EDUCATION AND TRAINING NEEDS IN RADIATION PROTECTION
Agustín Alonso
Chair of Nuclear Technology. Nuclear Engineering Department
Madrid Polytechnic University
José Gutierrez Abascal, 2. 28006 Madrid. Spain
Phone: +34 91 336 3112 ext 102
Fax: +34 91 336 3002
E-mail: agustin.alonso@ctn.din.upm.es

Abstract. Education and training needs in radiation protection increase worldwide with expanding uses of ionizing radiation, more strict requirements and new fields of interest, such as environmental protection and natural radioactivity. Professional education and training is regulated and controlled by international recommendations and national standards, but there are still practices, such as dismantling, remediation and disposal, which are not specifically covered; moreover harmonization has not yet been reached. Vocational education is practiced in high-level learning institutions, but the stagnation of nuclear power in many countries and the phobia of society for radiation are reducing the number of applicants. Social education and information is a basic human right difficult to achieve. The use of modern teaching tools and distance learning will increase the efficiency of education and training. Recent international conferences on education and training have analyzed in depth the needs and deeds of such endeavour. The IAEA has been making efforts to produce advanced teaching materials and has introduced the concept of teaching the teachers to multiply efficiency, it also has recognized the importance of native languages. The European Union is in the process of introducing harmonization among the member countries in the educational requirements for the qualified expert.

1. INTRODUCTION

The needs for education and training on radiation protection comes from the increasing range of applications of ionizing radiation in medicine, research and industry; from the increasing radiation safety and security requirements on the use of such radiation sources, and from new fields of interest such as the present concerns for the protection of the environment and natural radiation. Education and training on radiation protection is needed, inter alia, in regulatory organizations, operating nuclear power plants and fuel cycle installations, in facilities where radiation sources and radiation producing devices are used, in the transport of radiation sources, in the management of radioactive waste and in dismantling nuclear installations or cleaning old research and production facilities.

The education and training requirements vary considerably from practitioners requiring only elementary knowledge, to high-level educators and researchers, in need of the highest possible educational level. Radiation protection or radiation safety is considered an applied chapter of atomic and nuclear physics. In that sense it covers from the complicated concepts of quantum mechanics to simple descriptions on how radiation is produced and interacts with inert and biological matter. It also goes from the complicated technical aspects imbedded into radiation shielding of large sources of radiation to the most elementary protection procedures in the handling of small radiation sources.

But radiation protection is also founded on some basic principles – justification, optimization and limitation – that have become part of the legislative and legal framework. In particular, the optimization principle brings about concepts such as risk-benefit analysis, which introduces economics and ethics into education and training. The new movement
towards protecting the environment and the non-human species against the harmful effects of ionizing radiation includes a new field of research and ethical conduct.

The increasing radio phobia in our societies also invites to create activities aimed at educating the general public on the risks and benefits of ionizing radiation and in producing transparent information on the use and applications of such radiation.

Education and training in radiation protection can be accomplished for different purposes in different ways. The professional education and training has the main objective of obtaining recognition for work, generally under prescriptive requirements. The vocational education aims at gaining knowledge to obtain academic titles. Finally, social education and information is the way to increase the knowledge level of the society as a whole. Each country should analyse the education and training needs for each one of the existing modalities and take actions to satisfy such needs.

This presentation will cover the education and training needs on radiation protection, and how to fulfil such needs, in different fields of activities, including regulation; power applications; medical, research and industrial users; in the management of radioactive waste; in dismantling of installations and remediation of contaminated sites, and in natural radiation and protection of the environment, as well as on social education and communication.

In recent times two international events of a large significance for education and training have taken place: The International Conference on National Infrastructures for Radiation Safety: Towards Effective and Sustainable Systems (Rabat, Morocco 1-5 September 2003) and The II International Conference on Radiation Protection Training: Future Strategies (Madrid, 17-19 September 2003). The main findings and recommendations produced in these two events will also be included.

2. EDUCATION AND TRAINING NEEDS AND REQUIREMENTS

As said in the Introduction, education and training in radiation protection can have different objectives and can be obtained in different ways. The objectives can be divided into three major categories: professional, vocational and social.

Professional education and training is pursued by those individuals searching for working positions in licensed or registered practices and activities requiring recognized regulatory positions, such the qualified experts. In general the education and training programmes are well defined in regulatory documents and such individuals need to prove their levels of education and training. Licensees or registrants through in-house training programmes or through service companies generally deliver professional education and training. In occasion’s university departments, research institutions and other learning establishments offer ad hoc courses to cover at least part of such education and training. In some countries professional societies are also very active in this field.

Education and training of radiation protection experts is well established and defined in the IAEA Basic Safety Standards. The IAEA has also developed appropriate training material and has conducted pilot courses covering a large range of applications. Nevertheless, these recommendations could be interpreted in different ways, likewise the supporting training material used in different countries has not reached and appropriate level of harmonization.

The qualified expert on radiation protection is well defined in the 96/29 Euratom Directive, as well as its level of education and training. Nevertheless the details of such training and, most importantly, the accreditation system is left to the individual member countries, which have not yet reached a consensus on that important subject, neither agreements have been reached, nor even fully discussed on the mutual recognition of such experts.
Those individuals interested in gaining knowledge and obtaining academic degrees search for vocational education and training. They may or not end up working as professionals in radiation protection; in the first case they will have an advantage in obtaining the required recognition. Vocational education and training is offered in university departments, vocational schools and other recognized educational organizations, through under-graduated and graduated courses, as well as high-level doctoral courses.

University chairs and departments in national or private institutions can provide a wide variety of education and information activities, from high level doctoral courses to customized information courses in accordance with given syllabi to professionals at different levels, from industry executives to fire brigades. In fact, radiation protection has been part of the curricula in the Catalonian and Madrid Polytechnic Universities since the early sixties, valid texts and other teaching materials have also been published.

Social education and communication is a basic human right that must be properly fulfilled. The present social phobia to radiation, irrational in many respects, makes social education and communication an urgent issue; it includes many peculiarities and involves a set of abilities difficult to find together in single individuals and organizations. Communicating facts to the public requires knowledge, training and expertise. Those experts on communications are generally no knowledgeable enough in science and technology; on the other side, good scientists are rarely experts in communication.

Many professional societies and organizations, such as the Spanish Society on Radiation Protection, have established fora and other activities to inform the public. Even the IAEA has produced a handbook on how to communicate with the public. So far, in most cases, these activities have not produced significant results and the phobia to certain uses of radiation, mainly nuclear power, has not abated. This human dimension of the radiation protection specialist should not be forgotten. The creation of Codes of Ethics in many professional societies, including IRPA, is a step forward in gaining the confidence of the public.

Professional education and training may by pursue by thousands of individuals in a given country at different levels. Statistics are difficult to produce and compare. In Spain, for example, up to 76 thousand professionally exposed individuals are registered. In a worldwide basis a few million persons will require some radiation protection education and training. As a consequence, international organizations, such as the IAEA are recommending that countries should be prepared to provide such services. Likewise, vocational education and training, and a well-designed programme on social education and information must also cover many individuals. International and supranational organizations are also recommending to member countries that the necessary infrastructures be created to cope with such needs and demands.

3. EDUCATION AND TRAINING NEEDS AND DEEDS IN REGULATORY ACTIVITIES

Regulatory education and training is actually needed to create experts in radiation protection to serve both the regulatory organizations and their counterparts, that is the responsible licensees and registrants. The IAEA guide RS-G-1.4 “Building Competence in Radiation Protection and the Safe Use of Radiation Sources” clearly indicates the responsibilities of the different actors. Governments and regulatory authorities are the key players in introducing professional education and training on radiation protection in the respective countries, but such authorities themselves need to be highly competent on the matter.

The three major responsibilities of regulatory organizations are closely related to: Drafting regulations, verifying compliance with such regulations and exercising enforcement to prevent and correct deviations from the rules. Therefore, the education and
training of persons performing such activities goes beyond the technical knowledge and enter into legislation and judgement. The competence of the regulatory personnel on radiation protection has been termed by the International Nuclear Safety Advisory Group, INSAG, in a soon to be published report, as one of the main attributes for independence of regulatory decisions.

Regulatory education and training demands high level and well-coordinated educational activities. Writing legislation, requirements, guides, instructions and procedures demands deep knowledge of the scientific and technical aspects supporting the subject matter, a long accumulated experience and some legal skills. Moreover, such requirements need to be wide in scope to cover from complicated technical operations to simple activities and from elementary protection measures to complex emergency situations. Verifying compliance with regulations in analysing justifications in license applications and in performing inspections demands a deep knowledge of the activity to be licensed and on the applicable rules and standards. Inspecting installations or documentary information requires a deep knowledge of the installations proper and on what to look for when reviewing documentary evidences. Enforcement is a very delicate subject, as it normally includes subjective interpretation on how to grade the offences committed. The ethical need of being just in the interpretation requires a good understanding of the rules and the technicalities involved in the case.

Within the regulated organizations about the same type of knowledge should be required. Radiation protection aspects have to be incorporated into any application for a license in full compliance with the applicable regulations. Verification of compliance – both evaluation and inspection - is generally contained in written documents, which are presented to the responsible operating organization before the findings are made official. It is for the benefit of the responsible operator to have sufficient knowledge to debate about the correctness of such findings. The same comments apply also to any enforcement activity.

High-level educational institutions may provide for such education but not in a coordinated manner. Nuclear law, nuclear physics and nuclear technology, basic and applied radiation protection for a multitude of applications can be taught in the universities at different levels. The coordination of such knowledge with that of the installation specifics and procedures has to be managed by the regulatory institution itself. The Nuclear Safety Council of Spain, for instance, has in place a substantial internal training programme for its own personnel and sustains a number of scholarships for young graduates who receive on the job training on some radiation protection matters. The Council also maintains an Expert Group to analyze the enforcement activities.

4. EDUCATION AND TRAINING NEEDS AND DEEDS IN OPERATING INSTALLATIONS

The education and training of operating personnel is well considered in the IAEA Basic Safety Standards 115. Of particular importance is the introduction of the terms qualified expert and radiation protection officer, which have also been introduced in 96/29Euratom Directive, although with slightly different definitions, and therefore adopted in the national legislation of the member countries.

The figure of the qualified expert is receiving a great deal of attention within the European Union. As required in the definition, those individuals have to be technically competent and be designated as such. The Union is looking for the minimum requirements for technical competence and the formal designation process for that to be accepted in all countries across the Union. The survey performed clearly indicates that there is a large diversity of requirements and recognitions.
In the case of Spain, the figure was formally introduced in Decree 2869/72, enacted in 1972, and it has been honoured in the recent Royal Decree 783/2001. The Nuclear Safety Council has the power to include in the operating license whether or not a given installation should have a Radiation Protection Service of its own or count for that purpose on an external Technical Unit for Radiation Protection. In both cases, the head of the Service, or that of the Unit, is considered as the qualified expert, who has to be formally recognized by the Council under a proposal for the responsible owner/operator of the installation. The Council, in 1986, published a Safety Guide 7.2 establishing the minimum education and training requirements for obtaining the needed recognition. But education and training needs in installations where practices are conducted is not limited to the qualified expert, it also includes other personnel related to the installation and also to outsiders working temporarily in the installations. The degree of education and training depends upon the risk associated to the practice.

4.1 Education and Training in Nuclear Power Plants, Fuel Cycle Installations and Industry

Radiation protection activities in nuclear power plants are of a large variety, going from performing radiation surveys to planning for emergency interventions. In most cases each power plant will have a qualified expert and several radiation protection officers and practitioners. In the case of Spain, such plants will require a Radiation Protection Service as part of the operation team. One typical characteristic of the radiation protection activities in operating nuclear power plants is the preventive nature of such activities and the dependence from the specificities of the given plant. All this makes the ALARA principle to be heavily applied in operating nuclear power plants and applicable in the corresponding degrees to all types of operating personnel.

Radiation protection education and training in Spanish nuclear power plants is mainly performed in-house, in accordance with the specific regulatory requirements, but also attending the needs of the plant itself. The Spanish operating nuclear power plants have developed a common standard on plant personnel education and training, which has been accepted by the Nuclear Safety Council. This standard covers all types of operating personnel. In general, following such standard, each power plant has an in-house service that provides such training. The power plant management may contract with external organizations, generally reactor suppliers and service companies, to deliver such training, but always within the umbrella of the in-house training service.

Deregulation of the electricity market has fostered the economical aspects of reactor operation, that, together with the lack of short and medium term perspectives in the nuclear sector, are causing a loss of expertise and so it has created the risk of loosing the know-how acquired through many years of experience on radiation protection. Therefore there is the need for urgent action. The use of radiation sources in the industry may be confronted with a similar problem.

Radiation protection activities in fuel cycle installations have their own specificities. Activities in the first part of the cycle mainly include natural and enriched uranium. The use of MOX fuel introduces plutonium into the system. Radiation protection in reprocessing plants includes added difficulties. The experience in Spain is limited to the first kind and the licensee is a national company covering mining, milling, conversion and fuel manufacturing and transport. In any case, requirements and how to comply with them are generally well established.

The education and training in the safe use of radiation sources for industrial purposes, mainly radiography, is regulated in most countries. Nevertheless, the mobility of such sources and the economic incentives behind their use produce, in general, the highest
doses to personnel. This is of concern in many countries and actions are been taken to increase the safety of such operations and the radiation protection of the workers.

4.2. Education and Training in the Medical Field

Specific radiation protection education and training needs and deeds in the medical field are well covered in most countries by present standards. In Spain, Royal Decree 1132/1990 requires that appropriate radiation protection education and training is needed for any responsible person using ionizing radiation in medicine. Later on, to assure compliance with 97/43/ Euratom Directive, Royal Decree 815/2001 further establishes that radiation protection should be included in the teaching curricula and practices in University Faculties and Schools of Medicine. But harmonization is far from been achieved. This seems to be also the case in other countries.

The Spanish State Faculties for Medicine and Dentistry have been working in the development of a common education curricula, either compulsory or optional, to avoid the present differences and to reach an acceptable level of harmonization. The harmonization process should continue until it reaches the appropriate level, taken into account the peculiarities of each institution. In all cases, it is recommended that such training and education should be provided in close cooperation with the radiation protection services in the attached hospitals.

More recently, a group of high level professionals from several universities, radiation protection officers and representatives from research centres and the Nuclear Safety Council have proposed a basic radiation protection curricula for the Faculties of Medicine and Dentistry and other Medical Schools in the country. This course, with duration from 20 to 40 hours, is based on the recommendations coming from the European Union in publication *Radiation Protection* 116. A pilot course has already been conducted at the Faculty of Medicine in the Madrid Complutense University.

To contribute and help on the harmonisation process, the exchange of information among world-wide professionals and regulatory bodies should be reinforced. As a consequence, in the Rabat and Madrid International Conferences, it has already been proposed to create a network to circulate information. For the moment, this network could be simply based on a list of electronic mail addresses of all concerned persons and will allow the circulation of information of common interest, on a voluntary basis.

4.3. Education and Training in Radioactive Waste Management

Specific education and training is needed for the correct management of radioactive waste. The handling of low and intermediate level radioactive waste has been covered by several IAEA standards, but the final disposal of highly radioactive long life waste is still under consideration. Education and training on radiation protection for such activities has not been specifically considered, although general education and training in radiation protection may suffice for some given cases.

Waste is produced and treated in nuclear power plants, fuel cycle installations, medical applications, research institutions and industry. Low and intermediate waste is generally solidified, conditioned and transported to and stored in near surface installations. Highly radioactive waste is recycled or stored in preparation for the final disposal. Of special concern are the long-term storage and the final disposal of irradiated nuclear fuel. The first steps of the process, up to transportation to the disposal facility, are generally under the responsibility of the waste producer; transport and store are mainly under the responsibility of dedicated national institutions or waste operators. In all these operations the needs for experts on radiation protection is growing due to increasing number of practices using
radiation sources and producing waste, but also because of the accumulation of waste due to the absence of disposal facilities in many countries and the lack of appropriate or incomplete legislation on the matter. It is believed that such demands for education and training have not been properly analyzed in many countries.

In Spain the national Radioactive Waste Disposal Agency, Enresa, is sponsoring a certain number of training courses in several Spanish universities on how to manage radioactive waste in a safe manner and within the radiation protection standards. One of the most dedicated courses is the post grade course offered by the School of Industrial Engineering, Madrid Polytechnic University, in cooperation with the Institute of Energy Studies from CIEMAT. In that 50 hours course, which is now in its XV edition, the scientific background, the technical aspects and the legal requirements for the safe handling, transport and disposal of all types of waste are presented and discussed.

One point of observation in this type of activities is related to the safety and security of the disposal facilities. At the end, such facilities are left in place, but it has to be demonstrated that they will not pose any radiological risk to future generations, so creating a point of direct contact with society and ethical conduct. The final disposal of highly radioactive waste is a major endeavour requiring especial completely developed and validated techniques. It is believed that education and training for professionals on the matter and clear information to the society are highly in need.

4.4. Education and Training in Dismantling and Remediation

Specific education and training needs in dismantling and remediation operations have not been formally established. Dismantling of old nuclear power plants has already started and it will be increasing as old plants are put out of service for any reason. When a nuclear power plant, or any other fuel cycle installation, is dismantled, the early concerns with nuclear safety diminish, but there is a relative increase in the importance of radiation protection. Remediation of old nuclear research centres is becoming an increasing activity. This is due to the obsolescence of some of the old establishments or to the non-permissible contamination levels in some of these establishments when they operated to less strict requirements or malpractices. A recent standard on remediation has been approved by the IAEA, but not specific requirements are formulated on the education and training of those professionals who will be responsible for such operations.

There is an increasing amount of experience on dismantling nuclear power plants. From the radiation protection side there is a continuous change in the risk level. The radiation sources diminish as a consequence, but some of the protection and mitigation systems of the old installation disappear as they are removed; the amounts and types of waste become enormous and they should be classified for a better management; finally the dismantling workers, when they belong to the old operating staff, are not used to such operations, but if they come from outside they will not know the peculiarities and details of the installation to be dismantled.

In Spain, the dismantling, up to level 2, of the Vandellós I nuclear power plant has produced a valuable experience on the radiological protection aspects of such operations. The plant radiation protection service had to be increased up to more than 40 individuals and reorganized to cope with the increase in personal dosimetry, including internal dosimetry through the analysis of biological samples; the radiological control of the dismantling operations, which was performed within the ALARA principle, and the radiological control of the many materials to determine the exemption levels or the final destination of such materials.

The IAEA safety standard on “Remediation of Areas Contaminated by Past Activities and Accidents” is the first of its kind on the subject. Remediation is considered as an
intervention “to reduce prolonged exposure, to avert prolonged potential exposure, or to reduce the likelihood of the occurrence of such exposure due to contamination”. In this sense, the document treats at length radiation protection in such remediation situations. Spain has accumulated some experience in such interventions; mainly through remediation activities in abandoned uranium mining and milling operations and in the intervention that took place in a large area contaminated with plutonium as a consequence of the Palomares air accident. At present there is a large intervention plan to clean up some contaminated parts in the premises of Ciemat as a consequence of activities taken place in the old Nuclear Energy Board.

4.5. Education and Training on Natural Radioactivity and the Protection of Non-human Species

The fact that electromagnetic energy and that associated to nuclear particles is the most natural form of energy introduces a new dimension on education and training on radiation protection. Natural radiation should be recognized and how such radiation has intervened, and it is still intervening, in human evolution. These facts should be included into any educational activity regarding radiation protection. Apart from that, the complete and detailed knowledge of the natural radiation background will serve to understand radiation protection and to make comparisons with artificial sources.

The presence of radon in dwellings has been a serious concern in many countries since the early seventies. Radon measurements have been performed and remedial actions taken. From the scientific point of view the understanding of radon risk has some difficulties, moreover reliable mitigation measures take some advanced technical developments. From the social point of view the radon presence affects everybody and it is present in air and water within our living space. Therefore education and training on the radon risks is a necessary endeavour. In the recent Madrid II International Conference on radiation protection training, the Swedish Radiation Protection Authority presented a series of radon courses they have been maintaining in the country and attended by a large variety of health professionals.

The question of naturally occurring radioactive materials and its potentiality to produce occupational doses of concern has been recently recognized. In accordance with 96/29 Euratom Directive, the question has been formally introduced in the corresponding national regulations, nevertheless very few training activities in this matter seem to be offered so far. In recognition of the hazards associated to natural radiation and naturally occurring radioactive materials, it is to be recommended that such aspects be also treated in training courses as appropriate.

The International Commission on Radiation Protection in the year 2000 created a working group to study the protection of the environment against the harmful effects of ionizing radiation. A report has been produced and accepted by the Commission. As a follow up of such activities, the Commission has recently created a new working group to define reference animals and plants and so creating the scientific bases for a systematic approach to the protection of non-human species. All these activities will create certain needs for education and training in protecting the environment against ionizing radiation.

5. THE RABAT AND MADRID INTERNATIONAL CONFERENCES

The International Conference on National Infrastructures for Radiation Safety: Towards Effective and Sustainable Systems, held in Rabat 1-5 September 2003, was organized by the IAEA with the cooperation of WHO, ILO, EU and OECD/NEA. It included two topical sessions and a round table discussion on education and training. Topical session 5:
Sustainable Education and Training: Developing Skills (National Systems and Regional Solutions), included a dozen presentations from developed and developing countries and international organizations. Topical session 6: Needs for Education and Training at the International Level (Including IAEA Programmes Assisting in Establishing Adequate Infrastructures) included eight presentations from a variety of countries, the European Union and the IAEA itself. The conference was very well attended, as non IAEA Member States were invited and received support.

As it is common in the IAEA conferences, the final proceedings will be published, together with the conclusions and recommendations proposed by the chairs of the different sessions and round tables, from which specific actions may later be taken. The needs and requirements for education and training on radioprotection were amply recognized worldwide and in the individual countries. Although the mood of the Conference was optimistic, several proposals were formulated to improve the situation in the less developed countries and to increase harmonization in the developed countries. The activities of the IAEA on education and training were also widely recognized; such activities have materialized in guides and technical documents as well as on advanced teaching material.

The representatives of the Agency clearly indicated the determination of the Agency on being more pro-active in education and training and they introduced the concept of training the trainers to make education wider and more effective. As radiation protection education and training covers a wide range of subjects and educational levels, the problem of the education and training language was brought about; it was recognized that the training, to be effective, has to be conducted in the mother tongue of the individuals. In this context, the Conference strongly recommended the IAEA to translate all relevant education and training documents, as well as related standards, to the official languages of the Agency.

The II International Conference on Radiation Protection Training: Future Strategies, held in Madrid, 17-19 September 2003, was organized by Ciemat, the Spanish National Centre for Research on Energy, the Environment and Technology, under the auspices of the IAEA and the European Union and with the cooperation of several Spanish high level organizations and concerned professional societies. An official account of the Conference is being produced.

The I International Conference on Radiation Protection Training was celebrated in Saclay (France) under the slogan "Radiation Protection: What are the future training needs?". This first conference constituted a forum for discussion, in a general framework, on the problems associated with radiation protection training. The principal path at that time was the implementation of the IAEA Basic Safety Standards. During that conference exhaustive analyses were undertaken on education and training in different countries as well as on the establishment of responsibilities and competences related to the risks associated to the different practices.

The objective of this second conference was to analyse results and to discuss future strategies, mainly within the European framework, but with a significant representation from Ibero American countries. It may be considered as a continuation of the one celebrated in Saclay. In this sense, it is important to take account of several new entries: 1) the coming into effect of the VI Framework Euratom Research Programme in which all aspects related to education are reinforced, 2) the European Union has undertaken work on the situation of qualified experts on radiation protection in its different member countries, 3) advances have taken place in the incorporation of new teaching technologies. All this implies to optimise efforts, work as a group and strengthen national and supranational educational networks.

A session was specifically dedicated to future activities. Participants from international organisations discussed their views on the matter, including the European training platform
and activities based on electronic distant learning. Specific presentations included the activities of the working party on education and training of the expert group on article 31 of the EURATOM treaty, as well as the IAEA and UE radiation protection training programmes. The vision and role of IRPA in the field of education and training of radiation protection professionals was also discussed. All speakers transmitted an optimistic impression on the future of education and training on radiation protection.

6. CONCLUSIONS

1st. There is a general agreement on the need for increasing the level of education of our societies on the risks and benefits of using ionising radiation, even starting at the secondary schools. There is equally a general agreement that the professional practitioners and the experts controlling such uses acquire an acceptable training in radiation protection principles and practices. There is also a need for information on the basic aspects of radiation protection to related managers and ancillary workers.

2nd. There is a general appreciation for the requirements established in the IAEA Basic Safety Standards and the corresponding Safety Guides and Technical Documents, as well as for the Euratom Directives, dealing with training qualified experts and radiation protection officers. Nevertheless, there is a common feeling that in some countries these basic documents have not been fully translated into a complete set of regulatory requirements. Moreover, there is also the appreciation that education and training for some basic practices, such as dismantling, remediation and radioactive waste management and disposal, are not well covered by requirements.

3rd. It is widely recognized that radiation protection is a multidisciplinary subject, with its basic roots in nuclear and modern physics, as well as on biology and physiology, among other sciences. Moreover, it includes modern technologies such as shielding, filtration, robotics and others. At the same time, it is also recognized that a large number of stakeholders need to know about radiation protection principles and practices, including regulators, research personnel, all type of users and practitioners, designers, operators, ancillary service personnel and civil protection officers, inter alia.

5th A recent survey on the status of radiation protection experts in the Member States and applicant countries of the EU showed a broad range of education and training systems; it was concluded that international agreement criteria and qualifications of radiation protection experts, in accordance with the definition of the qualified expert in the directive 96/29/EURATOM, is a pre-requisite for harmonization of education, training and mutual recognition.

6th There is also the sentiment that the IAEA should maintain its proactive attitude in radiation protection training and help to create interconnected centres of training excellence and good quality training material in the official languages of the Agency.