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# **European Guidance on the Implementation of the Requirements of the Euratom BSS with respect to the Radiation Protection Expert and the Radiation Protection Officer**

Richard Paynter, Joanne Stewart, Annemarie Schmitt-Hannig, Michèle Coeck, Antonio Falcao

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# **1 Introduction**

## **1.1 Background**

The European Commission formally adopted the new Basic Safety Standards (BSS) Directive [1] on the 5th December 2013. The Directive, which lays down the basic safety standards for protection against the dangers arising from exposure to ionising radiation, repealed the previous BSS Directive and also incorporated the requirements of previous Directives on outside workers, medical exposures, high activity sealed sources, and public information in the event of a radiological emergency. The new BSS has also incorporated the Commission recommendations of 21 February 1990 on the protection of the public against indoor exposure to radon (90/143/Euratom). This revision was prompted primarily by the new recommendations of ICRP [2], which are based on the latest scientific findings in radiological protection. However, it also created the opportunity to consolidate the existing Directives on radiation protection, and take into account the regulatory experience in the use of ionising radiation gained in the seventeen year period since the previous BSS (Directive 96/29/EURATOM) was introduced. The revision also gave the opportunity to revise those topics in the previous BSS where further clarity was needed. One such topic was the requirement for the appointment of the Qualified Expert (QE) and the functions associated with this role.

The European Commission had previously expressed concern over the apparent lack of mobility of radiation protection specialists between Member States of the EU, particularly QEs, and had initiated a project to review how the requirement for the appointment of QEs had been enacted in national legislation [3]. This review revealed that Member States had widely differing interpretations of the role the QE, the level of skill required and the education and training requirements for the role. The 1996 BSS also required the QE to be recognised by the relevant national authority and, not surprisingly, there was considerable variation in the national mechanisms for recognition. Such wide variations in interpretation made any kind of mutual recognition of QEs across Member States very difficult to put in place, thus creating a barrier to movement of QEs between countries.

A further project was initiated to investigate this variation in interpretation in more detail (EUTERP) [4] and it was concluded that this variation was a consequence of the very general nature of the definition of the QE in the BSS and the limited guidance available on the role. The project recommended that in the new BSS, the definition and role of the QE should be replaced by a new expert: the Radiation Protection Expert (RPE). The definition would emphasise that the role of the RPE was the provision of expert advice on potentially complex radiation protection issues to undertakings using radiation sources. The project also concluded that effective radiation protection arrangements also required good supervision of radiation protection activities in the workplace and the maintenance of good operational radiation protection practices (workplace monitoring, record keeping etc). This role would inevitably be more closely associated with the daily use of radiation sources than that of the RPE and would require different competencies. It was recommended therefore that the revised BSS also include the definition of a new role, the Radiation Protection Officer (RPO). The RPE and RPO would collectively form an important component of radiation protection arrangements at an undertaking, one providing expert specialist advice to the employer on complex radiation protection issues and the other ensuring the maintenance of good radiation protection practices in the workplace.

These recommendations were accepted by the European Commission and the new BSS contains definitions for the roles of the RPE and RPO, together with some information on the respective functions of these roles. However, additional guidance on these roles and the associated competencies is needed if a common approach in the implementation of the RPE and RPO requirements across Europe is to be achieved, thus facilitating movement between Member States of persons in these roles.

## **1.2 Scope**

Member States are required to bring into force the laws, regulations and administrative provisions necessary to comply with the 2013 BSS Directive by 6 February 2018. This report:

- provides guidance to regulatory authorities and professional bodies on the roles of the RPE and RPO, as defined in the BSS.
- specifies the knowledge, competencies and practical skills RPEs and RPOs will need to have for the effective implementation of their roles
- outlines the core training requirements for RPEs and RPOs
- describes a process for the national recognition of RPEs
- provides guidance on the development of mutual recognition processes between Member States.

The guidance given in this report is intended to provide a **best practice** approach to the implementation of the BSS requirements for the RPE and RPO. Member States will need to develop training and recognition processes that take account of their own legislative and educational frameworks and hence it is inevitable that the methods of implementation will vary to some extent in each country. However, adoption of the model arrangements as described in this report will contribute to the development of a common approach between Member States to the roles of the RPE and RPO.

## **1.3 Radiation Workers**

The duties, competencies and training requirements for radiation workers are outside the scope of this report. The content and level of training required for workers involved in radiation activities will vary considerably depending on the nature of the work and the level of hazard. For lower risk applications appropriate instructions on operational and practical issues associated with the safe use of sources of radiation, provided at regular intervals will be sufficient. For higher risk applications a deeper insights in the hazards associated with the particular application is more appropriate, including training on good practice handling radiation sources or radioactive substances safely and practical scenarios of what might go wrong as well as contingency plans to deal with unexpected events.

## **2 Overview of the Euratom BSS requirements for the Radiation Protection Expert (RPE) and Radiation Protection Officer (RPO)**

This chapter analyses the definitions within the BSS [1] for the RPE and RPO, the duties associated with these roles and the education, training and recognition requirements. Direct quotes from the BSS are given in *italics*. For completeness, all references in the BSS to the RPE, RPO and education and training are reproduced in Appendix A.

### **2.1 Role, functions and duties of the Radiation Protection Expert (RPE)**

The Euratom BSS defines the Radiation Protection Expert as:

*"radiation protection expert" means an individual or, if provided for in the national legislation, a group of individuals having the knowledge, training and experience needed to give radiation protection advice in order to ensure the effective protection of individuals, and whose competence in this respect is recognised by the competent authority;*

Further information of the extent of knowledge expected of the RPE is given in Article 82 which specifies the range of topics on which the RPE is expected to provide advice:

*Article 82*

#### ***Radiation protection expert***

*1. Member State shall ensure that the radiation protection expert gives competent advice to the undertaking on matters relating to compliance with applicable legal requirements, in respect of occupational and public exposure.*

*2. The advice of the radiation protection expert shall cover, where relevant, but not be limited to, the following:*

- (a) optimisation and establishment of appropriate dose constraints;*
- (b) plans for new installations and the acceptance into service of new or modified radiation sources in relation to any engineering controls, design features, safety features and warning devices relevant to radiation protection;*
- (c) categorisation of controlled and supervised areas;*
- (d) classification of workers;*
- (e) workplace and individual monitoring programmes and related personal dosimetry;*
- (f) appropriate radiation monitoring instrumentation;*
- (g) quality assurance;*
- (h) environmental monitoring programme;*
- (i) arrangements for radioactive waste management;*
- (j) arrangements for prevention of accidents and incidents;*
- (k) preparedness and response in emergency exposure situations;*
- (l) training and retraining programmes for exposed workers;*
- (m) investigation and analysis of accidents and incidents and appropriate remedial actions;*
- (n) employment conditions for pregnant and breastfeeding workers;*
- (o) preparation of appropriate documentation such as prior risk assessments and written procedures;*

*3. The radiation protection expert shall, where appropriate, liaise with the medical physics expert.*

The role of the RPE is advisory, but Article 82(4) allows for the RPE to be assigned specific duties if required by national legislation:

*Article 82(4)*

*The radiation protection expert may be assigned, if provided for in national legislation, the tasks of radiation protection of workers and members of the public.*

Article 34 specifies five topics where the undertaking is required to seek advice from the RPE:

*Article 34*

***Consultations with a radiation protection expert***

*Member States shall require undertakings to seek advice from a radiation protection expert within their areas of competence as outlined in Article 82, on the issues below that are relevant to the practice:*

- (a) the examination and testing of protective devices and measuring instruments;*
- (b) prior critical review of plans for installations from the point of view of radiation protection;*
- (c) the acceptance into service of new or modified radiation sources from the point of view of radiation protection;*
- (d) regular checking of the effectiveness of protective devices and techniques;*
- (e) regular calibration of measuring instruments and regular checking that they are serviceable and correctly used.*

It is clear from these Articles that the RPE is expected to provide high-level specialist advice on radiation protection to undertakings using sources of radiation. This advice will provide an important input to both the setting up of radiation protection arrangements in the undertaking and the ongoing operation of those arrangements. As such, the RPE will need to have a very good understanding of radiation protection principles and how they are applied and implemented in the workplace. The RPE will also need to have a comprehensive understanding of the relevant national legislation and be able to advise on the actions to take to ensure compliance.

Most of the topics listed in Article 82 are those that will need to be addressed by an undertaking that is about to start work with ionising radiation for the first time, or is about to expand its range of radiation uses. It follows that an undertaking will need to consult extensively with an RPE prior to putting radiation protection arrangements in place and then will need to consult periodically on the maintenance of these arrangements and on any significant changes to the arrangements. However, the RPE is not expected to be the person who actually implements aspects of the radiation controls in place e.g. workplace monitoring; this will be the responsibility of other persons. This is not to say that RPEs should not carry out such duties, and in some practices (e.g. hospitals, nuclear sites) some of these tasks are likely to be carried out by an RPE. However, this is not required by the BSS

### **2.1.1 Competence**

The RPE definition requires the competence of the RPE to give radiation protection advice to be recognised by the competent authority (*whose competence in this respect is recognised by the competent authority*).

Article 14.2 requires Member States to have education and training arrangements in place that allow recognition of competence:

*Article 14.2*

*Member States shall ensure that arrangements are made for the establishment of education, training and retraining to allow the recognition of radiation protection experts and medical physics experts, as well as occupational health services and dosimetry services, in relation to the type of practice.*

In this context, competence is the ability to provide good and effective advice to ensure the effective protection of individuals. National recognition schemes will need to assess competence of individuals by looking at the components that lead to competence i.e. the required level of knowledge (obtained through education and training), operational experience and communication skills. Training and development schemes for RPEs will need to cover the knowledge and skills required to be able to provide effective advice.

Some smaller Member States may not have sufficient national expertise and training capability to be able to provide the required specialist training. The Article requires arrangements to be made, and these arrangements may include facilitating access to suitable training courses held in other countries. In this circumstance the national recognition scheme will need to be provided with details of the courses available so they can assess the adequacy of the training provided.

### **2.1.2 Suitability**

RPE advice will be required in a wide range of situations, from the use of level gauges in an industrial plant to complex exposure issues associated with nuclear power stations. The required specialist knowledge and operational experience of an RPE will vary considerably depending on those sectors where the RPE provides advice. This is the issue of *suitability*; an RPE will be suitable to provide advice for a specific sector if he/she has the required competence for that sector. This will not necessarily mean that this RPE will also be a suitable for a different sector. For example: an RPE who has the competence to provide advice in the medical sector is unlikely to have the required knowledge and operational experience to be suitable to provide advice in the nuclear power sector, and vice versa. Member States will need to take account of suitability in their own regulatory processes. Some countries may wish to operate a core competence scheme where the core competence of RPEs is recognised, and requiring the employer to take responsibility for ensuring that the RPE appointed is suitable for the radiation application. Other Member States may decide to incorporate suitability into the recognition process by operating a recognition system that recognises RPEs for specific radiation practices. Either approach will satisfy the BSS requirement.

## **2.2 Role, functions and duties of the Radiation Protection Officer (RPO)**

The new BSS gives the following definition for the Radiation Protection Officer:

*“radiation protection officer” means an individual who is technically competent in radiation protection matters relevant for a given type of practice to supervise or perform the implementation of the radiation protection arrangements;*

Further information on the duties of the RPO is given in Article 84:

*Article 84*

### ***Radiation protection officer***

*1. Member States shall decide in which practices the designation of a radiation protection officer is necessary to supervise or to perform radiation protection tasks within an undertaking. Member States shall require undertakings to provide the radiation protection officers with the means necessary for them to carry out their tasks. The radiation protection officer shall report directly to the undertaking. Member States may require employers of outside workers to designate a radiation protection officer as necessary to supervise or perform relevant radiation protection tasks as they relate to the protection of their workers.*

2. Depending on the nature of the practice, the tasks of the radiation protection officer in assisting the undertaking, may include the following:

- (a) ensuring that work with radiation is carried out in accordance with the requirements of any specified procedures or local rules;
- (b) supervise implementation of the programme for workplace monitoring;
- (c) maintaining adequate records of all radiation sources;
- (d) carrying out periodic assessments of the condition of the relevant safety and warning systems;
- (e) supervise implementation of the personal monitoring programme;
- (f) supervise implementation of the health surveillance programme;
- (g) providing new workers with an appropriate introduction to local rules and procedures;
- (h) giving advice and comments on work plans;
- (i) establishing work plans;
- (j) providing reports to the local management;
- (k) participating in the arrangements for prevention, preparedness and response for emergency exposure situations;
- (l) information and training of exposed workers;
- (m) liaising with the radiation protection expert.

3. The task of the radiation protection officer may be carried out by a radiation protection unit established within an undertaking or by a radiation protection expert.

The RPO role is primarily concerned with the oversight and supervision of the radiation protection arrangements in the workplace. The duties will be very specific to the undertaking where the RPO works and are likely to involve close liaison with the workers, supervisors and managers.

### **2.2.1 RPO competence and suitability**

The RPO needs to have an understanding of radiation protection principles and arrangements that are relevant to the practice he/she is involved with. It follows that, to be competent in the role, the RPO will need to have a practical understanding of the principles of radiation protection, the relevant regulatory requirements and operational arrangements.

In addition to having the knowledge and understanding described above, an RPO will need to be effective in the roles of supervision, communication and local management. Since radiation protection is part of the general Health and Safety structure, the RPO should have a direct communication channel with the RPE and the relevant Health and Safety managers within the undertaking. This will ensure that an independent channel is in place for the reporting of radiation safety issues to the appropriate managers and will facilitate the implementation of corrective measures. To carry out the required functions the RPO will need to have supervisory or local management responsibility for the work being undertaken. The suitability of a particular person for undertaking the role of RPO is the responsibility of the employer, who will need to consider the person's technical competence, communication and managerial skills and line management position in relation to the work being supervised. In considering the suitability of a person for the role of RPO, the employer may wish to consult an RPE on the criteria to be applied.

### **2.2.2 RPO appointment and recognition**

The appointment of an RPO by an undertaking is not a mandatory requirement of the BSS. It is the responsibility of the Member State to specify what work practices require an RPO to be appointed. Article 84 specifies the supervisory and managerial duties of the RPO and it follows that an RPO could

beneficially be appointed in circumstances where the work practices actively require the implementation of these duties. Practices such as industrial and medical radiography, and laboratory uses of unsealed radioactive material require regular supervision of work practices and the use of dosimetry, workplace monitoring etc. Such practices would clearly benefit from the appointment of an RPO. Static situations with limited radiation protection implications e.g. level gauges will obtain much less benefit from RPO input. In practice it is likely that any practice that requires the designation of a controlled area is likely to require an RPO. However, even in circumstances where the appointment of an RPO is not required by the Member State, it is important the specified persons in the health and safety infrastructure of the company are given responsibility for the oversight of the safe use of the radioactive sources.

The BSS does not require the competence of the RPO to be recognised by the national authority but does permit Member States to have RPO recognition arrangements in place if the member state considers it necessary. Article 14.3 states:

*Article 14.3*

*Member States may make arrangements for the establishment of education, training and retraining to allow the recognition of radiation protection officers, if such recognition is provided for in national legislation.*

Irrespective of the implementation of a RPO recognition arrangement, it is recommended that the appointment of an RPO by the employer is documented and communicated within the organisation and to the RPE linked to the installation. The RPE can be involved in the appointment process for the assessment the technical competence in radiation protection. The RPO should receive the necessary means and support from the management in order to supervise or to perform radiation protection tasks within the undertaking. These means and support should be mentioned in the documentation of the appointment, and can include resources such as time, equipment (for measurement and protection) and the managerial communication and notification arrangements.

## **2.3 Interactions between the RPE and other professionals in radiation protection**

### **2.3.1 Interactions between the RPE and RPO**

The RPE may be an employee of the company but may also be an external adviser who is contracted to provide expert radiation protection advice. Whether an external adviser or an in-house RPE is more appropriate will depend on the nature and complexity of the undertaking. A nuclear installation, for example may have a team of RPEs on site providing highly specialist advice on a range of complex topics. A company using only level gauges on hoppers may only need to consult with an RPE on an infrequent basis, making the use of an external adviser more cost-effective. In the event of an employee being appointed as RPE, it is important to ensure that he/she has managerial independence from production/sales issues to ensure there is no conflict of interest between safety advice and output demands.

The RPO will generally be an employee of an undertaking, in a supervisory or managerial position, and will be closely involved in the work involving sources of radiation, and have appropriate knowledge of the installation. The number of RPOs at an undertaking will depend on the range of radiation protection uses, their location and level of complexity. The important criterion is that the

undertaking must have sufficient RPOs to be able to ensure effective supervision of the radiation protection tasks.

The RPE and RPO will collectively ensure good standards of radiation safety at an undertaking. As such it is important that they liaise in the implementation and maintenance of radiation protection arrangements. In order to fulfil their roles effectively, and to avoid duplication of effort or neglected tasks, each will need to have a good understanding of the roles of the other. In circumstances where the undertaking uses an external consultant as RPE, the RPO is likely to be one of the main points of contact within the undertaking for an external RPE.

The RPE and RPO are likely to be primary contact points within an undertaking for the regulatory body for radiation protection issues. The nature of these communications will be dependent on the radiation application and whether the RPE is an employee or an external appointee. In circumstances where the RPE is an employee, he/she is likely to carry out an important liaison role between the regulators and the undertaking. In circumstances where the RPE is an external adviser, this liaison role is more likely to be a function of the RPO's role, although the RPE is likely to still have some involvement in discussions with the regulatory body in collaboration with the RPO.

It should be noted that the BSS permits the role of RPE to be carried out by a group of individuals who collectively satisfy the national recognition criteria. The task of the RPO may also be carried out by a Radiation Protection Unit (Article 84(3)). While the roles of the RPE and RPO are clearly defined and are different from each other, a single person may carry out the roles of both provided he/she has the required competencies for both roles (Article 84(3)).

### **2.3.2 Interactions between the RPE and the occupational health service**

The health professional or body competent to perform medical surveillance of exposed workers (the occupational health service) is one of the key roles in radiation protection for the workers, together with the RPE and RPO. Although this is not stated in the BSS, regular interactions between the RPE, RPO and the occupational health service are recommended. The RPE provides advice on the workplace and individual monitoring programmes and related personal dosimetry (Article 82), the RPO supervises its implementation (Article 84) and the occupational health service interprets the results of the individual monitoring for the implications of the results for human health (Article 44)., These three roles will interact both in normal circumstances and also in accidental exposure scenarios, where appropriate actions must be taken to assess and mitigate the risks. (Article 44) Regular communications will also be appropriate in the framework of the medical surveillance. The approach to be taken by the occupational health service will be based on (or determined by) the classification and type of work activities of the radiation worker, and this information will be provided by the RPE and RPO. Interaction between the RPE, RPO and occupational health service is also recommended in special circumstances, e.g. the employment conditions for pregnant and breastfeeding workers (Article 82), the dose assessment in the case of accidental exposure (Article 42) and the justification of specially authorised exposures (Article 52).

### **2.3.3 Interactions between the RPE and the MPE**

Employers who carry out medical exposures are required to appoint and seek advice from a Medical Physics Expert (MPE) on a range of issues associated with medical exposure. The BSS defines the medical physics expert as:

*"medical physics expert" means an individual or, if provided for in national legislation, a group of individuals, having the knowledge, training and experience to act or give advice on matters relating to radiation physics applied to medical exposure, whose competence in this respect is recognised by the competent authority.*

Article 83 states that the MPE acts or give specialist advice, as appropriate, on matters relating to radiation physics for implementing the requirements set out in Chapter VII (Medical Exposures) and in point (c) of Article 22(4) (Practices involving the deliberate exposure of humans for non-medical imaging purposes).

This is a highly specialised role, which includes the provision of advice on the radiation protection of the patient, optimisation of medical exposure, patient dosimetry, and assessment of equipment used in medical exposures. However, it is fundamentally different from the role of the RPE whose function is to give radiation protection advice in order to ensure the effective protection of workers and members of the public. The two roles will closely interact in the hospital environment with the MPE providing advice on optimisation of the radiation protection of the patient and the RPE providing advice on restriction of exposure to medical staff. In some circumstances the duties will overlap, with the RPE being responsible for the acceptance into service of new or modified radiation sources from the point of view of radiation protection (Article 34(c)) and the MPE being responsible for the acceptance testing of medical radiological equipment from the point of view of medical exposure (Article 83(c)). In view of this, the BSS requires the RPE and MPE to liaise where appropriate. It is important, therefore, that the RPE and MPE have a clear understanding of their own responsibilities and work closely together.

In some circumstances, a single person will carry out the roles of both RPE and MPE. This is acceptable provided the person satisfies the competency requirements for both roles and holds national recognition as both an RPE and an MPE.

Further information on the role and competency requirements of the MPE is given in European Guidelines on Medical Physics Expert [5].

## **2.4 Requirements for education and training for RPE and RPO**

### **2.4.1 General requirements for education and training in radiation protection for RPE and RPO**

Chapter IV of the BSS gives the requirements for radiation protection education, training and information.

Article 14 gives the general responsibilities for the education, training and provision of information for RPE and RPO:

#### *Article 14*

*1. Member States shall establish an adequate legislative and administrative framework ensuring the provision of appropriate radiation protection education, training and information to all individuals whose tasks require specific competences in radiation protection. The provision of training and information shall be repeated at appropriate intervals and documented.*

*2. Member States shall ensure that arrangements are made for the establishment of education, training and retraining to allow the recognition of radiation protection experts and medical physics*

experts, as well as occupational health services and dosimetry services, in relation to the type of practice.

3. Member States may make arrangements for the establishment of education, training and retraining to allow the recognition of radiation protection officers, if such recognition is provided for in national legislation.

The Radiation Protection Expert will advise the undertaking about the training and retraining programmes for exposed workers (Article 82), and the RPO will assist the undertaking in the provision of the necessary information and training. (Article 84)

This does not necessarily mean that the RPO will be solely responsible for providing information and training of exposed workers. The undertaking can rely on third party services for the provision of information, education and training in radiation protection.

In the context of this guide an adequate legislative and administrative framework incorporates the following:

- legislation requiring appropriate education, training and information to be provided to RPEs, RPOs and radiation workers
- sufficient arrangements in the Member States for such training to be provided
- assessment of the adequacy of the available training and training providers
- a formal mechanism for the recognition of RPEs

#### **2.4.2 Requirements for national education and training infrastructure and assessment bodies**

The administrative framework needs to include a competent authority for the recognition of RPEs (and, if required, RPOs). Article 4(16) defines the competent authority as:

*"competent authority" means an authority or system of authorities designated by Member States as having legal authority for the purposes of this Directive.*

Article 76 gives further information on the nature of the competent authority:

*Article 76*

##### **Competent authority**

*1. Member States shall designate a competent authority to carry out tasks in accordance with this Directive. They shall ensure that the competent authority:*

*(a) is functionally separate from any other body or organisation concerned with the promotion or utilisation of practices under this Directive, in order to ensure effective independence from undue influence on its regulatory function;*

*(b) is given the legal powers and human and financial resources necessary to fulfil its obligations.*

It follows that the competent authority for the purpose of RPE recognition cannot be a radiation protection training organisation, a professional radiation protection society or an undertaking that works with radiation. It must be an independent legal entity with the legal authority and knowledge and competence to carry out the recognition function.

### 3. The Radiation Protection Expert (RPE)

#### 3.1 The activities of the RPE

The intended role of the RPE is specified within the definition given in the BSS and the supporting Articles. The expectation is that the RPE will be a source of professional expertise with the primary function being to provide comprehensive, professional and independent advice to the employer/undertaking with respect to required (regulatory and operational) protection measures to restrict exposure.

The Euratom BSS specifies the range of topics on which the RPE is expected to provide to advice (see section 2.1 above) and this provides an indication of the level of expertise and competences required to execute the role. In Table 1 below, greater detail is provided with respect to what is required of the RPE (in practice) in order to provide the required advice effectively.

**Table 1: Advice expected from the RPE**

Topics for advice	Associated Activity
To provide advice to the employer/undertaking in respect of legislation compliance with regard to matters of occupational and public exposure. The range of issues that the RPE should be consulted on are summarised below :	
<ul style="list-style-type: none"> <li>• optimisation and establishment of appropriate dose constraints</li> <li>• plans for new installations and the acceptance into service of new or modified radiation sources in relation to any engineering controls, design features, safety features and warning devices relevant to radiation protection</li> <li>• preparation of appropriate documentation such as prior risk assessments and written procedures</li> </ul>	<p>Review with the undertaking the detail of the work in question to determine the potential for exposure (and to whom), the route of, and likely magnitude of, exposure under all prevailing or possible scenarios. Analyze this data in context and formulate an expert view on what constitutes ALARA, whether or not the use of dose constraints is applicable and, if so the level of dose at which they should be set. The period of usefulness/validity of any constraints should also be determined.</p> <p>Review, with the employer, the proposals for any new installations with specific reference to siting, occupancy, supplier information with respect to inherent radiation hazard, conditions of use etc. Review against specified radiation protection standards, any relevant requirements set in national legislation and accepted good practice. It need not necessarily fall to the RPE to draw up final plans for installation(s) etc. but it would be expected that he/she would have make a significant contribution to this.</p>
<ul style="list-style-type: none"> <li>• categorisation of controlled and supervised areas</li> <li>• classification of workers</li> </ul>	The required expert advice to the employer with respect to these issues should be obtained from a comprehensive risk assessment. Underpinning this risk assessment should be relevant data on dose/dose-rate/contamination levels,

<ul style="list-style-type: none"> <li>• workplace and individual monitoring programmes and related personal dosimetry</li> <li>• employment conditions for pregnant and breastfeeding workers</li> </ul>	<p>consideration of routine situations and accident/emergency situations - this facilitates decision making on categorisation and classification and on monitoring and dosimetry issues. While use can be made of technical data provided by the employer, it is expected that in many cases the RPE will take a “hands-on” approach to investigate and analyse the circumstances, in particular making appropriate measurements in situ. The RPE would also be expected to advise the employer with respect to any actions or advice that should be sought from other expert or specialist sources, for example the occupational health service with respect to Category A workers</p>
<ul style="list-style-type: none"> <li>• quality assurance</li> </ul>	<p>The RPE will advise on the appropriate QA procedures to be followed for the assurance of the radiation protection arrangements</p>
<ul style="list-style-type: none"> <li>• environmental monitoring programme</li> <li>• appropriate radiation monitoring instrumentation</li> <li>• arrangements for radioactive waste management</li> </ul>	<p>In order to advise appropriately, the RPE must have a good understanding of the circumstances and be able to match requirements to appropriate instrumentation. He/she must have a comprehensive understanding of sampling methodologies and reporting requirements.</p>
<ul style="list-style-type: none"> <li>• arrangements for prevention of accidents and incidents</li> <li>• preparedness and response in emergency exposure situations</li> <li>• investigation and analysis of accidents and incidents and appropriate remedial actions</li> </ul>	<p>Advice with respect to the required arrangements for prevention of accidents and incidents should be a key outcome of a comprehensive risk assessment. Likewise, any advice to the employer with respect to an appropriate level of preparedness and response for identified emergency situations (contingency planning).</p> <p>Investigation and analysis of accidents and incidents where they do occur is considered to be a key function of the RPE. Aside from assessing the circumstances of the accident/incident the RPE would be expected to determine the magnitude of any radiation exposures incurred – this may require the application of complex dosimetric methods, staging of the incident to determine exposure pathways etc and then analysis of any doses received in the context of legislative compliance, ALARA and possible health effects.</p>
<ul style="list-style-type: none"> <li>• training and retraining programmes for exposed workers</li> </ul>	<p>The RPE would be expected to advise the employer with respect to radiation protection training needs for exposed workers. The objective of such training should be to ensure that the workers know the risks posed by exposure to ionizing radiation, the precautions that should be taken in the workplace and importance of complying with prescribed procedures – the training should be in context for the workers and it is up to the RPE to advise on detailed content, suitability of events etc. In many cases, it will be appropriate, and practicable, for the RPE to assist the undertaking in the provision of the training to the workforce.</p>

Also inherent in the proposed definition is that the RPE is an individual whose capacity (ability) to undertake the role effectively is recognized by the national competent authority. In this context, “recognized” means that the individual’s ability has been endorsed and acknowledged by the competent authority. In practice, RPE recognition is a process; the individual’s competence to provide expert advice in the field of radiation protection has to be formally assessed and deemed to be satisfactory by the competent authority.

It is important to understand the objective of recognition. Put simply, the objective is to provide the employer/undertaking with confidence that the expert chosen to consult with has the necessary competence to provide advice over a wide range of radiation protection issues. This being the case, the recognition process – however it operates – should seek to ensure that competence is adequately and appropriately assessed so that the status of RPE need not be questioned.

### 3.2 RPE development: core competence

As noted above, the recognition of an individual as an RPE is confirmation that that individual has the necessary competence to give advice, that is, has those specific capabilities that provide the basis for the execution of the RPE role.

A number of discussions and consultations [6] with various stakeholder groups have resulted in a clear identification of the broad criteria that define, or constitute, core competence i.e. the critical capabilities that must be held by all RPEs, regardless of the sector in which they work. These stakeholders, which included regulators, radiation protection practitioners, professional bodies and training providers, had varying perspectives on the matter but in the main there was good agreement on the basic criteria; these are summarised in Table 2 below.

**Table 2: Statement of Basic Requirements for Core Competence**

*An individual may be deemed as having the core competence necessary to act in the capacity of a Radiation Protection Expert, and be formally recognized as such by the national competent authority if he/she is able to satisfy the following criteria:*

*(i) An education to:*

- Bachelor degree level either specifically in radiation protection, or in a physical/engineering/mathematical discipline*

*OR*

- An academic equivalent*

*(ii) Knowledge and understanding of fundamental principles of radiation protection*

*(iii) Knowledge of operational radiation protection methods*

*(iv) The ability to develop and provide appropriate advice with those topics on which the RPE is expected to provide advice.*

*(v) A minimum of 3 years’ experience working in a radiation protection environment, learning and/or applying the criteria specified in (iii) and (iv) above.*

The statements in Table 2 are summary statements of the key requirement for core competence; in effect, they highlight the steps in development of RPE status. Each of these is discussed further below.

### **3.2.1 Education**

The role of RPE is a specialist role and, as such, may be the primary function of the post holder. Amongst other things, satisfactory execution of the role requires a high level of intellectual ability with an in-depth understanding of physical principles, sound mathematical ability, an ability to analyse and interpret scientific and technical data (in context), an ability to rationalise behaviours and attitudes and ease in solving multi-faceted problems. For these reasons, an education to tertiary level is considered to be a pre-requisite for anyone aspiring to embark on an RPE development programme.

A bachelor degree, or academic equivalent, either in a physical science such as physics, mathematics or engineering is considered to be the minimum educational qualification required.

### **3.2.2 Training and development**

The broad requirements in (ii) (iii) and (iv) in Table 2 above point to the aspects of post-graduate training and development necessary to attain the full core competence required for recognition as an RPE. However, addressing these three areas, i.e. gaining

- knowledge and understanding of fundamental principles of radiation protection
- knowledge of operational radiation protection methods
- the ability to develop and provide appropriate advice with those topics on which the RPE is expected to provide advice

is not (necessarily) a sequential process, and there are options with respect to the route taken to gain the required knowledge, skills and attitude on which to build the required competences. Table 3 below gives a breakdown of the required skills and competencies required to provide the expert advice on the topics specified in the BSS. Many of the required skills can be attained via attendance and successful participation in appropriate training events. Others will be obtained by experience gained in on-the-job training, workplace experience etc.

It should be possible to address the knowledge requirements and some aspects of operational competence within training events, e.g. course and workshops, with events being designed to cover the operational topic areas below as well as the theoretical knowledge requirements. A detailed description of the theoretical knowledge requirements may be found in the relevant ENETRAP II report [7]. (It should be noted that further reports are under development in ENETRAP III that provide additional knowledge requirements in specific work sectors i.e. medical, nuclear power plants). This report describes a series of reference training modules that cover the RPE knowledge requirements. Detailed breakdown of the knowledge requirements in the topic areas radioactivity and nuclear physics, dosimetry, biological effects and radiation detection are given and some aspects of operational protection are also addressed.

**Table 3: Required skills and competencies for the RPE**

Topics for Advice	Required Skills	Specific Competence
<p><b>Optimisation and establishment of dose constraints</b></p>	<ul style="list-style-type: none"> <li>• The ability to identify appropriate control procedures to restrict exposures commensurate with ALARA.</li> <li>• The ability to interpret and apply data. For example, workplace monitoring results, manufacturers' data, dose histories, shielding calculations.</li> <li>• To recognise what constitutes ALARA for a given set of circumstances.</li> <li>• The ability to judge on whether or not the use of dose constraints is appropriate, and if so               <ul style="list-style-type: none"> <li>○ The value at which they should be set, and</li> <li>○ The period of usefulness/validity</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The estimation of doses that could be received during both routine and accident situations</li> <li>• The formulation of advice concerning the provision of engineering controls and/or working procedures - commensurate with the presented radiological hazard/risk.</li> <li>• The formulation of appropriate advice with respect to the content of written procedures/local rules all consistent with the principles of ALARA.</li> <li>• The formulation of advice with respect to the appropriateness of local rules.</li> </ul>
<p><b>Plans for installation and the acceptance into service or new or modified radiation sources in relation to any engineering controls, design features, safety features and warning devices relevant to radiation protection</b></p>	<ul style="list-style-type: none"> <li>• The ability to interpret supplier/provider information with respect to inherent radiation hazard, conditions and restrictions on use etc.</li> <li>• To understand and be able to apply any specific requirements of accepted radiation protection standards and good practice and any relevant requirements set in national legislation.</li> <li>• Be able to recognise potential exposure pathways, undertake shielding calculations.</li> <li>• Be able to recognise and formulate a judgement on the adequacy and efficacy of engineered controls, design features and safety and warning features.</li> </ul>	<ul style="list-style-type: none"> <li>• The estimation of doses that could be received during the use and/or operation of the facility/sources.</li> <li>• The formulation of a judgement on ALARA and compliance with any specified or legislative requirements.</li> <li>• The formulation of advice with respect to the acceptability of the proposed new installation/sources – with a rationale for any required changes.</li> <li>• Appropriate input to any developments or revisions plans and/or design.</li> </ul>

<p><b>Preparation of appropriate documentation such as prior risk assessments and written procedures</b></p>	<ul style="list-style-type: none"> <li>• The ability to distinguish between a “hazard” and a “risk” and understand the practical application of both concepts in the workplace.</li> <li>• The ability to identify and assess risks of actual and potential exposure.</li> <li>• The ability to interpret and apply data. For example, workplace monitoring results, manufacturers’ data, dose histories, shielding calculations.</li> <li>• To form a judgement with respect to the aspects and detail to be addressed in written procedures, local I rules etc.</li> <li>• The ability to formulate written procedures etc in a manner that is readily accessible and understood by the target group.</li> </ul>	<ul style="list-style-type: none"> <li>• The appropriate evaluation of hazards and risks arising from exposure and potential exposure to ionising radiation in the workplace.</li> <li>• The effective review and evaluation of existing risk assessments taking all relevant parameters into account.</li> <li>• The preparation and documentation of risk assessments and/or written procedures and local rules on behalf of the employer/undertaking, OR, the provision of information and advice sufficient to enable others to prepare appropriate documentation.</li> </ul>
<p><b>Categorisation of controlled and supervised areas</b></p>	<ul style="list-style-type: none"> <li>• The ability to identify the need for area categorisation as controlled or supervised.</li> <li>• The ability to identify appropriate access control measures for controlled and supervised areas.</li> <li>• The ability to propose the appropriate categorisation of a work area.</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation of dose, dose-rate and contamination data.</li> <li>• Estimation of potential doses from monitoring data.</li> <li>• Effective provision of advice with respect to administrative and practical arrangements associated with controlled and supervised areas, including: <ul style="list-style-type: none"> <li>○ Monitoring and dosimetry</li> <li>○ Access restriction</li> <li>○ Required procedures</li> <li>○ Access control</li> </ul> </li> </ul>
<p><b>Classification of workers</b></p>	<ul style="list-style-type: none"> <li>• The ability to identify the need for classification of workers and to advise in respect of the associated administrative and practical requirements.</li> <li>• The ability to identify appropriate protection measure and to assess the effectiveness of any procedures in place.</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation of dose, dose-rate and contamination data.</li> <li>• Estimation of potential doses from monitoring data.</li> <li>• Application of outcome of risk assessment.</li> <li>• Formulation of advice with respect to administrative and practical arrangements. associated with classification of workers, including:</li> </ul>

	<ul style="list-style-type: none"> <li>• The ability to propose the appropriate classification of an exposed worker.</li> </ul>	<ul style="list-style-type: none"> <li>○ Appropriate personal dosimetry</li> <li>○ Health surveillance</li> <li>○ Required procedures</li> <li>○ Training needs</li> </ul>
<b>Workplace and individual monitoring programmes and related personal dosimetry</b>	<ul style="list-style-type: none"> <li>• To determine the appropriate instrumentation, devices or techniques to obtain the required information.</li> <li>• To determine appropriate calibration regimes.</li> <li>• The ability to obtain, apply and interpret data.</li> <li>• To formulate appropriate record keeping regimes.</li> <li>• The ability to liaise effectively with Regulators and Occupational Health Services.</li> </ul>	<ul style="list-style-type: none"> <li>• The estimation of doses on the basis of the results of monitoring.</li> <li>• Formulation of advice with respect to legislative requirements.</li> <li>• Analysis of the outcome of a risk assessment: <ul style="list-style-type: none"> <li>○ Exposure pathways</li> <li>○ Circumstances that could result in exposures</li> <li>○ Need for ongoing monitoring</li> <li>○ Shielding requirements</li> <li>○ Effectiveness of engineered controls</li> <li>○ Appropriate instrumentation or measurement techniques</li> </ul> </li> <li>• Formulation of advice with respect to the adequacy and relevance of obtained data.</li> </ul>
<b>Employment conditions for pregnant and breastfeeding workers</b>	<ul style="list-style-type: none"> <li>• Be able to analyse and interpret relevant data, assess and re-assess risk and estimate doses.</li> <li>• The ability to assess the potential impact and significance of the working environment, particularly with regard to exposure pathways.</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation of dose, dose-rate and contamination data.</li> <li>• Estimation of potential doses from monitoring data to worker and foetus.</li> <li>• Application of outcome of risk assessment.</li> <li>• Formulation of advice with respect to administrative and practical arrangements associated with pregnant and breastfeeding workers: <ul style="list-style-type: none"> <li>○ Appropriate personal dosimetry</li> <li>○ Required procedures</li> <li>○ Training needs</li> </ul> </li> </ul>
<b>Quality Assurance</b>	<ul style="list-style-type: none"> <li>• The ability to identify appropriate and relevant QA procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Draw up QA procedures for: <ul style="list-style-type: none"> <li>○ Dosimetry</li> <li>○ Radiation monitoring</li> <li>○ Source handling</li> <li>○ Record keeping</li> </ul> </li> </ul>

<p><b>Environmental monitoring programme</b></p> <p><b>Appropriate radiation monitoring instrumentation</b></p>	<ul style="list-style-type: none"> <li>• The ability to assess and interpret the circumstances and to match requirements to instrumentation and monitoring regime.</li> <li>• Ability to advise on the set-up of an appropriate environmental monitoring programme.</li> </ul>	<ul style="list-style-type: none"> <li>• The estimation of doses on the basis of the results of monitoring.</li> <li>• Formulation of advice with respect to legislative requirements.</li> <li>• Analysis of the outcome of a risk assessment: <ul style="list-style-type: none"> <li>○ Exposure pathways</li> <li>○ Circumstances that could result in exposures</li> <li>○ Need for ongoing monitoring</li> <li>○ Appropriate instrumentation or measurement techniques</li> </ul> </li> <li>• Formulation of advice with respect to the adequacy and relevance of obtained data.</li> </ul>
<p><b>Arrangements for radioactive waste management</b></p>	<ul style="list-style-type: none"> <li>• The ability to identify potential sources of radioactive waste.</li> <li>• Undertake, or ensure, effective waste assay.</li> <li>• The ability to determine appropriate waste management regimes up to and including ultimate disposal.</li> </ul>	<ul style="list-style-type: none"> <li>• Application of best available techniques in relation to: <ul style="list-style-type: none"> <li>○ Minimisation of risk</li> <li>○ Facility design and operation</li> <li>○ Abatement of discharges</li> <li>○ Decommissioning</li> </ul> </li> <li>• Effective application of waste management hierarchy: <ul style="list-style-type: none"> <li>○ Avoidance, minimisation, reuse, recycle, disposal</li> </ul> </li> <li>• Effective implementation of treatment, storage and disposal options.</li> </ul>
<p><b>Arrangements for prevention of accidents and incidents</b></p> <p><b>Preparedness and response for emergency exposure stations</b></p> <p><b>Investigation and analysis of accidents and incidents and</b></p>	<ul style="list-style-type: none"> <li>• Determination of required arrangements for the prevention of accidents and incidents on the basis of a comprehensive risk assessment.</li> <li>• Formulation of effective and appropriate contingency plans for enactment in the event of a reasonable foreseeable accident or incident.</li> </ul>	<ul style="list-style-type: none"> <li>• The effective evaluation of hazards and risks and the assessment of potential exposures to ionising radiation in the workplace.</li> <li>• Assessment or estimation of doses.</li> <li>• Retrospective application of dosimetric methods.</li> <li>• Use of appropriate instrumentation and techniques for the measurement of dose rates and contamination.</li> </ul>

<b>appropriate remedial actions.</b>	<ul style="list-style-type: none"> <li>• Determination of an appropriate rehearsal interval for contingency plans.</li> <li>• The ability to analyse available dose information in order to identify possible health effects as well as any issues associated with ALARA and legislative compliance.</li> </ul>	<ul style="list-style-type: none"> <li>• The formulation of advice with respect to required remedial actions.</li> <li>• Effective liaison with specialist services, for example Occupational Health Services.</li> </ul>
<b>Training and re-training programmes for exposed workers.</b>	<ul style="list-style-type: none"> <li>• The ability to identify training and re-training needs.</li> <li>• The ability to determine the format and content of training that will satisfy the training objectives and achieve the desired outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• The effective evaluation of hazards and risks and the potential for exposure to ionising radiation.</li> <li>• Identification of arrangements and precautions required to achieve ALARA and to ensure legislative requirements</li> <li>• Effective communication.</li> </ul>

### 3.2.3 Work/operational experience/on-the-job training

The role of the RPE is that of a professional adviser with a high level of expertise. While the required knowledge and skills, and a degree of competence can be gained, in part, from education and training, attaining the required operational experience necessary to supplement training and to consolidate skills and competences takes time and can only be gained from a period of time active in a radiation protection environment. Such a development or probationary period also facilitates the development of some maturity in the individual and, ideally, provides an opportunity for mentoring by more experienced professionals.

A graded approach is appropriate when it comes to the required breadth and depth of operational experience before an individual becomes eligible for RPE recognition. The expected minimum duration is 3 years, which should provide sufficient operational experience to fully develop the necessary competence to provide advice in respect of the majority of routine applications. However, in order to be considered a suitably competent RPE for more complex or involved applications for example, within the nuclear industry or in a complex medical facility, a longer development period (in the appropriate environment) may be required.

### 3.3 Arrangements for RPE Recognition

Before an individual may take on the role, or status, of an RPE he/she must have his capacity to act in that role formally recognised by the competent authority. This recognition is a process and the Euratom BSS requires that Member States ensure that arrangements are in place for the operation of this process.

Arrangements for RPE recognition can be considered to be made up of two components:

- I. The establishment of a Recognition scheme or framework
- II. Routine operation of the scheme

### **3.3.1 Establishment of an RPE Recognition Scheme/Framework**

The establishment of a scheme or framework under which RPE recognition may be managed is a 4-step process:

#### ***Step 1 Establish requirement for RPE Recognition in national legislation***

A requirement for those wishing to act in the capacity of RPE to have their capacity to act recognized by the relevant competent authority must be included in national legislation.

#### ***Step 2 Establish the criteria upon which Recognition is awarded***

The criteria that are required to be satisfied for RPE Recognition should be clear to all parties, that is, to potential RPEs, those assessing RPE competence and those charged with awarding Recognition.

The overarching criterion is that anyone seeking RPE Recognition must be able to demonstrate that the requirements summarised in Table 3 in section 3.2 have met, with all the specific criteria associated with each of the individual competencies having been addressed.

These requirements should be readily available to all parties, either directly from the competent authority or via any third party organisation empowered by the competent authority to manage RPE Recognition within a national framework. Bespoke WebPages can be a useful tool in this respect.

#### ***Step 3 Identify/Recruit Assessors***

The role of the Assessor in the RPE Recognition process is a key one. For the status of RPE to have value and to be viewed as a trustworthy source of expert advice there must be confidence in the recognition process – specifically, confidence in the ability of those undertaking the assessment of competence of prospective RPEs to exercise sound judgement. This being the case Assessors should themselves be able to satisfy the criteria of core competence for RPE and have significant experience in operational radiation protection. They should be professionals in their own right with an expectation that they are able to remain independent and impartial and to act with rigor but remain flexible. It is a reasonable expectation that Assessors are members of national Radiation Protection Societies (where these exist) and, although not considered essential, there may be an advantage in Assessors being active in the international arena. In summary then, an Assessor is expected to be experienced, professionally competent and an active contributor in the radiation protection arena. In effect, the assessment is a peer review.

It need not always be the case that the assessment is undertaken by a single individual; a panel or consortium of individuals could make a collective decision. Such an approach may be an advantage where, for example, existing expertise within a Member State may be limited. It will also help eliminate any potential bias in the decision making process. However, irrespective of the approach taken the overall criteria for this undertaking the assessment should be the same.

Any individual, or group of individuals, charged with undertaking the assessment of competence of prospective RPEs should be expected satisfy the following criteria:

- (i) Be able to satisfy the criteria for core RPE competence
- (ii) Be active in the field of radiation protection, having a minimum of 10 years operational experience
- (iii) Act independently and remain impartial

- (iv) Be an active contributor to the radiation protection profession on a national basis and/or in the international arena.

Full membership of a recognised radiation protection professional society is also a positive criteria, indicating as it does a professional attitude and understanding of radiation protection arrangements.

The selection and appointment of assessors will be the responsibility of the competent authority. It would be expected that an assessor assigned to any individual applicant is familiar with the workplace situation(s) in which the applicant has gain his or her experience, as such, it is advisable to have assessors that, between them, have experience of a range of sectors (eg, healthcare, nuclear power production, industrial radiography etc ) relevant for the Member State.

**Step 4 Identify individuals or organizations with authority to award RPE Recognition**

Once a prospective RPE has demonstrated that he/she has met all the specified criteria of competence (see Table 4 below) then RPE status can be conferred, that is he/she may be formally recognised as a Radiation Protection Expert. The Competent Authority should clearly establish where responsibility for awarding, or conferring, RPE status lies.

There are a number of options for this:

- i) The competent authority undertakes both the assessment of competence and subsequent awarding of RPE recognition.

Or

- ii) The assessment of competence is undertaken by a 3<sup>rd</sup> party acting in accordance to an operating specification from the competent authority; the outcome of that assessment is forwarded to the competent authority for consideration and subsequent awarding of recognition. As with (i), the final decision lies with the competent authority.

Or

- iii) Both the assessment of competence and awarding of Recognition is undertaken by a 3<sup>rd</sup> party acting in accordance to a specification from the competent authority.

Whichever of the above options is adopted, the supporting administrative arrangements should be clear and any operating criteria or conditions specified by the competent authority should be traceable.

**3.3.2 Routine operation**

Once the framework has been established then the Recognition Scheme can become operational. The process to be followed by an individual seeking Recognition can be summarised as follows:

**Step 1: The prospective RPE submits the required documentary evidence to the RPE Assessor or Assessing Body.**

The nature and format of the evidence that prospective RPEs (once eligible) are required to submit to those assessing the competence should be clearly stated and understood. Documentary evidence should be submitted in support of all core requirements for recognition and must be sufficient in terms of quantity and level of detail to demonstrate that all specified criteria of competence have been satisfied. It is expected that evidence would take the following form.

**Table 4: Evidence of competence**

Development aspect	Appropriate evidence
Education	

Training & development activities	Proof of academic qualifications, e.g. certificates, diplomas  Training Course attendance certificates Training Course content Proof of exam passes Evidence of on-the-job or mentored training
Experience	Evidence of the developed competence <ul style="list-style-type: none"> <li>- Details of situations analysed</li> <li>- Evidence of advice given</li> <li>- Reports provided to employers</li> <li>- Risk assessments developed</li> <li>- Etc</li> </ul>

**Step 2: Assessors consider the evidence.**

All of the evidence submitted should be assessed against the relevant specified criteria for demonstrating competence in each of the core areas. Any evidence for education and training activities is likely to be straightforward and self-explanatory and with little, or no, interpretation required by the Assessors. The submitted evidence for developed professional competence must be sufficiently detailed to allow the assessor to gauge competence; this will require examination of the information provided for illustration of the effective application of knowledge and skills. Some examples are given in the table below.

**Table 5: Examples of suitable evidence**

Core topic for advice	Example of appropriate evidence	Interrogation of evidence
Appropriate radiation monitoring instrumentation	Detailed review of a workplace monitoring programme	Does the evidence illustrate: <ul style="list-style-type: none"> <li>- Knowledge and understanding of appropriate instrumentation?</li> <li>- The appropriate use of reference levels and/or dose constraints</li> <li>- Knowledge and correct application of relevant regulatory requirements?</li> </ul>
Classification of workers	Report detailing advice to an employer regarding classification of workers.	Does the evidence illustrate: <ul style="list-style-type: none"> <li>- Knowledge and correct application of relevant regulatory requirements?</li> <li>- Competence in assessing exposure pathways and quantifying risk?</li> <li>- Knowledge and understanding of appropriate methods of dosimetry?</li> <li>- An understanding of the objective of classification?</li> </ul>

Arrangements for radioactive waste management	Advice to an employer regarding appropriate waste management strategies for dealing with waste arising from the undertaking.	<p>Does the evidence illustrate:</p> <ul style="list-style-type: none"> <li>- An understanding of the principles of radioactive waste management e.g. dilute &amp; disperse, concentrate and contain, store for decay etc</li> <li>- Understanding and application of the waste characterization</li> <li>- Appropriated waste characterisation</li> <li>- Knowledge and understanding of waste storage and/or treatment options</li> <li>- Competence in identifying appropriate disposal options.</li> </ul>
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If the assessment, on the basis of the submitted evidence, is that core competence is demonstrated, it is considered prudent for the assessor(s)/assessing body to conduct an interview with the prospective RPE. The objective of such an interview would be to confirm that the RPE understands of the underpinning principles and the wider factors influencing radiation protection and to assess verbal communication skills.

**Step 3: Award Recognition**

If the Assessor(s) or Assessing Body is not content with any of the information gained in either of the two preceding steps then RPE recognition should not be granted. This should be notified to the prospective RPE, along with the justification for the decision and options for an appeal.

However, if all is in order then the individual’s capacity to act as an RPE should be formally recognised. The RPE should be provided with documentary evidence that recognition has been awarded, for example in the form of certificate or letter of endorsement and a record or register of recognised RPEs should be retained by, or on behalf of, the competent authority. It is recommended that the record or register of recognised RPEs includes a summary of the applications or sectors of work in which the RPE is considered suitable to provide advice on.

**Step 4: Retention of RPE status**

Once awarded, the period of validity of RPE recognition should not exceed 5 years. Re-recognition should be required if the individual wishes to continue to practice as an RPE.

In order to obtain re-recognition an RPE should be required to submit evidence to the assessor(s)/assessing body of continuous professional development (CPD) in:

- 1) operational radiation protection methods
- 2) technological advances and scientific insights relevant to radiation protection
- 3) understanding of any changes and developments in national legislation in radiation protection

Continuous professional development should be an ongoing process with RPEs being expected to be proactive with respect to maintaining their professional competence. This can, in part, be achieved by being active as an RPE but that is unlikely on its own to provide opportunity to keep pace with change and developments. Attendance at appropriate training events, participation in relevant conferences and seminars, active membership of relevant professional bodies and contribution to national and/or international working groups and committees all support CPD.

The submission of documentary evidence should be all that is required for the purposes of re-recognition; the objective is just to demonstrate that professional competence has been maintained. Specifically, this evidence should demonstrate:

- A clear understanding of the role of the RPE
- Detailed understanding of relevant national legislation
- General awareness of any legislative developments
- Continued awareness of operational radiation protection methods and any technological advances relevant to radiation protection.

Agreed criteria that the RPE must meet in order to satisfy each of the above should be established by the assessor(s)/assessing body.

The period of validity of any re-recognition should be the same as that specified for first recognition.

### **3.4 Transferability/acceptance of RPE status between Member States**

It is perhaps important to re-iterate the objective of RPE recognition on a national basis. Put simply, the objective is to provide the employer/undertaking with confidence that the expert he/she chooses to consult with has the necessary core competence to give advice over a wide range of radiation protection issues. This being the case, the recognition process – however it operates - should seek to ensure that competence is adequately and appropriately assessed so that the status of RPE, once gained, need not be questioned.

The acceptance, or mutual recognition, of professional qualifications between Member States in the EU is an established requirement [8]. The objective is to facilitate the movement of professionals between countries by having the qualification or endorsement to practice that profession in one country accepted or recognized in another country so that that same profession can be practiced there. This concept is clearly applicable to RPE status.

The process of mutual recognition should, as far as practicable, be pragmatic and straightforward; for this to be the case there must be a good degree of commonality with respect to the key elements of, and criteria applied to, the various national schemes which should be the case if the general guidance provided in this document is applied.

#### **3.4.1 Criteria for mutual recognition**

In very simple terms mutual recognition, or acceptance, means that RPE status gained in one Member State is accepted by another Member State. An RPE satisfying the criteria for core competence and having been awarded recognition in Country A would not have to go through the full process of RPE recognition again in order to practice in Country B.

Taking each of the criteria for core competence in turn:

*i) An education to:*

- *Bachelor degree level either specifically in radiation protection, or in a physical/engineering/mathematical discipline*

OR

- *An academic equivalent*

An RPE who has been recognized within his/her home country will, by definition have satisfied the above criteria. This basic educational foundation for RPE status is one of the first steps towards RPE development; once achieved it is not revisited. This aspect of competence is transferable to another Member State; evidence of educational level activities will have been provided at the time of first recognition and, as such, further investigation or requests for evidence/proof should not be necessary. Notwithstanding that, the provision of information on academic equivalence by the national authorities could be helpful in this matter.

*ii) Knowledge and understanding of fundamental principles of radiation protection*

Knowledge and understanding of the fundamental underpinning principles of radiation protection will have been acquired primarily during the training and development activities undertaken by the RPE and consolidated by practical application while the RPE was gaining operational experience. This acquired knowledge and understanding is valid irrespective of how and where the training and development was undertaken. Evidence of training and development activities undertaken will have been provided at the time of first recognition and, more importantly, competence in applying the acquired knowledge and understanding verified; further investigation or requests for evidence/proof are not necessary.

*iii) Knowledge of operational radiation protection methods*

In order to gain initial recognition in his home country, the RPE will have had to provide evidence that he/she has a good understanding of operational radiation protection and can use this to formulate appropriate advice; this is a key component of core competence.

Again, there is no reason why this attained competence would need to be re-visited. However, those undertaking the assessment of evidence provided during an RPE's initial assessment will have had the advantage of judging the validity and quality of the evidence produced in context. That is, they will have seen where and how the experience was gained; such information aids the assessment process. Assessor(s) or an assessing body being asked to confer mutual recognition on a visiting RPE is perhaps at a disadvantage. A pragmatic approach would be to accept this core competence, but to require the RPE provide a resume of experience.

*(iv) The ability to develop and provide appropriate advice with those topics on which the RPE is expected to provide advice.*

There are two issues that need to be considered here.

The topic areas

As noted above, having a good understanding of the operational "basics" of radiation protection, i.e. the topics listed in Article 82 and in Table 1, is a fundamental attribute for an RPE. An RPE having gained recognition in his/her home country will have provided evidence to demonstrate competence in these areas and there is little need, or value, in an assessing body in another country in re-assessing this evidence.

However, legislation is clearly a country-specific issue; any RPE advising within a country must have working knowledge of the national radiation protection legislation and be able to interpret, and advise in accordance with the various requirements. This being the case, an RPE wishing to practice in a country other than the country in which initial recognition was obtained should only

be permitted to do so once he/she is able to demonstrate an appropriate level of knowledge and understanding of relevant national legislation to the RPE assessing body in that country. It is up to the Assessor/Assessing Body to determine the means by which knowledge and understanding of national legislation is best evidenced. A straightforward question/answer test might be adequate but may be rather limited in terms of assessing required depth of knowledge. An alternative approach may be by means of “simulated evidence”. For this, the RPE is presented with one or more scenarios and is required to demonstrate that he/she is able to identify what is required in terms of legislative compliance.

#### Ability to provide advice

The primary function of the RPE, specified in the RPE definition is to “give radiation protection advice in order to ensure effective protection of individuals”. It follows that, in order to fully execute this role, RPEs must be able to communicate effectively with those to whom they are providing advice. In this respect, for RPEs moving between Member States there is the very basic issue of language; any professional will have difficulty communicating effectively with those to whom advice is to be provided if a common language isn’t shared. In practice, this is an issue of “suitability” rather than core competence but it is a relevant consideration with respect to mutual recognition. Whether or not an RPE is able to communicate effectively in a secondary (to the RPE) language will be a matter of judgment by the Assessor(s)/Assessing Body. With respect to written communications this is best assessed by reading submitted evidence or by requiring the RPE to undertake a written test. Internationally recognised language certificates may be of value in this process.

The effectiveness of oral communication (in a secondary language) is best assessed by interview.

#### *(v) A minimum of 3 years’ experience working in radiation protection environment*

Anyone already recognised as an RPE will have at a least 3 years’ experience working in a radiation protection environment. However, as noted above, for the purposes of mutual recognition, it the RPE should be required to provide the Assessor(s) or Assessing Body in the new country with a resume of professional experience.

The resulting criteria for acceptance or mutual recognition of RPE status is summarised in Table 6

**Table 6: Aspects to be addressed in accepting RPE status in other Member States.**

Core competence required for RPE Recognition	Transferable?	Further Evidence Required by Assessing Body?	Further Action Required by RPE?
(i) An education to : <ul style="list-style-type: none"> <li>• Bachelor degree level either specifically in radiation protection, or in a physical science</li> <li><i>OR</i></li> <li>• An academic equivalent</li> </ul>	Yes	No	No
ii) Knowledge and understanding of the fundamental principles of radiation protection	Yes	No	No
(iii) A knowledge of operational radiation protection methods	Yes	Summary of the disciplines or sectors in which the experience was gained would be of value.	No
(iv) Ability to develop and provide appropriate advice on those topics on which the RPE is expected to give advice.	Yes – with exception of knowledge of legislation in the new country. In addition, fluency in languages of the “new” country must be considered.	Yes	RPE to gain knowledge and understanding of national legislation, as directed by the Assessor(s). There may also be a need to improve language skills.
(v) A minimum of 3 years’ experience in the radiation protection environment.	Yes	Summary of the disciplines or sectors in which experience was gained would be of value.	No

### 3.5 Mechanism for mutual recognition

A model for national schemes for RPE recognition was outlined in section 3.3. The recognition of RPEs (who are already recognised by the relevant competent authority in their “home” country) from *other* Member States should be able to be readily accommodated within such schemes - the objective of mutual recognition is that it should be a process that facilitates the movement of radiation protection professionals within European Member States. In practice the same general process may be followed - an application is made, the evidence is assessed and then recognition (in effect, authorisation to practice) is, or is not, awarded on the basis of the assessed evidence. The only difference will be with respect to how the evidence is assessed.

How each individual aspect of a national scheme could operate with respect to the recognition of applicant RPEs from other countries is further discussed below

#### *i) Submission of documentary evidence*

The applicant RPE would be expected to supply:

- Evidence of RPE recognition in home country. This may be in the form of a certificate, letter of recognition etc but it must provide proof that recognition has been awarded by (either directly or via an approved assessing body) the relevant competent authority. A publically available list of nationally recognised RPEs, provided by the Competent Authority of the home country could facilitate this.
- A resume of RPE experience. This need not be overly detailed but should include an overview of where (what sectors) advice has been provided and to whom.
- A statement of language ability, i.e. level of writing/reading/proficiency in languages other than mother tongue. Internationally recognised language certificates could facilitate this aspect.
- Evidence sufficient to demonstrate knowledge and understanding of radiation protection legislation in the country where the application is being made. *Note the required level of knowledge/understanding should be specified by the competent authority.*

#### *ii) Interview*

The Assessor(s)/Assessing Body should conduct an interview with the applicant RPE. The primary objectives of this interview are:

- To assess knowledge and understanding of relevant national legislation
- To gain an appreciation of level and areas of expertise/experience, and
- To assess communication skills.

#### *iii) Authorisation to practice as an RPE*

If the assessor(s) or Assessing Body is not satisfied with any of the information gained in either of the two preceding steps then the authorisation/approval to practice as an RPE should not be given and instructions for appeal should be provided. However, if all is in order then authorisation should be granted although it may be prudent for the assessing body to include a statement to inform “suitability” in the formal authorisation. For example:

- a list of sectors/applications that the RPE has gained experience in
- any limitations on language skills.

iv) *Validity*

Validity of any authorisation to practice in a country other than the RPE's home country should be co-incidental with the period of validity of the original recognition; it would not be appropriate for any advantage to be conferred in the process of mutual recognition.

For example, a recognised RPE from the United Kingdom (UK) wishes to work in and is successful in gaining recognition in the Republic of Ireland (RoI):

UK recognition awarded 1/12/2014 - valid until 30/11/2019 (5 years)

RoI recognition awarded 1/06/2016 - would only be valid until 30/11/2019

v) *Retention of RPE status*

When the period of validity of an RPE's authorisation to practice in another country has, or is about to, expire then there are two options.

- The RPE seeks re-recognition in home country following the process specified in that country then re-applies for mutual recognition in the other country (countries), going through the steps outlined above. This option is probably most appropriate when the manner in which the RPE works tends to be peripatetic in nature.

OR

- The RPE seeks re-recognition of RPE status in the country in which mutual recognition was awarded following the same process as any other RPE from that country. If successful, then in effect this transfers the "home" status of the RPE to the "new" country. This option would probably be appropriate where the individual in question has in effect permanently moved or transferred to the other country.

### **3.6 European qualification arrangements**

The BSS requires Member States to put in place a system of recognition for RPEs. A common approach to training and recognition will also facilitate the development of mutual recognition arrangements between Member States, so that an RPE who has recognition in one member state will also be recognised in other Member States. A further aid to a common approach and mutual recognition is the application of the European Qualifications Framework (EQF). This framework is a translation tool that helps communication and comparison between qualifications systems in Europe. Its eight common European reference levels are described in terms of learning outcomes: knowledge, skills and competences. This allows any national qualifications systems, national qualifications frameworks (NQFs) and qualifications in Europe to relate to the EQF levels.

The EQF was adopted by the Council of the EU and the European Parliament in the Recommendation of 23 April 2008 [9]. The use of EQF in radiation protection qualifications is at an early stage, and to date no EQF levels have been formally determined for radiation protection activities. However, role of RPE falls in the range of EQF level 6 to 7, taking into account the EQF level descriptors. The role of RPO (which is not required to be subject to formal national recognition) is EQF level 5 or higher. For information the descriptors for all 8 EQF levels are given below.

**Table 7: Descriptors defining levels in the European Qualifications Framework (EQF)**

Each of the 8 levels is defined by a set of descriptors indicating the **learning outcomes** relevant to qualifications at that level in any system of qualifications

EQF Level	Knowledge	Skills	Competence
	<b>In the context of EQF, knowledge is described as <i>theoretical and/or factual</i></b>	<b>In the context of EQF, skills are described as <i>cognitive</i> (involving the use of logical, intuitive and creative thinking), and <i>practical</i> (involving manual dexterity and the use of methods, materials, tools and instruments)</b>	<b>In the context of EQF, competence is described in terms of <i>responsibility and autonomy</i>.</b>
Level 1	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context
Level 2	Basic factual knowledge of a field of work or study	Basic factual knowledge of a field of work or study	Work or study under supervision with some autonomy
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities
Level 5	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups
Level 7	Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research Critical awareness of knowledge issues in a field and at the interface between different fields	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams
Level 8	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research

## 4 The Radiation Protection Officer (RPO)

### 4.1 The duties of the RPO

Employees appointed to act as RPO will need to have an adequate level of understanding of concepts related to radiation protection and should also be acquainted with the safe and secure use of radiation sources as relevant to the application. The level of training required will be very dependent on the complexity of the radiation application the RPO is responsible for, and the associated duties and radiation protection tasks. There will, however, be a core level of training that is necessary for all RPOs regardless of the practice or sector in which they work. This publication provides guidance on this required core training and for many applications only minor changes or additions will need to be made to this core component to make the training appropriate for specific RPOs.

The BSS provides detailed information on the supervisory role of the RPO (see section 2.4 above) and this in turn gives a good indication of the competencies required to carry out the role. The core duties of the RPO, as specified in the BSS, are given in Table 8. These core duties will be appropriate for the majority of radiation applications and hence form the underlying basis for the training requirements.

**Table 8: Primary duties of the Radiation Protection Officer**

Duty	Main actions
Ensuring work carried out in accordance with procedures or local rules	Carry out close supervision of the work activities associated with sources of radiation and ensure that the local rules and relevant procedures are followed. Provide guidance and instruction to the workers to ensure safe working.
Supervise programme for workplace monitoring	Carry out or oversee the periodic dose rate and/or contamination monitoring around sources of radiation in the workplace. Maintain a record of the monitoring results. Review the results of the monitoring and initiate any required remedial actions.
Maintain radiation source records	Maintain the source accountancy record and ensure that it is always up-to-date. Enter the details of any new radioactive sources and record disposal details of old sources. Carry out or oversee the regular checks on the location of the radiation sources in the practice and enter details in the source accountancy record. Implement the relevant actions in the event of a source going missing.
Carry out periodic assessments of safety & warning systems	Oversee or carry out periodic checks on the satisfactory operation of interlock systems and visual/audible warnings. Maintain a record of these checks and arrange for the repair of any faulty systems.
Supervise personal monitoring programme	Oversee the provision of personal dosimeters to the relevant workers and maintain the associated dose records. In collaboration with the RPE, initiate a review of any unusually high recorded doses and promptly investigate any overexposures.

Supervise health surveillance programme	Arrange the pre-classification medical examination for new workers and the periodic health review for all category A workers.
Provide new workers with introduction to local rules and procedures	Explain the content of the local rules and associated procedures to all workers. Ensure that they have read the local rules and understand the safety procedures they must follow.
Advising on work plans	Provide advice to management on the radiation protection implications of any new work plans or proposed changes to existing work plans. Where any new plans or changes to existing plans have potential dose significance, advice should also be obtained from the RPE.
Establishing work plans	In collaboration with the RPE, draw up any required new work plans to ensure doses to workers and members of the public are optimised.
Providing reports to local management	Periodically provide reports to the local management giving an update on the current status of the radiation protection arrangements in the workplace, and the level of radiation doses being received by the workers. Promptly report any potential incidents, high dose or overexposures. Provide recommendations on actions needed to optimise the radiation protection arrangements. Take account of the recommendations of the RPE.
Participating in emergency exposure response arrangements	Carry out the actions specified for the RPO in the exposure response arrangements.
Provide information and training for exposed workers	Provide or arrange for relevant information and training to be provided. Ensure retraining is provided at appropriate intervals.
Liaise with the RPE	Provide the RPE with regular updates on the status of radiation protection in the practice. Promptly inform the RPE of any unusual high exposures or overexposures to persons, and significant changes to work practices that will have radiation dose implications. Consult the RPE on the radiation protection aspects of new equipment or proposed work plans.

#### 4.2 Core competence requirements

In considering the requirements for RPO competencies it should be noted that, other than the issues of general competency and suitability, there are no specific education, training and qualification requirements at the European level for persons who are going to be appointed as RPOs. The appropriate route to gaining the level of competence required to become an RPO will usually be a combination of training plus relevant experience in the appropriate area of work [10]. It is the employer's responsibility to determine the level of training a person requires to become an RPO for a specific application.

While the RPO role is primarily one of work supervision, it must be borne in mind that, in some undertakings with only limited radiation applications, the RPO is likely to be the primary point of reference for radiation protection in a practice. As such, the RPO may be the main internal authority

for radiation protection issues in an undertaking, the primary liaison point for an external RPE and the point of reference for the competent authority. It is very important, therefore, that the employer chooses a person who is in a suitable position within the undertaking to carry out these functions and provides suitable training for the person so that he/she can carry out the role that is required within that specific undertaking. The employer may wish to obtain advice from an RPE on the criteria to apply in choosing an RPO.

It follows that the content and level of training required for an RPO will vary depending on the role he/she is undertaking. However, core training outcomes and competencies can be specified that will form the basis of all RPO training. These are derived from the duties of the RPO stated in the BSS and are specified in Tables 9 and 10 below.

**Table 9: Core learning outcomes for the RPO: Radiation protection principles**

Knowledge (facts, principles, theories, practices)	Skills (cognitive & practical)	Competence
K1. Understand basic atomic structure. K2. Be aware of the laws of radioactive decay K3. Understand radiation quantities and units K4. Be aware of the mechanisms for the production of x-rays K5. Understand the fundamentals of radiation detection K6. Have a basic understanding of the biological effects of radiation K7. Understand the differences between deterministic and stochastic effects K8. Understand the general principles of radiation protection K9. Understand the application of the inverse square law. K10. Understand the shielding properties of different materials (e.g. paper, aluminium, steel, lead) K11. Understand the concepts of justification and optimisation.	S1. Explain the relative risks of different types of radiation and the shielding requirements for each.  S2. Correctly interpret dose, dose rate and surface contamination data.  S3. Calculate dose rates at varying distances from a source.  S4. Select appropriate shielding material for a range of sources.	C1. The application of the principles of radiation protection to workplace situations.

**Table 10: Core learning outcomes for the RPO: Operational requirements**

Knowledge (facts, principles, theories, practices)	Skills (cognitive & practical)	Competence
K12. Understand the regulatory requirements for local rules and procedures.	S5. Be able to draw up appropriate local rules and safety procedures for a range of straightforward applications. Be able to	C2. Draw up, or assist in drawing up, and issue suitable local rules for a practice and supervise their implementation.

<p>K13. Understand the regulatory requirements for workplace monitoring.</p> <p>K14. Be aware of the different types of monitoring equipment that are available for the measurements of dose rate and surface contamination monitoring, and the advantages and limitations of each type of monitor.</p> <p>K15. Understand the regulatory requirements for source accountancy.</p> <p>K16. Know the required safety and warning systems for the radiation equipment in use at the premises and understand the testing criteria and safety standards for these systems.</p> <p>K17. Understand the regulatory requirements for health surveillance and personal monitoring.</p> <p>K18. Be aware of the different types of personal dosimeter available and their suitability for different types of radiation.</p> <p>K19. Understand the national requirements for the maintenance of dose records.</p> <p>K20. Understand the emergency response arrangements in place at the practice and the RPO's role in these arrangements.</p> <p>K21. Understand the regulatory requirements for emergency response arrangements including any requirement for the periodic rehearsing of these arrangements.</p>	<p>assist in the drawing up of local rules and safety procedures for more complex applications.</p> <p>S6. Be able to carry out measurements using dose rate and contamination monitors.</p> <p>S7. Be able to interpret the monitoring results for comparison with the relevant criteria.</p> <p>S8. Select the appropriate dosimeter for different types of radiation.</p> <p>S9. Be able to draw up emergency response arrangements for a range of common applications</p>	<p>C3. Carry out a programme of workplace monitoring:</p> <ul style="list-style-type: none"> <li>- The selection and use suitable radiation monitors</li> <li>- Interpretation of results</li> <li>- Associated record keeping</li> </ul> <p>C4. Maintain suitable records of the sources of radiation at the practice.</p> <p>C5. Carry out periodic assessments of safety and warning systems.</p> <p>C6. Oversee the maintenance of a health surveillance programme. Select suitable personal dosimeters for the radiation practice. Provide suitable dosimeters to the persons working with radiation and keep appropriate dosimetry records. Review dose records and initiate remedial action.</p> <p>C7. Draw up emergency response plans for the practice in collaboration with the RPE. Implement the emergency response plans.</p> <p>C8. Liaise with the RPE in the specification of safety</p>
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K22. Be aware of general design and safety principles for a range of common practices.	S10. Draw up shielding and safety & warning system requirements for common practices.	systems and procedures for new installations.
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### 4.3 Educational requirements

The role of the RPO will in many cases not be the primary function of the person who holds the RPO post. The RPO may be an engineer, a scientist, a medical doctor, a health and safety specialist or an operational manager, and the amount of time that he/she devotes to the RPO role will be dependent on the nature and complexity of the radiation application. The educational requirements associated with the person's primary role will in most cases be sufficient for the function of RPO. For many radiation applications it is sufficient if the person carrying out the role of the RPO has a secondary level of education. In some facilities with complex radiation protection arrangements and the potential for significant dose e.g. nuclear reactors, large healthcare facilities, radiochemistry laboratories using a range of radionuclides, a tertiary educational level may be appropriate. The specifying of the educational requirements for the RPO is the responsibility of the employer, who will need to take into account the role of the RPO in the company and any relevant national regulatory requirements. The employer should also seek the advice of the RPE on this subject. This guide, therefore, does not specify a level of education required for the RPO, although the RPO would be expected to have at least a secondary educational level corresponding to a scientific or technical curriculum including 10 to 12 years of schooling.

### 4.4 Training requirements

The RPO must be provided with sufficient training to enable him to effectively carry out his supervisory duties. An example syllabus covering the core knowledge requirements for the RPO is given in Appendix B. This syllabus was derived from the learning outcomes given in Tables 9 and 10 above and also takes account of the recommendations of the ENETRAP II project [11].

However, education and training are only two of a number of attributes that result in a person being both competent and suitable to act as an RPO for a practice. The provision of core knowledge training will provide an appropriate level of knowledge and some of the required skills but this will need to be re-enforced with practical experience and on-the-job training before core competence is achieved.

The RPO may need to have further practice-specific training and experience before he/she is considered suitable for a specific practice. For example, an RPO may be considered to be competent and suitable for a straightforward practice, such as industrial gauges, if he/she has a good understanding of the core requirements of the RPO role, together with experience of applying this knowledge in the field. However, such a person will not be a suitable RPO for industrial radiography without first receiving additional training and experience on the radiation protection issues associated with this area of work. It follows that RPO training will fall into two categories: core training, common to all practices, and supplementary training related to practice-specific radiation protection elements.

The formal training of RPO should involve covering the core syllabus and, as appropriate, any supplementary content pertinent to the practice in question. The content may be covered separately (i.e. in modular form, core + specific 1 + specific 2 etc) or combined into a single course. Classroom based training is unlikely to cover all the practical radiation protection and safety aspects and skills associated with specific work tasks; hence additional experience in the workplace and on the job training can be very effective in the overall training programme for RPO. In this form of training the participant works in the normal place of work either under the direct supervision of, or with indirect input from, an experienced mentor.

The participant's progress and achievements may be recorded on a checklist of topics and tasks. On completion of the training it can be very useful for the trainer and participant to document the participant's progress, the areas of competence gained and any further training needs. The latter is likely to be dependent on the complexities of the practice and the RPO's previous work experience.

#### **4.5 Work experience required**

Work experience relevant for working as an effective RPO in a specific practice may range between weeks and years, depending on the complexity of the practice, the level of radiation risk involved and the specifics of the working environment. For example:

- A potential RPO in a small facility where only XRF (x-ray fluorescence) and XRD (x-ray diffraction) equipment would only need a few weeks work experience (assuming he/she was suitably qualified for his "normal" tasks) in order to exercise the RPO role. In this situation the radiation risks are low, the work routine and regulatory compliance straightforward to ensure.
- A potential RPO for industrial radiography employing both x- and gamma techniques would require substantial operational experience before taking on the role. The radiation risk is high, the work (probably) very dynamic in nature and regulatory compliance may be complex.

#### **4.6 Further requirements**

By definition a "competent and effective" RPO will also have specific personal attributes such as good communication skills and the ability to exercise sound judgement i.e. be capable of analysing a situation and coming up with a pragmatic course of action. A complete assessment of the competence of a person to act as RPO will also include an assessment of the person's ability to apply knowledge effectively using these skills. The assessment of these skills should be part of the routine performance assessment in place in a company for all staff. In the initial selection of an RPO, account should be taken of the effectiveness of the candidates in their previous work activities. The RPE may also have sufficient interactions with the RPOs to be able to contribute to the assessment of the effectiveness of RPOs that are in post.

#### **4.7 Assessment of competence**

Competence is the ability to undertake responsibilities and perform activities within an occupation or function to an agreed standard on a regular basis. Therefore, competence assessment entails measuring a person's performance against a standard. The assessment of competence before, during and after completion of training events is an ongoing process of continually building knowledge and skills on the basis of work experience. There are a number of different ways of doing

competence assessment. The key to competence assessment is that it is based on actual skills and knowledge that a person can demonstrate in the workplace or other contexts. This is different to other approaches where people just answer Knowledge-based questions as a test of their skills. It is recommended, that the employers make sure that RPOs are able to demonstrate competence on a regular basis, in particular after completion of training events. Training providers and RPE should be able to assist or advise employers in this matter.

A complete assessment of the competence of a person to act as RPO will also include an assessment of the person's ability to apply knowledge effectively using these skills. This could be done by observing the person's performance at work or by setting the person an exercise to carry out or a problem scenario to solve. RPE or other specialist input may be needed in the carrying out of such assessments in circumstances where the employer does not have the necessary radiation protection expertise.

#### **4.8 Maintenance of competence**

RPO competence needs to be maintained. Depending on the application, there is an expectation that refresher training is needed on a regular basis; 5 years is generally accepted as an appropriate interval but more frequent refresher training (plus participation in an appropriate Continuous Professional Development scheme) may be prudent in high risk situations/applications e.g. industrial radiography.

Employers should provide, as appropriate, necessary means (e.g. time during working hours, reimbursement of registration fees, attendance at training events) to keep RPO competence up-to-date. There might be circumstances where exchange of information through visits, meetings, dialog with other RPOs (in the same type of installation), and attendance at radiation protection conferences is valuable. The CPD activities of the RPO could usefully be assessed by the RPE (and possibly the competent authority) in order to verify that the competence of the RPO is maintained.

#### **4.9 Recognition and appointment**

In the Euratom BSS, formal national Recognition or RPO competence is not required. However, there are Member States where the availability of one (or more) competent and suitable RPOs is a condition of the operating license given by the competent authority, which also verifies their competence. The required competencies for an RPO beyond the core competencies described in 4.2 above will vary considerably depending on the nature of the practice and the specific duties of the RPO in the practice. It follows that any national recognition scheme would either be based on assessment of core competence or would include the assessment of specific competencies for each type of practice. It is the responsibility of the Member States to determine which approach to follow. It is recommended, however, that should a Member State decide to operate a recognition scheme for RPOs, a graded approach should be followed to avoid excessive knowledge and competence requirements for RPOs working with straightforward radiation uses with only relatively low risk.

The appointment of an RPO should be documented by the employer and communicated within the company and notified to the RPE. The RPE can be involved in the appointment process for the assessment of the technical competence of the RPO in radiation protection. The RPO should receive the necessary means and support from the hierarchy in order to supervise or to perform radiation protection tasks within an undertaking.

The documentation of the appointment should include

- the means and support in resources of time and equipment
- the direct communication and notification structures with the management of the undertaking and the RPE
- the validity of the appointment and conditions of re-appointment in terms of CPD

#### **4.10 Mechanism for mutual recognition**

An RPO can also perform his function in other countries. Since the required formal recognition will be different in the Member States, a straightforward mechanism for mutual recognition cannot be provided. However, the main points of attention will be similar of those with the RPE, namely the knowledge and understanding of the national legislation in radiation protection, and the official language.

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**Other relevant documents**

Radiation Protection No 174, European Guidelines on Medical Physics Expert, Directorate - General for Energy, Directorate D - Nuclear Safety & Fuel Cycle, Unit D 3, Radiation Protection, 2014

## Appendices

### Appendix A

#### **References to RPE, RPO and education and training requirements in the BSS (Council Directive 2013/59/EURATOM)**

##### **Article 4**

###### **Definitions**

"medical physics expert" means an individual or, if provided for in national legislation, a group of individuals, having the knowledge, training and experience to act or give advice on matters relating to radiation physics applied to medical exposure, whose competence in this respect is recognised by the competent authority;

"radiation protection expert" means an individual or, if provided for in the national legislation, a group of individuals having the knowledge, training and experience needed to give radiation protection advice in order to ensure the effective protection of individuals, and whose competence in this respect is recognised by the competent authority;

"radiation protection officer" means an individual who is technically competent in radiation protection matters relevant for a given type of practice to supervise or perform the implementation of the radiation protection arrangements;

#### CHAPTER IV

#### **REQUIREMENTS FOR RADIATION PROTECTION EDUCATION, TRAINING AND INFORMATION**

##### *Article 14*

###### **General responsibilities for the education, training and provision of information**

1. Member States shall establish an adequate legislative and administrative framework ensuring the provision of appropriate radiation protection education, training and information to all individuals whose tasks require specific competences in radiation protection. The provision of training and information shall be repeated at appropriate intervals and documented.
2. Member States shall ensure that arrangements are made for the establishment of education, training and retraining to allow the recognition of radiation protection experts and medical physics experts, as well as occupational health services and dosimetry services, in relation to the type of practice.
3. Member States may make arrangements for the establishment of education, training and retraining to allow the recognition of radiation protection officers, if such recognition is provided for in national legislation.

##### *Article 15*

###### **Training of exposed workers and information provided to them**

1. Member States shall require the undertaking to inform exposed workers on:
  - (a) the radiation health risks involved in their work;
  - (b) the general radiation protection procedures and precautions to be taken;
  - (c) the radiation protection procedures and precautions connected with the operational and working conditions of both the practice in general and each type of workstation or work to which they may be assigned;
  - (d) the relevant parts of the emergency response plans and procedures;

(e) the importance of complying with the technical, medical and administrative requirements. In the case of outside workers, their employer shall ensure that the information required in points (a), (b) and (e) is provided.

2. Member States shall require the undertaking or, in case of outside workers, the employer, to inform exposed workers on the importance of making an early declaration of pregnancy in view of the risks of exposure for the unborn child.

3. Member States shall require the undertaking or, in case of outside workers, the employer, to inform exposed workers on the importance of announcing the intention to breast-feed an infant in view of the risks of exposure for a breast-fed infant after intake of radionuclides or bodily contamination.

4. Member States shall require that the undertaking or, in case of outside workers, the employer, provides appropriate radiation protection training and information programmes for exposed workers.

5. In addition to the information and training in the field of radiation protection as specified in paragraphs 1, 2, 3 and 4, Member States shall require that the undertaking responsible for high-activity sealed sources shall ensure that such training includes specific requirements for the safe management and control of high-activity sealed sources with a view to preparing the relevant workers adequately for any events affecting the radiation protection. The information and training shall place particular emphasis on the necessary safety requirements and shall contain specific information on the possible consequences of the loss of adequate control of high- activity sealed sources. EN L 13/14 Official Journal of the European Union

#### *Article 16*

##### **Information and training of workers potentially exposed to orphan sources**

1. Member States shall ensure that the management of installations where orphan sources are most likely to be found or processed, including large metal scrap yards and major metal scrap recycling installations, and in significant nodal transit points, are informed of the possibility that they may be confronted with a source.

2. Member States shall encourage the management of installations referred to in paragraph 1 to ensure that where workers in their installation may be confronted with a source, they are:

(a) advised and trained in the visual detection of sources and their containers;

(b) informed of basic facts about ionising radiation and its effects;

(c) informed of and trained in the actions to be taken on site in the event of the detection or suspected detection of a source.

#### *Article 17*

##### **Prior information and training for emergency workers**

1. Member States shall ensure that emergency workers who are identified in an emergency response plan or management system are given adequate and regularly updated information on the health risks their intervention might involve and on the precautionary measures to be taken in such an event. This information shall take into account the range of potential emergencies and the type of intervention.

2. As soon as an emergency occurs, the information referred to in paragraph 1 shall be supplemented appropriately, having regard to the specific circumstances.

3. Member States shall ensure that the undertaking or the organisation responsible for the protection of emergency workers provides to emergency workers referred to in paragraph 1 appropriate training as provided for in the emergency management system set out in Article 97. Where appropriate, this training shall include practical exercises.

4. Member States shall ensure that, in addition to the emergency response training referred to in paragraph 3, the undertaking or the organisation responsible for the protection of emergency workers provides these workers with appropriate radiation protection training and information.

#### *Article 18*

##### **Education, information and training in the field of medical exposure**

1. Member States shall ensure that practitioners and the individuals involved in the practical aspects of medical radiological procedures have adequate education, information and theoretical and practical training for the purpose of medical radiological practices, as well as relevant competence in radiation protection.

For this purpose Member States shall ensure that appropriate curricula are established and shall recognise the corresponding diplomas, certificates or formal qualifications.

2. Individuals undergoing relevant training programmes may participate in practical aspects of medical radiological procedures as set out in Article 57(2).

3. Member States shall ensure that continuing education and training after qualification is provided and, in the special case of the clinical use of new techniques, training is provided on these techniques and the relevant radiation protection requirements.

4. Member States shall encourage the introduction of a course on radiation protection in the basic curriculum of medical and dental schools.

## CHAPTER VI

### **OCCUPATIONAL EXPOSURES**

#### *Article 32*

##### **Operational protection of exposed workers**

Member States shall ensure that the operational protection of exposed workers is based, in accordance with the relevant provisions of this Directive, on:

- (a) prior evaluation to identify the nature and magnitude of the radiological risk to exposed workers;
- (b) optimisation of radiation protection in all working conditions, including occupational exposures as a consequence of practices involving medical exposures;
- (c) classification of exposed workers into different categories;
- (d) control measures and monitoring relating to the different areas and working conditions, including, where necessary, individual monitoring;
- (e) medical surveillance;
- (f) education and training.

#### *Article 34*

##### **Consultations with a radiation protection expert**

Member States shall require undertakings to seek advice from a radiation protection expert within their areas of competence as outlined in Article 82, on the issues below that are relevant to the practice:

- (a) the examination and testing of protective devices and measuring instruments;
- (b) prior critical review of plans for installations from the point of view of radiation protection;
- (c) the acceptance into service of new or modified radiation sources from the point of view of radiation protection;
- (d) regular checking of the effectiveness of protective devices and techniques;
- (e) regular calibration of measuring instruments and regular checking that they are serviceable and correctly used.

*Article 37*

**Controlled areas**

1. Member States shall ensure that the minimum requirements for a controlled area are the following:
2. Member States shall ensure that the undertaking is responsible for implementation of these duties taking into account the advice provided by the radiation protection expert.

*Article 38*

**Supervised areas**

1. Member States shall ensure that the requirements for a supervised area are the following:
2. Member States shall ensure that the undertaking is responsible for implementation of these duties taking into account the advice provided by the radiation protection expert.

*Article 44*

**Access to the results of individual monitoring**

6. Member States shall ensure that arrangements are in place for the appropriate exchange, among the undertaking, in the case of an outside worker, the employer, the competent authority, occupational health services, radiation protection experts, or dosimetry services of all relevant information on the doses previously received by a worker in order to perform the medical examination prior to employment or classification as a category A worker pursuant to Article 45 and to control the further exposure of workers.

CHAPTER VIII

**PUBLIC EXPOSURES**

*Article 68*

**Tasks for the undertaking**

Member States shall require the undertaking to carry out the following tasks:

- (a) achieve and maintain an optimal level of protection of members of the public;
- (b) accept into service adequate equipment and procedures for measuring and assessing exposure of members of the public and radioactive contamination of the environment;
- (c) check the effectiveness and maintenance of equipment as referred to in point (b) and ensure the regular calibration of measuring instruments;
- (d) seek advice from a radiation protection expert in the performance of the tasks referred to in points (a), (b) and (c).

*Article 79*

**Recognition of services and experts**

1. Member States shall ensure that arrangements are in place for the recognition of:
  - (a) occupational health services;

- (b) dosimetry services;
- (c) radiation protection experts;
- (d) medical physics experts.

Member States shall ensure that the necessary arrangements are in place to ensure the continuity of expertise of these services and experts.

If appropriate, Member States may establish the arrangements for the recognition of radiation protection officers.

2. Member States shall specify the recognition requirements and communicate them to the Commission.

#### *Article 82*

##### **Radiation protection expert**

1. Member State shall ensure that the radiation protection expert gives competent advice to the undertaking on matters relating to compliance with applicable legal requirements, in respect of occupational and public exposure.

2. The advice of the radiation protection expert shall cover, where relevant, but not be limited to, the following:

- (a) optimisation and establishment of appropriate dose constraints;
- (b) plans for new installations and the acceptance into service of new or modified radiation sources in relation to any engineering controls, design features, safety features and warning devices relevant to radiation protection;
- (c) categorisation of controlled and supervised areas;
- (d) classification of workers;
- (e) workplace and individual monitoring programmes and related personal dosimetry;
- (f) appropriate radiation monitoring instrumentation;
- (g) quality assurance;
- (h) environmental monitoring programme;
- (i) arrangements for radioactive waste management;
- (j) arrangements for prevention of accidents and incidents;
- (k) preparedness and response in emergency exposure situations;
- (l) training and retraining programmes for exposed workers;
- (m) investigation and analysis of accidents and incidents and appropriate remedial actions;
- (n) employment conditions for pregnant and breastfeeding workers;
- (o) preparation of appropriate documentation such as prior risk assessments and written procedures;

3. The radiation protection expert shall, where appropriate, liaise with the medical physics expert.

EN L 13/32 Official Journal of the European Union.

4. The radiation protection expert may be assigned, if provided for in national legislation, the tasks of radiation protection of workers and members of the public.

#### *Article 84*

##### **Radiation protection officer**

1. Member States shall decide in which practices the designation of a radiation protection officer is necessary to supervise or to perform radiation protection tasks within an undertaking. Member States shall require undertakings to provide the radiation protection officers with the means necessary for them to carry out their tasks. The radiation protection officer shall report directly to the undertaking. Member States may require employers of outside workers to designate a radiation protection officer as necessary to supervise or perform relevant radiation protection tasks as they relate to the protection of their workers.

2. Depending on the nature of the practice, the tasks of the radiation protection officer in assisting the undertaking, may include the following:

- (a) ensuring that work with radiation is carried out in accordance with the requirements of any specified procedures or local rules;
- (b) supervise implementation of the programme for workplace monitoring;
- (c) maintaining adequate records of all radiation sources;
- (d) carrying out periodic assessments of the condition of the relevant safety and warning systems;
- (e) supervise implementation of the personal monitoring programme;
- (f) supervise implementation of the health surveillance programme;
- (g) providing new workers with an appropriate introduction to local rules and procedures;
- (h) giving advice and comments on work plans;
- (i) establishing work plans;
- (j) providing reports to the local management;
- (k) participating in the arrangements for prevention, preparedness and response for emergency exposure situations;
- (l) information and training of exposed workers;
- (m) liaising with the radiation protection expert.

3. The task of the radiation protection officer may be carried out by a radiation protection unit established within an undertaking or by a radiation protection expert.

## **A training course covering the core knowledge requirements for RPOs**

### **Syllabus**

#### **I Radiation protection principles**

##### **Basic concepts**

- Atomic structure
- Radionuclides
- Concept of radioactive decay
- Production of x-rays
- Radiation quantities and units

##### **Biological effects of radiation**

- Interaction of radiation with cells and tissues
- Stochastic and tissue (deterministic) effects
- Effects of low doses

##### **Legal requirements**

- Radiation protection legislation
- Codes of practice, guidance
- Dose limits

##### **The principles of radiation protection**

- Justification, optimisation, dose limits
- Time, distance, shielding
- Application of the inverse square law

#### **II Operational requirements**

##### **Practical aspects of radiation protection**

- Common uses of radiation
- The practical application of ALARA
- Safety and warning systems
- Local rules

##### **Tasks and duties of the Radiation Protection Officer**

- Source accountancy
- Supervision of work
- Environmental monitoring
- Dose record keeping
- Maintenance of safety and warning systems
- Health surveillance
- Source storage and security
- Waste disposal
- Liaison with the RPE

#### Radiation protection measurement techniques

- Environmental monitoring
- Dose rate and surface contamination monitoring
- Radiation monitoring instruments
- Personal dosimetry
- Types of personal dosimeters
- Regulatory requirements for monitoring

#### Emergency planning

- lessons learned from incidents and accidents
- Regulatory requirements
- Emergency response arrangements
- The RPO role in emergency response