

Field: NUCLEAR SAFETY

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

Course type: TRAINING

Date: 03-07 July 2023

Duration: One week

Location: Tallinn, Estonia

**Working language
of the course:** English

Objective and learning outcomes

Participants will become familiar with the current SMR designs as well as their safety and operation and purpose of use, and their expected licensing process in the future, including the regulatory issues concerning the deployment of SMRs and confirming their ultimate safety features.

Outline of course content

The prime objective of this course is to enable the trainees to become familiar with the current SMR designs developed around the world, mainly focusing on those concepts which are most likely to be licensed and operated in a near future.

The course is organized to provide the trainees with fundamental knowledge of the SMR safety and operation, as well as their expected licensing process with its mandatory regulatory issues (including the harmonization of practices for fabrication, inspections, and licensing), and confirming their ultimate safety features (e.g., the extensively adopted passive safety).

In parallel with safety features of the various SMR designs, the course will also provide the trainees with essential information about SMR political, economic and societal aspects and impacts, such as their objectives, their quite diverse purposes of use (including industrial heat generation, hydrogen production, urban heating etc.), their deployment strategies, and their economics, also including the industrial aspects, such as the consequences of the system modularity, the remote operation as well as the components supply chain.

Elements will also be provided relative to the R&D and innovations which will be necessary to support safety options, licensing and construction processes and the expected need for experimental facilities and computation tools, which are mandatory both for the design and for the safety assessment.

- After a reminder on the history of nuclear reactors and on the different generations, the motivations that led to the emergence and spreading of SMRs will be summarized, and their general characteristics will be presented.
- The economics of SMRs will then be approached from a general point of view to underline the interests of both states and industries, some of which are completely foreign to the nuclear world. The most fashionable business models will then be discussed.
- A review of the main technological concepts of SMRs will then be presented with the objective that the trainees understand why such and such type of SMRs are selected, which are the advantages and the main constraints of doing that from both the safety and/or licensing point of view.
- In a lecture, a representative of the Estonian government will present Estonia's energy strategy with a focus on its choice for SMRs.
- Safety of SMRs will be addressed in 3 lectures. After a short recall of the main safety issues and a glimpse on security and safeguards aspects, the main topics of SMR safety will be presented, without going into the details of the different concepts, but emphasizing the analogies and pointing out the differences with the main current power reactor families.
- For the sake of comparison with both power and research reactors, a lecture will be devoted to the licensing of SMRs, as a whole.
- 5 lectures will be devoted to the detailed description of the main types of SMRs, namely light water SMRs, fast neutron SMRs, high temperature SMRs and molten salt SMRs. For each type, the most advanced models will be also presented. Particular emphasis will be given to safety aspects.

Technical schedule and delivery methods

The course consists of one module taking a working week (i.e. 5 workdays).

- **Classroom lectures:** the course is organized in 13 theoretical lectures
- **Tabletop exercise:** a time of work in groups (4-5 persons each) is allotted in order the trainees could test their knowledge and evaluate the achievements.
- **Technical visit:** On the third day afternoon, a technical visit is planned to the former Soviet nuclear submarine training center of Paldiski, a site located at about 50 km west of Tallin.

Target audience

This course is intended to experts and professionals of Nuclear Regulatory Authorities (NRAs) and Technical Support Organisations (TSOs), preferably with knowledges on nuclear power.

Target number of participants: 15 – 25

Prerequisites and requirements for participants

Participants should have a university degree obtained in engineering or physics faculties with nuclear specialization, at least 1-2 years of related experience, and an adequate level of knowledge in English.

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

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.

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