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Version 1

Field: NUCLEAR SAFETY

Topic: SAFETY AND LICENSING OF SMALL MODULAR REACTORS (SMRs)

Course type	TUTORING
Host institute	Budapest University of Technology and Economics Budapest, Hungary
Date	13 November – 8 December 2023
Duration	Four weeks
Working language	English

Objective and learning outcomes

This course provides technical knowledge of the current SMR designs, their use and operation, and related safety aspects. Tuition will be provided on expected licensing process in the future, including the regulatory issues concerning the deployment of SMRs and confirmation of their ultimate safety features. The course will contribute to the tutees' preparedness and skills in related regulatory functions.

Outline of course content

- Overview of SMR designs based on conventional, light water-cooled, Generation III+ and advanced, innovative (Generation IV) technologies. Discussion of the potential advantages in economics, licensing and integration into a decarbonised system, as well as the potential contribution of the innovative technologies to the efficiency, alternative products (process heat, hydrogen, energy storage, etc.) and sustainability. Understanding of the nuclear fuel cycle and the role of fast reactors for waste minimisation and more efficient use of natural resources. Potential drawbacks and challenges of SMRs will be introduced.
- Overview of licensing regulation and procedures of nuclear sites and installations in general. Introduction of IAEA recommendations and examples of national licensing regimes. Summarising recommendations to facilitate the licensing of SMRs.
- Introduction of safety assessments of nuclear installations, including the role of deterministic and probabilistic safety assessment in the licensing procedure. Explanation of integrated safety assessment methodology for innovative (Generation IV) reactor designs.
- Details of deterministic safety assessment. Tools and methods used for reactor physics design and analysis. Challenges of modelling of small cores and fast reactors. Reactor physics measurements for code validation. Case studies on core modelling and reactor physics safety parameters of advanced SMR designs. Tools and methods used for thermal hydraulics design and analysis. Challenges of modelling of integrated systems, alternative coolants and natural circulation. Coupling reactor physics and thermal hydraulics. Thermal hydraulics measurements for code validation. Case studies on computational fluid dynamics (CFD) and system code modelling of advanced SMR designs.
- Technical tours and laboratory exercises (basic principle simulators, thermal hydraulics loop and measurements, operation of a training reactor) to experience safety features in practice.

Technical schedule and delivery methods

The course will take 4 working weeks (i.e. 4 × 5 workdays). Working days will be distributed focusing on the specific topics, and the tutees will be assigned to an expert in the field as a tutor mentoring in relation to the given topics.

- About 25 % of the time will be devoted to consultancy with the tutor, where tutees will be introduced to the subject, receive background information and further documents to process, and the tasks are specified.
- About 50 % of the time, the tutees will process the distributed documents and other educational resources and independently work on the assigned tasks, reports and presentations. At the same time, their mentor will be available for help.
- About 25 % of the time will be spent on presenting and discussing the results and evaluating the trainees' work. The tutors provide feedback to help the professional development of the tutees.
- Some days will be devoted to technical tours and laboratory exercises to gain practical experience.

Target audience

This course is intended to experts and professionals of Nuclear Regulatory Authorities (NRAs) and Technical Support Organisations (TSOs) with responsibilities in the field of nuclear safety.

Target number of participants: 2

Prerequisites and requirements for participants

Participants should have an adequate level of knowledge in English (at least an 'Independent user' level defined by the CEFR) and basic knowledge of nuclear power plant technologies and the underlying scientific and technical principles. A university degree with nuclear specialization and years of professional experience in functions relevant to the content of the course is also a prerequisite.

Relevancy of the course topic in the work and institutionally justified interest in participating will be considered as well as the need and opportunity for filling competence gaps. Efforts are made to ensure gender equality.

Terms of participation

The project is implemented under the European Union (EU) external assistance programme, called the European Instrument for International Nuclear Safety Cooperation (INSC), and aims to support the National Nuclear Regulatory Authorities (NRAs) and their Technical Support Organisations (TSOs) in non-EU countries in strengthening their capabilities with regard to their regulatory tasks and responsibilities in the field of nuclear safety and radiation protection.

Employees of the NRAs or their TSOs in the Beneficiary Countries are eligible for financially supported participation in the T&T courses. Beneficiary Countries of the project are published on the website https://training.ek-cer.hu/.

Costs

Travel and accommodation costs and subsistence allowances (including the international and national travel tickets, shuttle services, insurance and visa costs, per diems) for participants will be covered from the project budget.

Application

Application via the website https://training.ek-cer.hu/, according to the process and deadlines indicated there.

Examination

Technical and linguistic tests will be written as part of the application and selection process to assess the underlying knowledge and preparedness of applicants. Knowledge and development of selected participants will be assessed through technical tests throughout the course.

Work reports will be prepared to allow for progress monitoring and determining the final development through acquisition of knowledge, practical experience and expertise, as well as task completions.

Participants attending the full course will be issued with attendance certificates. Successful participants will receive certificates confirming their knowledge achieved and skills acquired.