

A Portuguese perspective of the role, duties and responsibilities for QE/RPE^{*}, QT/RPO^{*}, OT/RW^{*} on ionizing radiation

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* QE-Qualified Expert; RPE-Radiation Protection Expert;
QT-Qualified Technician; RPO- Radiation Protection Officer;
OT-Operator Technician; RW- Radiation Workers

ABSTRACT

In Portugal, ionizing radiation is being used in different fields of application such as medical, industrial, teaching and research areas, leading to the imperative need of having an optimized radiological protection framework in place including the establishment of a chain of trained and educated experts in radiological protection. In this work, a proposal concerning the duties and responsibilities assigned to the different categories of Radiological Protection Experts, as well as the fundamental education and training requirements in the area of radiological protection, are presented. A brief analysis of the proposal implications on future professional qualifications for the different National sectors is discussed, clearly showing the need for the establishment of regulations towards harmonization, a common objective with EUTERP goals.

1 – Introduction

Portugal has a complex regulatory framework characterized by the existence of various Competent Authorities on Radiation Protection and Nuclear Safety dependent on different Ministries and an Independent Commission on Radiological Protection and Nuclear Safety (CIPRSN) created by the Government under the Prime Minister (Decree Law nº 139/2005). Despite the fact that some of the duties of this Commission may correspond to those attributed to a Regulatory Body namely the evaluation of the present regulatory system, the main role of the CIPRSN is to prepare the framework for the establishment of the future Portuguese Regulatory Body on Radiation Protection and Nuclear Safety.

Portugal has no nuclear power plants but has a Research Reactor and, in the country, ionizing radiation is used in many areas of application (medical, industrial, education and research), justifying, the importance of having qualified professionals working in radiation protection.

The Directive 96/29/Euratom stresses the importance of having highly qualified professionals working in areas where ionizing radiation is used, and recognizes the fact that real protection of the users and of the public in general is only attainable through a comprehensive and effective educational and training program of the professionals dealing with ionizing radiations.

However, this is not a simple subject as reflected by the great diversity in the current approaches adopted by the Member States to the training and qualification procedures

required for the recognition of the different professional categories established by the Directive, as is the case of the Qualified Expert (QE) in Radiation Protection [EC, 2003].

These different approaches, resulting sometimes in sub-divisions of the main professional categories derive, mainly, from the existence of strong sectors such as the nuclear power sector which brings the need to distinguish between professionals working in this sector and the remaining.

In order to improve the existent legislative package making it compatible with 96/29/Euratom Directive, steps have been given towards the approval of a legislative framework defining the professional qualifications in radiological protection, considering three different levels of expertise and the corresponding roles, duties and responsibilities, in line with the EUTERP perspective.

It must be emphasized that in the Annex of the Communication 98/C133/03 [EC, 1998(a)] concerning the implementation of the Council Directive 96/29/Euratom, a basic syllabus was already proposed for the training of the QE. It recognizes that certain items should be covered in more detail for specific applications suggesting the need to consider specific requirements for the expertise of the QE according to the context of its field of work, such as nuclear installations, industrial facilities, education, training, research and medical applications. Concerning the medical sector, Directive 97/43/EURATOM, entitled Medical Exposure Directive (MED), was published and transposed to the Portuguese National Law by Decree Law nº 180/2002 from the Ministry for Health. This Directive has defined the Medical Physics Expert (MPE) as a professional that should assume the responsibilities of a Radiation Protection Expert in the scope of medical exposures, amongst his other duties.

To assist Member States with the transposition of the MED, the European Commission prepared a number of technical guidelines aiming at providing further clarification of the requests established by the Directive [EC, 1998(b)]. The Commission has also provided further guidelines on education and training in radiation protection for medical exposures - Radiation Protection 116 [EC, 2000].

With regard to radiation protection in the medical sector, two European directives (96/29/EURATOM and 97/43/EURATOM), currently known as the occupational and public exposure and the medical exposure directives respectively, have to be considered. It must be highlighted that from the point of view of the occupational

exposure, there is no distinction between industrial, medical or research applications in what concerns the QE or QT (Qualified Technician) qualifications,. The duties are identical for all these areas with no exception.

It is acceptable that, in the medical field, the expertise of a QE can be attributed to the Medical Physics Expert (MPE), but the ability of a MPE to carry out the duties of a QE will depend on the specific training and experience of the individual MPE. In other areas, however, the professionals need to undergo education and training programs adequate to their level of responsibilities.

It should not be ignored that, as part of a correct safety culture, the owner of a given facility or activity should be considered the first responsible for radiation protection safety [IAEA, 2006]. The proper application of the safety culture should be stated in the radiation protection and safety programme, which includes the definition of duties and responsibilities of all the professionals that are engaged in activities related to the use of ionizing radiation. At national level, the duties of the experts should be in agreement with the contents of the relevant European Directives, as well as the recommendations of other international bodies such as ICRP and IAEA. At the radiation user level, the action of the experts should be clearly stated in a radiation protection and safety programme that must be in accordance with the national legislation.

2 – Professional qualifications in Radiological Protection

A proposal related to professional qualifications in radiological protection is currently under governmental evaluation. It considers a common training and education framework for all areas of activity, but does not close the door for specific approaches to specific sectors of application of ionizing radiation: medical, industrial and education and research.

The new proposal takes into account three levels of professional qualifications in radiological protection:

Level 1: Qualified Expert (QE) equivalent to the RPE;

Level 2: Qualified Technician (QT) equivalent to the RPO;

Level 3: Operator Technician (OT) equivalent to the RW.

The QE/RPE will establish the radiation protection and safety programme in accordance with the relevant national requirements. He also will supervise radiation protection and safety within the facility.

The QT/RPO will ensure that work involving radiation is carried out in compliance with the established programme.

The OT/RW has to follow the instructions from the radiation protection and safety programme during the routine work.

2.1 – QUALIFIED EXPERT (QE)

2.1.1 – Duties of the Qualified Expert

The Qualified Expert shall:

- a) Collaborate in the preparation of technical and safety documents required to obtaining the licensing of radiological installations;
- b) Coordinate the activities related to radiological protection of the qualified technicians working at the same facility (institution);
- c) Establish safety and radiological protection rules and procedures to be followed in the course of any work involving ionizing radiation carried out at the same facility (institution).
- d) Classify and signalize the radiation hazard areas, as well as carrying out the classification of the workers into different categories as far as radiation protection is concerned;
- e) Evaluate the radiological hazard of the highest possible exposure/ contamination risk at workplaces;
- f) Advise on (or elaborate) the contingency and emergency plans, namely those related to monitoring and contamination;
- g) Advise on the optimization of safety and radiological protection taking into account new techniques or results of research related to the use of ionizing radiation;
- h) Carry out the analysis of records, namely those of area monitoring and individual dosimetry, and tests carried out on the control, safety and signalization systems as well as other prevention and control procedures;
- i) Elaborate recommendations for corrective actions when necessary;
- j) Evaluate the safety and radiological protection conditions of the installations by means of internal auditing;

- k) Advise on, and participate in, the radioprotection planning of new radiological installations (perform/verify the calculations related to new/existent radioprotection barriers and supervise the construction work);
- l) Perform the compliance/acceptance tests related to the radioprotection of new radiological equipments;
- m) Elaborate radioactive waste management and clearance plans;
- n) Elaborate the emergency plan and supervise the required practical training on site;
- o) Elaborate the notice that will be sent to the authority, mentioned in Decree-Law n.º 174/2002, responsible for the technical intervention, required to reestablish the safety and radiation protection standards in an installation where an emergency situation occurred.
- p) Investigate the causes for deficient functioning, incidents or accidents occurred in radiological installations and elaborate proposals of corrective actions to prevent new occurrences;
- q) Coordinate the dismantling of radiological installations in the context of the decommissioning of those installations;
- r) Be directly involved in the education and training of the modules devoted to the establishment of guidelines adequate to the liability and radiation risk of the tasks to be performed by exposed workers
- s) Supervise the activities of workers external to a given radiological installation, guaranteeing, when necessary, the fulfillment of radiation protection measures in controlled areas;
- t) Guarantee that radiation workers undergo adequate education and training programs.

All advices of a QE should be delivered in written documents.

2.1.2 – Requirements (Basic Education)

In order to become a QE, the applicant must have an academic degree in:

- a) Physics, Physics Engineering, Technological Physics or Biomedical Engineering;
- b), Any other certificate issued by an University, subject to CV analysis.

2.1.3 – Education and training

It is recommended that the duration of the education and training course should be at least 300h, including theoretical and practical activities (with the latter consisting of approximately 50% of the total course duration).

All applicants must undertake an on-the-job training of 6 months, deliver a final report and go through a final examination.

The contents of the training program will depend on the specific area of work of the QE candidate.. A QE for medical applications will perform the on-the-job training in a medical facility whereas a QE for industrial application will do the on-the-job training in a company where ionizing radiation is regularly used.

2.1.4 – Basic Syllabus for QE in radiation protection

The reference program of the training course of a Qualified Expert follows the syllabus of EU/IAEA.

Additional topics will be recommended for QE specialized in different fields.

2.2 – QUALIFIED TECHNICIAN (QT)

2.2.1 – Duties of Qualified Technician

The Qualified Technician shall:

- a) Carry out the procedures determined by the qualified expert;
- b) Oversee compliance of the requirements regarding the safety and the radiological protection established for the supervised and controlled areas;
- c) Oversee the correct use of individual dosimeters by all the exposed workers;
- d) Collaborate in the supervision of the activities of external workers guaranteeing, when necessary, the fulfillment of radiation protection measures in controlled areas;
- e) Verify that the radiation monitoring equipments is operational and correctly used;
- f) Perform the area and individual monitoring, keeping updated records;
- g) Perform the periodic tests of the control, safety and signaling systems;
- h) Verify that the storage of the radioactive sources and waste is done according to the safety provisions;
- i) Report to the qualified expert any incident or accident;
- j) Train the emergency plans;

2.2.2 – Requirements (Basic Education)

The requirements to become a QT are those mentioned above for a QE, but graduates in Physics, Chemistry, Medicine, Engineering, Veterinary or Health Sciences from the University or Polytechnic Institutes, can also apply.

2.2.3 – Education and training

Concerning education and training in radiation protection it is suggested that the duration of a course will depend of the complexity of the exposures. It is suggested in the governmental proposal that the duration of a course will be at least 100h, including theory and practice (experimental and tutorial) with the practical part being about 50% of the total course's time. However, this minimum must depend on the complexity of the exposures. For some professionals it could be less than 100h.

There should be written examinations of all the modules contained in the course.

2.2.4 – Basic Syllabus for QT in radiation protection

The reference training course programme for a Qualified Technician follows the syllabus of UE/IAEA.

Specific additional topics may be recommended.

2.3 – OPERATOR TECHNICIAN

2.3.1 – Duties of the Operator Technician

The Operator Technician shall:

- a) Operate the equipment under the conditions defined by the Qualified Expert and Qualified Technician;
- b) Perform the tasks assigned by the Qualified Expert and Qualified Technician.

2.3.2 – Requirements (Basic Education)

The minimum requirement is the degree corresponding to approval in the 12 first years of the national education system.

2.3.3 – Education and training

The requirements for education and training for **OT** are established in artº 30º and 31º and Annex II of Decree – Law nº 167/2002 from the Ministry for Health.

3. Professional qualifications sector by sector

In this Chapter, some of the specificities of the different sectors dealing with ionizing radiation, medical, industrial and research and education, are presented. The text that follows reflects the views of authors directly involved in specific sectors. As expected, in each sector different views can arise resulting from individual experience due to distinct perceptions on the role, the duties and competences of the radiation protection experts. In this sense, the efforts envisaged by EUTERP towards harmonization are welcome.

3.1 – Medical sector

Reinforcing the EFOMP Malaga Declaration [EFOMP, 2006] it is fully subscribed the view that “The MPE must be the professional to supervise and assume the responsibilities of the Radiation Protection activities in Hospitals, including patients, working staff, members of the public and visitors to the Hospitals”.

In fact, it is believed that the QE as defined by the Council Directive 96/29/EURATOM [EC, 1996] concerning the medical environment is represented by the MPE as defined by the Council Directive 97/43/EURATOM [EC, 1997].

The Communication 98/C133/03 [EC, 1998(a)] stresses the three-fold aspects to achieve the required expertise of the QE: education, training and practical experience. The basic syllabus of the Annex of this Communication together with the previous required qualifications (basic education) completes the first aspect. Training in the sense of on-job training can be part of the education phase but by itself it is not sufficient. It needs to be supplemented by appropriate practical experience, the duration of which will depend on the complexity of the field of work.

Concerning the medical sector, training in general and specific training in radiation protection are widely recognised as one of the basic components of optimisation programmes for medical exposures [EC, 1998(b)]. General recommendations for training programmes in radiation protection are provided in Radiation Protection 116 [EC, 2000] including lists of topics for different areas like diagnostic radiology, interventional radiology, radiotherapy and nuclear medicine.

All staff with responsibility for medical exposures will need training in radiation protection. A proposal for training areas and levels of knowledge is included in the

document concerning the different groups of health workers according to their roles and responsibilities (medical doctors, nurses, maintenance engineers, radiographers, etc.). Medical physicists are excluded from this list on purpose because it is stressed that “Medical Physics Experts (MPE) should know all the training areas at the highest level” (paragraph 24) [EC, 2000].

Comparing the “Training modules on radiation safety for the medical field” proposed in Annex 6 [EC, 2000] and recommended for MPE with the “Basic syllabus” of the Annex of Communication 98/C133/03 concerning the training of the QE, we can conclude that they are coincident in more than 90% of the items.

Also EFOMP, in 1999, produced the Policy Statement No. 9: “Radiation Protection of the Patient in Europe: The Training of the Medical Physics Expert in Radiation Physics or Radiation Technology” [EFOMP, 1999] which constitutes the EFOMP contribution to the Medical Exposure Directive in what concerns the needs for education and training of the MPE in radiation protection. And being aware for the needs in harmonizing and providing appropriate answers to the new European challenges EFOMP carried out a complete revision of the EU status concerning training and education [EFOMP, 2007].

EFOMP proposes a common education scheme for medical physicists divided into three stages: the basic education, the post-graduation (university master’s degree) in medical physics (including a recommended core curriculum that contemplates radiation protection) and the third an at least a 2 years in-service training in hospitals. Once completed, the medical physicist can be recognised as a Qualified Medical Physicist.

The skills needed to achieve the qualification equivalent to MPE should not only be based on this total score but also on a minimum period of effective work as Medical Physicist, gaining experience, for at least one cycle of Continuous Professional Development (CPD) [EFOMP, 1998].

Recognized capacity means more than training. The needs for recognition by the competent national authorities, based on education, training and evidenced based professional experience is reinforced in the referred European documents both for QE and for MPE, in a very similar way, as we have demonstrated.

In either case a CPD-based renewal mechanism should be approved at the national level and wishfully within a global framework to complete profession harmonization within Europe.

The recently issued European Directive 2005/36/EC on the recognition of professional qualifications [EPC, 2005] establishes rules according to which specific professional qualifications should lead to automatic recognition in all Member States. A set of health care professions listed in the Appendix 5 of this Directive has an automatic recognition through the EU member states, solely based on the co-ordination of minimum training conditions.

The EFOMP efforts that aim at achieving recognition of Medical Physics as a regulated health care profession, on the basis of co-ordination of minimum training conditions allowing the free movement of professionals within Europe, are welcome.

In the scope of the European Directive 2005/36/EC, the requirements for the mutual recognition of QEs should follow or could be implemented by a clear definition of professions; this can easily be done if the division of QEs by sectors of work is followed.

The present status in Portugal favours the definition of a scheme complying with the European recommendations. In one hand, the legislative framework to be approved concerning the professional qualification in radiological protection and, on the other hand, the restructure process concerning the Medical Physics profession that is presently going on may lead to the implementation of education, training and recognition patterns that benefit from European discussion platforms like EUTERP.

Internal national movements towards the discussion and the reach for consensus in these issues are already the proof of this benefit.

3.2 – Industrial sector

Equipment using radiation sources can be found in many Portuguese industries ranging from gamma irradiators containing sealed radioactive sources, usually ^{60}Co and ^{137}Cs (gammaography) to radiation generators emitting either radiation beams such as in the case of electron beams, or X rays (radiography), not forgetting other sealed sources (ex: ^{192}Ir and ^{241}Am) of smaller dimension and activity that are being used in density or level meters (stationery or portable).

Accidents/incidents involving workers dealing with industrial radiation sources (even when classified as radioactive waste) have been reported all over the world showing a clear need for specific training in this area. In many cases, these occurrences are the

result of inexistent/deficient radiological protection procedures in the Company, often occurring in companies with a small non-specialized number of workers, due to ignorance on how to do it properly. Even accidents involving the melting of sealed sources or just the fact that these sources can be lost from the regulatory control and may be found in scrap metal cargos, show how important is the establishment of radiological protection programs at industrial level as well as the assignment of responsibilities to the correct experts in this area of application.

Education and training in radiological protection fundamentals, safety and security of sources and facilities, occupational radiation protection including designation of areas, workplace and individual monitoring, public exposure, storage of sources not in active use, decommissioning and source disposal as radwaste, safe transport of radioactive materials (class 7) including return to the supplier of spent or disused sources, emergency planning, preparedness and response procedures are fundamental in any training action at industrial level, regardless the Company's dimension. However, and due to the variety of the industrial scenarios, RPP (Radiological Protection Programs) are not yet guided by harmonized principles and the training needs may differ from site to site accordingly to the licensee choices.

Some publications of the IAEA [IAEA, 2003] mention the fact that “those with responsibility on radiation protection or whose actions or decisions could affect safety or lead to an accident or accidental exposure, shall have documented evidence of relevant education and training”. The documents considers the existence of a RPO, a QT/QO (small Companies dealing with low radiation doses) or both QT/QO and QE (for higher radiological risk situations, when additional expertise may be needed and the Company does not have the required expertise, a QE in radiological protection may be needed for safety assessments and hazard analysis) depending on the type and activity of the sources and the job involved.

The education and training and requirements must consider the different degrees of knowledge each class of workers has and requires to safely accomplish his/her job with radiation sources, in compliance with radiation protection principles and assuring that the general public and the environment are safe from any detrimental effects related to the industrial use of ionizing radiations.

3.3 – Education and Research Sector

The use of ionising radiation sources in Portuguese academic and research institutes is typically related to practical activities aimed at supporting education, training and research on subjects where radiation is directly or indirectly the topic of interest.

Current Portuguese regulations establish that all organisations using radiation sources in their premises must report their practices involving radiation to the competent authorities. Universities and research institutes are covered by these regulations. However, when the use of radiation is maintained at levels below the established exemption limits, reporting the practice is sufficient and no further authorisation is required [DL 165/2002, EC 1996].

In the absence of further national guidance on the organisation of radiation protection within the academic and research environments it is expected that practices regarding this topic may vary within organisations. Available data and information on how radiation protection issues are held allowed the identification of two different scenarios.

More frequently, radiation protection tasks were defined, planned and implemented by a senior member of staff (ex. researcher, group leader, and lecturer) with knowledge in the use of ionizing radiation within the context of its particular area of education or research. His/her decisions on the necessary radiation protection tasks to implement were based on his/her own judgment and examples of his duties are: the provision of basic training to students/researchers involved with the use of radiation, managing personal dosimeters and acting as the point of contact in case of radiation incident and/or emergency.

Less frequently, it was found that research institutes cooperated with on-site Health and Safety Departments to decide on radiation protection practices such as the organisation of basic training sessions on the safe use of radiation.

For both scenarios, no evidence was found of the existence of a radiation protection written policy defining clear responsibilities, guidelines or practical procedures and in both cases the people acting as the point of contact for radiation protection routine issues or emergencies had received no specialized training in radiation protection, and based his/her actions on acquired empirical knowledge.

Although these conclusions are based on a limited knowledge of the national situation, however, the need to establish a framework that assures good practices in the use of radiation sources in academia and research nationwide can be emphasised.

The role of radiation protection services within the university or a research institute should be to support education and research by providing advice and guidance to assure that practices involving the safe use of radiation for education, training and research purposes are implemented and maintained. In the existence of a Health and Safety Department in the organisation, cooperation between both services should be promoted.

Duties of a radiation protection service within academic and research environments, to a large extent, are similar to other sectors (medical and industrial).

The radiation protection services needs can only be adequately defined following a risk assessment survey based on the identification of the characteristics of the radiation sources to be used and the potentially exposed people. This will allow the estimation of local radiation risks providing useful information for the definition of the duties and responsibilities and the associated level of the expertise required (1, 2 and/or 3).

In the particular situation of university hospitals where the hospital is supported by a radiation protection service it may also provide radiation protection services to the university considering that there should be appointed a permanent point of contact in the university.

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