessment is not required by the legislation, but occurs in some cases by an assessment talk with the supervisor, according to internal quality management rules of the institute. In France, competence is checked for the medical physicist, by a competence sheet signed by the senior supervising medical physicist. Greece also assesses the competence of the medical physicist, by an examination, which assesses knowledge, competency and if the learning objectives have been achieved. Ireland does not assess the competences of medical physicist, but instead of that the practical and theoretical knowledge of the industrial radiographer is tested. Latvia assesses the knowledge and competency of the RPO, but the answer is unclear for the RPE and for the medical sector. In Luxembourg it is left to the Member State where the relevant education took place. Switzerland assesses the competence of the RPO by an exercise in the practice. Spain did not specify the assessment.

The answer of the UK (“Not applicable”) is unclear. The rest of the countries (39 %; 11/28) do not assess the competency acquired during OJT, although several countries have legal requirements for work experience (Austria, Belgium, Finland, Italy, Norway, Slovenia and Sweden; see question C12).

The results of question C16 are given in table 8.

Conclusions

About half of the countries do not assess the competency required during OJT, although requirements for work experience have been specified in a majority of these countries. Only four countries assess the required competency in all cases, the rest of the countries are doing this only in some cases (mainly the medical physicist). The assessment methodology differs, although in most cases it is claimed that the competence is tested.

Table 8: Countries' responses on question C16.

Country	Assessment of competency acquired during OJT			
	Yes All cases	**Yes Some cases**	**Assess what**	**No**
Austria				
Belgium				
Bulgaria	State exam		Knowledge, competency, learning objectives	
Croatia	Final examination		Knowledge	
Cyprus				
Czech Republic	Examination Commission		Competency (Decree No 146/1997 Coll, amended No 315/2002 Coll.)	
Denmark		Med. Phys.	Competence by documentation to National Board of Health	
Estonia		Assessment talk with supervisor	According to internal rules; testing competency not required by legislation	
Finland				
France		Med. Phys.	Competence sheets signed by supervisor	
Germany	By authorities	By Univ. Karlsruhe	Written training reports to confirm objectives	
Greece		Exam of Med. Phys.	Knowledge, competency, objectives	
Hungary	Examination			
Ireland			Practical and theoretical assessment of ind. radiographers; No assessment for Med. Phys.	
Italy				
Latvia			Knowledge and competency for RPO; RPE?? Medical professions??	
Lithuania			Interviews; informal assessment of ability	
Luxembourg		Where required in other Member States	What is required in other Member States	
Malta				
Netherlands				
Norway				
Poland				
Portugal				
Slovenia				
Spain				
Sweden				
Switzerland			RPO: exercise in the practice (competence)	
United Kingdom	Not applicable			

1.9 OJT training providers (question C17)

About half of the countries (57 %; 16/28) have specific training providers for OJT. These are sometimes officially recognized, and vary for the different sectors (mainly the medical sector). The information is included in Annex A, table A.1. Belgium, Cyprus, Denmark, Estonia, Ireland, Lithuania, Malta, Norway and Portugal (29 %; 8/28) do not have specific OJT training providers. There is no information on this question from Finland, the Netherlands and Sweden. Only Austria, France, Greece, Italy, Latvia, Poland, Switzerland and the UK responded on the question of numbers of trainees. This varied between "not possible to give a number" and "many".

In Austria, Germany, Greece, Hungary (Hungarian speaking is prerequisite) and Latvia (individual cases) the OJT is accessible for foreigners. In Finland, this would be difficult to arrange because of the difficult Finnish language. The answer of Switzerland is unclear. There is no information from the other countries.

Conclusions

The answers suggest that OJT training providers are available in about half of the countries, mainly in the medical sector. There is only in a few cases information about the capacity, in terms of numbers of places, and whether these places are available for foreigners. In Finland and Hungary, the difficulties for foreigners to access these places are caused by language problems.

Table 9: Countries' responses on question C17.

Country	Specific Training providers for OJT		
	Type of providers	**Capacities**	**Accessible for foreigners**
Austria	Res. centres; Universities	30	Yes
Belgium	(C11: no OJT training events)		
Bulgaria	Recognized centres (NPP, univ., hospitals, NCRRP, Mil. Med. Acad.		
Croatia	State Office of Radiation Protection		
Cyprus	No		
Czech Republic	11 recognized centres (NPPs, univ., medical centres)		
Denmark	No		
Estonia	No specific providers		
Finland			Due to Finnish language difficult to arrange
France	Large number (CEA, EdF, IRSN, nucl. industry, hosp.	Not possible to give a number, but many	
Germany	2 to 3 research centers		Yes
Greece	Recognized hospitals	50 Med. Phys. from PG and other courses; 15 regulators/inspectors from PGEC	Yes, GAEC provides international courses
Hungary	"Yes"		Hungarian speaking
Ireland	No specific providers		
Italy	All recognized hospitals, research centres, etc	Not available	
Latvia	Oncology centre	Enough for national oncology specialists	Accessible in individual cases
Lithuania	No		
Luxembourg	Radiographer school		
Malta	No		
Netherlands			
Norway	No		
Poland	Institute of Atomic Energy; Central Laboratory for Radiation Protection	Limited	
Portugal	(C11: no OJT training events)		
Slovenia	Jožef Stefan Inst.; Inst. Occ. Safety; NPP Krško; Univ. Med. Centre; Inst. of Oncol.		

Spain	Enough		
Sweden			
Switzerland	PSI	10 – 20	
United Kingdom	Various on request	Not possible	

2 Part D: Regulatory Requirements

2.1 Legal requirements, definitions and provisions for education, training and recognition for RPE, RPO and workers (question D1, D2 and D3)

All countries have legislation in place that requires the RPE, the RPO or the worker to be suitably trained and qualified (question D1). There are, however, some differences for these three types of persons.

A large majority of countries (82 %; 23/28) has specifications for the RPE, some of them specifically for certain sectors, such as the Medical Physicist. The response of Luxembourg indicates that there are requirements for qualifications, but there are no training specifications given in the legislation. Lithuania does not have any requirements in their legislation. In Portugal, it is in preparation. Croatia did not define the RPE. Czech Republic and France do not make a distinction between the RPE and the RPO. Czech Republic has defined "selected personnel" with different requirements for different activities. France has defined the "personne compétente", for which also specific requirements are described.

About the same majority (86 %; 24/28), but with different countries, has specifications for the RPO. In this case, Belgium, Italy and Sweden have no legislation for the RPO, while Portugal is preparing such legislation. Czech Republic and France have been included in the 86 %.

All countries require that workers are suitably trained and qualified. In Austria this means on-the-job training. In Belgium and Denmark only training is required, without any further qualifications.

About half of the countries (54 %; 15/28) claim that the definition of the RPE in their legislation reflects exactly the definition of the Qualified Expert, as defined in Council Directive 96/29/Euratom (question D2). 25 % of the countries (7/28) claim that their definition is only partly reflecting the QE. Austria and Portugal have no definition in their current legislation, but these are in the process of revision. Croatia, Czech Republic and France have no RPE, therefore there does not exist a definition in their legislation. The same is true for Norway.

Amazingly, the provisions for education, training and recognition for the RPE (question D3) differ from the answers on question D2. Here, only 32 % (9/28) of the countries claim that their provisions reflect exactly the provisions as specified in Communication 98/C 133/03 from the Commission. About half of the countries (46 %; 13/28) claim to have provisions partly reflecting those of Communication 98/C 133/03. Cyprus makes use of the Communication during approval or licensing procedures. Austria and Portugal have no provisions yet, France has its "personne compétente". Malta has no provisions in its legislation, but the authority refers to the Communication in its criteria for recognition of the RPE. Croatia and Norway have no reference to RPE in their legislation.

For a detailed comparison of the requirements, it would be necessary to have English translations of the relevant legal text available. Unfortunately, this is not the case for a number of countries. It

is therefore not easy to compare the qualifications of the various persons.

Table 10 gives an overview of the responses.

Conclusion

Only a minority of countries have no requirements in their legislation regarding the training an qualification of the RPE and/or RPO. In a few countries, the legislation is being revised at the moment. For the countries having such requirements, the qualifications of the various persons are difficult to compare.

The results are in good agreement with the 2002 survey.

Table 10: Countries' responses on question D1, D2 and D3

Country	Suitably trained and qualified			Definition RPE equals QE			Provisions equal Communication		
	RPE	RPO	Worker	Exactly	Partly	No	Exactly	Partly	No
Austria	Med. Physicist	Training	OJT						
Belgium			Training, no qualific.						
Bulgaria									
Croatia						Not defined			
Cyprus									
Czech Republic	No distinction between RPE and RPO, but different requirements for "selected personnel" for different activities								
Denmark									
Estonia									
Finland									
France									
Germany									
Greece									
Hungary									
Ireland									
Italy									
Latvia									
Lithuania									
Luxem-bourg									
Malta									
Netherlands									
Norway									
Poland									
Portugal	In preparation	In preparation							
Slovenia									
Spain									
Sweden									
Switzerland									
United Kingdom									

2.2 Guidance on minimum education, training and experience (question D4) and accreditation of training providers and schemes (question D6)

75 % (21/28) of the countries have regulatory guidance available (question D4). In some cases, this is specified in detail, and in some countries this is only specified for certain sectors of work. Croatia, Czech Republic, Estonia, Luxembourg, Portugal and the UK do not have such regulatory guidance. The answer of Belgium is unclear.

57 % of the countries (16/28) have a system in place both for the accreditation of training providers and training schemes (question D6), although the answer of France regarding training schemes remains unclear. In the Netherlands, the authorities formally recognize training providers when the training schemes comply with the regulations. In Norway the accreditation system is only for industrial radiography. It looks as if all countries that use such an accreditation system, also maintain the records at the regulatory body, although the answer of France (for schemes) remains unclear.

43 % of the countries (12/28) do not have an accreditation system in place.

Table 11 gives an overview of the responses on question D4 and D6.

Conclusion

It seems that there is a consistency in the use of accreditation systems for training providers and training schemes, and the maintenance of records of the accreditation by the regulatory body.

The accreditation issue as such was not addressed in the 2002 survey, but the survey concluded that in many countries training centers have to be recognized by the authorities, albeit sometimes only in certain sectors. In this respect, the results of the survey are in agreement with the results of this study.

Table 11: Countries' responses to questions D4 and D6

Country	Guidance on mimimum education level etc.		Accreditation of training providers			Accreditation of training schemes		
	Yes	No	Yes	Records maintained	No	Yes	Records maintained	No
Austria								
Belgium								
Bulgaria								
Croatia								
Cyprus								
Czech Republic								
Denmark								
Estonia								
Finland								
France								
Germany								
Greece								
Hungary								
Ireland								
Italy								
Latvia								
Lithuania								
Luxembourg								
Malta								
Netherlands								
Norway								
Poland								
Portugal								
Slovenia								
Spain								
Sweden								
Switzerland								
United Kingdom								

2.3 Time limitation of the recognition of the RPE and RPO (question D5)

The question addresses the restriction in time of the validity of the recognition of the RPE and RPO, as well as the requirements in the legislation that specify the duration and content of the

education, training or OJT-activities necessary for keeping the recognition.

Half of the countries (50 %; 14/28) have legislation in place that restricts the validity of the registration of RPEs, unless the RPE has complied with the requirements for renewal of his recognition. The systems vary however. In some countries, the time-restricted recognition depends on the sector of work, the most striking difference being the recognition of the RPE in the medical sector. Austria uses a time-restricted recognition of the RPE in the medical sector, while Czech Republic and Sweden restrict the period of recognition of the RPE in all sectors except the medical field (the latter country also has no limitation in time of the recognition of the RPE in the nuclear sector; the RPE for other sectors has been dealt with at a later stage, including a time limitation of 5 years). Belgium uses a system of general rules, but it is not laid down in a Decree). The answers of Lithuania and Luxembourg are unclear. Luxembourg claims not to have a time-limited recognition, but this is in conflict with the response on question E6.

Only 25 % (7/28) gave a clear positive answer on the time-limited recognition of the RPO. Sweden has no recognition system for the RPO, but quite some countries (Austria, Bulgaria, Germany, Hungary, Lithuania and Luxembourg) did not respond clearly on this issue for the RPO. The response of Switzerland ("No") seems to be in contradiction with the regulations, as the radiation protection decree (art 7) specifies a period of 10 year. However, there are many unofficial contacts at meetings, inspections etc, and it is concluded that maintaining competence is not a problem in Switzerland, although a more formal system is considered for the future.

There is no information from Italy, nor from Denmark, but for the last country it is concluded from question E5 that there is no time limitation for the RPE. The Netherlands will have a time-limited registration system in short time.

The period of recognition in most countries is 5 year, but differences to shorter and longer times exist.

Table 12 gives an overview of the responses on question D5.

Conclusion

A time-limited restriction of the validity of recognition for the RPE and RPO is common in about half of the countries, and in most of the countries the period of recognition is 5 year.

The results of the study are in agreement with this study.

Table 12: Countries' responses to question D5

Country	RPE		RPO	
	Yes	No	Yes	No
Austria				
Belgium	FANC uses general rules		FANC uses general rules	
Bulgaria	5 year		5 year	
Croatia				
Cyprus				
Czech Republic	1-10 y for the rest	In the medical field	No difference between RPE and RPO (see D1)	
Denmark		(Concluded from E5)		
Estonia	5 year			
Finland				
France			5 year	
Germany	5 year		5 year	
Greece				
Hungary	5 year			
Ireland	5 year			
Italy				
Latvia	5 year		3 year	
Lithuania				
Luxembourg				
Malta				
Netherlands				
Norway				
Poland	5 year		5 year	
Portugal				
Slovenia	3-5 year		2-5 year	
Spain	3-5 year		3-5 year	
Sweden	5 y for the rest	In medical and nuclear field		
Switzerland		Officially 10 y, but not in practice		Officially 10 y, but not in practice
United Kingdom	5 year			

3 Part E: Recognition

3.1 Systems for recognition of RPEs, RPOs and workers (questions E1, E2 and E3) and systems for mutual recognition (question E4)

The questions address whether there are formal recognition systems in place by regulatory authorities or professional bodies for RPEs, RPOs and workers educated within the country (question E1) and, if yes, whether such systems are mandatory or voluntary (question E2). In question E3 a brief description of the method of operation was asked. Question E4 addresses whether there is a formal recognition system in place for recognition of RPEs, RPOs and workers who are educated outside the country.

A large group of countries claim to have formal systems in place for recognition of RPEs (79 %; 22/28), RPOs (68 %; 19/28) and workers (46 %; 13/28) (question E1). Most of the countries that recognize workers (9/13) also recognize RPEs and RPOs; and most of the countries that recognize RPOs also recognize RPEs (17/19). Belgium, Estonia and Sweden only recognize the RPE. The Netherlands uses at the moment only the diploma of the RP course as a formal recognition system for RPEs and RPOs, but this will change in the near future, when there will be a recognition system in place that takes work experience and refresher courses into account. Austria, Czech Republic, Denmark, Finland, Switzerland and the UK recognize only RPEs and RPOs, but no workers. France and Lithuania recognizes RPOs and workers, but no RPEs (France doesn't have an RPE). Croatia only recognizes workers. Luxembourg, Norway and Portugal do not use a recognition system at all. There is no information from Ireland for workers, from Italy for RPOs and Malta for RPOs and workers.

In the large majority of countries with a formal recognition system, the participation in the system is mandatory (question E2). Malta uses a voluntary basis for the RPE; Switzerland uses a voluntary basis for both RPE and RPO. Ireland and the Netherlands (in the near future) use both a voluntary and mandatory basis for RPE and RPO. There is no information from Ireland (for workers), Italy (for RPO) and Malta (for RPO and workers). The answers of Finland (for RPE, RPO and workers) are unclear.

Most of the countries have provided details (Finland unclear), but they have not yet been checked (question E3).

When it comes to recognition of RPEs, RPOs and workers from other countries (question E4), the picture is quite different. The numbers drop to 32 % (9/28) for RPEs, 25% (7/28) for RPOs and 18 % (5/28) for workers. In 39 % (11/28) there is information available, but this has not yet been checked. The answers from France (for RPE and RPO) are unclear. No information from France for workers and from Italy for RPOs.

Table 13 gives an overview of the answers on the questions E1, E2, E3 and E4.

Conclusions

Although it is encouraging that many countries are using formal recognition systems, the response also showed quite some differences. Only in a minority of countries there is a formal system for mutual recognition in place. More detailed research in the additional information provided by the countries is necessary to identify similarities and differences in the various recognition schemes.

The results are in agreement with the results of the 2002 survey.

Table 13: Countries' responses to questions E1, E2, E3 and E4

Country	Recognition system for RPE			Recognition system for RPO			Recognition system for workers			Details available	
	Yes	Mand Volunt	From abroad	Yes	Mand Volunt	From abroad	Yes	Mand Volunt	From abroad	E3	E4
Austria											
Belgium											
Bulgaria											
Croatia											
Cyprus											
Czech Republic											
Denmark											
Estonia											
Finland											
France											
Germany											
Greece											
Hungary											
Ireland											
Italy											
Latvia											
Lithuania											
Luxembourg											
Malta											
Netherlands											
Norway											
Poland											
Portugal											
Slovenia											
Spain											
Sweden											
Switzerland											
United Kingdom											

3.2 Time limitation of recognition and mechanisms for re-recognition of RPEs (question E5, E6, E7, E8, E9 and E10)

These questions are all related to restriction of the period of validity of recognition and to the requirements for re-recognition.

In a minority of countries (25 %; 7/28) the recognition of the RPE is for an indefinite period (question E5). Of those countries, the recognition in the Netherlands and in Portugal will change in the near future to a finite period. At the moment, 57 % (16/28) of the countries use a recognition system for the RPE that is time limited. The answers from Finland, Luxembourg and Switzerland are unclear. Croatia and France did not respond on this and the following questions, as they do not have defined an RPE.

The period of validity of the recognition (question E6) is in most cases 5 year, although there are some differences. The answer of Switzerland is unclear (answer on E5 was "No", but decree art 7 defines 10 year). Cyprus specifies the period of validity during approval. Luxembourg uses fixed periods of validity for the medical physicist (3 year) and for regulators (2 year).

As for the mechanism for re-recognition (question E7), in all cases the candidate has to show a sort of continuous professional development of skills, by following refresher courses, by examinations, or by some sort of assessments by other bodies. The evidence to show the progress in CPD (question E8) varies however, although in most cases evidence of practical experience and refresher training is required. OJT is required in about half of the cases. Practical experience or additional training is in most cases not sufficient on its own for re-recognition. In some countries the mechanism for re-recognition is dependent on the sector of work. Finland, France and Switzerland did not respond on question E8, Austria, Belgium and Luxembourg did not respond on some specific parts of question E8.

In most of the countries with a re-recognition system (question E9), the RPE is required to take action to maintain the status of RPE. The responses show again that the nature of such action is CPD-like. Some countries without a formal system of re-recognition still require evidence of experience, training or examinations for keeping the recognition valid (question E10).

Table 14 gives an overview of the answers on these questions.

Conclusions

Most countries use a time-limited system of recognition and require a demonstration of some form of CPD for keeping the status of RPE. The evidence to show, however, varies from one country to the other. The period of validity of the recognition is in most cases 5 year, but differences below or above that period occur.

The results are in agreement with the results of the 2002 survey.

Table 14: Countries' responses to questions E5, E6, E7, E8, E9 and E10

Country	Recog-nition limited	Period of validity	Mechanism of recognition	E81	E82	E83	E84	E85	E86	E87	Action required	Other require-ments
Austria		5 year	Refresher courses								Attending refr. courses	
Belgium		3-6 year	File to auth.								Submit File	
Bulgaria		5 year	Examination								CPD	
Croatia	No RPE											
Cyprus		Specified during approval	New approval by Dept. of Labour Inspection								Indicate activities and training	
Czech Republic		1-10 year See D5	Examination									Examination
Denmark												
Estonia		5 year	Case by case									Being active
Finland		Not fixed	Licence								CPD	
France	No RPE											
Germany		5 year	Refresher course								Experience	
Greece												
Hungary		5 year	CPD									Experience; Training
Ireland		5 year	Later									
Italy												
Latvia		5 year	Attestation committee								CPD	
Lithuania												
Luxem-bourg		Med. Phys 3 y; Regul. 2 y	Med. phys. cont. training; Regul. exam.								See E6	See E4 and E6
Malta		3 year	CPD									
Nether-lands	Later											
Norway												
Poland		5 year	Additional examination									No additional training necessary
Portugal	Now no recogn.										Law	
Slovenia		Maximum 5 year	Experience committee								Committee	
Spain		5 year										
Sweden		5 year	Assessment								CPD	
Switzer-land		10 year??									Retraining; extension studies	
United Kingdom		5 year	CPD								CPD	

3.3 Minimum criteria for mutual recognition (question E11)

The last question in the questionnaire tried to get information on the responder's view on the minimal requirements for mutual recognition of RPEs, RPOs and workers within the European Union, taking into account the national recognition policy.

Most of the respondents gave suggestions for minimal requirements. Only 18 % (5/28; France, Lithuania, Norway, Portugal and Spain) did not answer the question at all. Cyprus referred to education and training, as well as experience. Denmark referred to suitable academic training for RPEs and RPOs, supported by OJT or relevant experience from a former job (for RPEs); minimal requirements could depend on the area of work, but there was no information on the requirements to be applied. Also Estonia found it difficult to define minimal requirements and suggested to check the provided information of the applicant with the register of the country of origin. However, there was no information about which criteria to check. Greece and Hungary suggested that a harmonized education and training system would be sufficient, but gave no information on what should be harmonized. The responses of Cyprus, Denmark, Estonia, Greece and Hungary therefore do not really answer the question.

Other countries presented more specific views for mutual recognition. Obvious requirements for recognition within a country are knowledge of the national regulations and the national language. Several countries (Austria, Bulgaria, Czech Republic, Finland, Germany, Malta, Poland and UK) referred to compliance with the national regulations, but did not specify minimal requirements for mutual recognition. Belgium suggested establishing assessment bodies and to formulate general, but pragmatic and flexible rules for the appraisal of applicants, and possibly restrict the recognition to specific sectors of work. Experience should be taken into account and additional training may be imposed before a person can be recognized. Croatia, Latvia and Malta, all supported by the IAEA, referred to the Agency's requirements. Luxembourg and the Netherlands referred to requirements that should be dependent on the complexity of the practice. This reflects for the Netherlands the system of radiation protection training, which is divided in complexity grades, irrespective of the sector of work. Luxembourg suggested to develop guidance for the most common sectors, such as has been done in RP116 for the medical sector.

An interesting comment was made by Malta, stating that harmonized requirements should take into account problems of small countries (lack of resources, low number of workers, no full time RP training programmes). Minimal requirements that could not be met in Malta could lead to severe disruption to radiation employers, mainly in the medical area.

Table 15 gives an overview of the answers on question E11.

Conclusion

Some respondents took the opportunity to share their views on reaching common minimal requirements for mutual recognition, and made interesting and encouraging suggestions for further exploration of this important issue. However, a number of respondents only referred to compliance with national regulations, which is not very helpful in reaching consensus on the

requirements. Further research is needed to see whether these regulations leave room for establishing minimal requirements that are acceptable for all countries. Such requirements should take into account the sector of work, the complexity of the practice, obligations of member states to the IAEA and the specific problems of small countries.

Table 15: Countries' responses on question E11

Country	Requirements
Austria	Knowledge of regulations. Similar duration and curriculum of education as in Austria
Belgium	General but pragmatic and flexible rules for assessment bodies with a possibility to limit the expertise to a specific area; to evaluate the basic training on a quantitative and qualitative appraisal; to impose additional specific courses; to consider experience
Bulgaria	Compliance with the Bulgarian RP Ordinance
Croatia	E&T of RPE, RPO and worker in MS should be adequate (i.e. IAEA standard syllabus of PGEC or similar)
Cyprus	Difficult to answer. Law not yet fully implemented
Czech Republic	Compliance with Czech Decree on requirements on knowledge and practical skills
Denmark	Suitable academic training for RPE and RPO, supported by OJT and experience (for RPE). Minimal requirements could depend on area of work
Estonia	Check recognition registers. Difficult to define minimal requirements
Finland	Fluency in Finnish or Swedish. Compliance with Finnish RP guides
France	
Germany	Equivalent duration and curriculum of education as in Germany. Equivalent duration of work and practical experience as in Germany
Greece	A harmonised system of education, training and accreditation
Hungary	Harmonization of RP training schemes
Ireland	Training, knowledge and experience according to OJ C133. Degree in a physical science
Italy	Training, knowledge and experience according to OJ C133. Pass official examination
Latvia	Requirements of IAEA, but with less experience. RPE: National legislation in some cases; official language of IAEA and EU. RPO: National legislation in appropriate fields; national language. Workers: National legislation in appropriate fields
Lithuania	
Luxembourg	Dependent of level of complexity. Further guidance from EC, like table 1 of RP116 for the most common domains, including models for European certificates, like EN 45013
Malta	Comply with Maltese requirements. Harmonized requirements should take into account problems of small countries (lack of resources, low number of workers, no full time RP training programmes), and obligations to IAEA. Minimal requirements that could not be met in Malta could lead to severe disruption to radiation employers (mainly medical)
Netherlands	RPE: Dependent on level of complexity, with highest level comparable with Dutch level-2 course or IAEA PGEC. RPO: Preferably in combination of professional training, specific for the application. Workers: RP in professional training, specific for the application
Norway	
Poland	As adopted in Poland
Portugal	
Slovenia	References and work in last 5 years. Status in original country. Consensus of users
Spain	
Sweden	Knowledge of the RPE in original country. Knowledge of language
Switzerland	Education according to OJ C133. OJT in 2 different NPPs (1 y RPE; 1-4 y RPO). Participation in emergency exercise
United Kingdom	Compliance with the criteria for RPA/RPO

ANNEX 1

Table A.1: List of institutes providing RP training and OJT

Country	Institutes providing general RP training	Institutes providing RP training for specific professions	Institutes providing OJT, including information about capacity (2nd column) and accessibility for foreigners (3rd column: Y = "Yes"; L = only for country language speaking guests)		
Austria	Universities; no specified institutes	Medical Physicists; no specified institutes	Research centers and universities; no specified institutes	30	Y
Belgium	1) Technical universities/XIOS/ISIB/ SCK/IRE: for RPE 2) UCL: DEC (diplôme d'études complémentaires; 1 y, >120 h) for class II experts 3) UCL: DES (diplôme d'études spécialisées; 1 additional y) for class I experts (RP + nuclear safety) 4) ULg: DES (1 y, > 120 h) in nuclear sciences, for basic education of RPEs 5) ULB (École de santé public): DES (1 y, >120 h) for basic education of class II experts	1) MSc Engineering Sciences and MSc in Physics or Chemistry: provides education in nuclear physics, including an optional RP course; no specified institutes 2) Medical physics course (2 y): provides education in nuclear physics and RP (>120 h); no specified institutes			
Bulgaria	Shumen Univ.: MSc Medical Physics and Radioecology	1) Plovdiv Univ.: MSc Medical Radiation Physics 2) Plovdiv Univ.: MSc Engineering Physics 3) Sofia Univ.: MSc Engineering Physics	List of MoH: Medical universities; other universities; Military Medical Academy; some big hospitals; NPPKozloduy		
Croatia	State Office of Radiation Protection		State Office of Radiation Protection		
Cyprus	RP Association: RP courses (1 or 2 w)				
Czech Republic	1) Czech TU: BSc RP and Environment 2) Czech TU: MSc Dosimetry and Application of Ionizing Radiation	1) Czech TU: MSc Radiological Physics (= Med. Physics) 2) Sth Bohemia Univ.: BSc Radiological Assistant 3) Sth Bohemia Univ.: MSc Crisis Radiobiology and Toxicology	11 recognized centers (NPP; Technical university; Medical training centers		
Estonia					
Finland					L

Country	Institutes providing general RP training	Institutes providing RP training for specific professions	Institutes providing OJT, including information about capacity (2nd column) and accessibility for foreigners (3rd column: Y = "Yes"; L = only for country language speaking guests)		
France	1) Grenoble Univ./ INSTN: MSc RP 2) INSTN: 2 RP courses for technicians	1) MSc Medical Physics + 1 y specific course including RP; INSTN 2) Education of all medical staff (physicians, radiographists, technicians, nurses) include RP; no specified institutes	Many: CEA; EDF; IRSN; nuclear industry; many big hospitals (specifically cancer treatment hospitals)	Many	
Germany	1) Karlsruhe Univ.: RP 2) FZK-FTU: RP 3) LPS Berlin: RP 4) GSF/Natl. Res. Center for Env. & Health: RP 5) Berufsgenossenschaft: RP 6) Univ. Hannover: RP & Radioecology 7) Haus der Technik: RP	1) Medical Physicist: needs additional academic RP course; no specified institutes (several univ.) 2) German Society for NDT: RP for NDT	2-3 research centers (on request); not specified		Y
Greece	1) GAEC: various courses on RP 2) GAEC/NCRS "Democritos"/Univ. Athens/ Natl. TU Athens/Univ. Ioannina/IAEA: PGEC	1) GAEC/Univ. of Athens/Ioannina/Thessaloniki/ Thrace/Crete: MSc Medical and Radiation Physics (2 y); Optional PhD 2) RP for medical specialists; no specified institutes	MoH approved hospitals for medical physicists; GAEC for regulators and inspectors	50 15	Y Y
Hungary					L
Ireland		MSc Medical Physics; no specified institutes (2 third level institutions)			
Italy	1) Univ. Bologna: 1° level MSc "Engineering of RP" (6 m lectures + 3-6 m training) 2) Univ. Padua: 2° level MSc "Industr. Applic. of Ion. Rad., Radioisotopes techniques, Env. Radiochem., RP and Decomm. of Nucl. Fac."; (6 m lectures + 3-6 m training + final thesis) 3) Univ. Calabria: 1° + 2° level Msc "Formation of Expert on RP and Dosimetry" (4 m lectures + 4 m training) 4) Several univ.: "Specialisation School on HP" (4 y) 5) ANPEQ: "School for the preparation of QEs"		All centers licensed to use ionizing radiation (hospitals, research centers, etc); not specified	?	

Country	Institutes providing general RP training	Institutes providing RP training for specific professions	Institutes providing OJT, including information about capacity (2nd column) and accessibility for foreigners (3rd column: Y = "Yes"; L = only for country language speaking guests)		
Latvia	1) Univ. Latvia: RP for Radiation Workers (in industry, research, service, scrap metal, others) 2) TU Riga: RP for Radiation Workers in medicine 3) Univ. Riga's Stradina: RP for Radiation Workers in medicine 4) Radiation Safety Center: Seminars for service workers of radiodiagnostic facilities and scrap metal companies	1) Border Guards College: RP for Border Guards 2) BSc and MSc Medical Physics; no specified institutes	Latvian Oncology center (enough for national oncology specialists)		Y
Lithuania	TU Vilnius Gediminas: MSc Technologies of environmental RP (2 y)	Kaunas Med. & TU: MSc Medical Physics			
Luxembourg			Radiographers school		
Malta					
Netherlands	1) Level 2 course (RPE) of Univ. Leiden / TU. Delft (40 d theory, practices and examinations; 30 d self study) 2) Level 3 courses (RPE) at universities of Leiden, Delft, Twente, Nijmegen, Groningen, Eindhoven and at NRG (120-150 h, including practices) 3) Level 4 & 5 courses (RPO) at various institutes (~40 h)	Univ. of Eindhoven: Level 3 medical for Medical Physicist (~120 h, including practices)			
Norway					
Poland	1) Institute of Atomic Energy (research reactor) 2) Central Laboratory for Radiation Protection		1) Institute of Atomic Energy (research reactor) 2) Central Laboratory for Radiation Protection	Limited	
Portugal	TU Lisbon/ITN: MSc RP (dosimetry, BSS, legislation, nucl. physics, experimental nucl. techniques, biological effects); started 2004				

Country	Institutes providing general RP training	Institutes providing RP training for specific professions	Institutes providing OJT, including information about capacity (2nd column) and accessibility for foreigners (3rd column: Y = "Yes"; L = only for country language speaking guests)		
Slovenia	1) Univ. Ljubljana: Post graduate course Nuclear Technology 2) Approved institutes (not specified): RP for workers (2-40 h) and RPO (24-200 h) for nuclear, medical, industrial sectors and natural radiation	Post graduate course for Medical Physicists; no specified institutes	Jožef Stefan Institute; Institute of Occupational Safety; NPP Krško; University Medical Center Ljubljana; Institute of Oncology Ljubljana		
Spain			"Enough"; not specified		
Sweden	Univ. of Lund, Stockholm, Umeå, Gothenburg and Linköping: MSc Radiation Physics	Univ. of Lund, Stockholm, Umeå, Gothenburg and Linköping: Medical Physicist (= MSc Radiation Physics + specialized courses in diagnostics and radiotherapy			
Switzerland			Paul Scherrer Institute	10-20	
United Kingdom	Univ. Surrey: MSc Radiation and Environmental Protection	MSc Medical Physicist: Grade A training; no specified institutes (a number of courses)	A number of large organizations support OJT occasionally on request; not specified	?	