ENETRAP: Comparing the scientific content of the IAEA Standard Syllabus to European requirements

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Abstract
The overall objective of the ENETRAP* (European Network on Education and Training in Radiological Protection) project is to establish an Education and Training Network that will facilitate the sustainable integration of education and training infrastructures in radiation protection in Europe. Within the framework of this project, a number of discrete and measurable objectives are defined. These objectives will be reached by a number of actions grouped in work packages (WP), one of which is the WP on "IAEA E&T modules and European requirements". The main focus of this work package is to compare strategies proposed and/or implemented at the IAEA and the EU level, to analyse more specifically the approaches to training, and to propose modifications for a new approach of the European Radiological Protection Course.

1. Introduction

Requirements related to radiation protection training for European Union Member States are laid down in the European Basic Safety Standards and appendant documents [1, 2].
The International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, issued by the International Atomic Energy Agency (IAEA), were co-sponsored by a number of international organisations, e.g. the World Health Organization (WHO), the International Labour Organization (ILO) and the Nuclear Energy Agency. The IAEA, however, is the only organisation running an extensive training programme in radiation protection [3, 4, 5].
The content of the current European Radiation Protection Course (ERPC) has been compared with the requirements published by the EC and by the IAEA.

2. European Radiological Protection Course

The European Radiation Protection Course (ERPC) was initiated in 1999 at the INSTN in Saclay by a group of interested colleagues from European radiation protection organisations and/or national training centres (Germany (BFS), The Netherlands (NRG), Belgium (SCK/CEN), Spain (CIEMAT, CSN), Italy (ENEA, AMPA), France (DGSNR, INSTN)) in an attempt to implement EU training requirements for qualified experts.
The objective of this training was to provide the theoretical knowledge needed for recognition as a qualified expert in radiation protection according to the European community requirements. It was open to postgraduate students (initial training) and professionals (continuous professional development) from all European countries.
The training was organised in four independent modules. 50% of the syllabus was devoted to theoretical lectures, while the other 50% was dedicated to practical work, exercises and visits (for example, to the crisis management centre, environmental monitoring labs, nuclear waste storage facilities, hospitals, radiopharmaceutical production sites, and industrial irradiators).
Lectures, practical work, exercises and visits were given by European lecturers in English. Students had the possibility of registering in one or several modules over one or several years. Participants were either students or professionals from all European countries, thereby satisfying the prerequisite defined by the European board. A written examination was organised at the end of each module and a certificate validating the successfully concluded modules was issued by the INSTN (National Institute of Nuclear Sciences and Technologies). Safety authorities and academic schools of several countries recognise the ERPC.
Practical experience (3 to 6 months in a facility dealing with ionising radiation applications in any of the participating country) was mandatory for postgraduate students.
For professionals, practical experience was organised upon request of the individual participants.

MODULE 1: Basics Radioactivity and nuclear physics, interaction with matter, detection and measurement methods, biological effects of radiation, applied dosimetry	17 November to 9 December 2003
MODULE 2: Occupational exposures in nuclear And industrial applications General principles of radiation protection, putting radiation protection principles into practice, safety culture	10-19 December and 5-30 January 2004
MODULE 3: Radiation protection of the members of the public and of the environment Sources of contamination of the environment, radioecology principles, public exposure from industrial, medical practices and from natural sources of ionising radiation	2-25 February
MODULE 4: Medical exposures (patients and workers) The use of ionising radiation in medical applications, legal and regulatory basis, protection against occupational exposure, exposure of the patient.	26 February to 12 March

Table 1. ERPC - Programme implemented in 2003/2004

3. European regulatory requirements

In "*Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of the workers and the general public against dangers arising from ionising radiation*", qualified experts are defined as

> "*Persons having the knowledge and training needed to carry out physical, technical or radiochemical tests enabling doses to be assessed, and to give advice in order to ensure effective protection of individuals and the correct operation of protective equipment, whose capacity to act as a qualified expert is recognised by the competent authorities. A qualified expert may be assigned the technical responsibility for the tasks of radiation protection of workers and members of the public*."

What qualifications are necessary for the qualified expert are not specified in this directive. The only mention of training is in Article 22: "*Member States shall require the undertaking to arrange for relevant training in the field of radiation protection to be given to exposed workers, apprentices and students*" and, as a task of Member States in respect of protection of exposed workers, in Article 38: "*Each Member State shall make the necessary arrangements to recognise, as appropriate, the capacity of:*

- *approved medical practitioners,*
- *approved occupational health services,*
- *approved dosimetric services,*
- *qualified experts.*

To this end, each Member State shall ensure that the training of such specialists is arranged."

More specific guidance in relation to the training of qualified experts is given in the "*Communication from the Commission concerning the implementation of Council Directive 96/29/Euratom laying down basic safety standards for the protection of the health of the workers and the general public against dangers arising from ionising radiation (98/C133/03)*". This is a reference document, which is not binding for EU Member States but which assists in transposing the Council Directive into national law. Advice on basic and additional training for qualified experts is given in Annex 1 of this Communication. Due to the wide diversity of current national approaches to training and qualifications necessary for recognition as a qualified expert, a rather general basic syllabus is proposed, the content of which all qualified experts should have received. Previous qualifications and training may already have covered part or all of this syllabus. It is stated that the depth of coverage should depend on the level and complexity of advice required from the qualified expert, which is generally linked to their level of involvement.

It is also stated that certain items should be covered in more detail for specific applications. Additional topics have been identified which are recommended for five specific areas, i.e. nuclear installations, general industry, research and training, medical applications, and accelerators.

4. IAEA Standard Syllabus

The objective of the IAEA "Standard Syllabus of the Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources" [5] is to facilitate the integration of courses in radiation protection into the curricula of educational institutions in Member States and to achieve both consistency and a common level in the technical content of such courses.

The focus of the Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources (PGEC) is on the technical and administrative framework necessary for regulatory and operational controls for protection against ionising radiation and the safe use of radiation sources in all their applications.

Section 2 of the document provides an overview of the Standard Syllabus and its structure, prerequisites and learning objectives, and suggested duration for each part. Section 3 describes the content of each part of the syllabus and provides a list of practical exercises and a list of reference publications. A compiled list of references is given in the bibliography at the end of the document.

The Standard Syllabus of the PGEC is divided into eleven parts and each part is divided into modules. For each module, the prerequisite is indicated as well as the general learning objective. Each module is described by the content and linked to the training material and the reference publication. The content of each module is described by short sentences and key words. The list of reference publications for each module is also presented. For each module, a list of practical training sessions is suggested. These sessions can be either demonstrations, laboratory exercises, case studies, technical visits, simulation exercises or workshops.

Prerequisites, general learning objectives and recommended duration for each module are summarised in Appendix 3. Prerequisite for the course is that participants should have had a formal education to a level equivalent to a university degree in physics, chemistry, life sciences or engineering and been selected to work in the field of radiation protection and the safety of radiation sources in their countries.

5. Comparison of the content of curricula

The scientific/technical content of the ERPC is totally in accordance with *the Basic Syllabus of the Qualified Expert in Radiation Protection* in Communication 98/C133/03. The *Additional Material* of this Communication is also covered in detail. Most of the *Additional Topics* of this Communication are covered fully, such as *Medical Applications* and *Accelerators*. Other areas, such as *General Industry, Research and Training* are also covered widely. Nuclear Installations are covered to a great extend except for issues of fuel fabrication, processing and storage.

A very important point of the ERPC is that 50% of the training is theoretical courses and 50% is practical, exercises, demonstrations and scientific visits. In addition to this distribution, 3-6 months of practical experience in a company is mandatory (postgraduate) or offered (professionals). This approach fits entirely the statement in Communication 98/C133/03 that training needs are to be supplemented by practical experience.

The aim of the IAEA PGEC is to meet the initial training needs of professionals at the graduate level or equivalent in order to acquire a sound basis in radiation protection and the safe use of radiation sources. It is tailored for a wide range of professionals but not specifically addressing the qualified expert as defined in the European Basic Safety Standards.

The PGEC syllabus gives more emphasis to the basic issues compared with the ERPC syllabus. The legislative framework and regulatory system is also covered in more detail than in the ERPC. The PGEC syllabus is focussing more on the train-the-trainers approach in order to strengthen the sustainability of training activities in the developing Member States. However, in comparing the curricula they can be considered as very much equivalent.

Practical exercises are described in detail in the PGEC and a number of references are given for each module.

The duration of the IAEA PGEC is 18 weeks and includes theoretical lectures as well as practical exercises, demonstrations and visits, as does the ERPC. The ERPC, however, has a duration of about 13 weeks but requires/suggests an additional 3-6 months of practical experience (on-the-job training).

In Table 2, the comparison of the basic concepts for training in radiation protection shows the much broader approach of the IAEA to training. It would be advantageous for both, the European Community and the IAEA to establish a closer cooperation in relation to training in radiation protection.

	Basic Concept	Target Group	Remarks
EU	Training according to Communication 98/C133/03, focussing on qualified experts in radiation protection as defined in the EU BSS	Qualified experts in radiation protection only	- Sustainability in Member States is given - More flexible “European Trainers” are needed - Differences in E+T are on the legislative level in Member States
IAEA	- Statutory function to assist Member States in developing sustainable E+T in radiation protection - train-the-trainers-concept	- Staff of regulatory authorities - Trainers - Radiation protection specialists	Broad range of training activities: - PGEC - Specialised courses - Workshops - Fellowships
ERPC: tailored to fit both, EU concept and IAEA PGEC			

Table 2: Comparison of basic concepts for training in radiation protection

6. Input for a new approach of the European Radiological Protection Course

In order to bring a new approach to the ERPC, learning objectives for each module or module parts should be formulated as appropriate. These objectives are the knowledge and skills participants are expected to have attained upon completion of training. The objectives can be seen as performance goals for the participants with measurable outcomes.

As far as technical content is concerned, new EC directives should be taken into account and issues such as the control of radioactive sources as dealt with in ”Council Directive 2003/122/EURATOM of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources” should be included. Practical exercises should be described in more detail and references should be given.

References

[1] Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation

[2] Communication from the Commission concerning the implementation of Council Directive 96/29/Euratom (98/C133/03), 2003

[3] IAEA Safety Guide No. RS-G-1.4 “Building Competence in Radiation Protection and the safe Use of Radiation Sources”, 2001

[4] IAEA Safety Report No. 20 “Training in Radiation Protection and the Safe Use of Radiation Sources”, 2001

[5] IAEA Training Course Series No. 18 “Postgraduate Educational Course in Radiation Protection and the Safe Use of Radiation Sources - Standard Syllabus”, 2002

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