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RESTORING NUCLEAR EDUCATION AND TRAINING IN SERBIA

Abstract: Nuclear renaissance requires new human resources with a wide spectrum of qualifications to achieve sustainable development in both nuclear energy and nuclear applications, to maintain high safety standards and secure a knowledge base for future R&D and innovations. Capacity building in developing countries is a significant demand as well.

Nuclear technology is the comprehensive field, which ponders integration of energy, economy and environment aspects, comparison of various models and alternative scenarios in order to provide the assessment and evolution of sustainable development.

The initiative of the University of Belgrade to launch the postgraduate course in Nuclear Engineering at Serbian universities, and initiating of the LLL courses for professionals is the first step towards developing systematic approach and the appropriate education programme.

The wider objective is capacity building and human resources development through education programmes, hands on training, and knowledge transfer. This will preserve nuclear scientific and technical competence for the safe use of existing applications and practices in Serbia, and enable development of new applications and methods to satisfy future demands in nuclear related sectors.

Regional availability of education programme and knowledge transfer to West Balkans countries (WBC) is anticipated, with the aim to apply high international standards and improve nuclear and radiation safety and security in the region. This will make a significant impact on national development and contribute to the EC integration efforts of the region.

Strategic approach has to be developed, aiming at establishing sustainable education and training programmes.

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1. INTRODUCTION

The decades long stagnation of the nuclear industry caused decreasing interest for nuclear sciences and disciplines, a reduced numbers of students, no successors for retiring professors and discontinuing nuclear related courses and closing faculties. The skills and expertise are not being passed on to new generations of professional, leading to increasing deficiency in expertise. This poses a significant risk to the community who will need to manage nuclear liabilities for long times into the future in order to protect future society from radiological hazards. Furthermore, nuclear security environment has been seriously changed during recent years and new challenges have significantly increased demands. It became clear that, regardless the trend in nuclear sector, there is continuous need for the provision of education and training in this area.

In that regard, the situation in Serbia can be considered as paradigm, although there are some specifics resulting from diverse and dynamic developments and changes that country was undergoing in the past.

2. HISTORY

Serbia had the leadership in the extensive nuclear programme of the former SFRY from 1958 to 1988, which was supported by comprehensive research and development (R&D) activities, appropriate educational programs at the Universities and valuable courses for postgraduate studies at the Institute of Nuclear Sciences. As a result, sufficient number and diversity of experts were available for various assignments in nuclear technology and related fields.

Three research reactors and one nuclear power plant were constructed with the major participation of domestic experts, who successfully operated these facilities without unwanted events. During that time significant knowledge and operating experience was gained, and high nuclear and radiation safety and security standards achieved.

The adequate funding was provided, governmental infrastructure, legal framework and various policy documents were in place to support the national nuclear programme.

In 1989 the *Law on Ban for nuclear power plants construction and related activities* was adopted, followed by cancellation of the SFR Yugoslavia nuclear program and very weak economic situation. That was the beginning of the overall deterioration in nuclear field. Nuclear courses at the University were revoked, many professionals left the country and the loss of nuclear knowledge and expertise was inevitable.

3. MANAGING THE NUCLEAR LEGACY

During the last decade, with only a few nuclear experts remaining in the country, the issue of managing the nuclear legacy of the past emerged as significant. Some extensive nuclear and radioactive waste management projects have

been launched with the support of the IAEA to resolve nuclear and radiation safety issues:

- Safe removal of the spent fuel from the RA research reactor at the Vinča Institute of Nuclear Sciences,
- RA research reactor decommissioning, and
- Radioactive waste management.

These projects exposed the lack of nuclear professionals to carry out project activities, and a strong need to launch appropriate nuclear engineering education and training was observed. General approach was adopted that knowledge management initiatives have to be driven at first by specific needs of the above projects, but also with the view to building-up technical and scientific capabilities in nuclear technology for future.

In addition, the existing Law on Protection against Ionising Radiation and Nuclear Safety (Official Gazette of RS No. 36/09) stipulates the education and continued professional training in the nuclear and radiological sectors. Other acts or regulations stipulate specific competencies and educational qualification for personnel in charge of process management and supervision in nuclear facilities, as well as in radiation practices.

Regardless the trend in nuclear power expansion in the coming decades, it is agreed that we need to preserve nuclear scientific and technical competence to manage nuclear liabilities for long times into the future, for the safe operation of existing facilities and applications, but also for future technological development.

This was the rationale for the professionals from the University of Belgrade to initiate development of post graduate course in nuclear engineering and the life-long learning programme in nuclear technology (LLL) as a first step towards renovation of higher education and professional training in the field.

4. INITIATIVE FOR NUCLEAR EDUCATION AND TRAINING

The initiative of the University of Belgrade was accepted by other two University of Novi Sad and University of Kragujevac, which includes several technical and faculties of sciences, various departments and two institutes. They have joined resources and efforts in the multidisciplinary project to develop new Master Programme in Nuclear Engineering (MPNE).

The interdisciplinary character of the programme implies that will be more convenient to develop it in the auspices of university than at a specific faculty. However, it is planned to involve teachers from several faculties and two institutes.

Faculty of Electrical Engineering at University of Belgrade has a tradition in nuclear engineering education, renowned in the nuclear community, and engineers that graduated from Department for Engineering Physics hold prominent positions in nuclear industry and education worldwide. The remaining experts from that school that work at the University of Belgrade will provide valuable knowledge and teaching experience in nuclear technology to the proposed project. Those experts that are employed at the Vinča Institute of Nuclear Sciences will contribute

experience in design of research reactors and accelerators, and practical experience in use of these facilities. The Vinča Institute has been a leading institution in nuclear R&D from the beginning of the national nuclear programme and has expertise in nuclear technology research, accelerator physics and related medical applications, radioactive waste management, radiation protection, nuclear applications in biology, pharmacy, health and emergency services.

The first step in commencing development of the postgraduate programme is to analyse and evaluate current activities in nuclear and radiological sectors, as well as future R&D demands so that necessary human resources can be identified. The information of specific knowledge, skills and competencies is a basis for identification of educational programmes which can provide professionals of required vocation.

In that regard, the subjects of study and degree of specialisation involved will be created to provide the necessary competence and expertise for the safe use and new applications of nuclear technology in industry, medicine and other relevant disciplines. Several bachelor and Ph. D. courses will be adjusted accordingly.

Additionally, the new Master Programme in Nuclear Engineering has to comply with the existing European study programmes and Bologna declaration. It will be implemented at three Serbian Universities, but they will also be available for regional students. Therefore, courses curricula and syllabi will be developed both in English and Serbian languages.

This initiative also encompasses establishing of a framework for cooperation and dissemination between universities and with non-academic partners, promotes interactive approach in teaching, provide essential teaching tools and infrastructure upgrade. Thus, further improvements and responsiveness to new demands and opportunities will be enabled.

The proposed Master programme will be designed to develop professional engineering leaders who understand the technical, environmental, economic, and social issues involved in the design and operation of nuclear engineering devices, systems, and organizations.

The LLL training programs in nuclear technology are intended to complement formal education with practical and job related knowledge and skills. The training system has to make appropriate use of information technology and industry lessons learned.

5. MASTER COURSE IN NUCLEAR ENGINEERING

The objective is to develop new interdisciplinary Master Programme in Nuclear Engineering which can provide the necessary background, both in scope and in depth, for students wishing to enter the nuclear and nuclear related industries, radiation practices, research and development activities. Hence, the basis for education will be established in order to make available nuclear knowledge and expertise that is necessary for maintaining nuclear and radiation safety and security in Serbia.

The Programme will be developed using the ECTS, and will be verified through the accreditation process. The lifelong learning programme (LLL) in Nuclear Technology will be organized for professionals from relevant fields.

Three Universities in Serbia will participate in development and implementation of MPNE, which includes several technical and faculties of sciences, various departments and two institutes. The knowledge, expertise, skills and experience these institutions provide is extensive and diverse, and will be employed in designing a new interdisciplinary programme.

The proposed Master programme in Nuclear Engineering will be designed to provide engineers with interdisciplinary skills and an essential perspective of the complexity of the field. That includes presentation of various topics in nuclear technology research, radioactive waste management, radiation protection, nuclear applications in biology, pharmacy, health and emergency services, but also explores potential for electricity generation in the future.

The integrated approach that consider technological development of the nuclear sector in the context of current economic constrains, energy policy, sound environmental performance and sustainable development aspects, will be emphasized throughout the Programme. The engineers would be able to deal with complex interdisciplinary problems, understand the technical, environmental, economic, and social issues and therefore significantly contribute in the development of Serbia.

