



IAEA

International Atomic Energy Agency

Atoms for Peace and Development

Technical Meeting on Experiences in Using Probabilistic Safety Assessment in the Design of Nuclear Power Plants

IAEA Headquarters, Vienna, Austria
and virtual participation via Cisco Webex

5–8 April 2022

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Information Sheet

Introduction

Probabilistic safety assessment (PSA) is recognized as a powerful tool used for nuclear power plants (NPPs) to identify vulnerabilities of their designs and of related human actions that, following the occurrence of an initiating event or hazard, might lead to dreadful consequences, such as large release of radioactive material. Consequently, PSA have multiple applications for NPPs such as for assessing the risk related to design or operating procedures modifications, for development of severe accident management guidelines or for identifying organizational and design interactions and dependencies in a multi-unit NPP site.

In accordance with paragraph 3.5 of IAEA Specific Safety Guide on Development and Application of Level 1 PSA (IAEA SSG-3, 2010), more recently, NPP designers have also started to develop PSA models at the early stage of design to get risk insights to improve the NPP design safety and to avoid later modifications or backfittings. Some of the advantages of development of PSA models at the early stage of NPP design are:

- Identify the major contributors to the overall risk and explore design solutions to improve reliability and to reduce that contribution;
- Identify vulnerabilities of design, including system dependencies and potential common cause failures;

- Compare different design solutions with regard to the risk;
- Obtaining a balance design with regard to the contribution to the overall risk of initiating events and internal and external hazards as well as the preventive and mitigating measures;

Using PSA at the early stage of NPP design has however, some limitations and constraints related to the development of the PSA model, such as:

- Incomplete design information during the design process related to structures, systems and components;
- Lack of or limited reliability data;
- Reduced operating experience feedback related to innovative design solutions proposed;
- Incomplete or limited information for proper consideration and assess potential operator errors;
- Incorporate new designs solutions requiring research and tests, which might be in progress, to substantiate their performance and reliability;
- Limited time for detailed development of the PSA model due to constraints related to the different design phases such as conceptual design, preliminary and final design;
- Consideration in the PSA model of country and site design specifics.

Therefore, it is expected that discussions among PSA practitioners and decision makers with regard to their experiences in development and use of PSA models for NPP at the early stage of design and during design evaluation, will contribute to the on-going efforts to strengthen nuclear safety by allowing harmonization of relevant approaches used in Member States. The outcomes from the meeting will allow to enhance the processes for use of PSA studies in justification of design safety in particular for innovative reactor technologies, including those used for Small and Modular Reactors.

It is also expected those discussions will provide insights to be considered in the current process of revision of both IAEA Specific safety Guides on Development and Application of Level 1 and of Level 2 PSA for NPPs (IAEA SSG-3 and IAEA SSG-4 respectively).

Objectives

The objective of the event is to provide the participants with an opportunity to share experiences and discuss challenges related to the use of PSA in the design and in design evaluation of nuclear power plants. Special emphasis will be placed on experience in the development of PSA models that could be instrumental in supporting the use of PSA for justification and optimization of design safety for innovative technologies, including those used for small modular reactors.

Target Audience

The event is targeted at professionals from NPP design organizations, operating organizations, nuclear regulatory authorities, technical support organizations and research institutions who are engaged in activities related to or in support to the development and application of probabilistic safety assessment in the design and in design evaluation of nuclear power plants. Particular areas are listed in the Topics section, here below.

The event is open to representatives of all Member States with an active nuclear power programme, including those from embarking countries in Phase 3 of their nuclear programme.

Working Language(s)

English.

Expected Outputs

Participants will gain sound knowledge and a better understanding related to the different challenges, advantages and limitations related to the development of probabilistic safety assessment models at the early stage of design and design evaluation of nuclear power plants based on the current practices in Member States. The information exchanged will serve as a basis for development of an IAEA publication on the adequate use of PSA models at the early stage of development of innovative reactors technologies, including those used for SMRs.

In addition, the results of discussions from the event are expected to contribute to the revision of the Level 1 PSA IAEA Safety Guide SSG-3 “Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants” and of the Level 2 PSA IAEA Safety Guide SSG-4 “Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants” by providing information on the consensus reached on practices and experiences in Member States.

Topics

The event will address recent experiences in Member States to overcome challenges and limitations as well as to promote advantages in the development and the application of PSA at the design stage and in design evaluation of nuclear power plants, such as:

- Use of PSA for NPP at the design evaluation conducted for the regulatory decision making process;
- Overcome incomplete reliability data and design information of structures, systems and components in the development of PSA models;
- Development of PSA models for new NPP designs using current operating experience feedback available;
- Overcome lack of information related to the development of operating procedures and severe accident management guidelines;
- Evaluation of considerations and factors related to modelling of human performance;
- Use of PSA at the design stage to help the development of operating procedures and severe accident management guidelines;
- Consider the development of PSA at the design stage to help defining priorities for research and tests related to new designs solutions;

- Examples of evaluation of risk to prioritize and compare design solutions using PSA at the design stage for NPPs;
- Use of PSA at the design stage to help defining the safety classification of structures, systems and components important to safety.

Participation and Registration

All persons wishing to participate in the event have to be designated by an IAEA Member State or should be members of organizations that have been invited to attend.

In order to be designated by an IAEA Member State, participants are requested to send the **Participation Form (Form A)** to their competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) for onward transmission to the IAEA by **11 February 2022**. Participants who are members of an organization invited to attend are requested to send the **Participation Form (Form A)** through their organization to the IAEA by the above deadline.

Selected participants will be informed in due course on the procedures to be followed with regard to administrative and financial matters.

Papers and Presentations

The IAEA encourages participants to give presentations on the work of their respective institutions that falls under the topics listed above.

Participants who wish to give presentations are requested to submit an abstract of their work. The abstract will be reviewed as part of the selection process for presentations. The abstract should be in A4 page format, should extend to no more than two pages (including figures and tables) and should not exceed 1500 words. It should be sent electronically to Mr Jorge Luis Hernández, the Scientific Secretary of the event (see contact details below), not later than **11 February 2022**. Authors will be notified of the acceptance of their proposed presentations by **18 March 2022**.

In addition, participants have to submit the abstract together with the **Participation Form (Form A)** to their competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or their organization for onward transmission to the IAEA not later than **11 February 2022**.

IAEA Contacts

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Subsequent correspondence on scientific matters should be sent to the Scientific Secretary and correspondence on other matters related to the event to the Administrative Secretary.

Event Web Page

Please visit the following IAEA web page regularly for new information regarding this event:

www.iaea.org/events/EVT2102725