

Field: NUCLEAR SAFETY

Topic: PROBABILISTIC SAFETY ASSESSMENT (PSA)

Date: 10-14 June 2024

Duration: One week

Location: Lucca, Italy

**Working language
of the course:** English

Objective

The course provides the trainees with theoretical basics and hands-on experience about selected elements and aspects of the probabilistic safety analysis (PSA) and risk quantification to have a deeper understanding of the underlying concepts. The acquired fundamental knowledge supports both the practitioners in developing risk models, verifying designs and conducting analysis, and the regulators in reviewing and assessing PSAs.

Outline of course content

The main objective of the course is to equip trainees with a comprehensive understanding of quantitative risk modeling and its key elements, regardless of the software or system being modeled. This enables them to build quantitative risk models using any software tool for various industries or facilities. While many PSA training courses focus on event trees and fault trees as the foundation of risk models for complex systems, it is essential for analysts to have the fundamental knowledge in reliability engineering, probability theory, human reliability analysis (HRA) techniques, quantitative parameter estimation, and uncertainty treatments to develop event trees and fault trees in (nuclear safety) engineering practice. Furthermore, members of a PSA or risk quantification project or team should understand the principles of risk curves and the roles of deterministic safety margin analyses and probabilistic risk analyses in the design verification process.

This course deliberately avoids introducing specific PSA software tools. Instead, it offers practical examples that address relevant aspects of risk quantification using elementary tools like spreadsheets or manual calculations. This approach provides participants with hands-on experience and a deeper understanding of the underlying concepts.

The course is structured around the following topics and components:

- Introduction to Risk Modeling
- Outline of basics of Boolean Algebra, Probability Theory and Reliability Theory
- Overview of initiating Events, Event Tree Analysis, System Fault Tree Analysis
- Introduction to Dependency and Common Cause Failures Analysis
- Discussion of Data Analysis and PSA Model Parameters Estimation
- Introduction to Human Reliability Analysis
- Introduction to PSA Model Integration and Quantification
- Introduction to Basic Elements of Level 1 and Level 2 PSA
- Discussion of PSA Applications with illustrative examples, with particular focus on PSA for Internal Hazards, Seismic Events and Other External Events

Technical schedule and delivery methods

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

- **Lectures:** the course is organized in 12 theoretical, classroom lectures.
- **Tabletop group exercises and Hands-on training:** throughout the week trainees are engaged in various tabletop group exercises and Hands-on training, offering multiple opportunities to improve their practical skills in risk quantification and development of event trees and fault trees as well as to measure their progress and accomplishments throughout these sessions.
- **Technical visit:** a Laboratory close to Lucca is visited on the third day afternoon.

Target audience

This course is intended to experts and professionals of Nuclear Regulatory Authorities (NRAs) and Technical Support Organisations (TSOs), with knowledge on nuclear power and preferably with responsibilities in the field of nuclear safety, particularly in the preparation and review of Probability Safety Analysis (PSA).

Target number of participants: 10 – 20

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](#)). A university degree obtained in engineering or physics faculties with nuclear specialization and at least 1 year 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 costs and subsistence allowances (including the international and national travel tickets, per diems, shuttle services, insurance and visa application 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.
