Development and application of a mechanism for the evaluation of training material

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ABSTRACT

To maintain a high level of competency in Europe regarding radiation protection and to facilitate harmonisation and (mutual) recognition of Radiation Protection Experts (RPEs) and Officers (RPOs) quality assurance and quality control might play an important role. The European Network for Education and Training in Radiation Protection II (ENETRAPII) project (FP7-EURATOM) aims at developing European high-quality 'reference standards' and good practices for education and training in radiation protection. In Work Package 5 (WP5) the quality issue is addressed. Therefore, WP5 deals with the development and application of mechanisms for the evaluation of training material, training events and training providers by means of a transparent and objective methodology. The results can be used by regulatory authorities to benchmark their national radiation protection training programme and will be communicated to other networks, e.g. EUTERP. This paper addresses the comparison and evaluation of training material (books and duplicated lecture notes).

The comparison mechanism exists of two parts. The first one is a list of knowledge based learning outcomes and the other one is a system to describe the range of detail the subjects are treated in the training material. The evaluation mechanism is tested on different types of training material to evaluate whether they meet the learning outcomes of the book used in the European Radiation Protection Training Scheme (ERPTS). It was concluded that the described mechanism can be used to evaluate training material against a standard.

Keywords

Mobility, evaluation, training, book, material

1 Introduction

Today's challenge in the field of radiation protection involves measures to make the work in radiation protection more attractive for young people and to provide attractive career opportunities. In addition, young students and professionals should be supported in their need to gain and maintain high level

knowledge in radiation protection. These objectives can be reached by the development and implementation of a high-quality European standard for initial education and continuous professional development for Radiation Protection Experts (RPEs) and Radiation Protection Officers (RPOs).

The FP7 European Network for Education and Training in Radiation Protection II (ENETRAPII) project is a specific tool for EURATOM policy for education and training implementation in the radiation protection field. In addition, the project is a tool towards a mutual recognition of professional qualifications.
For the purposes of this project the Radiation Protection Expert can be defined as:
"An individual having the knowledge, training and experience needed to give radiation protection advice in order to ensure effective protection of individuals, whose capacity to act is recognized by the competent authorities."
and the Radiation Protection Officer as:
"An individual technically competent in radiation protection matters relevant for a given type of practice who is designated by the registrant or licensee to oversee the application of the requirement of the Standards".
These are the definitions as proposed during the second EUTERP workshop in Lithuania in 2008. These definitions became part of the draft EURATOM BSS directive [1].
To reach high-quality European standards for initial education and continuous professional development, there has to be an agreement between the European countries concerning the duties and responsibilities of both RPEs and RPOs. These standards are developed in Work Packages 3 and 4 (WP3 and WP4) of the ENETRAPII project.
As soon as these standards are set, each country will be able to access and benchmark their own education and training against the European standards. It will also be possible for a country to benchmark an RPE or RPO, educated and trained in another country, to their national standards. Shortcomings of education and training materials, events and providers, become clear when it is possible to compare national standards of education levels to the European standards. Therefore one of the cornerstone work packages in ENETRAPII is work package 5 (WP5), entitled: Develop and apply mechanisms for the evaluation of training material, events and providers.
In this paper the mechanism to evaluate training material is presented, where after it is tested on different types of training materials.

1.1 Boundary conditions for the comparison of training material

To build a comparison system for training material two boundary conditions were set. These boundary conditions are given and explained below.

- Nowadays learning outcomes are not only knowledge based, but also skills and sometimes attitude based. The comparison model for events however has to deal only with the knowledge based learning outcomes, since one cannot learn skills and attitude from training material.
- Training materials can be studied by students that have different backgrounds. Due to this difference no entrance level can be specified. The comparison model for training material has to be used, without a prescribed entrance level.

2 A mechanism for the evaluation of training events

The inventory has started with the subjects addressed in the IAEA syllabus [2], the syllabus EG133 [3], the ENETRAP training scheme [4], the Dutch existing table of subjects for education and training in radiation protection [5]. This will lead to a common reference table, which can be used to compare and evaluate training material. Training material in this paper is defined to be a text book or duplicated lecture notes.

2.1 IAEA Basic Syllabus PGEC

The IAEA basic syllabus [2] can be used for the training and education of post graduate students to become a qualified expert[1]. The basic syllabus is split up in 11 modules, which cover the whole basic radiation protection. The duration of the course is 18 weeks.
Each module is divided in main subjects and these are subdivided in more detailed subjects. For the modules only the number of hours spent is clear. For each main subject lecture notes and practical exercises are given.

2.2 EG Basic Syllabus 98/C133/03

In its Communication 98/C133/03 [3] the European Council guides the European countries in how to implement the European basic safety standards 96/29/EURATOM in their own legislation. In this document the basic syllabus for the qualified expert[2] in radiation protection is published as a list of subjects to be addressed in radiation protection training. Most of the subjects mentioned in the basic syllabus are not subdivided in detail. No information can be found about the hours spent on the different subjects, except for the statement: "the depth, to which topics of the syllabus should be covered, should depend on the level of advice/input required from the qualified expert".
The listed subjects cover the basic radiation protection training and additional training in five different fields: nuclear installations, general industries, research and training, medical applications, and accelerators.

2.3 ENETRAP training scheme

The ENETRAP training scheme of the ENETRAP 6th FP project [4] is based on the IAEA syllabus [2], the European basic syllabus [3], EUTERP[3] recommendations and other ENETRAP output. The scheme consists of different modules. The first three modules are the basic modules. Afterwards at least one additional module has to be followed, concerning the area of interest. This area can be nuclear power plants or research reactors, waste management and decommissioning, non-nuclear research or oil and gas, medical or NORM.
The ENETRAP training scheme modules are divided in main subjects, with the numbers of hours spent on all the main subjects. The main subjects are subdivided in more detail. It is not clear which level of education is required to enter the ENETRAP training scheme. The duration of the whole course is 42 days.

2.4 Tables of issues in radiation protection training

In the Netherlands a reference table [5] is used since 1984 to determine the content of the different levels of training and education in radiation protection throughout the Netherlands. This table is divided in main subjects and subdivided in more detail. There are no numbers of spent hours in this table, but only a characterization of the level of detail at which the (detailed) subjects have to be covered during the training, together with its training goal (Table 1). The advantage of using grades above hours spent on the different subjects is that the entrance level of students doesn't have to be set. Theoretically people with different levels can enter all courses.

[1] The Qualified Expert of the IAEA is considered the same as the Radiation Protection Expert.
[2] The Qualified Expert of the EC is the predecessor of the Radiation Protection Expert.
[3] EUTERP: European Foundation for Education and Training in Radiation Protection

Table 1 Descriptors at which subjects are covered in training material

Descriptor	Covered
0	not covered
1	global, qualitative
2	important subjects covered, quantitative
3	Detailed, quantitative

2.5 The final mechanism for the comparison and evaluation of training material

With respect to the main subjects, the different syllabi and reference tables are more or less the same. We preferred the reference table of the Netherlands, because of the usefulness of its format.
In this table descriptors are used corresponding to the ones in Table 1 and not hours or pages spent on different subjects, as explained above. The advantage is that the entrance level of students and the number of pages spent on a topic do not matter.
This reference table can be used for the comparison of training material. Filling in the demands from the standard material for the RPE, RPO or the radiation worker (RW), results in a clear overview of which material should be used for each course and whether additional material is needed
To use this table next to the ENETRAP training scheme [4], the Dutch reference table is rearranged like the ENETRAP training scheme. Subjects mentioned within the ENETRAP training scheme that were not present in the Dutch reference table are added which resulted in the proposed list.
The proposed mechanism than consists of two parts: a list with subject that can be covered in training material and the comparison descriptors of Table 1.

3 Testing the developed mechanism for the evaluation of training material

The table with learning outcomes for material was sent to all WP5 partners. The partners were asked to describe the learning outcomes, which are knowledge based, of their training material, according to Table 1.
For comparison of training material the institutes choose one or more of their books or other training materials used during the courses for RPE, RPO or Radiation Worker (RW). Six institutes filled in the table for trial comparisons of material for in total twelve courses. Apart from that the table was filled in by the WP leader of WP 7 for the standard book for RPE training [6]. At the moment of comparing, the book was only written for the first module of the new developed European Radiation Protection Training Scheme (ERPTS [4][7]), the successor of the training scheme developed within ENETRAP [4].
All the institutes mentioned for which level of radiation protection course the material was used. In Table 2 the result is shown for the materials A up to L (for different training material) and in the last column for the ERPTS book [6]. The indication of the level of the training material (RPE, RPO or RW) given by the partner can be found on the last row.

Table 2 An excerpt from the filled in learning outcomes list for 12 different materials and the ERPTS book.

Training material →	A	B	C	D	E	F	G	H	I	J	K	L	ERPTS
Composition of matter				3	3	0	1	2	1	1	3	2	2
Proton-Neutron ratio, ionisation, excitation	0	2	2	3	3	0	0	2	1	1	3	2	3
Alpha decay	0	2	2	3	3	0	1	3	1	2	3	2	3

Indication of the level of material by the provider*	W O E E E W W E W O E W E

* W: material for an RW course, O: material for an RPO course, E: material for an RPE course.

The learning outcome of the standard ERPTS training material is met, if the descriptor is at least the same as that in the last column or higher. For the learning outcome: 'knowledge about composition of matter' the ERPTS rated this as 2: "important subject covered, quantitative". From Table 2 it can be concluded that material D, E, H, K and L meet the learning outcome with the amount of detail as required.

For all tables it was concluded by comparing the descriptors of the material with that of the ERPTS that there are shortcomings, except for one (training material D). This institute indicated that their training material D covers all the learning outcomes "detailed and quantitative"(score 3). The EW training material deviates in general in more learning outcomes than that of the RPE. This was expected, since we compared with the RPE course material.

3.1 Self-assessment

The evaluations showed that the proposed mechanism is a very useful instrument. To make the evaluation as efficient as possible, we suggest performing the mechanism as a self-assessment. However we than have to take into account that one can fill in the list arbitrarily or choose the wrong descriptor.
Self-assessment cannot be done without a certain random auditing of an independent organisation or institute. This organisation can randomly judge whether the description of the learning outcomes in the list is carried out at the right way and if there is a certain conformity.
The organisation should exist of different education and training experts in radiation protection, mastering different languages to understand the content of the training material. Since the consequence of this auditing is far-reaching one should not do this task as a volunteer, but one needs to be assigned to carry out this task.

4 Conclusion and discussion

The evaluation system consists of a list of knowledge based learning outcomes together with a descriptive system. Training material can be compared and evaluated against the standard ERPTS book. Shortcomings can be noticed and given back by an assessment team to the institute that sent in the material for evaluation.
A remark can be made that this list is too detailed, but it is seen that the more detailed the learning outcomes on the list, the easier it becomes to give the right subscription to the learning outcome.
Point for discussion is the self-assessment.

Acknowledgement

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