THE DEVELOPMENT OF A SPECIALISED TRAINING COURSE FOR THE RADIATION PROTECTION WORKERS OF VVER TECHNOLOGY (CORONA II)

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ABSTRACT

The project CORONAII has the aim to provide a structure for training and qualification of personnel for serving VVER technology as one of the nuclear power options used in the EU. The CORONAII project is co-financed by the EURATOM 2014-2015 working program of HORIZON 2020. The main objective of the proposed CORONA II project is to enhance the safety of nuclear installations through the further improvement of the training capabilities aimed at building up the necessary personnel competencies. The project aims at the continuation of the European cooperation and support in the area for preservation and further development of expertise in the nuclear field by the improvement of higher education and training. The implementation of ECVET, which is one of the main goals of EC in the education and training areas, has to be tested through pilot courses; to integrate VVER education and training into European education and training in nuclear safety and radiation protection. Non-nuclear professionals or students who graduated at least from the level of bachelor's or are currently bachelor's students, with negligible prior knowledge or without knowledge and experience in the nuclear field could be trained. The aim of the pilot training for radiation protection workers is to provide an introduction to nuclear power technology and an overview of radiation protection, nuclear fuel and radioactive waste management for students and non-nuclear graduates to participate in further nuclear course(s) or to perform works related to VVER NPP, radiation monitoring and radiation protection of places of ionizing radiation for medicine and industry applications, radioactive waste management and custom offices. The pilot training course is going to give competencies at EQF Level 3. It is intended to cover different aspects needed to start working in the nuclear related area with sufficient general nuclear knowledge and culture. A pilot teaching course was organised and delivered in January 2017.

Introduction

The project CORONAII has the aim to provide a structure for training and qualification of personnel for serving VVER technology as one of the nuclear power options used in the EU.

The CORONAII project is co-financed by the EURATOM 2014-2015 working program of HORIZON 2020.

Education, training and maintenance of competencies i.e. knowledge management in engineering and sciences is a cornerstone in Europe's vision for the development of safe nuclear energy. If one is going to deliver the long term goal of sustainable nuclear fission, it will be necessary to have an adequate resource of well-educated and trained young professionals coming into the field, whilst retaining the expertise and competencies.

Within the European Union (EU) there is a strong need for maintaining and preserving knowledge and nuclear competence including VVER competence. Russian technology is very popular amongst European countries but is operated mainly in small countries, which do not have enough resources to maintain the entire necessary knowledge individually.

The general objective of the project is to enhance the safety of nuclear installations through further improvement of the training capabilities for providing the necessary personnel competencies.

The specific objectives of the CORONA II project are:

- To elaborate a harmonized approach to education in the nuclear science and nuclear engineering in VVER countries to support improving the safety of nuclear installations;
- To achieve co-operation and sharing of academic resources and capabilities at national and international levels;
- To accelerate and optimize the development of competences in the nuclear area to ensure the high quality of nuclear education and training in VVER area;
- To further develop the VVER training infrastructure;
- To promote the implementation of modern training methodologies and technologies, dissemination of experience and best practices in Europe in the field of training;
- To promote the establishment and development of national training systems for the nuclear power sector in the newcoming countries;
- To establish a framework for mutual recognition: the implementation of ECVET, which is one of the mail goals of EC in the education and training areas, will be supported through the testing of its elements and pilot implementations;
- To integrate VVER education and training with the European education and training in nuclear safety and radiation protection;
- To foster and strengthen the relationship with technology platforms, networks and other organisations in the nuclear education and training sector;
- To enhance knowledge sharing, dissemination and online collaboration through an advanced knowledge management portal.

The baseline for this structure is the work done in the previous CORONA project. The applied approach for the development of training schemes and target groups is based on the Systematic Approach to Training (SAT) and European Qualification Framework (EQF). A pilot implementation of ECVET system is planned as part of the work on the project. The list of participants of the CoronaII project can found in Table 1.

Table 1. The list of participants of the CoronaII project

Participant No	Participant organisation name	Country
1	Kozloduy NPP PLC (Coordinator)	Bulgaria
2	Institute of Nuclear Research and Nuclear Energy – Bulgarian Academy of Sciences	Bulgaria
3	Engineering Support and Intellectual Solutions (ESIS GmbH)	Germany
4	TECNATOM S.A.	Spain
5	Centrum Vyzkumu REZ S.R.O.	Czech Republic
6	National Research Nuclear University MEPhI	Russian Federation
7	Risk Engineering Ltd.	Bulgaria
8	Budapesti Muszaki és Gazdasagtudomanyi Egyetem	Hungary
9	Reseau Europeen pour l Einsegnement des Sciences Nucleaires (ENEN Association)	France

The structure of the pilot course

The unit of learning outcomes

The structure of the selected qualification of RPW was based on the job profile of the Radiation Protection Worker, developed by IET_JRC, which contains the role and functions, as well as the knowledge, skill and competences that are required for this qualification. The following unit of learning outcomes (ULOs) were defined:

ULO 1 Introduction to nuclear power technology
ULO 2 Radiation protection
ULO 3 Radiation monitoring
ULO 4 Nuclear fuel and Radioactive waste
ULO 5 Accident and emergency issues
ULO 6 Decontamination
ULO 7 Safety culture

Who could be trained?

Non-nuclear professionals or students who are graduated at least to the level of bachelor's or are currently bachelor's students, with negligible prior knowledge or without knowledge and experience in nuclear could be trained. It is expected that the candidates have the intention to perform works related to VVER NPP, nuclear applications and education or to participate in course(s) of nuclear education. The pilot training will be useful to students or professionals working in support of nuclear facilities as civil engineers, physical protection employees, government employees, secondary school teachers, journalists, etc.
For the training course within the training programme the following information was provided:

- Objectives of the training course
- Requirements for the trainees
- Content of the training course (topics)
- Suggested duration of the course (in working days and in academic hours)
- Type of training – theoretical, practical, simulator / initial, refreshing
- Methods for evaluation

Participants

Eight (8) trainees: three (3) from Bulgaria, three (3) from the Czech Republic and two (2) from Russia participated in the training. The main fields of activities during the last three years of the trainees were:

- nuclear technology and nuclear engineering
- radiation protection and radiation monitoring
- material science study
- dosimetric control in hot cells
- training (rad. protection, industrial and fire safety, first aid)

During the pilot training two observers from Bulgaria and the Czech Republic participated. The main tasks of the observation of conductance of the pilot training were to assess the training organisation and effectiveness and to evaluate whether learning outcomes had been achieved or not.

The venue of the pilot course

The lectures (classroom and video conference) were organised at the Budapest University of Technology and Economics (BME) (Figure 1.), the Institute of Nuclear Techniques. The practical training was conducted in the Training Reactor of BME (Figure 2.) and the National Research Institute for Radiobiology and Radiohygiene (OSSKI).

Figure 1. *Budapest University of Technology and Economics*

Figure 2. *Training Reactor, Institute of Nuclear Techniques*

The aim of the pilot training:

The aim of the training is to provide an introduction to nuclear power technology and an overview of radiation protection, nuclear fuel and radioactive waste management for students and non-nuclear graduates to participate in further nuclear course(s) or to perform works related to VVER NPP, radiation monitoring and radiation protection of places of ionizing radiation for medicine and industry applications, radioactive waste management, custom offices, etc. The training course aims to give competencies at EQF1 Level 3. It is intended to cover different aspects needed to start working in the nuclear related area with sufficient general nuclear knowledge and culture.

Three modules were organised during the pilot course:

1. Introduction to nuclear power technology (4 hours of lecture and 4 hours of laboratory work)
2. Radiation protection (12 hours of lecture and 4 hours of laboratory work (Figure 3 and 4.))
3. Nuclear fuel and radioactive waste (10 hours of lecture)

The duration of the training was 40 hours: introduction – 2 hours, lectures – 26 hours, laboratory practice – 8 hours, consultation – 2 hours and evaluation – 2 hours. The working language was English. All training materials were prepared in English. At the beginning of the training the trainees passed entrance tests in order to assess their level of experience and knowledge on the training topics.
The observers' evaluation was based on the preliminary prepared and agreed instructions. The instructions are intended for the unification of observers' responses and to highlight important areas to be evaluated.

Figure 3. Laboratory work in the Training Reactor

Figure 4. Laboratory work in the National Research Institute for Radiobiology and Radiohygiene (OSSKI).

Results

The knowledge of the participants became more homogeneous: the total average fraction of right answers is around two thirds (66%) varying between 58-76%. It is a remarkable increase compared to the results of the jump-in test where the total average of fraction of right answers was around half (50-55%) varying between 25-78%.
The participants' satisfaction survey was filled out by all of the trainees and observers directly before the end of the training.
Some important comments and suggestions from the trainees' can be found below:

1. The presentations were sufficient for them to understand the learning objectives required for Radiation Protection Workers
2. There was sufficient information on practicalities (e.g. organizational aspects, training material, assessment, etc.)
3. The knowledge, skills and attitudes supported by this course are in accordance with their expectations for radiation protection workers.

The participants answered the following for the question of "What 3 aspects of this course did you think were most effective in helping you achieve the learning objectives?":

- practicalities,
- guidance,
- the content of presentations,
- the approach of lecturers,
- practical examples, laboratory work,

The participants answered the following for the question of "What 3 changes could be made to improve this course?":

- more discussion,
- less lectures
- more practical lessons.

Observers' evaluations

The quality of organisation was very good. The working conditions were appropriate for carrying out the training. The laboratory exercises were provided in well-equipped facilities.
The duration of the training was 5 days and was enough for the training purposes. The duration of the training hours was 40 academic hours - 8 hours per day (one academic hour consists of 45 minutes of teaching plus a 15 minute break) - thus the time for self-study, review and assimilation of the obtained knowledge was not enough. The size of the group was appropriate and corresponded with the conditions for conducting lectures and laboratory work.

At the end of the training the trainees were awarded with certificates for attendance and for achieved competencies within the pilot training course.

References

[1] Recommendation of the European parliament and of the council of 18 June 2009 on the establishment of a European Credit System for Vocational Education and Training
[2] JRC Technical Reports, Second Workshop on Qualifications for Nuclear Decommissioning, Bergen, The Netherlands, 24-28 October 2015
[3] New Basic Safety Standards Directive 2013/59/Euratom